INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

COMMISSION INTERNATIONALE POUR LA CONSERVATION DES THONIDES DE L'ATLANTIQUE

COMISIÓN INTERNACIONAL PARA LA CONSERVACIÓN DEL ATÚN ATLÁNTICO

ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA

(ICCAT- GBYP)

PHASE 1

EC GRANT AGREEMENT SI2.542789

ANNUAL REPORT 2009-2010

March 10, 2011

ICCAT – Calle Corazón de Maria 8, 6° - 28001 Madrid - España

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SUMMARY

The Atlantic-wide research programme on bluefin tuna, conventionally GBYP, proposed by the SCRS and adopted by the Commission in 2008, officially begun on October 2009. The Coordinator was officially hired on March 2010 and the activity practically started on the same month. During this first period of activity, the Programme was set-up at the ICCAT Secretariat and several initiatives have been taken, following the guidelines included in the Programme. In particular, in this first phase the coordination become effective together with the GBYP Steering Committee, the aerial surveys have been properly designed, the first aerial survey on spawning aggregation was completed and the data have been elaborated. The data mining and data recovery exercise was started, and many data sets have been added to the ICCAT data base. It was also possible to organize the tagging design for the Eastern stock and to plan in detail the research initiatives for the next two phases. The GBYP publication policy, editorial and data rules have been defined and adopted at the early beginning of the activities. This first phase demonstrated the high relevance of the GBYP for providing fishery independent data and improving the current bluefin tuna assessment.

RÉSUMÉ

Le Programme de recherche sur le thon rouge englobant tout l'Atlantique, dénommé conventionnellement « GBYP », proposé par le SCRS et adopté par la Commission en 2008, a officiellement commencé en octobre 2009. Le coordinateur a été recruté au mois de mars 2010 et les activités pratiques ont démarré le même mois. Au cours de sa première période d'activité, le Programme a été établi au Secrétariat de l'ICCAT et plusieurs initiatives ont été prises, suivant les directives établies dans le Programme. La première phase a notamment porté sur la coordination effective avec le Comité de direction du GBYP, la conception adéquate des prospections aériennes, la première prospection aérienne de concentration de reproducteurs ayant été achevée et les données élaborées. L'exercice d'exploration des données et de récupération des données a démarré et de nombreux jeux de données ont été ajoutés à la base de données de l'ICCAT. Il a également été possible d'organiser la conception du marquage pour le stock de l'Est et de planifier dans le détail les initiatives de recherche pour les deux prochaines phases. La politique de publication ainsi que les règles éditoriales et en matière de données du GBYP ont été définies et adoptées au tout début des activités. La première phase a démontré que le GBYP était un programme très important pour fournir des données indépendantes des pêcheries et améliorer l'évaluation actuelle du thon rouge.

RESUMEN

El Programa de investigación sobre atún rojo para todo el Atlántico, denominado convencionalmente GBYP, propuesto por el SCRS y adoptado por la Comisión en 2008, y se inició oficialmente en octubre de 2009. El Coordinador fue contratado en marzo de 2010 y las actividades prácticas empezaron ese mismo mes. Durante este primer periodo de actividad, el Programa se estableció en la Secretaría de ICCAT y se han emprendido varias iniciativas siguiendo las directrices del Programa. En particular, en esta primera fase se ha hecho efectiva la coordinación a través del Comité directivo del GBYP, se han diseñado adecuadamente las prospecciones aéreas, se ha finalizado la primera prospección aérea sobre concentraciones de reproductores y se han elaborado los datos. Se han empezado los ejercicios de minería y recuperación de datos, y se han incorporado muchos conjuntos de datos a la base de datos de ICCAT. También fue posible organizar el diseño de marcado para el stock oriental y planificar detalladamente las iniciativas de investigación para las dos próximas fases. Al iniciar las actividades, se ha definido y adoptado la política de publicación y la normas editoriales y en cuanto a datos del GBYP. La primera fase ha demostrado la gran importancia del GBYP a la hora de proporcionar datos independientes de la pesquería y de mejorar la evaluación actual del atún rojo.

KEYWORDS

Bluefin tuna, large pelagic species, ICCAT, research, aerial survey, data recovery, data analysis, tagging, Mediterranean Sea, Atlantic Ocean.

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1.0 Summary of the activities in Phase 1

1.1 Background

The Atlantic-wide research programme for bluefin tuna was officially adopted by SCRS and the ICCAT Commission in 2008, after a long process.

In 2003, as an input of the Working Group established by Rec. 02-11, SCRS presented the Commission with a research plan to improve knowledge on bluefin tuna, with a special focus on mixing between the two stocks (ICCAT, 2004, Col. Vol. Sci. Pap., 56(3): 987-1003). The various research elements included in this first proposal are still pertinent today, even if some other activities have been included in the following years.

During the Marrakech Commission meeting (2008), the SCRS chair met with all the scientists present at the meeting and a detailed proposal was forwarded to the Commission. The proposal was adopted by the Commission in plenary (ICCAT Report 2008-2009 (I), 1: 40) and resulted in a first official document, Res.08-06, which covered only the 2004 SCRS proposal but under a broader title. At the same time, the Commission approved the STACFAD Report (ICCAT Report 2008-2009 (I), 1: 42), which included the agreement to endorse the Atlantic-wide research programme (ICCAT Report 2008-2009, (I), 1, Appendix 10 to Annex 9: 284-287), establishing three priorities in 2009 (Coordinator, data mining and Aerial surveys), other action to be further discussed by SCRS in 2009 and the provision for the programme to be adjusted in the following years taking into account the evolution of its implementation and research needs. The total budget of the programme was estimated at about 19 million Euros in 6 years. The same document reports the engagement of the European Community and some other Contracting Parties to contribute to this programme in 2009 and in the following years.

The SCRS, in 2009, reviewed the updated research proposal submitted by SCRS chair, as it was discussed and presented to the Commission at its meeting in 2008 (ICCAT Report 2008-2009 (II), 1: 224 and ICCAT Report 2008-2009 (II), 2: 223-224). The SCRS indicated the priorities identified in the 2008 document, as follows:

a) Improve basic data collection through mining (including information from traps, observers, and VMS), developing methods to estimate sizes of fish caged, elaborating accurate CPUE indices for Mediterranean purse seine fleets, development of fisheries-independent information surveys and implementing a large scale well planned conventional and genetic tagging experiment;

b) Improve understanding of key biological and ecological processes through electronic tagging experiments to determine habitat and migration routes, broad scale biological sampling of live fish to be tagged and dead fish landed (e.g. gonads, liver, otoliths, spines, etc.), histological analyses to determine bluefin tuna reproductive state and potential, and biological and genetics analyses to investigate mixing and population structure; ecological processes, including predator-prey relationships;

c) Improve assessment models and provision of scientific advice on stock status trough improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and developing and use of biologically realistic operating models for more rigorous management option testing.

A number of Contracting Parties expressed a willingness to make extra-budgetary contributions to such a programme with a view towards initiation of activities in 2009 related to programme coordination, data mining, aerial surveys, and tagging design studies, with additional research activities to be undertaken in the following years. The first Phase costs were set at 750,000 Euro and voluntary contributions sufficient to initiate the year 1 activities were jointly committed by the European Community, United States, Japan, Canada, Norway, Croatia, Turkey and Chinese Taipei, while Morocco indicated its interest in future contributions. The provision to accept additional contributions from various entities and private institutions or companies was also agreed. In the same document, it was recommended to form a Steering Committee comprised by the SCRS Chair, the ICCAT Executive Secretary or his/her Assistant, bluefin tuna rapporteurs, and an outside expert with substantial experience in similar research undertakings for other tuna RFMOs, to guide and refine the Programme as necessary.

The GBYP Steering Committee, during its meetings in September 2010, set-up the priorities for Phase 2 and Phase 3 (Coordination, Data mining and data recovery, Aerial Surveys, Tagging, Biological sampling and Modelling), under two different scenarios: a full availability of funds, according to the SCRS plan for GBYP adopted by the ICCAT Commission, or a reduced programme able to comply with the minimum research requirements and to face a possible reduction of available funds by all CPCs concerned (see the concerned ICCAT-GBYP Steering Committee Reports on http://www.iccat.int/GBYP/en/scommittee.htm).

The Grant Agreement SI2.542789 between the European Commission and the ICCAT was signed on October 12, 2009, having the duration of 12 months. The Grant Agreement was amended on October 12, 2010 and prolonged for further two months, due to need to complete all the necessary actions.

1.2 Organisation and implementation

1.2.1 Start-up organisation

Phase 1 of GBYP was initially devoted to hire a GBYP Coordinator, to set-up a detailed weekly workplan, to organise the coordination structure at the Secretariat, to set-up the Steering Committee and nominate its members (13/03/2010). The ICCAT Secretariat set-up the administrative structure and the administrative rules were agreed and established, accordingly with the ICCAT system and taking into account also the programme administrative

This organisation will continue to be active during the following Phases of the Programme, improved by the dedicated staff foreseen by the Steering Committee, which include two positions, one G2-1 and one P2), who will support the Coordinator and which are necessary for the amount of workload required.

The GBYP Coordinator, Dr. Antonio Di Natale, is in charge of implementing the Atlantic-Wide Research Programme for Bluefin Tuna at the ICCAT Secretariat, while the ICCAT Secretariat will provide the support organisation.

1.2.2. Arrangements for evaluation and supervision of the GBYP activities

According to the ICCAT Commission decision, the GBYP is supervised by the GBYP Steering Committee, which is actually composed by the Chair of SCRS, Ph.D. Josu Santiago, the BFT-W Rapporteur, Ph.D. Clay Porch (NMFS), the BFT-E Rapporteur, Ph.D. Jean-Marc Fromentin (IFREMER), the ICCAT Executive Secretary, Dr. Driss Meski, and an external expert, Ph.D. Tom Polacheck (CSIRO).

The international Steering Committee has the role to refine and guide the GBYP, according to the general planning adopted by the ICCAT Commission and to provide a continuous supervision. The GBYP Coordinator has the role to inform the Steering Committee about all the initiatives and eventually ask for their opinion for decisions to be taken (complex calls for tenders, selection of bids, research strategies and alternatives, etc.).

According to the Commission decision, the ICCAT SCRS has reviewed the annual GBYP report at that date and adopted it (Madrid, 4 to 8 October 2010) (SCRS/2010/135, see Annex 1a). This report was endorsed by the Commission in the 17th Special Meeting in Paris (17 to 27 November 2010) (ICCAT REPORT 2010-2011(I), sees Annex 1b).

1.2.3 Steering Committee Meetings

The Steering Committee meetings were not planned at the beginning of the activity, because of logistic difficulties. For this reason, it was a precise duty of the GBYP Coordinator to constantly inform by e-mail all the Members, about the detailed activities of the Programme and request their opinion when necessary. Apart from that, there was a continuous and productive contact with all Members, to better refine the various contents of the Programme.

The first informal meeting of the Steering Committee was hold at the ICCAT Secretariat on April 23 and 24, 2010, to discuss about the aerial survey design and the aerial survey strategies. Besides of the formal invitation, most of the Steering Committee members had troubles for participating, due to the flight troubles caused by the volcano in Iceland. For this meeting, due to the presence of only the SCRS Chair (Dr. Scott) and the ICCAT Secretariat staff, it was decided not to adopt any formal decision and to continue the discussion by mail.

The second informal meeting was hold at the ICCAT Secretariat on June 19, 2010, to discuss about the Call for Tenders to be released and the various tagging options, again with the presence of the SCRS Chair, Dr. Scott and the ICCAT Secretariat. It was decided not to adopt any formal decision and to continue the discussion by mail.

The third meeting, formal, was on September 4 and 5, at the ICCAT Secretariat. The draft agenda for the meeting was prepared by the GBYP Coordinator in consultation with the ICCAT Secretariat and distributed to the Steering Committee for comments. An annotated agenda, with all the necessary information was also distributed to the Steering Committee. The meeting report was produced in real time (Annex 2a) and it is posted on the new GBYP page within the ICCAT web page (Annex 2a).

A fourth meeting was convened *ad horas* at the ICCAT Secretariat on 10, 11 and 12 September 2010, due to the information received about the availability of a reduced budget for the next two phases of the GBYP and the consequent need to revise the various items within the budget. Furthermore, the Steering Committee discussed some proposals forwarded by the participants at the Bluefin Stock Assessment meeting. The meeting report was produced in real time (Annex 2b) and it is posted on the new GBYP page within the ICCAT web page.

A fifth meeting was convened *ad horas* at the ICCAT Secretariat on September 30, 2010, to discuss the revised proposal for the tagging design and various additional issues. The Steering Committee decided to request some additional details to the tender, and approved various items, including the request to ask for a prorogation of Phase 1 of the GBYP until December 12 and amend the contract with the cofounders accordingly. The meeting report was produced in real time (Annex 2c) and it is posted on the new GBYP page within the ICCAT web page.

1.2.4 Definition of GBYP Publication Policy, Editorial and Data Rules

The need to have a clear and defined publication policy, along with editorial and data use rules, was one the first issue tackled within the GBYP coordination. The discussion was carried out at the Secretariat level, taking into account the ICCAT rules in this sector and the SCRS statements, and the final document was officially adopted on March 15, 2010 (Annex 3). These rules will be updated annually.

1.2.5 Implementation of Phase 1 activities

All the activities in Phase 1 were made according to the approved programme and they were fully completed even if the operational time was restricted to 9 months instead of the original 12, due to the late hiring of the Coordinator.

The Coordinator participated officially to the following meetings:

date	place	Meeting	motivation
12-14/04/2010	Malta	FEAP (Med tuna Industry)	Presentation of GBYP and request for cooperation
15/04/2010	Rome (IT)	Direction General for Fishery	Presentation of GBYP and discussion about the possibility to develop a national aerial survey programme on spawners and juveniles to enlarge the GBYP possibilities
19/04/2010	Madrid (SP)	Balfego Group	Presentation of GBYP and request for cooperation
21-23/04/2010	Madrid (SP)	ICCAT Working Group on Stock Assessment Methods	participation
31/5-4/6/2010	Madrid (SP)	ICCAT Intersessional Meeting of the Sub-Committee on Ecosystems	participation
30-31/05/2010	Barcelona (SP)	Tuna RFMOs	Informal meetings with scientists and CPCs to further support the GBYP initiatives
2-5/06/2010	Carloforte (IT)	Workshop on Tuna	Presentation of GBYP, workshop on tuna issues, contacts with the trap industries for cooperation
14-16/06/2010	Bonn (GE)	OSPAR Biodiversity Comm.	Presentation of GBYP and discussion on tuna problems
17-18/06/2010	Madrid (SP)	Bluefin Tuna Data Preparatory Meeting	Presentation of GBYP and participation to the meeting
19/06/2010	Madrid (SP)	Steering Committee Meeting	Discussion about strategies and agenda
24-25/06/2010	Bruxelles (BE)	EC-DG MARE	Discussions about the administrative duties of GBYP and future biannual funding
14/07/2010	Madrid (SP)	IEO national meeting on tuna research programmes	Presentation of GBYP and discussion about possible cooperation
4-5/09/2010	Madrid (SP)	GBYP Steering Committee	Review of the first year activities; planning for the next two years; budget
6-12/09/2010	Madrid (SP)	Bluefin tuna assessment meeting	Presentation of GBYP and participation to the meeting
4-7/10/2010	Madrid (SP)	SCRS Plenary	Reporting the GBYP activities in Phase 1 for revision, discussion and approval.
23/10/2010	Santa	Status of large pelagic in	Review of the bluefin tuna

	Margherita Ligure (IT)	the Mediterranean Sea (bluefin and swordfish) and correlation with environmental factor.	status (SCRS), presentation of GBYP and participation to the meeting
27/10/2010	Ametlla de Mar (SP)	The bluefin tuna in the Mediterranean: research for sustainability	Review of the bluefin tuna status (SCRS), presentation of GBYP and participation to the meeting
28/10/2010	Rome (IT)	Italian society of Marine Biology national meeting on tuna research programmes	Presentation of GBYP and discussion about possible cooperation
14-28/10/2010	Paris (FR)	17th Special Meeting of the Commission	Support to SCRS Chair for the presentation og GBYP activity in Phase 1 and planned activity in Phase 2; informal meetings with tuna scientists.
10/12/2010	Siena (IT)	Workshop on "Monitoring of Biodiversity"	Presentation of GBYP, including techniques and methodologies

Furthermore, the GBYP coordinator is providing a scientific support to all the national initiatives which are potentially able to increase the effectiveness of the GBYP and its objectives. For this reason, he was also asked to join the Steering Committee for the bluefin tuna programmes of the NOAA (BTRP), together with other members of the GBYP Steering Committee. The BTRP is a twin programme to support scientific research on bluefin tuna in the Western Atlantic, with many objectives in common with the GBYP.

The GBYP Coordination has become rapidly a neutral focal point for initiatives and discussions among scientists, and more than 12.000 e-mails were received or delivered during Phase 1.

In conformity with the Atlantic-Wide Bluefin Research Programme (GBYP) adopted by the SCRS and the Commission, the following research initiatives have been initiated (see also Table 1).

a) Aerial survey

b) Data mining and data recovery

c) Tagging design

1.2.6 Budget

The budget initially established by the SCRS for the first year of the GBYP, presented to the ICCAT Commission meeting in Marrakech in 2008, was set at 890.000,00 Euro. After the official endorsement of the GBYP at the Commission meeting in 2009, the agreed budget was set at 750.000,00 Euro, co-funded by the European Union (80%), Canada, Croatia, Japan, Norway, Turkey, United States of America and Chinese Taipei, supported by the ICCAT Secretariat.
The final version of the first year of GBYP budget, as it was defined by the Grant Agreement between the European Union and the ICCAT includes the following issue:

Coordination.. Euro 210.000,00
Data mining... Euro 200.000,00
Aerial surveys.. Euro 300.000,00
Conventional tagging design study... Euro 40.000,00

1.3 Aerial surveys

The aerial surveys have the scope to provide fishery independent indices, concerning various fractions of the stock. The aerial surveys targeting spawning aggregations can potentially provide indices for the spawning stock biomass, while aerial surveys targeting aggregations of juveniles can potentially provide indices for the recruitment. In every case, surveys shall be conducted with a statistically sound design and for several years in order to get reliable indices.

The GBYP set up general rules for standardising the aerial surveys to be conducted: all aircraft shall have upper wings, possibly two engines, should stay at an altitude between 300 to 330 m over the sea level, and shall have a GPS able to continuously recording the track and the related data. Each aircraft shall be identified by an ICCAT number in contrasting colour with the aircraft, on one lower side of the wings and on one side of the aircraft. Each team on board shall include an expert pilot, a professional tuna spotter and a scientific observer. All sightings shall be properly recorded on a common form in excel, to facilitate the data elaboration, and documented by photos.

The budget available (300,000 Euro) for the first phase was not enough to cover all areas and all needs (spawning aggregations and juvenile aggregations). After a discussion with the Steering Committee, it was decided to concentrate all efforts and resources only on bluefin tuna spawning aggregations, with the purpose to get a first minimal estimation of the spawning stock biomass and to develop and index. It was also agreed to postpone any eventual intercalibration exercise to the next years, because of time, budget organisation and administrative constrains. It was also agreed to support eventual additional activities of aerial surveys on juveniles and aerial surveys in other spawning areas, conducted with national funds, providing them common methodologies.

1.3.1 Aerial survey design

The preliminary work was devoted to identify the most relevant areas and it was carried out at the ICCAT Secretariat, by using the 2008 and 2009 VMS data from purse-seine vessels (figure 1). It was agreed to concentrate the efforts only on areas where the PS fishing activity was more intense in these last two years, even if it was clear that the spawning areas were possibly much larger than those identified. It was established to define them by squares of 1°x1°.

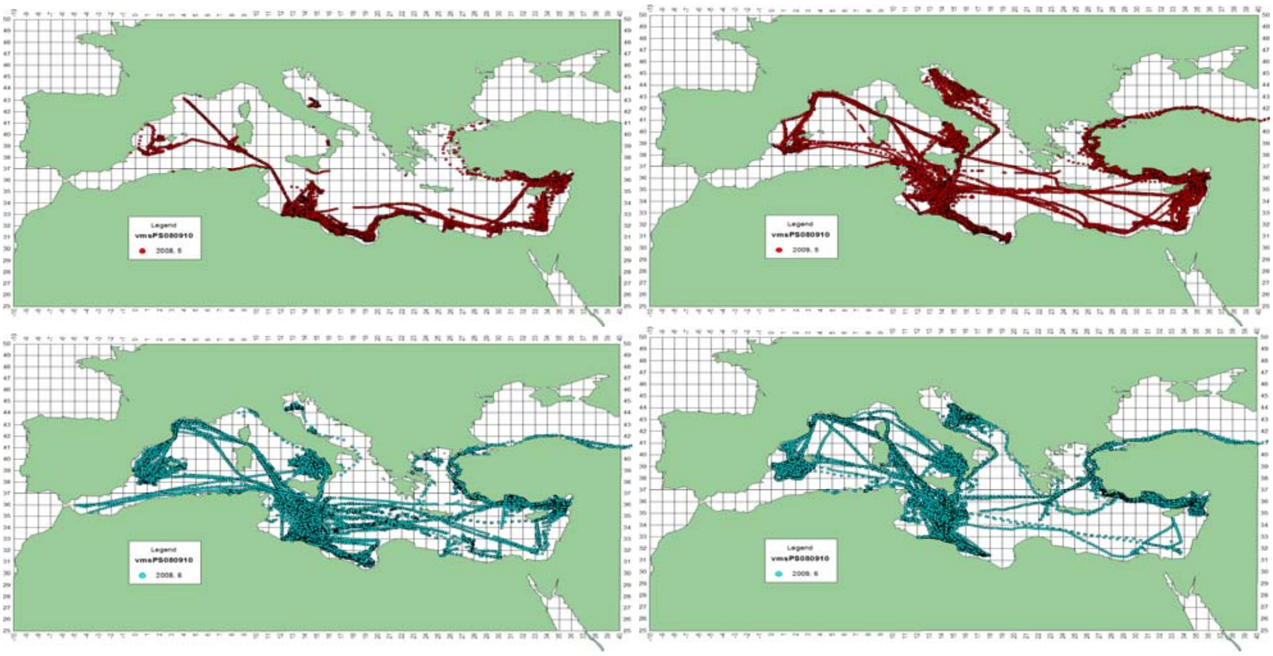

Figure 1 – VMS data from bluefin tuna purse-seiners in May and June 2008 (left) and 2009 (right).

This preliminary study revealed 6 sub-areas where the purse-seine fishing activity was more intense during the spawning period in 2008 and 2009 (figure 2), but it was necessary to exclude fishing activities not targeting bluefin tuna spawners (e.g.: those in central-north Adriatic Sea).

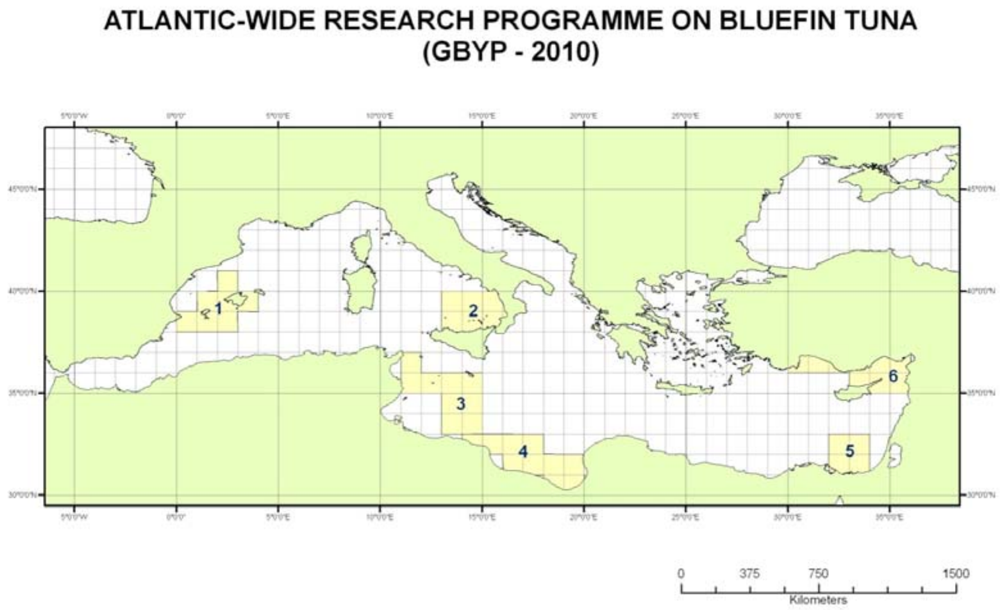

Figure 2 – The 6 sub-areas identified for conducting the aerial survey on spawning aggregations in 2010, based on the 2008-2009 purse-seine fishing activity.

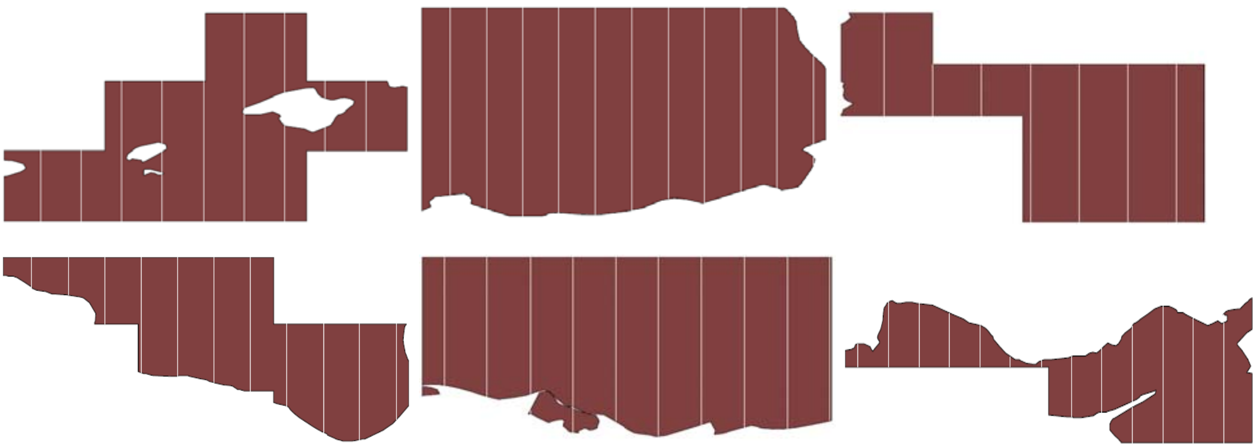

Figure 3 – An example of the various aerial survey designs in all the sub-areas. First line, from left to right, tracks in sub-areas 1 to 3; second line, from left to right, tracks in subareas 4 to 6.

Even if there was no specific mention on the budget or in the Programme, it was decided that a survey design, statistically sound, was absolutely necessary before beginning the survey activity and this item was considered as an essential preliminary part of the "Aerial Survey". The sampling design, agreed by the Steering Committee, was required in a way that it should balance the available funds with the flight hours required.

The Call for Tenders was released on March 23, 2010 (ICCAT Circular 812/2010), receiving only one bid. The contract was awarded to Prof. Philip Hammond (UK) on April 5, 2010. Prof. Hammond provided a first version of the Aerial Survey Design on April 22, 2010, based on the "DISTANCE" method, well in advance of the date established by the contract (May 15). This allowed some Members of the Steering Committee, during a meeting held at the ICCAT Secretariat on April 23, 2010, to directly discuss with Prof. Hammond and to require some modifications (e.g.: more distance between transects), with the purpose to have more replicates in each area.

The new adapted version of the sampling design, with all the necessary tables and figures, was provided on May 1, 2010 (figure 3) (Annex 4a).

The design was subsequently modified in emergency at the ICCAT Secretariat and in strict contact with Prof. Hammond, after the impossibility to get the flight permit over the Tunisian, Libyan and Egyptian air spaces (see chapter 1.3.2) (Annex 4b).

1.3.2 Aerial survey on spawning aggregations

In parallel with the sampling design activities, due to the lack of sufficient time, a Call for Tenders for the Aerial Survey on Spawning Aggregations was released on April 6, 2010 (ICCAT Circular n. 1000/2010). The Secretariat received 7 bids and 3 of these were awarded on April 29, 2010: Grup Air Med (SP) for sub-areas 1 and 3, Consorzio UNIMAR (IT) for sub-area 2 and Périgord Travail Aérien (FR) for sub-areas 4, 5 and 6. The contracts were discussed in three meetings at the Secretariat from 11 to 13 May 2010 and all were signed within a few days. The date for beginning the surveys was set on May 24, 2010, for all tenders. It was agreed that preliminary data should be delivered just before the 2010 BFT Assessment meeting. A common format to transmit the aerial survey data to the ICCAT Secretariat was provided to all the contractors, with the purpose to get the data “ready to use”.

All tenders were able to get the flight permits from Spain, Italy, Malta, Cyprus and Turkey in due time. Both Grup Air Med and Périgord Travail Aérien had serious troubles for obtaining the flight permits from Egypt, Libya and Tunisia. Finally, with a lot of delay, Périgord Travail Aérien got the flight permit from Egypt. It was impossible to obtain the flight permits from Libya and Tunisia, despite of several interventions officially made by the ICCAT Executive Secretary and various diplomatic efforts. Another problem raised when one of the aircrafts belonging to Périgord Travail Aérien approached the airspace of Egypt, because the Egyptian Authorities changed the authorisation for the requested altitude (300 m), imposing a different one (1500 m), not suitable for the survey, and requested the aircraft to land in Alexandria to apply for a new permit, to be eventually released in the future. All these problems together imposed a revision of the contracts with Grup Air Med and Périgord Travail Aérien and, at the same time, a revision of the aerial sampling design.

Sub-area 4 (all inside the Libyan airspace) and sub-area 5 (all inside the Egyptian aerial space) were cancelled, creating a serious problem for the survey in general, because the biological information on bluefin tuna spawning and behaviour in these areas were almost nil, and then precious to be collected for a better understanding of the bluefin tuna in the Mediterranean. Sub-area 3 has been reduced in size (cutting off 18 miles in the southern part, because they were within the Libyan airspace, and cutting another section, till the eastern limit of the Tunisian airspace, on the western side).

In agreement with the Steering Committee, it was decided to define two additional sub-areas, where the fishing activity on spawners was anyway present in 2008 and 2009, even if it was apparently less intense. The two new sub-areas, 7 and 8 (figure 4), were given to Périgord Travail Aérien, in substitution of sub-areas 4 and 5. It was necessary to provide in emergency a new aerial survey design, following the same design made on near or similar sub-areas. Even in this case, it was necessary to adjust the design for sub-area 8, cutting off 18 miles from the southern limit, due to the Libyan airspace boundary. The amendment to the contract was provided to Périgord Travail Aérien on June 24, 2010.

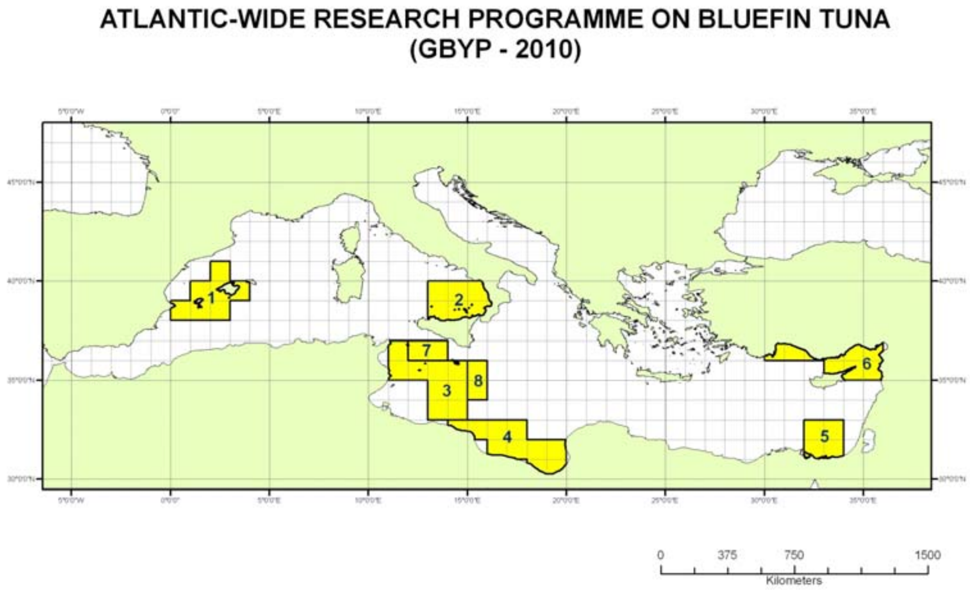

Figure 4 – The updated map of all the 8 sub-areas identified for the aerial survey on spawning aggregations in 2010. The sub-areas 3 and 8 are not showing the zones were the survey activity was excluded due to the lack of permits from the Tunisian and Libyan Aviation Authorities.

The same aerial survey design approach was applied by Italy, with national funds, in two additional zones close attached to sub-area 2 (figure 5). The survey was carried out testing the possibility to use a different type of aircraft (ATR 42 MP), much bigger that the aircrafts used by the GBYP Aerial Survey. The results of this additional survey were supposed to be reported to ICCAT-SCRS and ICCAT-GBYP by Italy.

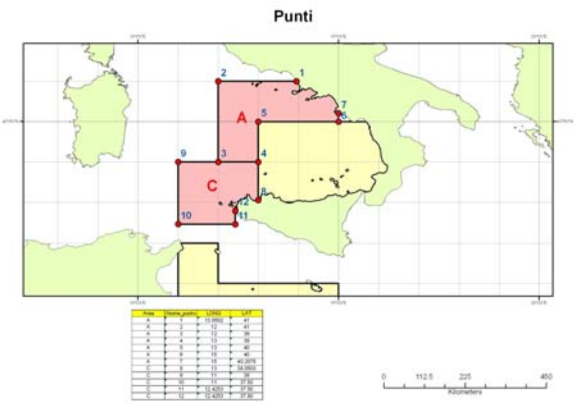

Figure 5 – The map of the two additional zones (A and C) attached to sub-area 2, where Italy decided to carry out an additional aerial survey in summer 2010.

It was decided to continuously monitor the sea surface temperatures and the waves forecast, with the purpose to have a better understanding of the various operative and environmental situations during the aerial survey campaign in 2010. The maps have been collected daily from http://gnoo.bo.ingv.it/mfs/Forecast/bulletin.htm?link=F for the sea surface temperatures and from http://isramar.ocean.org.il/isramar2009/wave_model/default.aspx?region=coarse&model=wam for the wave forecast (figure 6). The complete archive is kept by GBYP and it is available for the scientists.

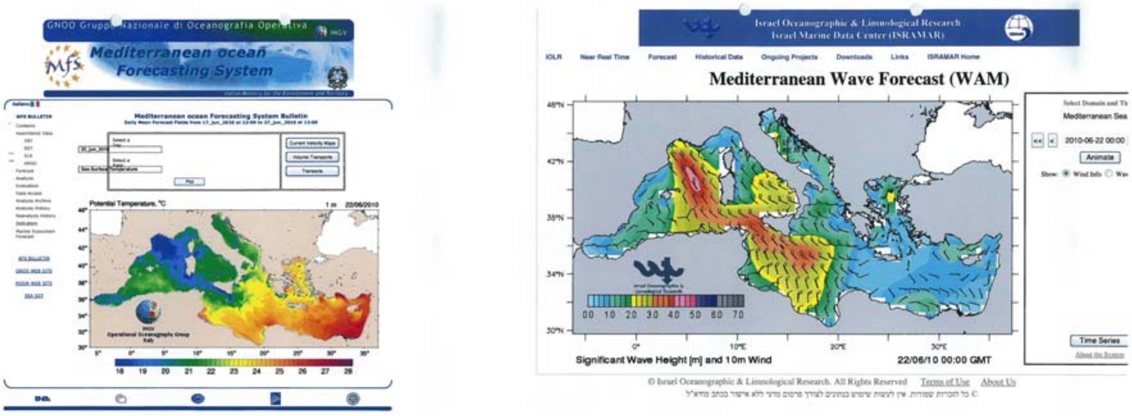

Figure 6 – An example (22 June 2010) of the daily maps for surface temperatures (left) and wave (right) collected by GBYP during the 2010 aerial survey campaign.

The aerial survey on spawning aggregation in 2010 was affected not only by the bureaucratic problems, but also by the unusual situation in terms of temperatures and winds. The surface temperature was unusually very cold in all the western and central Mediterranean till about mid-June, while even in the eastern Mediterranean the sea temperature was lower than usual in most of the areas till the last part of May. The strong winds and the bad weather conditions had a relevant presence in many days (figure 7), much more than the 20% considered when planning the activities and the budget. As a matter of fact, according to a preliminary estimate, the average of unsuitable conditions for aerial survey, taking into account both the sea surface temperature and the wind, was 37.5% among the various areas, with a better situation in sub-area 6 (only 23% of unsuitable conditions) and a worse situation in sub-area 8 (56.4% of unsuitable conditions), but local winds were able to further reduce the operative days.

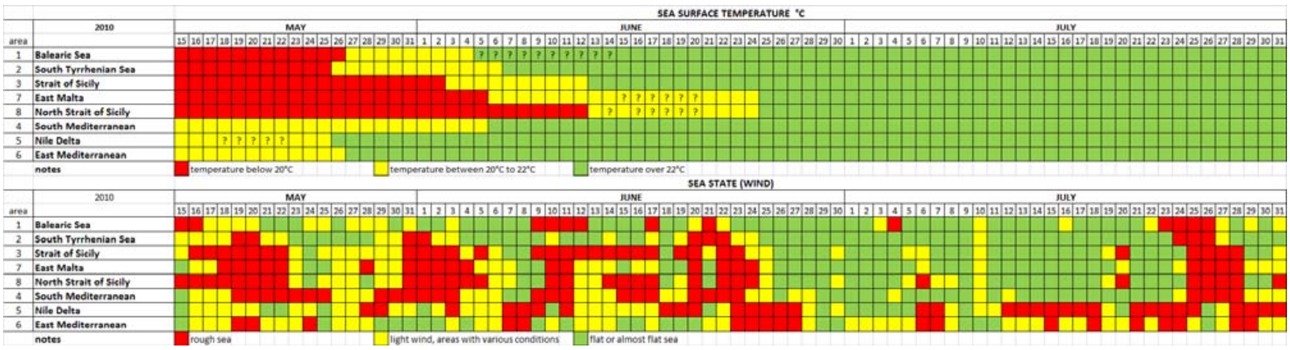

Figure 7 – A first estimate of the environmental conditions during the GBYP Aerial Survey in 2010 in the various sub-areas. The upper table shows the average surface temperatures, confirming the relevant delay for establishing the proper temperature for spawning in the western and central Mediterranean Sea. The lower table shows the sea state conditions, which clearly indicates the difficulties for carrying out the survey in many sub-areas, due to the strong winds during spring 2010.

It is possible that the wind, in presence of marginal optimum temperature for spawning (>20.5°C), prevented the thermocline to be established at the right depth in various areas during the first part of the season. These environmental facts implied a delay in the bluefin tuna spawning activities in most of the areas and prolonged the survey activities, even if full details should be available later. The aerial survey data have been provided on schedule by all teams and the individual reports are already available. The complete sets of all pictures taken during the survey have been delivered in electronic format to ICCAT-GBYP, from all areas.

The three reports of the surveys are available on the ICCAT-GBYP web page (http://www.iccat.int/GBYP/en/Products.htm) and they are attached to this report as Annex 5a (Grup AirMed), Annex 5b (Périgord Travail Aérien) and Annex 5c (Consorzio UNIMAR).

This first year activity of aerial surveys is considered essential and extremely useful to better plan and refines the aerial surveys in the following years of the Programme, including the necessary preliminary official contacts with all CPCs interested by the Aerial Survey activities, in order to inform the local Authorities and get flight permits on time. This fact will allows also revising and adapting the aerial survey design according to the flight possibilities and then correlating the available budget with the maximum flight time. At the same time, the first year activity was very useful to detect gaps and areas for improving the quality of the survey, showing the absolute need to have a dedicated short training course for the pilots, the professional spotters and the scientific observers in Phase 2, preliminary to the field activities.

1.4 Data mining and data recovery

The first preliminary activity was conducted at the ICCAT Secretariat. An analysis of the ICCAT data base on bluefin tuna was carried out at the ICCAT Secretariat, with the purpose to identify the most relevant gaps in the data series which are potentially useful for the stock assessment; this gap analysis was provided by GBYP to the SCRS Scientists and National statistical correspondents, along with a complete detailed table of the bluefin tuna data base, with the purpose to help them in detecting the lacking data.

1.4.1 Data recovery

The first Call for Tender on this item was issued on April 13, 2010 (ICCAT Circular n. 1094/2010). Besides of the very large distribution of the Call, passed also to various national scientific networks, the ICCAT Secretariat received only one bid, which was not accepted after a cross-check with the bluefin tuna data base (May 28, 2010).

A second Call for Tenders was released immediately after, on June 11, 2010 (ICCAT Circular n. 2351/2010). This Call received 5 bids. After a cross-check of the bluefin tuna data base, an internal review of the bids, and in strict consultation with the Steering Committee, all bids were accepted and the award was provided on July 30, 2010, to Direction des Pêches Maritimes (SEN), Fundación AZTI (SP), Institute of Marine Research (NO), Necton S.C. (IT) and Ricerca Mare Pesca (IT), along with the related contracts. The various proposed data sets, actually missing from the bluefin tuna data base, concerns about 180,000 specimens and a wide range of years and data sets, and should improve the knowledge on several fisheries in various areas. Many data are related to detailed CPUE and precise locations. A common format for transmitting the data to the ICCAT Secretariat was provided to all the contractors, with the purpose to get the data “ready to use” and in a format allowing their immediate incorporation in the bluefin tuna data base. All data sets have been provided to the GBYP on due time and they have been checked internally by the ICCAT Secretariat, confirming that all these important sets were not included before in the ICCAT data base. The final reports (mostly Excel data files) were submitted on schedule, by October 4, 2010. The data, all covered by contract by a confidentiality agreement, are available for the scientific purposes of the SCRS. In two cases, a formal summary report was available (Annex 6a and 6b).

A target Call for tender was issued on September 8, 2010, about the collection and supply of satellite SST (Sea Surface Temperature) data sets and maps, corrected with measures *in situ*. Among the two participants, a contract was awarded to CLS Collect e Localisation Satellites (FR) on October 26, 2010 and data sets (0.25°x0.25°, for the last ten years, were provided to ICCAT-GBYP by November 11, 2011, in electronic format under a special licensed software. These data were essential for developing the first analysis of the aerial survey data and can be used for several future analyses. They will be updated annually.

1.4.2 Data analysis

Another important part of the data recovery trials is to carry out specific analysis on both already existing data and some of the new data sets. A Call for Tenders was issued on June 30, 2010 (ICCAT Circular n.2668/2010), specifically focused on the "Elaboration of 2010 Data from the GBYP Aerial Survey on Spawning Aggregations" within the GBYP Data Recovery Plan. The purpose of this Call was to make immediately available for the SCRS all the data obtained during the aerial surveys carried out by GBYP in 2010. This Call received only one bid. The tender, Alnilam Investigación y Conservación SL (SP), was awarded on August 6, 2010 and the contract was delivered on the same date. The report was provided on due time and the detailed results, regularly posted on the ICCAT GBYP web page (http://www.iccat.int/GBYP/Documents/Aerial_survey_analysis_2010.pdf), are considered very useful for improving the aerial survey activities in the following years (see also Annex 7a). At the same time, the report provides the CVs for the data collected in 2010, which appear much lower than any other CV related to data actually used for the bluefin tuna stock assessment, and the time-frame required to develop reliable indexes of the relative abundance of the SSB at various CVs. The latter is an important element to better assess the GBYP research plan for the following years.

The GBYP contracted and provided a high level Chair for the ICCAT bluefin tuna stock assessment, Dr. Joseph Power, unanimously indicated by the ICCAT Secretariat, the SCRS Chair and the two BFT Rapporteurs (which are also all members of the GBYP Steering Committee). Dr. Powers had the difficult duty to ensure a neutral management of this very important meeting held in Madrid on September 6 to 12, 2010, and to coordinate the very complex and difficult analytical work required for the assessment, carried out by the best scientist in this field, with the participation of 58 scientists from many CPCs, NGOs, and experts from the industry, and the full GBYP Steering Committee, assisted by the ICCAT Sercretariat scientists and staff. The executive report is attached as Annex 7b, while the complete report is available on the ICCAT web site (http://www.iccat.int/Documents/Meetings/Docs/2010_BFT_ASSESS_REP_ENG.pdf).

The last Call for tenders on the GBYP Data analysis was issued on October 20, 2010, target to the elaboration of the GBYP 2010 Aerial Survey data in correlation with SST data. This call received only one bid and the contract was awarded to Alnilam Investigación y Conservación SL (SP) on October 29, 2010. The report was submitted on time, on December 2, 2010, and the results provide a very first correlation between the sea-surface temperature and the bluefin tuna spawning aggregation, demonstrating the possibility to develop (with multi-year data) a prediction model which might be very useful for both management purposes and biological studies (Annex 7c). The first examples of the outcome of the prediction model for detecting the areas with bluefin spawning aggregations is provided on figure 8 (June 2010) and figure 9 (July 2010).

The potentialities of these data elaborations for research and management purposes are considered very important, particularly if working on multi-year data sets, on additional oceanographic parameters and reefing the methodology year after year. The use of aerial survey data, the first fishery independent data which are available for the scientists, will become important for the assessment in the medium-time run, reducing the huge uncertainties induced by the actual fishery-dependent data sets.

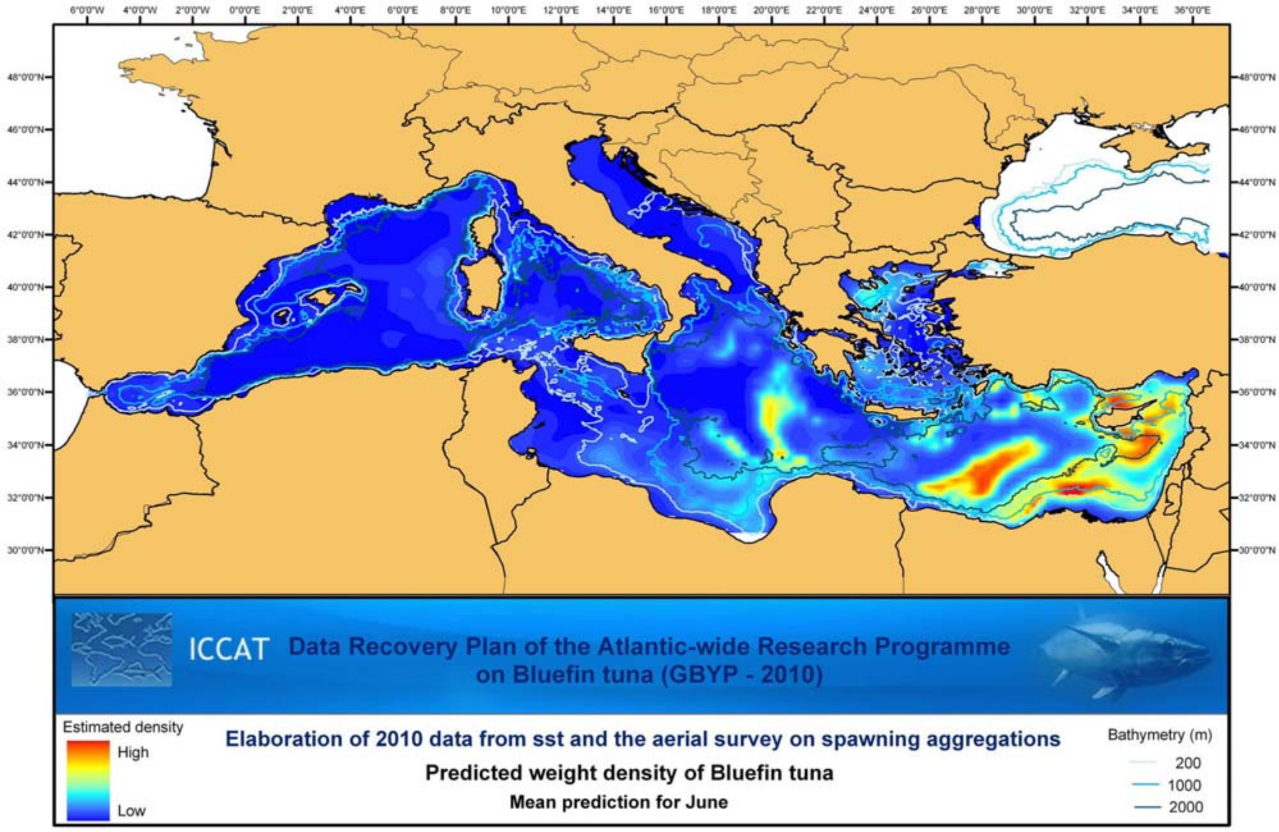

Figure 8 – Predicted density of bluefin tuna spawning aggregations in June 2010.

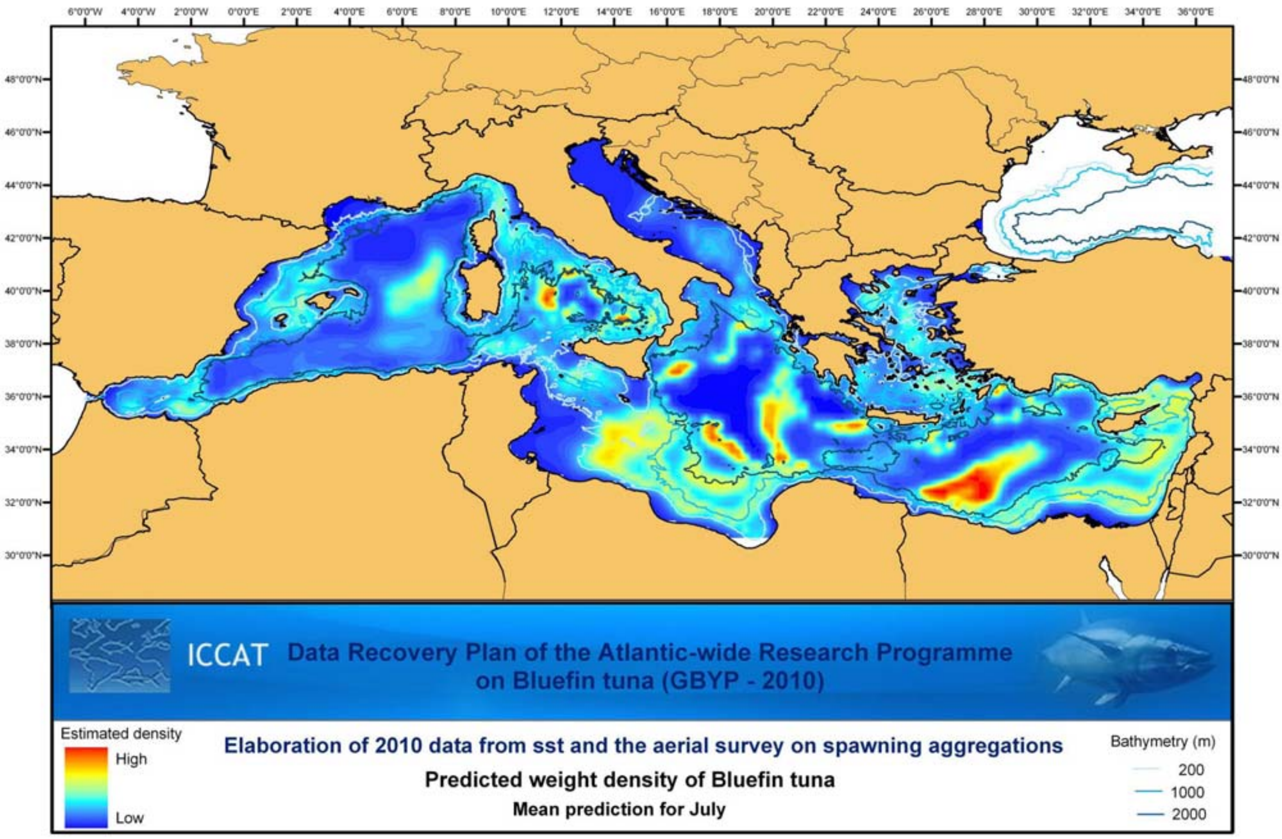

Figure 9 – Predicted density of bluefin tuna spawning aggregations in July 2010.

1.5 Tagging design

This item was largely discussed, at first at the Secretariat level, and then with the Steering Committee during the meetings and after an intense mail correspondence, because of the various possible option of tagging techniques and their different possible use for the assessment. At the end of the discussion, which was very useful in both scientific and practical terms, it was decided to release a Call for Tenders for the Tagging Design on July 26, 2010 (ICCAT Circular 3122/2010). Besides of the very large distribution of the Call, passed also to various national scientific networks, the ICCAT Secretariat received only one bid. The Steering Committee, during its meeting on September 4 and 5, 2010, in agreement with the ICCAT Secretariat and the GBYP Coordinator, asked the tender to modify the proposal, in order to get a tagging design limited to the Eastern Atlantic and the Mediterranean, for conventional tags and PITs (and electronic tagging in Phase 3), asking to verify the practical tagging possibilities with tuna trap owners and purse-seine fishermen, and including a manual for tagging. The official request to modify the offer, also taking into accounts the revised and reduced budget adopted by the Steering Committee, was delivered on September 14, 2010 and the revised offer arrived on September 24, 2010.

The contract was awarded to IEO (SP) on October 29, 2010 and the draft report was delivered before the original expiry date of GBYP Phase 1. The draft report was provided on time, but the Steering Committee asked for an extensive revision and for more detailed simulations, taking into account what was specifically required. The revised report was provided before the GBYP Operational Meeting on Tagging, held in Madrid on February 18, 2011 and completed by a SWOT analysis (Annex 8). This tagging design will be used for establishing the GBYP tagging activities in Phase 2 and as an important component of the TORs for the Call of tender to be released on this important issue.

This item is considered extremely relevant, because it should provide a better estimate of natural mortality rates (M) by age or age-groups and/or total mortality (Z); it should provide also updated tagging reporting rates by major fisheries and areas, and it should improve the knowledge on the habitat utilisation and movement patters of bluefin tuna in the various areas. The general objectives are to reduce the uncertainties. It shall provide the base to carry out the tagging activities in the following years, with important implications on the GBYP budget.

Table 1 - Summary status of the various items included in the first year activity of the GBYP

Item	Award date	deliverables		
	or contract date	Preliminary report	Draft final report	Final report
Aerial survey design	05/04/2010	-	22/04/2010	01/05/2010
Aerial survey on spawning aggregations (1 to 6)	29/04/2010	20/06/2010	03/09/2010	22/09/2010
Aerial survey on spawning aggregations (7 and 8)	24/06/2010		03/09/2010	22/09/2010
Data recovery (5 contracts)	30/07/2010	06/09/2010	27/09/2010	04/10/2010
Data recovery – Elaboration of Aerial Survey Data	06/08/2010	06/09/2010	27/09/2010	04/10/2010
Tagging Design	03/11/2010	-	12/12/2010	16/02/2011
Data recovery - Supply of SST data and maps	26/10/2010	01/11/2010	04/11/2010	26/11/2010
Data recovery - SST/Aerial Survey Data Elaboration	29/10/2010	-	02/12/2010	12/12/2010

1.6 GBYP web page

The ICCAT Secretariat, in agreement with the GBYP Coordinator, decided to include a GBYP dedicated page to the official ICCAT web page (http://www.iccat.int/GBYP/en/index.htm), with the purpose to provide full and transparent information about all the activities carried out by the GBYP and the products.

The page was set-up by the Secretariat staff and the contents are regularly provided by the GBYP Coordinator. The page is regularly updated.

2.0 GBYP Phase 2: Expected results and their use

The Atlantic-Wide Research Programme for Bluefin Tuna is planned as a medium period research programme, able to provide fishery independent data and fishery independent indices, improve the knowledge on bluefin tuna and also improve the stock assessment methods.

The actions in GBYP Phase 1 provided the necessary coordination start-up and a series of very precise inputs for the following parts of the multi-year programme, including the importance of prolonging some research activities for additional years (i.e.: the aerial surveys), with the purpose to get fishery independent reliable indices for the assessment. Phase 1 provided also a good overview of the several practical difficulties concerning a wide programme as GBYP is.

The important reduction of the original budget for Phase 2 imposed a revision of the original plan, which was faced and endorsed by the GBYP Steering Committee

The actions included in Phase 2 of the GBYP are a part of the whole, but able to provide in most of the cases several stand-alone results of the single actions, as agreed by the GBYP Steering Committee in 2010.

A – **Coordination**. This action shall ensure the regular implementing of the GBYP in the second year, including also the Steering Committee activities for guidance and refining, and the administrative duties. The coordination staff will be improved with an assistant (P2) and an administrative support (G2), with the purpose to deal with the huge number of duties in Phase 2.

B - The **data mining and data recovery** exercise should be able to provide additional data sets for the ICCAT data base, able to improve the available ones (a complete table is provided to tenders by the ICCAT Secretariat, in order to identify the existing gaps to be filled). The already available data in the ICCAT data base for bluefin tuna includes all data (Task I and Task II) officially reported by CPCs[1] and those data reported by SCRS scientists, revised and approved by SCRS; it also includes the new 180,000 additional data sets obtained by GBYP in Phase 1, related to historical data sets from Norway and the Bay of Biscay, and complete data sets from several Mediterranean artisanal fishing activities, plus completely new data from Senegal.

The objectives for data mining in Phase 2 will be searching for additional historical and detailed data for tuna traps, detailed data from artisanal fisheries (also trying to recover data on the fishery for juvenile tunas) and detailed tuna auction data, with the purpose to fill other gaps and to reduce the substitutions in the catch and size tables.

This action, after the Symposium on Tuna Trap Fishery, should also provide practical indications for the standardization of the CPUE for the trap fishery and the continuation of the analysis to correlate fishery independent data with oceanographic data, which will help improving the understanding of this stock. The final objective is to reduce the uncertainties in the analysis of fishery-dependent data, limiting the number of substitutions and improving the necessary substitutions with more reliable data sets.

C – The **aerial survey on bluefin tuna spawning aggregations** will be conducted with a refined design, taking into accounts the experience done in Phase 1 and the result of the Aerial Survey Workshop held in Madrid on February 14 to 16, 2011, and the following approval by the GBYP Steering Committee.

As a matter of fact, it is necessary to revise the design used in 2010, because Phase 1 was seriously affected by the denied flight permits in three subareas (sub-area 4 and 5, and two parts of sub-area 3) and then it was partly modified to include two new sub-areas (7 and 8); the revised aerial survey

[1] Those data include also all the data collected by EU member States within the Data Collection Framework programme (DCF in the previous years), officially annually reported to ICCAT by the EC. This fact will automatically avoid any possible duplication, because a detailed cross-check is provided by the ICCAT Secretariat before awarding any bid to tenders.

design will take into account the data from Phase 1 and the new information resulting from contacts with the CPCs concerned, regarding the possibility to obtain the flight permits in Phase 2[2].

The VMS data analysis, which was the base for defining the most relevant areas in Phase 1, was updated with the 2010 VMS data and this might imply to identify other possible sub-areas (alternative or additional) for the survey.

The revised design should also match the statistical needs with the available budged and the actualized costs. Furthermore, an analysis of the precision of the survey design used in 2010 and alternatives designs (e.g. based on oceanographic variables) was conducted in Phase 1. This was done in order to help evaluate how such a survey could be used to monitor the BFT recovery plan. For example how many years would it take to be able to detect a given change in the stock status.

These results will be also an important part of the modelling work, because the main goal of the survey is to provide fishery independent data and reduce the uncertainties in the models.

The current stock assessment and advice for bluefin tuna is based upon Adapt-VPA. A main assumption of Adapt VPA is that the catch data are known without error and that unbiased time series of Catch Per Unit Effort (CPUE) are available to calibrate the VPA. i.e. to help estimate numbers-at-age in the oldest age used in the VPA and the plus-group (i.e. all ages greater than the oldest true age) and in the most recent year. These terminal numbers-at-age are the most uncertain values in the VPA, but also the most important since for bluefin 60% of the spawning stock biomass is in the plus-group and current estimates are needed to agree on management. If the data are biased due to misreporting or changes in catches and fishing effort due to management then the estimates will highly uncertain.

An aerial survey by providing an unbiased estimate of the SSB is therefore essential in providing robust advice consistent with a precautionary approach. An aerial survey will also be an important component of alternative methods and management advice frameworks being developed under the GBYP.

The aerial survey planned in Phase 2 will provide data on bluefin tuna spawning aggregations in 2011 and these data will be necessary, over the years, to develop the fishery independent indices on the minimum spawning stock biomass.

This action includes also a short training course for the pilots, professional spotters and scientific spotters engaged in the GBYP aerial survey in Phase 2[3]. The training course is necessary to avoid some of the reporting problems encountered in Phase 1 and improve some techniques in a standard manner.

D – The **tagging** will be carried out following the design and the methodologies provided by the specific study conducted at the end of GBYP - Phase 1. The tagging activity will be limited to the Eastern Atlantic and Mediterranean, while tagging in the Western Atlantic will be conducted by the twin project running in the US and under the coordination of NOAA, in strict collaboration with GBYP. Also, as part of the tagging design, a detailed evaluation of how different tagging protocols and designs would provide data of use for stock assessment and management was delivered.

The results will be an important input to the modeling work.

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[2] The contacts were carried out officially by the ICCAT Secretariat, together with the GBYP Coordinator, and the very beginning of 2011, before the Workshop on Aerial Survey in February, with the purpose to identify the areas where it will be possible to obtain the flight permits for Phase 2. The current situation in several north-African CPCs is followed day-by-day by the GBYP Coordinator and the ICCAT Secretariat, and several emergency plans have been decided, with the purpose to be ready for all the various options.

[3] Due to the need to specifically identify the participants, the training course can be held only after the selection of the bids, awarded following the Call for Tenders for the Aerial Survey in 2011. The Call can be released only after obtaining the revised design of the aerial survey, which should be delivered after the Aerial Survey Workshop in February 2011. The Aerial Survey in 2011 is planned in June, due to the need for the selected Companies to obtain the flight permits and to avoid the possible instable weather conditions at the end of May; if possible and depending on the final agreed outputs of the Workshop, the survey will be anticipated to the last week of May only in sub-area 6. The Calls and the related selections will be accelerated as much as possible, with the purpose to provide more time for the preparation of the survey and to possibly slightly anticipate the training course, taking into account all the logistic constrains.

The main objectives of the ICCAT Atlantic-Wide Bluefin Tuna Research Programme (GBYP) are to improve (a) the understanding of key biological and ecological processes, (b) current assessment methodology, (c) the management procedures and (d) advice.

Key tasks are to reduce uncertainty in stock assessment and to provide robust management advice. This requires improved knowledge of key biological processes and parameters. However, currently almost all the data used in stock assessments are obtained from the fisheries-dependent data. It is therefore important to obtain data from alternative sources, such as tagging studies, in order to verify the assumptions made when conducting the assessments.

Many assumptions used in the previous assessments, such as stock structure and natural mortality, have been called into question by recent studies who suggest that bluefin have a complex population structure with genetic differences within the Mediterranean and central North Atlantic. The GBYP also includes an Aerial Survey and therefore knowledge about behavior that influences sighting probability, such as vertical habitat utilisation and movement between survey areas, is important when deriving indices of abundance. As well as mixing between the bluefin tuna management units, the existence of a meta-populations is an important issue to be considered. A well-designed tagging programme will therefore be important in improving our understanding of bluefin tuna ecology and ethology and for developing better stock assessment methods.

The specific objectives of the tagging design protocol are: a) Validation of the current stock status definitions for populations of bluefin tuna in the Atlantic and Mediterranean Sea. If the hypothesis of two stock units (eastern and western stocks) holds, the tagging design should provide estimates of mixing rates between stock units by area and time strata (ICCAT main area definitions and quarter at least). It is also important to consider possible sub-stock units and their mixing or population biomass exchange, particularly in the Mediterranean Sea. b) Estimate the natural mortality rates (M) of bluefin tuna populations by age or age-groups and or total mortality (Z). c) Estimate tagging reporting rates for conventional tags, by major fishery and area, using the observer programs currently deployed in the Mediterranean fisheries. d) Evaluate habitat utilization and movement patterns (spatio-temporal) of the spawning population within the Mediterranean Sea, with emphasis on: (i) vertical and horizontal distribution patterns of the spawning stock, to help calibrate the aerial surveys and estimate sighting probabilities; (ii) investigating how mature specimens use the spawning grounds (e.g., do bluefin tuna visit the same spawning grounds every year to the exclusion of all others, or do they visit several spawning sites and, if so, over what periods).

Awareness and communication activities should be able to improve the reporting and recovery rates. The reporting and recovery should be ensured by the network of ICCAT statistical correspondents in each CPC, by all the scientific Institutions concerned, by CPCs Fishing Authorities and by the fishers organizations, which will be contacted though a specific awareness activity.

Furthermore, this action will take advantage from the BFT Regional Observer Programme, because the observers will be used to detect and report tags found in cages during the harvesting; for this purpose, the GBYP will possibly participate to the observers training, providing them the necessary instructions or support.

The tagging will be conducted by conventional tags[4], tagging the maximum number of fish allowed by the dedicated budget, which should be over 5,000 specimens in Phase 2[5]. The tagging strategy was finally defined after the operative meeting on February 17, 2011 with all the interested scientists, and the Call for Tenders will be released immediately after the final adoption of the meeting report.

[4] The original tagging programme was including the deployment of a certain number of PIT tags. This part of the programme was recently suspended, due to the prohibition to export fish with PITs to Japan, which was communicated by the Japanese authorities to ICCAT-GBYP in February 2011.

[5] The total number of fish to be tagged with only conventional tags was set in 10,000 specimens in the original GBYP Programme, having a dedicated budget of Euro 2,455,000 in Phase 2. The revised budget for Phase 2 for tagging has a total of 1,000,000 Euro, including the conventional tags, the PITs tags, PITs readers and the all the supporting actions for reporting and recovery. Optimising the costs, it should be possible to tag a minimum of 5,000 specimens with conventional tags and a minimum of 200 specimens with PITs.

The results of this action should be in line with the number of fish indicated to be tagged and the tagging strategy and the recaptures will be used in the assessment models. Electronic tagging with satellite tags (PATs) was moved to Phase 3, but a limited satellite tagging activity should be possible conducted by external organizations through a MOU to be signed with ICCAT-GBYP at the beginning of Phase 2, making the results available for GBYP without any budget implication.

E – The **biological** (action E.1.1) and **genetic** (action E.2.1) **sampling** will provide the first set of important information concerning the age of the fish and their possible origin, and the fecundity status, basic elements for improving the inputs in the assessment models.

The sampling strategies were refined during the operative meeting held at the ICCAT Secretariat on February 18, 2010 (actions E.1.2 and E.2.2), with the participation of many interested scientists from the entire distribution area of Atlantic bluefin tuna and representatives of the industry and traps. A short-time contract will better refine the sampling scheme.

Sampling will be conducted mostly in the Eastern Atlantic and in the Mediterranean Sea, while sampling in the Western Atlantic will be conducted by the twin project running in the US, in strict contact with GBYP. The number of specimens to be sampled should be over 2000, but the definitive figure will be available only after the study[6] and the following approval by the GBYP Steering Committee.

The sampling should be further increased by taking advantage of the BFT Regional Observer Programme on cages and purse-seiners, but also sampling from traps catches. The cooperation of the tuna industry will be essential for this action.

The Calls for the biological sampling and the genetic sampling will be released immediately after defining the strategies and the following approval by the GBYP Steering Committee, ideally at the beginning of March 2011 (depending on the procedures agreed during the meeting).

F – The first round on **modeling approac**hes (action F.1) will provide the necessary guidelines for the Modeling trials to be conducted in the following Phases of the GBYP. The Workshop is not intended as a one-off exercise.

Initially, under the GBYP general programme, modeling was due to start in the 3rd year, however it was recognised that improvement of current modeling approaches needs to be integral part of the data collection and vice-versa. Therefore the date of the meeting was changed to the end of June so that sufficient time would be available to conduct intersessional modeling work. This work will be reviewed at the meeting in June, as part of the Working Group on Stock Assessment Methods, and depending upon the outcome of this review a future work plan modeling work plan will be agreed that will be reviewed again during the SCRS in October.

The work requires sub-contracts under the GBYP to do specific tasks (action F.2) and a Call for tender will be released at the beginning of March 2011. The modeling work will first identify the main sources of uncertainty and their impact on achieving management objectives. Then an evaluation will be conducted on how improved knowledge, scientific data collection, assessment methods and Monitoring, Surveillance and Control (MSC) will help achieve the management objectives.

This process will help drive the data collection parts of the GBYP, i.e. determining what data should be collected, what are the appropriate precision levels and how it should be analysed. The final outcome from the modeling work will be recommendations on the data needed for stock assessment, development of new assessment methods and improved advice on management plans. In order to focus this work it is suggested that a formal risk assessment be conducted and used to identify, assess, prioritise and manage risks in order to ensure that objectives are likely to be achieved consistent with the precautionary approach.

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[6] With the intention to avoid any possible duplication in sampling with the already ongoing activities of EU member States within the EC Data Collection Framework or other national programmes, the scientists should inform GBYP about the eventual biological data collection on bluefin tuna planned in 2011 and already funded from other sources different from GBYP. ICCAT-GBYP will be in touch with EC-D.G. MARE to coordinate efforts and avoid duplications. GBYP sampling, anyway, includes all ICCAT CPCs and many of them are not EU member States.

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Appendix 6

ICCAT GBYP ATLANTIC-WIDE BLUEFIN TUNA RESEARCH PROGRAMME 2010 ACTIVITY REPORT FOR 2009-2010

1. Introduction

The Atlantic-wide Bluefin Tuna Research was officially adopted by the SCRS and the Commission in 2008, after a long process. In 2003, as an input of the Working Group established by Rec. 02-11, the SCRS presented the Commission with a research plan to improve knowledge on bluefin tuna, with a special focus on mixing between the two stocks (ICCAT, 2004, Col. Vol. Sci. Pap.ICCAT, 56(3): 987-1003). The various research elements included in this first proposal are still pertinent today, even if some other activities have been included in the following years. During the Marrakech Commission meeting (2008), the SCRS chair met with all the scientists present at the meeting and a detailed proposal was forwarded to the Commission. The proposal was adopted by the Commission in plenary (ICCAT Report 2008-2009 (Part I), Vol. 1: p. 42) and resulted in a first official document, Res.08-06, which covered only the 2004 SCRS proposal but under a broader title. At the same time, the Commission approved the STACFAD Report (ICCAT Report 2008-2009 (Part I), Vol. 1: p. 42), which included the agreement to endorse the Atlantic-wide research programme (ICCAT Report 2008-2009, (Part I), Vol. 1, Appendix 10 to Annex 9: pp. 284-287), establishing three priorities in 2009 (Coordinator, data mining and aerial surveys), other action to be further discussed by SCRS in 2009 and the provision for the programme to be adjusted in the following years taking into account the evolution of its implementation and research needs. The total budget of the programme was estimated at about 19 million Euros in six years, with the engagement of the European Union and some other Contracting Parties to contribute to this programme in 2009 and in the following years.

The SCRS, in 2009, reviewed the updated research proposal submitted by the SCRS Chair, as it was discussed and presented to the Commission at its meeting in 2008 (ICCAT Report 2008-2009 (Part II), Vol. 1: p. 224 and ICCAT Report 2008-2009 (Part II), Vol. 2: pp. 223-224). The SCRS indicated the priorities identified in the 2008 document, as follows:

a) Improve basic data collection;
b) Improve understanding of key biological and ecological processes;
c) Improve assessment models and provision of scientific advice on stock status.

A number of Contracting Parties expressed a willingness to make extra-budgetary contributions to such a programme with a view towards initiation of activities in 2009 related to programme coordination, data mining, aerial surveys, and tagging design studies, with additional research activities to be undertaken in the following years. The first phase costs were set at 750,000 Euros and voluntary contributions sufficient to initiate the year 1 activities were jointly committed by the European Union (80%), United States, Japan, Canada, Norway, Croatia, Turkey and Chinese Taipei, while Morocco indicated its interest in future contributions. The provision to accept additional contributions from various entities and private institutions or companies was also agreed.

2. Coordination activities

The GBYP officially started on 12 October 2009, with the signature of the agreement between the European Community and the ICCAT Secretariat. The GBYP co-ordination full-time activity officially started on 3 March 2010, after hiring the Coordinator (Dr. Antonio Di Natale).

The very first period was devoted to set-up a detailed weekly workplan for 2010 and to organise the coordination structure at the Secretariat, The ICCAT Secretariat set up the administrative structure and the administrative rules were agreed and established, accordingly with the ICCAT system and taking into account the GBYP administrative needs.

During the 1st Phase of the GBYP, the Coordinator participated officially in 15 meetings in various countries. Furthermore, the GBYP Coordinator is providing scientific support to all the national initiatives which are potentially able to increase the effectiveness of the GBYP and its objectives. For this reason, the Steering Committee recommended cooperating with the program on bluefin tuna developed by the NOAA.

The detailed report is available on SCRS/2010/135.

3. Steering Committee

The GBYP Steering Committee was nominated on March 13, 2010; the members are the SCRS Chair (Dr. Gerald Scott), the BFT-W Rapporteur (Dr. Clay Porch), the BFT-E Rapporteur (Dr. Jean-Marc Fromentin), the ICCAT Executive Secretary (Mr. Driss Meski), and an external expert (Dr. Tom Polacheck), who kindly accepted this duty.

The Steering Committee's activities included continuous and constant e-mail contacts with the GBYP Coordinator, who provided all the necessary information. The Steering Committee held various meetings (23-24 April 2010; 19 June 2010; 4-5 September 2010; 10-11-12 September 2010; and 30 September 2010) to discuss various aspects of the programme, providing guidance and opinions. During the first two meetings in September, the Steering Committee also provided the detailed plans for Phase 2 and Phase 3 of the GBYP, under two different scenarios, a budget according to the original figure and a reduced minimum budget.

4. Aerial surveys

The aerial surveys have the scope to provide fishery independent indices, concerning various components of the stock. The aerial surveys targeting spawning aggregations can potentially provide trends and indices for the spawning stock biomass, while aerial surveys targeting aggregations of juveniles can potentially provide indices for recruitment. Surveys will be conducted with a statistically sound design and for several years in order to get reliable indices.

The budget available (300,000 Euros) for the first phase was not enough to cover all areas and all needs (spawning aggregations and juvenile aggregations) and then it was decided to concentrate all efforts and resources only on bluefin tuna spawning aggregations.

4.1 Aerial survey design

The preliminary work was devoted to identifying the most relevant areas and this was carried out at the ICCAT Secretariat using the 2008 and 2009 VMS data from purse seine vessels. It was agreed to concentrate efforts only on areas where the purse seine fishing activity was more intense in these last two years and 6 sub-areas were identified.

The study for the aerial survey was awarded to a well-known specialist, who provided a detailed design, which is statistically sound and able to balance the available funds with the flight hours required. After two revisions, the design was provided on 1 May 2010 and the ICCAT Secretariat provided the file to submit the survey data.

4.2 Aerial survey on spawning aggregations

The aerial survey on spawning aggregations was carried out by three companies, selected from among seven tenders and the contracts were discussed and agreed from 11 to 13 May 2010. All tenders were able to obtain flight permits from Spain, Italy, Malta, Cyprus and Turkey in due time, but it was not possible to obtain flight permits from Libya and Tunisia, while the permit from Egypt was changed and withdrawn when the aircraft entered Egyptian airspace. All these problems imposed a revision of the contracts and, at the same time, a revision of the aerial sampling design. The aerial survey started on May 24 and ended on August 3.

Two sub-areas were cancelled and another was reduced, creating a serious problem for the survey in general, because the biological information on bluefin tuna spawning and behaviour in these areas was almost non-existent. In agreement with the Steering Committee, it was decided to define two additional sub-areas, where fishing activity on spawners was present in 2008 and 2009, providing in the emergency a new aerial survey design for those new sub-areas and amending one contract accordingly.

The monitoring of the sea surface temperatures and sea state and winds was carried out by the Coordinator and data were provided to the various teams in real time. The unfavourable weather conditions and the cold water temperatures in spring 2010 created additional operational problems for the aerial survey, prolonging the time required to fulfil the necessary flight time. A delay in bluefin tuna spawning activities was noticed in several sub-areas. Five aircraft and teams conducted the surveys in the various sub-areas. The aerial survey data have been provided on schedule by all teams and the individual reports are already available.

A contract was granted to a company on 6 August 2010 to analyse the aerial survey data. The report was provided in due time (27 September 2010) and the results are considered very useful for improving the aerial survey activities in the following years. This first year's aerial survey activity is considered essential and extremely useful to better plan and refine the next aerial surveys, including the necessary preliminary official contacts with all CPCs interested in the aerial survey activities, in order to inform the local Authorities and to obtain the flight permits on time.

5. Data mining and data recovery

The first preliminary activity was conducted at the ICCAT Secretariat. An analysis of the ICCAT database on bluefin tuna was carried out for the purpose of identifying the most relevant gaps in the data series which are potentially useful for the stock assessment. This gap analysis was provided by the GBYP to the SCRS scientists and national statistical correspondents to help them in detecting the missing data.

Three Calls for Tenders were issued on this item and five contracts were awarded on 30 July 2010 to various entities, public and private. The various proposed data sets, actually missing from the bluefin tuna database, concern about 180,000 specimens and a wide range of years and gears, and should improve knowledge on several fisheries in various areas. A common format for transmitting the data to the ICCAT Secretariat was provided to all the contractors, with the purpose to obtaining the data "ready to use" and in a format allowing their immediate incorporation in the bluefin tuna database. Many data sets have been already provided to the GBYP on due time. The final report must be submitted by 4 October 2010.

Sea surface temperature data sets will be acquired, to allow various type of analysis, either for VMS or aerial survey data.

6. Tagging design

This item is considered extremely relevant because it should provide a better estimate of natural mortality rates (M) by age or age-groups and/or total mortality (Z). It should provide also updated tagging reporting rates by major fisheries and areas, and it should improve the knowledge on habitat utilisation and movement patters of bluefin tuna in the various areas. It will provide the base to carry out the tagging activities in the following years, with important implications on the GBYP budget. This item was largely discussed, at first at the Secretariat level, and then with the Steering Committee, because of the various possible options of tagging techniques and their different possible uses for the assessment. At the end of the discussion, a Call for Tender was issued on 26 July 2010 and a single bid was received. The Steering Committee (4-5 September 2010, in agreement with the ICCAT Secretariat and the GBYP Coordinator) asked the tender to modify the proposal, in order to obtain a tagging design limited to the eastern Atlantic and Mediterranean, for conventional tags and PITs (and electronic tagging in Phase 3), and to verify the practical tagging possibilities with tuna trap owners and purse seine fishermen, and including a manual for tagging. The official request to modify the offer, also taking into account the revised and reduced budget adopted by the Steering Committee, was delivered on 14 September 2010 and the revised offer arrived on 24 September 2010 and is now under examination.

7. Definition of GBYP publication policy, editorial and data rules

The need to have a clear and defined publication policy, along with editorial and data use rules, was one the first issues undertaken within the GBYP coordination. Discussion was carried out at the Secretariat level, taking into account the ICCAT rules in this sector and the SCRS statements, and the final document was officially adopted on 15 March 2010.

8. GBYP web page

It has been agreed that the ICCAT Secretariat would add a GBYP page to the official ICCAT web page, for the purpose of providing full and transparent information about all the activities carried out by the GBYP. This page will be updated regularly.

9. Following activities

The next phases of the Atlantic-Wide Research Programme for Bluefin Tuna will only include activities able to provide fishery-independent data and indices within the time-frame of the overall programme and in agreement with the GBYP general plan adopted by the SCRS and the Commission. Due to the limited budget available for Phase 2 (2010-2011) some activities already included in the original general planning have been temporarily excluded (i.e., egg and larval survey, intercalibration of aerial surveys), others have been delayed (i.e., electronic tagging), while others (i.e., conventional and PITs tagging) have been considerably reduced. The Steering Committee agreed to keep only the activities already initiated or absolutely essential for the programme, but confirmed the need to follow the original list and volume of activities whenever appropriate funds are available. For this reason, GBYP Phase 2 is considered a contingency minimal programme, while a similar strategy is temporarely planned for Phase 3.

GBYP Phase 2 (under the reduced minimum budget perspective) will include the following activities:

1) **Coordination**, reinforcing the coordination team with two additional staff (1 G2.1 and 1 P2), due to the workload and with contracts for the external members of the Steering Committee.
2) **Data mining, data retrieval and data elaboration**, including data collection on juveniles from small-scale and recreational fisheries, elaboration of VMS, environmental and aerial survey data, and a symposium on tuna trap data issues.
3) **Aerial surveys,** including a workshop to refine the activity, the revision of the aerial survey design, a training course for pilots, spotters and observers, and the 2nd year survey on spawning aggregations.
4) **Tagging**, including conventional and PITs tagging and activities to improve tag reporting and tag recovery, with related rewards.
5) **Biological sampling**, including hard parts sampling for ageing and micro-constituent analysis, genetic sampling and related analysis.
6) **Modelling**, only including a workshop on modelling approaches.

GBYP Phase 3 (still temporarily under the reduced minimum budget perspective) will include the following activities:

1) **Coordination.**
2) **Data mining, data retrieval and data elaboration**, including data collection on juveniles from small scale and recreational fisheries, elaboration of VMS, environmental and aerial survey data.
3) **Aerial surveys,** including the up-dating of the aerial survey design and the 3rd year survey on spawning aggregations.
4) **Tagging**, including conventional and PITs tagging, a limited electronic tagging and activities to improve tag reporting and tag recovery, with related rewards.
5) **Biological sampling**, including hard parts sampling for ageing and micro-constituent analysis, genetic sampling and related analysis.
6) **Modelling,** including modelling trials.

The GBYP Phase 3 budget and activities will be revised by the Steering Committee and SCRS in the last part of Phase 2, according to the updated budget perspectives and the research needs.

The provisional calendar for the meetings is as follows:

- Symposium on Tuna Trap Fishery and Data Standardisation: May 2011 (in Italy, Morocco or Spain, 3 days);
- Training course for aerial survey staff: May 2011 (ICCAT Secretariat, 2 days)
- Modelling Workshop: July 2011 (ICCAT Secretariat, 5 days).

Table 1. GBYP budget in Phase 1 (2009-2010).

Contributors	*Amount (€)*	*Allocation*	*Amount (€)*
European Union	600,000.00	Coordination	210,000.00
United States	71,200.00	Data mining and data recovery	200,000.00
Turkey	22,500.00	Aerial survey	300,000.00
Norway	20,000.00	Conventional tagging design	40,000.00
Canada	15,000.00	Total	**750,000.00**
Japan	10,000.00		
Croatia	7,000.00		
Chinese Taipei	3,000.00		
ICCAT Secretariat	1,300.00		
Total	**750,000.00**		

Table 2. GBYP reduced minimum budget for Phase 2 (2010-2011) and Phase 3 (2011-2012).

GBYP PHASE 2 (2010-2011)		***GBYP PHASE 3 (2011-2012)***	
Allocation	*Amount (€)*	*Allocation*	*Amount (€)*
Coordination	443,000.00	Coordination	448,980.00
Data mining, data recovery, data elaboration, trap symposium	149,000.00	Data mining, data recovery, data elaboration	123,000.00
Aerial survey (including updating design, workshop and training course)	465,000.00	Aerial survey (including updating design)	404,080.00
Tagging (conventional, PITs, tag recovery and reporting, rewards)	890,000.00	Tagging (conventional, PITs, PATs, tag recovery and reporting, rewards)	965,000.00
Biological sampling (including hard parts, genetic sampling and analysis)	505,000.00	Biological sampling (including hard parts, genetic sampling and analysis)	490,000.00
Modelling (workshop)	40,000.00	Modelling trials	90,000.00
Contingencies	10,000.00	Contingencies	13,000.00
Total	**2,502,000.00**	Total	**2,534,060.00**

GBYP STEERING COMMITTEE MEETING
Madrid 4-5 September 2010
MEETING REPORT

The GBYP Steering Committee meeting was held at the ICCAT Secretariat on 4 and 5 September 2010, with the participation of Dr. Driss Meski, Dr. Tom Polacheck, Dr. Gerald Scott and Dr. Antonio Di Natale (GBYP Coordinator). Dr. Laurence Kell and Dr. Mauricio Ortiz (ICCAT Secretariat) have been invited to the meeting. Dr. Clay Porch joined the Steering Committee on 5 September in the evening.
Dr. Meski was nominated chair of the meeting and he welcomed all the participants. After a short introduction, the Agenda was approved (GBYP-2010 Annex 1) and the Coordinator was invited to present his report on the activities carried out in 2010.

1. Summary and Revision of the activities in 2010

1.1 Coordination activity – Review of the project activities and procedures

The Coordinator provided a summary report of all the activities carried out so far, including the followings:

a) Coordination activity (internal organization, meetings, monitoring);
b) Aerial Survey (aerial survey design, emergency adaptation, aerial survey activities, total cost).
c) Data Recovery (first call for data recovery, second call for data recovery, third call for aerial survey data elaboration, fourth call for west Atlantic data recovery, total cost).
d) Tagging design advancement (details and cost);
e) Steering Committee meetings.

The detailed report is attached as GBYP-2010 Annex 2.

1.2 Definition of the GBYP Publication Policy, Editorial and Data Use Rules.

The Coordinator presented the GBYP Publication Policy, Editorial and Data Use Rules (GBYP-2010 Annex 3) officially adopted on March 15, 2010, which are also in agreement with the ICCAT publication rules already enforced and which take into account the scientific needs of the Programme.

1.3 Budget implementation

The Coordinator presented the pre-closing budget at September 3, 2010, which takes into account the incomes (contributions and extra incomes), all the costs already paid and the cost engagement till October 2010 (GBYP-2010 Annex 4).

The Steering Committee discussed in details all the activities carried out since the beginning of the GBYP activities, expressing its appreciation for the strong support provided by the ICCAT Secretariat and the Coordinator's extensive efforts in completing all the activities included in this first year program besides of the very short time available and the various operational difficulties.

The Steering Committee discussed in some detail the aerial survey design with particular focus on ensuring that design is robust to future changes in the spatial distribution of spawning aggregations as a result of environmental variability and increases in the spawning biomass. The Steering Committee emphasized that in its view that the primary objective of the aerial survey is to provide a long term relative index of the spawning stock that can be used in the stock assessment. The Steering Committee noted that it had previously expressed it view that the first year survey needed to be considered as pilot one, which would provide important data for refining the original design and that experience from other fisheries indicated that developing a stable and robust design often required several years. In this regard, it is critical to ensure to the extent possible that any large changes in the index in the future reflects actual changes in abundance and not simply large shifts to or from areas in which no survey is occurring. The Steering Committee recommended that the spatial coverage used in the first year survey be reviewed to ensure that it was adequate to provide a long term robust index. It expressed its view that consideration should be given to the trade-off between enlarging the survey areas and/or the number of areas to improve robustness and decreasing effort in each area by either increasing distances between tracks or decreasing the number of replicates. It was decided to better examine the data from this first year trials as soon as they will be elaborated and available and then evaluate the various design options. This would allow for an examination of the potential bias/variance trade off between the total area surveyed and the precision (CV) of the estimates from reduced effort in each area, The Steering Committee also recommended consulting with specialists in aerial surveys design around the world to further improve the survey in the future. The further details for the near future were discussed under a different item of the agenda.

The Steering Committee noted with regrets the problems created by the lack of cooperation for the aerial survey. The Steering Committee strongly supports the need to propose a recommendation to SCRS and the Commission for CPCs to more actively support and cooperate with the GBYP, with the purpose to limit as much as possible the practical problems encountered during the first year. It recommended that both the ICCAT Executive Secretary and the GBYP Coordinator continue to work together to inform CPCs about the research needs and make the necessary arrangements at the beginning of the year.

As concerns the tagging design, the Steering Committee, after having examined the only bid presented, decided to invite the tender to discuss about possible modifications of the proposal, and that it should be limited to conventional and PIT tagging in the Eastern Atlantic and the Mediterranean. This reflects the need to prioritize the tagging activies in light of the objectives of the GBFY taking into account funding constrains in 2011. The electronic tagging will be included for 2012 if the budget permits. The Steering Committee will also propose the tender to include in the offer the organizations of two 1-day workshops with the major tuna trap owners and tuna purse seiner companies, with the purpose to identify the best possible strategies for tagging, particularly large fish. The tender should also include consultation (possibly through a workshop) with tagging experts on what would be the best and most feasible approach for actually inserting the tags on large fish that were to be released from purse seiners or tuna traps. The tender should also include the provision of a tagging manual of the proposed procedures to be used for tagging and release of fish from the three gear types (bait boat, purse seiener and traps) and for different size fish. Discussions with the proposer were held on 8 September in Madrid. It was the opinion of the Steering Committee that the actual US BFT Programme could cover the needs for the Western Atlantic, while the electronic tagging will be discussed under a different item of this agenda. The Steering Committee recommends a strict collaboration between GBYP and the US BFT Program, in order to get the best possible results.

The Steering Committee also examined the unsolicited proposal for a detailed growth study of juvenile bluefin tuna in Malta. The Steering Committee appreciated the high percentage of contribution by the industry in the proposal. The Steering Committee decided to take the opportunity of the presence of the responsible of this proposal during the following bluefin tuna assessment meeting to meet him and discuss the proposal with the purpose to get a broader view of bluefin tuna growth rates in cages and possibly to release tagged fish including ones with PIT tags.

The Steering Committee also requested the GBYP Coordinator to make a presentation of the Programme also during the Bluefin Tuna Assessment meeting.

2. Status of the GBYP – Review of General Planning

2.1 Discussion

The Steering Committee considers that the GBYP general planning for the first year was strictly followed and expressed its satisfaction with the large amount of work accomplished so far. The Steering Committee noted that the GBYP is multi-year programme and the potential value of the data to be obtained is dependent upon continuity in the activies over its multi-year time span. The Steering Committee discussed the implications of the uncertain situation of the multi-year budget of the GBYP coming out from the different figures available in various documents (particularly the detailed document prepared for the Commission meeting Marrakesh in 2008 and the presentation by SCRS chair to STACFAD in 2009). The Steering Committee recommends that the ICCAT Secretariat as a matter of urgency issue a circular to all CPCs, reminding the GBYP agreed needs and asking for a clear identification of the contribution to be expected from each CPCs concerned. This information is crucial for planning of effective future activities and effective utilization of the funds received.

The Steering Committee also stresses the fact that the ICCAT observers have critical role in the long term success of the program, particularly with respect to the estimation of tag reporting rates and improving the overall return of rate of tags from recaptured fish. The observers also have a potentially important role in the collection of biological samples for the GBYP. The Steering Committee recommended that the ICCAT Secretariat explore the possibility of improving the operational part of the observer's contract with MRAGG, taking into account these needs. It was also recognized that direct liason between the observers and the individual coordinating the tagging and biological sampling aspects of the GBYP is important both to ensure consistency in the information collected and to ensure that the objectives and needs of the program are appreciated by the observers.

2.2 Priorities and functions of the Steering Committee

The discussion about the priorities and functions of the Steering Committee were mostly focused based on the experience from the first year of activity. The Steering Committee was very helpful in more precisely focus all the various issue and was essential for several decisions to be taken. At the same time, it is clear that it is not always possible to communicate with everybody, because of the various activities carried out by the members. It was decided that it should be likely to pay for the time and for the engagement and this will constitute an additional budget item within the Coordination. At the same time, it was decided to propose the Commission to have a larger Steering Committee, including two external members, to improve the functionality, taking into account more broad views and experiences.

Dr Polacaheck advised the Steering Committee that personal commitment meant that he was likely to be frequently be unavailable to communicate and make contributions to the work of the Steering Committee during the next year. As such, he considered it would be better for the GBYP to replace him, although he was still willing to have an advisory role in the committee, if this was deemed useful.

2.3 Contacts and agreements with other CPCs or entities

The Steering Committee confirmed the need to enlarge the cooperation with other CPCs, entities, industry and NGOs, with the purpose to have a larger cooperation and support of the GBYP activities. It encouraged the GBYP Coordinator to increase the number of contacts and propose possible MOUs with industries and NGOs interested in cooperating and contributing to the GBYP, either with funds or in kind support.

Planning of activities for 2011-2012

Being aware of a possible substantial budget reduction for 2011, the Steering Committee used a reduced budget figure for planning the GBYP activities in 2011, but maintained a total budget figure for the period 2011-2012 close to the budget presented top STACFAD in 2009.

a) **Coordination**

The Steering Committee, on the basis of the activities already carried out and taking into account the increasing activities in the following years, concluded that there was a need for more support for coordination.

a1) need for support staff (TORs)

After this first year of the GBYP activity, it is clear that the amount of working time required by the various activities is much higher than the total working time of the Coordinator, in particular due to administrative activities (preparation of the contracts, controls, administrative correspondence, etc.). The ICCAT Secretariat is currently covering the internal administration duties (secretariat, registrations, accountability, translations, publication of Calls for tenders on the web page, preliminary data analysis to support the Call, etc.), but the administrative activities proper of the GBYP require a further support, particularly in view of the following years developments. The Steering Committee recommended hiring an administrative support (G2-1), because of the administration duties and the need to help the coordinator in several bureaucratic duties.

The Steering Committee also recommended hiring two new professional figures to support the growing scientific activities and to ensure a constant monitoring and reporting of the main research activities. The professionals to be hired should be a P1 (mostly for the aerial survey monitoring and for helping in improving the tag reporting) and a P2 (mostly for monitoring the tagging activities and the biological sampling).

Furthermore, a lump sum for the two external members of the Steering Committee shall be included in the budget, together with increased costs for travels and for the logistic needs of the support staff. The Secretariat overhead shall be increased considerably, taking into account the total budget and the translations and secretary increasing workload caused by the GBYP.

a2) budget

The budget for Coordination is Euro 586,075.00 (including G2, P1&P2 salaries and Steering Committee allowances) in 2011 and 592,696.50 Euro (including G2, P1&P2 salaries and Steering Committee allowances) in 2012

b) **Aerial Survey**

b1) Objectives: survey on spawners only or also on aggregations of juveniles?

The first aerial survey (2010) was conducted only on spawning aggregations. The Steering Committee recommended that the surveys should continue for the following years concentrating on spawning aggregations, with the purpose to develop a long tern index of the spawning biomass/abundance for use in the stock assessment. Based on experience in other fora with aerial surveys and problems associated with the fact that only an unknown fraction of the fish are likely to be detectable when surveying, the Steering Committee considered that the aerial survey was unable to produce reliable estimates of total abundance and that estimates of minimun absolute abundance would unlikely be informative. The Steering Committee noted that it is important to have clarity on the objective of the survey in terms of relative or absolute abundance as this has large implications for the survey design. The Steering Committee discussed the following general questions:

i. Should the aerial surveys be conducted also on juvenile aggregations? However, this would entail substantial increases in costs and it was not specified in the general Programme. There are also additional methodological and design complications in being able to develop a meaningful aerial survey for juvenile. For these reasons, the Steering Committee did not recommend that the aerial survey be extended to cover juveniles, particularly in light of the limitations in funding. It noted that some countries are requesting funds from other sources to carry out surveys on juvenile aggregations.

ii. Should aerial surveys be extended to the Gulf of Mexico spawning grounds? They are included in the Programme approved in Marrakech, but the current budget is limited. The Steering Committee considered that such surveys were of lower priority then other activities planned given the overall objectives of the GBYP. Such surveys may be eventually conducted in 2011 and 2012 under the US BFT budget, possibly in strict collaboration with GBYP.

The Steering Committee recommended that future aerial surveys should continue to focus on spawners aggregations, leaving CPCs the freedom to complementary conduct aerial surveys on juveniles or adult surveys in additional areas.

b2) survey strategy and importance of the two alternatives in terms of timing of the survey: having simultaneous surveys in all areas or having area dependent time periods. ?

The Steering Committee discussed about the alternative possibilities. There are arguments both in favour and against. Having good environmental data series that can be used to define spawning periods is important for being able to define area dependent time periods. Also information on the extent that individual fish move between spawning areas is important if an area time dependent approach were to be adopted. Otherwise, a common period should be defined taking into account the total period of spawning in all of the areas to develop a robust design.

b3) intercalibration: specifications.

The Steering Committee noted that in aerial surveys for developing relative abundance indices it is important to be able to standardized the results from different areas and survey platforms for observer and plane effects related to school size and fish size estimates and sighting efficiencies. In terms of sighting efficiency, the main issue in terms of the application of line transect theory to the aerial survey sighting data is differences in probability of detecting schools directly on the trackline (the g(0) estimate). This is both dependent upon the characteristics of the plane and differences in observer ability. The Steering Committee noted that this is one reason to attempt to utilize only a single type of aircraft, if possible. Further, planes with a propeller at the front of the plane can be problematical because of the problem in detecting schools in front of the plane. Use of such planes should be avoided if at all possible.

The Steering Committee had decided not to carry out the intercalibration exercise for such purposes in the first year because of the short timeframe available for develop and implement the survey. Instead it recommended that such calibration experiments be conducted in 2011. This involves bring all aircrafts and observers involved in the survey in the same place so that direct comparisons of the estimates of school size and fish size can be made on the same schools by the various observers and the pilots. The problem of how to conduct calibration experiments for differences in sighting efficiencies is a more difficult one to design and needs to be developed and implemented if possible.

The Steering Committee decided to support the Coordinator's request to organize a 2 days training course at the ICCAT Secretariat before the 2011 survey, to improve the consistency among all the staff in implementing the survey protocols. The Steering Committee also recommended hiring a professional figure (P1) within the GBYP Coordination staff to help ensure the consistency of the survey implementation in the various areas. This should involve direct monitoring of the field activities. This includes participating in some flights of each of the survey teams during the course of the annual survey as well as frequent liasoning with the survey personal in terms of implementation issues. The budget for this professional figure is included in the Coordination one.

b4) need to meet some CPCs for preliminary information and agreements

The Steering Committee recognized the need for the ICCAT Executive Secretary and the GBYP Coordinator to hold dedicated meetings well in advance of the surveys and on site with the CPCs in which the surveys are to be conducted and the local Fishery, Civil Aviation and Military Authorities to explain the permit necessities and the scope of the GBYP. It was recommended to provide opportunities for a direct participation in the aerial surveys for local scientists. A recommendation will be forwarded to SCRS and the Commission for providing the necessary support.

b5) issues of secondary sightings

The Steering Committee noted that the occurrence of secondary sightings (i.e. schools that are detected after the plane left the trackline to confirm the sighting as adult bluefin and estimate the quantity and size of fish) was common in some of the areas. The number detected could constitute a significant percentage of the total sightings and biomass detected during the survey and this percentage is likely to increase if the spawning stock increases. The Steering Committee noted that how best to deal with these secondary sightings both in terms of the data collection and their incorporation into the overall index is not a straightforward problem. However, it is important that standardized protocols be developed for distinguishing primary and secondary sightings during the surveys. The question of secondary sightings is one question that should be considered by the Workshop proposed under b7 below.

b6) use of an adaptive survey design

As discussed above, two issues with the survey are that the timing and location of spawning in the Mediterranean can vary among years depending upon environmental and other unknown factors and that spawning schools can be highly aggregated. The Steering Committee considered two possible “adaptive” survey strategies for dealing with these issues. The first was having an adaptive time/area window for the survey which would be determined each year based on available environmental data at the beginning of the earliest date for a survey (e.g. wait until the surface temperature was above a certain level in a specified percentage of the total area to be survey). The other alternative would be to conduct the survey as a truly adaptive survey in which the amount of survey effort was re-allocated during the course of the survey to allow for the concentration of effort in the higher density areas while ensuring a wide overall coverage. The Steering Committee recommended that consideration should be given to both of these but this needs to be done taking into account the underlying assumptions and ensuring that such designs would be able to provide a robust long term index. The Coordinator mentioned the issue of the difficulty in terms of contracts and flight permits for this adaptive survey design. The Steering Committee considered that this question should be considered by the proposed Workshop in b8 below.

b7) need to adapt the survey design

As noted above, the Steering Committee considered that the first year’s survey to be in many ways a pilot experiment and that there was a need to modify the design based on the information gained in the first year experiment. The Steering Committee considered that the first year survey was successful in this regard and what was learned from the first year experience provides a good opportunity to improve the design. The Steering Committee underlined the importance of ensuring that the design was robust to fluctuations in spatial and temporal distribution of spawning. Consideration needs to be given to enlarging the areas and to find the best balance between the total flight time allowed for by the budget and the number of replicates and the distance between transects. The Steering Committee recommendede the GBYP Coordinator to organize a workshop between late January and early February 2011 to improve the current survey design, taking into account the 2010 results and with the focus on a design that is robust for the long term detection of changes in abundance. Prior to the workshop, analyses should be prepared on long term variability in the environmental conditions in the Mediterranean during the spawning season and, for this reason, it was recommended to immediately acquire at least surface temperature data in the last ten years, in a format which is compatible with a GIS software. Additional, calculations should be preformed on how the CV of the survey indices are likely to be effected by changing the distance between transects and the number of replicates based on the data collected during the first year’s survey. The GBYP recommended that these analyses by conducted by the contractor in charge of analyzing the aerial survey data The Steering Committee also recommended the design workshop include both individuals with first hand knowledge of aerial sighting of adults in the Mediterranean and experts in the design, implementation and analysis of line transect aerial surveys.

b8) budget

The budget for the aerial survey in 2010 was clearly not sufficient to cover the full need of the survey design and the survey design itself was not included. The budget was increased taking into account the major cost of fuel and flight hour occurred in the first year. The budget figures are 605,000.00 Euros for 2011 (including intercalibration, workshop and training course) and 463,080.00 Euros in 2012.

c) Tagging strategy

c1) objectives and alternative strategies

The tagging activities are considered among the most important of the GBYP as well designed and implemented tagging experiments can provide direct estimates of fishing, natural, mixing and/or abundance for incorporation into the stock assessments. The Steering Committee was aware that the time constrains of the first year were a strong limit for advertising the call for the tagging design and that now is necessary to restudy the tagging strategy. Without a serious and parallel activity to improve the tagging recovery rate and allow for the estimation of reporting rates from at least the major fisheries, even the best possible design will not be able to provide quantitative estimates of mortality, mixing and/or abundance. The Steering Committee endorsed the Coordinator's proposal to include the communication and awareness strategy within the overall design of the tagging experiment. The Steering Committee emphasised the importance of having ICCAT observers in each farm cage and scientific observers in traditional trap at the times of harvest because these observers provide the best opportunity for a complete monitoring of the catches in terms of tag recovery and thus for estimation of reporting rates for a large fraction of the current catches.. The rewards to be provided for return of tags needs careful consideration with suitable adaptation depending on on the local situations. The purpose of the rewards is to provide sufficient incentive to ensure high reporting rates. The Steering Committee noted the importance of direct contact with fishermen and the quick provision of reward for motivating them to return tags. The Steering Committee recommended that an individual (P2) with previous experience in tagging experiments be included in the coordination part of the GBYP whose primary responsibility would be to undertake the required liason work for tag recovery activities. The activity of this person, who will act in strict contact with the GBYP Coordinator, would also entail liason activity with the ICCAT observers in the farms and traps with respect to data collection required for the tagging experiments. The work of this scientist would entail extensive travel in various countries and the development of the local contacts to improve the reporting system.

c2) conventional tagging strategy (juveniles, pre-spawners, spawners)

The Steering Committee recommended as discussed above that the tagging experiments focus mostly on conventional and PIT tagging in the Eastern Atlantic and the Mediterranean. Ideally the tagging should attempt to cover all the different age classes and conditions, possibly taking advantage also of available fish in traps to be released because of the quota and availability of purse seiners for tagging fish after the close of the fishing season. For smaller fish, pole and line techniques are well known to provide an efficient method with minimal tagging related mortality. With respect to the tagging of large fish, the Steering Committee noted the procedures and methods for the efficient tagging of large number of individuals with conventional and/or PIT tags are not well developed. Developing appropriated techniques will be an important part of the current reseach program. The Steering Committee recognized the importance of have an individual with extensive knowledge of tuna tagging having the role to monitor the implementation of the tag release component of the tagging experiment according to the agreed protocols and recommended that such a person (P2) be recruited as part of the coordination activities of the GBYP.

c3) pop-up tagging strategy

Pop-up tagging was originally planned for the second year of the GBYP. The Steering Committee noted that pop-up tags are still presenting several technological limits and the success rate is still low. This is particularly true with respect to achieving long term attachments, which are important relative to the main objectives of the GBYP. Also, the GBYP is facing budget constraints in the second year. For these reasons, the Steering Committee recommended delaying deployment of electronic tags to the third year of GBYP (2012), contingent on sufficient funds be available.

c4) implanted archival tagging

The Steering Committee decided not to recommend the implanted archival tagging at this stage due to budget constraints, low return rates and the potential data they can provide relative to the main objectives of the program during its life.

c5) PIT tagging strategy

The Steering Committee discussed the possibilities and additional information coming from the PIT technology and noted that that further developments might be necessary. It strongly recommended that the use of PITs should be included in the tagging program because of their potential to improve recovery rates and more importantly for their ability to provide quantitative estimates of reporting rates from the farms and traps.,. For this reason, the Steering Committee decided to include PITs in the tagging strategy for 2011 and 2012.. PIT detectors should be made available to all ICCAT observers in cages and to scientists monitoring the traps.

c6) budget

The total budget figure for tagging is estimated at 1,000,000.00 Euro (including the rewarding system) in 2011 and at 3,040,000.00 in 2012. The cost for the professional figure required (P2) and related travels is included in the Coordination budget.

d) Communication activities for tag recovery

d1) strategy and budget

This point was discussed within the previous issues and the budget is included in c6).

e) Eggs and Larval survey

e1) objectives

The objective of the eggs and larval survey should be to monitor the evolution of spawning success and the various possible changes in spawning areas in the Mediterranean and the Gulf of Mexico. Some surveys are already carried out in some areas. The Steering Committee decided to postpone the eggs and larval survey campaign by one year because of budget constraints and the priority provided for this activity, leaving 2011 for the survey design and developing the survey in 2012 and possibly in the following years. The design should take into account existing activities.

e2) strategy adaptation: Mediterranean and Gulf of Mexico?

The Steering Committee decided to postpone this decision to a next meeting, waiting for the development of the US BFT Program in the West.

e3) survey strategy and design.

See point e2).

e3) budget

The total budget figure for the eggs and larval survey design is set at 10,000.00 Euro in 2011 and at 670,000.00 Euro in 2012.

f) Biological sampling

The biological sampling is considered very important and the Steering Committee recommends that sampling commences as soon as possible. The strategy should be mostly focused on otoliths sampling for micro-constituents analysis in the first year. This will continue in the second year together with genetic sampling.

f1) sampling for age determination: objectives and strategy.

The Steering Committee considered that the objectives of this item are very clearly referred not only to better define the age-length or age-weight correlations for the stocks, but also to improve mixing rate estimates using micro-constituents analytical methodology. The sampling should also takes advantage of the sampling opportunities in the Japanese markets and investigate cooperative analytical opportunities with CPCs research institutions already undertaking such work. The Steering Committee suggests identifying in advance some storage places for long term archiving of the samples, possibly in Government institutions able to ensure a long-term storage.

f2) genetic sampling: objectives and strategy.

The Steering Committee decided that it is necessary to get a genetic sampling design (including storage protocols) before going on with the genetic sampling and analysis. The sampling in 2011 should be limited at a minimal level, while it would be increased in 2012, possibly taking advantage of the biological sampling and then reducing the sampling costs.

f3) reproductive biology programme: objectives and strategy

The Steering Committee decided to postpone to the following years the studies on the reproductive biology.

f4) Growing in cages studies.

This issue was not originally included in the GBYP, but the FEAP presented a proposal that was considered as an interesting opportunity of cooperation with industry by the Steering Committee (see point 1). This proposal will be discussed, eventually may be restructured to align with high priority needs of and included in GBYP.

f5) budget

The total budget figure for the biological surveys is set at 1,020,000.00 Euro in 2011 and at 1,163,000.00 Euro in 2012 (pending the growth in cages proposal).

g) Data recovery and data elaboration

g1) data recovery call: strategy

The Steering Committee recommended continuation of the data recovery and data retrieval exercise, particularly for very old data sets (before 1950) and for data concerning fisheries on juveniles. The Steering Committee also stressed the importance to get the data and analyses of these from the Japanese market (particularly from auction of individual fish). The Steering Committee also recommended that a specific call should be released for proposals to provide actual data on the small scale and recreational fishery on juveniles in the Mediterranean Sea, allocating about 25,000 to 30,000 euro per year in the next two years, because the information on these fisheries is entirely missing in the ICCAT data base. These calls might imply also a job to be done in two years.

g2) VMS data elaboration: strategy

The Steering Committee agreed about the additional information on the most important fisheries which the analysis of the VMS data is potentially able to provide. An external contract (under a confidentiality agreement) could be released.

g3) Aerial survey data elaboration

The Steering Committee agreed about the need to analyse the aerial survey data at the end of each season and present the yearly data to SCRS. The Steering Committee recommends prolonging the contract to the same team contracted in 2010, with the objective to better use the first year experience. Environmental data analysis might corroborate the aerial survey data, trying to find better indices. See discussion on the needs for modification of the aerial survey design above, the proposed workshop and the required preparatory work for this workshop, including the sea surface temperature data elaboration.

g4) Budget

The total budget figure for the data recovery and data elaboration is set at 200,000.00 Euro in 2011 and at 200,000.00 Euro in 2012.

h) Modelling

Operating modelling was considered with a high priority by the Programme in all its versions. The activity was planned to be conducted in 2013, 2014 and 2015, but a revision of this schedule is considered necessary by the Steering Committee, particularly after the most recent analysis.

The total budget per year available for this item is 200,000 Euro and all the activities should be carried out with external contracts.

h1) objectives and strategy

According to the Programme agreed in Marrakech, the aim of this item would be "to invest in the development of methods to improve assessments that incorporate information on mixing and to simulation test management procedures in the face of uncertainty about mixing". The SCRS 2009 improved the objectives, stating that the aim will be to "Improve the assessment models and provision of scientific advice on stock status through improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and developing and use biologically realistic models for more rigorous management option testing". The Coordinator suggests considering also the development or use of models able to take into account the most relevant oceanographic variables, which are able to considerably modify the distribution of bluefin tuna in various areas and, then, to impact on the CPUE and other indices, including fishery-independent ones. The Steering Committee agreed that it is necessary to anticipate this item as much as possible, because of the complex work to be done and suggested to organise a modelling workshop in 2011 (taking advantage of the Working Group on Stock Assessment Methods) and then to begin the modelling activities in 2012. The Steering Committee considers these two years as the transition to a more adequate modelling approach.

This activity needs a strict cooperation between the Secretariat scientific staff and the external contractor(s). The additional Secretariat workload should be taken into account.

h2) budget

The total budget figure for the data modelling is set at 40,000.00 Euro in 2011 and at 200,000.00 Euro in 2012.

i) Milestones and deliverables

i1) milestones – yearly SC and SCRS review and approval

The Steering Committee activity needs to be planned in advance, together with the procedures for the consultation. The Steering Committee agrees to plan a meeting per year, before the SCRS plenary, with the purpose to review the activity done and to agree about the activities and the budget proposal for the following year. The meeting should be always of 2 days.

After the Steering Committee meeting, the GBYP Coordinator will be able to prepare the official GBYP annual report for the SCRS, for the official approval.

Extra Steering Committee meetings may be eventually called as needed, after a previous consultation. The Steering Committee shall be consulted every time there is a substantive issue not fully specified in the annual plan or an issue that should be discussed before taking a decision. The Steering Committee shall be immediately informed about all the Calls for Tenders and the selection of the proposals and eventually consulted on these.

i2) deliverables – GBYP summary reports, GBYP detailed reports, sub-programme reports by tenders, products, powerpoint presentations, WEB info.

The Steering Committee agreed that the GBYP Coordinator shall annually provide the following deliverables:

- The annual GBYP activity report for the Steering Committee.
- An annotated agenda for the Steering Committee meeting (restricted circulation).
- The Steering Committee annual report.
- The annual GBYP detailed report (after the SC review) as SCRS document.
- The annual GBYP summary report for the inclusion in the SCRS Report and to be presented to the ICCAT Commission. After the approval, the summary report should be available on the web page.
- The reports provided by each contractor, as SCRS documents.
- The contractors shall provide also individual PowerPoint presentation to SCRS.
- The PowerPoint presentation concerning the annual GBYP summary report and the next year activity, to be presented to SCRS and the ICCAT Commission. After the approval, the summary report should be available on the web page.
- An annual planning of the GBYP activities, to be distributed to the SC in December.
- A GBYP institutional PowerPoint, to present the Programme in various for a, when required or necessary, to be updated according to the advancements.

j) Other issues

The Steering Committee recommended that the GBYP Coordinator to include a lump sum for "Contingencies" in the annual budget, to eventually cover unexpected costs of a complex programme like this. The Contingencies were set at 15,000 Euro in 2011 and 20,000 in 2012.

Due to the need to discuss two proposals to better define the next activities and agree about the final text of the meeting report, the Steering Committee, including Dr. Jean-Marc Fromentin, agreed to meet again during the intervals of the coming ICCAT Bluefin tuna assessment meeting, with the following calendar: September 7, lunch time, meeting with IEO for the tagging design; September 8, in the morning, meeting with FMAP for eventually restructuring the proposal; September 8, dinner time, meeting of the Steering Committee to revise and approve the meeting report.

ICCAT ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (GBYP)
GBYP STEERING COMMITTEE *AD HORAS* MEETINGS
Madrid 10, 11 and 12 September 2010
MEETING REPORT

The GBYP Steering Committee *ad horas* meetings were held at the ICCAT Secretariat on 10. 11 and 11 September 2010, with the participation of Dr. Antonio Di Natale (GBYP Coordinator), the Steering Committee members except Dr. Tom Polacheck, Dr. Laurence Kell and Dr. Mauricio Ortiz (ICCAT Secretariat) have been invited to the meeting.

The meetings were called after the information, provided by the ICCAT Secretariat and the GBYP Coordinator, concerning the new budget figures available for the contract with the European Community, which is the main co-funder of GBYP, and after the discussions on various research issues during the Bluefin tuna assessment meeting.

1. Budget updating and reduction.

1.1 Updated figures about the budget funding.

The GBYP Coordinator informed the Steering Committee about the availability of funds from the European Commission for supporting the GBYP activities in the next two years. According to the general reduction of budget, the main co-funder of the GBYP informed that the European Commission will be able to provide 2,000,000 euro for each following phase (year 2 and 3 of the GBYP). The Coordinator informed about the potential possibility have additional funding for phase 3, depending on the eventual availability of residual non-used funds from other activities, but this eventuality cannot be forecast at the moment and any additional funding will be agreed with an amendment to the 2-year co-funding contract between the European Commission and the ICCAT Secretariat.

The Steering Committee discussed about the implication of this new budget figure on the general GBYP research activities for the two following years. The Steering Committee noted that the new figures are lower than the already considered low figure used for phase 2 in the previous meeting.

The Steering Committee agreed that the GBYP should be carried out according to the Programme written by the SCRS and confirmed by the ICCAT Commission and decided to keep the budget as it was discussed and agreed in the Steering Committee meeting on September 4-5, 2010 as the objective to properly conduct the Programme.

Anyway, taking into account the concrete budget availabilities and the contingency, the Steering Committee requested the GBYP Coordinator to provide a revised and reduced version of the budget for the two next years of the Programme, taking into account the following constrains:

a) reducing the support staff for the Programme to one administrative support (G2-1) and a professional scientific support (P2);
b) eliminate the eggs and larval survey;
c) reduce the funds available for the aerial surveys on spawning aggregations;
d) reduce the funds available for data mining and data recovery;
e) reduce the funds available for tagging;
f) bring the total reduced budget figure around 2,500,000 Euro per year.

The Steering Committee reiterates its point of view that this minimum reduced budget will be considered as a provisional figure and that more funds should be necessary require bettering fulfilling the engagement required both by the SCRS and the Commission.

1.2 Minimum reduced budget for GBYP in phase 2 and 3.

The Coordinator presented the new GBYP minimum reduced budget for phase 2 and phase 3 of the Programme, in agreement with the guidelines provided by the Steering Committee.

It was necessary to revise almost all components and figures in the general agreed budget to reach a total amount close to 2,500,000 euro per year, always taking into account the need to provide enough funds to carry out the various scientific activities in a serious way, even under the contingency constrains and the budget reduction. All original budget components have been reduced in different ways and the larval surveys have been actually removed and eventually delayed to following phases.

The Steering Committee examined and discussed all the various changes and reductions, noting that the current figures are considered a limit below which it should be necessary to delete entirely some scientific activities because of the need to ensure a solid scientific base for those that shall be conducted. The Steering Committee agreed about the new minimum and reduced budget (annex 1a), asking the ICCAT Secretariat and the Coordinator to rely on it for discussing the next co-funding agreement with the European Commission.

The Steering Committee agreed that if additional funds will be made available from any CPC, entity or external sponsors, these will be used to improve the high priority researches till reaching the total amount agreed in the original budget for phase 2 and 3 of the Programme. The Steering Committee requests the ICCAT Secretariat and the GBYP Coordinator to continue working on external contact and to inform the Steering Committee in real time about any eventual improvement in budget figures.

2. Proposals for additional activities to be included in the GBYP

2.1 Some additional scientific activities have been proposed and agreed by the bluefin tuna scientists during the 2010 Bluefin tuna assessment meeting. In particular, the Steering Committee considered that the proposals to recover and analyse the historical detailed data series from about 1880 to 1950 from the Portuguese tuna traps from archives existing in Portugal and in the Monaco Oceanographic Museum, which will be able to provide important data to better understand the historical evolution of this fishery, provides a very interesting opportunity and recommended that this should be considered within the data recovery activity.

2.2 The Steering Committee also considers that the proposal to organize a Bluefin tuna trap fishery symposium, proposed by scientists from various CPCs (annex 2a) is potentially able either to improve the standardization and analysis of the tuna trap fishery data and to better use the sampling and tagging opportunities provided by the traps. The Steering Committee recommended that this proposal should be considered within the data recovery activities, if the budget will allow the cover the costs.

3. Other issues

The Steering Committee discussed about the meetings hold with tenders according to the calendar set in the previous meeting. The proposal concerning the tagging design should be revised and the ICCAT Secretariat is recommended to ask for this revision to the tender, in order to have a proposal including the following points:

a) a tagging design for the Eastern Mediterranean and the Mediterranean Sea, for traditional tags and PITs;
b) a workshop to be organized with the purpose to identify the opportunities and best practices to carry out the tagging activities in tuna traps, particularly taking advantage of fish to be released, with the participation of trap owners or their associations;
c) a workshop to be organized with the purpose to identify the opportunities and best practices to carry out the tagging activities from tuna purse seines, with the participation of purse-seiner owners or their associations;
d) an operational tagging manual including the operational details and protocols for the two types of tags required and for the various tagging activities.

As concerns the proposal to carry out growth studies in tuna cages in Malta, the Steering Committee hold a meeting with the tender and requested the proposal to be fully revised, with the aim to double tagging the fish and find the best technical ways to estimate both size composition of tuna going to cages and their growth for various year classes. The proposal should also include fishes to be released in the wild after tagging.

ICCAT GBYP				
PHASE 2 (2010-2011) AND PHASE 3 (2011-2012) REDUCED MINIMUM BUDGET				
ALLOCATION	**Amount (€)**			
	2010-2011	**total 2010-2011**	2011-2012	**total 2011-2012**
Coordination		443000,00		448980,00
Coordinator's salary and benefits	142100,00		144942,00	
Suppor staff salary and benefits (G2-1 and P2)	136900,00		139638,00	
Contracts for external Steering Committee members	60000,00		60000,00	
Travel and subsistence	70000,00		71400,00	
Computer hardware and software	6000,00		5000,00	
Consumables and supplies	3000,00		3000,00	
ICCAT Secretariat overhead	25000,00		25000,00	
Data mining, data retrieval and data elaboration (external contracts)		149000,00		123000,00
Data mining and data retrival exercise (including data collection on juveniles from small scale and recreational fisheries, Workshop on truna trap data, VMS, environmental and other data elaboration)	137000,00		110000,00	
Aerial survey data elaboration.	12000,00		13000,00	
Aerial surveys		465000,00		404080,00
Aerial surveys (external contracts)	410000,00		400000,00	
Survey design revision and adaptation (external contract)	4000,00		4080,00	
Intercalibration exercise (direct costs including aircraft and external staff)	0,00		0,00	
Training course (direct costs, including external experts)	21000,00		0,00	
Workshop on aerial survey (direct costs, including travels and subsistence for external experts)	30000,00		0,00	
Tagging		890000,00		965000,00
Conventional and PITs tagging (external contracts)	550000,00		700000,00	
PITs readers	80000,00		5000,00	
Electronic tagging (external contracts)	0,00		100000,00	
tags	60000,00		30000,00	
Tags recovery, tags reporting and rewards (partly external contracts)	150000,00		100000,00	
various	50000,00		30000,00	
Biological sampling (external contracts)		505000,00		490000,00
Hard parts sampling (including travels for samplers)	300000,00		310000,00	
Genetic sampling (including design)	75000,00		50000,00	
Analysis of samples	100000,00		100000,00	
other costs	30000,00		30000,00	
Eggs and larval sampling (external contracts)		0,00		0,00
Eggs and larval sampling design			0,00	
Eggs and larval survey				
Sorting, species identification labour, etc.				
Modelling		40000,00		90000,00
Workshop on modelling approaches	40000,00			
Modelling trials (mostly external contracts)			90000,00	
Contingencies		10000,00		13000,00
Total reduced minimum budget		**2.502.000,00**		**2.534.060,00**

ICCAT ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (GBYP)
GBYP STEERING COMMITTEE *AD HORAS* INFORMAL MEETING
Madrid September 30, 2010
MEETING REPORT

In order to take urgent action on some pending issues, a short consultation among members of the Steering Committee, with the presence of some ICCAT Secretariat staff, was called by the GBYP Coordinator. The following points have been discussed:

1. Prorogation of GBYP Phase 1

The Secretariat has requested the EU to extend the completion date of Phase 1 until December 13, 2010, in order to accomplish some pending activities and fulfil the revision duties.

2. Tagging design offer

The GBYP Coordinator summarised the revised offer received from the tender, after the previous comments provided by the Steering Committee on September 8 (see the related Steering Committee report) and transmitted by the Secretariat to the tender.
It was considered that the revised proposal was done taking into account the previous comments, but needs still some clarifications and details, particularly concerning the detailed list of deliverables, the simulation tests and the budget items.
Due to the urgent need to have a tagging design, also to purchase the necessary tags, the ICCAT Secretariat is requested to ask for this revision to the tender.

3. Sea Surface Satellite Temperature Data

The GBYP Coordinator informed about the need to get sea surface temperature data sets for better analyse both the VMS and the aerial survey data, exploring possible correlations with environmental factors, able to better understand the presence and distribution of bluefin tuna in the Mediterranean Sea. The two offers received to perform this work have been discussed and it was agreed to award the contract to CLS. It was requested to provide these data for May, June, July for the last 10 years, at a resolution of 0.25°x0.25°, in a format usable by GIS.

4. GBYP web page

It was agreed to develop a dedicated GBYP web page, within the ICCAT site, in order to post all the products of the Programme.

5. Proposals for recommendations.

It was agreed to propose draft recommendations to be adopted by SCRS to support the programme (particularly concerning the support of CPCs for getting the necessary permits) and to help in defining the budget contributions.

6. GBYP reports and presentations.

It was agreed that a GBYP PowerPoint presentation shall be provided by the Coordinator to the SCRS Plenary and that a shorter presentation shall be provided by the SCRS Chair to the ICCAT Commission, during the coming meetings.

ICCAT ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (GBYP)

PUBLICATION POLICY, EDITORIAL AND DATA USE RULES

The ICCAT Atlantic Wide Research Programme for Bluefin Tuna (GBYP) is an international research, co-funded by the European Community (80%), Canada, Croatia, Japan, Norway, Turkey, United States, Chinese Taipei and ICCAT Secretariat.

The publication policy concerning the results obtained by the various researches carried out within this programme must follow the rules included in the contract between the ICCAT and the funders and those rules will be mandatory for all the participants to the GBYP. The acceptance of a contract provided by the GBYP will automatically imply the acceptance of the "Publication policy and Editorial rules" here detailed.

1) Ownership of the results of the Programme (GBYP), including industrial and intellectual property rights, and of the reports and other documents relating to it, shall be vested by the ICCAT.
2) The result of each action carried out within the Programme (GBYP) and all the scientific results obtained by these actions shall be presented to the ICCAT-SCRS at the first opportunity.
3) The scientific results of actions carried out within the Programme (GBYP), after the presentation to the ICCAT/SCRS, can be published, entirely or partly, on the ICCAT Collective Volume of Scientific Papers, the Aquatic Living Resources journal with which ICCAT has a special publication agreement or in other scientific journals. The Authors who wish to publish these results in other scientific journals shall previously require a permit to ICCAT. ICCAT, following the spirit of this scientific programme, encourages the Authors engaged in research action within the Programme (GBYP) to disseminate their results, particularly in international scientific journals.
4) Each report or article concerning the results obtained within the actions of the Programme (GBYP) must include the following sentence: "This work was carried out under the provision of the ICCAT Atlantic Wide Research Programme for Bluefin Tuna (GBYP), funded by the European Community (grant SI2/542789), Canada, Croatia, Japan, Norway, Turkey, United States, Chinese Taipei and the ICCAT Secretariat. The contents of this paper do not necessarily reflect the point of view of ICCAT or of the other funders, which have not responsibility about them. Neither does it necessarily reflect the views of the funders and in no ways anticipate the Commission's future policy in this area."
5) All the data collected under the Programme (GBYP) shall be used only for scientific purposes and according to the ICCAT rules (see also SCRS/09/122). Any other use of these data should be specifically authorised by ICCAT.

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Design for aerial line transect survey in the Mediterranean Sea

Final Report

1 May 2010

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Background

The comprehensive ICCAT Atlantic Wide Research Programme on Bluefin Tuna (GBYP) aims to improve basic data collection, understanding of key biological and ecological processes, and assessment models and management. An important element of this programme is to carry out aerial line transect surveys of the spawning population in the Mediterranean when and where schools can traditionally be sighted close to the surface to support development of fishery-independent indices. This report describes the survey design for those aerial surveys.

Objectives

The objective of this report is to develop designs for the aerial survey based on the available information on areas and available survey time. Specifically, to develop designs for a synoptic survey to provide a minimum population estimate and also for generating a relative index based on using a comparable design over an extended time period (i.e. 4 years). The survey designs should be accompanied by estimates of their potential uncertainty as a function of coverage, i.e. how this would vary with increased or reduced spatial and temporal coverage.

Survey design methods

Program DISTANCE http://www.ruwpa.st-and.ac.uk/distance/, the "industry standard" software for line transect distance sampling, includes a robust software engine for designing survey transects to achieve equal coverage probability over the survey area. Input to the program includes survey area coordinates or a GIS shape file of the same, information on coverage (e.g. spacing, number of transects, total length of transect), whether transects should be laid out as parallel or zig-zag lines, etc. From this input, the program simulates multiple surveys according to the design specified and generates information on the survey, including a visual representation of how well equal coverage probability has been achieved. The survey design input parameters can then be modified until an optimum design is achieved.

Aerial surveys for bluefin tuna in the Mediterranean Sea are designed here using program DISTANCE based on: the six defined survey areas (see Figure 1), the expected available aircraft time (69 days, already accounting for time lost to bad weather), target survey speed (100 $nm.h^{-1}$), and time for circling over detected schools to estimate their size (unknown, but set at 10%). Aircraft time has been allocated to each block in proportion to its area. Transect lines are placed in a north-south direction to be approximately perpendicular to the coast in most blocks and to give shorter transects.

Surveys are designed as equal spaced parallel lines rather than zig-zag lines. Parallel line designs achieve equal coverage probability exactly – an important design feature. However, a disadvantage (compared to a zig-zag design) is that some flying time is spent in transit between transects. Time spent transiting can be minimised by increasing airspeed between transects. In addition, there is some advantage to having short off-effort periods between transects to allow observer(s) to rest.

Surveys for each block are designed so that the whole block can be surveyed in two days and then repeated multiple times. The number of surveys in each block is determined by the size of the block.

Uncertainty associated with the survey design

Uncertainty in line transect estimates of abundance (or relative abundance) comprises components describing variance in the detection function (if a strip is not assumed), in the group size of targets, and in the encounter rate of target groups. Overall variance is generally dominated by variance in encounter rate, which is primarily a function of the number of detections (if transect length does not vary much) and how aggregated is their distribution. The number of detections is determined by the density of the target organisms and the amount of survey coverage. In the absence of information on these, relative uncertainty in abundance estimates can only be examined as a function of coverage (length of survey transect) for some nominal densities and aggregations. If schools are distributed randomly, the variance of the number of detections equals the number of detections. Aggregation can be incorporated as a multiplier of this.

Minimum population size vs relative index

Survey design (layout of transects) need not be different for estimating minimum population size and a relative index. If less survey effort is anticipated for estimating a relative index, designs can be modified to reflect this simply by reducing expected survey effort (transect length). The effect of this reduced effort on expected uncertainty in estimates of relative abundance can be seen in the results of the exercise described above.

Aerial surveys often use strip transect sampling in which the detection of target organisms within a defined strip on either side of the transect line is assumed to be certain, or at least constant. This is an unrealistic assumption unless data are available to demonstrate that it is not violated. Probability of detection must eventually decline with perpendicular distance from the transect line. To obtain unbiased estimates of abundance, line transect sampling uses data on the distribution of perpendicular distances of detected animals or groups to estimate the probability of detection within a defined strip.

Line transect sampling also assumes that detection on the transect line itself is certain. On aerial surveys, it is not possible to assume this because the speed of flight means that some animals/groups available to be sampled will inevitably not be detected (so-called perception bias). In addition, tuna spend much of their time at depth and unavailable to be detected (so-called availability bias). Estimates of abundance from conventional aerial survey are thus underestimates (minimum estimates) even if perpendicular distance data are used to correct for animals missed within the survey strip.

In addition, even if surveys are conducted only in good conditions (Beaufort 0-2, for example) probability of detection may still vary within these conditions, as is the case for some cetaceans, e.g. harbour porpoise (Palka 1996). A good protocol is to record sighting conditions with effort data so that these data can be used as covariates when estimating the detection function.

Perpendicular distance data are best obtained on aerial survey using an inclinometer to record the angle of declination when a detected target is abeam. Ideally, the aircraft should provide unimpaired visibility directly under the aircraft through fitted bubble windows. If this is not possible, it may still be feasible to obtain a useful detection function, depending on the distribution of the perpendicular distance data.

For the best estimate of the minimum population size, a detection function should be fitted and used to account for animals missed in the survey strip as a function of perpendicular distance and sighting conditions. This partially corrects for perception bias. If data are available on the proportion of time tuna are sufficiently close to the surface to be detected by aerial survey, e.g. from archival or pop-up tags, these could be used to account for availability bias. In this way, estimates from the survey will be as unbiased as possible, whilst still being minimum estimates. Accounting fully for perception bias can only be done using double team observations (e.g. Hiby & Lovell 1998; Hiby 1999; Heide-Jørgensen *et al.* in press) or so-called cue-counting (Hiby & Hammond 1989), which are beyond the scope of this survey.

For a relative index, availability and perception bias may be ignored if it can be assumed that they do not change over time and area. However, it will still be valuable to collect data on sighting conditions and perpendicular distance for estimating relative density to account for variation in detection rates over sighting conditions.

Data collection and analysis

Following discussion with the GBYP Steering Committee, the following data were agreed should be collected on the aerial survey:

Each survey day

- Date, personnel, equipment, departure and arrival airport, other relevant information.

Searching effort (as a continuous record)

- Time when searching starts and when it stops (record of on and off effort)
- Position (from GPS) when searching starts and when it stops
- Altitude (target 300m)
- Number of observers, side searched (left, right, both)
- Searching conditions (to be recorded every 15 minutes or when conditions change):
  - sea state (Beaufort scale); glare (side, sector affected, intensity); haziness of air (subjective scale); turbidity of water (subjective scale)

Sightings

- Time and position when sighting made, observer making sighting, cue (e.g. splash, ripples, birds, etc)
- Species, school size (number, weight)
- Perpendicular distance (inclinometer reading when abeam)
- Break track (yes, no)
- Photographs taken (yes, no, frame numbers)

Suggested forms for the collection of effort and sightings data are attached as Appendix 1.

Survey designs

The areas identified by the GBTP Steering Committee were used to create survey blocks in program DISTANCE. Figure 1 shows a map of these areas. Table 1 gives the area and the length of transect allocated to each block based on the amount of flying time available taking account of time expected to be lost for poor weather and time for circling over detected schools, as described above. These figures result in the expected number of 2-day surveys per block given in Table 1.

Survey designs were created for each block to achieve the approximate coverage indicated. Table 2 gives summary statistics for the survey designs for each block. Appendix 2 gives a map and way points (beginning and end of each transect) for surveys for the number of days that can be supported by the time available, plus one extra survey for each block in case the weather is better than expected.

Exploration of uncertainty

Table 3 gives a simple set of examples to show how the CV of the number of encounters (the main component of variance) varies with density of target organisms, the amount of survey effort and the aggregation of detections. These tables can be modified to explore more realistic scenarios when more information becomes available on density and aggregation following the surveys. The resulting information will allow surveys for generating a relative index to be designed effectively.

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Heide-Jørgensen, MP, Laidre, KL, Hansen, RG, Burt, ML & Borchers, DL, Hansen, J, Harding, K, Rasmussen, M, Dietz, R & Teilmann, J (in press). Rate of increase and current abundance of humpback whales in West Greenland. Journal of Cetacean Research and Management.

Hiby, L (1999). The objective identification of duplicate sightings in aerial survey for porpoise. In: Garner, GW, Armstrup, SC, Laake, JL, Manly, BFJ, McDonald, LL & Robertson, DG (eds). *Marine mammal survey and assessment methods*, pp. 179-189. Balkema, Rotterdam.

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Hiby, AR & Hammond, PS (1989). Survey techniques for estimating abundance of cetaceans. Reports of the International Whaling Commission (Special Issue 11): 47-80.

Palka, D (1996). Effects of Beaufort sea state on the sightability of harbour porpoises in the Gulf of Maine. Reports of the International Whaling Commission 46: 575-582.

TABLES

Table 1. Areas, transect lengths and expected number of 2-day surveys for each survey block, based on 69 days of flying and allocating survey effort in proportion to block area. Available transect takes account of the expected extended positioning time in block 5.

Block	Area (km^2)	Proportion of total area	Available transect (km)	Expected number of 2-day surveys
1	62,263	0.160	12,835	5.5
2	52,461	0.134	10,814	4.6
3	90,796	0.233	18,717	8.0
4	74,313	0.190	15,319	6.6
5	55,248	0.142	9,989	4.9
6	55,034	0.141	11,345	4.9
Total	**390,115**		**79,020**	**34.5**

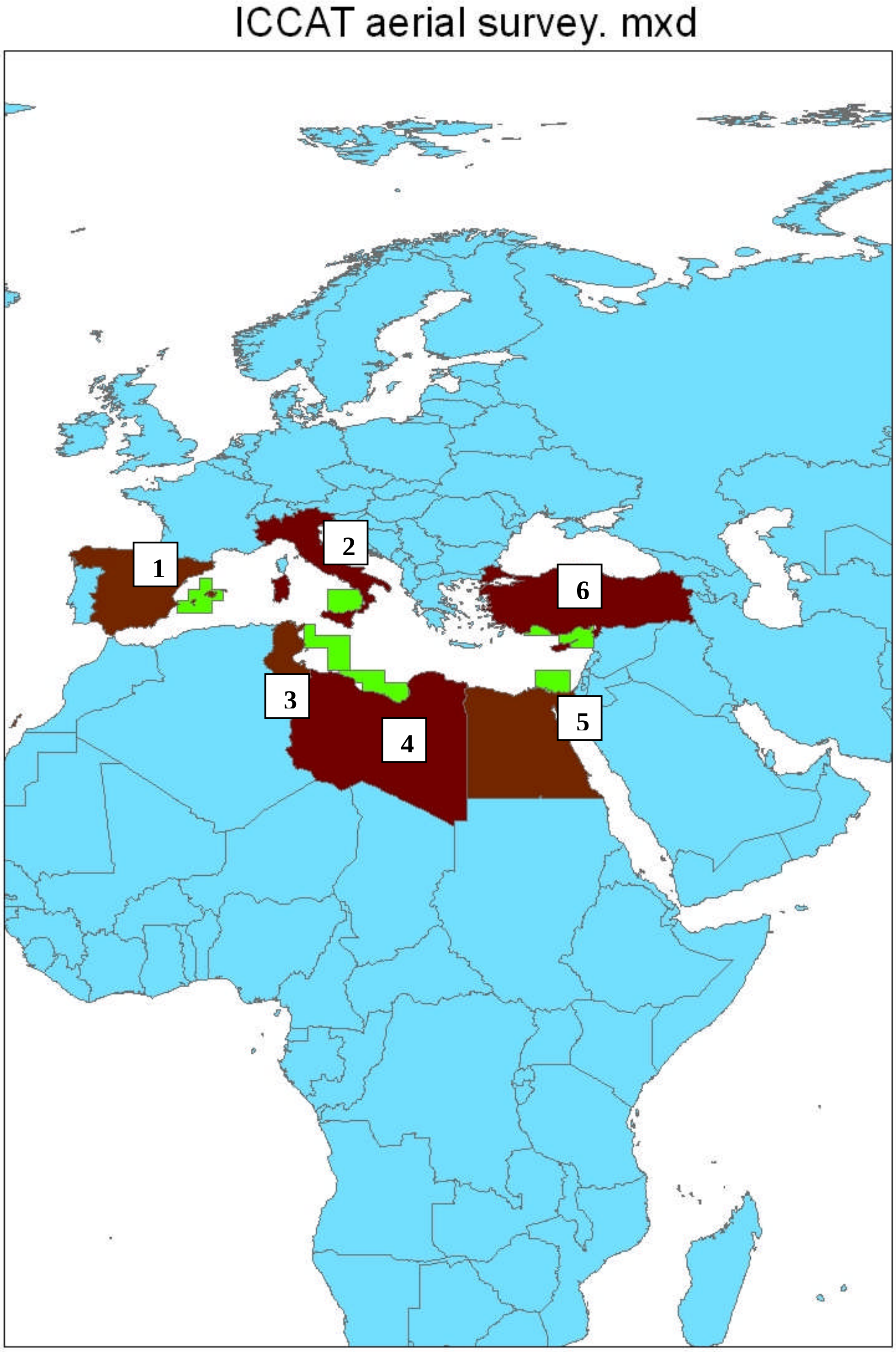
Table 2. Summary statistics for the survey designs for the six blocks shown in Figure 1.

	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6
Area (km squared)	62,264	52,461	90,796	74,313	55,248	55,034
Kilometers available	12,835	10,814	18,717	15,319	9,989	11,345
Hours available	69	58	101	83	54	61
Hours per survey	14	14	14	14	14	14
Number of surveys	5.0	4.2	7.2	5.9	3.9	4.4
Kilometers per survey (km)	1,538	1,885	1,631	1,518	1,820	1,154
Line spacing (km)	45	30	60	60	35	50
Trackline on effort (km)	1,380	1,751	1,508	1,408	1,582	1,099
Number of lines	10	11	7.5	11	10	13
Trackline total (km)	1,961	2,069	1,939	2,048	1,891	1,753
Proportion on effort : total	0.721	0.846	0.778	0.688	0.837	0.627
Trackline total cyclic (km)	2,415	2,397	2,347	2,708	2,206	2,379
Proportion on effort : cyclic	0.571	0.730	0.643	0.520	0.717	0.462
Prop sampled (2km strip)	0.044	0.067	0.033	0.038	0.057	0.040
Hours on effort	7.5	9.5	8.1	7.6	8.5	5.9
Average line length (km)	138	159	201	128	158	85
Hours: total cyclic	13.0	12.9	12.7	14.6	11.9	12.8
Coverage per survey (%)	4.4	6.7	3.3	3.8	5.7	4.0
Coverage per block (%)	21.9	27.8	24.0	22.4	22.1	17.5

Table 3. Variation in CV of expected number of encounters (n) as a function of density and transect length for a nominal area. The CV is calculated assuming a random distribution of encounters and also aggregated distributions in which the variance of n is 2 times and 5 times n (b = 2, 5). Other sources of variation (detection function, school size) have been ignored but would increase the final CV.

Area	Density	Transect length	% coverage (nominal 2km strip)	Expected n	CV n (random)	CV n (b=2)	CV n (b=5)
50000	0.00001	500	2	1	1.00	1.41	2.24
50000	0.00001	1000	4	2	0.71	1.00	1.58
50000	0.00001	2000	8	4	0.50	0.71	1.12
50000	0.00001	5000	20	10	0.32	0.45	0.71
50000	0.0001	500	2	10	0.32	0.45	0.71
50000	0.0001	1000	4	20	0.22	0.32	0.50
50000	0.0001	2000	8	40	0.16	0.22	0.35
50000	0.0001	5000	20	100	0.10	0.14	0.22
50000	0.001	500	2	100	0.10	0.14	0.22
50000	0.001	1000	4	200	0.07	0.10	0.16
50000	0.001	2000	8	400	0.05	0.07	0.11
50000	0.001	5000	20	1000	0.03	0.04	0.07
50000	0.01	500	2	1000	0.03	0.04	0.07
50000	0.01	1000	4	2000	0.02	0.03	0.05
50000	0.01	2000	8	4000	0.02	0.02	0.04
50000	0.01	5000	20	10000	0.01	0.01	0.02

Figure 1. Survey blocks (in green) used for the survey designs.



APPENDIX 1

Data collection forms

ICCAT **GBYP Bluefin Tuna Spawners Aerial Survey 2010** **EFFORT FORM**

Date: ____________ **Personnel:** ______________________________

Departure airport: ____________ **Arrival airport:** ____________ **Aircraft:** ______________________________

Time start effort	Lat - Lon start effort	Time end effort	Lat - Lon end effort	Altitude (m)	Sea state	Haziness air	Turbidity water	Glare side	Glare sector	Glare intensity	Observer		Notes (insert also, with their position, sightings of fishing vessels)
											P	S	

Sea State: Beaufort scale (0, 1, 2, etc)
Haziness air: (Clear, Slight, Heavy)
Turbidity water: (Clear, Slight, Heavy)
Glare side: P (port side), S (starboard side) - **Glare sector**: start and end angle - **Glare intensity**: (Slight, Strong)
Observer: code for observer on Port and Starboard sides (add codes for observers)

ICCAT **GBYP Bluefin Tuna Spawners Aerial Survey** **2010** **SIGHTINGS FORM**

Date:_____________________ **Personnel:**____

Departure airport:____________________ **Arrival airport:**_____________________ **Aircraft:** ____

Time	Lat - Lon	Observer	Cue	Species	School size	Estimated weight	Declination angle	Break track?	Photos taken?	Frame numbers	Notes (size components of the shoal are important) (please note also sightings of marine mammals and seabirds)

Observer: (add codes for observers)
Cue: (splash, Ripples, shining, other associated fauna, etc)
Break track: Y (yes), N (no)
Photos taken: Y (yes), N (no)

Appendix 2

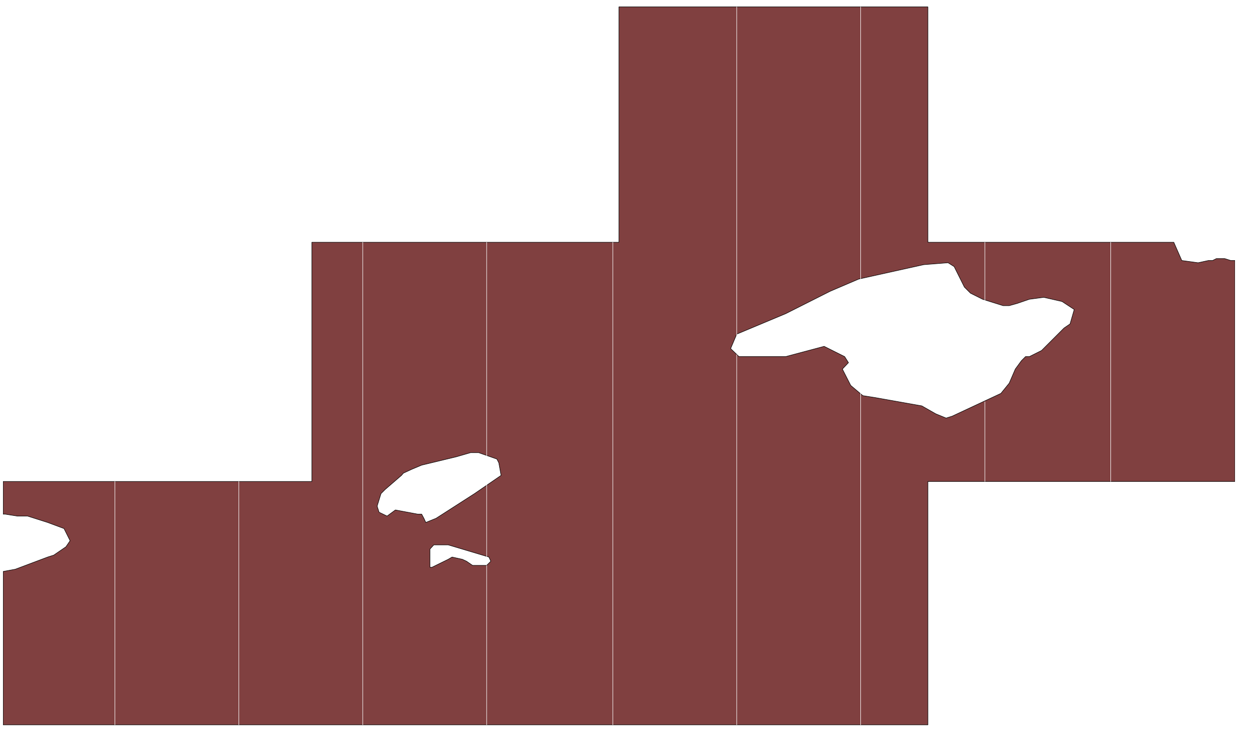
Surveys for blocks 1-6

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Block 1

Survey 1

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1362.112 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2724.223 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1965.075 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2379.311 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2113.997 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.034

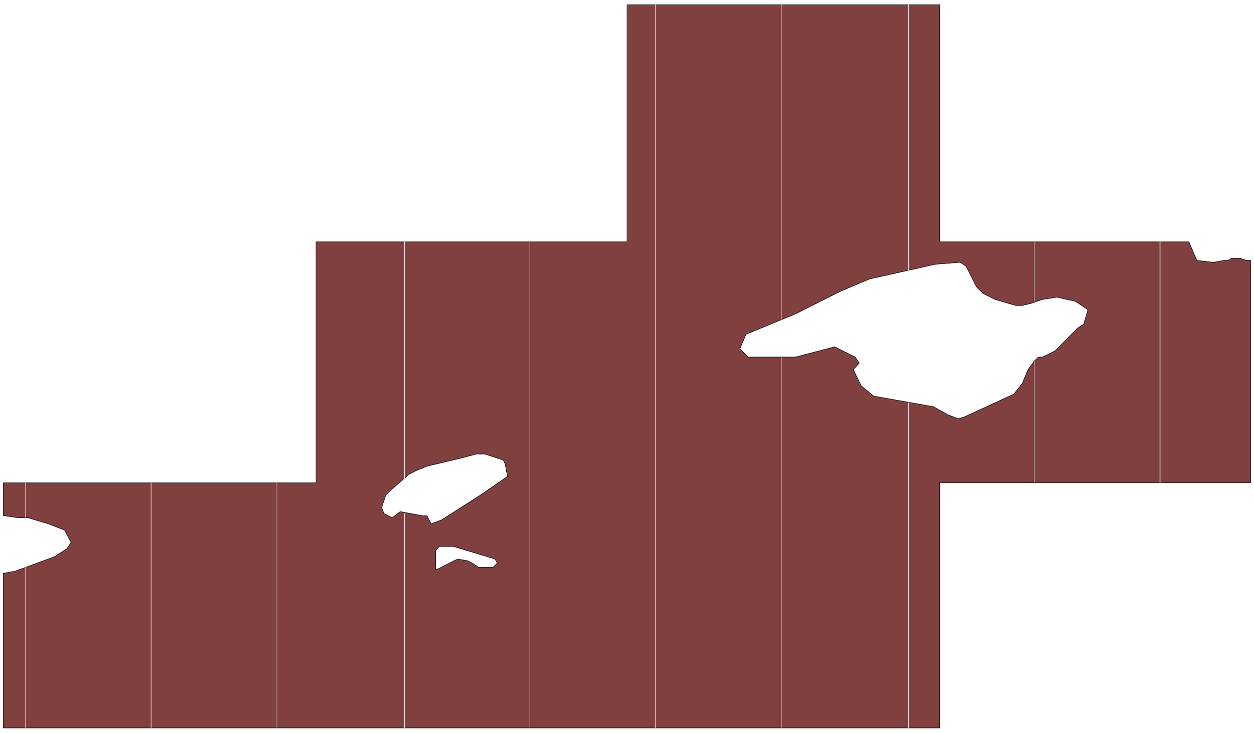


Sample layer name: 45 km spacing **survey 1**
Number of samplers: 10

Sampler 1
0.3603697 38
0.3603697 39
--
Sampler 2
0.7646116 38
0.7646116 39
--
Sampler 3
1.168854 38
1.168854 40
--
Sampler 4
1.573095 38
1.573095 38.65518
--
1.573095 38.6905
1.573095 38.98991
--
1.573095 39.10651
1.573095 40
--
Sampler 5
1.977337 38
1.977337 40
--
Sampler 6
2.381579 38
2.381579 39.53435
--
2.381579 39.60101
2.381579 41
--
Sampler 7
2.785821 38
2.785821 39.36891
--
2.785821 39.84726
2.785821 41
--
Sampler 8
3.190063 39
3.190063 39.33479
--
3.190063 39.75644
3.190063 40
--
Sampler 9
3.594305 39
3.594305 40
--
Sampler 10
3.998547 39
3.998547 39.92704
--

Survey 2

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1438.507 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2877.014 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2005.838 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2524.882 Kilometers
REALIZED SAMPLER AREA COVERAGE: 1821.15 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.029

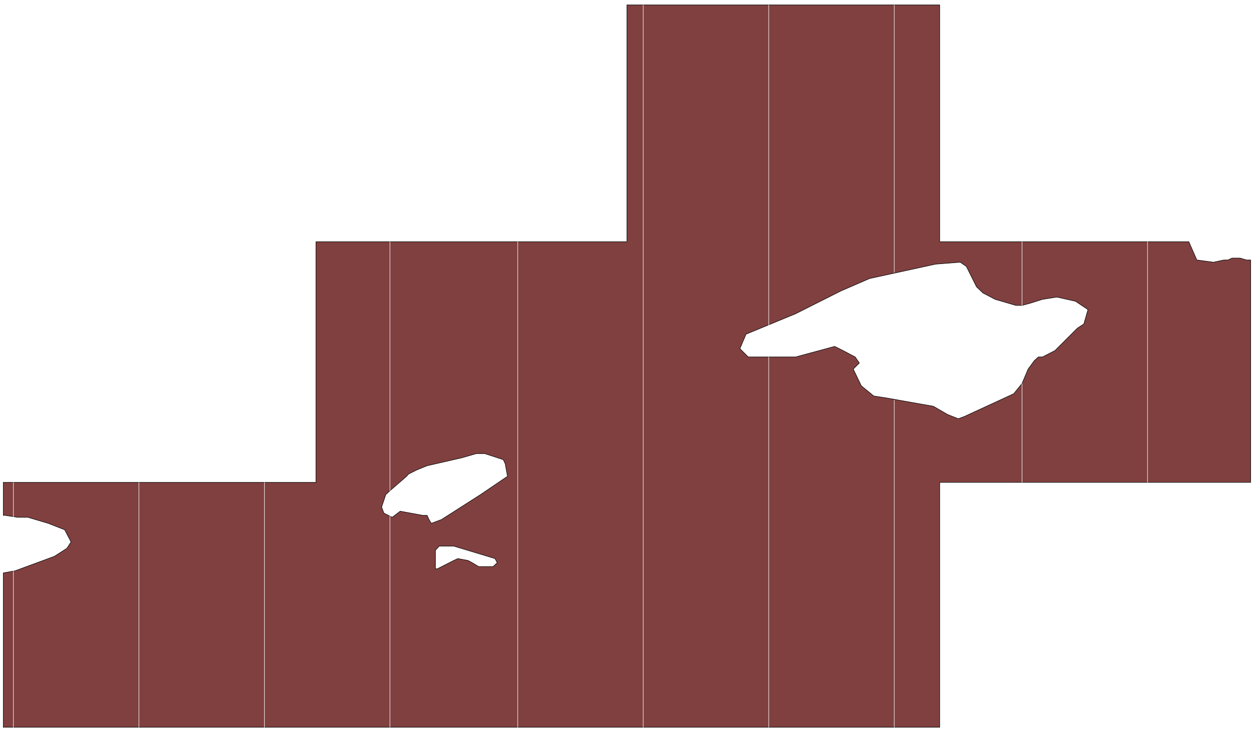


Sample layer name: 45 km spacing - **survey 2**
Number of samplers: 10

Sampler 1
7.141364E-02 38
7.141364E-02 38.65158
--
7.141364E-02 38.85804
7.141364E-02 39
--
Sampler 2
0.4756555 38
0.4756555 39
--
Sampler 3
0.8798974 38
0.8798974 39
--
Sampler 4
1.284139 38
1.284139 38.87764
--
1.284139 39.01909
1.284139 40
--
Sampler 5
1.688381 38
1.688381 40
--
Sampler 6
2.092623 38
2.092623 41
--
Sampler 7
2.496865 38
2.496865 39.52213
--
2.496865 39.67631
2.496865 41
--
Sampler 8
2.901107 38
2.901107 39.33742
--
2.901107 39.8837
2.901107 41
--
Sampler 9
3.305349 39
3.305349 39.50181
--
3.305349 39.75199
3.305349 40
--
Sampler 10
3.70959 39
3.70959 40
--

Survey 3

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1437.256 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2874.511 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2005.838 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2524.882 Kilometers
REALIZED SAMPLER AREA COVERAGE: 1833.938 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.029



Sample layer name: 45 km spacing - **survey 3**
Number of samplers: 10

Sampler 1
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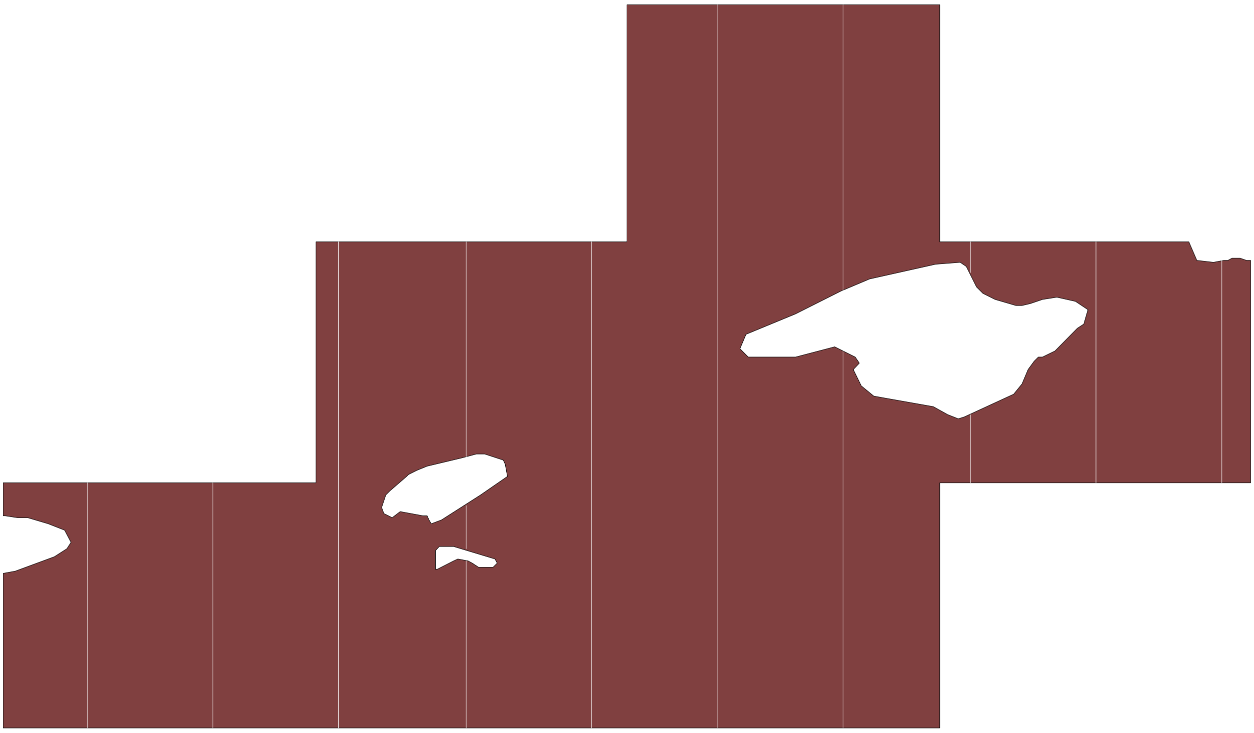
3.037497E-02 38.63542
--
3.037497E-02 38.86086
3.037497E-02 39
--
Sampler 2
0.4346168 38
0.4346168 39
--
Sampler 3
0.8388587 38
0.8388587 39
--
Sampler 4
1.243101 38
1.243101 38.86437
--
1.243101 38.96878
1.243101 40
--
Sampler 5
1.647342 38
1.647342 40
--
Sampler 6
2.051584 38
2.051584 41
--
Sampler 7
2.455826 38
2.455826 39.5218
--
2.455826 39.65276
2.455826 41
--
Sampler 8
2.860068 38
2.860068 39.34657
--
2.860068 39.87073
2.860068 41
--
Sampler 9
3.26431 39
3.26431 39.40768
--
3.26431 39.73565
3.26431 40
--
Sampler 10
3.668552 39
3.668552 40
--

Survey 4

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1364.697 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2729.394 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1964.949 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2379.185 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2003.375 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.032

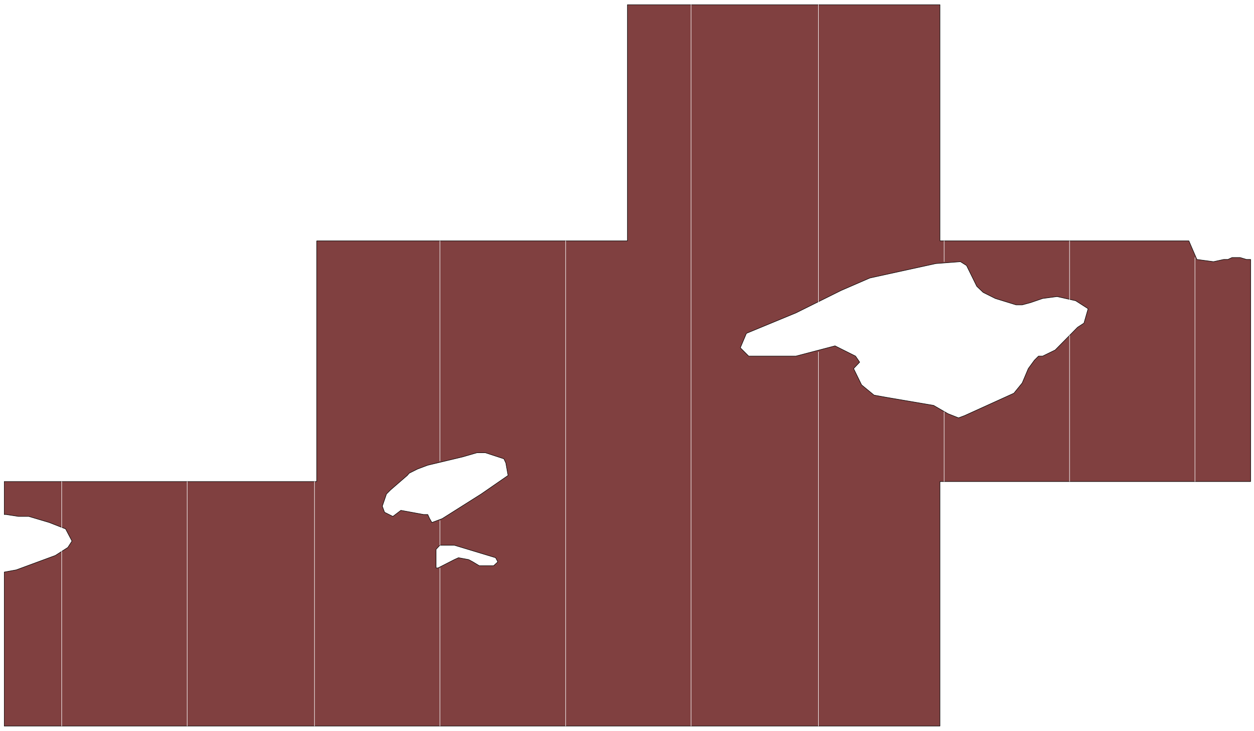


Sample layer name: 45 km spacing - **survey 4**
Number of samplers: 10

Sampler 1
0.2703577 38
0.2703577 39
--
Sampler 2
0.6745996 38
0.6745996 39
--
Sampler 3
1.078841 38
1.078841 40
--
Sampler 4
1.483083 38
1.483083 38.67907
--
1.483083 38.72613
1.483083 38.91085
--
1.483083 39.10814
1.483083 40
--
Sampler 5
1.887325 38
1.887325 40
--
Sampler 6
2.291567 38
2.291567 41
--
Sampler 7
2.695809 38
2.695809 39.55104
--
2.695809 39.80033
2.695809 41
--
Sampler 8
3.100051 39
3.100051 39.28339
--
3.100051 39.87594
3.100051 40
--
Sampler 9
3.504293 39
3.504293 40
--
Sampler 10
3.908535 39
3.908535 39.92532
--

Survey 5

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1252.402 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2504.804 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1830.562 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2345.688 Kilometers
REALIZED SAMPLER AREA COVERAGE: 1986.31 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.032



Sample layer name: 45 km spacing - **survey 5**
Number of samplers: 10

Sampler 1
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0.1858317 38.71495
--
0.1858317 38.80987
0.1858317 39
--
Sampler 2
0.5900735 38
0.5900735 39
--
Sampler 3
0.9943154 38
0.9943154 39
--
Sampler 4
1.398557 38
1.398557 38.64942
--
1.398557 38.73703
1.398557 38.84239
--
1.398557 39.0834
1.398557 40
--
Sampler 5
1.802799 38
1.802799 40
--
Sampler 6
2.207041 38
2.207041 41
--
Sampler 7
2.611283 38
2.611283 39.54384
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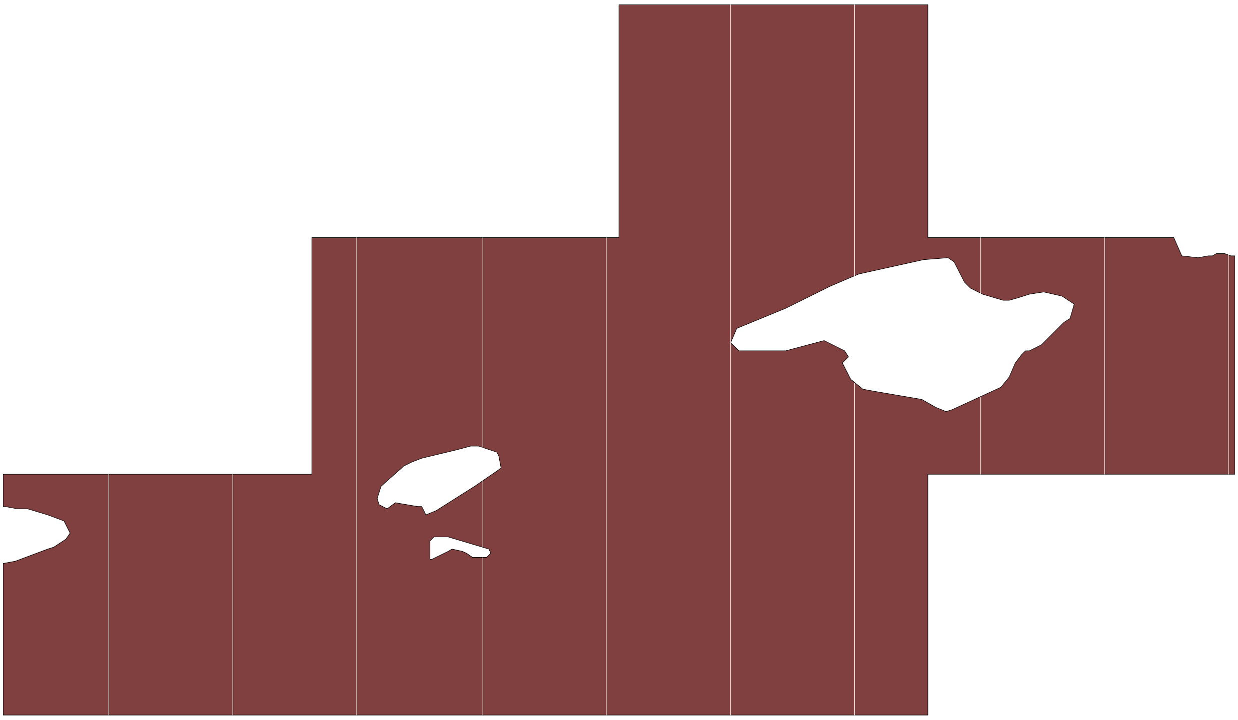
2.611283 39.74709
2.611283 41
--
Sampler 8
3.015525 39
3.015525 39.29417
--
3.015525 39.9147
3.015525 40
--
Sampler 9
3.419767 39
3.419767 39.60629
--
3.419767 39.75835
3.419767 40
--
Sampler 10
3.824008 39
3.824008 39.93096
--

Survey 6

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1365.747 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2731.493 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1965.368 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2379.604 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2228.898 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.036

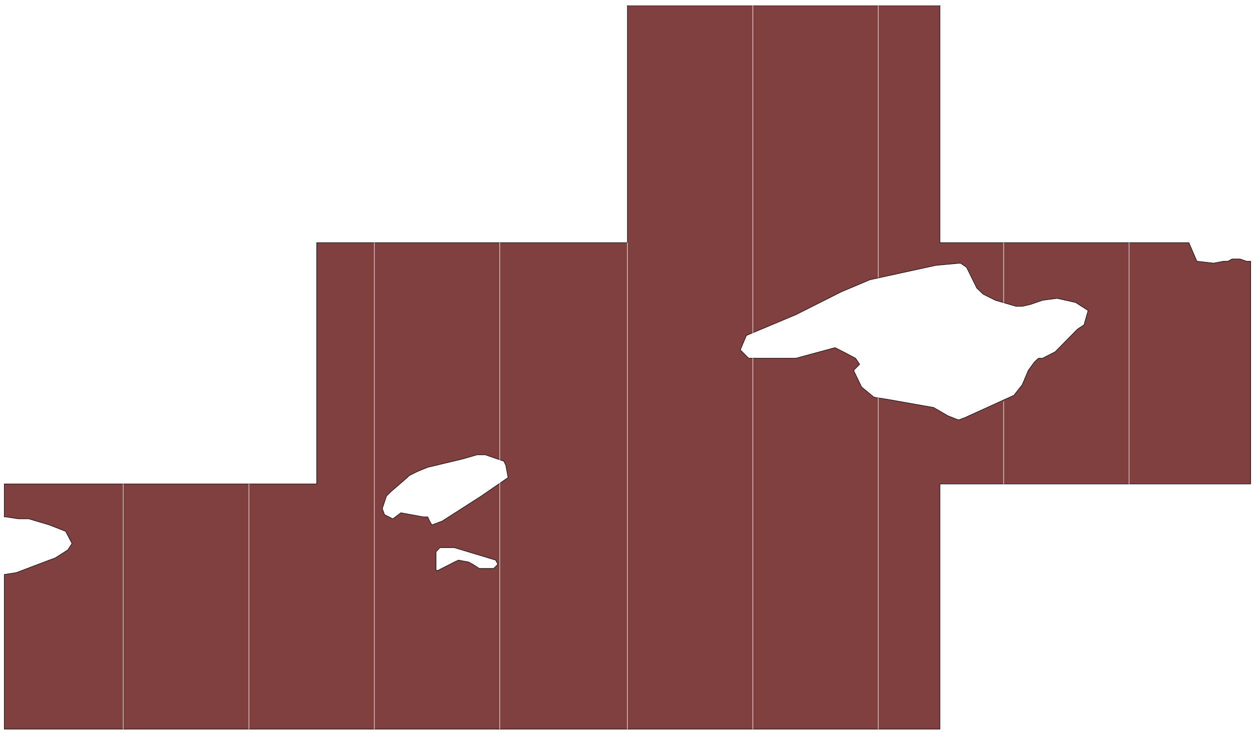


Sample layer name: 45 km spacing - **survey 6**
Number of samplers: 10

Sampler 1
0.3424219 38
0.3424219 39
--
Sampler 2
0.7466637 38
0.7466637 39
--
Sampler 3
1.150906 38
1.150906 40
--
Sampler 4
1.555148 38
1.555148 38.65422
--
1.555148 38.6976
1.555148 38.97346
--
1.555148 39.11411
1.555148 40
--
Sampler 5
1.959389 38
1.959389 40
--
Sampler 6
2.363631 38
2.363631 41
--
Sampler 7
2.767873 38
2.767873 39.38477
--
2.767873 39.83936
2.767873 41
--
Sampler 8
3.172115 39
3.172115 39.32454
--
3.172115 39.76574
3.172115 40
--
Sampler 9
3.576357 39
3.576357 40
--
Sampler 10
3.980599 39
3.980599 39.93099
--

Survey 7

LINES GENERATED: 9
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1538.144 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1285.561 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2571.123 square Kilometers
LINE SPACING: 45 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1840.081 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2239.392 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2213.737 square Kilometers
STRATUM AREA: 62263.802 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.036



Sample layer name: 45 km spacing - **survey 7**
Number of samplers: 9

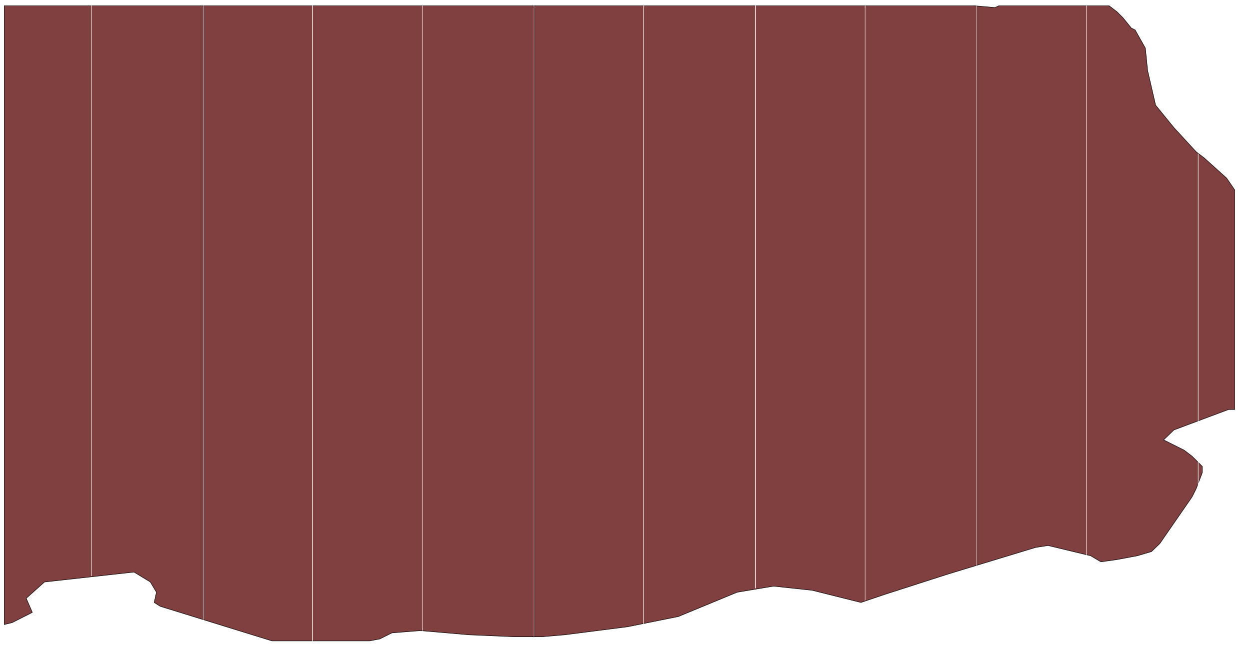
Sampler 1
0.3798918 38
0.3798918 39
--
Sampler 2
0.7841337 38
0.7841337 39
--
Sampler 3
1.188376 38
1.188376 40
--
Sampler 4
1.592618 38
1.592618 39.0078
--
1.592618 39.09824
1.592618 40
--
Sampler 5
1.996859 38
1.996859 40
--
Sampler 6
2.401101 38
2.401101 39.52416
--
2.401101 39.62137
2.401101 41
--
Sampler 7
2.805343 38
2.805343 39.36
--
2.805343 39.85343
2.805343 41
--
Sampler 8
3.209585 39
3.209585 39.34595
--
3.209585 39.74891
3.209585 40
--
Sampler 9
3.613827 39
3.613827 40
--

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Block 2

Survey 1

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1885.047 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1705.956 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3411.911 square Kilometers
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2025.587 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2346.874 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3391.44 square Kilometers
STRATUM AREA: 52460.607 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.065

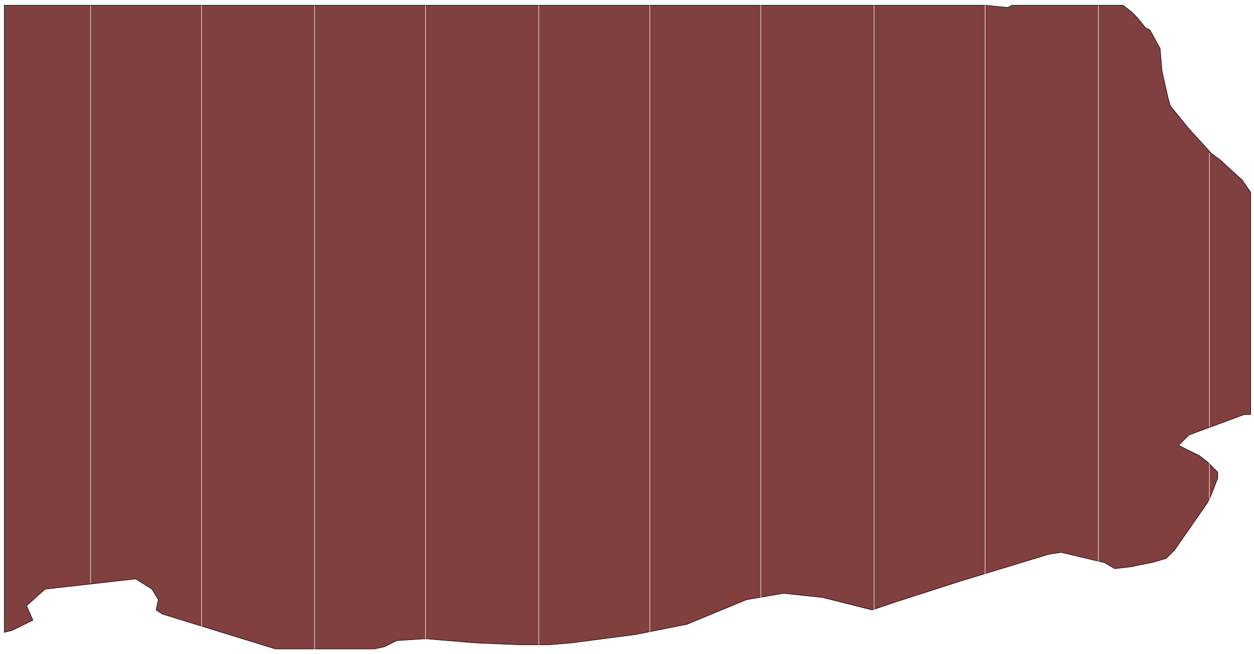


Sample layer name: 30 km spacing - **survey 1**
Number of samplers: 11

Sampler 1
13.21237 38.19681
13.21237 39.99518
--
Sampler 2
13.48187 38.06263
13.48187 39.99518
--
Sampler 3
13.75136 37.99518
13.75136 39.99518
--
Sampler 4
14.02086 38.03011
14.02086 39.99518
--
Sampler 5
14.29035 38.0074
14.29035 39.99518
--
Sampler 6
14.55984 38.04955
14.55984 39.99518
--
Sampler 7
14.82934 38.15787
14.82934 39.99518
--
Sampler 8
15.09883 38.1219
15.09883 39.99518
--
Sampler 9
15.36833 38.22963
15.36833 39.99382
--
Sampler 10
15.63782 38.26256
15.63782 39.99518
--
Sampler 11
15.90732 38.47595
15.90732 38.55631
--
15.90732 38.68058
15.90732 39.52548
--

Survey 2

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1885.047 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1709.366 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3418.731 square Kilometers
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2027.286 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2348.818 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3398.219 square Kilometers
STRATUM AREA: 52460.607 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.065

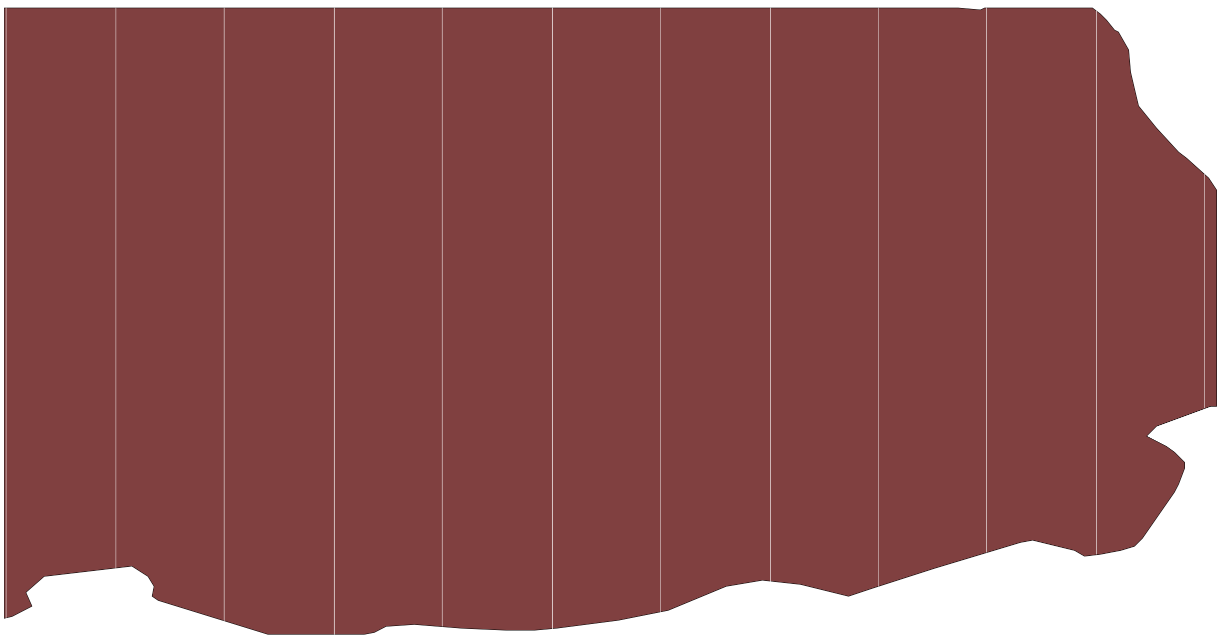


Sample layer name: 30 km spacing - **survey 2**
Number of samplers: 11

Sampler 1
13.20546 38.19577
13.20546 39.99518
--
Sampler 2
13.47495 38.06538
13.47495 39.99518
--
Sampler 3
13.74445 37.99518
13.74445 39.99518
--
Sampler 4
14.01394 38.03086
14.01394 39.99518
--
Sampler 5
14.28344 38.0074
14.28344 39.99518
--
Sampler 6
14.55293 38.04763
14.55293 39.99518
--
Sampler 7
14.82243 38.15662
14.82243 39.99518
--
Sampler 8
15.09192 38.11933
15.09192 39.99518
--
Sampler 9
15.36142 38.22686
15.36142 39.99488
--
Sampler 10
15.63091 38.26475
15.63091 39.99518
--
Sampler 11
15.9004 38.45921
15.9004 38.56378
--
15.9004 38.67727
15.9004 39.53237
--

Survey 3

LINES GENERATED: 12
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1885.047 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1854.335 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3708.67 square Kilometers
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2210.39 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2547.625 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3667.875 square Kilometers
STRATUM AREA: 52460.607 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.07

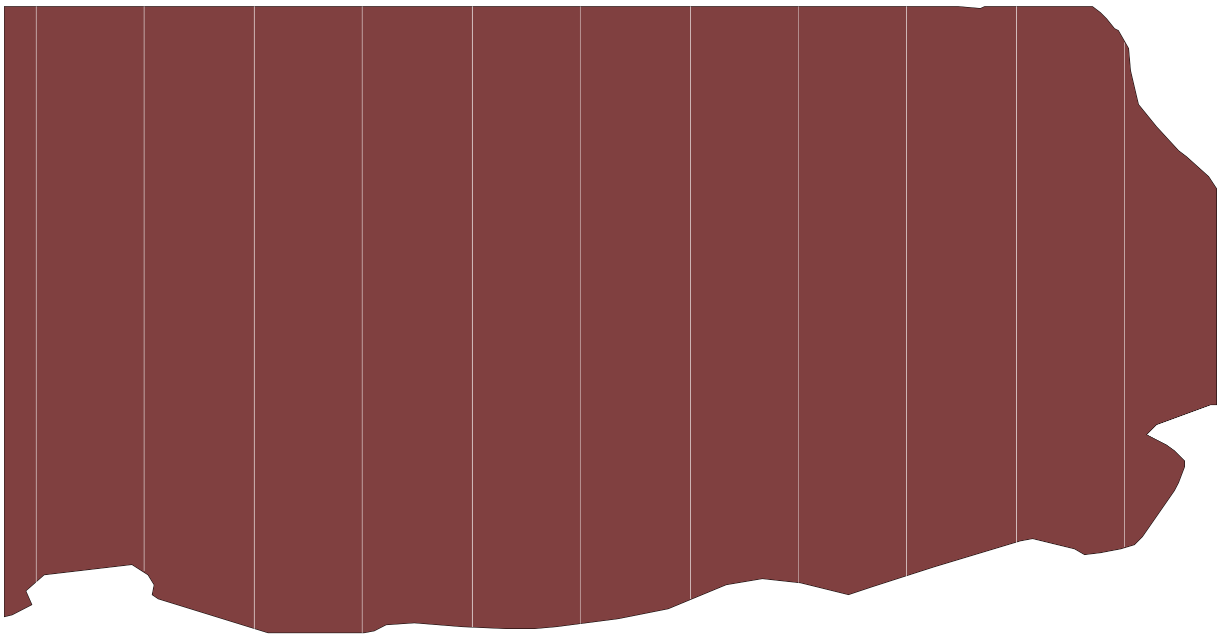


Sample layer name: 30 km spacing - **survey 3**
Number of samplers: 12

Sampler 1
13.00584 38.04912
13.00584 39.99518
--
Sampler 2
13.27534 38.20633
13.27534 39.99518
--
Sampler 3
13.54483 38.03757
13.54483 39.99518
--
Sampler 4
13.81433 37.99518
13.81433 39.99518
--
Sampler 5
14.08382 38.02319
14.08382 39.99518
--
Sampler 6
14.35332 38.01206
14.35332 39.99518
--
Sampler 7
14.62281 38.06707
14.62281 39.99518
--
Sampler 8
14.89231 38.16305
14.89231 39.99518
--
Sampler 9
15.1618 38.14574
15.1618 39.99518
--
Sampler 10
15.43129 38.25487
15.43129 39.99518
--
Sampler 11
15.70079 38.2485
15.70079 39.98608
--
Sampler 12
15.97028 38.71069
15.97028 39.45634
--

Survey 4

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1885.047 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1766.066 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3532.133 square Kilometers
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2069.762 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2405.628 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3528.601 square Kilometers
STRATUM AREA: 52460.607 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.067

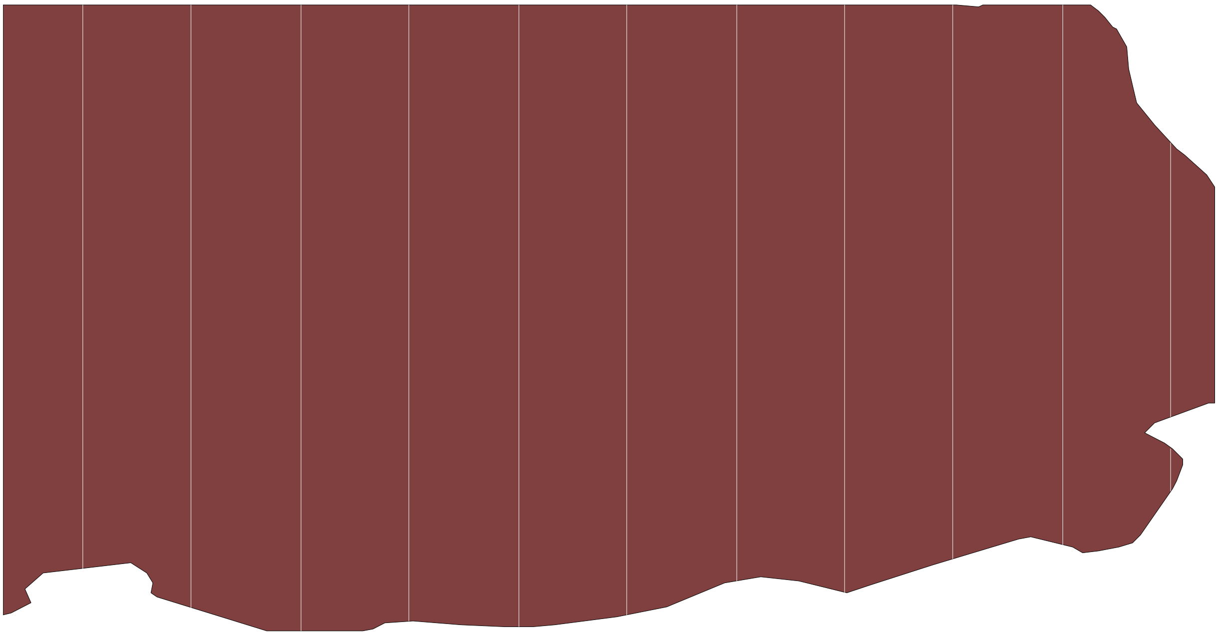


Sample layer name: 30 km spacing - **survey 4**
Number of samplers: 11

Sampler 1
13.0777 38.15519
13.0777 39.99518
--
Sampler 2
13.3472 38.18946
13.3472 39.99518
--
Sampler 3
13.61669 38.009
13.61669 39.99518
--
Sampler 4
13.88619 37.99518
13.88619 39.99518
--
Sampler 5
14.15568 38.01564
14.15568 39.99518
--
Sampler 6
14.42518 38.02295
14.42518 39.99518
--
Sampler 7
14.69467 38.10112
14.69467 39.99518
--
Sampler 8
14.96417 38.15296
14.96417 39.99518
--
Sampler 9
15.23366 38.17512
15.23366 39.99518
--
Sampler 10
15.50316 38.28369
15.50316 39.99518
--
Sampler 11
15.77265 38.2674
15.77265 39.8746
--

Survey 5

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1885.047 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1713.576 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3427.152 square Kilometers
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2029.462 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2351.455 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3406.589 square Kilometers
STRATUM AREA: 52460.607 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.065

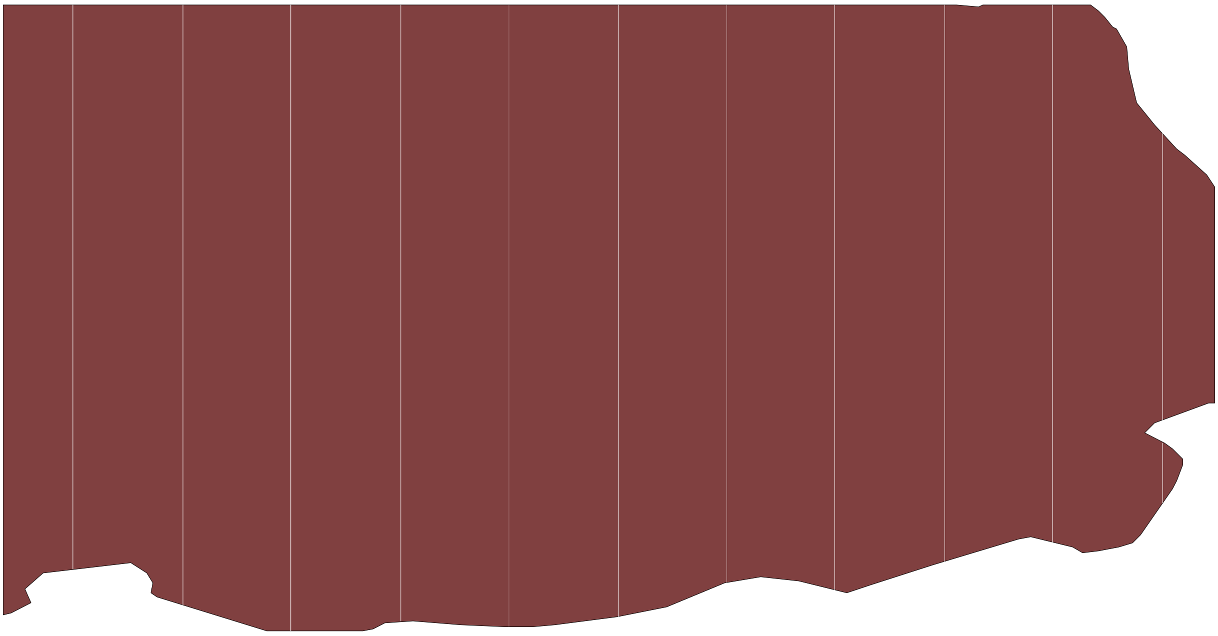


Sample layer name: 30 km spacing - **survey 5**
Number of samplers: 11

Sampler 1
13.19645 38.1944
13.19645 39.99518
--
Sampler 2
13.46594 38.06896
13.46594 39.99518
--
Sampler 3
13.73544 37.99518
13.73544 39.99518
--
Sampler 4
14.00493 38.03032
14.00493 39.99518
--
Sampler 5
14.27443 38.0074
14.27443 39.99518
--
Sampler 6
14.54392 38.04512
14.54392 39.99518
--
Sampler 7
14.81341 38.15501
14.81341 39.99518
--
Sampler 8
15.08291 38.11901
15.08291 39.99518
--
Sampler 9
15.3524 38.22325
15.3524 39.99518
--
Sampler 10
15.6219 38.2676
15.6219 39.99518
--
Sampler 11
15.89139 38.44175
15.89139 38.57328
--
15.89139 38.67296
15.89139 39.54586
--

Survey 6

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1885.047 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1722.935 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3445.869 square Kilometers
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2034.348 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2357.513 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3425.194 square Kilometers
STRATUM AREA: 52460.607 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.065



Sample layer name: 30 km spacing - **survey 6**
Number of samplers: 11

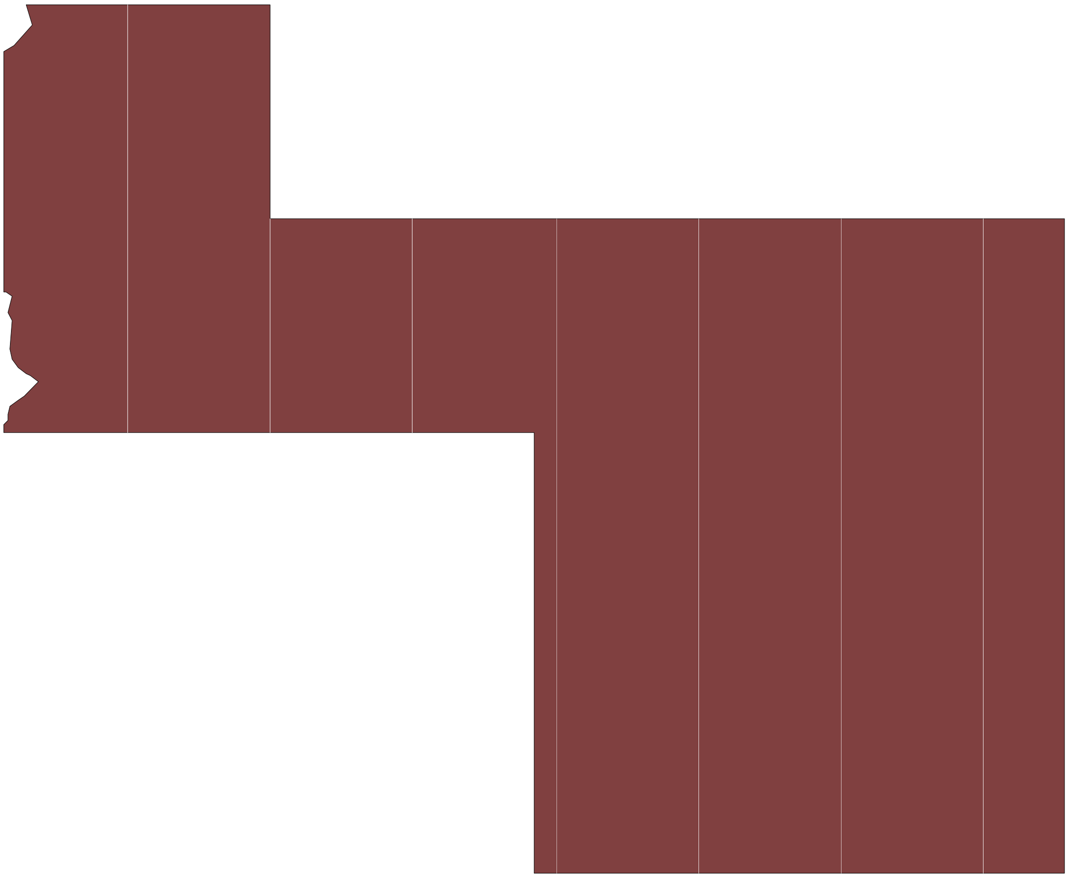
Sampler 1
13.17391 38.191
13.17391 39.99518
--
Sampler 2
13.4434 38.07793
13.4434 39.99518
--
Sampler 3
13.7129 37.99518
13.7129 39.99518
--
Sampler 4
13.98239 38.0283
13.98239 39.99518
--
Sampler 5
14.25189 38.0074
14.25189 39.99518
--
Sampler 6
14.52138 38.03885
14.52138 39.99518
--
Sampler 7
14.79087 38.15096
14.79087 39.99518
--
Sampler 8
15.06037 38.12557
15.06037 39.99518
--
Sampler 9
15.32986 38.21421
15.32986 39.99518
--
Sampler 10
15.59936 38.27475
15.59936 39.99518
--
Sampler 11
15.86885 38.39976
15.86885 38.59274
--
15.86885 38.66219
15.86885 39.57961
--

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Block 3

Survey 1

LINES GENERATED: 7
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1458.7 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2917.399 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1866.291 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2237.474 Kilometers
REALIZED SAMPLER AREA COVERAGE: 1800.035 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.02

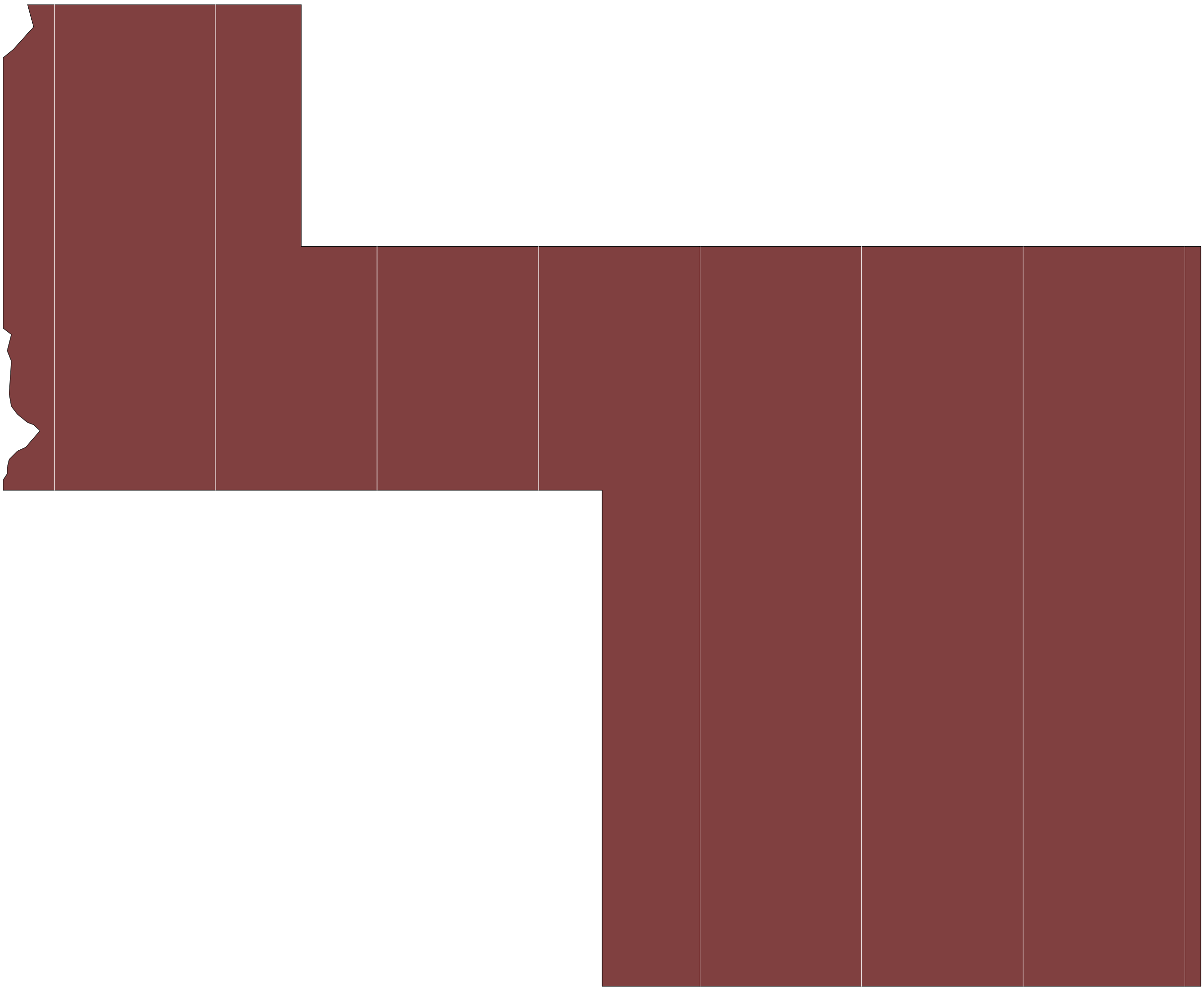


Sample layer name: 60 km spacing - **survey 1**
Number of samplers: 7

Sampler 1
11.46407 35
11.46407 37
--
Sampler 2
12.00306 35
12.00306 36
--
Sampler 3
12.54205 35
12.54205 36
--
Sampler 4
13.08104 33
13.08104 36
--
Sampler 5
13.62003 33
13.62003 36
--
Sampler 6
14.15902 33
14.15902 36
--
Sampler 7
14.69801 33
14.69801 36
--

Survey 2

LINES GENERATED: 8
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1638.434 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3276.868 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2106.025 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2536.58 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3519.356 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.039

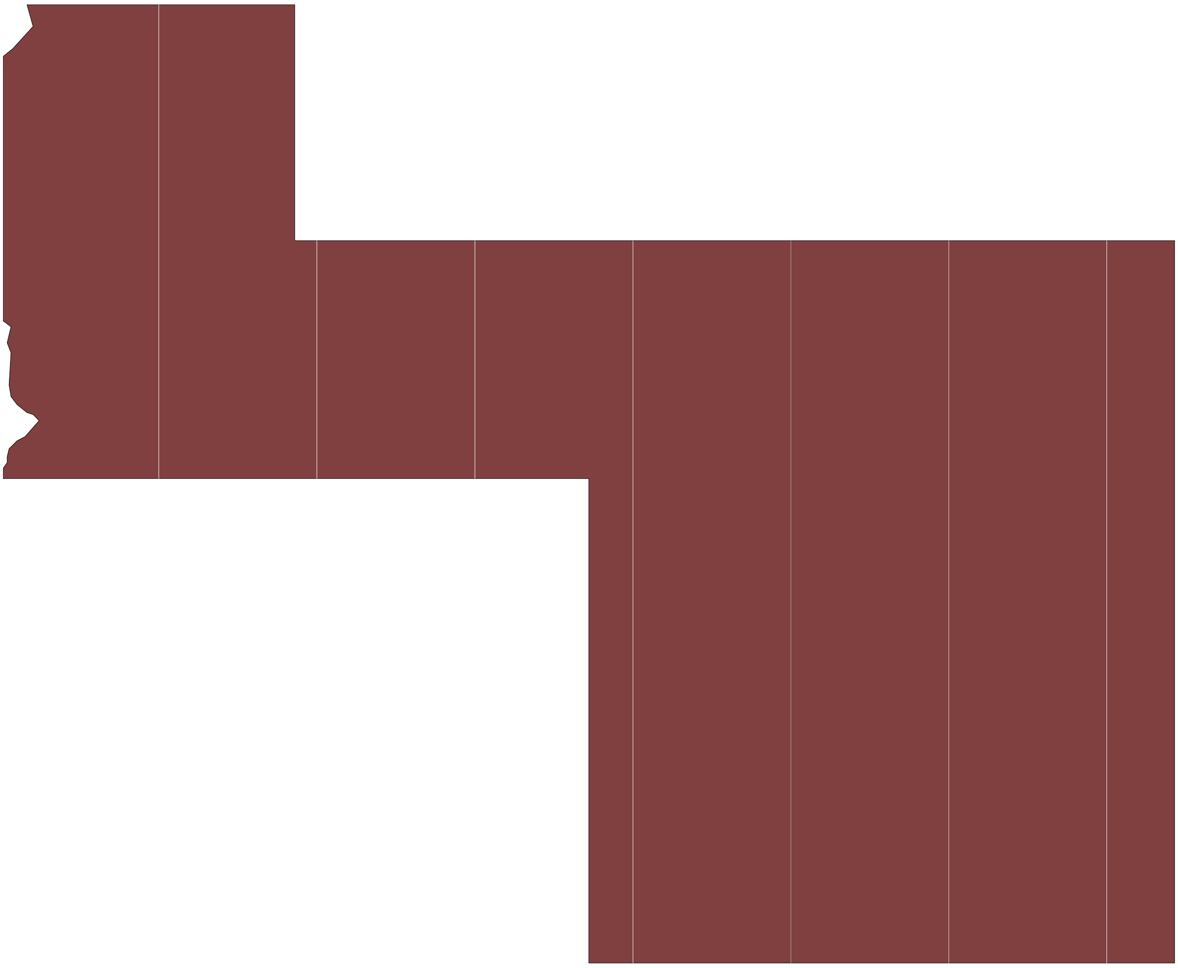


Sample layer name: 60 km spacing - **survey 2**
Number of samplers: 8

Sampler 1
11.17128 35
11.17128 37
--
Sampler 2
11.71027 35
11.71027 37
--
Sampler 3
12.24926 35
12.24926 36
--
Sampler 4
12.78825 35
12.78825 36
--
Sampler 5
13.32724 33
13.32724 36
--
Sampler 6
13.86623 33
13.86623 36
--
Sampler 7
14.40522 33
14.40522 36
--
Sampler 8
14.94421 33
14.94421 36
--

Survey 3

LINES GENERATED: 7
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1458.7 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2917.399 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1866.291 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2237.474 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3165.378 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.035

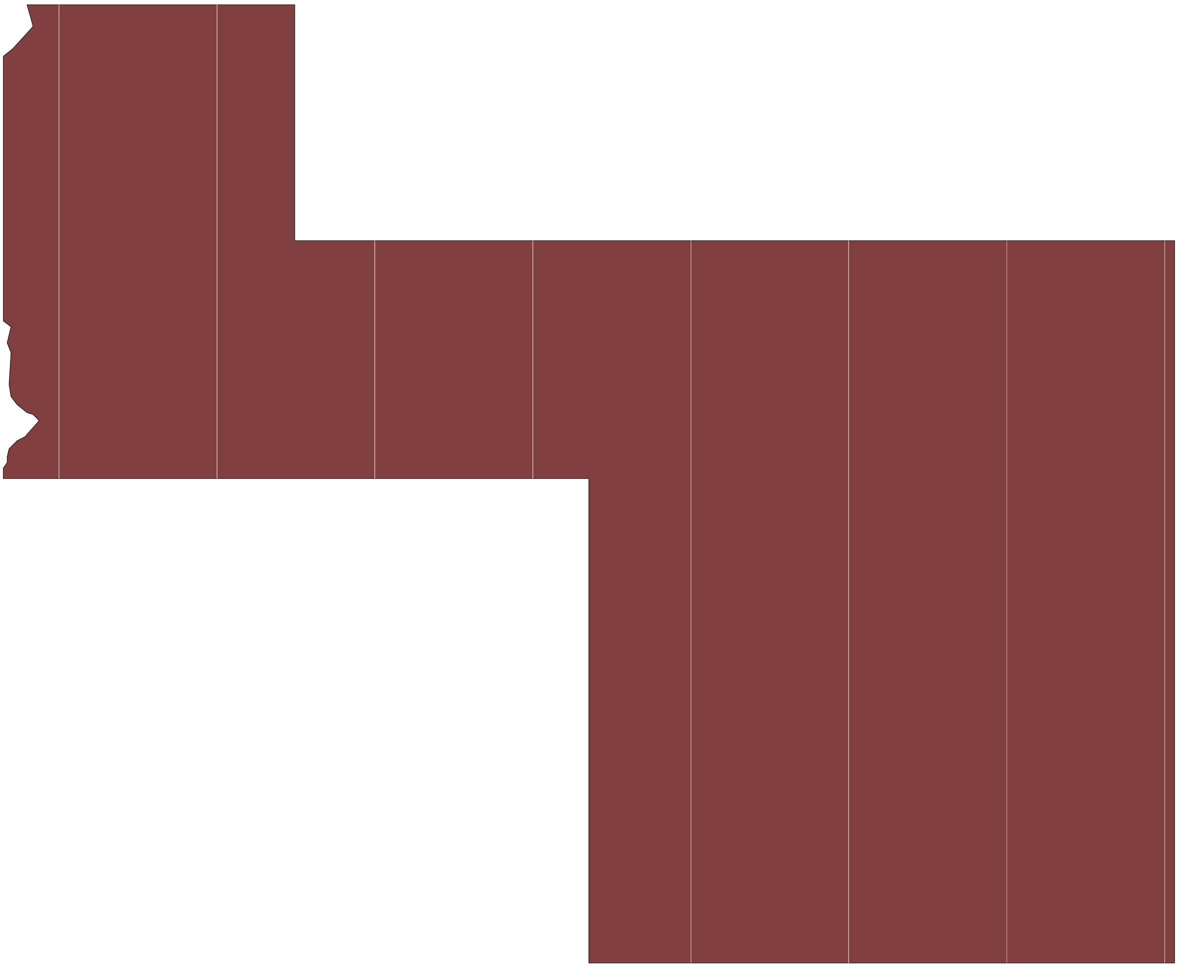


Sample layer name: 60 km spacing - **survey 3**
Number of samplers: 7

Sampler 1
11.53405 35
11.53405 37
--
Sampler 2
12.07304 35
12.07304 36
--
Sampler 3
12.61203 35
12.61203 36
--
Sampler 4
13.15102 33
13.15102 36
--
Sampler 5
13.69001 33
13.69001 36
--
Sampler 6
14.229 33
14.229 36
--
Sampler 7
14.76799 33
14.76799 36
--

Survey 4

LINES GENERATED: 8
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1638.434 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3276.868 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2106.025 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2536.58 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3519.356 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.039

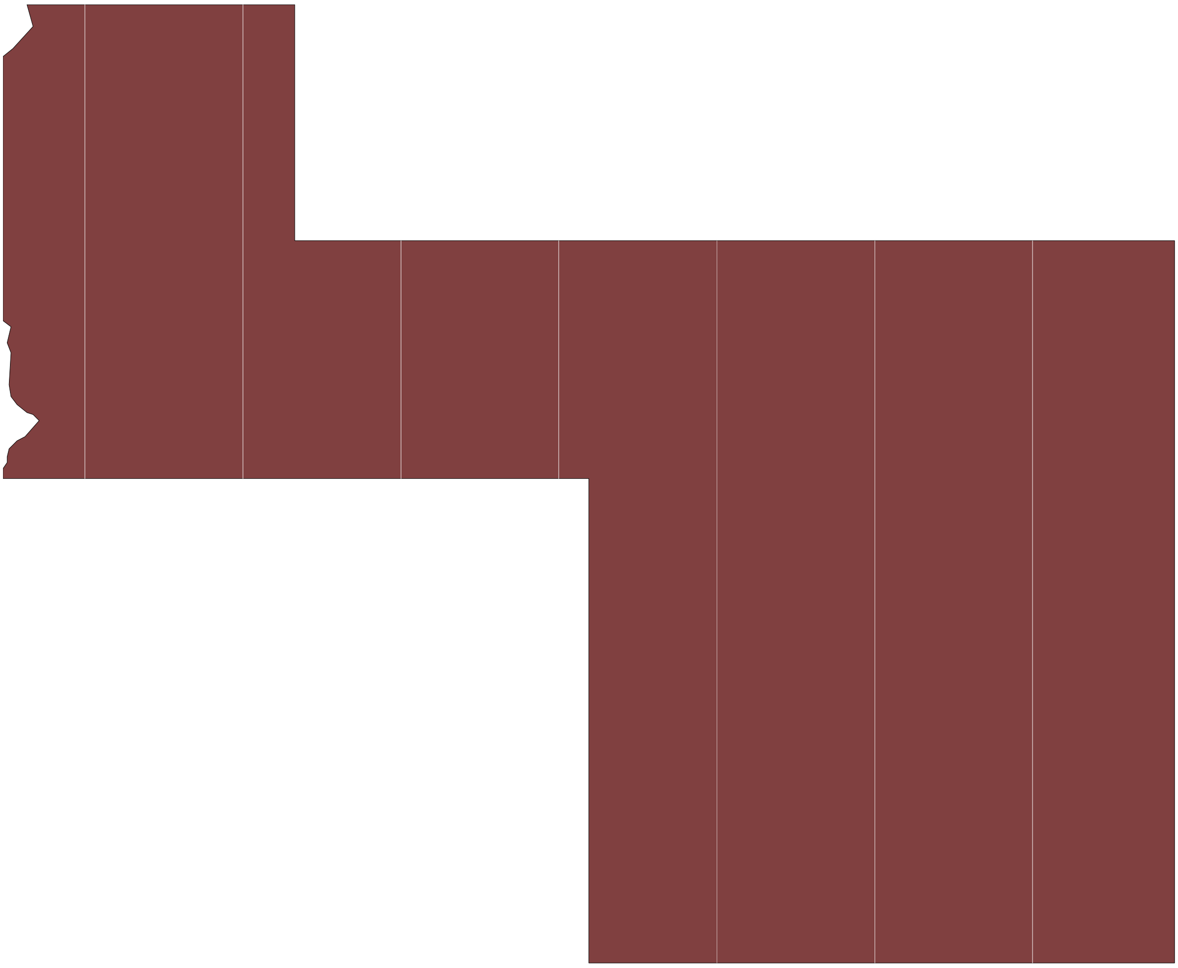


Sample layer name: 60 km spacing - **survey 4**
Number of samplers: 8

Sampler 1
11.19003 35
11.19003 37
--
Sampler 2
11.72901 35
11.72901 37
--
Sampler 3
12.268 35
12.268 36
--
Sampler 4
12.80699 35
12.80699 36
--
Sampler 5
13.34598 33
13.34598 36
--
Sampler 6
13.88497 33
13.88497 36
--
Sampler 7
14.42396 33
14.42396 36
--
Sampler 8
14.96295 33
14.96295 36
--

Survey 5

LINES GENERATED: 7
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1363.906 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2727.812 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1771.497 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2176.771 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3093.339 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.034

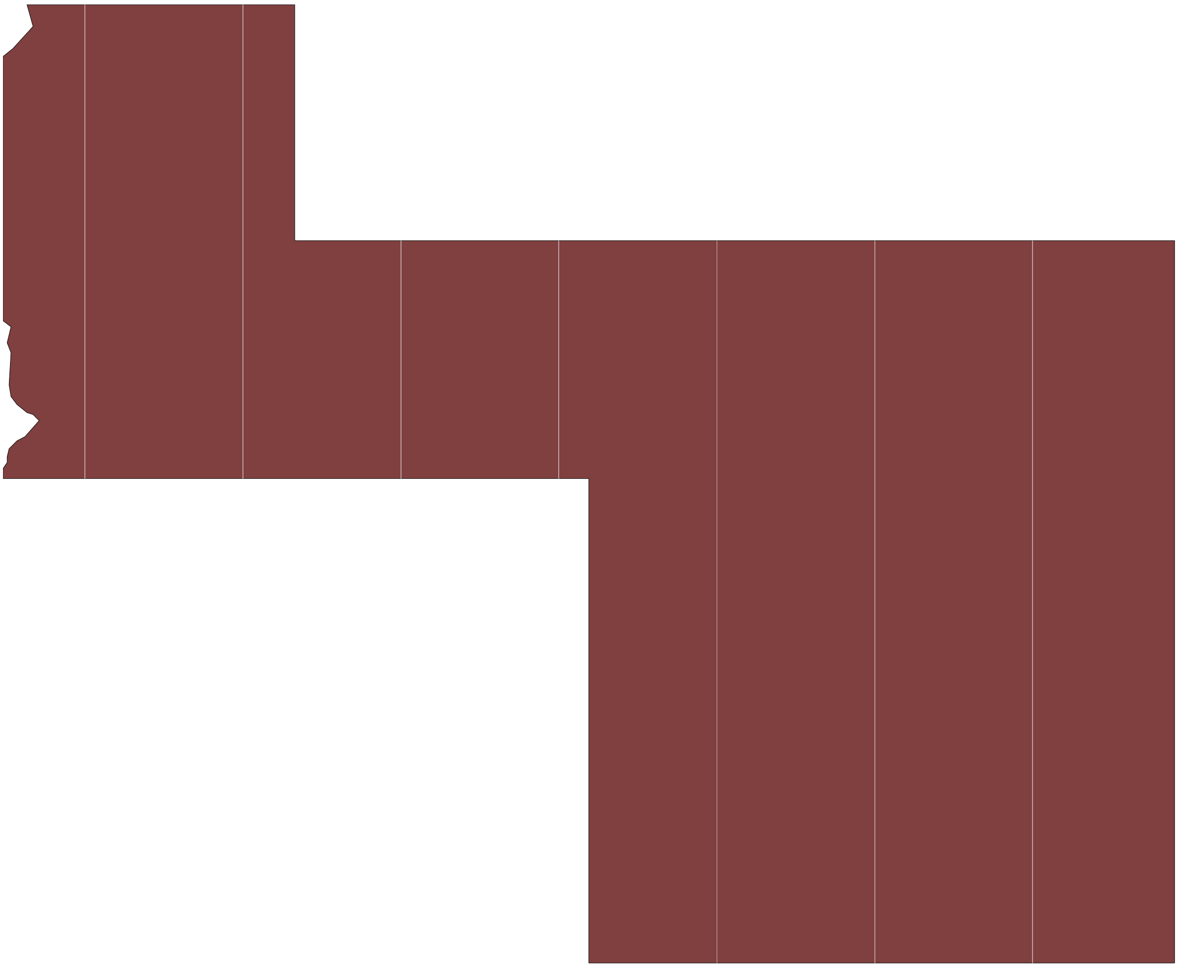


Sample layer name: 60 km spacing - **survey 5**
Number of samplers: 7

Sampler 1
11.28251 35
11.28251 37
--
Sampler 2
11.8215 35
11.8215 37
--
Sampler 3
12.36049 35
12.36049 36
--
Sampler 4
12.89948 35
12.89948 36
--
Sampler 5
13.43847 33
13.43847 36
--
Sampler 6
13.97746 33
13.97746 36
--
Sampler 7
14.51645 33
14.51645 36
--

Survey 6

LINES GENERATED: 7
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1363.906 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2727.812 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1771.497 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2176.771 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3093.339 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.034



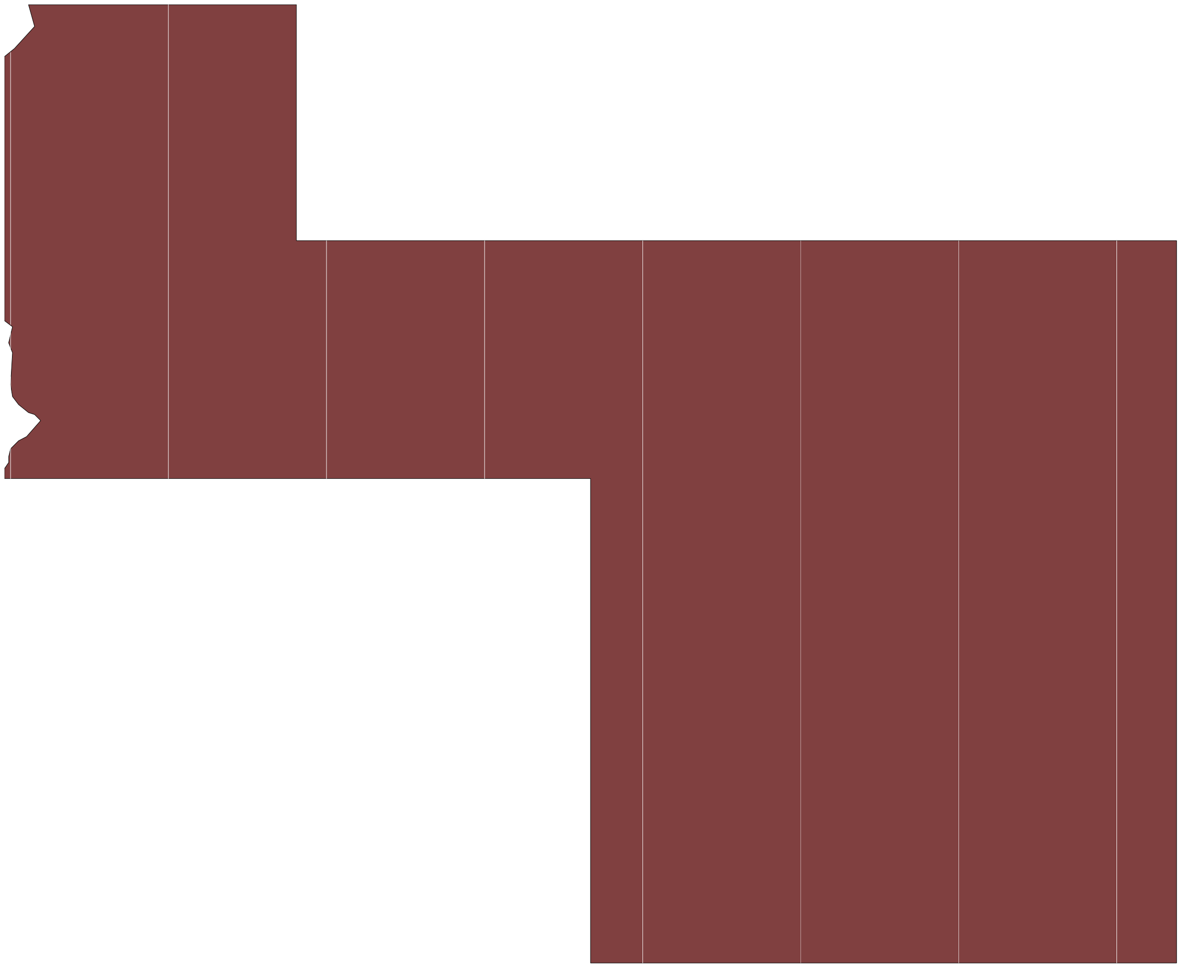
Sample layer name: 60 km spacing - **survey 6**
Type of sampler: Line
Number of samplers: 7

List of samplers:
x-coord y-coord

Sampler 1
11.27995 35
11.27995 37
--
Sampler 2
11.81894 35
11.81894 37
--
Sampler 3
12.35793 35
12.35793 36
--
Sampler 4
12.89692 35
12.89692 36
--
Sampler 5
13.43591 33
13.43591 36
--
Sampler 6
13.9749 33
13.9749 36
--
Sampler 7
14.51389 33
14.51389 36
--

Survey 7

LINES GENERATED: 8
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1585.276 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3170.552 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2088.153 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2521.313 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2111.588 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.023

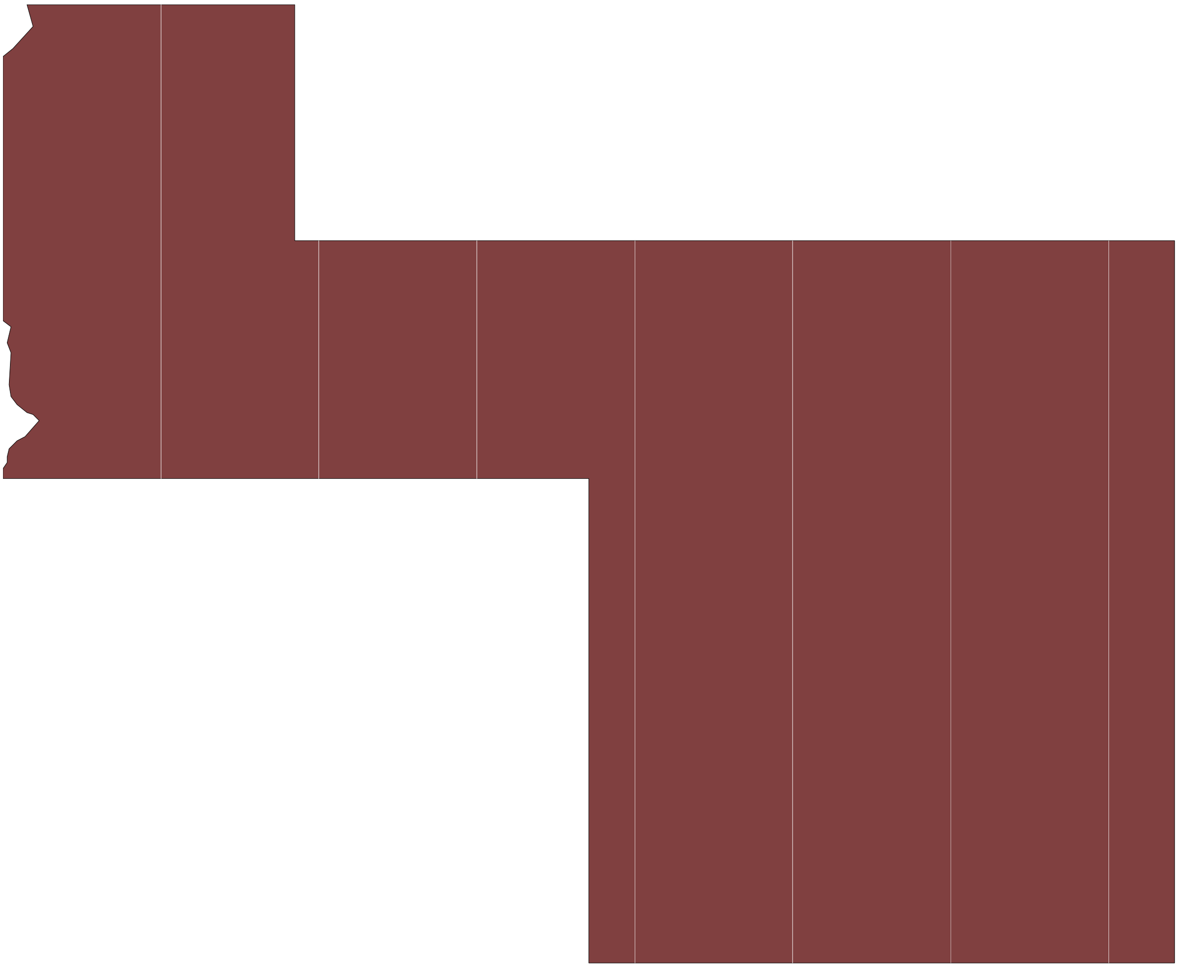


Sample layer name: 60 km spacing - **survey 7**
Number of samplers: 8

Sampler 1
11.02225 35
11.02225 35.1272
--
11.02225 35.368
11.02225 35.42305
--
11.02225 35.54119
11.02225 35.61038
--
11.02225 35.64093
11.02225 36.79886
--
Sampler 2
11.56124 35
11.56124 37
--
Sampler 3
12.10023 35
12.10023 36
--
Sampler 4
12.63922 35
12.63922 36
--
Sampler 5
13.17821 33
13.17821 36
--
Sampler 6
13.7172 33
13.7172 36
--
Sampler 7
14.25619 33
14.25619 36
--
Sampler 8
14.79518 33
14.79518 36
--

Survey 8

LINES GENERATED: 7
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1458.7 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2917.399 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1866.291 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2237.474 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3165.378 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.035

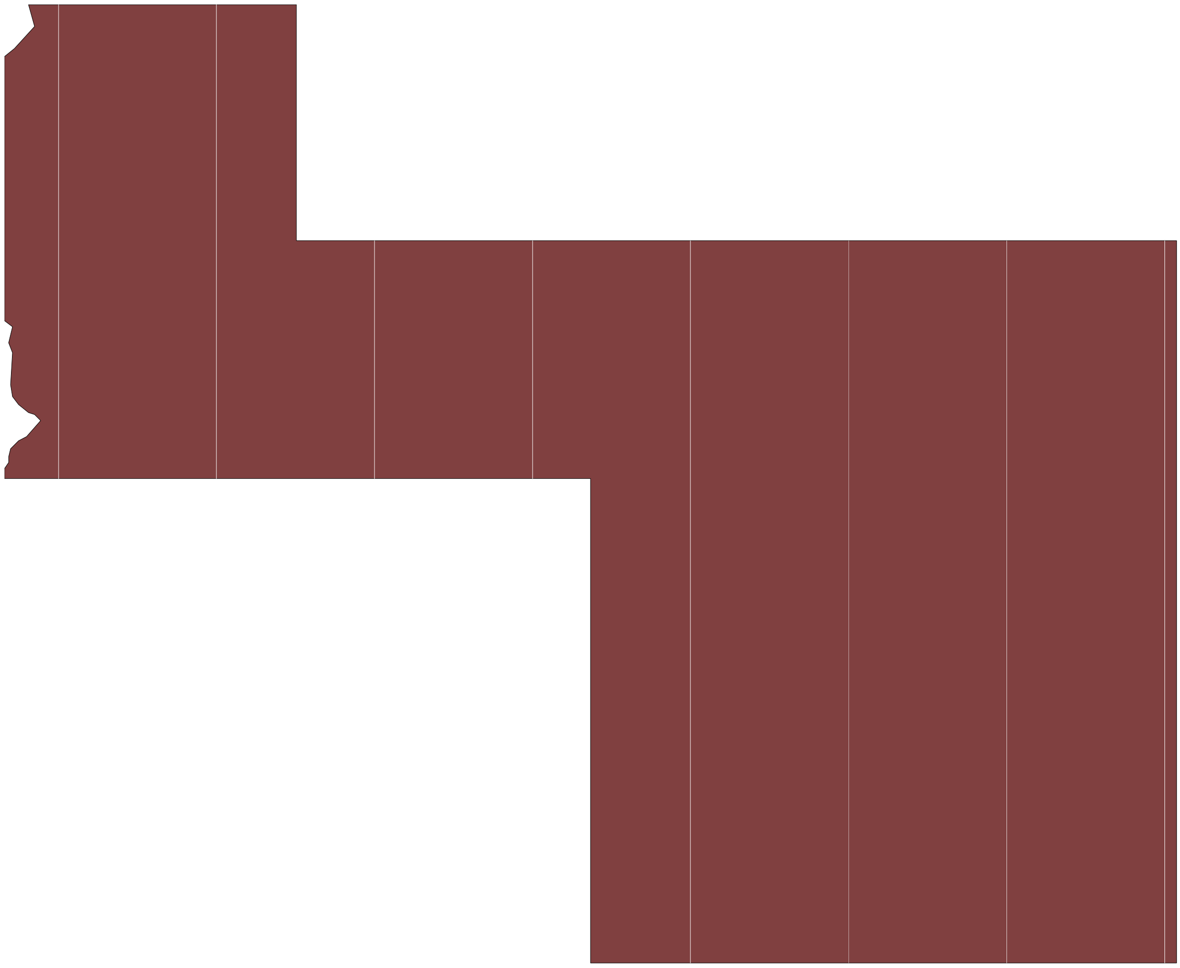


Sample layer name: 60 km spacing - **survey 8**
Number of samplers: 7

Sampler 1
11.53742 35
11.53742 37
--
Sampler 2
12.07641 35
12.07641 36
--
Sampler 3
12.6154 35
12.6154 36
--
Sampler 4
13.15439 33
13.15439 36
--
Sampler 5
13.69338 33
13.69338 36
--
Sampler 6
14.23237 33
14.23237 36
--
Sampler 7
14.77136 33
14.77136 36
--

Survey 9

LINES GENERATED: 8
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1638.434 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3276.868 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2106.025 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2536.58 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3519.356 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.039

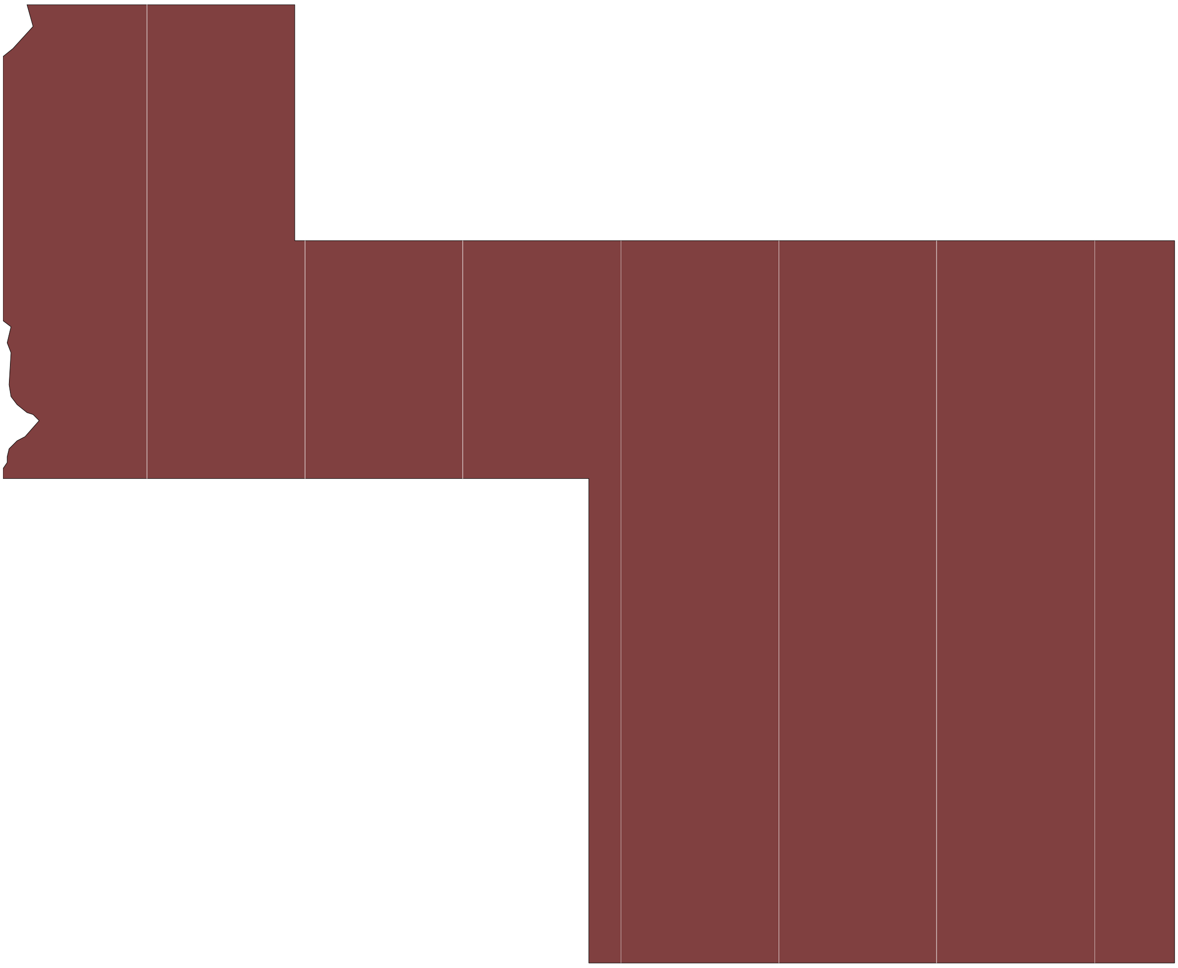


Sample layer name: 60 km spacing - **survey 9**
Number of samplers: 8

Sampler 1
11.18596 35
11.18596 37
--
Sampler 2
11.72495 35
11.72495 37
--
Sampler 3
12.26394 35
12.26394 36
--
Sampler 4
12.80293 35
12.80293 36
--
Sampler 5
13.34191 33
13.34191 36
--
Sampler 6
13.8809 33
13.8809 36
--
Sampler 7
14.41989 33
14.41989 36
--
Sampler 8
14.95888 33
14.95888 36
--

Survey 10

LINES GENERATED: 7
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1631.265 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1458.7 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2917.399 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1866.291 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2237.474 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3165.378 square Kilometers
STRATUM AREA: 90795.781 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.035



Sample layer name: 60 km spacing - **survey 10**
Number of samplers: 7

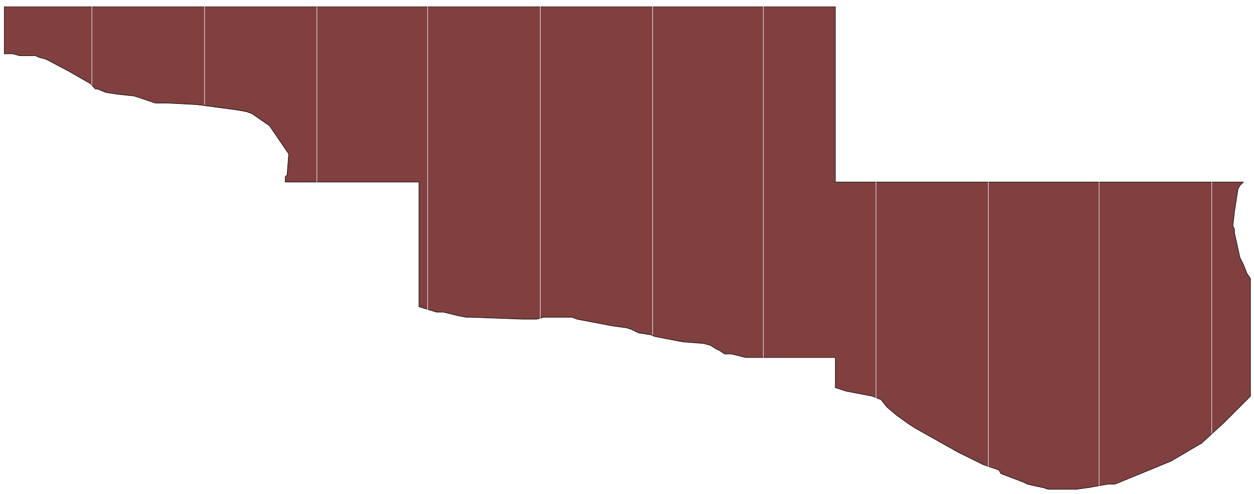
Sampler 1
11.48979 35
11.48979 37
--
Sampler 2
12.02877 35
12.02877 36
--
Sampler 3
12.56776 35
12.56776 36
--
Sampler 4
13.10675 33
13.10675 36
--
Sampler 5
13.64574 33
13.64574 36
--
Sampler 6
14.18473 33
14.18473 36
--
Sampler 7
14.72372 33
14.72372 36
--

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Block 4

Survey 1

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1451.238 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2902.476 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2088.839 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2735.029 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2768.962 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.033

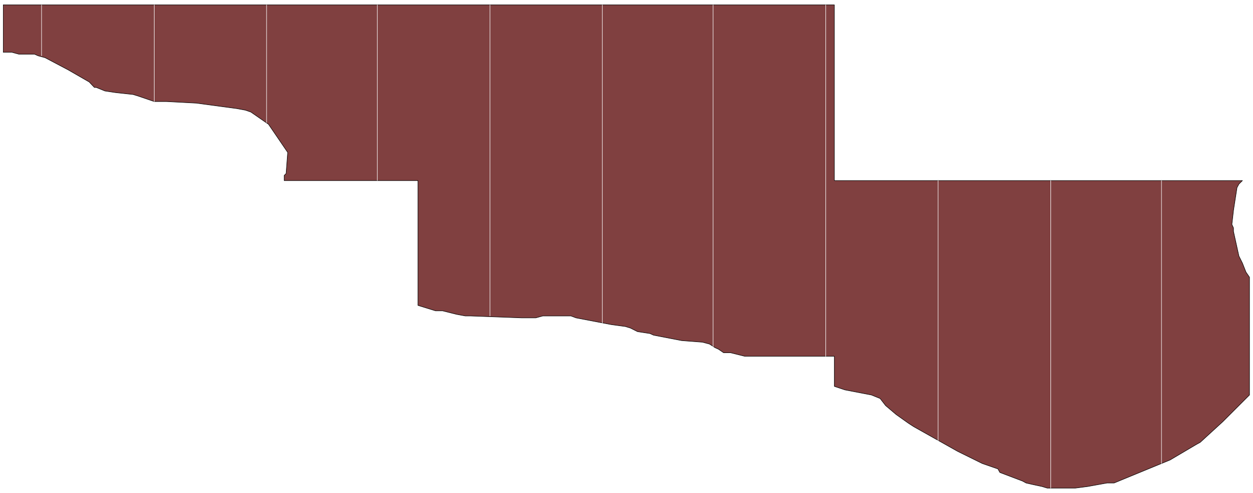


Sample layer name: 60 km spacing - **survey 1**
Number of samplers: 11

Sampler 1
14.42511 32.54662
14.42511 33
--
Sampler 2
14.9641 32.43308
14.9641 33
--
Sampler 3
15.50309 32
15.50309 33
--
Sampler 4
16.04208 31.27286
16.04208 33
--
Sampler 5
16.58107 31.22343
16.58107 33
--
Sampler 6
17.12006 31.12505
17.12006 33
--
Sampler 7
17.65905 31
17.65905 33
--
Sampler 8
18.19804 30.77144
18.19804 32
--
Sampler 9
18.73703 30.38737
18.73703 32
--
Sampler 10
19.27602 30.27841
19.27602 32
--
Sampler 11
19.81501 30.57188
19.81501 32
--

Survey 2

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1399.614 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2799.227 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2053.035 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2656.695 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2706.853 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.032

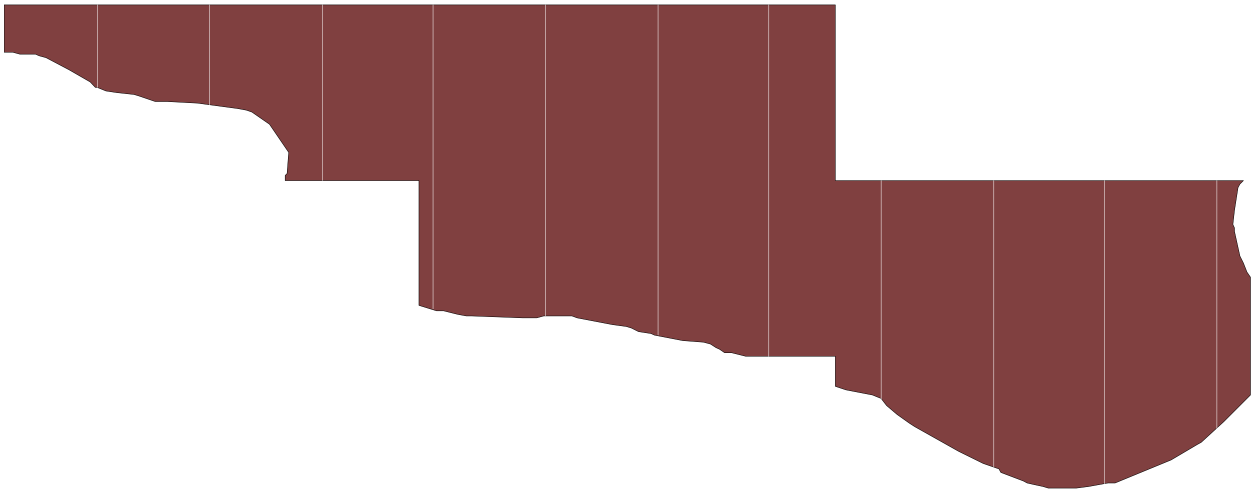


Sample layer name: 60 km spacing - **survey 2**
Number of samplers: 11

Sampler 1
14.18867 32.70794
14.18867 33
--
Sampler 2
14.72766 32.44917
14.72766 33
--
Sampler 3
15.26665 32.32542
15.26665 33
--
Sampler 4
15.80564 32
15.80564 33
--
Sampler 5
16.34463 31.22627
16.34463 33
--
Sampler 6
16.88362 31.19313
16.88362 33
--
Sampler 7
17.42261 31.05247
17.42261 33
--
Sampler 8
17.9616 31
17.9616 33
--
Sampler 9
18.50059 30.53016
18.50059 32
--
Sampler 10
19.03958 30.26488
19.03958 32
--
Sampler 11
19.57857 30.39952
19.57857 32
--

Survey 3

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1453.947 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2907.895 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2092.176 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2737.859 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2777.039 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.033

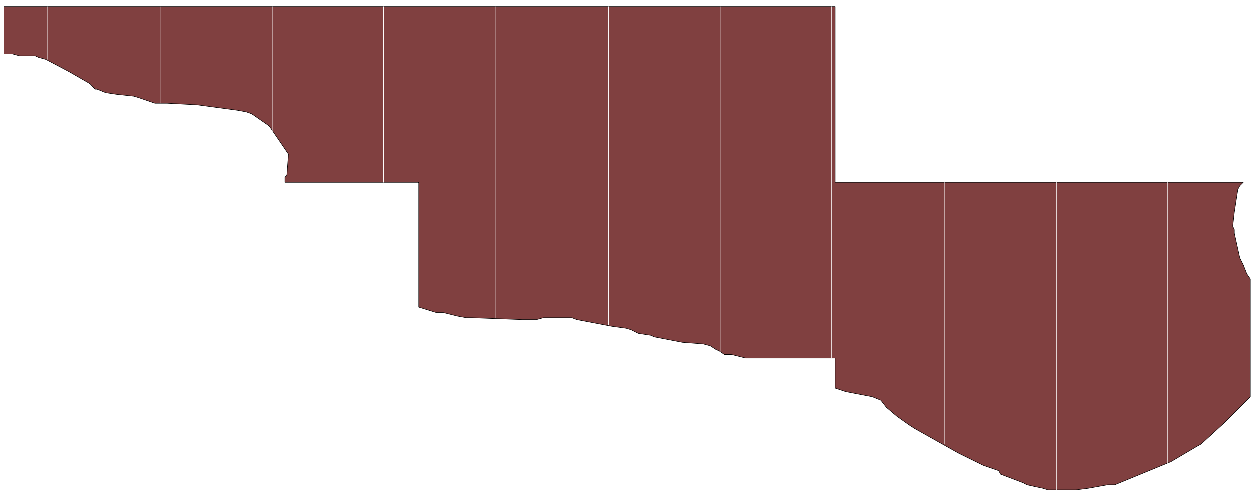


Sample layer name: 60 km spacing - **survey 3**
Number of samplers: 11

Sampler 1
14.44998 32.52508
14.44998 33
--
Sampler 2
14.98897 32.42955
14.98897 33
--
Sampler 3
15.52796 32
15.52796 33
--
Sampler 4
16.06695 31.26585
16.06695 33
--
Sampler 5
16.60593 31.22578
16.60593 33
--
Sampler 6
17.14492 31.11958
17.14492 33
--
Sampler 7
17.68391 31
17.68391 33
--
Sampler 8
18.2229 30.7563
18.2229 32
--
Sampler 9
18.76189 30.37744
18.76189 32
--
Sampler 10
19.30088 30.28336
19.30088 32
--
Sampler 11
19.83987 30.59824
19.83987 32
--

Survey 4

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1407.552 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2815.104 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2063.392 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2666.921 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2733.466 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.032

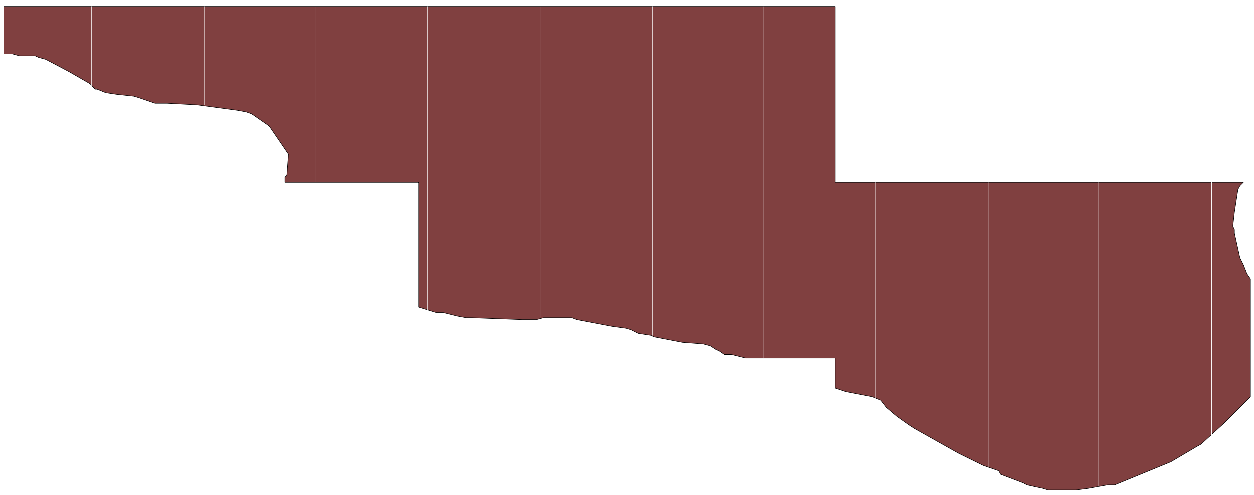


Sample layer name: 60 km spacing - **survey 4**
Number of samplers: 11

Sampler 1
14.21482 32.69501
14.21482 33
--
Sampler 2
14.75381 32.4479
14.75381 33
--
Sampler 3
15.2928 32.28749
15.2928 33
--
Sampler 4
15.83178 32
15.83178 33
--
Sampler 5
16.37077 31.22499
16.37077 33
--
Sampler 6
16.90976 31.18763
16.90976 33
--
Sampler 7
17.44875 31.03344
17.44875 33
--
Sampler 8
17.98774 31
17.98774 33
--
Sampler 9
18.52673 30.51228
18.52673 32
--
Sampler 10
19.06572 30.26467
19.06572 32
--
Sampler 11
19.60471 30.41132
19.60471 32
--

Survey 5

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1451.063 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2902.125 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 2088.634 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2734.847 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2768.627 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.033

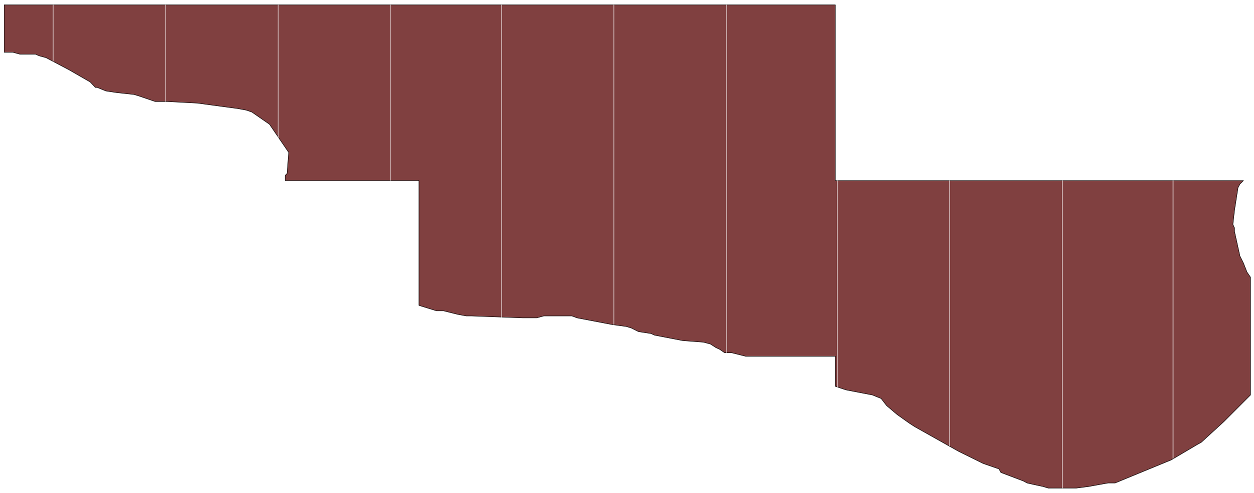


Sample layer name: 60 km spacing - **survey 5**
Number of samplers: 11

Sampler 1
14.4236 32.54814
14.4236 33
--
Sampler 2
14.96259 32.4333
14.96259 33
--
Sampler 3
15.50158 32
15.50158 33
--
Sampler 4
16.04057 31.27328
16.04057 33
--
Sampler 5
16.57956 31.22324
16.57956 33
--
Sampler 6
17.11855 31.12541
17.11855 33
--
Sampler 7
17.65754 31
17.65754 33
--
Sampler 8
18.19653 30.77229
18.19653 32
--
Sampler 9
18.73552 30.38797
18.73552 32
--
Sampler 10
19.27451 30.27811
19.27451 32
--
Sampler 11
19.8135 30.57028
19.8135 32
--

Survey 6

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1338.387 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2676.775 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1953.241 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2642.435 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2612.532 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.031

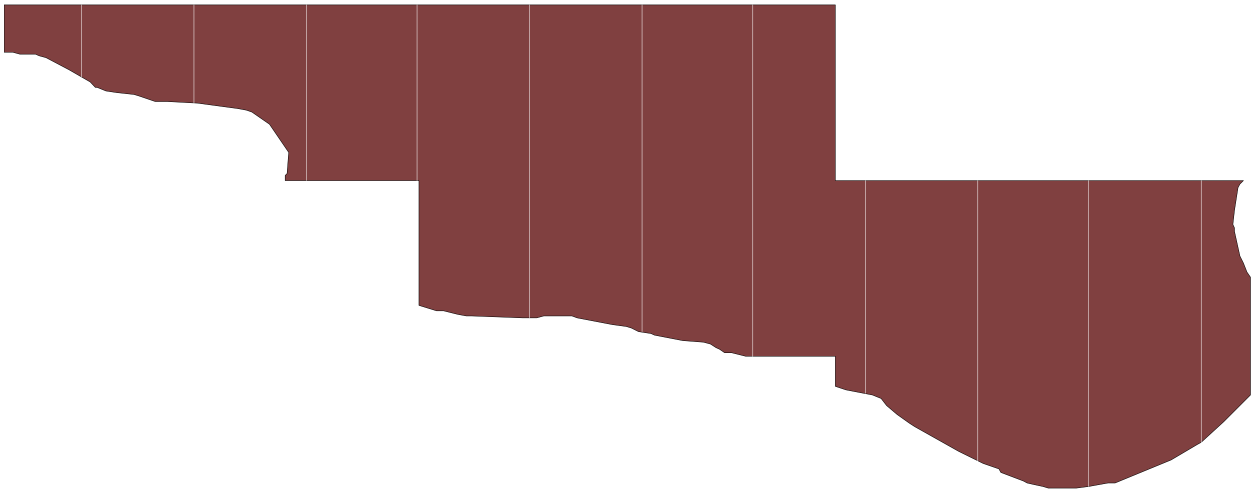


Sample layer name: 60 km spacing - **survey 6**
Number of samplers: 11

Sampler 1
14.24096 32.67905
14.24096 33
--
Sampler 2
14.77995 32.44662
14.77995 33
--
Sampler 3
15.31894 32.24207
15.31894 33
--
Sampler 4
15.85793 32
15.85793 33
--
Sampler 5
16.39692 31.2237
16.39692 33
--
Sampler 6
16.9359 31.1817
16.9359 33
--
Sampler 7
17.47489 31.02222
17.47489 33
--
Sampler 8
18.01388 30.82662
18.01388 32
--
Sampler 9
18.55287 30.4944
18.55287 32
--
Sampler 10
19.09186 30.26446
19.09186 32
--
Sampler 11
19.63085 30.42605
19.63085 32
--

Survey 7

LINES GENERATED: 11
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1518.348 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1379.133 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2758.266 square Kilometers
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1986.042 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2696.837 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2518.297 square Kilometers
STRATUM AREA: 84510.846 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.03



Sample layer name: 60 km spacing - **survey 7**
Number of samplers: 11

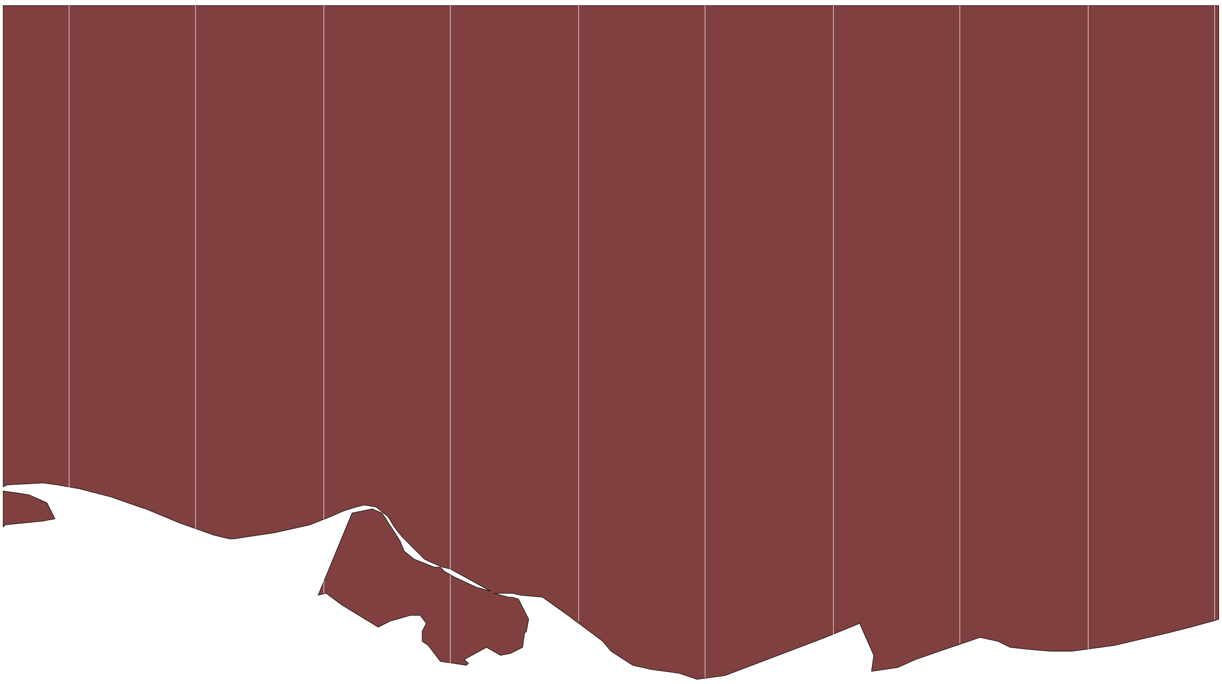
Sampler 1
14.37341 32.58901
14.37341 33
--
Sampler 2
14.9124 32.43861
14.9124 33
--
Sampler 3
15.45139 32
15.45139 33
--
Sampler 4
15.99038 32
15.99038 33
--
Sampler 5
16.52937 31.21828
16.52937 33
--
Sampler 6
17.06836 31.1386
17.06836 33
--
Sampler 7
17.60735 31
17.60735 33
--
Sampler 8
18.14633 30.79077
18.14633 32
--
Sampler 9
18.68532 30.413
18.68532 32
--
Sampler 10
19.22431 30.26813
19.22431 32
--
Sampler 11
19.7633 30.51754
19.7633 32
--

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Block 5

Survey 1

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1647.295 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3294.589 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1988.976 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2306.099 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3264.938 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.059

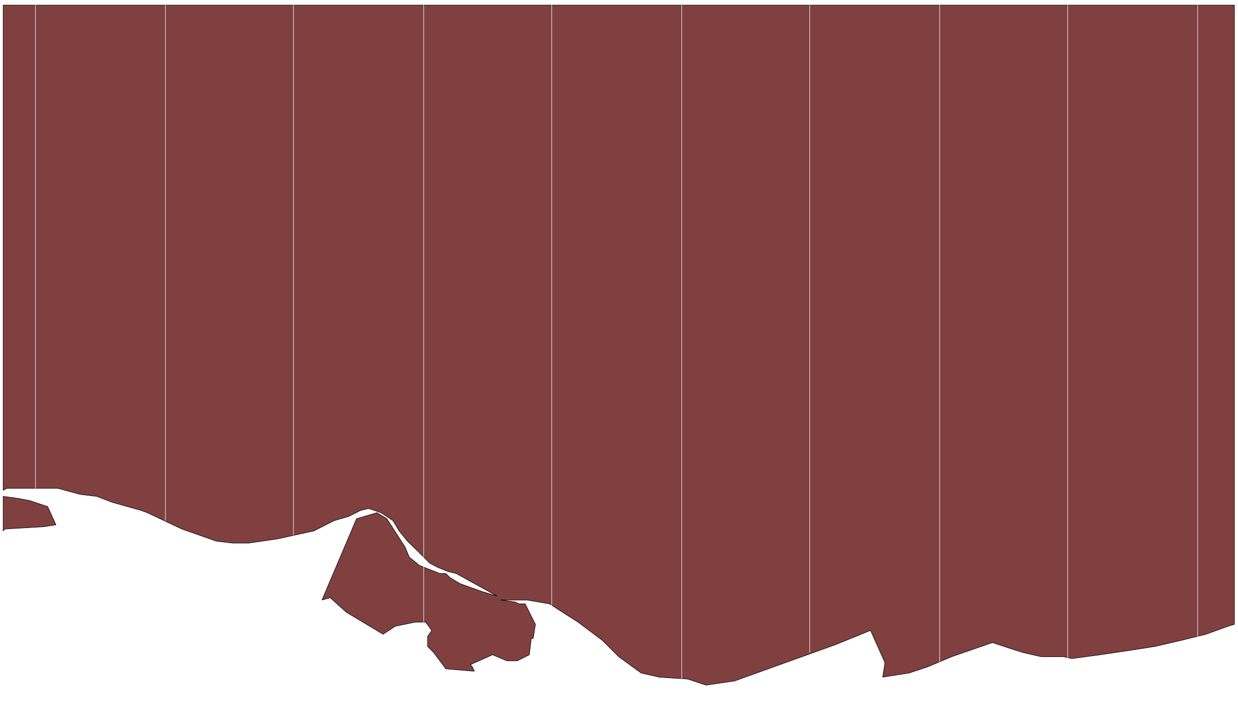


Sample layer name: 35 km spacing - **survey 1**
Number of samplers: 10

Sampler 1
31.16274 31.59094
31.16274 33
--
Sampler 2
31.47715 31.46672
31.47715 33
--
Sampler 3
31.79156 31.28235
31.79156 31.31759
--
31.79156 31.49558
31.79156 33
--
Sampler 4
32.10597 31.07892
32.10597 31.33224
--
32.10597 31.35243
32.10597 33
--
Sampler 5
32.42038 31.1984
32.42038 33
--
Sampler 6
32.73479 31.03771
32.73479 33
--
Sampler 7
33.0492 31.16302
33.0492 33
--
Sampler 8
33.36361 31.13548
33.36361 33
--
Sampler 9
33.67802 31.12094
33.67802 33
--
Sampler 10
33.99244 31.20421
33.99244 33
--

Survey 2

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1630.936 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3261.872 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1949.416 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2266.976 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3258.61 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.059

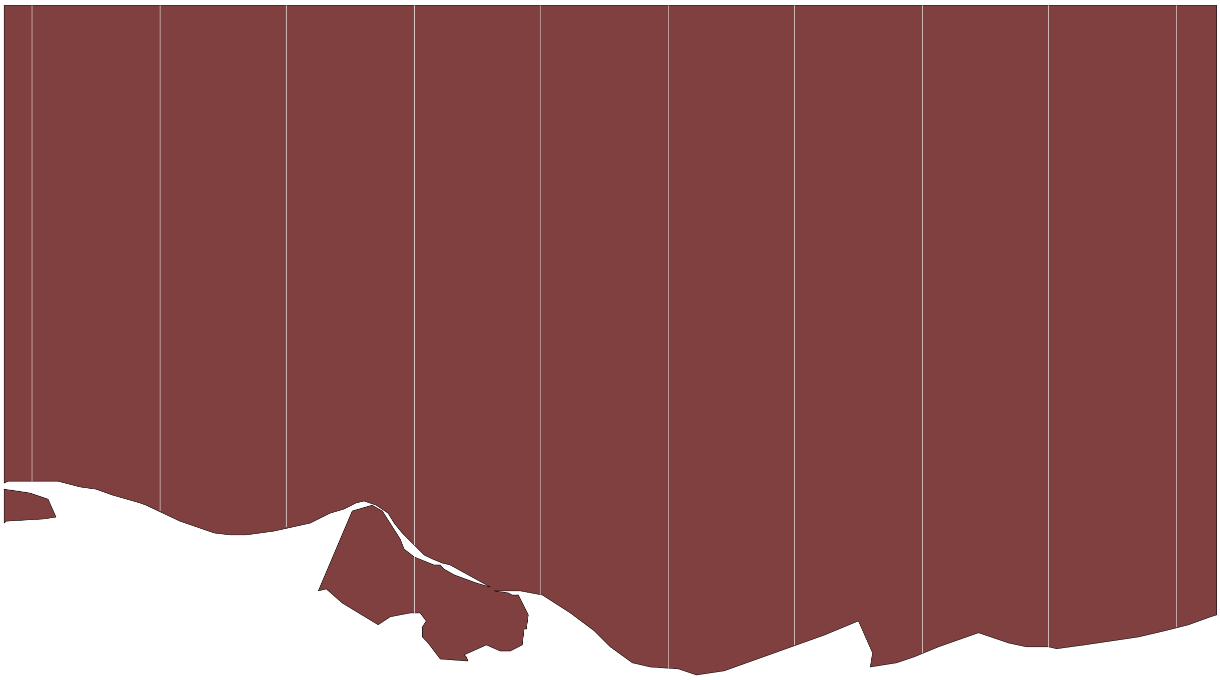


Sample layer name: 35 km spacing - **survey 2**
Number of samplers: 10

Sampler 1
31.07951 31.60065
31.07951 33
--
Sampler 2
31.39392 31.50591
31.39392 33
--
Sampler 3
31.70833 31.46673
31.70833 33
--
Sampler 4
32.02274 31.21612
32.02274 31.37771
--
32.02274 31.40198
32.02274 33
--
Sampler 5
32.33715 31.26361
32.33715 33
--
Sampler 6
32.65157 31.05385
32.65157 33
--
Sampler 7
32.96597 31.1266
32.96597 33
--
Sampler 8
33.28038 31.1017
33.28038 33
--
Sampler 9
33.5948 31.114
33.5948 33
--
Sampler 10
33.90921 31.17586
33.90921 33
--

Survey 3

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1630.614 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3261.228 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1949.509 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2267.094 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3257.967 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.059

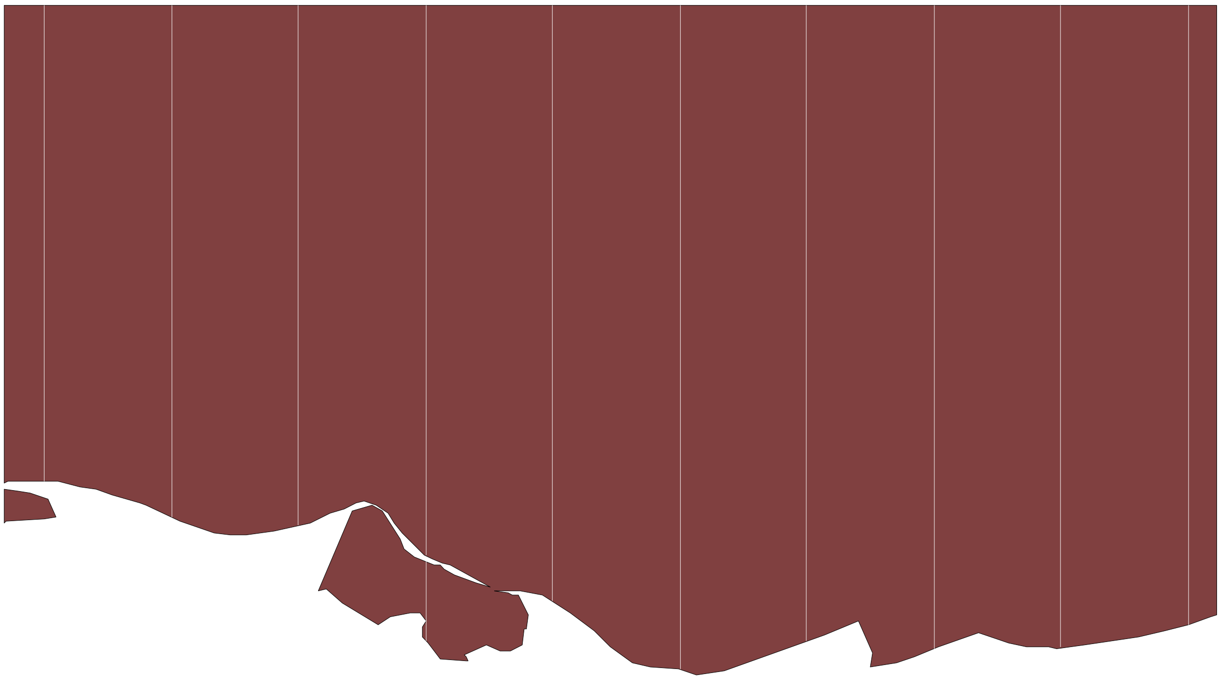


Sample layer name: 35 km spacing - **survey 3**
Number of samplers: 10

Sampler 1
31.07038 31.60015
31.07038 33
--
Sampler 2
31.3848 31.51079
31.3848 33
--
Sampler 3
31.69921 31.46432
31.69921 33
--
Sampler 4
32.01361 31.21688
32.01361 31.38375
--
32.01361 31.41166
32.01361 33
--
Sampler 5
32.32803 31.26957
32.32803 33
--
Sampler 6
32.64244 31.05495
32.64244 33
--
Sampler 7
32.95685 31.12263
32.95685 33
--
Sampler 8
33.27126 31.09784
33.27126 33
--
Sampler 9
33.58567 31.11438
33.58567 33
--
Sampler 10
33.90008 31.17331
33.90008 33
--

Survey 4

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1639.244 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3278.487 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1958.226 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2275.73 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3275.209 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.059

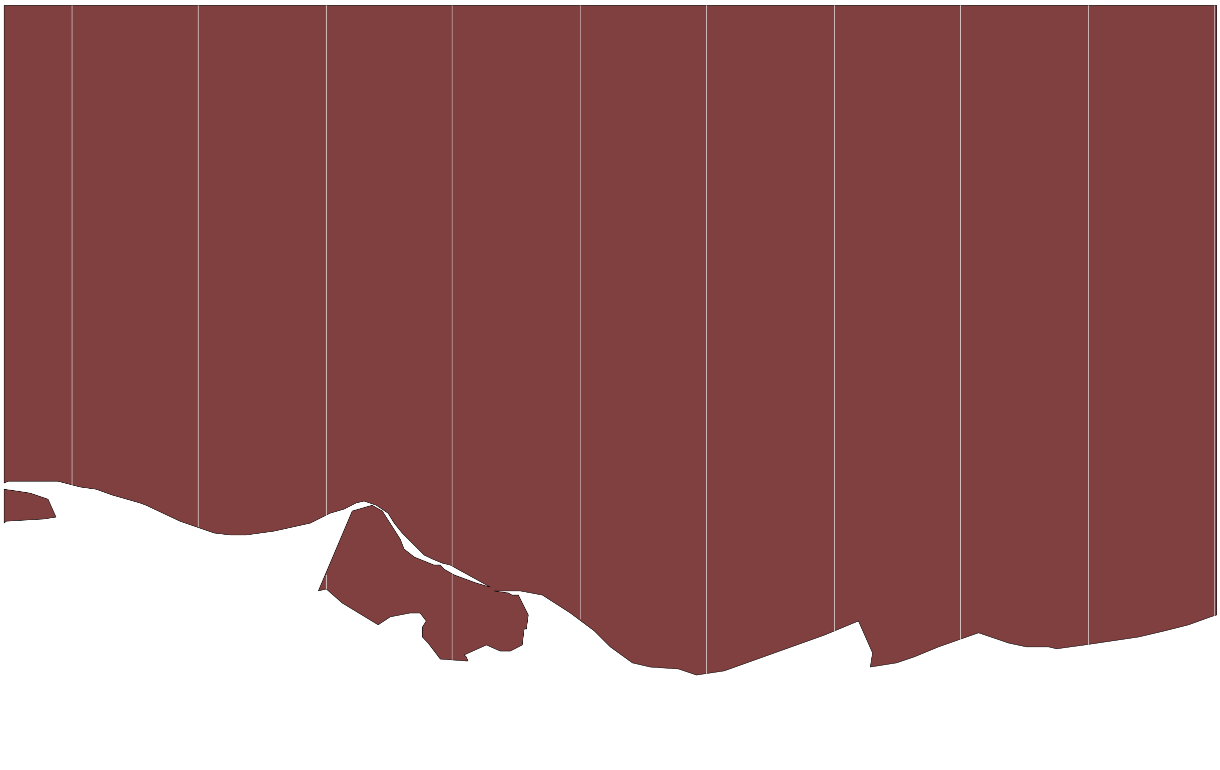


Sample layer name: 35 km spacing - **survey 4**
Number of samplers: 10

Sampler 1
31.09953 31.60153
31.09953 33
--
Sampler 2
31.41394 31.49523
31.41394 33
--
Sampler 3
31.72835 31.472
31.72835 33
--
Sampler 4
32.04276 31.13717
32.04276 31.19286
--
32.04276 31.19403
32.04276 31.36739
--
32.04276 31.38141
32.04276 33
--
Sampler 5
32.35717 31.24857
32.35717 33
--
Sampler 6
32.67158 31.05086
32.67158 33
--
Sampler 7
32.98599 31.13532
32.98599 33
--
Sampler 8
33.3004 31.11016
33.3004 33
--
Sampler 9
33.61481 31.11425
33.61481 33
--
Sampler 10
33.92922 31.18146
33.92922 33
--

Survey 5

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1647.901 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3295.801 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1988.747 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2305.849 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3210.11 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.058

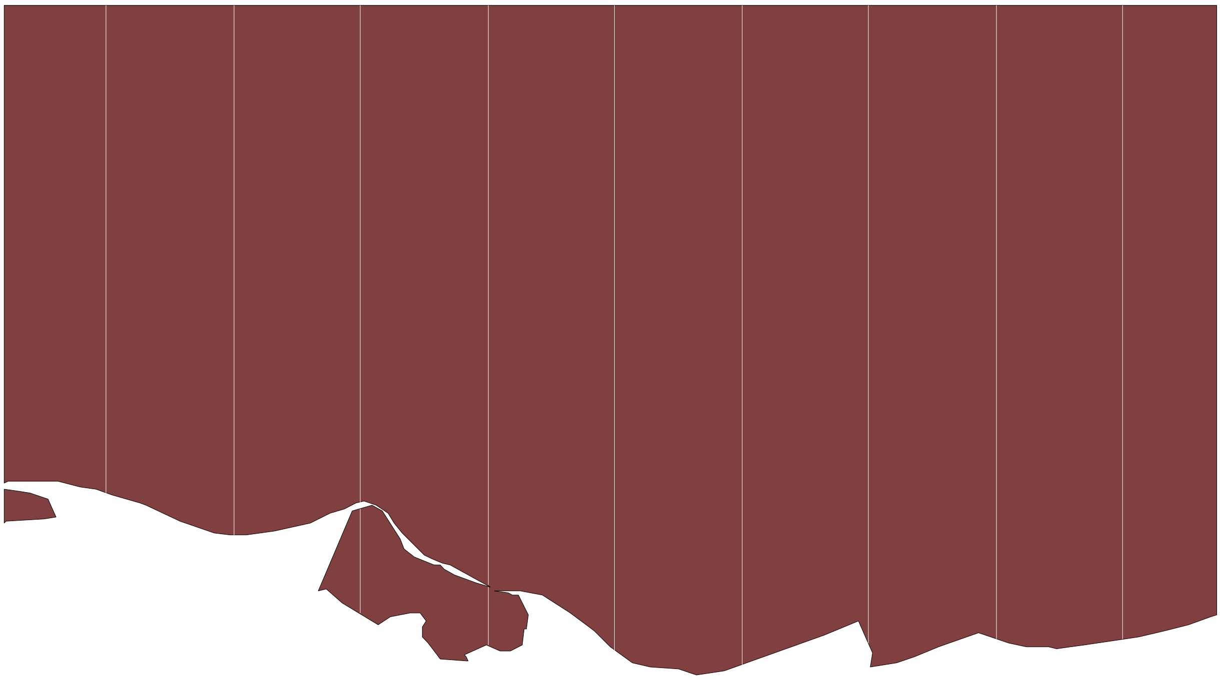


Sample layer name: 35 km spacing - **survey 5**
Number of samplers: 10

Sampler 1
31.16588 31.59021
31.16588 33
--
Sampler 2
31.48029 31.46542
31.48029 33
--
Sampler 3
31.7947 31.28345
31.7947 31.32654
--
31.7947 31.49701
31.7947 33
--
Sampler 4
32.10911 31.07852
32.10911 31.33001
--
32.10911 31.35043
32.10911 33
--
Sampler 5
32.42352 31.19558
32.42352 33
--
Sampler 6
32.73793 31.03828
32.73793 33
--
Sampler 7
33.05234 31.16442
33.05234 33
--
Sampler 8
33.36675 31.13672
33.36675 33
--
Sampler 9
33.68116 31.12153
33.68116 33
--
Sampler 10
33.99557 31.20544
33.99557 33
--

Survey 6

LINES GENERATED: 9
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1509.974 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3019.948 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1794.923 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2109.072 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3016.928 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.055

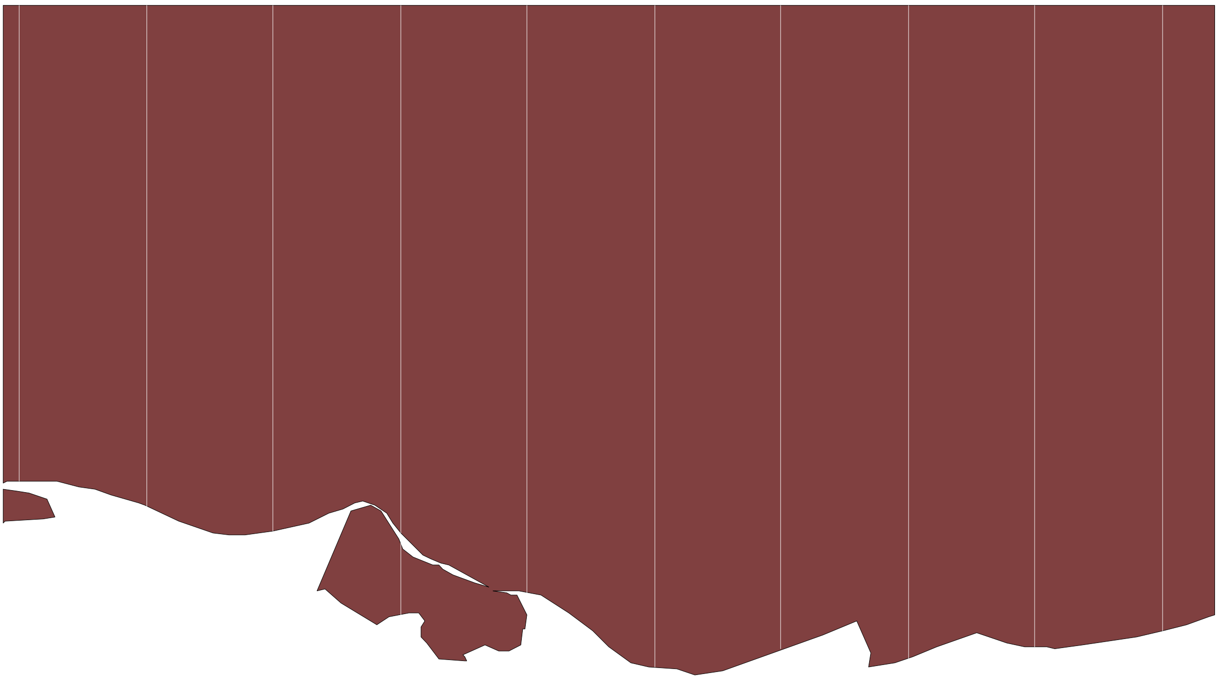


Sample layer name: 35 km spacing - **survey 6**
Number of samplers: 9

Sampler 1
31.25406 31.56531
31.25406 33
--
Sampler 2
31.56847 31.442
31.56847 33
--
Sampler 3
31.88288 31.21351
31.88288 31.52045
--
31.88288 31.53707
31.88288 33
--
Sampler 4
32.19729 31.12186
32.19729 31.29235
--
32.19729 31.29425
32.19729 33
--
Sampler 5
32.5117 31.10586
32.5117 33
--
Sampler 6
32.82611 31.0657
32.82611 33
--
Sampler 7
33.14052 31.12617
33.14052 33
--
Sampler 8
33.45493 31.14147
33.45493 33
--
Sampler 9
33.76934 31.13964
33.76934 33
--

Survey 7

LINES GENERATED: 10
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1819.764 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1632.903 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 3265.805 square Kilometers
LINE SPACING: 35 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1952.073 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2269.739 Kilometers
REALIZED SAMPLER AREA COVERAGE: 3262.539 square Kilometers
STRATUM AREA: 55247.772 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.059



Sample layer name: 35 km spacing - **survey 7**
Number of samplers: 10

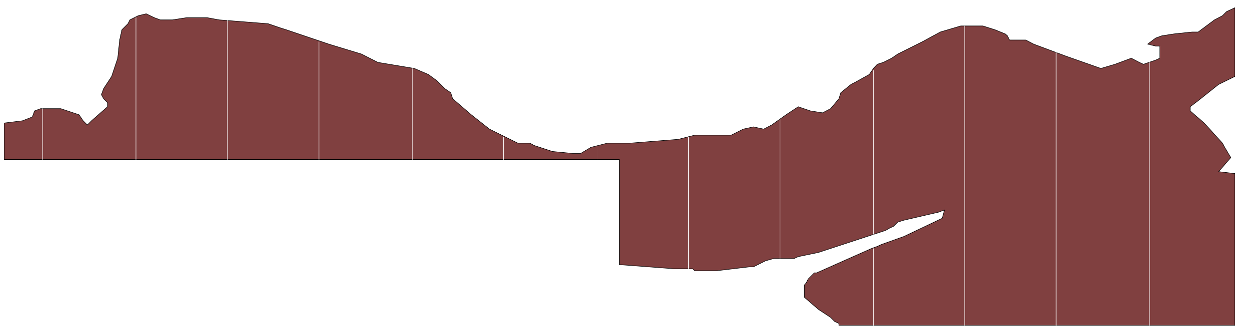
Sampler 1
31.04111 31.59857
31.04111 33
--
Sampler 2
31.35552 31.52643
31.35552 33
--
Sampler 3
31.66993 31.45662
31.66993 33
--
Sampler 4
31.98434 31.21079
31.98434 31.41961
--
31.98434 31.44674
31.98434 33
--
Sampler 5
32.29875 31.27467
32.29875 33
--
Sampler 6
32.61316 31.05848
32.61316 33
--
Sampler 7
32.92757 31.10987
32.92757 33
--
Sampler 8
33.24198 31.085
33.24198 33
--
Sampler 9
33.55639 31.116
33.55639 33
--
Sampler 10
33.8708 31.16513
33.8708 33
--

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Block 6

Survey 1

LINES GENERATED: 13
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1044.64 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2089.281 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1674.804 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2284.893 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2083.013 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.038

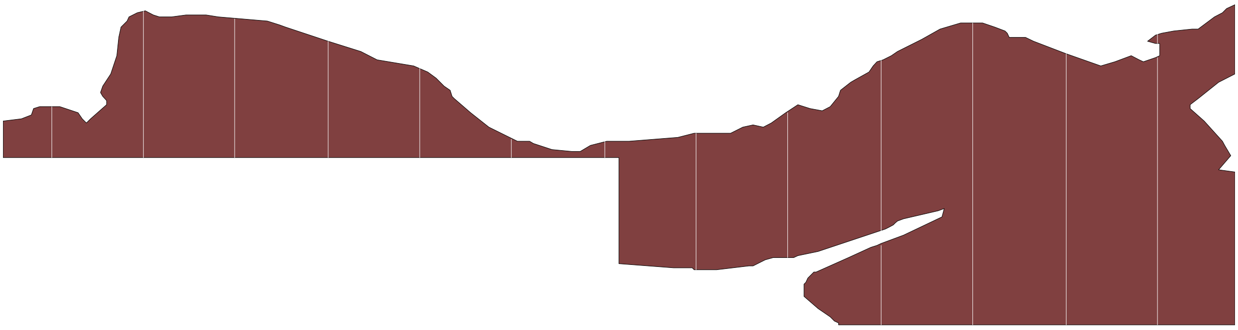


Sample layer name: 50 km spacing – **survey 1**
Number of samplers: 13

Sampler 1
30.19181 36
30.19181 36.30105
--
Sampler 2
30.64097 36
30.64097 36.86257
--
Sampler 3
31.09013 36
31.09013 36.84324
--
Sampler 4
31.53928 36
31.53928 36.71564
--
Sampler 5
31.98844 36
31.98844 36.5487
--
Sampler 6
32.4376 36
32.4376 36.13556
--
Sampler 7
32.88676 36
32.88676 36.07679
--
Sampler 8
33.33591 35.3324
33.33591 36.13303
--
Sampler 9
33.78507 35.40162
33.78507 36.23697
--
Sampler 10
34.23423 35
34.23423 35.45868
--
34.23423 35.54317
34.23423 36.5374
--
Sampler 11
34.68339 35
34.68339 36.8083
--
Sampler 12
35.13255 35
35.13255 36.64539
--
Sampler 13
35.5817 35
35.5817 36.58618
--
35.5817 36.69189
35.5817 36.70021
--

Survey 2

LINES GENERATED: 13
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1053.988 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2107.977 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1683.042 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2293.643 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2101.653 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.038

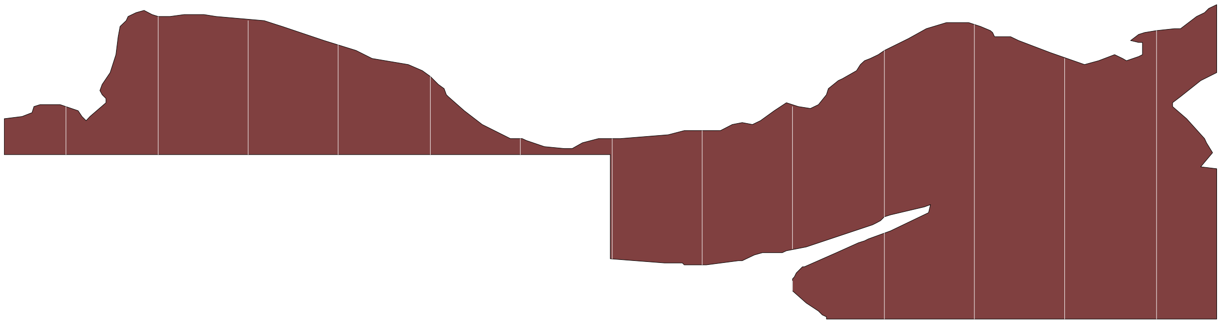


Sample layer name: 50 km spacing - **survey 2**
Number of samplers: 13

Sampler 1
30.23344 36
30.23344 36.30387
--
Sampler 2
30.6826 36
30.6826 36.87849
--
Sampler 3
31.13176 36
31.13176 36.83759
--
Sampler 4
31.58092 36
31.58092 36.6972
--
Sampler 5
32.03008 36
32.03008 36.53248
--
Sampler 6
32.47923 36
32.47923 36.11187
--
Sampler 7
32.92839 36
32.92839 36.09258
--
Sampler 8
33.37755 35.32846
33.37755 36.13793
--
Sampler 9
33.82671 35.40144
33.82671 36.27103
--
Sampler 10
34.27586 35
34.27586 35.47475
--
34.27586 35.56004
34.27586 36.58073
--
Sampler 11
34.72502 35
34.72502 36.81229
--
Sampler 12
35.17418 35
35.17418 36.62432
--
Sampler 13
35.62334 35
35.62334 36.60383
--
35.62334 36.68505
35.62334 36.74135
--

Survey 3

LINES GENERATED: 13
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1112.221 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2224.442 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1749.081 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2362.036 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2188.851 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.04

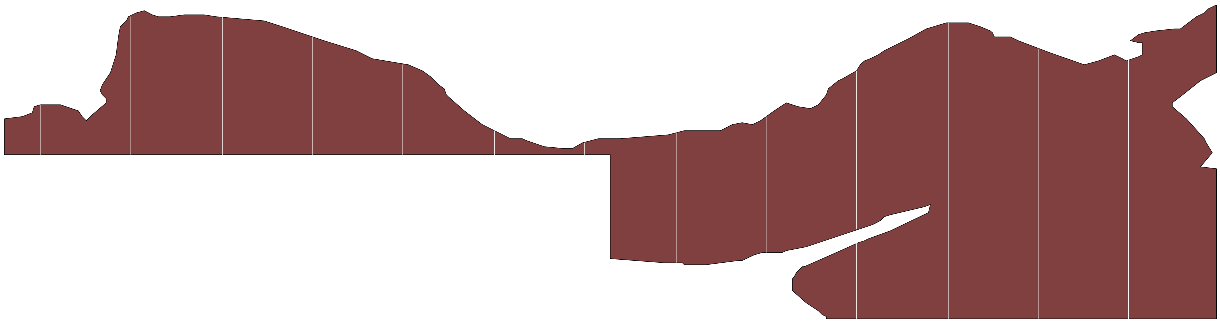


Sample layer name: 50 km spacing - **survey 3**
Number of samplers: 13

Sampler 1
30.31065 36
30.31065 36.28553
--
Sampler 2
30.75981 36
30.75981 36.84562
--
Sampler 3
31.20897 36
31.20897 36.8271
--
Sampler 4
31.65812 36
31.65812 36.66727
--
Sampler 5
32.10728 36
32.10728 36.47269
--
Sampler 6
32.55644 36
32.55644 36.09283
--
Sampler 7
33.0056 35.36528
33.0056 36.09324
--
Sampler 8
33.45476 35.32838
33.45476 36.13877
--
Sampler 9
33.90392 35.16114
33.90392 35.22922
--
33.90392 35.41627
33.90392 36.29671
--
Sampler 10
34.35307 35
34.35307 35.51675
--
34.35307 35.60844
34.35307 36.63305
--
Sampler 11
34.80223 35
34.80223 36.80084
--
Sampler 12
35.25138 35
35.25138 36.58876
--
Sampler 13
35.70054 35
35.70054 36.76107
--

Survey 4

LINES GENERATED: 13
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1040.978 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2081.957 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1661.186 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2270.177 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2075.711 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.038

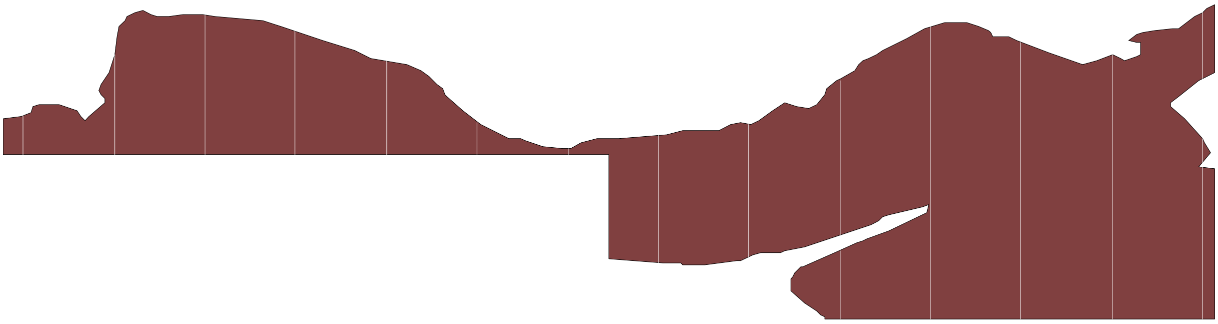


Sample layer name: 50 km spacing - **survey 4**
Number of samplers: 13

Sampler 1
30.17848 36
30.17848 36.29873
--
Sampler 2
30.62764 36
30.62764 36.85223
--
Sampler 3
31.0768 36
31.0768 36.84505
--
Sampler 4
31.52596 36
31.52596 36.72155
--
Sampler 5
31.97511 36
31.97511 36.552
--
Sampler 6
32.42427 36
32.42427 36.14314
--
Sampler 7
32.87343 36
32.87343 36.07174
--
Sampler 8
33.32259 35.33392
33.32259 36.13068
--
Sampler 9
33.77174 35.40166
33.77174 36.22672
--
Sampler 10
34.2209 35
34.2209 35.45328
--
34.2209 35.53777
34.2209 36.51666
--
Sampler 11
34.67006 35
34.67006 36.80662
--
Sampler 12
35.11922 35
35.11922 36.65213
--
Sampler 13
35.56837 35
35.56837 36.5825
--

Survey 5

LINES GENERATED: 14
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1147.613 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2295.225 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1864.298 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2524.988 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2286.044 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.042



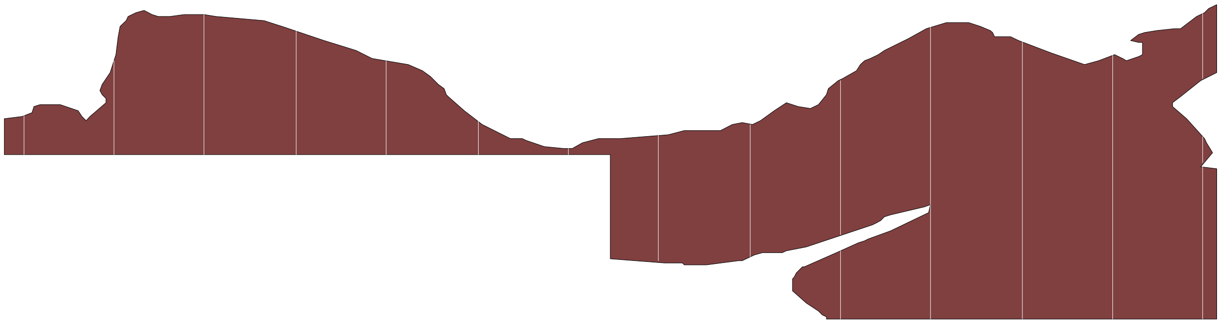
Sample layer name: 50 km spacing - **survey 5**
Number of samplers: 14

Sampler 1
30.10228 36
30.10228 36.23969
--
Sampler 2
30.55144 36
30.55144 36.60541
--
Sampler 3
31.0006 36
31.0006 36.85345
--
Sampler 4
31.44976 36
31.44976 36.75532
--
Sampler 5
31.89891 36
31.89891 36.5709
--
Sampler 6
32.34807 36
32.34807 36.1953
--
Sampler 7
32.79723 36
32.79723 36.03041
--
Sampler 8
33.24639 35.34217
33.24639 36.11881
--
Sampler 9
33.69555 35.37388
33.69555 36.18104
--
Sampler 10
34.1447 35
34.1447 35.41367
--
34.1447 35.50692
34.1447 36.45702
--
Sampler 11
34.59386 35
34.59386 36.78195
--
Sampler 12
35.04302 35
35.04302 36.69072
--
Sampler 13
35.49218 35
35.49218 36.60782
--

Sampler 14
35.94133 35
35.94133 35.92147
--
35.94133 35.9525
35.94133 36.09608
--
35.94133 36.46246
35.94133 36.88034
--

Survey 6

LINES GENERATED: 14
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1146.956 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2293.913 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1862.588 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2523.182 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2284.737 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.042



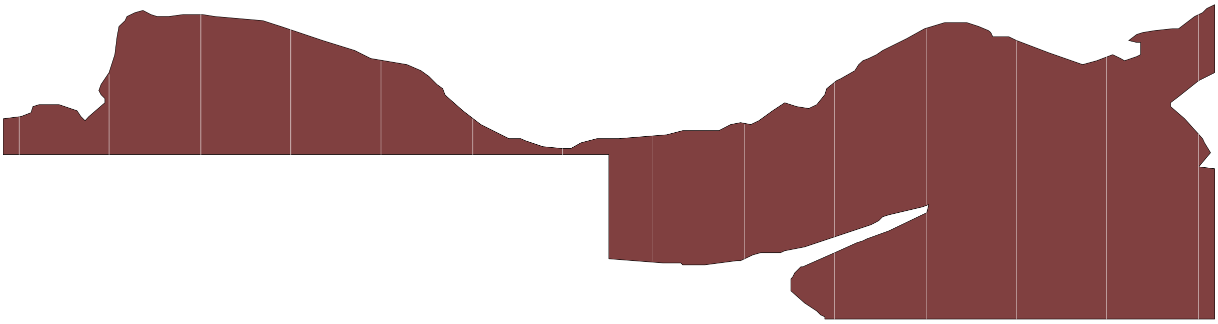
Sample layer name: 50 km spacing - **survey 6**
Number of samplers: 14

Sampler 1
30.09609 36
30.09609 36.23697
--
Sampler 2
30.54525 36
30.54525 36.57564
--
Sampler 3
30.9944 36
30.9944 36.85403
--
Sampler 4
31.44356 36
31.44356 36.75807
--
Sampler 5
31.89272 36
31.89272 36.57244
--
Sampler 6
32.34188 36
32.34188 36.20156
--
Sampler 7
32.79103 36
32.79103 36.03004
--
Sampler 8
33.24019 35.34277
33.24019 36.11796
--
Sampler 9
33.68935 35.37102
33.68935 36.18206
--
Sampler 10
34.13851 35
34.13851 35.41045
--
34.13851 35.50441
34.13851 36.45378
--
Sampler 11
34.58767 35
34.58767 36.77975
--
Sampler 12
35.03682 35
35.03682 36.69386
--
Sampler 13
35.48598 35
35.48598 36.60567
--

Sampler 14
35.93514 35
35.93514 35.92329
--
35.93514 35.94413
35.93514 36.10443
--
35.93514 36.45812
35.93514 36.87441
--

Survey 7

LINES GENERATED: 14
SAMPLER WIDTH: 1 Kilometers
ESTIMATED ON EFFORT TRACKLINE LENGTH: 1153.546 Kilometers
REALIZED ON EFFORT TRACKLINE LENGTH: 1140.667 Kilometers
EXPECTED SAMPLER AREA COVERAGE: 2281.333 square Kilometers
LINE SPACING: 50 Kilometers
LINE ANGLE: 90 degrees
TOTAL TRACKLINE LENGTH: 1857.901 Kilometers
The total travel path starts at the beginning of the first sampler line.
TOTAL CYCLIC TRACKLINE LENGTH: 2518.337 Kilometers
REALIZED SAMPLER AREA COVERAGE: 2276.771 square Kilometers
STRATUM AREA: 55033.784 square Kilometers
PROPORTION OF STRATUM SAMPLED: 0.041

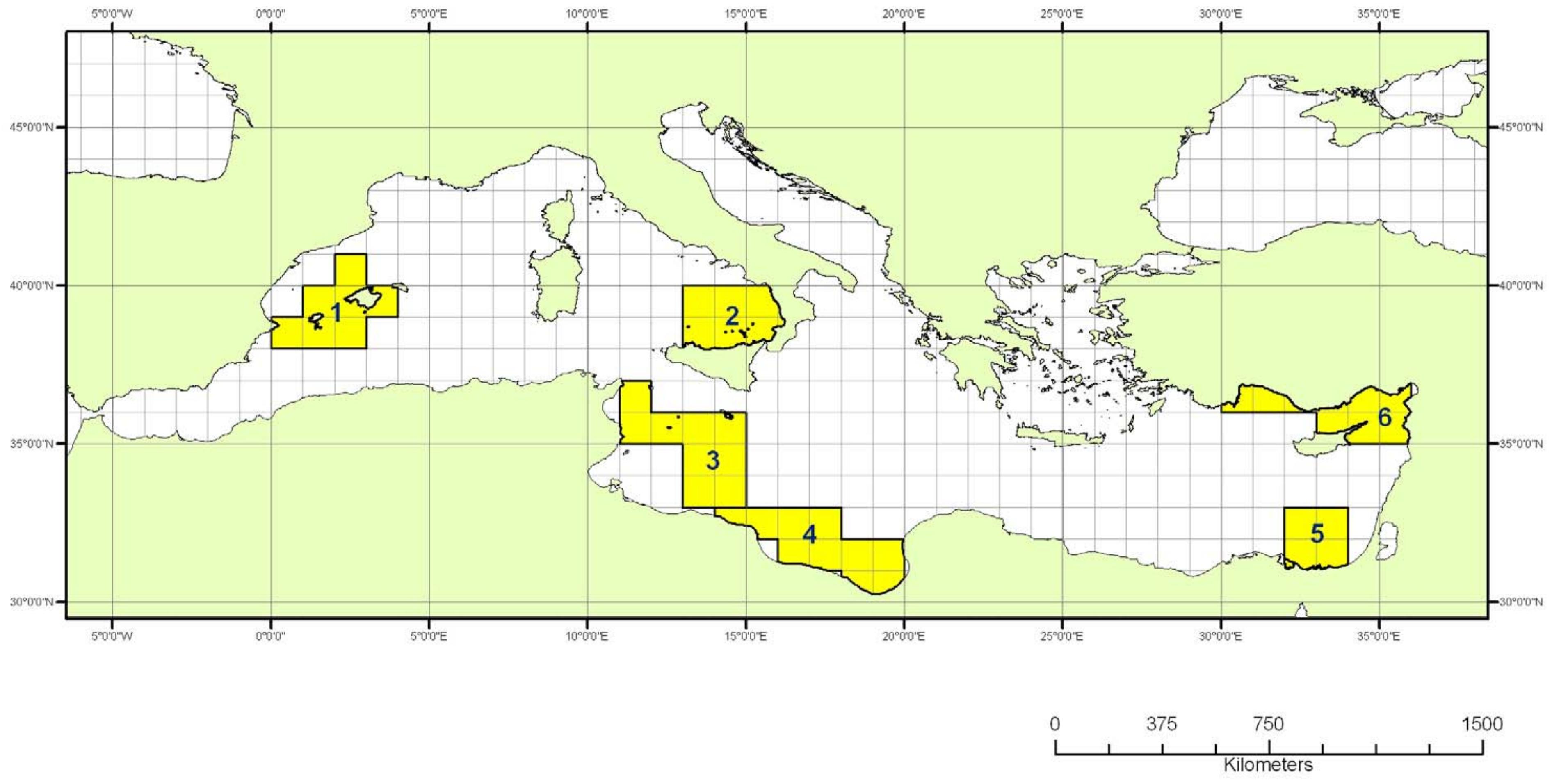


Sample layer name: 50 km spacing - **survey 7**
Number of samplers: 14

Sampler 1
30.07817 36
30.07817 36.23242
--
Sampler 2
30.52733 36
30.52733 36.49299
--
Sampler 3
30.97649 36
30.97649 36.8552
--
Sampler 4
31.42565 36
31.42565 36.76601
--
Sampler 5
31.87481 36
31.87481 36.57688
--
Sampler 6
32.32396 36
32.32396 36.21967
--
Sampler 7
32.77312 36
32.77312 36.02897
--
Sampler 8
33.22228 35.34449
33.22228 36.11549
--
Sampler 9
33.67144 35.36277
33.67144 36.18502
--
Sampler 10
34.12059 35
34.12059 35.40115
--
34.12059 35.49716
34.12059 36.44105
--
Sampler 11
34.56975 35
34.56975 35.6437
--
34.56975 35.68537
34.56975 36.77338
--
Sampler 12
35.01891 35
35.01891 36.70266
--
Sampler 13
35.46807 35
35.46807 36.59948
--

Sampler 14
35.91722 35
35.91722 36.12857
--
35.91722 36.44404
35.91722 36.85471
--

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA
(GBYP - 2010)



The revised survey design in Tables 1 and 2, is based on the principle of allocating approximately the same number of surveys to each Area. Actually coverage varies between blocks due to the distance from the assumed base airport varies between survey area and because of the irregular shape of some the survey areas.

In terms of the impact of reducing the number of replicate surveys in some areas, this will simply reduce the coverage and the expected CV on any estimate of abundance will be higher as a result. The surveys have not been designed to achieve a target CV because there is no information on encounter rates and their variance. So this is not a problem for the survey design. Coverage is not identical over Areas (as noted above) so the data would not be able to be pooled over Areas for analysis, anyway. So this also presents no problems.

In future, survey design can take account of such logistical constraints, if they are known in advance, when allocating effort to Areas. In practice, this will mean either accepting lower coverage or allocating more hours to contracts surveying larger areas.

May 13, 2010

Prof. Philip Hammond

Table 1. Areas, transect lengths and expected number of 2-day surveys by block.

Block	Area (km2)	Mean Length of Trackline on Effort	Expected number of 2-day surveys	Proportion of total area
1	62264	1380	5.0	22%
2	52461	1751	4.4	30%
3	90796	1508	4.5	15%
4	74313	1408	4.6	17%
5	55248	1582	4.6	26%
6	55034	1099	4.7	19%

Table 2. Detailed statistics for the survey designs for the six blocks shown in Figure 1.

	Block 1	*Block 2*	*Block 3*	*Block 4*	*Block 5*	*Block 6*
Area (km squared)	62,264	52,461	90,796	74,313	55,248	55,034
Line spacing (km)	45	30	60	60	35	50
2 day transect						
Trackline on effort (km)	1,380	1,751	1,508	1,408	1,582	1,099
Trackline total (km)	1,961	2,069	1,939	2,048	1,891	1,753
Trackline total cyclic (km)	2,415	2,397	2,347	2,708	2,206	2,379
Kilometers per survey (km)[1]	2,657	2,637	2,582	2,979	2,427	2,617
Average line length (km)	138	159	201	128	158	85
Prop. sampled (2km strip)	4%	7%	3%	4%	6%	4%
Number of lines	10	11	7.5	11	10	13
Hours per survey	14.3	14.2	13.9	16.1	13.1	14.1
Complete survey						
Hours	72	63	63	73	60	66
Number of surveys transects[2]	5.0	4.4	4.5	4.6	4.6	4.7
Proportion on effort : total	72%	85%	78%	69%	84%	63%
Proportion on effort : cyclic	57%	73%	64%	52%	72%	46%

[1] Kilometres per survey is based upon total cyclical trackline plus 10% for off transect school size validation.

[2] It is not expected that part survey transects will be performed, part transects are to allow for unplanned contingencies

SUB-AREA 7 (NEW)
STRAIT OF SICILY (SOUTH OF SICILY – WEST OF MALTA)

SQUARES LIMITS: 36°00’00N - 37°00’00 N & 12°00’00 E - 14°00’00 E
STRATUM AREA: 7200 snm

LINES GENERATED: 4
SAMPLER WIDTH: 1 Kilometer
LINE SPACING: 60 Kilometers
LINE ANGLE: 90 degrees
The total travel path starts at the beginning of the first sampler line.
Sample layer name: 60 km spacing - **survey 1**
Number of samplers: 4
Sampler 1
12.00306 36.0000
12.00306 37.0000
--
Sampler 2
12.54205 37.0000
12.54205 36.0000
--
Sampler 3
13.08104 36.0000
13.08104 37.0000
--
Sampler 4
13.62003 37.0000
13.62003 36.0000
--

Sample layer name: 60 km spacing - **survey 2**
Number of samplers: 4
Sampler 1
12.24926 36.0000
12.24926 37.0000
--
Sampler 2
12.78825 37.0000
12.78825 36.0000
--
Sampler 3
13.32724 36.0000
13.32724 37.0000
--
Sampler 4
13.86623 37.0000
13.86623 36.0000

Sample layer name: 60 km spacing - **survey 3**
Number of samplers: 4
Sampler 1
12.07304 36.0000
12.07304 37.0000
--
Sampler 2
12.61203 37.0000
12.61203 36.0000
--
Sampler 3
13.15102 36.0000

13.15102 37.0000
--
Sampler 4
13.69001 37.0000
13.69001 36.0000
--

Sample layer name: 60 km spacing - **survey 4**
Number of samplers: 4
Sampler 1
12.268 36.0000
12.268 37.0000
--
Sampler 2
12.80699 37.0000
12.80699 36.0000
--
Sampler 3
13.34598 36.0000
13.34598 37.0000
--
Sampler 4
13.88497 37.0000
13.88497 36.0000
--

Sample layer name: 60 km spacing - **survey 5**
Number of samplers: 4
Sampler 1
12.36049 36.0000
12.36049 37.0000
--
Sampler 2
12.89948 37.0000
12.89948 36.0000
--
Sampler 3
13.43847 36.0000
13.43847 37.0000
--
Sampler 4
13.97746 37.0000
13.97746 36.0000
--

Sample layer name: 60 km spacing - **survey 6**
Type of sampler: Line
Number of samplers: 4
List of samplers:
Sampler 1
12.35793 36.0000
12.35793 37.0000
--
Sampler 2
12.89692 37.0000
12.89692 36.0000
--

Sampler 3
13.43591 36.0000
13.43591 37.0000
--
Sampler 4
13.9749 37.0000
13.9749 36.0000
--

Sample layer name: 60 km spacing - **survey 7**
Number of samplers: 4
Sampler 1
12.10023 36.0000
12.10023 37.0000
--
Sampler 2
12.63922 37.0000
12.63922 36.0000
--
Sampler 3
13.17821 36.0000
13.17821 37.0000
--
Sampler 4
13.7172 37.0000
13.7172 36.0000
--

Sample layer name: 60 km spacing - **survey 8**
Number of samplers: 4
Sampler 1
12.07641 36.0000
12.07641 37.0000
--
Sampler 2
12.6154 37.0000
12.6154 36.0000
--
Sampler 3
13.15439 36.0000
13.15439 37.0000
--
Sampler 4
13.69338 37.0000
13.69338 36.0000
--

Sample layer name: 60 km spacing - **survey 9**
Number of samplers: 4
Sampler 1
12.26394 36.0000
12.26394 37.0000
--
Sampler 2
12.80293 37.0000
12.80293 36.0000
--

Sampler 3
13.34191 36.0000
13.34191 37.0000
--
Sampler 4
13.8809 37.0000
13.8809 36.0000
--

Sample layer name: 60 km spacing - **survey 10**
Number of samplers: 7
Sampler 1
12.02877 36.0000
12.02877 37.0000
--
Sampler 2
12.56776 37.0000
12.56776 36.0000
--
Sampler 3
13.10675 36.0000
13.10675 37.0000
--
Sampler 4
13.64574 37.0000
13.64574 36.0000
--

SUB-AREA 8 (NEW)
CENTRAL MEDITERRANEAN SEA (EAST OF MALTA)

SQUARES LIMITS: 34°00’00N - 36°00’00 N & 15°00’00 E - 16°00’00 E
STRATUM AREA: 7200 sqnm

LINES GENERATED: 4
SAMPLER WIDTH: 1 Kilometer
LINE SPACING: 30 Kilometers
LINE ANGLE: 90 degrees
The total travel path starts at the beginning of the first sampler line.

Sample layer name: 30 km spacing - **survey 1**
Number of samplers: 4
Sampler 1
15.09883 36.0000
15.09883 34.20
--
Sampler 2
15.36833 34.20
15.36833 36.0000
--
Sampler 3
15.63782 36.0000
15.63782 34.20
--
Sampler 4
15.90732 34.20
15.90732 36.0000
--

Sample layer name: 30 km spacing - **survey 2**
Number of samplers: 4
Sampler 1
15.09192 36.0000
15.09192 34.20
--
Sampler 2
15.36142 34.20
15.36142 36.0000
--
Sampler 3
15.63091 36.0000
15.63091 34.20
--
Sampler 4
15.9004 34.20
15.9004 36.0000
--

Sample layer name: 30 km spacing - **survey 3**
Number of samplers: 4
Sampler 1
15.1618 36.0000
15.1618 34.20
--
Sampler 2
15.43129 34.20
15.43129 36.0000
--

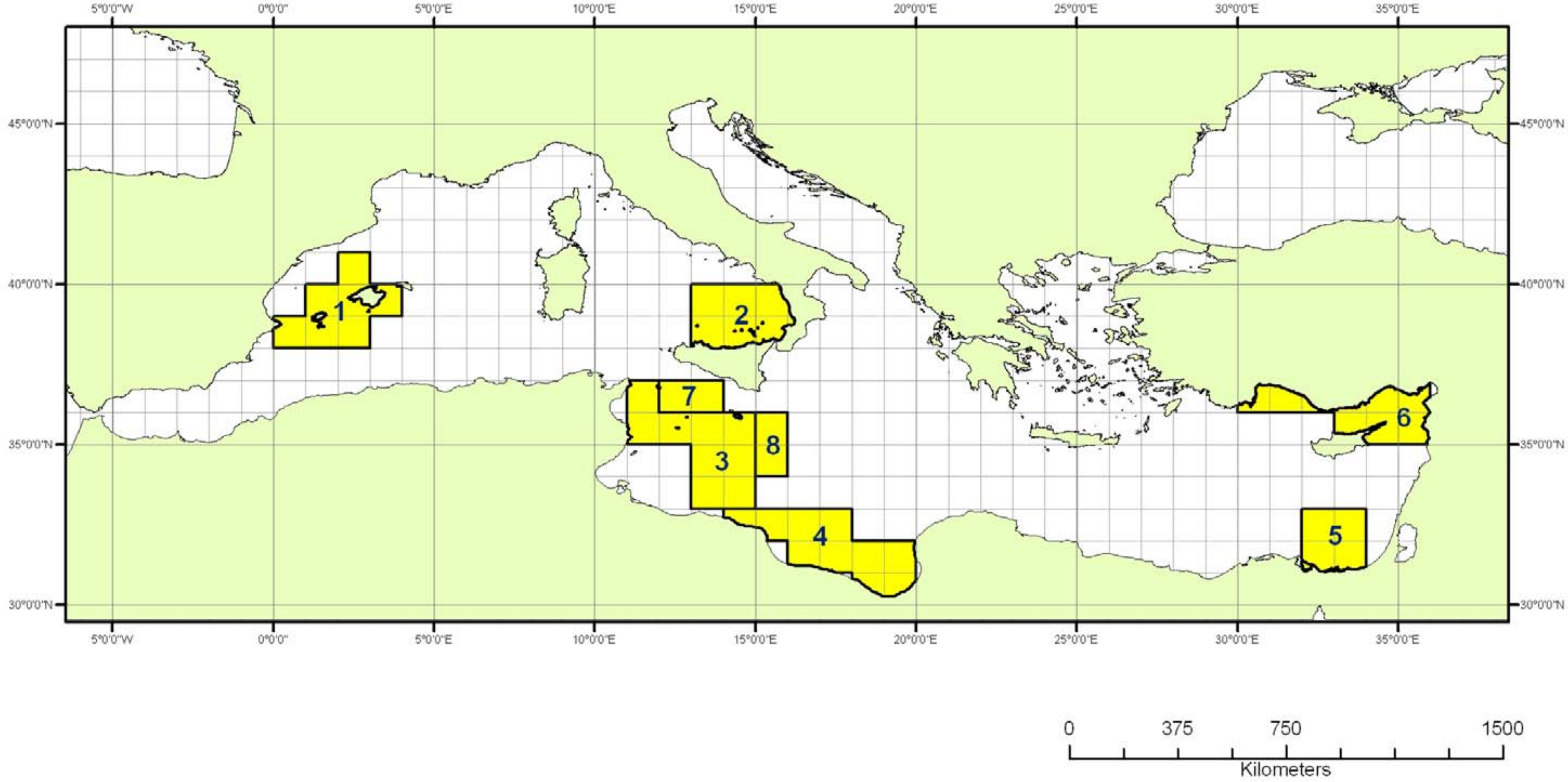
Sampler 3
15.70079 36.0000
15.70079 34.20
--
Sampler 4
15.97028 34.20
15.97028 36.0000
--

Sample layer name: 30 km spacing - **survey 4**
Number of samplers: 3
Sampler 1
15.23366 36.0000
15.23366 34.20
--
Sampler 2
15.50316 34.20
15.50316 36.0000
--
Sampler 3
15.77265 36.0000
15.77265 34.20
--

Sample layer name: 30 km spacing - **survey 5**
Number of samplers: 4
Sampler 1
15.08291 36.0000
15.08291 34.20
--
Sampler 2
15.3524 34.20
15.3524 36.0000
--
Sampler 3
15.6219 36.0000
15.6219 34.20
--
Sampler 4
15.89139 34.20
15.89139 36.0000
--

Sample layer name: 30 km spacing - **survey 6**
Number of samplers: 4
Sampler 1
15.06037 36.0000
15.06037 34.20
--
Sampler 2
15.32986 34.20
15.32986 36.0000
--
Sampler 3
15.59936 36.0000
15.59936 34.20
--
Sampler 4
15.86885 34.20
15.86885 36.0000

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA
(GBYP - 2010)



ICCAT BLUEFIN TUNA AERIAL SURVEY 2010

Technical report

Aerial surveys explorations in the reproduction area of bluefin tuna

(Thunnus thynnus) in Balearics waters.

Prepared by

In collaboration with:

Sub - area 1

- Joan Miquel Sorell Barón (Biologist)
- José Luis Cort (Biologist)

Sub - area 3

- Edwin Zammit (Biologist)
- Joseph A Borg (Biologist)

Index

Sub - area 1

Sub - area 3

Sub - area 1 - IBIZA

Introduction

The aerial survey campaigns in the breeding areas of bluefin tuna in the Mediterranean Sea are one of the scientific activities initiated by the ICCAT in the research program GBYP. The results of the exploration carried out in the reproduction area of the Balearic Islands in 2010 are presented in this report.

Material and methods

Sampling campaign

An aerial campaign was carried out during the period: 06.01.2010–07.02.2010, applying the work methodology planned by ICCAT. The working area has been divided into 10 straight transects oriented North to South forming a working survey. Once the survey was finished, the whole zone of work annotated by ICCAT in Balearic has been completed. In the Balearic Islands area, are planned five working surveys.

In order to maximize the flight schedule of transects 6, 7 and 8 established for ICCAT, these transects were divided in two (North part and South part) due to the geography of the zone as a lot of flight time it would have been lost for crossing the islands. Therefore, during a flight work has been done in the northern part of the island of Mallorca, while in other flights in the South. In addition, transects passing over land, the coast was turned so that the transect planned was regained. Using this methodology effective search effort was maximized.

In the campaign has been involved a team of three people: a scientist, Joan Miquel Sorell Baron; a marine expert in sightings and evaluation of schools, Lluís Navarro Martinez, and a pilot.

The materials resources used consisted of: a small plane equipped with a GARMIN GPS 430 GARMIN 128 GPS computer, with navigation and mapping software Oziexplorer, 7X50 binoculars: 113m/1000m, a Nikon camera (Nikkon AF-S 18-200mm. 1:3,5-5.6 G ED) and Samsun R55 laptop.

The working conditions planned by ICCAT were kept during the flights, with an altitude of 1000-1200 feet and an average speed of 120 knots. The duration did not exceed 4 hours, attending to the regulation proposed in the rule 16B in conformity with the JAR´s regulations of the European Union. The surveys have been conducted only when weather conditions were good.

Methodology of work and operational protocol

The coordinates of the transects were transferred to the pilot which introduced them in the aircraft ´s GPS global positioning system (GARMIN 430) and executed the selected flight plan. During the flight, the sailor and scientist observed the presence of bluefin tuna schools. Once located the school, the pilot directed the plane in the specific area, circling in the sense of clockwise, which facilitated the scientist take pictures, as he was seated in the co-pilot right side of the plane.

Once confirmed the presence of bluefin tuna, the scientist proceeded to record all relevant information in the job template. Meanwhile, the marine expert estimated the average weight of individuals and total biomass.

Once the exploration air was finished, all the material was unload: graphic material, pictures, GPS´tracks. Computerization of data collected in the templates was also completed..

In order to register the paragraph track on the "Glare sector" and "Declination angle", the next methodology has been followed: the plane's direction considered was always to the North. Therefore, when we recorded the "Glare sector" and the "Declination angle" that came to starboard, has always been for us the East. Depending on the angle of incidence is on file as: NNE, NE, E, SE, SSE all records observed to the right of the direction of the aircraft.

It was created a paragraph in the electronic templates, in part biological was introduced a note section to record the relevant biological information given for the study.

Results

During the aerial surveys in Baleares a total of 27 flights in 17 days were carried out. During 7 days only a flight was done, while the remaining 10 days 2 flights were carried out (Table 1). A total of 94.38 flight hours have been completed during the campaign. Of these, 55 hours were effective flying hours, that corresponds to the flight time used in each one of the different planned transects.

Total number of flight schedule	Total number of effective flight schedule	Number of days flown	Number of days without flying	Number of flights	Number of schools of bluefin tuna observed	Number of possible schools of bluefin tuna repeated
94,38	55	17	17	27	38	3

Table 1: Summary Table

Throughout the aerial campaign a total of 38 schools of bluefin tuna have been registered whose estimated amount ranges from 3,674.5 t and 3,724.5 t. Of all these, 370 t are estimated to be repeated. The amount of 3 schools,could not be determined due to the stabbed (tuna disappeared in the depths), or because the tuna were in depth and could not be estimate the actual amount of the school (Table 2). The 52 % of bluefin tuna registered corresponded to individuals with an estimated weight of 150 to 300 kg, while the 46 % corresponded to individuals from 25 to 150 kg. The amount of individuals of tuna registered with a weighing less than 25 kg or a weighing more than 300 kg was very low with a percentage that does not exceed 2 % of total observed.

Bluefin Tuna School Components	Small		Medium		Large		Giant		Total	
	t	%	t	%	t	%	t	%	t	%
t (min)	38,5	1,05	1691,7	46,04	1942,5	52,86	1,8	0,05	3674,5	100
t (max)	38,5	1,03	1729,7	46,44	1954,5	52,48	1,8	0,05	3724,5	100
t (Repeated)	0,0	0,00	209,6	56,65	160,4	43,35	0,0	0,00	370,0	100

Table 2: Tons of tuna registered during the campaign by groups of sizes and the percentage that every group of sizes represents the total registered.

When observed for the first time, more than half of registered bluefin tuna schools were in quiet formation (ripples); in this kind of formation, bluefin tuna swam calmly on the surface. Next formation, so called splash, was observed with a frequency of 31,6 %; in this case, bluefin tuna were swimming and splashing the water making a white foam. Finally, with a smaller percentage, bluefin tuna were seen showing the ventral part of the body making a bright as sunlight (Table 3).

	Ripples	Shining	Splash	Total
Number	22	4	12	38
%	57,9	10,5	31,6	100%

Table 3: Number of schools of tuna and percentage of each one of the observed formations.

Most of the schools of bluefin tuna registered were observed in surveys 5 and 4 respectively (Figure 1). By contrast, in the survey 3 no bluefin tuna was found (Table 4).

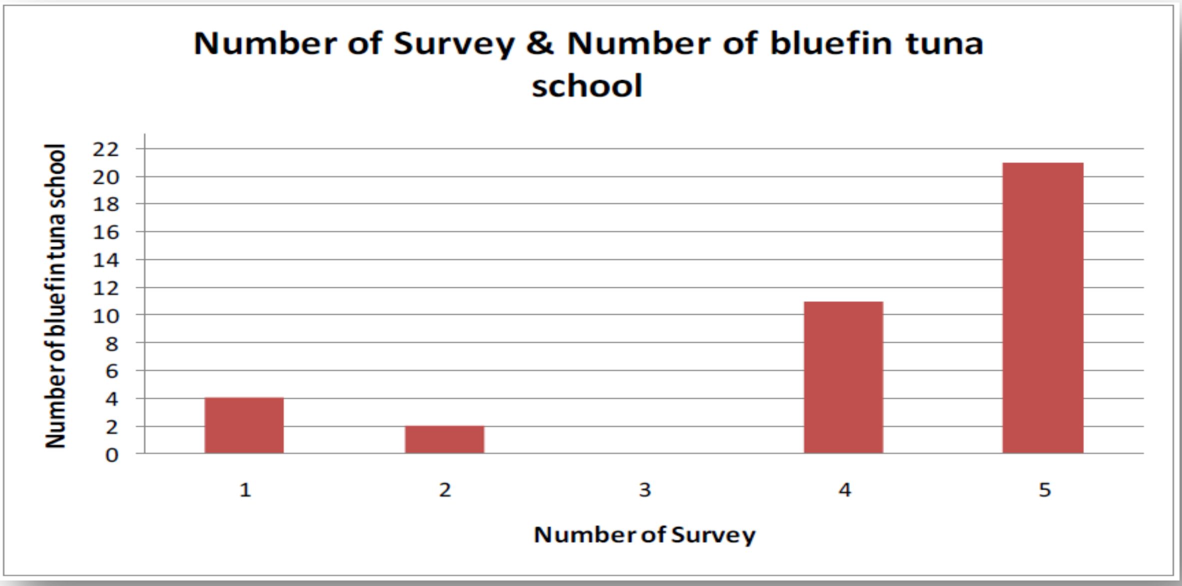


Figure 1: It represents the number of bushes observed in each of the 5 surveys realized.

It notes that in the transects 8 and 9 we found no kills of tuna (Figure 2). Transects 6, 2 and 4 respectively, the areas with a greater number of school of tuna (Table 4).

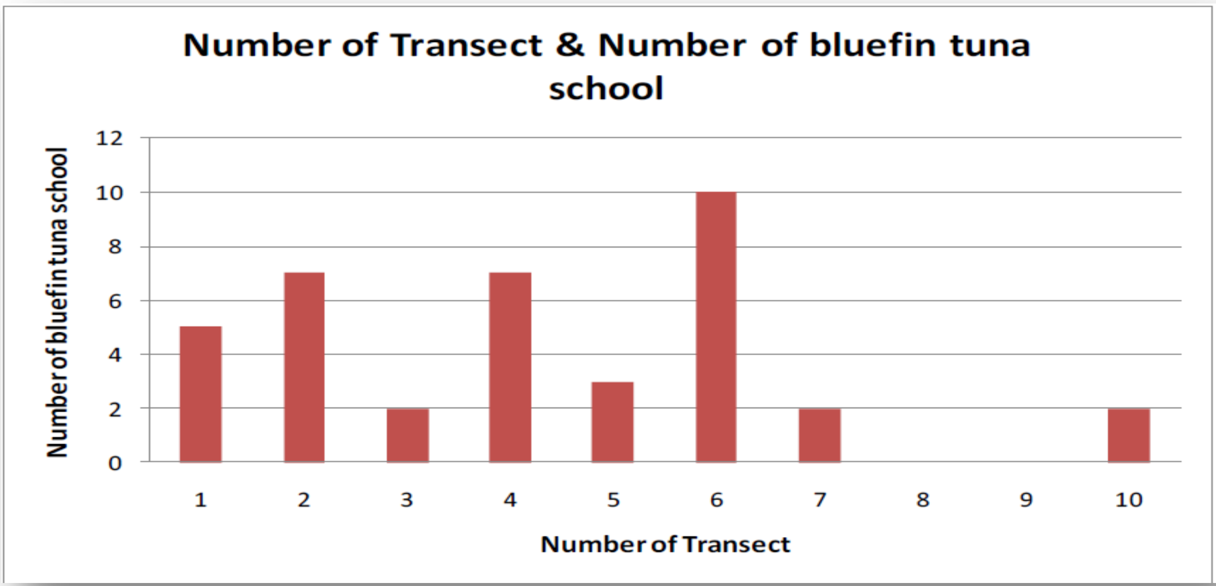


Figure 2: Bar graph showing the number of schools of bluefin tuna recorded in each of the transects.

Survey	Transec									
	1	2	3	4	5	6	7	8	9	10
1				4						
2				1		1				
3										
4	3	3				3	1			1
5	2	4	2	2	3	6	1			1

Table 4: Table summary of the number of school of tuna recorded in each of the surveys and transects

- **Flights calendar realized during the campaign from 01.06.2010 to 02.07.2010**

Sunday	Monday	Tuesday	Wednesday	Tuesday	Friday	Saturday
		1 1 Flight	**2** 1 Flight	**3** 2 Flight	**4** 1 Flight	**5** 2 Flight
6 2 Flight	**7** 1 Flight	**8**	**9**	**10**	**11**	**12**
13 1 Flight	**14**	**15**	**16**	**17**	**18** 2 Flight	**19**
20	**21**	**22**	**23**	**24** 1 Flight	**25**	**26**
27	**28** 2 Flight	**29** 2 Flight	**30** 2 Flight	**1 July** 2 Flight	**2 July** 2 Flight	

Sightings (*Thunnus thynnus*)

Control of flight schedule

Day	Start eng	Stop eng	Hours	Sub area	Nº Survey	Transect	Start survey	Stop survey	Effective hours	notes
31/05/2010	15:30	17:30	2:00	1	0	0	0	0	0	Mobilization
06/01/2010	9:45	13:45	4:00	1	1	3,4,5	10:35	13:24	2:49	Job day
06/02/2010	13:00	16:15	3:15	1	1	1,2,3	13:20	15:34	2:14	Job day
06/03/2010	6:55	10:55	4:00	1	1	6,7,8,9,10	7:50	10:42	2:52	Job day
06/03/2010	12:45	16:15	3:30	1	1	9,7,10	13:19	15:26	2:07	Job day
06/04/2010	14:15	17:05	2:50	1	2	1,2	15:10	14:19	1:09	Job day
06/05/2010	6:45	10:45	4:00	1	2	10,9,8	7:55	10:17	2:22	Job day
06/05/2010	12:35	16:25	3:50	1	2	7,6,5	12:37	14:00	3:23	Job day
06/06/2010	6:50	10:50	4:00	1	2	8,7,6	8:16	10:22	2:06	Job day
06/06/2010	13:10	16:00	2:50	1	2	3,4	13:42	15:29	1:47	Job day
06/06/2010	13:05	16:15	3:10	1	2	3,4	13:30	15:52	2:22	Job day, repeated for bad weather
06/07/2010										No job bad weather
06/08/2010										No job bad weather
06/09/2010										No job bad weather
06/10/2010										No job bad weather
06/11/2010										No job bad weather
06/12/2010										No job bad weather
06/13/2010	13:05	16:15	3:10	1	2	3,4	13:30	15:52	2:22	Job day
06/14/2010										No job bad

GrupAirMed
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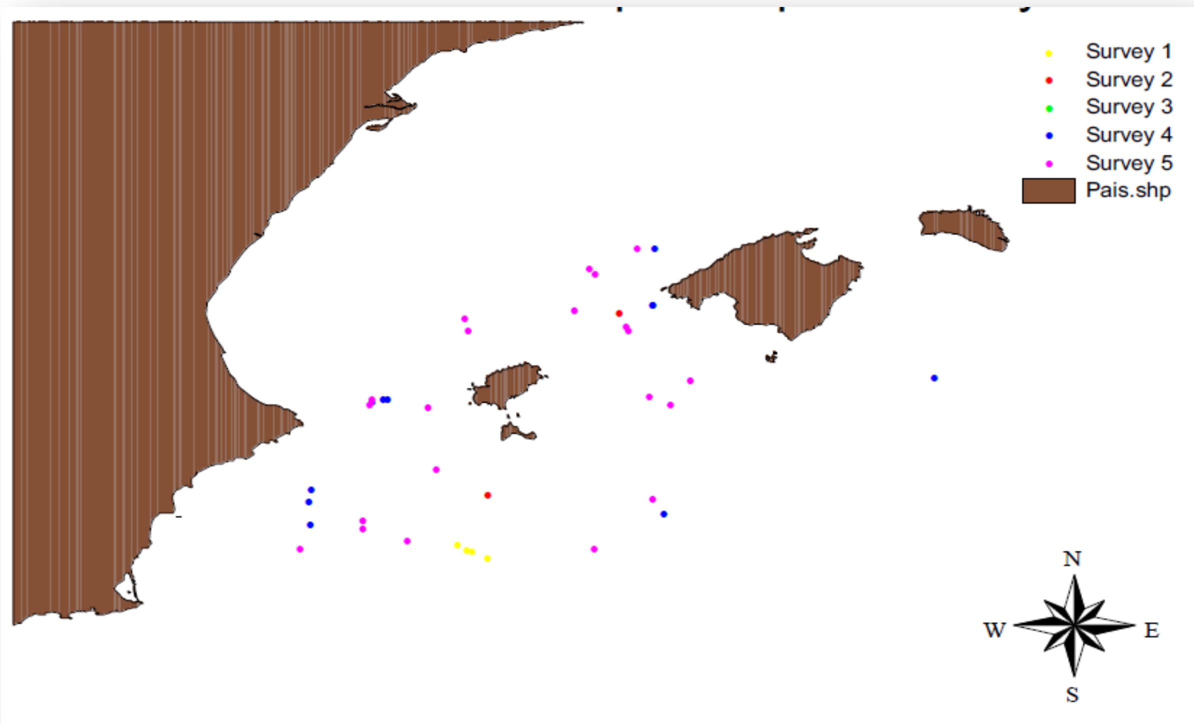
BALFEGØ GRUP

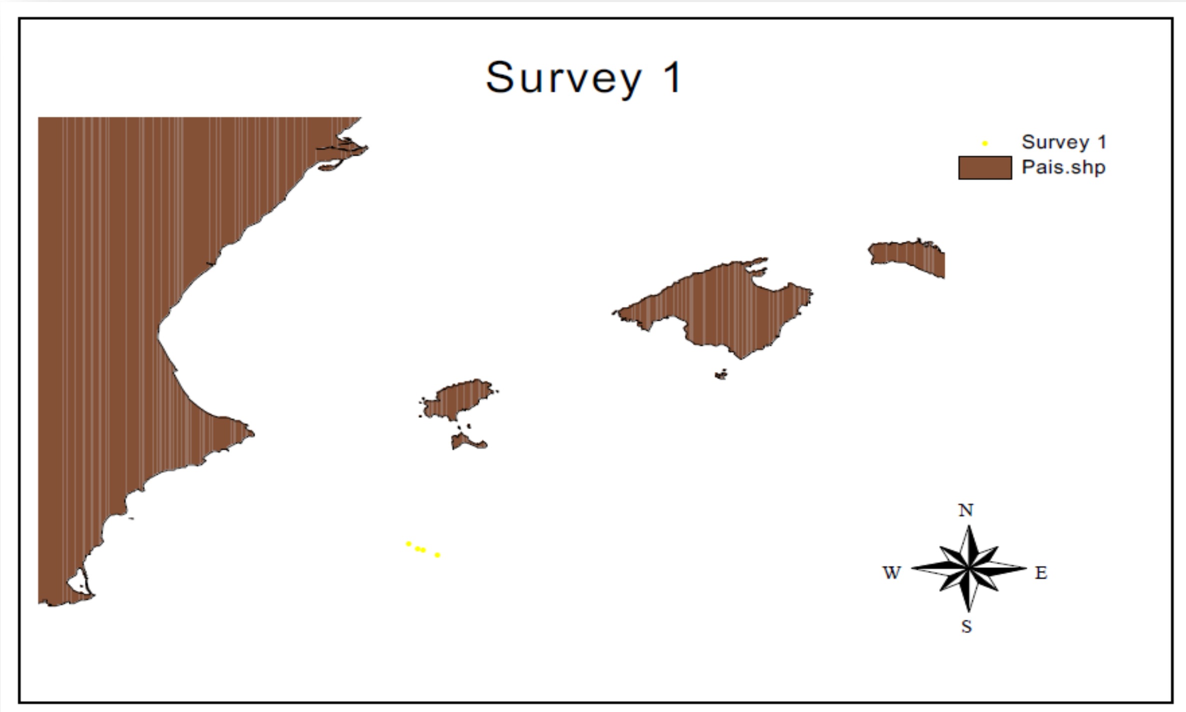
										weather
06/15/2010										No job bad weather
06/16/2010										No job bad weather
06/17/2010										No job bad weather
06/18/2010	7:17	10:30	3:13	1	3	4,5,6	7:42	10:12	2:30	Job day
06/18/2010	13:00	17:00	4:00	1	3	6,7,8	13:46	15:44	1:58	Job day
06/19/2010										No job bad weather
06/20/2010										No job bad weather
06/21/2010										No job bad weather
06/22/2010	8:05	11:00	2:55	1	3	7,8	9:00	10:37	1:37	Job day
06/22/2010	12:50	15:50	3:00	1	3	9,10	13:35	14:15	0:40	Job day
06/23/2010	7:45	11:45	4:00	1	4	4,5,6	8:28	10:10	1:42	Job day
06/24/2010	11:30	15:30	4:00	1	4	6,7	12:20	14:41	2:21	Job day
06/25/2010										No job bad weather
06/26/2010										No job bad weather
06/27/2010										No job bad weather
06/28/2010	8:30	12:15	3:45	1	4	7,8,9	9:48	11:35	1:47	Job day
06/28/2010	13:40	16:15	2:35	1	4	10	13:59	14:45	0:46	Job day
06/29/2010	6:50	10:35	3:45	1	5	4,5	7:11	10:13	3:02	Job day
06/29/2010	12:40	16:40	4:00	1	4	4,3,2	12:54	15:54	3:00	Job day
06/30/2010	8:00	11:00	3:00	1	4	1	8:47	10:08	1:21	Job day
06/30/2010	13:00	16:25	3:25	1	4	4,5,6	13:18	15:37	2:19	Job day
07/01/2010	6:55	10:30	3:35	1	5	6,7	7:46	9:27	1:41	Job day
07/01/2010	13:05	17:05	4:00	1	5	3,2,1	13:32	15:57	2:25	Job day
07/02/2010	7:30	10:45	3:15	1	5	7,8,9	8:25	10:07	1:42	Job day
07/02/2010	13:00	15:30	2:30	1	5	10	13:40	13:50	0:10	Job day

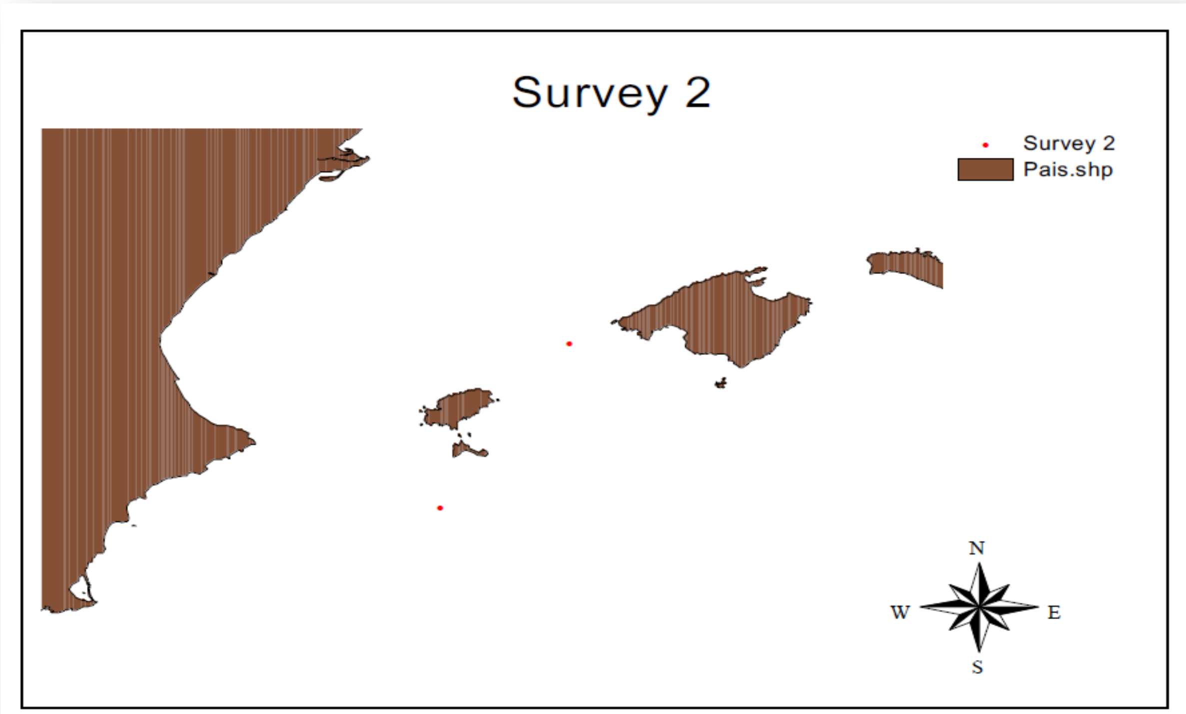
Spatial distribution of bluefin tuna schools registered

- **Survey 1**

- **Partial distribution Survey**




Survey 1
Survey 1
Pais.shp
N
W
E
S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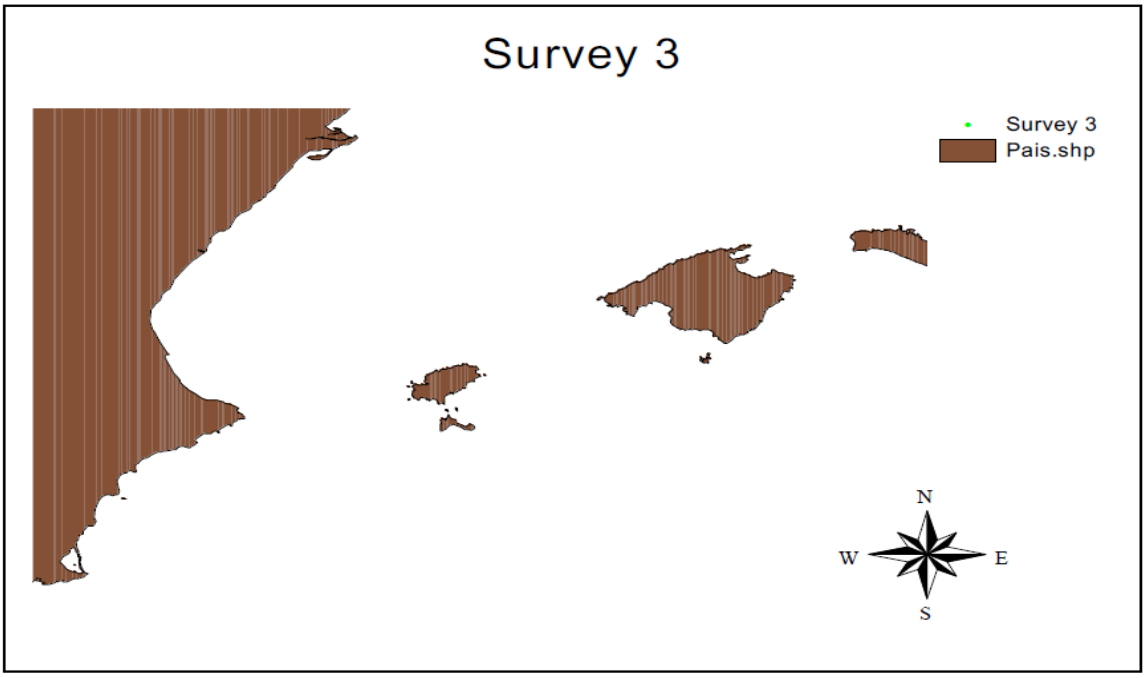
Survey 2
Pais.shp
N
W
E
S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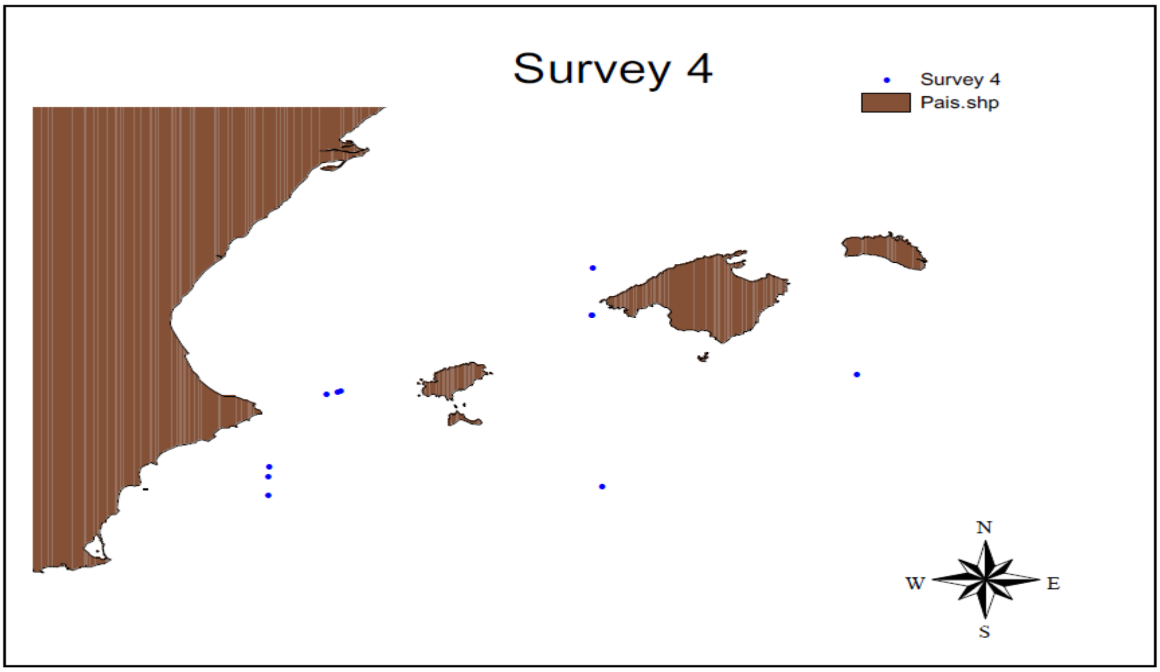
Survey 3
Pais.shp
N
W
E
S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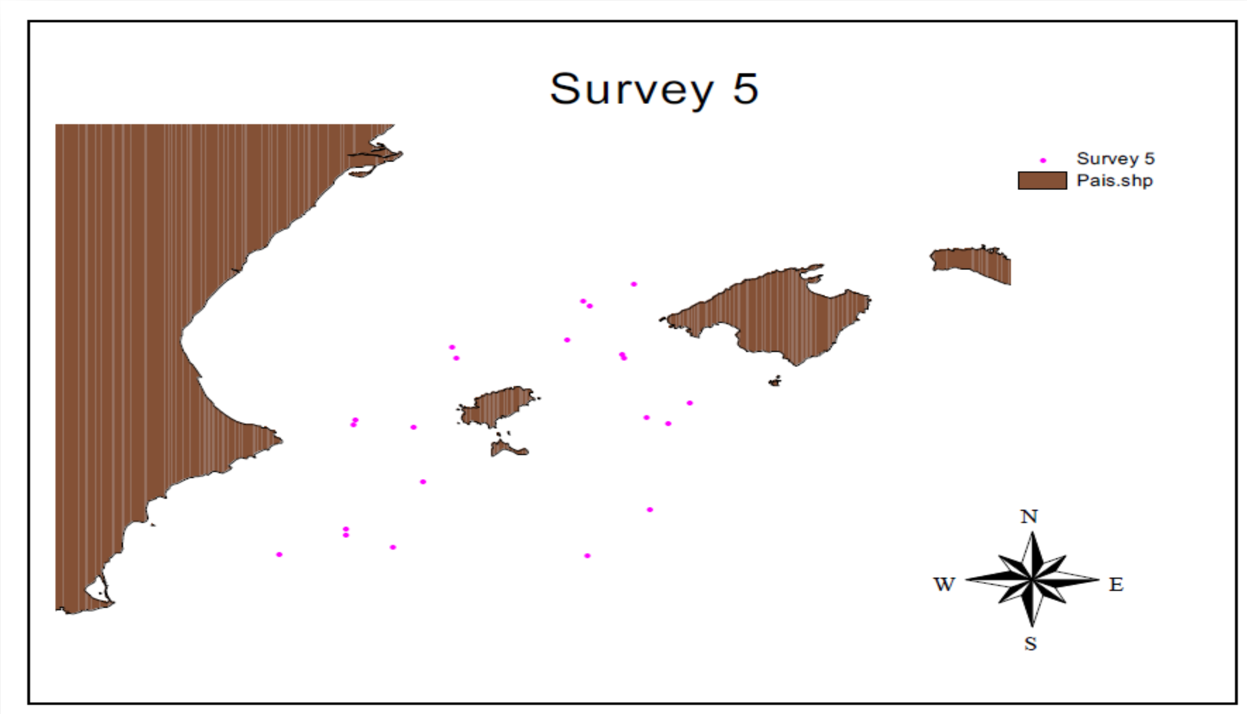
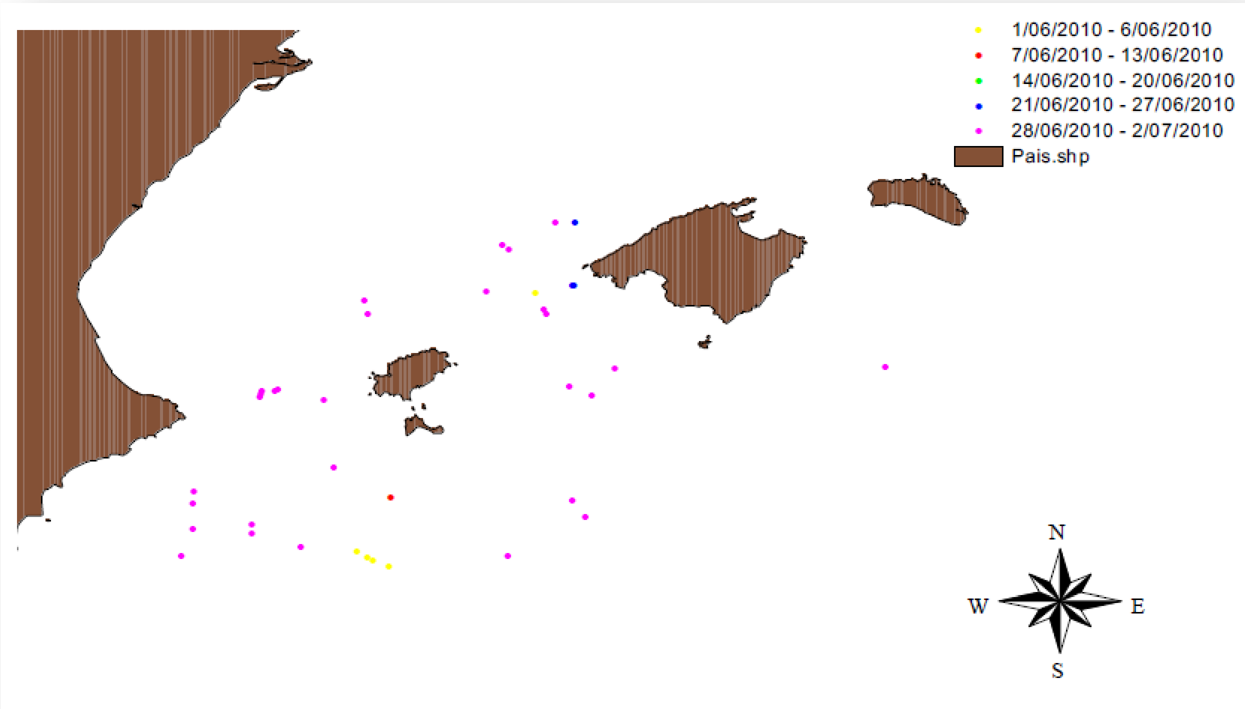


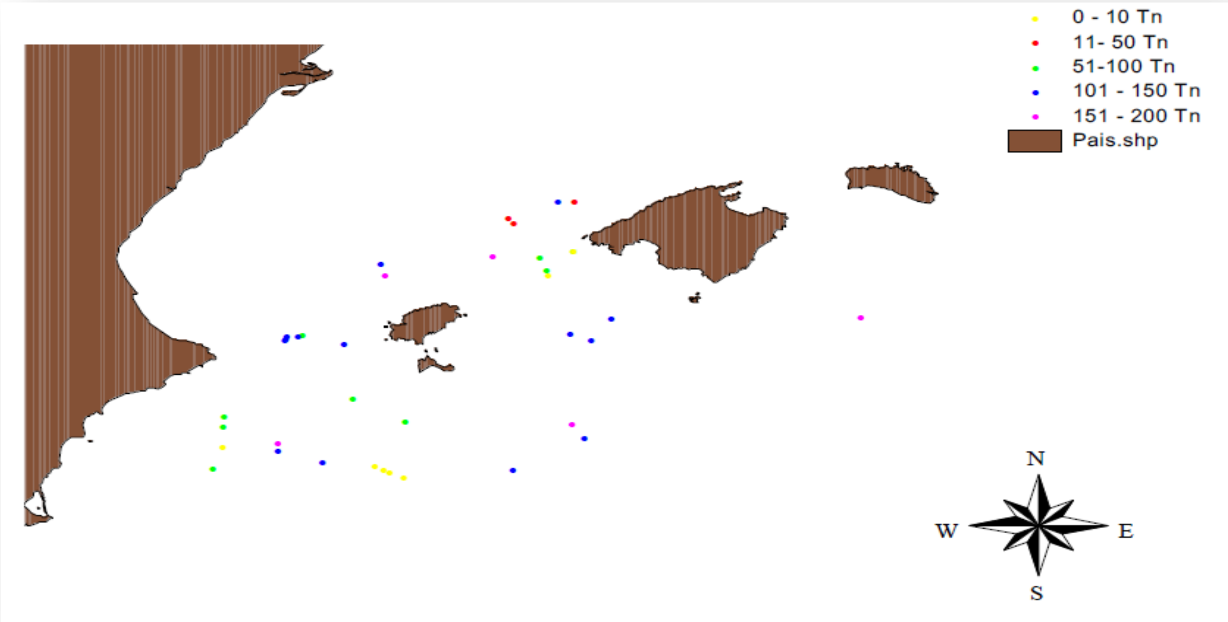
Date

Spatial distribution for weeks

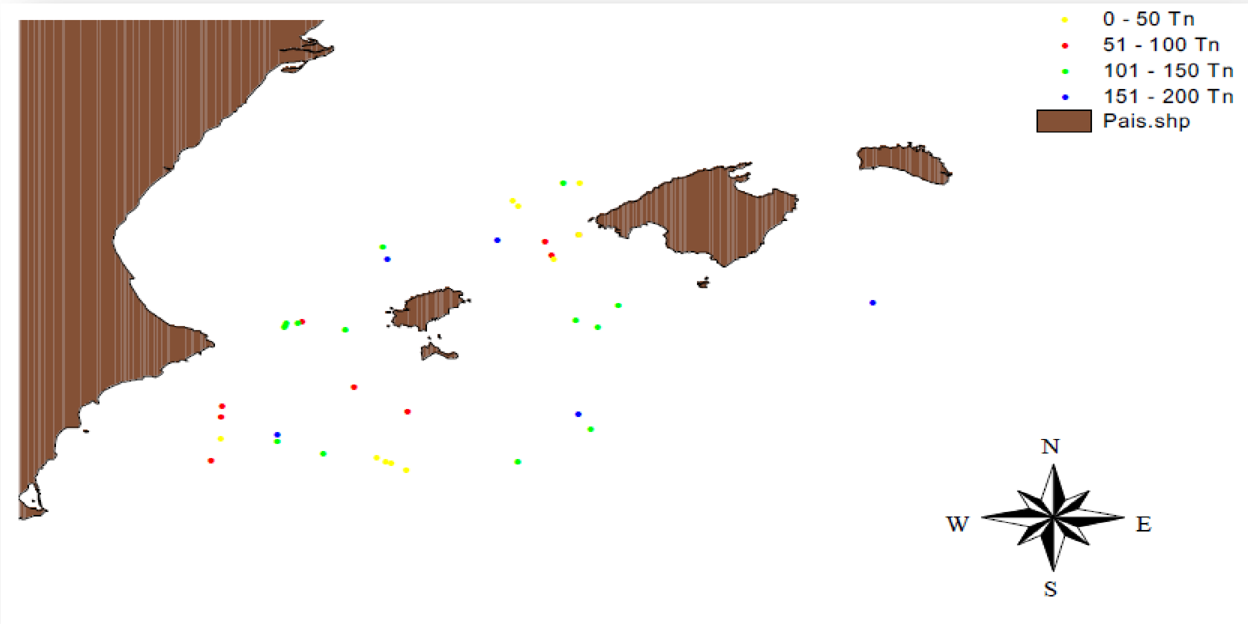


Minimal tons – 3

- **Minimum size of school Tn**

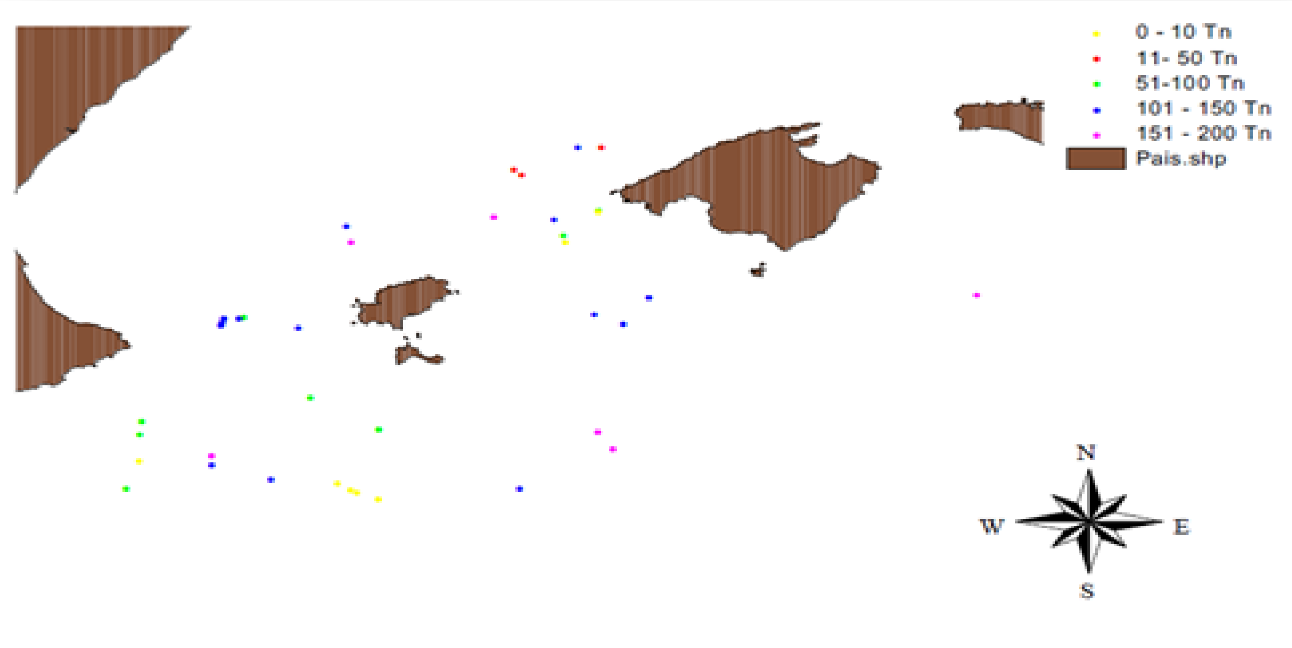


- **Minimum size of school Tn**



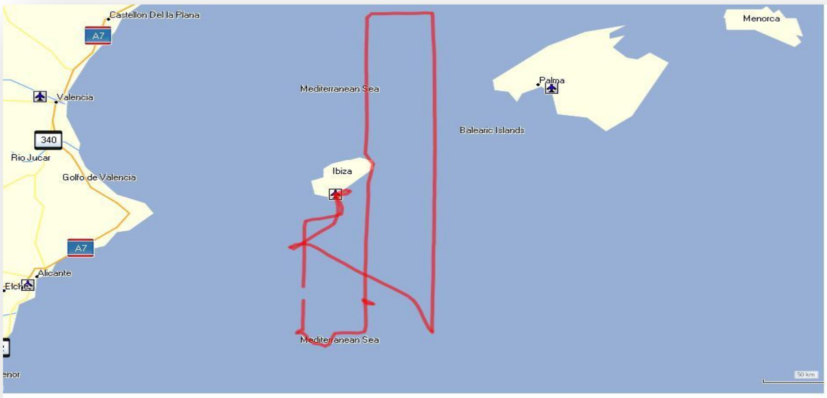
Maximal tons - 4

Maximum size of the school Tn



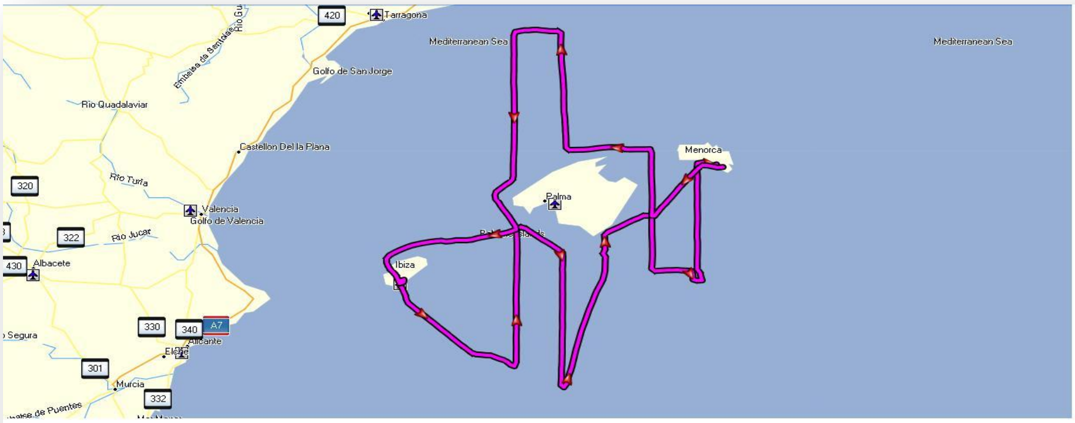
Maximum size of the school

IBIZA 01/06/2010



IBIZA 02/06/2010

IBIZA 03/06/2010



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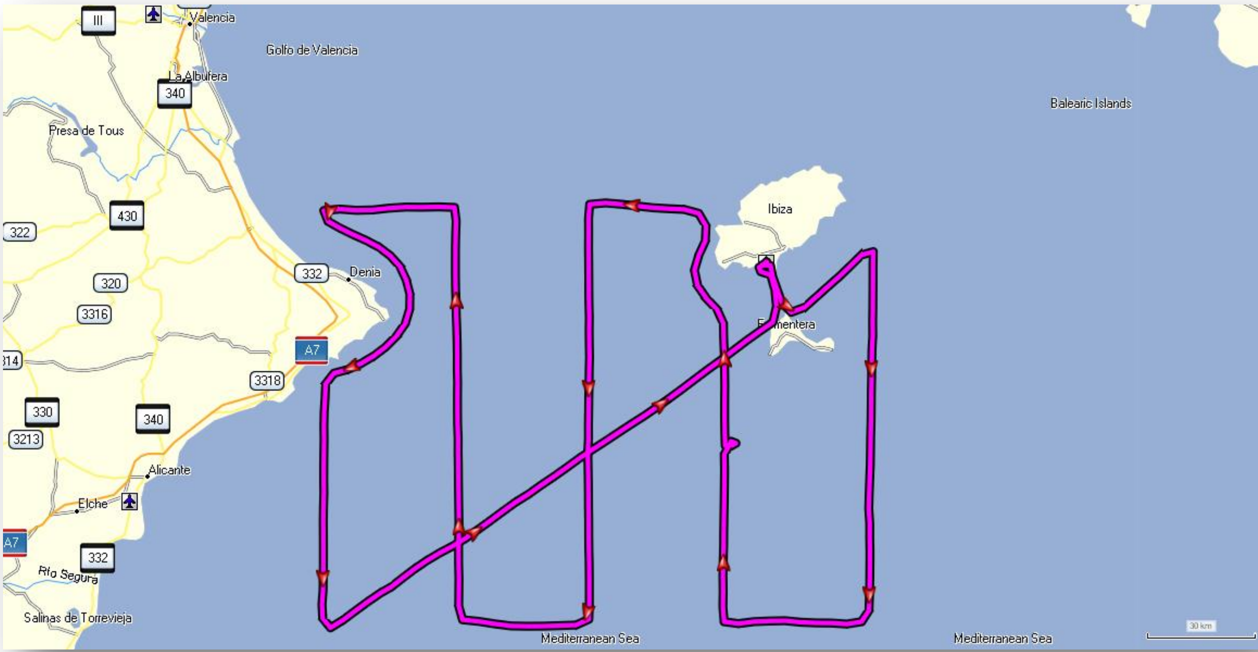
IBIZA 06/06/2010

IBIZA 07/06/2010

IBIZA 13/06/2010



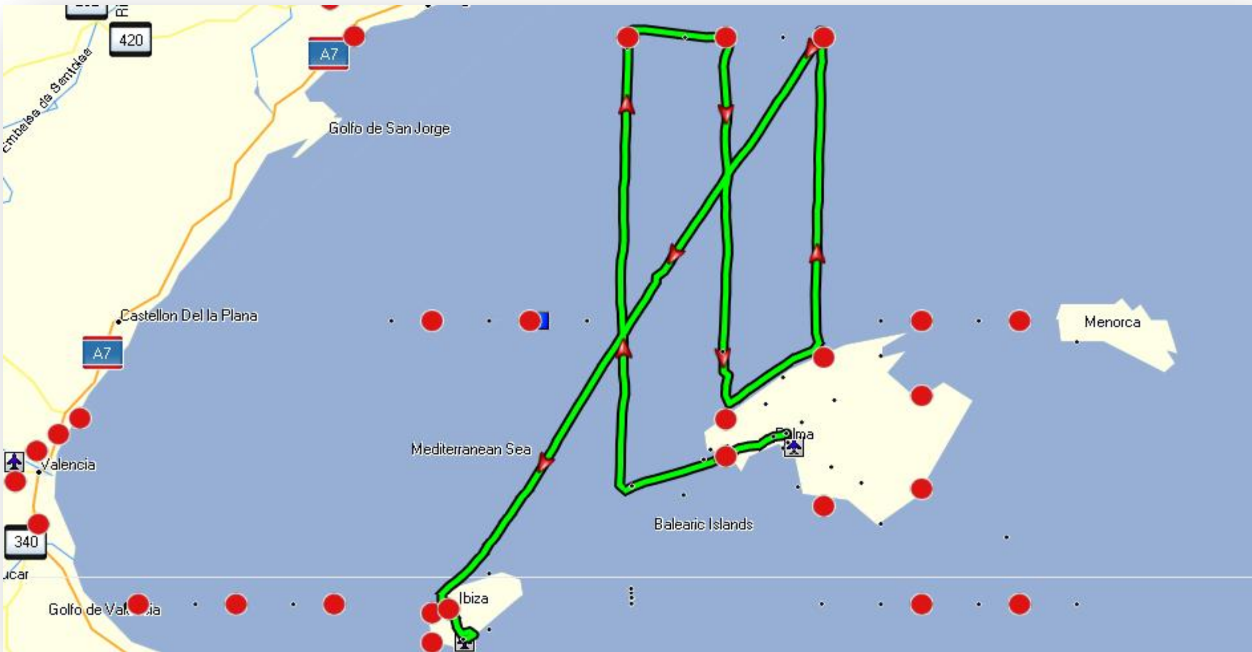
IBIZA 18/06/2010

IBIZA 22/06/2010

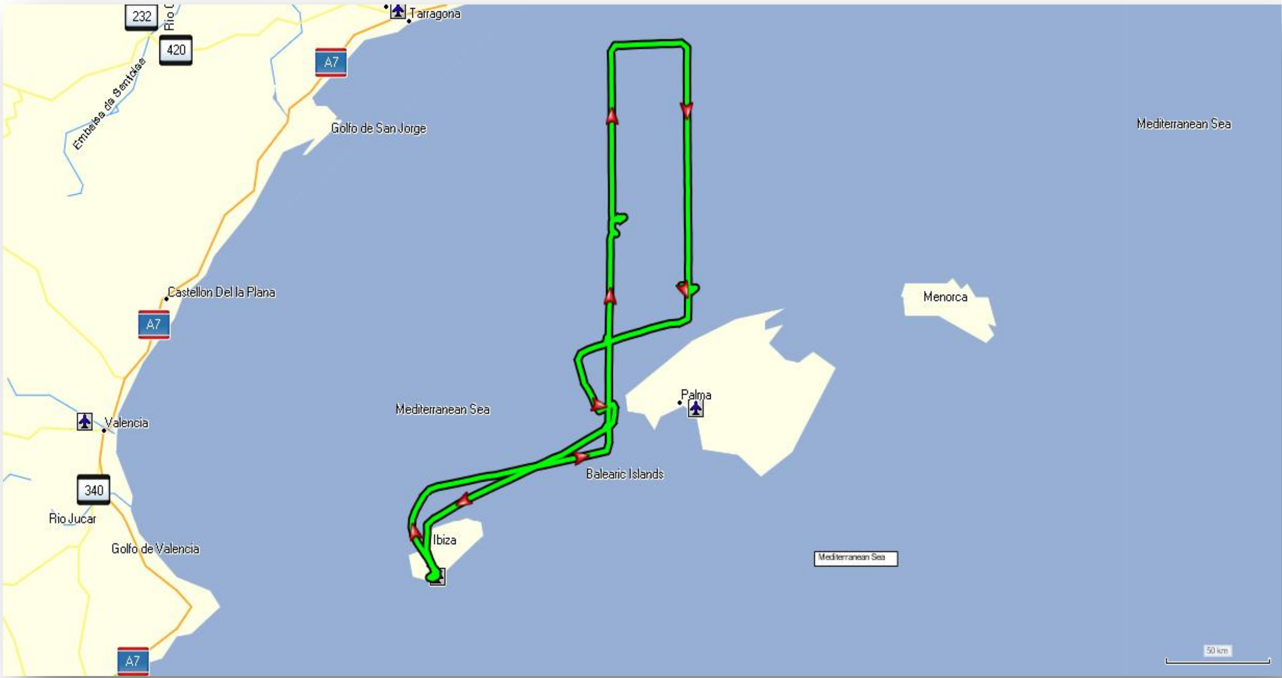
IBIZA 22/06/2010

IBIZA 23/06/2010

IBIZA 23/06/2010



IBIZA 24/06/2010



IBIZA 28/06/2010

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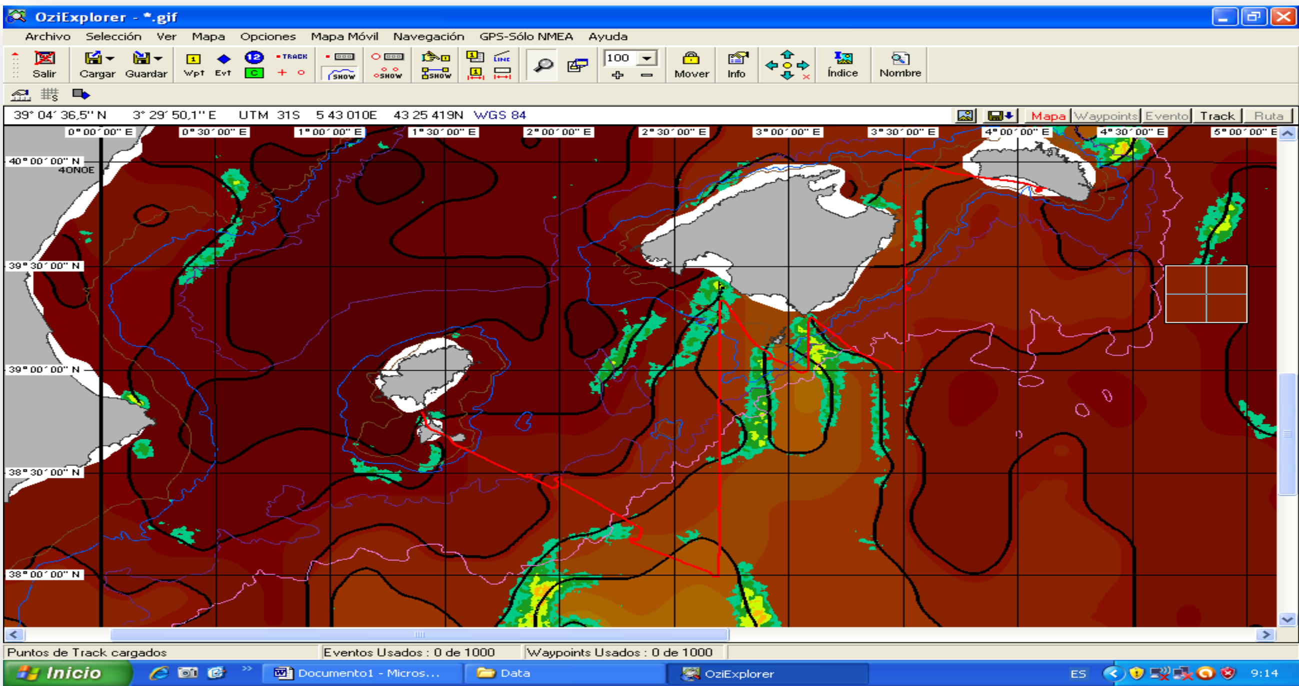
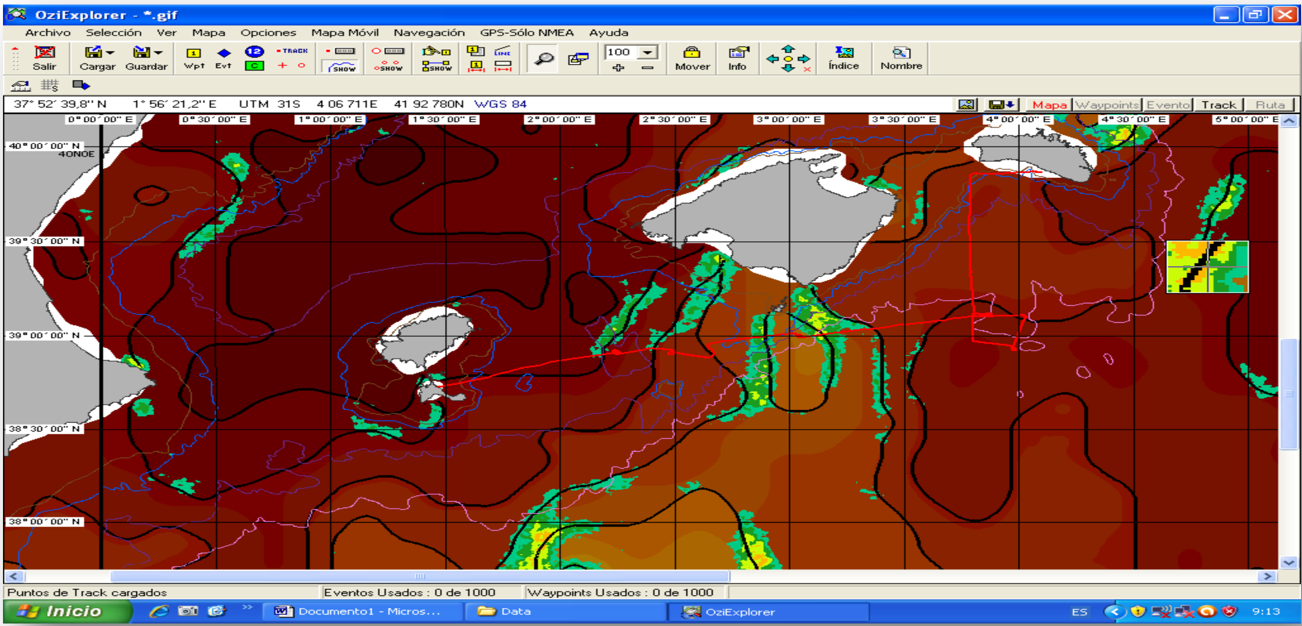
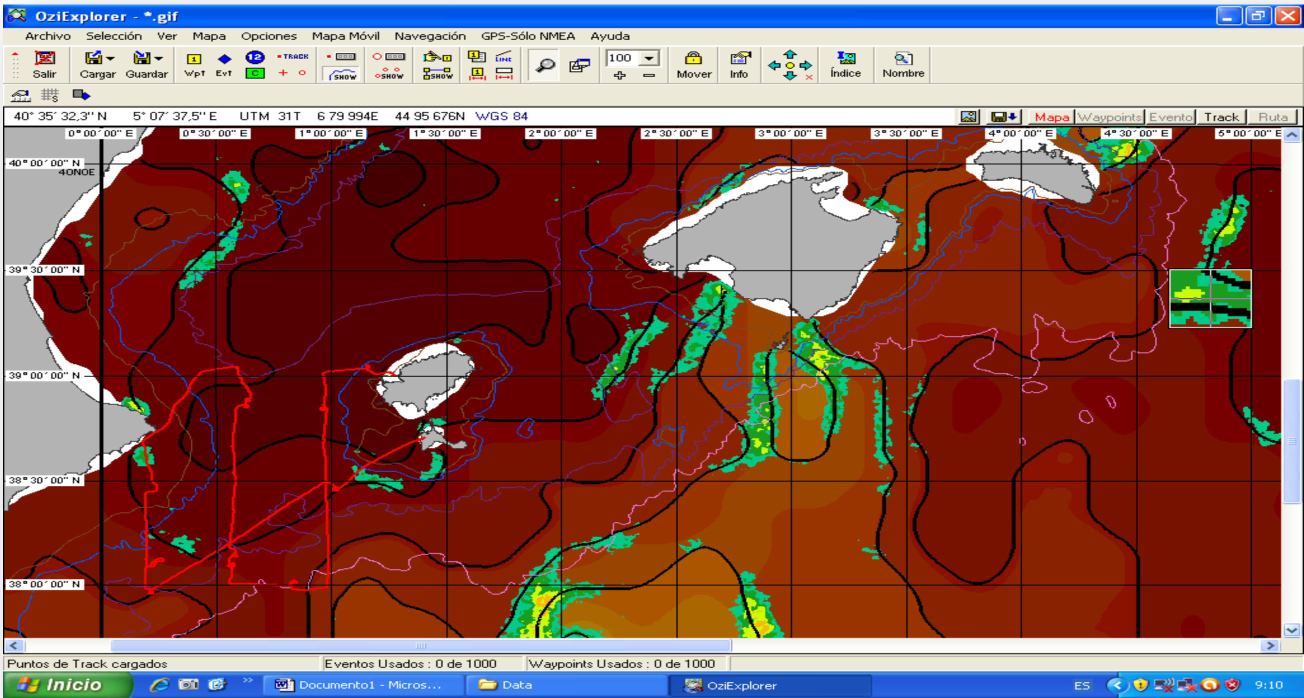


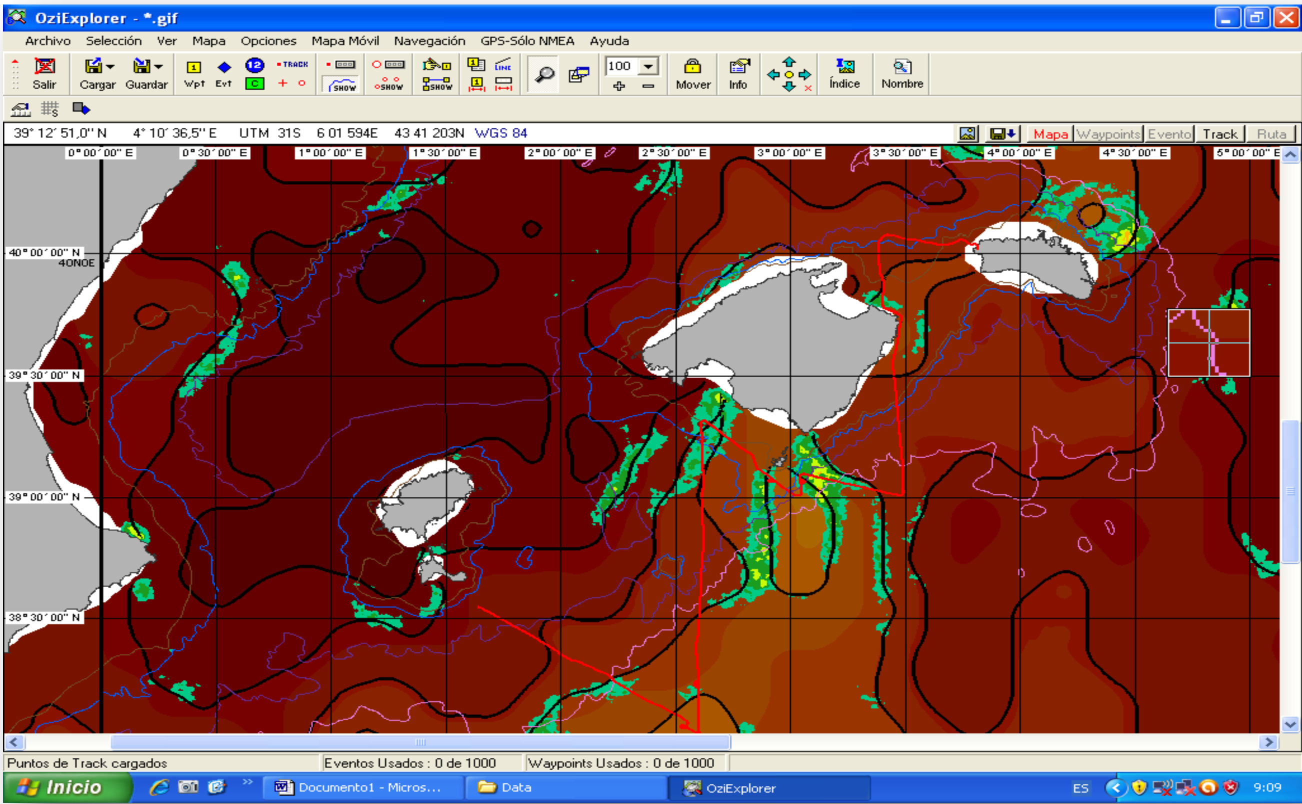
IBIZA 30/06/2010



IBIZA 01/07/2010



IBIZA 02/07/2010



Sub - area 3 - MALTA

SURVEY SESSIONS

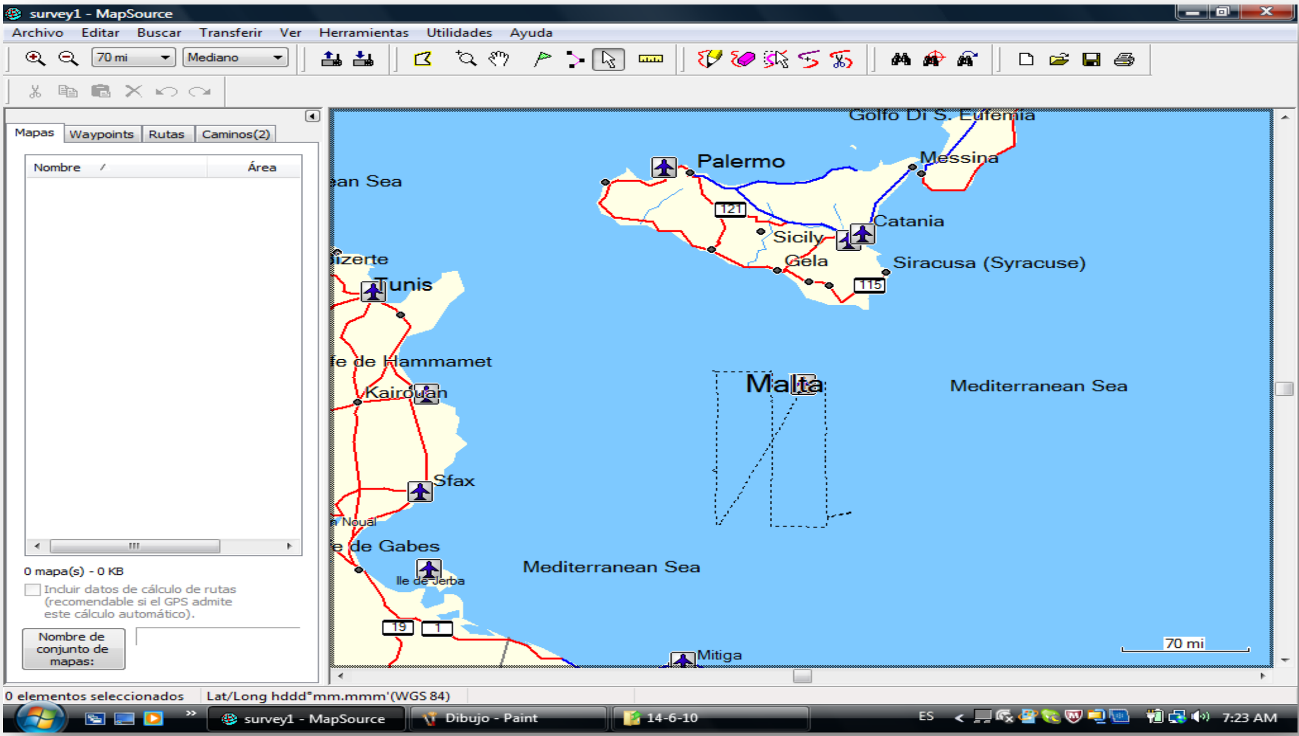
An outline of calendar events concerning the survey sessions follows.

MALTA 06/06/2010

First session of aerial surveys conducted. Details of the surveys are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:05	19:23	3

The weather conditions were good (Force 1-2 winds and a clear sky).



Surveys were carried out along the three line transects 5,6, and 7 of survey 1 (subarea 3), which were 47 minutes, 53 minutes, and 1 hour and 3 minutes long respectively. The aerial survey design speed and altitude were respected throughout all the three line transects.

No free swimming *T. thynnus* shoals were observed in any of the three surveys.
Whilst conducting transect number 7, a tuna pen containing a school with an estimated weight of 80 tons was observed at Lat 34°30 07.7 Long 14°56 21.6 . The sighting was recorded through digital photography.

It is to be noted that seven tuna ships were observed whilst conducting the three aerial line transects.

MALTA 07/06/2010

Second session of aerial surveys conducted. Details of the surveys are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	11:10	15:05	2

The weather conditions were good (Force 1-2 winds and a clear sky).

Surveys were carried out along two line transects 3 and 4 and of survey 1 (subarea 3) and were 30 minutes and 49 minutes long respectively.

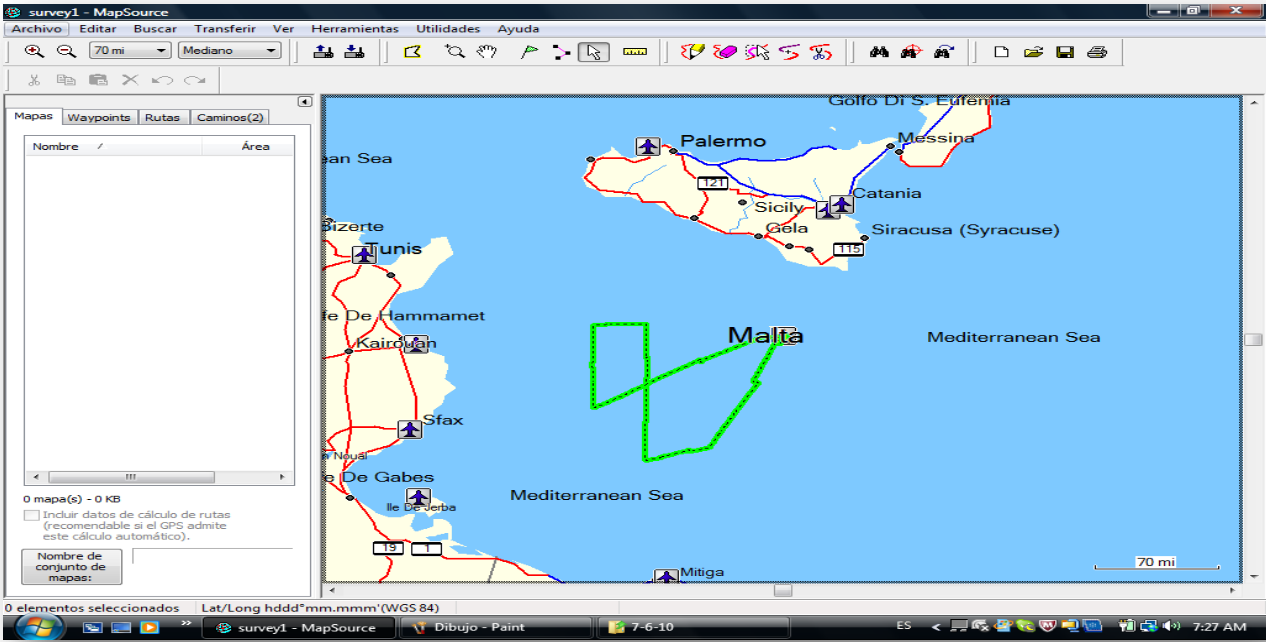
The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
1	3	36°00 03.8	12°33 45.1	35°00 19.0	12°32 23.0	00: 30	0
1	4	34°20 43.6	13°05 24.6	35°59 35.4	13°04 42.8	00: 49	0

The aerial survey design speed and altitude were respected throughout the survey. No *T. thynnus* shoals were observed during any of the surveys conducted on this day.

One tuna fishing ship was sighted during transect 3.

Whilst conducting the line transect, the plane flew over Lampedusa (Approximate duration 1 min)



MALTA 08/06/2010 – 13/06/2010

No aerial surveys were conducted during this period due to adverse weather conditions (wind speed exceed 3 on the Beaufort scale). Pilot and spotters were on call during this period.

MALTA 14/06/2010

Third aerial survey conducted. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	9:59	13:55	2

The weather conditions were good (Force 1-2 winds and a clear sky).

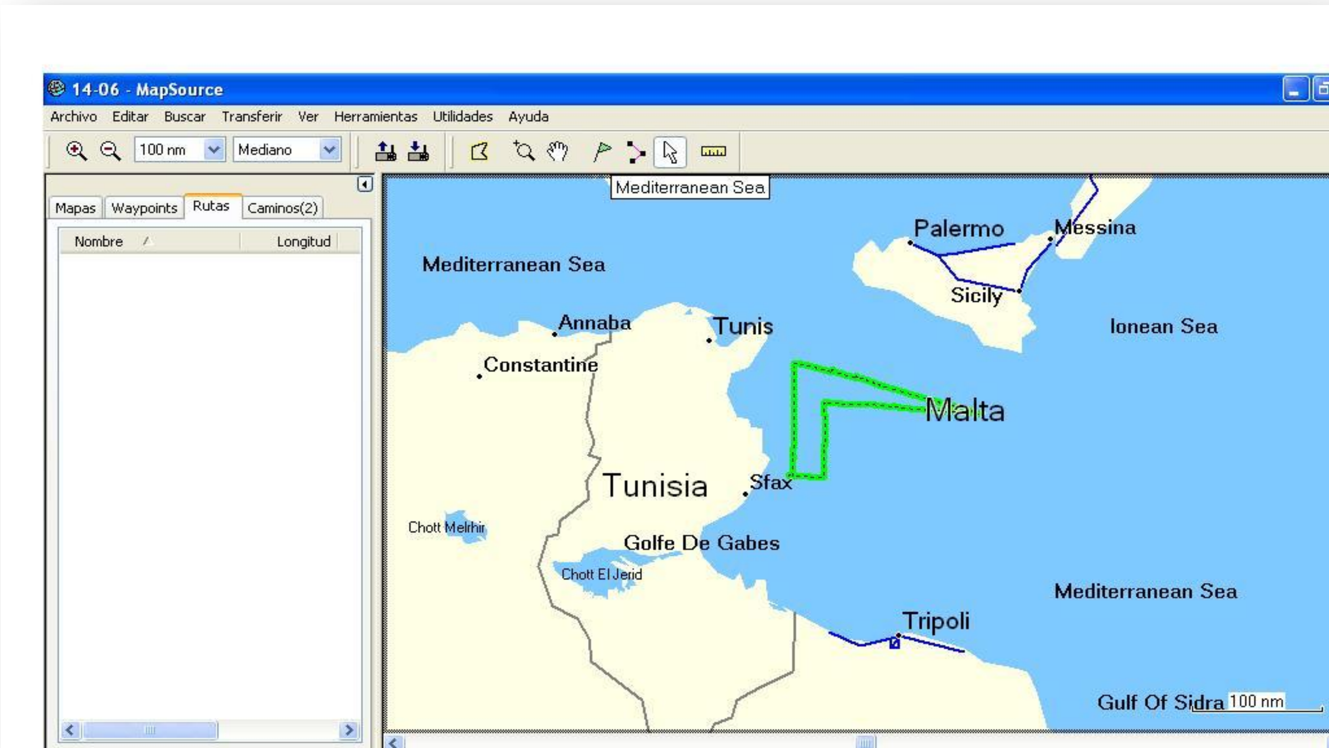
Line transects 1 (part of) and 2 of survey 1 (subarea 3) were conducted on the day. It is to be noted that the planned line transect 1 was not followed since this is located in Tunisian airspace.
A parallel line transect was conducted approximately 2 miles from the planned transect. The duration of transects 1 and 2 were 41 minutes and 31 minutes respectively. The aerial survey design speed and altitude were respected throughout the survey.

The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
1	1	35°01 39.6	11°30 15.9	36°30 45.8	11°31 51.7	00: 41	0
1	1	36°00 00.0	12°00 00.8	35°00 36.0	12°00 46.1	00: 31	0

No *T. thynnus* shoals were observed in any of the surveys conducted on the day.

In both transects, tuna fishing vessels were sighted.



MALTA 15/06/2010 – 16/06/2010

No aerial surveys were conducted during this period due to adverse weather conditions (wind speed exceeded Force 3 on Beaufort scale). Pilot and spotters were on call during this period.

MALTA 17/06/2010

Fourth aerial survey conducted. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	9:40	13:40	2

The weather conditions were good (Force 0-1 winds and a clear sky).

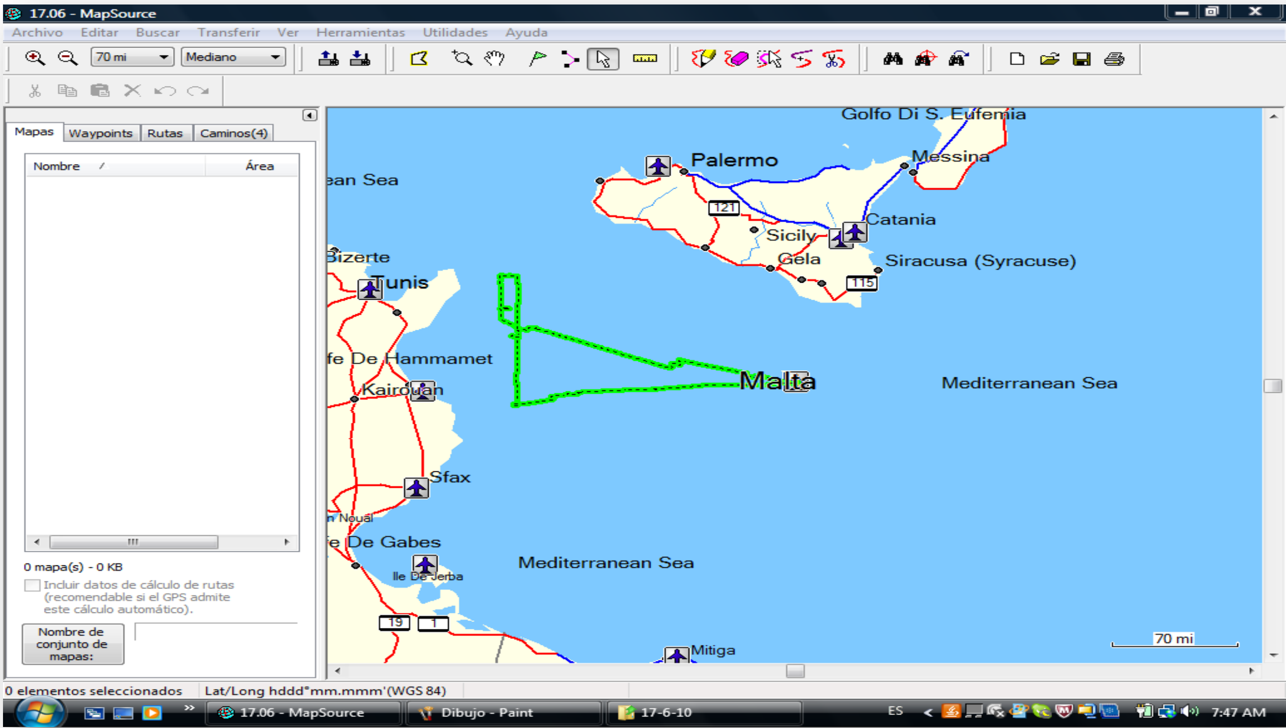
Line transects 1 (continuation from 14/06/2010) of survey 1 (subarea 3) and 2 of survey 2 (subarea 3) were conducted. The duration of transects 1 and 2 were 18 minutes and 50 minutes respectively. The aerial survey design speed and altitude were respected throughout the survey.

The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
1	1	36°31 35.2	11°32 32.7	36°59 36.9	11°31 17.6	00: 18	0
2	2	36°59 40.2	11°41 18.3	35°37 21.2	11°42 10.0	00: 50	0

No *T. thynnus* shoals were observed in any of the surveys conducted on the day. Nevertheless, whilst cruising on the way back to Malta a 150 ton *T. thynnus* shoal was sighted at Lat 35°4717.3 Long 13°03 16.8.

Tuna ships were only sighted along line transect 2.



MALTA 18/06/2010 – 23/06/2010

No aerial surveys were conducted during this period due to adverse weather conditions (wind speed exceeded Force 3 on the Beaufort scale). Pilot and spotters were on call during this period.

MALTA 24/06/2010

The fifth session of aerial surveys made. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	11:28	15:13	2

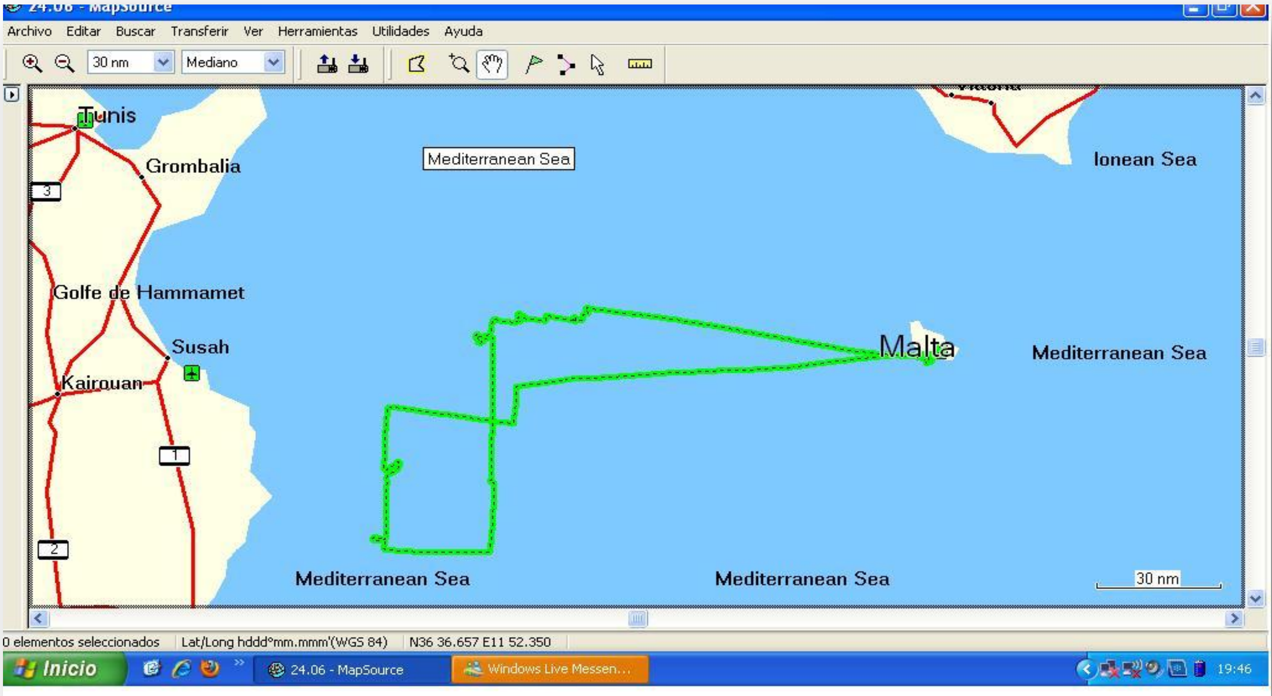
The weather conditions were good (Force 0-1 winds and a clear sky).

Line transects 2(continuation from 17/06/2010) and transect 3 of survey 2 (subarea 3) were made on the day.
The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
2	2	35°37 07.8	11°44 14.2	35°00 50.6	11°42 33.0	00: 25	0
2	3	34°59 58.2	12°14 03.9	35°59 26.5	12°14 56.5	00: 46	2

While conducting transect 3, two shoals of *T. thynnus* were spotted. The first school, which was sighted at Lat 35°54 46.8 Long 12°10 47.4, was esti mated to be 35 Tons and made up of 2000 individuals of whom 75% were considered to be small and the rest were medium size according to the classification system used during this survey. The second *T. thynnus* shoal was smaller in size (approximately 25 Tons and 1400 individuals in total). Nevertheless the latter school had the same school composition as the first one.

In both transects, no tuna purse-seine vessels were sighted.



MALTA 25/06/2010

The sixth session of aerial surveys made. Details of the survey are given in the table below.

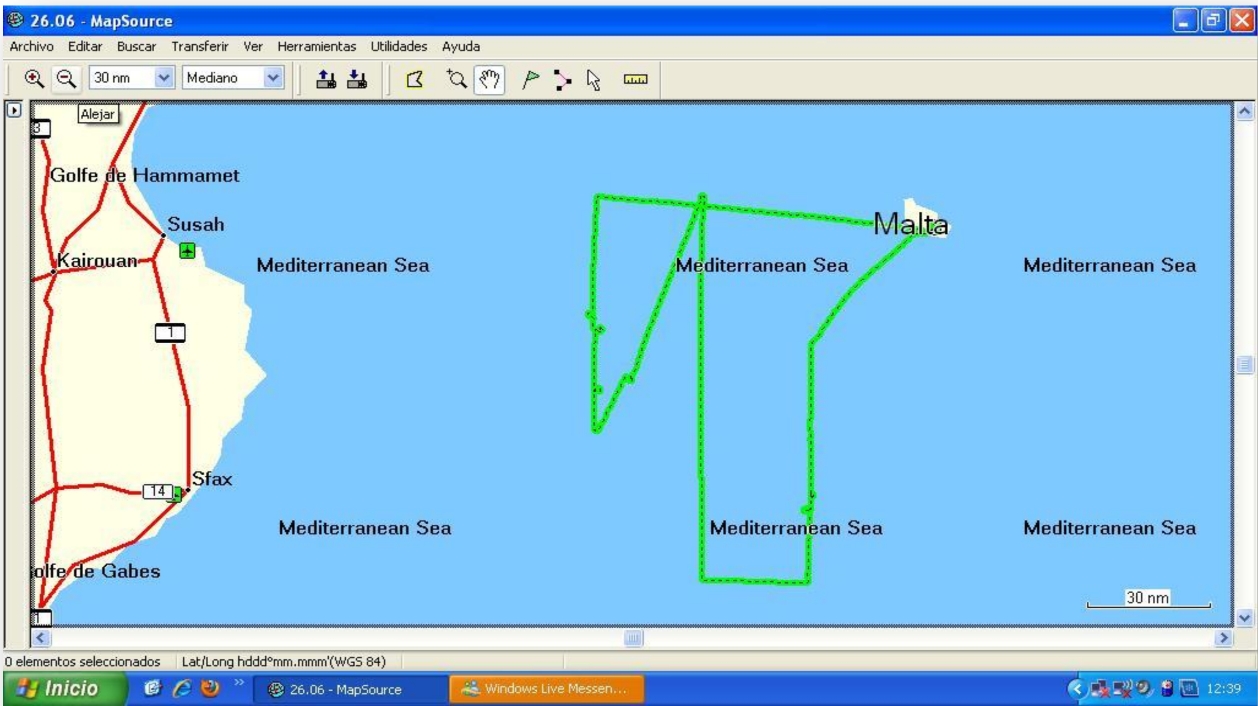
Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:38	12:30	3

The weather conditions were good (Force 0-1 winds and a clear sky). Surveys were carried out along the three line transects 4, 5, and 6 of survey 2 (subarea 3). The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
2	4	35°59 09.7	12°47 35.6	35°00 36.5	12°46 57.1	00: 37	1
2	5	35°59 49.9	13°19 05.3	34°22 11.8	13°19 12.9	00: 47	0
2	6	34°20 29.7	13°50 08.3	35°21 26.9	13°52 01.5	00: 37	2

A 5-6 Ton school of *T. thynnus* was spotted at Lat 35°29 33.6 Long 12°44 56.6 whil e conducting transect 4. The school was composed of approximately 1500 small individuals. During transect6, two shoals of bluefin tuna were spotted. The total weight of the schools were 0.5 and 0.4 Tons respectively. Both schools were made up of small individuals.

Tuna purse-siene ships were only sighted along line transect 4.



MALTA 26/06/2010

Seventh session of aerial surveys made. Two 4 hour flights were performed on the day. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:20	12:12	3
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	14:30	18:28	3

Six aerial line transects were carried out on the day. Transects 3, 4 and 5 of survey 3 (subarea3) were made in the morning flight while transects 6, 7 and 8 of survey 2 (subarea 3) were carried out in the afternoon flights. Details of the individual line transects are given in the table below.

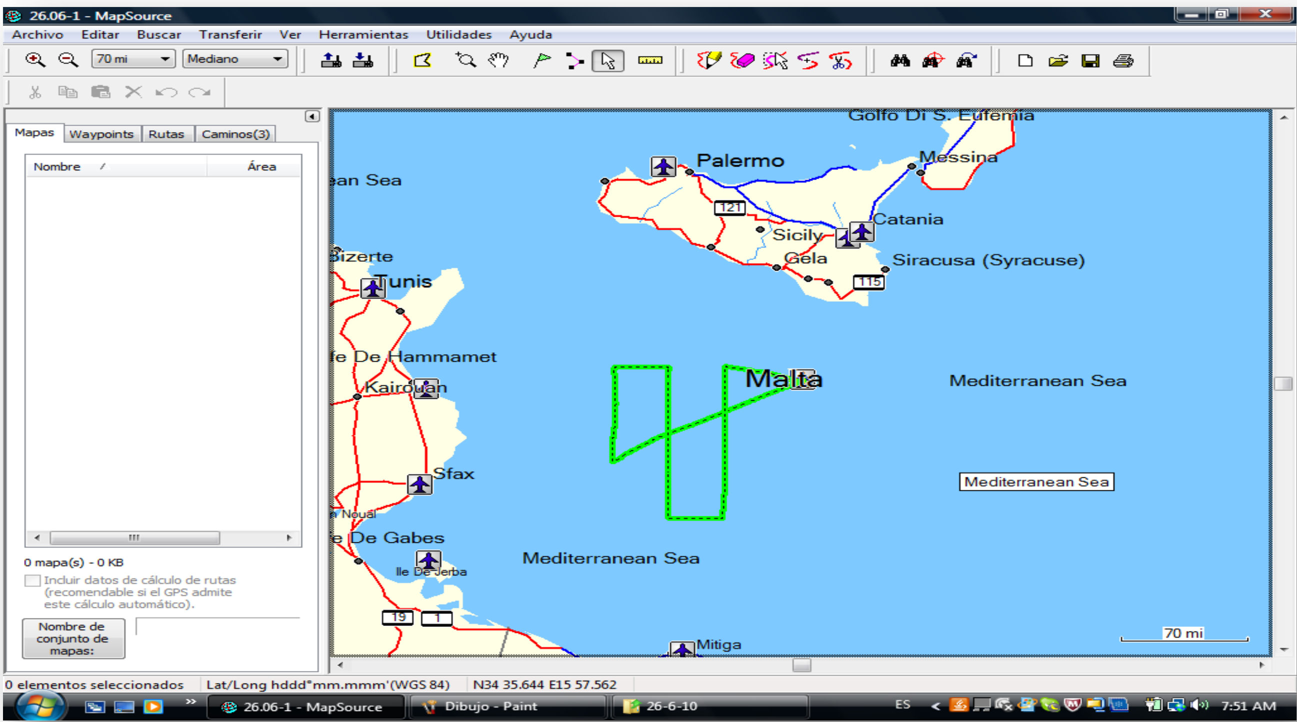
Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
3	3	34°58 10.0	12°35 47.3	35°59 24.9	12°36 46.0	00:29	1
3	4	35°59 41.0	13°08 30.8	34°21 58.9	13°08 35.1	00:50	0
3	5	34°20 55.6	13°39 56.5	35°59 13.4	13°41 41.9	00:45	0
2	6	35°59 50.7	13°53 09.7	35°23 20.8	13°51 38.1	00:19	0
2	7	35°48 02.8	14°24 18.7	34°21 44.8	14°23 02.6	00:52	0
2	8	34°20 54.7	14°55 58.5	35°58 30.9	14°56 46.6	01:38	6

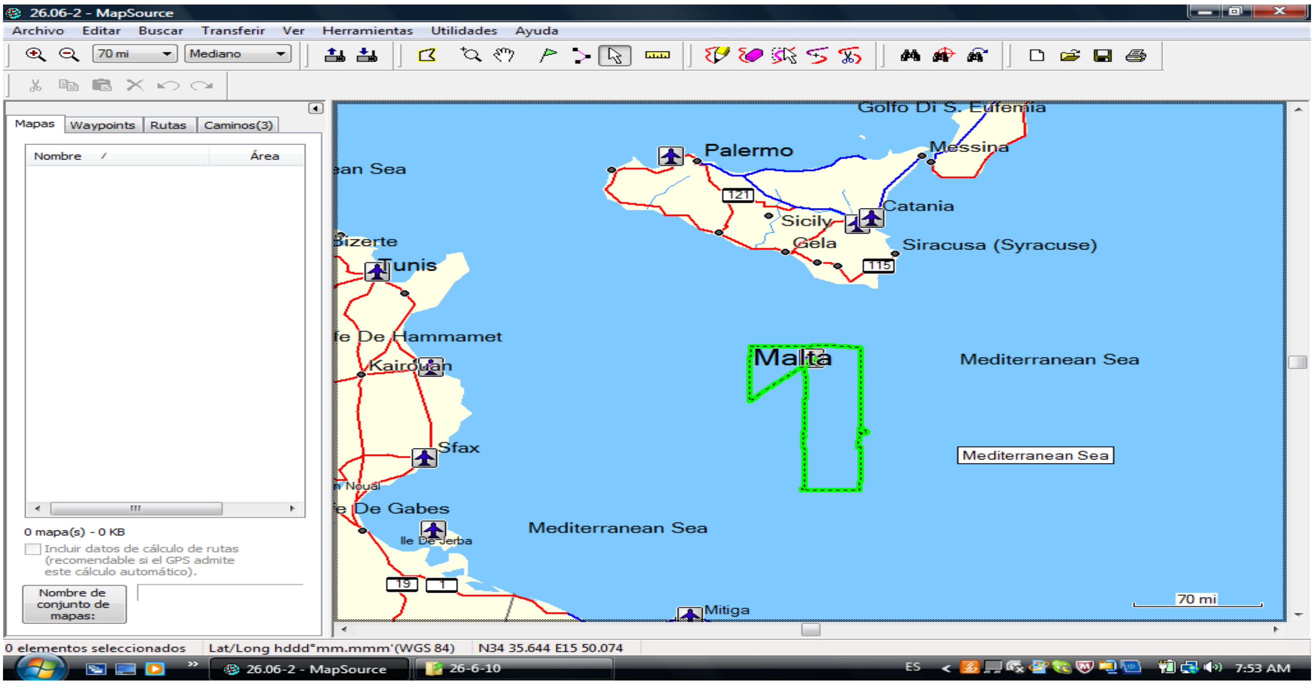
The surveys were made in force 0-1 wind conditions and clear to slightly hazy skies. The aerial survey design speed and altitude were respected throughout the six line transects carried out on the day. While conducting line transect 3, the plane flew over Lampedusa (Approximate duration1 min).

Seven shoals of tuna were spotted on the day. The shoal dynamics data on the particular schools is summarized in the table below.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
3	3	35°37 02.2	12°37 14.4	20	0.08	100	0	0	0
2	8	35°01 17.7	14°58 02.2	2300	50	50	5	0	0
2	8	35°00 40.1	14°58 23.2	1600	80	0	100	0	0
2	8	35°01 33.4	14°59 06.6	800	100	0	100	0	0
2	8	35°01 10.7	14°58 48.6	2000	50	50	50	0	0
2	8	35°01 59.8	14°58 06.1	700	40-50	0	100	0	0
2	8	34°59 55.3	14°57 34.4	1200	150	0	100	0	0

Tuna fishing vessels were sighted while conducting transects 7 and 8.





MALTA 27/06/2010

Eight session of aerial surveys were made. Four aerial line transects were carried out during one flight in the morning and another in the afternoon. The following table illustrates a summary of the survey details.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:34	12:45	2
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	16:00	18:35	2

Transects 1, 2 of survey 3 (subarea 3) were made during the morning flight, while transects 6, 7 of survey 3 (part of) (subarea 3) were carried out during the afternoon flights.

Details of the individual line transects are given in the table below.

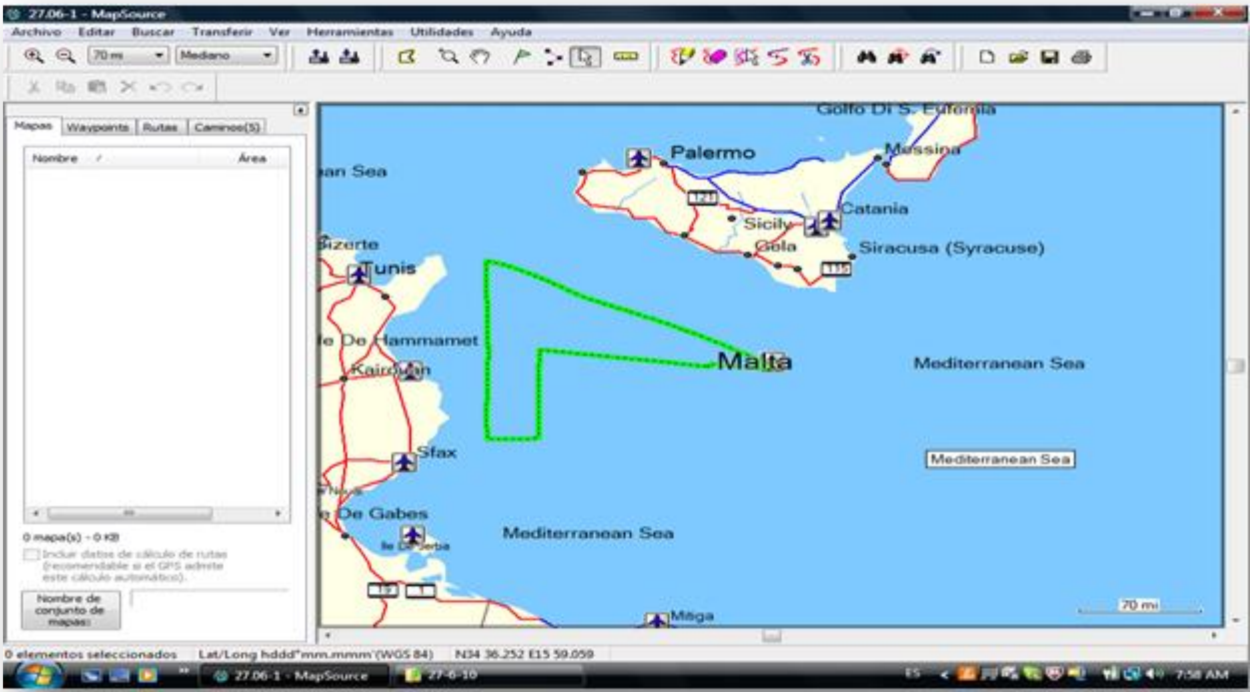
Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
3	1	34°59 24.6	11°33 49.8	37°00 00.5	11°31 49.0	01: 06	0
3	2	36°00 12.5	12°05 50.5	35°01 08.8	12°03 55.5	00: 28	0
3	6	36°00 00.9	14°14 39.2	34°23 09.6	14°13 09.1	01: 09	2
3	7	34°22 04.6	14°44 50.3	34°55 07.0	14°49 08.6	00: 31	1

The weather conditions were good (Force 0-1 winds and a clear sky).
The aerial survey design speed and altitude were respected throughout the four line transects carried out on the day. Four shoals of tuna were spotted on the day.

Details of the recorded shoals are given in the table below.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
3	6	35°12 58.0	14°13 04.3	3	0.012	100	0	0	0
3	6	34°54 34.8	14°16 00.9	7	0.100	100	0	0	0
3	7	34°54 30.6	14°49 09.2	2400	40	100	0	0	0
Sighted while cruising back to Malta		35°22 15.6	14°36 23.3	20	0.040	100	0	0	0

Tuna purse-seine ships were only sighted along line transect 6.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Malta
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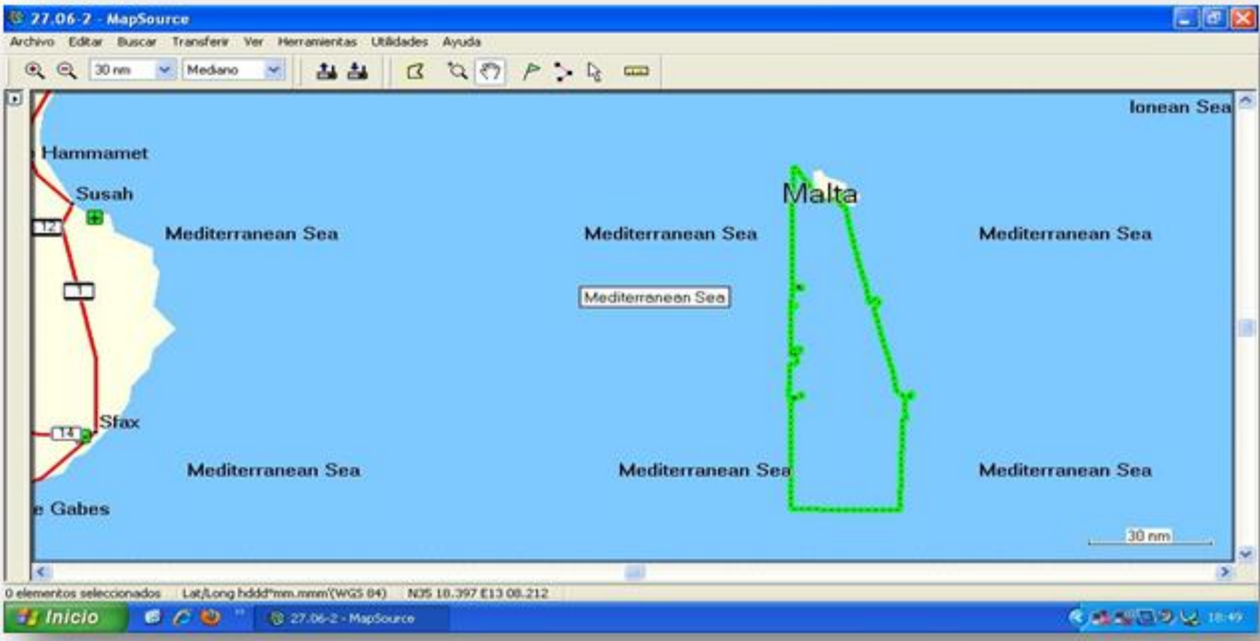
27.06-2 - MapSource
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Mediterranean Sea
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N35 18.397 E13 08.212

MALTA 28/06/2010

The ninth session of aerial surveys was made. Five aerial line transects were carried out during a morning and afternoon flights.

The following table illustrates details of the survey.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:23	12:15	3
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:20	18:31	2

Transects 2 (part of), 3 and 5 (part of) of survey 4 (subarea 3) were made during the morning flight, while transects 6 and 8 of survey 4 (subarea 3) were carried out during the afternoon flights. Line transects made during the morning were, at times, carried out in slightly hazy to medium hazy skies.. On the other hand, the sky was clear during the afternoon flights. On the day, winds of force 0-1 on the Beaufort scale were recorded.

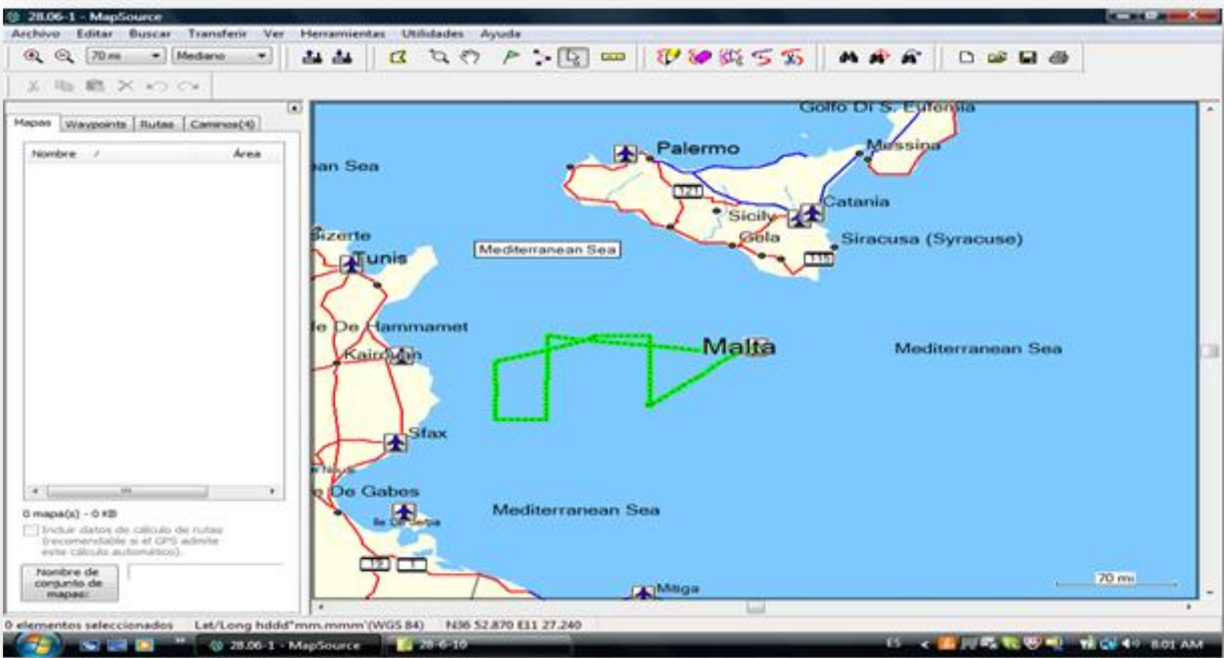
The table below summarizes the details of the individual aerial line transects.

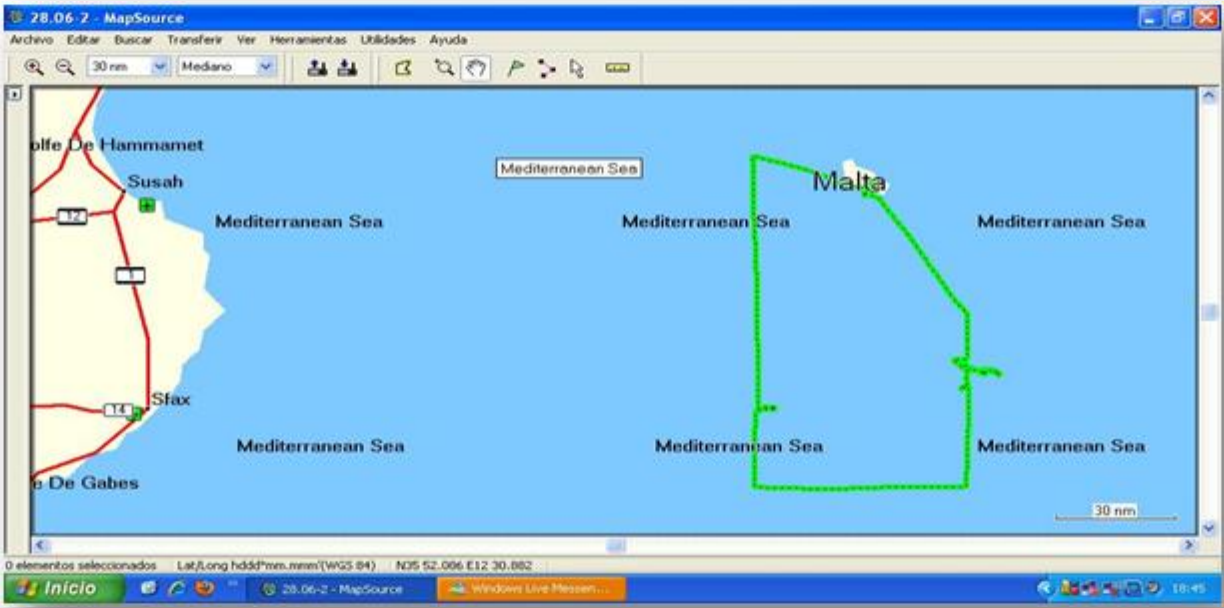
Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
4	2	35°00 06.2	11°45 03.5	35°23 43.7	11°43 44.9	00: 12	0
4	3	36°00 08.0	12°17 12.7	35°00 57.3	12°15 49.8	00:27	0
4	5	36°00 17.2	13°19 25.2	35°11 16.5	13°22 27.1	00:32	1
4	6	36°00 10.0	13°52 52.8	34°21 56.1	13°52 07.3	00:56	1
4	8	34°21 08.5	14°56 43.8	35°11 11.9	14°57 52.4	01:02	5

A summary of assessment of the observed shoals of tuna are summarized in the following table.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
4	5	35°10 05.0	13°20 44.0	15	0.045	100	0	0	0
4	6	34°44 42.5	13°58 34.5	7-8	0.060	100	0	0	0
4	8	34°50 10.7	14°58 12.5	4	0.015	100	0	0	0
4	8	34°51 02.5	14°56 09.5	15	0.008	100	0	0	0
4	8	35°57 42.2	14°56 44.6	1600	40	100	0	0	0
4	8	34°57 16.8	14°56 50.3	1400	50	0	80	20	0
4	8	34°56 49.0	14°58 19.2	500	80-100	0	50	50	0

On the day no tuna purse-seine fishing vessels were seen in the area of study.





MALTA 29/06/2010

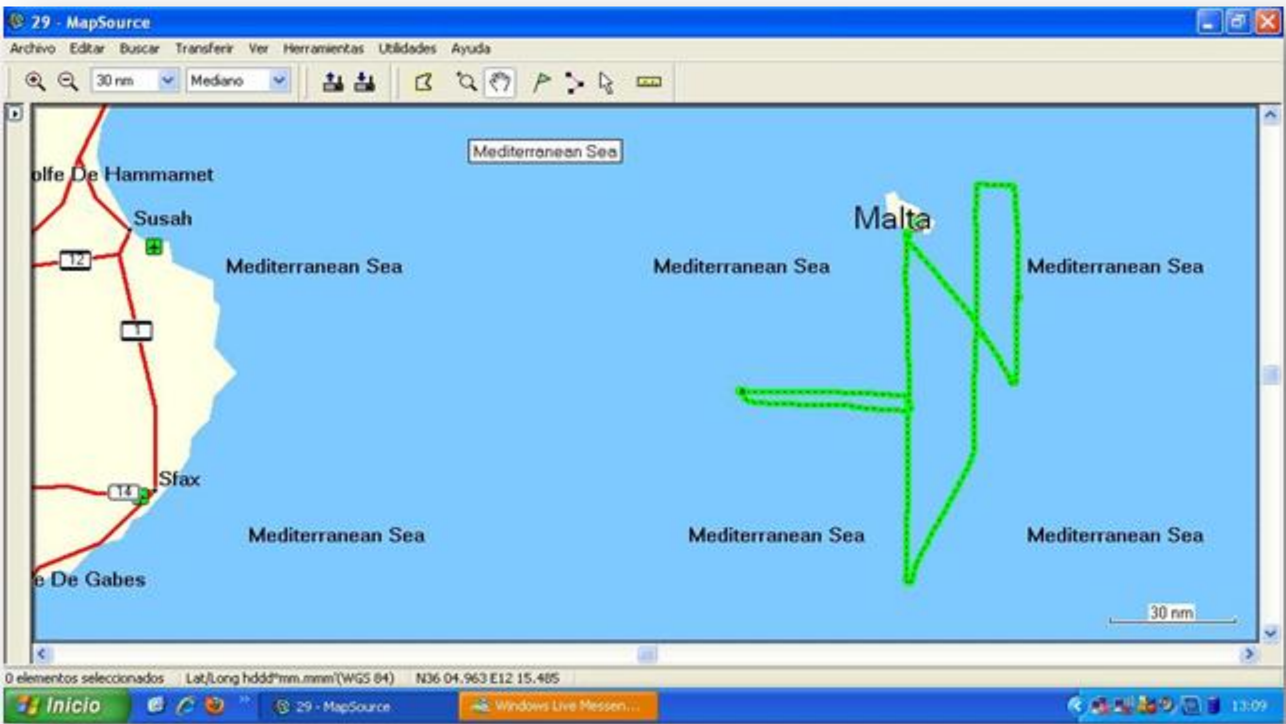
The tenth session of aerial surveys made. The following table illustrates details of the survey.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	9:15	12:50	3

Surveys were carried out along line transect 7 (continuation from 27/06/2010) of survey 3(subarea 3) and transects 7 and 8 of survey 4 (subarea 3). It is to be noted that transect 7 (survey 4) was interrupted and hence was considered as two separate line transects. This was done to take into account the 'no effort' time. The table below shows a summary of details of the transects made on the day.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
3	7	36°00 37.7	14°46 08.2	34°55 13.6	14°45 30.2	00: 25	0
4	7	34°21 27.2	14°26 13.5	35°07 24.2	14°25 47.4	00: 33	0
4	7	35°07 33.8	14°26 18.5	35°47 25.7	14°25 44.7	00: 23	0
4	8	35°12 02.3	14°57 42.4	36°00 46.9	14°57 07.5	00: 22	0

The surveys were made during Force 0-1 winds. All line transects, except for transects 7(Survey 3) and 7 (Survey 4), were made in clear sky conditions. No tuna shoals were observed in any of the surveys made on the day. Nevertheless, while cruising between transects a 150 ton *T. thynnus* shoal was sighted at Lat 35°09 45.6 Long 13°36 55.5. No tuna purse-seine vessels were sighted on any of the line transects made.



MALTA 30/06/2010

No aerial surveys were made since the aircraft was being serviced.

MALTA 01/07/2010

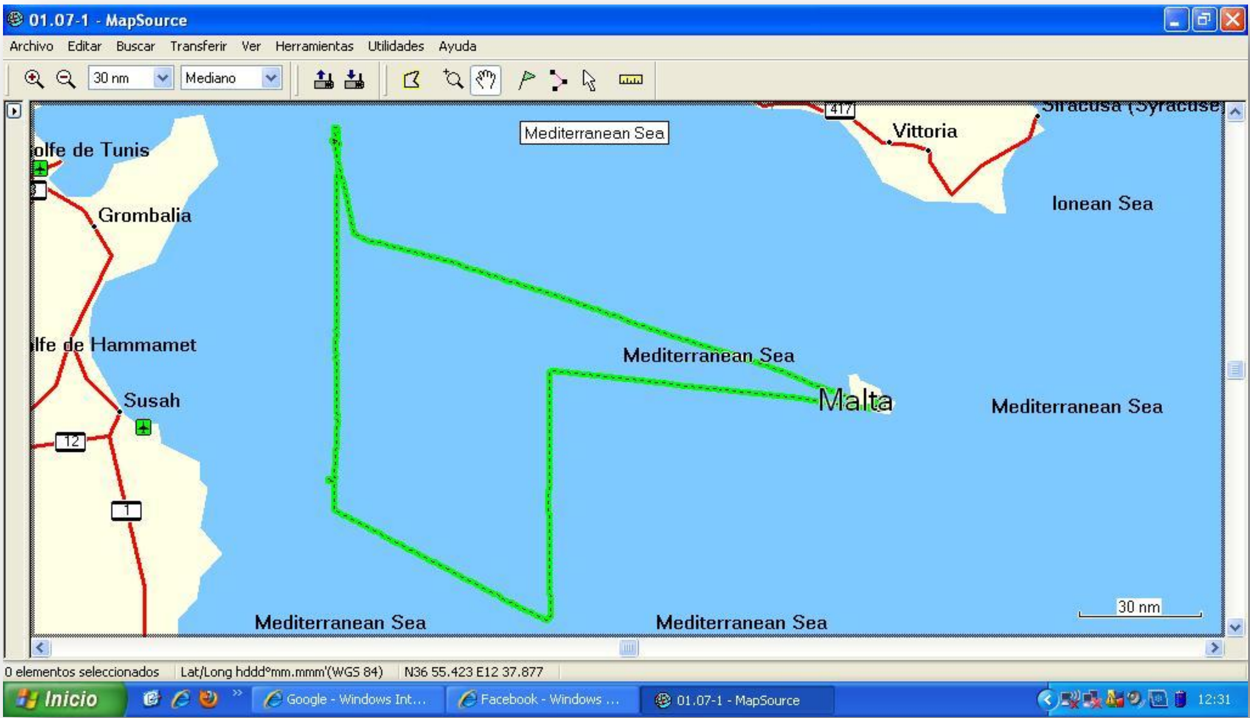
The eleventh session of aerial surveys was made. Two flights were performed on the day.
Details of the survey are given in the table below.

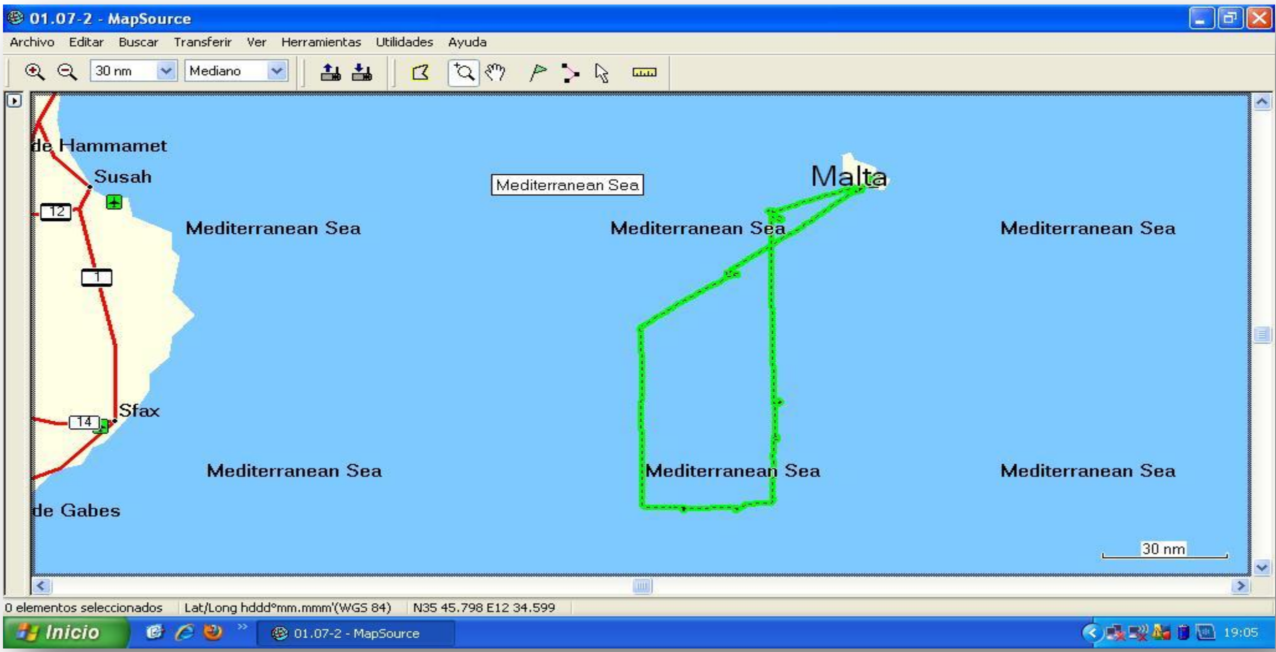
Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:19	12:18	2
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:56	18:34	2

Four aerial line transects were made on the day. Transects 2 (continuation from 28/6/2010) and4 of survey 4 (subarea 3) were made in the morning flight while transect 5 (continuation from28/6/2010) of survey 4 (subarea 3) and transect 6 of survey 5 (subarea 3) were carried out in the afternoon flights. Details of the individual line transects are given in the table below.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
4	2	35°24 29.0	11°43 54.6	36°59 48.8	11°44 13.0	00: 27	0
4	4	35°59 58.1	12°49 32.4	34°58 46.4	12°48 52.9	00: 55	0
4	5	35°10 45.6	13°20 39.2	34°21 30.9	13°20 43.7	00: 23	0
5	6	34°21 39.6	13°58 30.9	35°41 52.3	13°59 20.2	00: 51	0

A 0.6 Ton shoal of *T. thynnus* was seen while cruising between transects. While conducting transect 4 (survey 4) a tuna fishing fleet consisting of 6 vessels was spotted.





MALTA 02/07/2010

Twelfth and final session of aerial surveys made. Five aerial line transects were carried out during one flight in the morning and another in the afternoon. The following table illustrates details of the survey.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:35	12:25	3
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:36	17:28	2

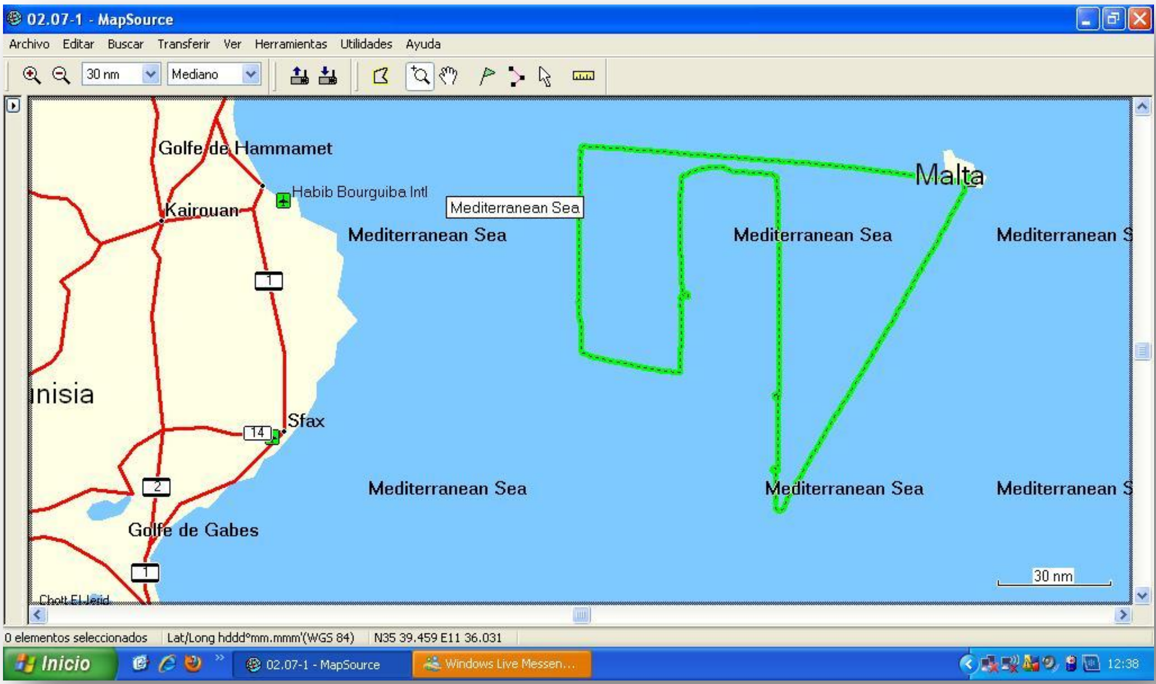
Transects 3, 4 and 5 of survey 5 (subarea 3) were made in the morning flight while transect 7 of survey 5 (subarea 3) and transect 7 of survey 6 (subarea 3) were carried out in the afternoon flights. The aerial line transects were, at times, carried out in slightly hazy to medium hazy skies. On the day, winds of force 0 -1 on the Beaufort scale were recorded.

The table below summarizes the details of the individual aerial line transects.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
5	3	36°00 17.6	12°22 50.8	35°38 55.2	12°21 42.1	00:10	0
5	4	35°00 11.9	12°52 51.9	35°48 30.6	12°54 12.2	00:26	0
5	5	35°50 15.3	13°25 32.3	34°24 26.8	13°25 13.5	00:15	1
5	7	35°22 52.6	14°30 49.7	34°21 55.9	14°31 10.1	00:41	0
6	7	34°20 54.5	14°42 56.6	35°20 00.6	14°43 24.9	00:39	1

Assessment of the observed shoals of *T. thynnus* is summarized in the following table.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
5	5	34°53 56.7	13°26 05.3	7-8	0.05	100	0	0	0
6	7	34°56 54.2	14°43 21.3	1750	200	0	50	50	0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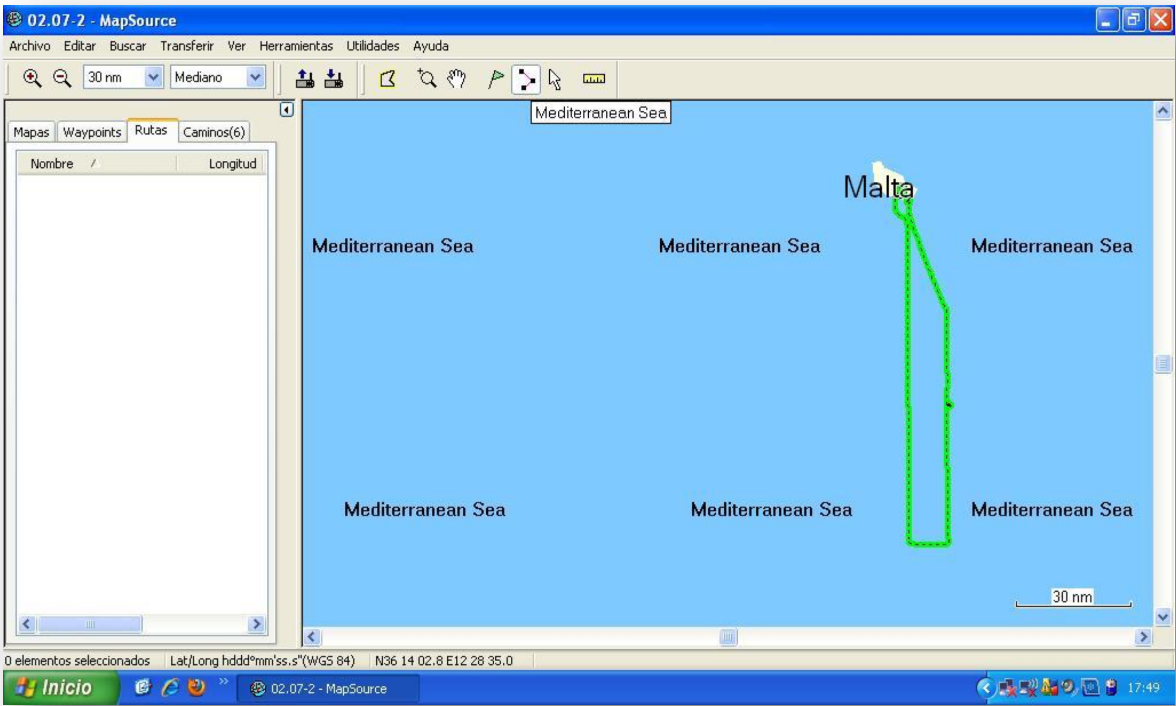
Archivo Editar Buscar Transferir Ver Herramientas Utilidades Ayuda
30 nm
Mediano
Golfe de Hammamet
Habib Bourguiba Intl
Kairouan
Mediterranean Sea
Malta
nisia
Sfax
Golfe de Gabes
Chott El Jerid
30 nm
0 elementos seleccionados
Lat/Long hddd°mm.mmm'(WGS 84)
N35 39.459 E11 36.031
Inicio
02.07-1 - MapSource
Windows Live Messen...
12:38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Archivo Editar Buscar Transferir Ver Herramientas Utilidades Ayuda
30 nm
Mediano
Mapas
Waypoints
Rutas
Caminos(6)
Nombre
Longitud
Mediterranean Sea
Malta
30 nm
0 elementos seleccionados
Lat/Long hddd°mm'ss.s"(WGS 84)
N36 14 02.8 E12 28 35.0
Inicio
02.07-2 - MapSource
17:49

REPORT SUMMARY

Total number of hours flying	Number of operative days (during which surveys were made) between 04/06/10 to 22/06/10	Number of days on standby during the period 04/06/10 to 22/06/10	Number of shoals recorded
16 hours 9 minutes	4	13	2

Control of flight schedule

Day	Start eng	Stop eng	Hours	Subarea	Nº Survey	Lines	Start Survey	Stop Survey	Efective Hours	Notes
06/04/2010	6:50	12:05	5:15	0	0	0	0	0	0	movilization
06/05/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/06/2010	12:55	16:55	4:00	3	1	5,6,7	15:14	18:29	3:15	1º job day
06/07/2010	9:00	13:00	4:00	3	1	4,3	12:28	14:00	1:32	2º job day
06/08/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/09/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/10/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/11/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/12/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
13/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather

14/6/2010	7:55	11:55	4:00	3	1	2,1	11:05	12:33	1:28	3º job day
15/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
16/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
17/6/2010	7:25	11:25	4:00	3	2	2	11:01	12:14	1:13	4º job day
18/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
19/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
20/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
21/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
22/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
23/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
24/6/2010	9:10	13:10	4:00	3	2	2,3	12:43	14:07	1:24	5º job day
25/6/2010	6:20	10:20	4:00	3	2	4,5,6	9:16	12:07	2:51	6º job day
26/6/2010	6:05	10:05	4:00	3	3	3,4,5	9:14	11:46	2:32	7º job day
26/6/2010	12:20	16:40	4:00	3	2	6,7,8	14:33	18:04	3:31	7º job day
27/6/2010	6:25	10:25	4:00	3	3	1,2	9:36	11:22	1:46	8º job day
27/6/2010	13:50	17:00	3:10	3	3	6,7	16:11	18:05	1:54	8º job day
28/6/2010	6:10	10:10	4:00	3	4	2,3,5	9:22	11:39	2:17	9º job day
28/6/2010	13:10	16:30	3:20	3	4	6,8	15:40	18:05	2:25	9º job day
29/6/2010	7:00	10:45	3:45	3	3,4	7(nºs.3),7,8	9:41	12:44	3:03	10º job day
30/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
31/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
07/01/2010	6:05	10:05	4:00	3	4	4,2	9:01	10:55	1:54	10º job day
07/01/2010	13:40	16:30	2:50	3	4,5	5,6(nºs.5)	16:36	18:12	1:36	10º job day
07/02/2010	6:20	10:20	4:00	3	5	3,4,5	9:28	11:32	2:04	11º job day
07/02/2010	13:20	15:25	2:05	3	5,6	7,7(nºs.6)	15:40	17:05	1:25	11º job day
07/03/2010	7:25	12:45	5:20	0	0	0	0	0	0	movilization
			73:45:00						**36:10:00**	

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GBYP 2010

ATLANTIC-WIDE RESEARCH PROGRAM ON BLUEFIN TUNA

Areas 4, 5, 6, 7, 8   Observation Report Sept. 2010

Scientists : Déborah Belleney, Morgane Ramonet

TABLE OF CONTENT

INTRODUCTION

The objectif of this GBYP program (ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA) was to create a DataBase of biological, ecological and weather parameters during an Aerial Survey of Red Tunas in the Meditarranean Sea (Bluefin Tuna, *Thunnus thynnus, L.*). This Study being made from planes over the Sea, in order to build Statistical Models. This program was directed by ICCAT, with the idea to collect as much Datas as possible, abiding by the Protocol established after the GBYP Programme.

Several strategical zones have been determined, and they will be also studied along the years to come (i.e 4 years *(Hammond P. and al., 2010)*) in order to finalize a complete study. ICCAT chose 6 areas (the Balearic Islands, the North of Tunisia, the North of Lybia, the Ouest of Sicilia, the North of Egypt, the South of Turkey).

The company Périgord Travail Aérien (PTA) has been granted the Market Offer for 3 out of these 6 zones : the North of Lybia (called zone 4), the North of Egypt (zone 5) and the South of Tukey (zone 6).

Two teams have been sent on site, each one composed with trois persons : a pilot, a spotter, and a scientist. The first team included Alexandre Kratz (pilot), José Molina (spotter) and Déborah Belleney (scientist) and was based at Malta, for surveys over the zone 4 (Lybia), the biggest regarding flight time planned (73 hours). The second team was composed by Paul Girmes (pilot), Fransisco Bilora Valverde (Spotter) and Morgane Ramonet (scientist) and was based in Cyprus, to overfly zone 6 et 5 (respectively 66 et 60 hours flight time planned).

This mission began on May 26th, departure of the planes from PTA's Headquarters for an initial Time schedule until end of June, allowing flights during optimum spotting conditions for Tunas at Sea surface.

This Report states for complementary information about certain technical points of the Protocol, and sets a Sum-up of all the flights made by PTA, per zone, detailing Tuna Species observations, mainly Red Tuna (*Thunnus thynnus, L.*) and Albacore Tuna (*Thunnus albacores*).

1. MEANS AND METHODS

1.1 The Observation Protocol

The Protocol has been defined by ICCAT, 6 zones have been chosen in the Mediterranean Sea : the Balearic Islands, the North of Tunisia, the North of Lybia, the West of Sicilia, the North of Egypt, the South of Turkey, respectively zones 1 to 6 (see Figure 1).

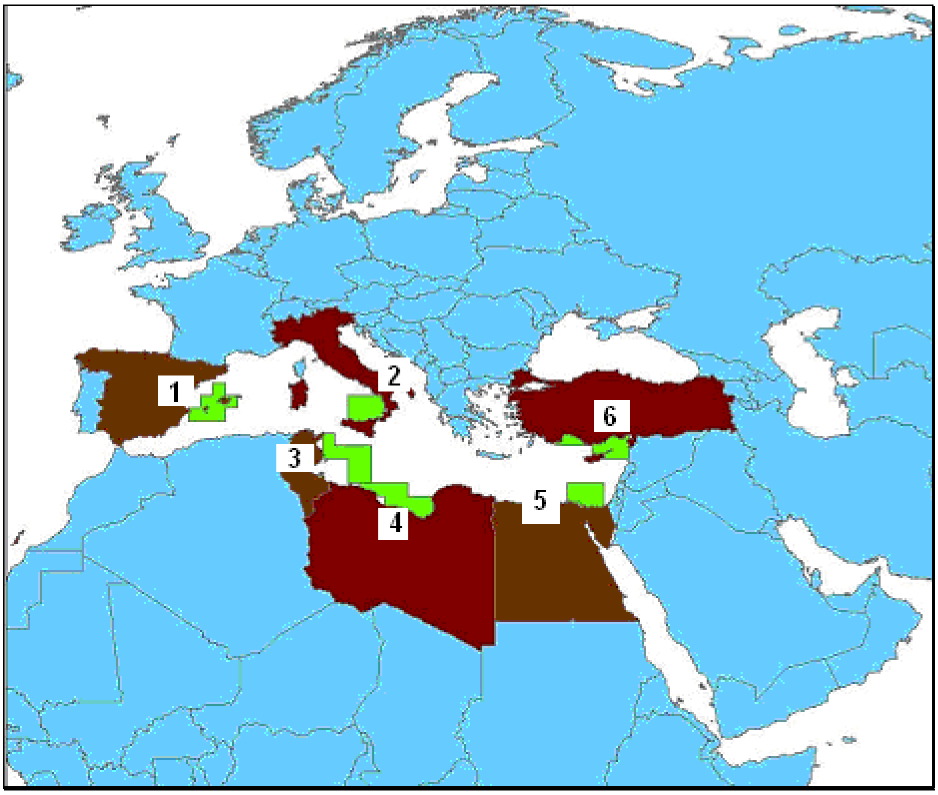

Figure 1 : Mediterranean Sea chart, representing the 6 working zones defined by ICCAT *(source Hammond P. and al.,2010)*

The mission of P.T.A. was thus to observe zones 4, 5 and 6. Each zone had been composed with North-South lanes, separeted by 30 to 60 km according to the zones. From one Survey Flight to another, the lanes had been offset in latitude. The number of Survey Flights also varied depending on the zones.

During the Flight, the job of pilot was to:

- maintain a constant speed of 100kt
- maintain an altitude of 330 m (1000 Feet)
- stay on course as precisely as possible (heading)
- record the GPS flight track

The job of ths scientist was to :

- fill the Effort Report (see Annex 1) which includes time of the observation, GPS position, altitude, weather conditions and other details,
- fill the Sighting Report (see Annex 2) in case of spotting a Tuna Schoal, which included time of spotting, position of the schoal, estimated mass (in tons), size (small, medium, large), and also behaviour of species,
- take pictures as much pictures as possible of the schoal in case of spotting Tunas

The job of the spotter was to :

- maintain a carefull watching to spot for fish schoals
- guide the pilot around the schoal in case of spotting Tunas
- be able to determine mass, size, behaviourof the observed Tunas

Each flight was recorded on a GPS (WGS84 referential), and captured track were transfered to a computer with the help of software MapSource (software designed to operate with Garmin GPS on computers), then exported to GoogleEarth for an enhanced visibility.

Weather conditions were a limiting factor to Observation, with the following parameters to take into account : cloud base (ceiling), wind strength, and sea aspect. When not at calm sea, waves and with horses on the sea could be mistaken with tuna schoals. This is why none of the flights were carried out at more than 4 on the beaufort scale, also considering than 2 or below on the beaufort scale are the ideal observation conditions *(Hammond Philip et al. 2010)* with a maximum 1,25m high swell.

Thus the altitude notified by ICCAT was 1000Feet, some observations were made at lower altitudes (approximately 800Ft, with minimum safety altitude at 700Ft) due to low clouds ceiling, scattered or overcast. Furthermore, some weather condition have prevented the plane to take-off sometimes, (thunderstorm, haze, mist...), preventing the observation to occur whereas the weather could have been fair on site.

1.2 The Plane

The plane type was Cessna 337 – Sky Master, a twin-piston with central traction. Both engines thus both propellers are on the fuselage axis, one afterwards the other rearward. The wings are in a upper position, enabling full-time observation of the sea on the sides. Other characteristics are detailed on Figure 2.

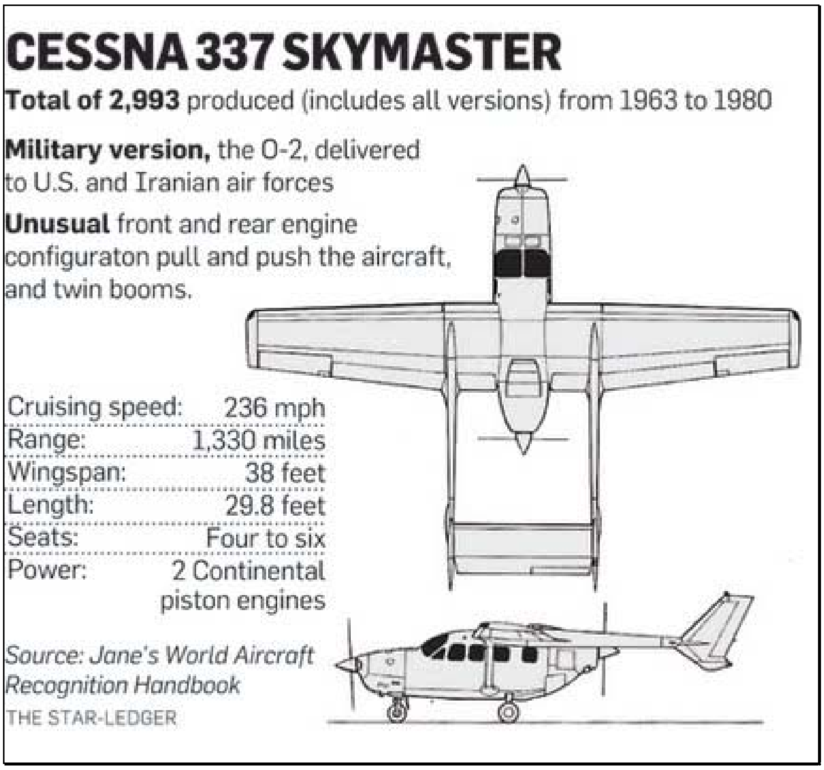

Figure 2 : Characteristics of the Cessna 337 Skymaster *(source : Jane's World Aircraft Recognition Handbook)*

Both planes used were the same model Cessna 337 Skymater : registrated N53420 for zone 4 (Lybia) and registrated N86306 for oriental Mediterranean. These planes had already been flying over the sea to search for Tuna Schoals before, for Mediterranean Thoniers senneurs. Despite very safe, these planes have nevertheless visibility flaws as every other type of aircraft.

Air flow disturbed from front propeller, so as the sometimes rather low position of the pilot and spotter (the two persons seated on the front seats in the plane) does not allow a very good visibility just in front of the plane. The different angles of visibility are detailed further (Figure 3). Angles are represented around the plane's symetrical axis and are the same both sides of the aircraft. In red are the "dead angles" (no visibility), which represent about 30° to the front, and about 45° to the rear per side, so nearly 150° obstructed out of 360°. In green is represented the ideal angle of observation and spotting, thanks to which the spotter has a very good possibility to detect a tuna schoal, and in blue the angle where visibility can be reduced due to the wing support.

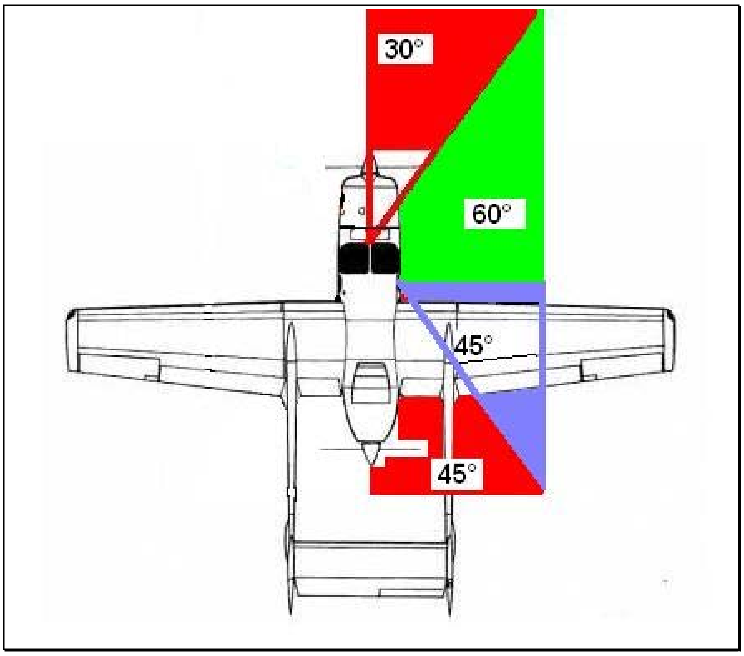

Figure 3 : Different lateral visibility angles for the spotter, on the right hand sideof the Cessna 337 *(source : Morgane Ramonet after Jane's World Aircraft Recognition Guide)*

We can estimate a total lateral visibility angle of 105° per side, thus 210° on complete horizon, but knowing that the spotter, as seated on the right hand side, was a much more likely to actually detect a fish schoal on the right hand side. Left side is obstructed by scientist in the rear and pilot in the front seat, even if they also watch carrefuly. Furthermore, planes not being equiped with a bulb window the overhead visibility is limited, the estimated angle is around 40 degrees (Figure 4).

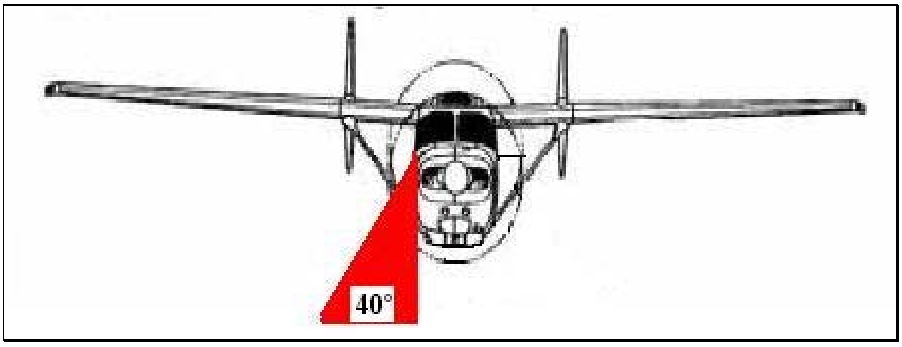

Figure 4 : The overhead "dead angle" from the plane above the sea, on the right hand side of the Cessna 337 *(source : Morgane Ramonet after Jane's World Aircraft Recognition Guide)*

For the spotter, visibility can be enhanced on demand with short banking of the plane, realised by the pilot. While taking air shots, a plane bank of 30° to 45° allows a very good overhead of the observed Tunas Schoal.

1.3 Cameras

While observing the Tunas Schoals, taking air pictures can allow a completion with image for the Database. Many parameters can be taken into account while taking shots. For instance, the Cameras used were synchronized with Garmin GPS clocks (UTC time slot) and the output compressed format for files generated was JPG. The lenses used were Nikon 70-200 and Nikon 70-300, other main characteristics of cameras are described in following Table 1.

Tableau 1 : Main characteristics of Nikon D40x and D90.

Caractéristiques techniques	Nikon D40X	Nikon D90
Nb de pixels effectifs en millions	10,2	12,9
Nb total de pixels en millions	10,75	12,3
Filtre polarisant	Circulaire, verre CPL 67 (BW)	Circulaire, verre CPL 77 (BW)
Téléobjectif Nikon	70-300mm	70-200mm
Sensibilité ISO (indice d'exposition recommandé)	100-1600 ISO	200-1600 ISO
Taille lentille frontale	67mm	77mm
Angle de champs	24x36mm	24x36mm
Définition maximum (L)	3872 x 2592 pixels	4288 x 2848 pixels
Plage de détection	–1 à +19 IL (ISO 100 à 20°C)	-1 à + 19 IL (ISO 100 à 20°C)
Plage d'exposition	- 0 à 20 IL (mesure matricielle couleur 3D ou pondérée centrale) - 2 à 20 IL mesure en spot	- 0 à 20 IL (mesure matricielle et pondérée centrale) - 2 à 20 IL en spot
Vitesse d’exposition	30 à 1/4000s par incréments de 1/3 IL, Pose B	30 s à 1/4000 s, Pose B

2. RESULTS

2.1 Zone 4 : Libya

Malta being the nearest european country from zone 4, it was the only available possibility for the Team to be based to operate the Survey over North Lybia. It was just impossible to be based in Lybia, which might have been more efficient, at least for a large central part of the zone. Thus unfortunately from Malta, it required 1 hour and a half to reach the Survey zone, leading to a reduced operating time on site.

Furthermore, without authorizations from lybian authorities, Team had to cut out lanes 50 Nautical miles (Nm) from the lybian coasts. In this process, only 4 lanes out of 11 were feasible. In the following days, the FIR (Flight Information Region) administrated by lybian Air Control) was entirely forbidden. As northern limits of this FIR is located 34°20'00''N, so around 110 Nm and 250 Nm from the coastline, and covers consequently the whole zone 4.

This is why two other zones, 7 and 8, have been defined by ICCAT board a few days after aknowledgment of the situation, in order to be able to carry on the mission. In doing so, therotical time effort (number of hours) the be flown over zone 4 were reported to zone 7 and 8.

Geographical boundaries of zone 4 could be divided into two parts, a northern area 33°00'00''N down to lybian coast high, 14°11'19,9''E to the right to 17°39'32,0'' E wide (7 lanes north) and southern part from 32°00'00''N down to lybian coast high, 14°39'32,0''E to 19°48'54,0'' E wide (5 lanes south, see Figure 5).

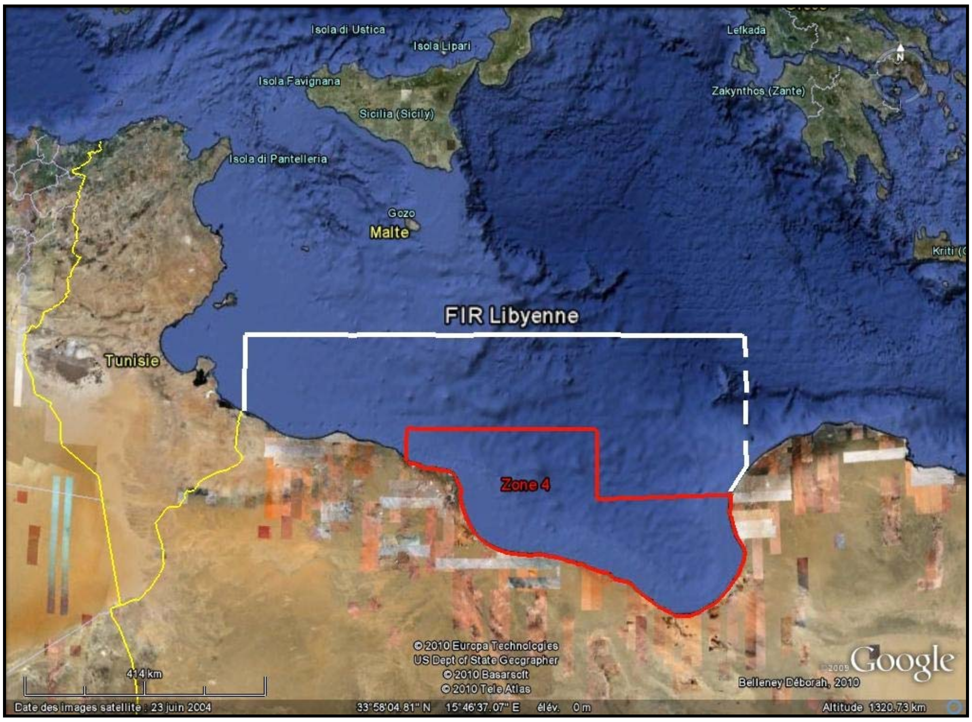

Figure 5 : boudaries of Zone 4 (Libya) *(source : Déborah Belleney after Google Earth)*

The area was to be covered by 7 surveys, each of them divided into 11 lanes, spaced by 60 Km. Each survey being separated form another by 1 km in latitude.
2 flights have been carried out on lanes 5, 6, 7 of survey 1, on june 3rd and 5th 2010 (Figure 6).

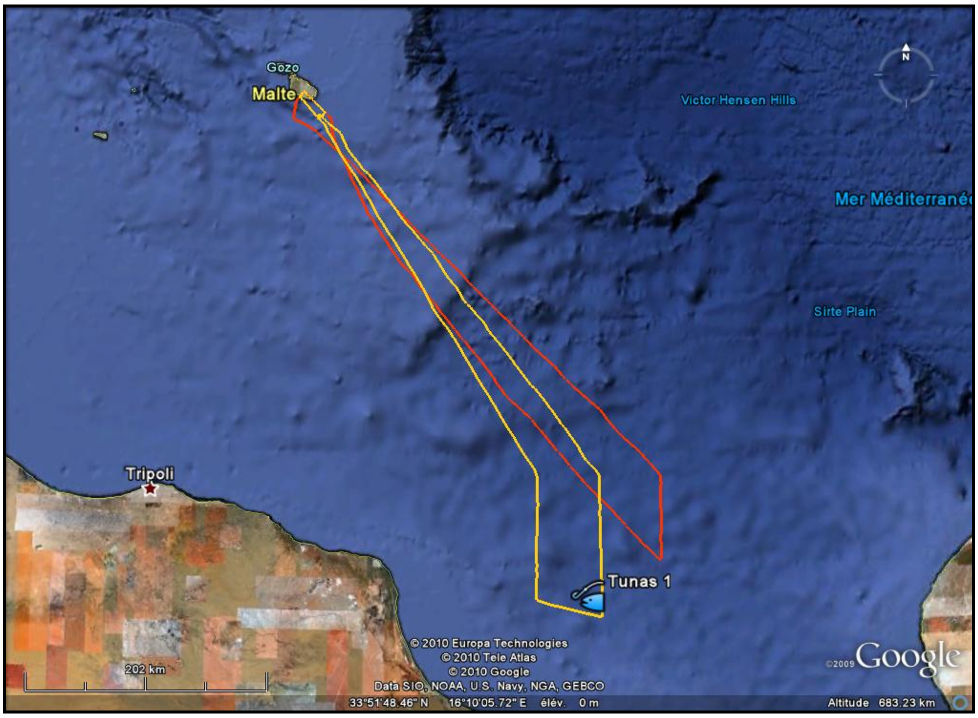

Figure 6 : Tracks of survey 1, lane 5, 6, 7 of zone 4. *(source : Déborah Belleney after Google Earth)*

On this figure, tracks of flight 1 is in yellow, lanes 5 and 6 of survey 1 on june 3^{rd}, and on june 5^{th} with red track the lane 7 during flight 2 : flight 2 had to be interrupted due to lybian authorities (again). It had been impossible after this fligth to resume any survey.

We can also spot on the map the rather long distance between Malta and north lanes, requirering for the future different solutions for Lybia : flight time to get to the working zone had been here greater than work time ! This is why on these two flights before closure of the lybian airspace, 9.9 hours had been flown for only 1.8 hours really onsite (see Table 2) with 3 lanes of survey 1.

Table 2 : hours flown (Block-Block) and on site zone 4, per date

Dates	Numéro Survol	heures de prospection	Heures Bloc-Bloc
03/06/10	1	0,20	5,2
05/06/10	1	0,18	4,7
	Total	**0,39**	**9,9**

During the two flights, a Tuna Schoal has been detected and observed as approaching lane 6. A dozen individuals of Red Tunas (BFT), of medium size (25 to 150 kg), for 0.25 ton.

2.2 Zone 8 : East of Malta

As explained before, zone 8 (East Malta) had been created on june 10th 2010, following closure of lybian airspace on june 5th 2010. Waiting for new zone 8 "designs", and as the weather was finaly fair, PTA had carried out 2 flights, on 6 and 7 of june, East of Malta. Following, these 2 flights named "essai 1" and "essai 2" had been validated by ICCAT, and treated with other zone 8 flights that could start from june 14th. (Figure 7)

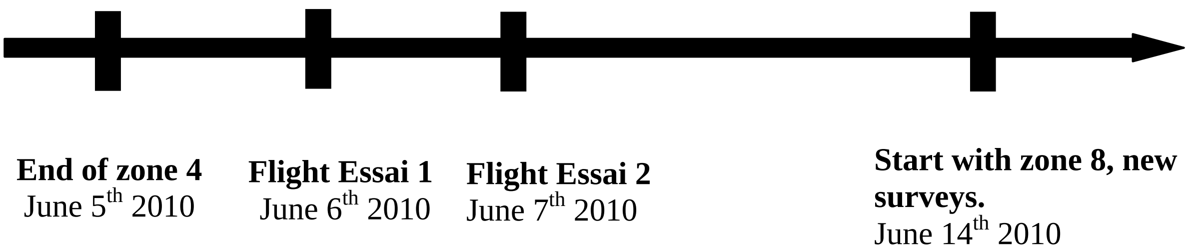

Figure 7 : Chronology from june 5th to 14th 2010.

2.2.1 ZONE DESCRIPTION : "ESSAIS" AND ZONE 8

Flights "essai 1" and "essai 2" had been defined ont the same model than other surveys of zone 4 for instance, with 3 lanes separated by 60 km, and surveys spaced by 18,5 km from one to another flight. Which gave following geographical boundaries : 34°20’00"N (lybian FIR limit) – 36°01’00" N and 16°20’00" E – 14°50’00"E.

Zone 8 also had the lybian as a southern limit, and Malta Island as a Westerly limit. The team being based in Malta, a survey per day could be carried out. Observations began on june 14th 2010 and have been flown in alternance with flights over zone 7. Geographical boundaries were : 34°20’00"N - 36°00’00" N and 15°00’00" E - 16°00’00"E, that is to say 7200 sqnm (milles Nautiques²) (Figure 8).

Figure 8 : Zone 8 boundaries *(source : Déborah Belleney after Google Earth)*

2.2.2 SURVEY AND HOURS FLOWN RESULTS

The observing period extended from june 6th to july 31st. The Team based in Malta (closed from site) could realize one whole survey per flight, so per day, thus 9 flights had been necessary to cover the 8 surveys of zone 8. With 2 surveys "essai" (Figure 9) and 6 surveys directly provided by ICCAT (Figure 10, then detail for each survey in annexe 4) representing 44.9 hours of flight (block-block), that is to say 31.1 hours of real prospection (Table 3).

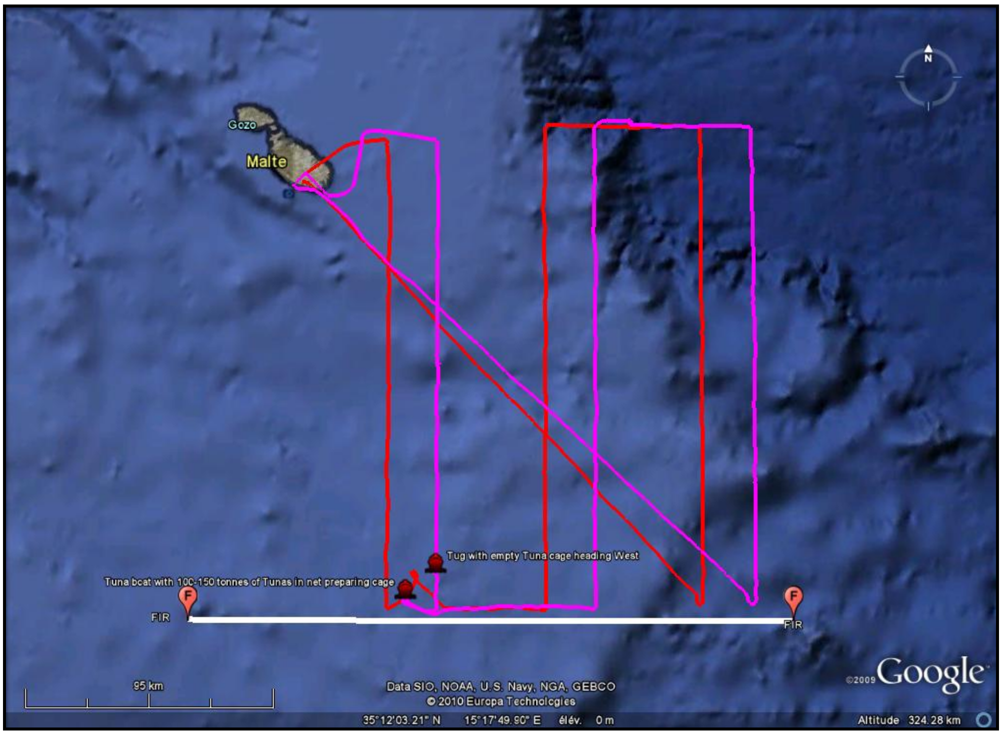

Figure 9 : tracks of essai 1 (in red) and essai 2 (in white) *(source : Déborah Belleney after Google Earth)*

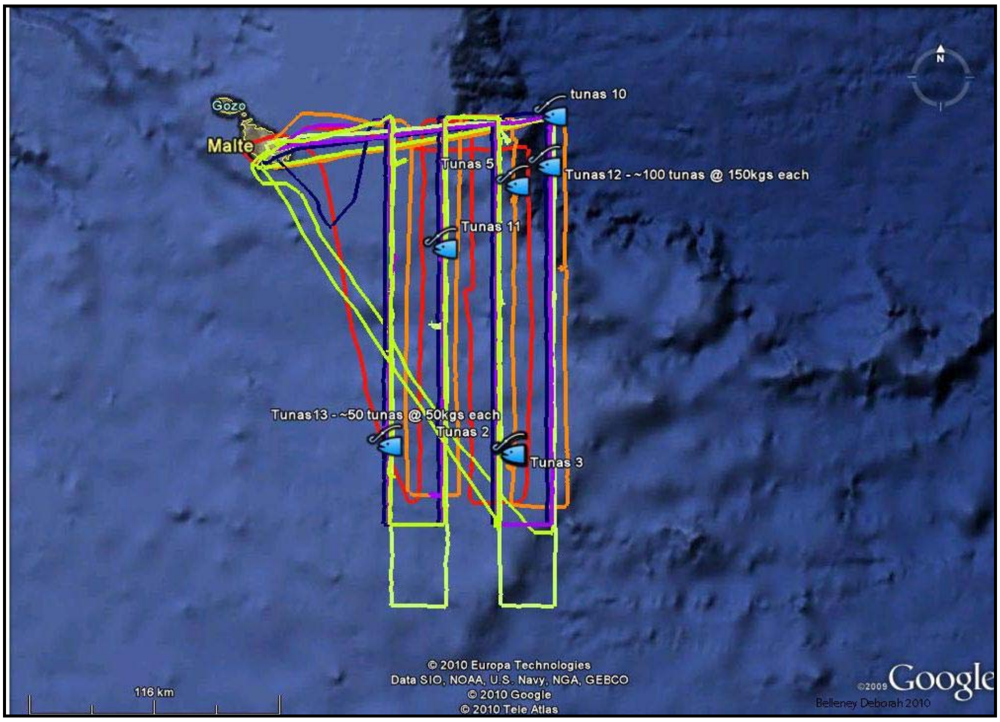

Figure 10 : Tracks of surveys 1 to 6 of zone 8, and Tuna Schoals observed. *(source : Déborah Belleney after Google Earth)*

Table 3 : hours flown (Block-Block) and on site zone 4, per date.

Dates	Numéro Survol	heures de prospection	Heures Bloc-Bloc	Comments
06/06/10	7	3,50	5,0	
07/06/10	8	3,40	5,1	
14/06/10	1	5,00	6,6	
17/06/10	2	0,90	3	Bad weather on zone
25/06/10	2	3,30	4,8	
05/07/10	3	3,70	5	
06/07/10	4	2,50	4	
15/07/10	5	4,50	5,7	
31/07/10	6	4,30	5,7	
	Total	24,20	44,9	

In the Table above, flights "essai 1" and " essai 2" of june 6th and 7th 2010, had been numered as surveys 7 and 8. On june 17th 2010, once arrived on site, cloud base was too low to allow Tuna spotting conditions. A non-efficent test of 0.9 hour had been carried out on lane 1 of survey 2. It had been renew on june 25th 2010.

2.2.3 TUNA SCHOALS OBSERVATION

During the 9 observation days, 7 surveys allowed observation of seven Tuna Schoals that have been listed in the table hereunder. With each schoal corresponds a waypoint, numbered in a chronogical order in accordance with the sequence order of observation on the zones 4, 7 and 8. (table 6, full table in Annexe 3)

Tableau 6 : Tuna Schoals observed on zone 7.

Date	Time	num	Subarea	Survey	Transect	Species	School size	Estimated weight en tonne
13-07-10	10:15	6	7	3	1	BFT	M	45
13-07-10	13:10	7	7	3	1	BFT	L	450
13-07-10	09:20	8	7	3	1	BFT	M	350
14-07-10	12:39	9	7	4	3	BFT	M	0,5
02-08-10	09:40	14	7	6	1	BFT	L	7,5
02-08-10	10:20	15	7	6	1	BFT	L	2,5
03-08-10	11:05	16	7	7	2	BFT	M	5

It represents 400.5 tons of BFT of 25 to 150 Kg and 460 tons of BFT of 150 to 250 Kg. That is to say 860.5 tons including 845 tons of Rd Tunas (*Thunnus thunnus*) the same day, on july 13th 2010 day of survey 3, lane 1.

No Tuna Schoal were observed during these two "Essai" flights. On the other hand during these two days, 2 Tuna Boats have been spotted, with their cage. On june 6th the spotter indicated up to 200 tons of tuna in the Seine. One june 7th, only one seine has been observed, filled with around 200 tons again of Red Tunas. Then between june 14th to 31st , 8 Tunas Schoals of BFT, mid-size (25 to 150 kg) have been spotted, within 3 days. Two major Tuna Schoals of 750 tons each have been observed on july 5th 2010, the first at 8h43 the other at 8h45. It could be a unique Schoal, divided into two parts as the plane was flying by.

On the whole, it represented 1777 tons of Red Tunas (observed within 3 days of survey, whereas 9 fligths had been carried out on a 56-days sampling period.

2.3 Zone 7 : West of Malta

Zone 7 is limited south by zone 3, and the Island of Malta for Estern part, zone 3 being flown by other contractors then PTA. The Team being based in Malta, it enabled to fly a survey per day. Observations occurred froml june 20th to August 3rd2010 and have been carried out in alternance with surveys of zone 8.

2.3.1 ZONE DESCRIPTION : "ESSAIS" AND ZONE 8

The geographical boundaries of this zone were : 36°00’00"N - 37°00’00" N and 12°00’00" E - 14°00’00" E, that is to say 7200 sqnm (miles Nautiques²) (Figure 11).

Figure 11 : Zone 7 boundaries. *(source: Déborah Belleney after Google Earth)*

2.3.2 SURVEY AND HOURS FLOWN RESULTS

For this study, zone 7 had been divided into 10 surveys of 4 lanes, spaced from one another by 60 Km. One Km separates each survey start. 7 surveys have been flown out of the 10 available (Figure 12 and tracks of each survey in Annexe 5)

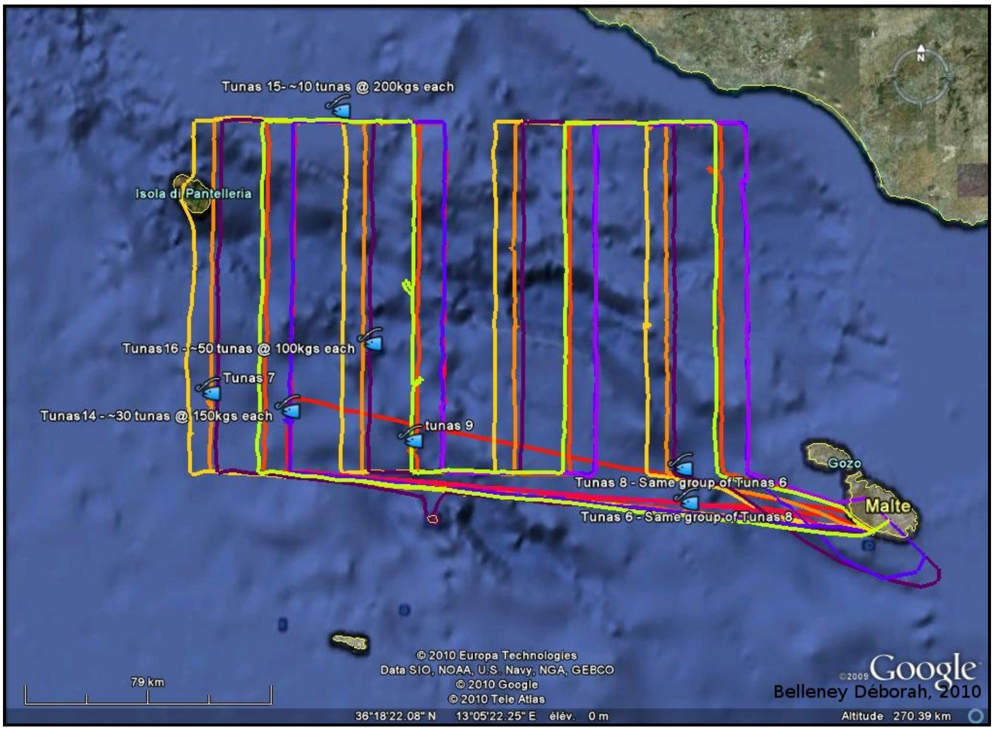

Figure 12 : Surveys 1 to 7 of zone 7, with Tunas Schoals Observed *(source: Map source et Google Earth)*

As shown on Figure 11 lane 1 of survey 1, passing threw Panteleria Island were no propsection possibility, from 10h20 (36°41'08,9" N ; 12°00'08,6"E) to 10h30 (36°50'36,2"N; 11°59'54,6"E). All these flights had been carried out within 9 days of flights from june 20th until August 3rd 2010, representing 36.9 hours total flight time (block-block) and 28.1 prospections hours (Table 5).

2.4 Zone 5 : Egypt

For the Egyptian zone, a flight has been realised on june 9th from the base of Paphos (Cyprus), with the authorization number. Once arrived near the Observation area, the Egyptian Civil Aviation only authorized overflying the area at a altitude of 8000 Feet, refusing the flight at the working altitude of 1000 Feet (330m), thus it was impossible to work. Without a proper authorization "on flight", despite the civilian and military authorization number on the paper, the team had to turn back.
So just a 2.7 hour-flight has been carried out directly on this zone. (More details on the attempt can be found on the report from the Pilot), giving way to no observation results. So the Team based in Cyprus focused on zone 6 (South of Turquey).

2.5 Zone 6 : south of Turquey

For this Turquey zone, the Team was based in Paphos, south western part of Cyprus, in a relatively central position regarding the zone to study. The arrival on site was realised on june 3rd 2010, after being delayed and held in Malta by bad weather conditions.

2.5.1 Flight Hours Description

Flights took place from june 5th to 30th 2010, for a total flight time of 66 hours block-block (100% of the time effort planed), corresponding to 29.4 observation hours (Table 7).

Table 7 : Flight time description on zone 6 (hour tenth) per day flown

date	Avion	Heures Block-block	prospection	zone 6 – Turquie
5-juin-10	N86306	5,2	1,9	delayed by ATC 30 minutes
7-juin-10	N86306	2	0	Bad weather on zone
11-juin-10	N86306	4,7	2,3	
12-juin-10	N86306	6	3,3	
13-juin-10	N86306	4,9	2,6	
15-juin-10	N86306	2	0,1	Bad weather on zone
16-juin-10	N86306	4,5	2,1	
17-juin-10	N86306	5,2	2,3	
18-juin-10	N86306	3	0,9	REJECTED by turkish civil aviation
19-juin-10	N86306	3,5	1,6	Bad weather on zone
21-juin-10	N86306	5,4	3,3	
25-juin-10	N86306	5,2	2,3	
27-juin-10	N86306	5,1	3,2	
28-juin-10	N86306	4,3	1,9	
30-juin-10	N86306	5	1,6	
	Total	66	29,4	

Bad weather conditions on site, despite good forecast, urged the Team to fly back to the base in Paphos (Cyprus) without being able to work on june 7th and 15th 2010.

2.5.2 PROSPECTION ZONE DESCRIPTION

The prospection zone was located North of the lanes in rose on the map (Figure 13). Western part of the zone is limited to the North by the turkish Coastline, and by the South by parallel 35°00'00"N for lanes 1 to 7 and parallel 36°00'00"N for Eastern part, with lanes 8 to 13. In latitude, the zone extended on around 530 Km from point 35° 08' 00"E, until the Syrian Coastline, 35° 50' 00"E. It represented a whole surface of 53033,784 Km².

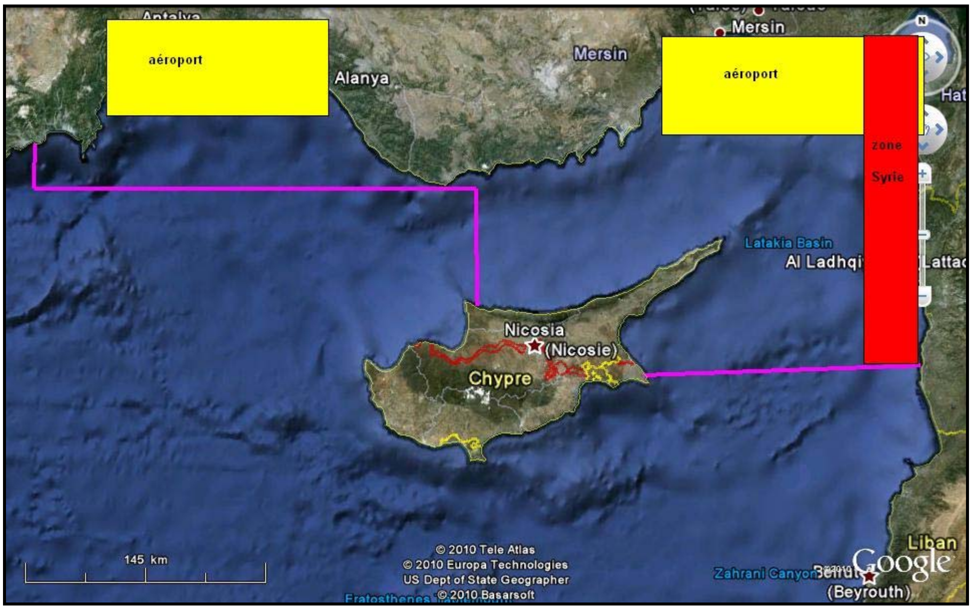

Figure 13 : Zone 6 description, boundaries and flight constraints *(source: Morgane Ramonet after Google.Earth 2010)*

Each Survey was composed by 13 lanes, disposed North to South from east to west. This zone was related to certain constraints : two airports (area in yellow on the map) in south of Turkey (Antalya to the West and Adana to the East) forced the Team to shorten the lanes, and the zone determined on the map had to be modified to match with Air Trafic Control requirements (from Turkish civilian Aviation). This is why the area in red had never been authorized to be overflown, including lane 13 of Survey. This specific area was located inside Syrian airspace (FIR) which would not give any specific overflying authorizations. This also concerned the north-east point of Cyprus Island, administrated by the Turkish Army, urging the Team to fly the long way around instead, unfortunately for working flight time compared to total flight time to get to the other side of the Island.

2.5.3 FLOWN SURVEYS

The 66 hours flown enabled the Team to realize 3 complete surveys (except for lane 13) and a fourth survey nearly complete (with lane 12 partialy overflown), during 15 flying days, from june 5th to 30th 2010.

The flights for the first survey on zone occurred from june 5th to 12th 2010 within 3 valid flights (and a void flight on june 7th due to bad meteorological conditions on site), that is to say 17.9 hours flight time (block-block) for 7.5 hours prospection on site (Figure 14).

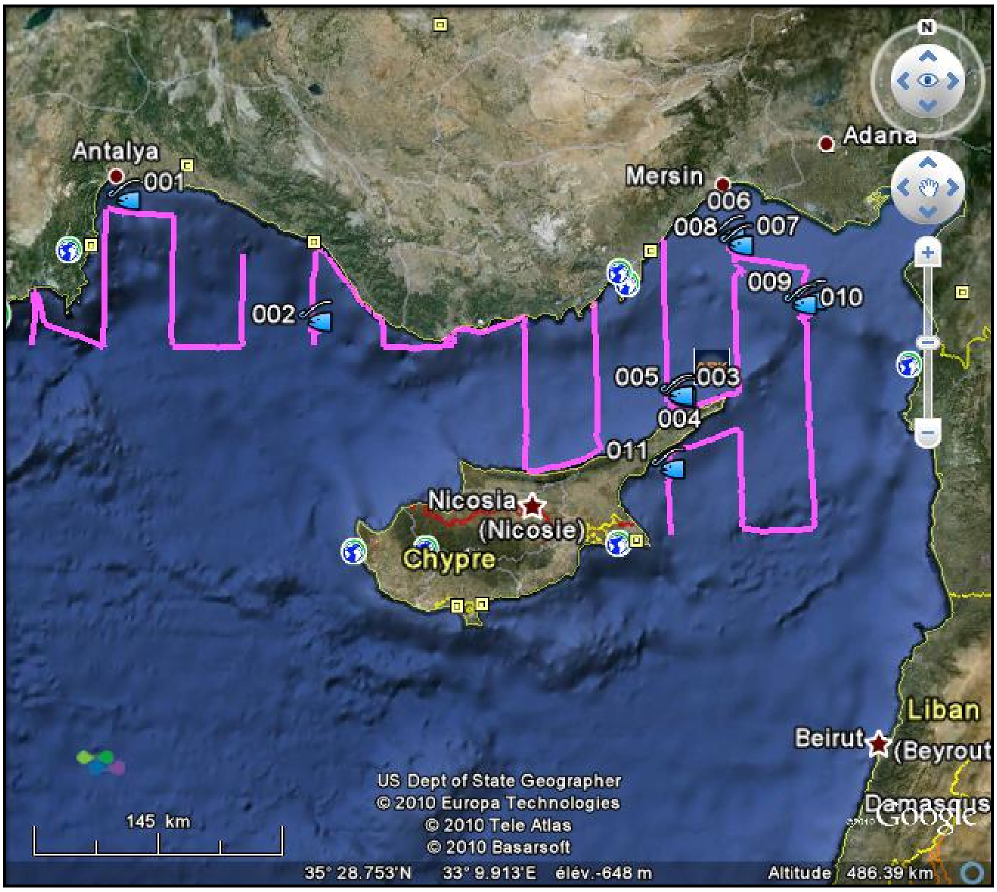

Figure 14 : Tracks of flights on 5, 11 and 12 of june 2010, representing survey 1
(source : Morgane Ramonet after Google.Earth 2010)

This first survey gave way to observation of 11 Red Tuna Schoals (BFT, *Thunnus thynnus*) with a concentration of 82% on lanes 10,11 and 12 at the East of the zone.

This second survey was flown from june 13th to 17th 2010, within 4 flights corresponding to 16.6 hours flight time (block-block) including 7.1 hours of prospection on site (Figure 15).

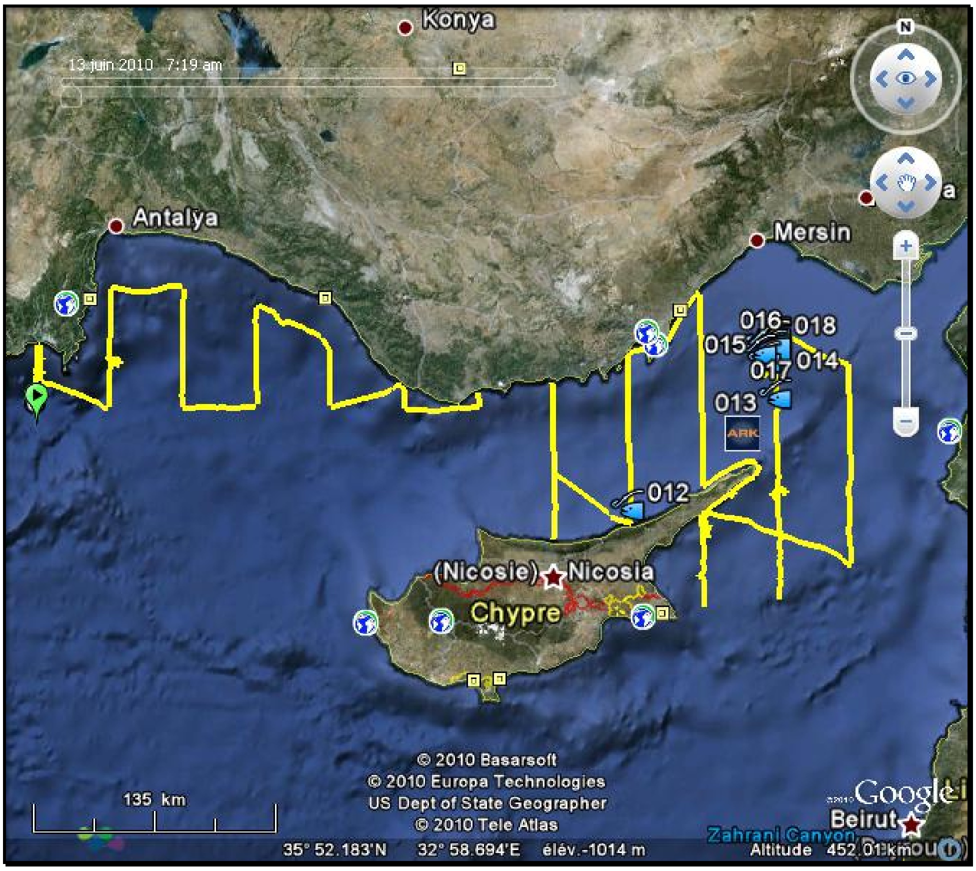

Figure 15 : Tracks of flights on 13,15,16 and 17 of june 2010 representing survey 2 (*source : Morgane Ramonet after Google.Earth 2010)*

Seven schoals of Albacores Tunas (ALB, *Thunnus albacares*) have been identified at waypoints 12, and 14 to 19 on zone and a Red Tuna Schoal (BFT, *Thunnus thynnus*) at waypoint 13. Points 14 to 19 stand for only 6 Albacores Tunas schoals identified and pictured, but the spotter estimated that around 20 schoals were present in this area of 4 square milles[2]. Observations Results are detailed in paragraph 2.5.4.

The third survey was flown from june 18th to 25th within 4 flights, in a total flight time of 17.1 hours (bock-block) including 8.1 prospection hours. This survey gave way to an important number of observations with 22 schoals identified, spread on the whole zone. (figure 16).

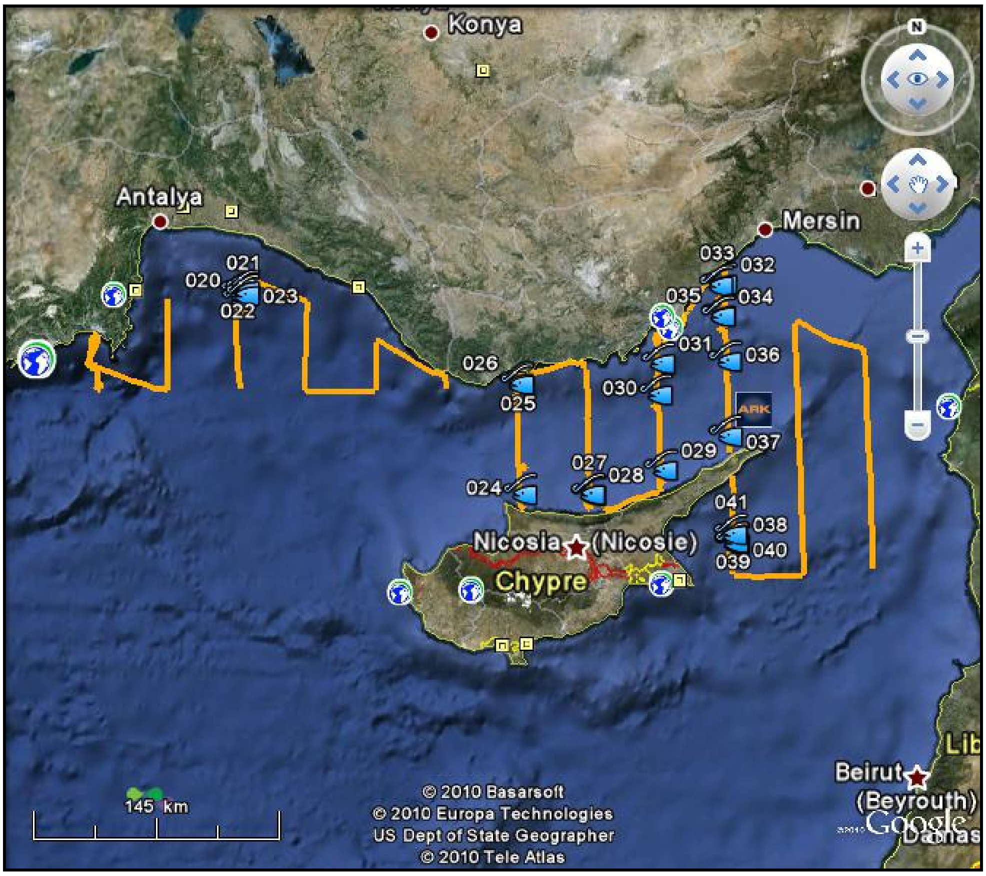

Figure 16 : Tracks of flights on 18,19, 21 25 of june representing survey 3
(*source : Morgane Ramonet after Google.Earth 2010)*

The two species Albacore and Red Tunas (ALB, *Thunnus albacares* and BFT, *Thunnus thynnus*) were observed on zone. Waypoints 20 to 26 on the Western part of the zone, waypoint 30 in lane 9 and waypoints 32 to 36 and 38 to 41 in lane 10 are BFT schoals that is to say 17 waypoints, representing 77% of observations during this survey. The 5 other waypoints are ALB observations at waypoints 27 to 29, 31 and 37. Again the Team could spot a higher concentration in the eastern part, with close to 40% of observations in lane 10. The Team could also stress that observations 24 to 37 were all on the same day (june 21st 2010) and representent around 61% of lane 10 observations.

The fourth survey was flown from june 27th to 30th 2010 within 3 flights for a total flight time of 14.4 hours (block-block) including 6.7 prospection hours. This survey is not complete since total flight effort time had been reached for the zone : so lane 12 has been been flown 20 minutes instead of around an hour (Figure 17)

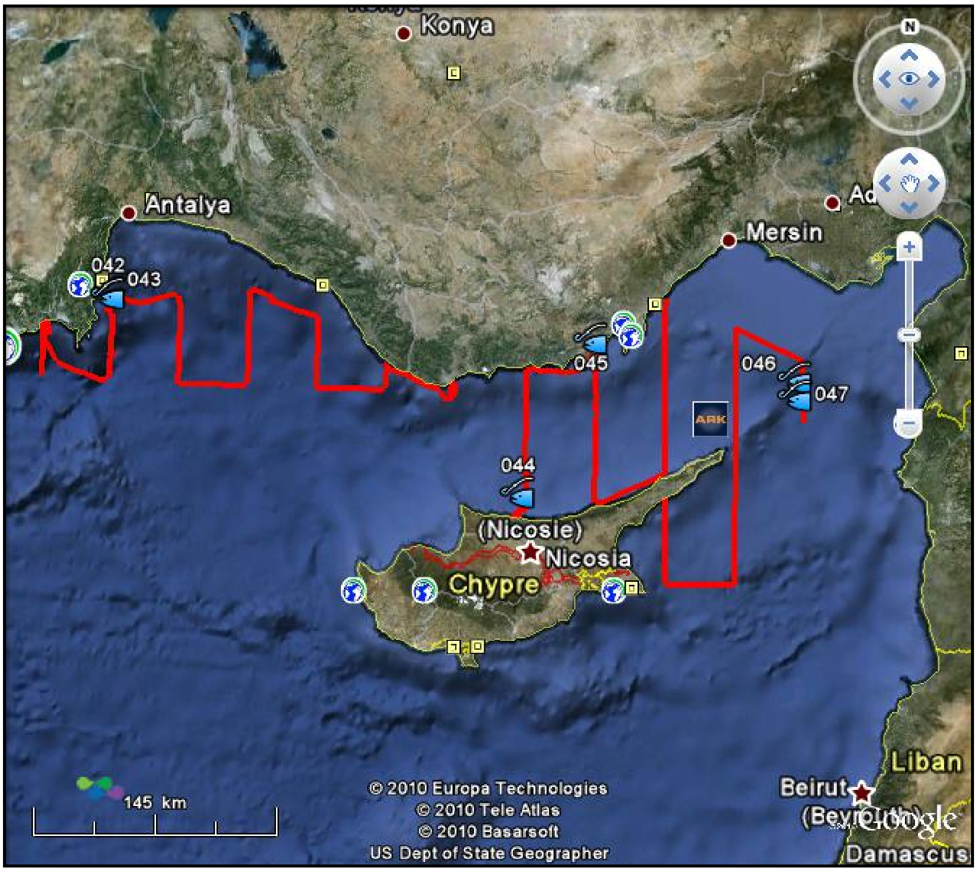

Figure 17 : Tracks of flights on 27, 28 30 of june, representing survey 4
(*source : Morgane Ramonet after Google.Earth 2010)*

This survey only gave way to six observations, the 2 first on the western part of the zone in lane 2, and the last two at the extreme East on lane 12 and the two others in central position in lane 8 and 9. Waypoints 42, 43 on the west and 46, 47 on the East are Red Tuna spotting (*Thunnus thynnus*). Waypoint 44 was Albacore Tuna *(Thunnus albacares*), and waypoint 45 stands for Bonitou Tuna (BLT, *Auxis rochei*).

2.5.4 TUNA SCHOALS OBSERVATION

As result on zone 6, the 4 surveys on zone allowed to identify 47 shoals of 3 different species : Red Tunas, Albacore and Bonitou in different proportions (Table 8).

Table 8 : Tuna Schoals observed zone 6, by species, number and surveys

Espèce/ survol	Survol 1	Survol 2	Survol 3	Survol 4	**TOTAL**
BFT,*Thunnus thynnus*	11	1	17	4	33 (70,2 %)
ALB, *Thunnus albacares*	0	7	5	1	13 (27,7%)
BLT, *Auxis rochei*	0	0	0	1	1 (2,1%)

2.5.4.1 Red Tunas (BFT)

Red Tunas (BFT) represented most of the observations with 70.2%. They were observed during each survey in very different proportions though, with two surveys having high concentrations, 11 and 17 schoals respectively in survey 1 and 3. The observation number of Albacore Tunas (ALB) was also significant with 27.7%. Albacore Tunas were spotted along surveys 2 to 4 with a higher concentration during surveys 2 and 3, that is to say from june 16th to 21st 2010. The unique observation of Bonitou Tuna (BLT) with an approximate mass of 2 tons is anecdotal, since very unlikely to be spotted due to their small size (with an average of 2 Kg) and due to their behaviour (constantly under the surface). Moreover, this was not the tagetted specie for the spotter.

As previously described in 1.1 the spotter's role extended to other parameters beyond the pure schoals detection : determine the observed individuals size, mass and behaviour information. Here is a comparison of cumulated schoals mass (in tons) depending on their location on surveys. When dividing each survey into 3 areas, from lane 1 to 5 for western part, 6 to 9 for central part and 10 to 12 for eastern, it allows to stress a more suitable area for observation.(Figure 18).

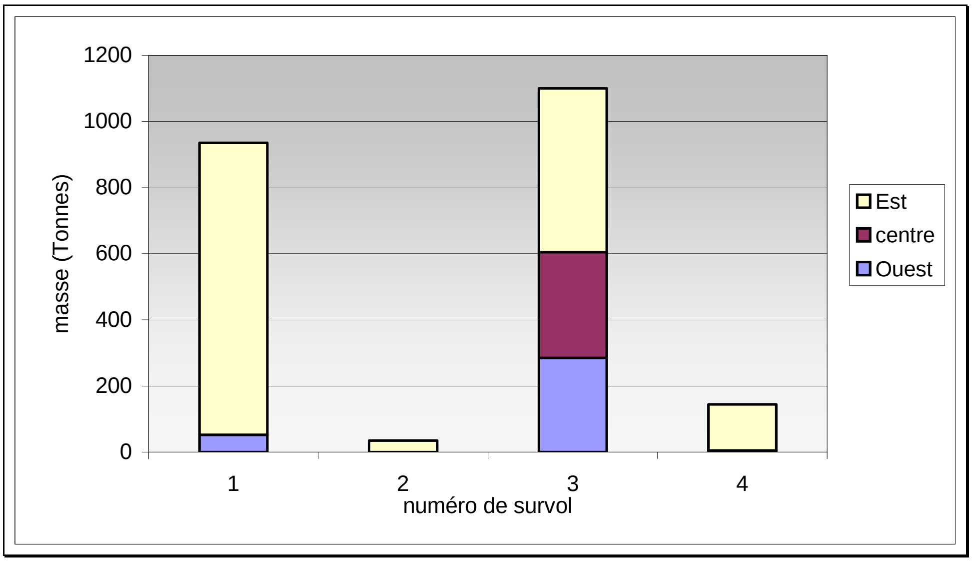

Figure 18 : Tuna Schoals Cumulated Mass in tons along surveys (1 à 4) per area (Western, central and Easter) part of zone 6.

This figure points out that surveys 1 to 3 had more important cumulated mass with respectively 934 and 1000 tons. Moreover, separation of the zone into 3 areas (Western, central and Easter) stresses the Eastern area to be the more suitable for observation. Acutally 95% of survey 1 total mass was located there, 100% total mass in survey 2, 45% in survey 3 and 97% in survey 4. This can lead to two hypothesis, either schoals were more numerous in this Eastern area, or their mass was greater (individuals size or total number of individuals). According to surveys maps and this table (Table 9), it could be pointed out rather clearly than mass importance in this Esatern area is linked with the numbers of observed schoals

.

Table 9 : Observation number per survey and area on zone 6

	Ouest	centre	Est
survol 1	2	0	9
survol 2	1	1	1
survol 3	4	4	9
survol 4	2	0	2

This table enables a new question, effectively the number of aerial observations in survey 1 and 3 was the same, but figure 18 had a total mass of 882.5 tons for Eastern part of survey 1, whereas 495 tons for survey 3. It could then be interesting to visualise mass of each waypoints on Eastern part to better understand the schoals composition evolution between june 12th and 25th, respective date of flights over this Eastern part for survey 1 and 3. (Figure 19).

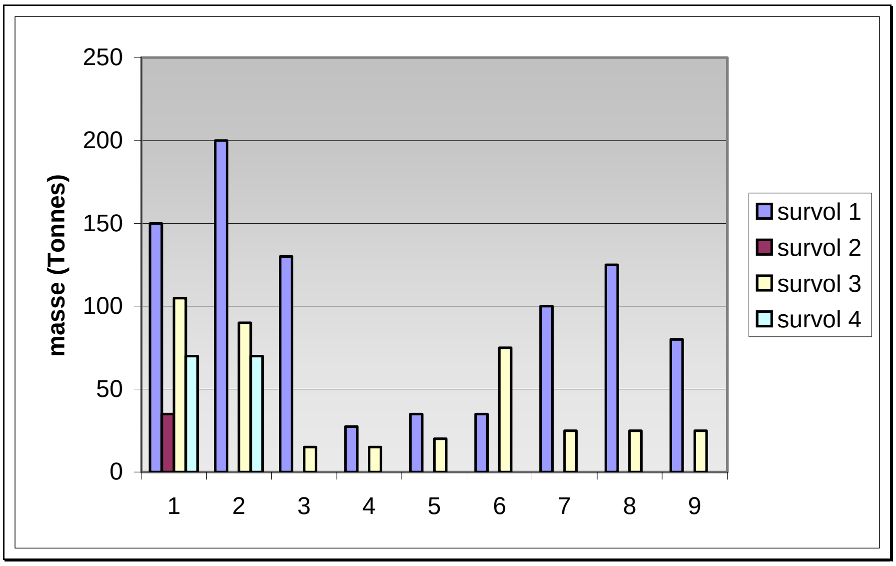

Figure 19 : Mass visualisation of schoals on eastern part, according to survey at stake.

This figure indicates that tunas schoals observed on june 25th were smaller, with an average of 43.9 tons for survey 3, whereas average is 98 tons for survey 1 with more than 6 schoals reaching or above 100 tons, whereas in survey 3 one single schoal reached over 100 tons. Individual mass of Tunas estimated by the spotter were also smaller during survey 3, with an average of 30 Kg per individual, whereas at least 45 Kg per individual in survey 1 observations, but this individual mass alone cannot explain mass differences.
Tuna Schoals observed along survey 3 are then smaller individual size and smaller total mass (less indivuduals per schoal).

2.5.4.2 Albacores Tunas

This specie represented 27.7% of the observations number , concentrated on surveys 2 and 3 (0 observations in survey 1 and one observation in survey 2). All waypoints are located in the same area of lanes 8 to 11. The individual size estimated is always the same, between 10-15 Kg per tuna. In the other hand, schoals configuration vary (Figure 20).

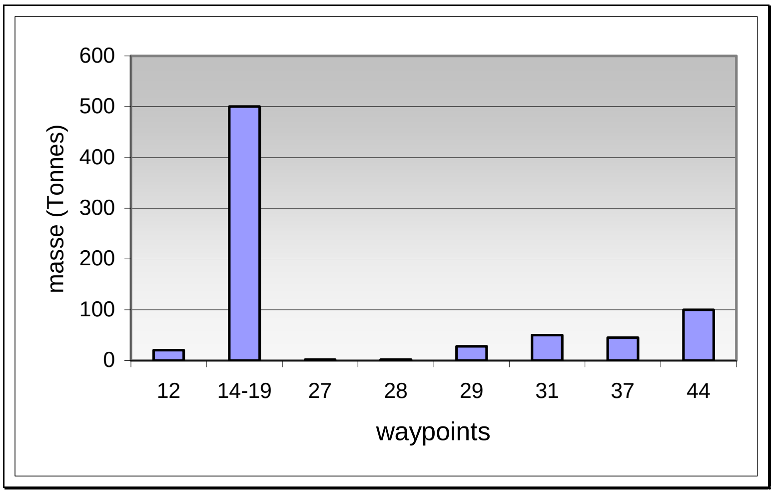

Figure 20 : Albacores Tunas Schoals mass (tons) according to waypoints

There were isolated schoals observed in waypoint 12, 27 and 28 with quite small mass (respectively 20, 2 and 2 tons). Besides, the 6 identified observations of waypoints 14 to 19 stand for more : there were on zone around 20 schoals of 20-30 tons each, that is to say a medium mass of 500 tons on a 4 square miles surface. Other observations were schoals composed by 2 groups, more or less merged with a schoal head well ahead in distance generally speaking (see pictures). The total mass of observations can be estimated at around 750 tons

As a conclusion on these results, in most cases BFT observations (*Thunnus thynnus*) and ALB observations (*Thunnus albacores*) took place in the eastern part of lanes 8 to 12. The 33 BFT observations (*Thunnus thynnus*) representing an average biomass of 2114 tons, and the 13 ALB observations (*Thunnus albacores)* representing an average biomass of 750 tons, next to the 2 tons of bonitou (*Auxis rochei*).

3. DISCUSSION

The objective of this mission was to collect as many biological and meteorological Datas as possible, while observation of Red Tuna schoals (*Thunnus thynnus*), in order to establish mathematical models on spawning population migration, and presence of young tunas, etc.

Prospections zones choosen by ICCAT were specificcaly known areas of spawning, and consequently fishing areas also. The protocole established by ICCAT *(Hammond, P. , 2001)* is relatively simple, thus reproductible from a year to another. Nevertheless it might remain a few points to enhance aiming at a better Datas quality ?

The spotters were, as far as PTA was concerned, ancien spotters for the fish industry, consequently very experienced but also specialised in searching for big-size Tunas. It could be noticed that observation parameters could vary according to spotters, such as perpendicular distance, precision on biomass and size of tunas. Switching people during a mission, such as what PTA had to deal with on Malta areas, can rise bias on datas. It might be interesting in the future that all spotters abide by the very same technical observation protocol, in order to limit this bias ?

The planes used (Cessna 337, Skymaster) are upper wings plane ideal to watch the sea, but as described in Methods and Means has dead angles. Both PTA Teams used this plane, but it seems not all other Teams did so. Having several airplane types to carry out the observations could also induce a bias. Fit the aircrafts with bulb windows could possibly lower the bias between different planes ?

Teams were based in Cyprus for Turkish area, in a rather central position for the zone to study, and in Malta initialy for Lybian area in a remote location from the zone to study. (Then same location for area around Malta, which was perfect). The location of the base for each zone could also be enhanced on the years to come, trying to base planes near the middle of zones to study, according to diplomatic authorizations ?

Regarding results, this first year of Study shows a lot of diversity between zones, which can be partly explained by all sort of delays Teams had to cope with (including especially bad weather conditions on sites this year), time-shifting observations beyond what was originally planed.

Offsetting observation could disturb results. Red Tunas have a spawing cycle relatively well-know in Mediterranean Sea with spawing dates from may in eastern Mediterranean (Turkish and Egyptian zone) and from june in central Mediterranean (Malta zones) *(Heinisch, G., and al., 2008)*. These spawning periods are the best to observe spawning Tunas, grouped and searching for food at the surface. Next to them, only small individuals (below 25 Kg) and medium size individuals (25 à 150 Kg) were observed in zone 6 (Tukey), including mostly schoals with 30 to 50 Kg individuals, so non matures or juvenile spawning *(Heinisch, G., and al., 2008.)*. None individuals above 100 Kg could be observed in zone 6. First flights began on june 5^{th} in zones 4 and 6 at the same time, time period which could likely lead to observation of big-individuals schoals in central Mediterranean (zone 4) but seemed a little late already for zone 6, since spawning period is very short from end of may *(Karakulak, S., and al., 2003)*.

Moreover, this year the fishing-season extended from may 15^{th} til june 15^{th}. It is then likely that part of the big size spawning individuals had aleady been caged before observation on sites. This hypothesis could be verified in the future by checking in parallel the captures datas observed by spotters at sea working for ICCAT on fishing-boats ? For central Mediterranean, time period seemed thus more suitable for flights aiming observation of big-individuals schoals. Considering a Red Tuna becomes mature at the age of 4, for an approximate mass of 25 Kg, several schoals of these spawning individuals could be observed on zone : in zone 8 for instance, sizes varried between 25 to 300 Kg. But for zone 7, the late date of flights from june 20^{th} might have biased spawning observations, as some of them might already be in cage or migrating.

4. CONCLUSION

The GBYP programme aims to collect as much basic data as possible, with biological and ecological informations for ICCAT while aerial observation of BFT schoals.

Zones at stake here are the ones for which PTA (Périgord Travail Aérien) had been granted the Study, that is to say zones 4, 5 and 6 respectively North Libya, Egypt, and South Turkey.

To face diplomatic situations, flight effort time had to be moved from zones 4 and 5 to zones 7 and 8. Total flight time realized was 158.8 hours (block-block) for 75.78 hours of active prospection on differentes zones. For Malta zones (4, 7 and 8), 91.7 hours have been flown (out of 73 initialy planed on zone 4 : 9.9h for zone 4, 36.9h for zone 7 and 48.9h for zone 8). Zone 5 (Egypt) couln't be overflown. A flight of 2.7h had been realizes on june 9th and 18.7h reported on Malta zones 7 and 8, reaching a total of 21.4h out of 60 initialy planed. In zone 6 (Turkey) 100% of time effort could be realized with 66 hours.

Regarding final results, this first year of Study shows diversity according to zones. In Eastern Mediterranean, flights gave way to 47 Tunas schoals observations, including 33 BFT (*Thunnus thynnus*), 13 ALB (*Thunnus albacores*) and 1 bonitou tuna schoal (*Auxis rochei*), respectively 2114, 750 and 2 tons. For BFT (*Thunnus thynnus)*, there were mostly individuals with mass between 30 to 60 Kg. Flights occurred from june 5th to 30th 2010 in 15 flights, with rather few bad weather constraints. On the opposite in Central Mediterranean, numerous flights have been canceled or delayed due to bad weather conditions. This is mostly why flights occurred from june 3rd until august 3rd 2010, exceeding by far what was initially planed. flights gave way to 47 Tunas schoals observations 1, 7 and 8 schoals so 0.25 tons, 860.5 tons and 1 777 tons of Red Tunas (*Thunnus thynnus*), respectively on zones 4, 7 and 8. On zone 4, Red Tunas observed were smaller sized (below 25Kg), whereas average size (25 to 150 Kg) on two other zones, even up to 300Kg for certain on zone 7.

In order to obtain an accurate tendancy of Tunas observations, it would be interesting to compare them with studies to come in the following years of the GBYP programme to confirm these first results.

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Aerial survey on spawners aggregations of the Atlantic-wide research program on bluefin tuna (GBPY - 2010) South Tyrrhenian Sea (Sub-area 2)

Final report

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Summary

Summary

Aerial surveys have been carried out with the aim of providing fishery-independent indices to improve the knowledge of bluefin tuna population in the Mediterranean, particularly for what is concerning the spawners aggregations. The surveys have been performed in June 2010 in an area comprised between Sicily and Calabria (South Tyrrhenian Sea), one of the traditional fishing area in Central Mediterranean. Probably due to the abnormal meteorological situation of that season, sightings of bluefin tuna were quite poor, even if with some schools of huge dimensions. Data contribute to the knowledge of the species in the area, and gather with other data at the same time collected for the whole Mediterranean in the framework of the general programme. Methodology has been checked and tuned for future activities.

Keywords

Atlantic bluefin tuna, Thunnus thynnus, Mediterranean, South Tyrrhenian Sea, aerial survey

1. Background and objectives

The policy of conservation of Mediterranean bluefin tuna requires to improve the scientific knowledge regarding biology, reproductive behaviour and the broodstock status.

The situation of the stock is under close observation, and great care is paid by scientists and national and international organisations. Many elements can contribute to a better knowledge of the species and the stock situation, and one of this is the development of fishery-independent indices of abundance.

The programme "Aerial survey on spawning aggregations of the Atlantic-wide research programme on bluefin tuna (GBYP - 2010)" has been undertaken with the goal of improving basic data collection, understanding of key biological and ecological processes, assessment models and management.

With this aim, the programme has identified in the Mediterranean six different zones to carry out aerial surveys for the detection of spawners aggregations.: the Balearic Sea (1), the South Tyrrhenian Sea (2), the area south of Malta with the Strait of Sicily (3), the area off the Libyan coast (4), the area off the Egyptian coast (5) and the Eastern Mediterranean off the Turkish and Cyprus coasts (6).

The present report describes activities and results relative to the South Tyrrhenian Sea (Sub-area 2).

2. Methodology and activities

Methodology strictly followed the methodology of the general project, because of the crucial importance of common operative standards with the other operative units.

<u>Aircraft and equipment</u>

The aircraft was a Partenavia P68C previously used for professional activities in support of bluefin tuna fishing. Stickers with "ICCAT2" on the left side and under the right wing have been applied (Figure 1).

- Brand: Partenavia
- Model: P68C
- Code: I-DMPL

Figure 1 - Aircraft

The aircraft has upper wings, good forward visibility, and capable of flying at a spotting altitude of 300 m and a speed of 100 nm. Flying autonomy is over six hours.

Equipment made up of:

- GPS Garmin Map 60CSx whit statistical survey design reported (the same route were sent to the pilot to be transferred in the aircraft GPS as well).
- Camera Nikon D3000 with 1600 ISO maximum sensitivity, lenses 18-55 and 55-200, and polarised filter.

On board was a professional tuna spotter and a scientific spotter. Effort and eventual sightings were registered through specific forms, as well as GPS recording of all flights and sighting positions. During a survey, the GPS recorded every 30s the exact position of the plane as well as all the waypoints entered by the operator. All the information is directly sent to the PC, in which route and track of the plane are simultaneously plotted.

Survey period indicated was comprised between 17 May and 18 July 2010.

Adverse weather conditions have been considered like conditions which prevents a reliable observation of tuna schools close to the sea surface (winds over 3 or 4 on the Beaufort scale, or low clouds less than 300 m high, or heavy rain).

Study area

The study area was comprised between Sicily and Calabria (area 2) (Figure 2) corresponding to South Tyrrhenian Sea (Table 1).

A detailed map of the study area is reported in Figure 3. It is an area comprised approximately between the perpendicular of Ustica island to the west until Calabria coasts to the east, with an approximate area of 52,461 Square kilometres.

Table 1 - Features about the area 2

area (sq km)	52,461
mean length of trackline on effort (km)	1,751
expected number of 2-day surveys	4.4
proportion of total area	30%

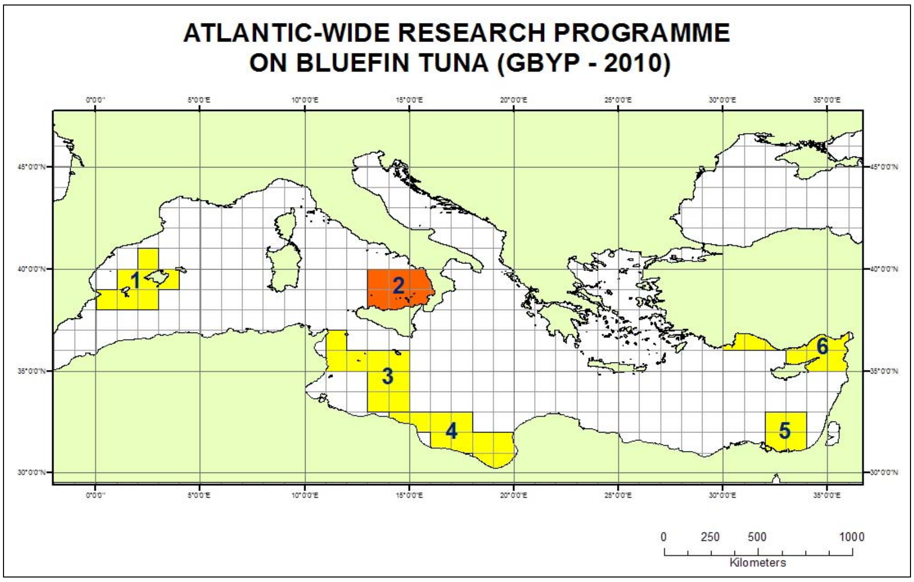

Figure 2 - Mediterranean blocks

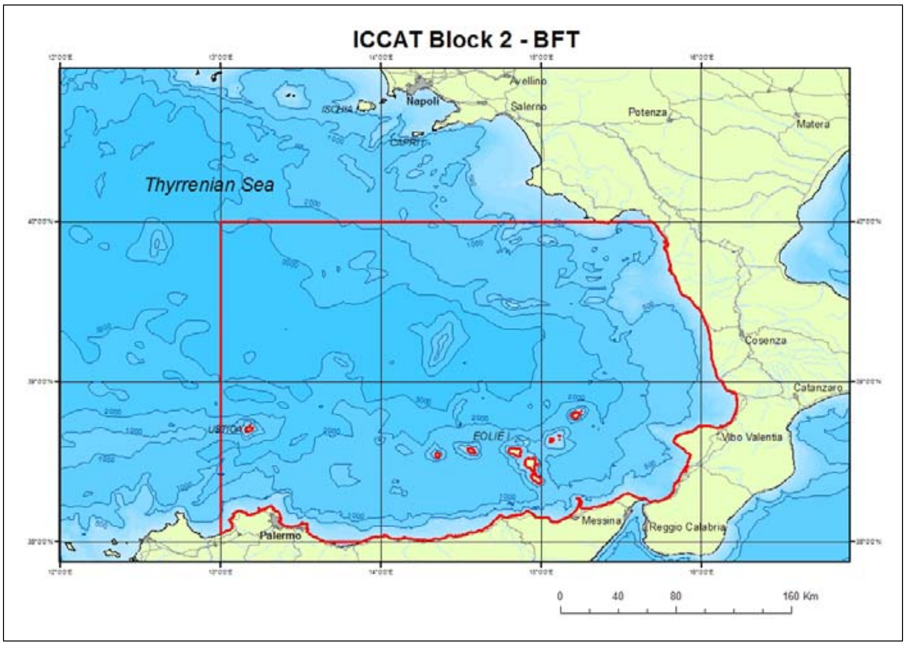

Figure 3 - Sub-area 2

From an hydrological point of view, the area is characterised during springtime by the presence of a main cyclonic current of Atlantic origin, as well as anti-cyclonic and other local currents, creating a mixing of water masses of different origin (Figure 4, from Arena, 1990)

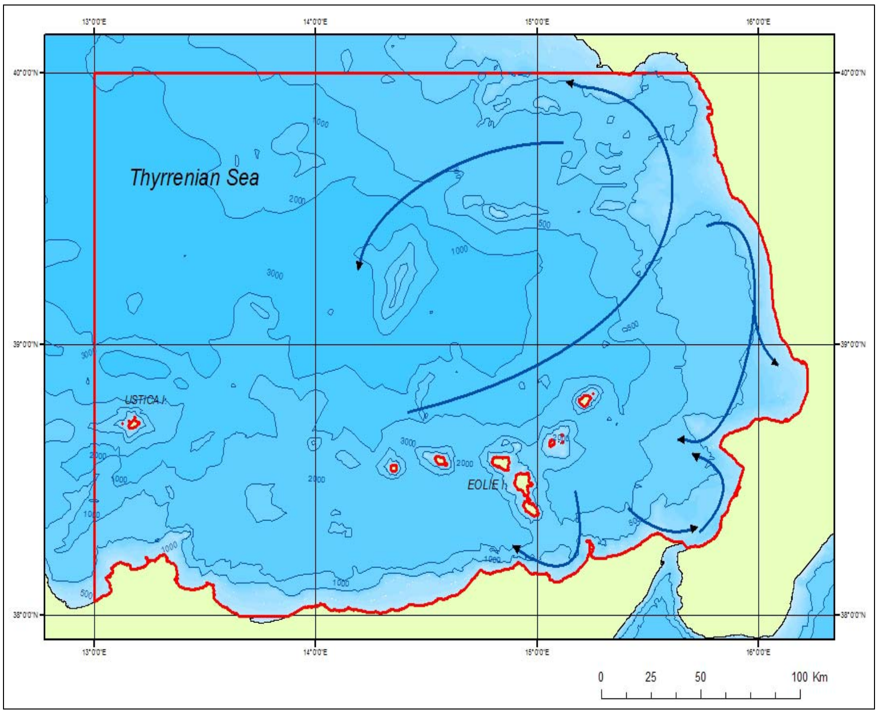

Figure 4 - Main currents in South Tyrrhenian sea during springtime

It is one of the main fishing areas of bluefin tuna, historically well known for the genetic concentration of big size adults (Arena, P. 1978, 1982). A series of fixed fish traps ("*tonnare*") were present as well, but none of them are still in place. On the contrary, an intense activity of purse seine fishing has developed starting from the early Seventies (Arena, P. 1990) . The area was important until the last season of Italian purse-seiners , as witnessed by Figure 5, in which the positions of fishing operations and catches are reported for the Italian purse seine fishery in 2009 (Unimar, 2009).

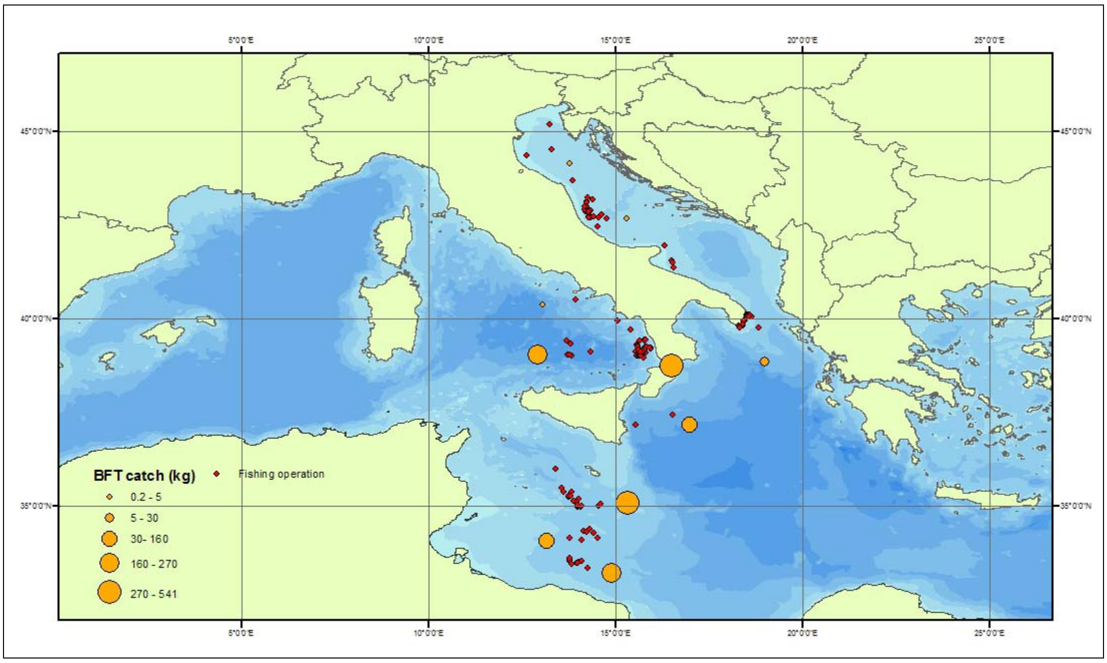

Figure 5 - Position of fishing operations and catches for the Italian purse seine fishery in 2009

Survey design

Aerial surveys were designed using program "DISTANCE". In each block, a series of transects have been created, based on the amount of flying time available and the dimensions of the area, to achieve the approximate coverage indicated. Surveys are designed as equal spaced parallel lines rather than zigzag lines. Parallel line designs achieve equal coverage probability (Hammond P. et al, 2010).

Statistical design identified for the Sub-area 2 six possible surveys, each one with its specific characteristics. Among this, four surveys have been chosen. Figure 6 to 8 represent the transects for each survey obtained by statistical method (Table 2).

Table 2 - features of the surveys

Data	**survey 1**	**survey 2**	**survey 3**	**survey 4**
lines generated	11	11	12	11
sampler width (km)	1	1	1	1
estimated on effort trackline length (km)	1885.047	1885.047	1885.047	1885.047
realised on effort trackline length (km)	1705.956	1709.366	1854.335	1766.066
expected sampler area coverage (sq km)	3411.911	3481.731	3708.67	3532.133
line spacing (km)	30	30	30	30
line angle (degrees)	90	90	90	90
total trackline length (km)	2025.587	2027.286	2210.39	2069.762
total cycling trackline length (km)	2346.874	2348.818	2547.625	2405.628
realised sampler area coverage (sq km)	3391.44	3398.219	3667.875	3528.601
stratum area (sq km)	52460.607	52460.607	52460.607	52460.607
proportion of stratum sampled	0.065	0.065	0.07	0.067

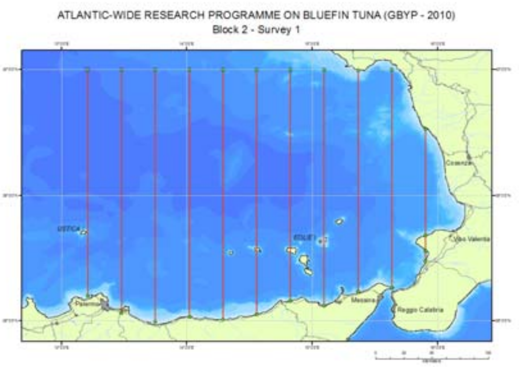

Figure 6 - Transects survey 1

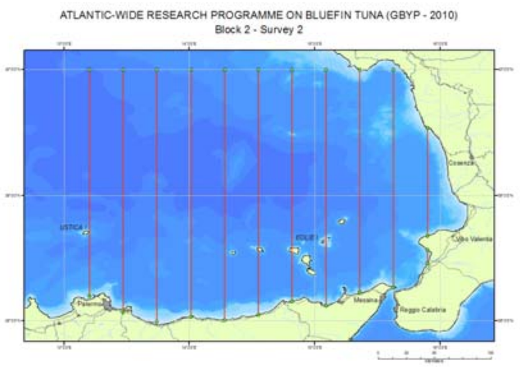

Figure 7 - Transect survey 2

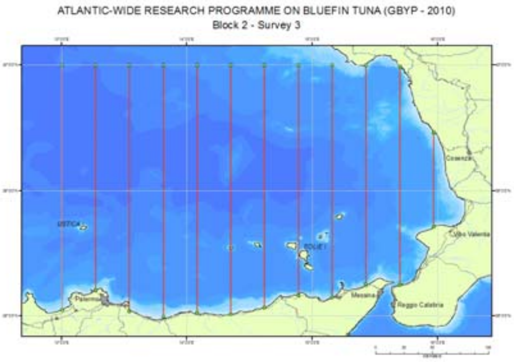

Figure 8 - Transect survey 3

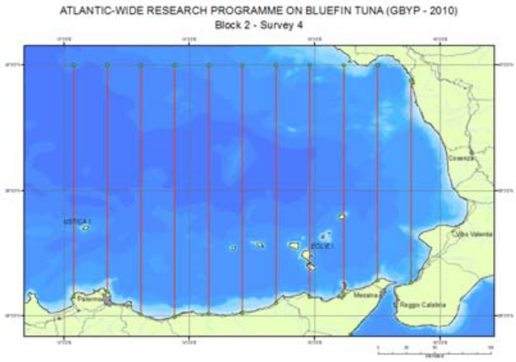

Figure 9 - Transect survey 4

<u>Organisation of field activities</u>

Activities have been carried out taking into account what foreseen by the methodology and according to the behaviour of bluefin tuna in respect to the season and water temperature. This behaviour was reported in detail by Arena (Arena, P. 1979, 1982 a/b/c/d) for the South Tyrrhenian; at the beginning of the season (April - May), first individuals start to aggregate in small schools widespread in the whole area. In this phase, they tend to stay deeper (10 - 50 m) and moving to the surface only for feeding. With the increase of temperature (more than 18°C) and the development of sexual maturation, they aggregate in bigger schools. The maximum aggregation occurs when water temperature exceeds the 20 °C, variable according to the season trend but typically situated around the first ten days of June; in the meantime, a thermocline forms and stabilises at a depth of 15 - 30 m, inducing bluefin tuna schools to remain in the superficial layers.

According to this, activities were organised registering the evolution of surface temperatures in the area (Figure 10): 20°C were reached constantly only after the beginning of June.

Four surveys, chosen among those identified by the statistical design, have been therefore organised, subdivided in two periods, before and after the middle of June. The days around the middle of June are also a traditional point of reference for bluefin tuna fishermen. The decision of concentrating the flights in two periods, instead of spreading them in the whole period, was taken as a compromise with the need of concentrating the flights when meteorological conditions were suitable.

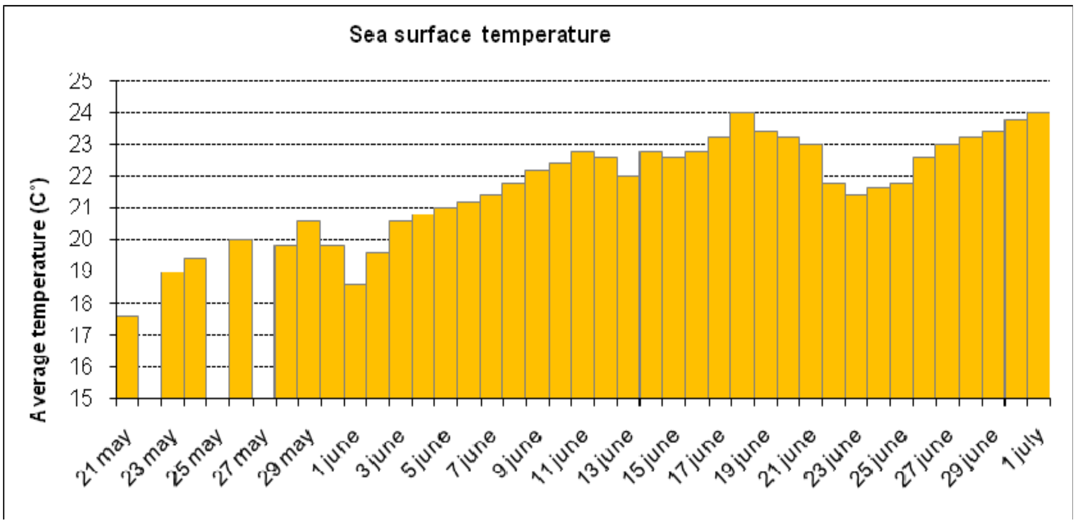

Figure 10 - Sea surface temperature

3. Results

The surveys have been organised in two periods in the month of June, the first one from 3rd to 9th and the second one from 25th to 29th. In each period, two surveys of two days each have been performed (Table 3). Operative airport was Pontecagnano, on the south of Salerno. The flights have been organised with an intermediate landing in Palermo or Reggio Calabria airports for refuelling.

From a chronological point of view, activities started with survey n. 2, due to military activities taking place near the transect 10 of survey 1 on June 5th.

Table 3 - Time series of the surveys

survey	date	flight transfer total times	survey total times (on effort)	flight total times
	04/06/2010	0	stand by because of bad time	
2	05/06/2010	2.50	4.40	7.30
	06/06/2010	3.15	7.00	10.15
	survey 2 total	**6.05**	**11.40**	**17.45**
1	07/06/2010	3.00	6.47	9.47
	08/06/2010	2.28	4.54	7.22
	survey 1 total	**5.28**	**11.41**	**17.09**
3	26/06/2010	2.33	6.33	9.06
	27/06/2010	2.28	5.34	8.02
	survey 3 total	**5.01**	**12.07**	**17.08**
4	28/06/2010	2.27	6.28	8.55
	29/06/2010	2.37	5.08	7.45
	survey 4 total	**5.04**	**11.36**	**16.40**
Sub-area 2 total times		**21.38**	**47.04**	**68.42**

Flights were generally performed at the altitude and speed (300 m, 100 nm/h) requested; any difference has been registered as well.

For all the performed flights, the tracks get by GPS have been registered and checked with aircraft GPS as well. Written forms about effort and sightings have been filled. Whereas have been taken, the pictures have been identified according to frame numbers.

Each survey has been performed with one or two scientific observers, and the professional spotter.

In Figure 11 to 13 are represented the maps with the tracks of each aerial survey.

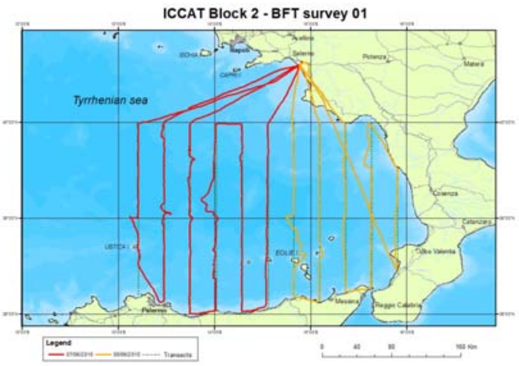

Figure 11 - Tracks survey 1

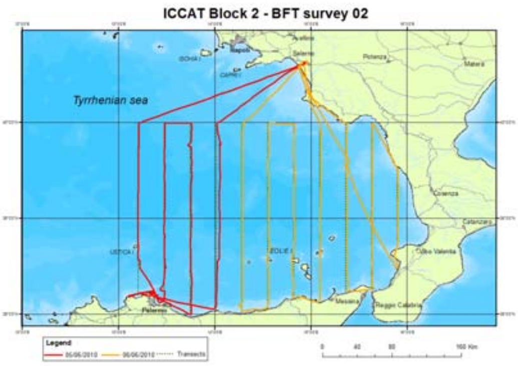

Figure 12 - Tracks survey 2

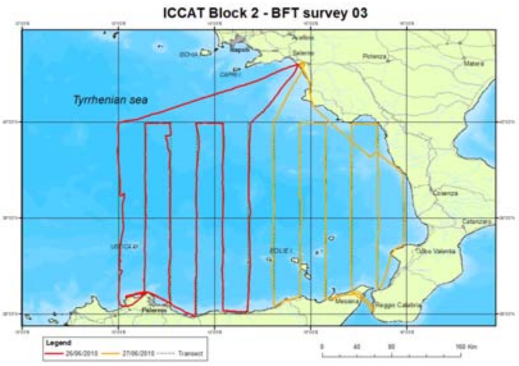

Figure 13 - Tracks survey 3

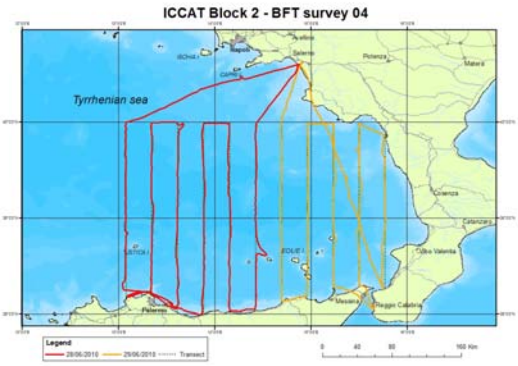

Figure 14 - Tracks survey 4

In Figure 15 to 18 are represented the maps with the sightings of bluefin tuna.

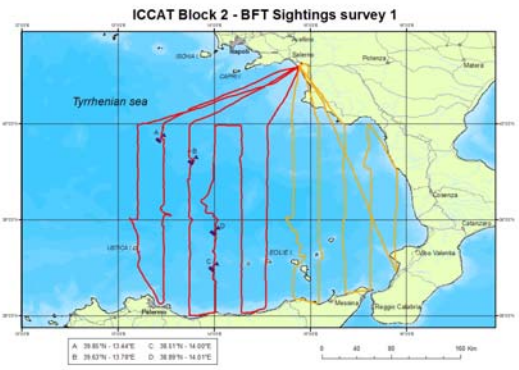

Figure 15 - Sightings survey 1

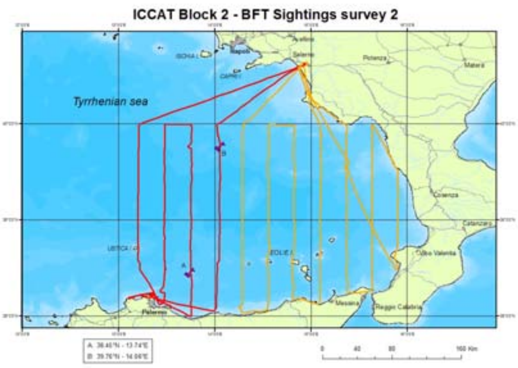

Figure 16 - Sightings survey 2

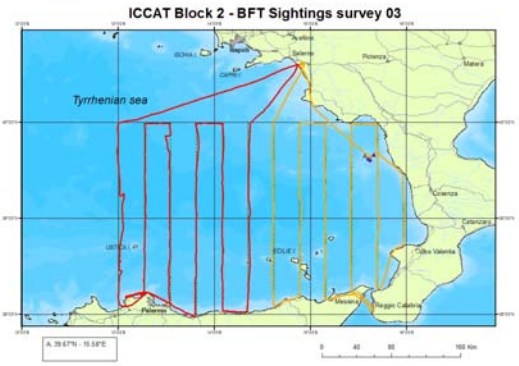

Figure 17 - Sightings survey 3

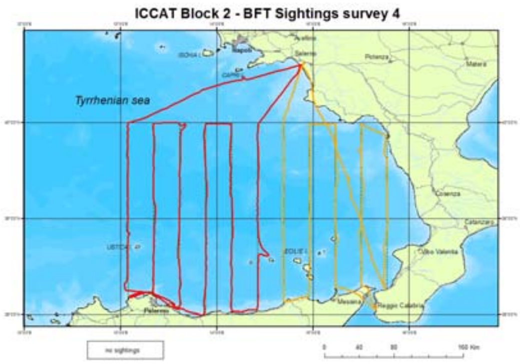

Figure 18 - Sightings survey 4

In Table 4 are reported data about the sightings of bluefin tunas.

Table 4 - Data collected for sightings

Date	Time	Sub-area	Survey	Transect	Lat	Lon	Cue	School size	Estimated weight	School heading	School Components			
											% small	% medium	% large	% giant
05-06-10	12.39	2	2	3	38.45	13.74	splash	1	40	Random		100		
05-06-10	17.12	2	2	4	39.76	14.06	shining	1	60	"		100		
07-06-10	11.47	2	1	2	39.85	13.44	shining	800	150000	"			100	
07-06-10	13.54	2	1	3	39.63	13.78	ripples	1700	227000	"		40	50	10
07-06-10	15.22	2	1	4	38.51	14	ripples	1100	40000	"		90	10	
07-06-10	15.35	2	1	4	38.89	14.01	ripples	800	48000	"		100		
27-06-10	17.01	2	3	off effort	39.67	15.58	ripples	1500	150000	"		67	33	

Figure 19 represents a summary of the bluefin tuna sightings in every single survey.

As it could be seen, not many sightings occurred: some of them are of huge schools, a few others of isolated individuals. Even the sightings of marine mammals have been generally scarce.

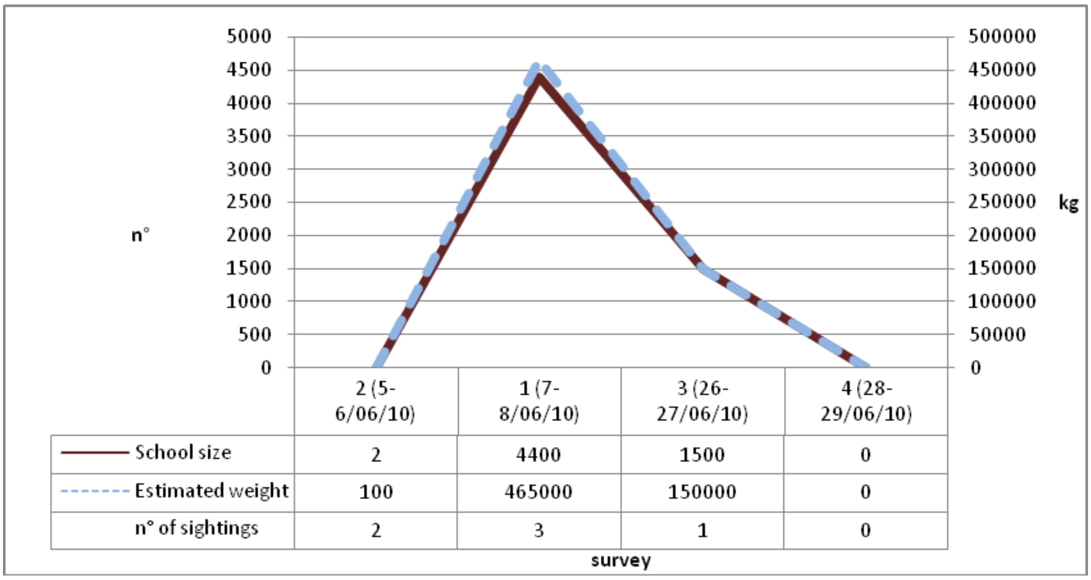

Figure 19 - Summary of the bluefin tuna sightings in every single survey

4. Discussion

As concerning the results, we report some qualitative remarks, while a common statistical analysis will be more properly implemented for the whole macro-area. For this purpose, the work has been carried out following the standard methodology.

The meteorological trend of the Spring 2010 has been very peculiar and for sure has deeply influenced the movement and behaviour of Bluefin Tuna schools in the spawning season, particularly for what is concerning their presence at the surface. Even if many fishermen with other fishing methods, as well as the fixed fishing traps ("*tonnare*") registered an abundant and widespread presence of tunas, the spawners aggregations at the surface were not frequent.

Only a few sightings have occurred, some of which of schools of huge dimensions, with fishes arranged in more than one layer below the surface. The sightings of other marine mammals were generally scarce as well.

Many factors are known to influence the behaviour and aggregation of tunas, and therefore their accessibility to aerial surveys; among them, maturity and surface temperatures are the main ones, but the meteorological conditions, the sea state, and sometimes the hour of the day can also influence their behaviour.

Other factors could be related to fishing activity; it has been reported (Arena, 1990) a change in tuna tracks and behaviour probably related to the presence of drifting gill-nets, as long as this gears were allowed, and many fishermen in the last years report an apparent change in the behaviour of tuna schools, that tend to stay at or near the superficial layers for a shorter period.

According to other authors (Fromentin, et al 2003) it is quite common that spawners, particularly the big ones, stay in the layers between the sub-surface (1 - 2 m depth) down to 10 meters, resulting therefore hardly detectable from the plane. In this case it is worth to remind that important factors are also related to the personal experience of professional spotters, who normally can detect the schools even at the sub-surface; in fact, an intense activity of aerial spotting, as long as it was permitted, had always been performed in support of the purse seine fishery.

It seems therefore more probable that a central role has been played by meteorological factors, such as a delay in the reaching of temperatures suitable for the reproduction, bad weather conditions and a lack of stabilisation of the thermocline at the right depths.

Moreover, a delay in sexual maturation and an uneven presence and behaviour have been reported for the South Tyrrhenian corresponding to a season with features similar to the 2010 ones (Arena, P. 1981).

The methodology has been checked and tuned, and modifications and/or integrations have been carried out or proposed as a focus base for possible future activities.

5.References

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6.Appendix

Effort

PAGE 1

		Observer					Start			End		
Date	Time	Port	Starboard	Subarea	Survey	Transect	Time	Lat	Lon	Time	Lat	Lon
05-06-10			X	2	2	1	9.20	39.98	13.21	10.20	38.58	13.2
05-06-10		X		2	2	2	10.25	38.3	13.47	11.40	40	13.48
05-06-10			X	2	2	3	11.45	39.99	13.76	12.55	37.99	13.75
05-06-10		X		2	2	4	16.10	38.05	13.99	17.25	39.99	14.02
06-06-10			X	2	2	5	9.10	40	14.3	10.20	38.04	14.28
06-06-10		X		2	2	6	10.30	38.07	14.55	11.40	39.99	14.56
06-06-10			X	2	2	7	11.45	39.98	14.83	12.45	38.18	14.81
06-06-10		X		2	2	8	12.53	38.12	15.08	14.00	40	15.09
06-06-10		X		2	2	9	15.48	40	15.36	16.45	38.25	15.38
06-06-10			X	2	2	10	16.53	38.27	15.64	17.52	39.99	15.64
06-06-10		X		2	2	11	18.05	39.53	15.9	18.42	38.48	15.89
07-06-10		X		2	1	1	9.33	39.94	13.2	10.27	38.44	13.24
07-06-10			X	2	1	2	10.42	38.12	13.44	11.55	40.01	13.49
07-06-10				2	1	3	13.38	40	13.75	14.55	38	13.75
07-06-10		X		2	1	4	15.03	38.06	14.01	16.17	40	14.01
07-06-10			X	2	1	5	16.23	40	14.28	17.27	38.03	14.3
07-06-10		X		2	1	6	17.33	38.07	14.52	18.38	39.99	14.56
08-06-10		X		2	1	7	9.15	40.02	14.8	10.29	38.19	14.83
08-06-10			X	2	1	8	10.37	38.14	15.09	11.43	40	15.05
08-06-10				2	1	9	13.53	40.01	15.35	14.50	38.24	15.36
08-06-10		X		2	1	10	14.57	38.28	15.63	16.00	40	15.61
08-06-10				2	1	11	16.15	39.54	15.9	16.49	38.47	15.9
26-06-10		X		2	3	1	9.55	40	13	11.04	38.1	13
26-06-10			X	2	3	2	11.12	38.2	13.27	12.12	39.98	13.28
26-06-10		X		2	3	3	12.17	39.99	15.53	13.22	38.12	13.52
26-06-10		X		2	3	4	15.07	38	13.8	16.15	39.99	13.81
26-06-10			X	2	3	5	16.22	39.99	14.09	17.25	38.04	14.1
26-06-10		X		2	3	6	17.32	38.04	14.34	18.40	40	14.37
27-06-10		X		2	3	7	9.12	39.99	14.62	10.15	38.09	14.63
27-06-10			X	2	3	8	10.22	38.18	14.88	11.27	39.99	14.88
27-06-10		X		2	3	9	11.33	39.99	15.16	12.38	38.16	15.15
27-06-10		X		2	3	10	14.00	38.23	15.43	15.00	39.98	15.43
27-06-10			X	2	3	11	15.07	39.99	15.69	16.05	38.27	15.69
27-06-10		X		2	3	12	16.22	39.71	15.95	16.45	39.45	15.97
28-06-10		X		2	4	1	9.29	40	13.08	10.29	38.27	13.05
28-06-10			X	2	4	2	10.37	38.23	13.33	11.38	39.95	13.38
28-06-10		X		2	4	3	11.44	40	13.61	12.52	38.05	13.61
28-06-10		X		2	4	4	14.37	38.01	13.87	15.41	39.99	13.89
28-06-10			X	2	4	5	15.47	39.99	14.15	16.53	38.03	14.17
28-06-10		X		2	4	6	16.59	38.04	14.42	18.08	39.99	14.43
29-06-10		X		2	4	7	9.10	40	14.69	10.15	38.14	14.69
29-06-10			X	2	4	8	10.22	39.18	14.95	11.23	39.99	14.96
29-06-10		X		2	4	9	11.29	39.99	15.23	12.27	38.3	15.24
29-06-10		X		2	4	10	13.45	38.29	15.51	14.56	39.99	15.5
29-06-10			X	2	4	11	15.02	39.87	15.75	15.55	38.27	15.76

PAGE 2

				Glare			Notes	
Altitude	Sea State	Haze	Turbidity	Side	Sector	Intensity	Fishing vessels	Other
300	calm (rippled)	Clear	Clear	Left		STRONG		Transect not finished because there is the "No fly zone" near Airport of Palermo "Punta Raisi"
300	calm (glassy)	Clear	Clear	Right		STRONG		Low clouds
300	calm (glassy)	Clear	Clear	Left		STRONG		12.35 A tug boat sail with empty cage in SW direction
300	calm (glassy)	Clear	Clear	Right		SLIGHT		
300	calm (rippled)	Slight	Clear	Left		STRONG		Low clouds (200-300 m) in the north part of transect.
300	calm (rippled)	Clear	Clear	Right		STRONG		Low clouds (200-300 m) in the north part of transect.
300	calm (rippled)	Clear	Clear	Left		SLIGHT		
300	calm (glassy)	Clear	Clear	Right		SLIGHT		
300	calm (glassy)	Clear	Clear	Right		STRONG		
300	calm (glassy)	Clear	Clear	Left		STRONG		
300	calm (glassy)	Slight	Clear	Right		SLIGHT		
300	smooth (wavelets)	Slight	Clear	Right		STRONG		Transect not finished because there is the "No fly zone" near Airport of Palermo "Punta Raisi".
300	calm (rippled)	Slight	Clear	Left		SLIGHT		
300	calm (rippled)	Slight	Clear			SLIGHT		
300	smooth (wavelets)	Slight	Clear	Right		SLIGHT		
300	calm (rippled)	Slight	Clear	Left		SLIGHT		
300	calm (rippled)	Slight	Clear	Right		STRONG		
300	calm (rippled)	Heavy	Clear	Right		STRONG		
300	calm (rippled)	Slight	Clear	Left		SLIGHT		
300	calm (rippled)	Slight	Clear					
300	calm (rippled)	Slight	Clear	Right		SLIGHT		
300	calm (rippled)	Heavy	Clear	Left				Clouds.
300	calm (rippled)	Slight	Clear	Right		STRONG		Transect not finished because there is the "No fly zone" near Airport of Palermo "Punta Raisi".
300	calm (glassy)	Clear	Clear	Left		STRONG		
300	calm (glassy)	Slight	Clear	Right		STRONG		
300	calm (rippled)	Slight	Clear	Right		STRONG		
300	calm (glassy)	Slight	Clear	Left		STRONG		
300	calm (glassy)	Slight	Clear	Right		STRONG		
300	smooth (wavelets)	Slight	Clear	Right		STRONG		
300	calm (rippled)	Slight	Clear	Left		STRONG		
300	smooth (wavelets)	Slight	Clear	Right		STRONG		
300	calm (rippled)	Slight	Clear	Right		STRONG		
300	calm (rippled)	Slight	Clear	Left		STRONG		
300	calm (rippled)	Slight	Clear	Right				
230	calm (rippled)	Heavy	Clear	Right		STRONG		Lower altitude due to haze. Transect not finished because there is the "No fly zone".
300	calm (rippled)	Heavy	Clear	Left		STRONG		
300	calm (rippled)	Slight	Clear	Right		SLIGHT		
300	calm (rippled)	Slight	Clear	Right		SLIGHT		
300	calm (rippled)	Slight	Clear	Left		STRONG		
300	smooth (wavelets)	Slight	Clear	Right		STRONG		
150	calm (rippled)	Heavy	Clear	Right		SLIGHT		Lower altitude due to haze.
300	calm (rippled)	Heavy	Clear	Left		STRONG		
300	calm (rippled)	Heavy	Clear	Right		SLIGHT		
300	calm (rippled)	Heavy	Clear	Right		SLIGHT		
300	calm (glassy)	Slight	Clear	Left		SLIGHT		

Sightings

PAGE 1

Date	Time	Observer	Subarea	Survey	Transect	Lat	Lon	Cue	Species	School size	Estimated weight	Declination angle
05-06-10	10.31	De Martino Salvatore	2	2	2	38.26	13.43		common			
05-06-10	10.49	De Martino Salvatore	2	2	2	38.48	13.49		common			
05-06-10	10.53	De Martino Salvatore	2	2	2	38.83	13.48		common			
05-06-10	11.54	De Martino Salvatore	2	2	3	39.76	13.73		common			
05-06-10	12.35	De Martino Salvatore	2	2	3	38.54	13.75		common			
05-06-10	12.39	De Martino Salvatore	2	2	3	38.45	13.74	splash	BFT	1	40	
05-06-10	17.12	De Martino Salvatore	2	2	4	39.76	14.06	shining	BFT	1	60	
06-06-10	10.18	De Martino Salvatore	2	2	5	38.11	14.28		common			
06-06-10	10.51	De Martino Salvatore	2	2	6	38.67	14.55		common			
06-06-10	11.54	De Martino Salvatore	2	2	7	39.68	14.82		common			
06-06-10	12.22	De Martino Salvatore	2	2	7	38.86	14.82		common			
06-06-10	12.44	De Martino Salvatore	2	2	7	38.22	14.81		common			
06-06-10	13.26	De Martino Salvatore	2	2	8	39.11	15.09		common			
06-06-10	13.54	De Martino Salvatore	2	2	8	39.88	15.1		common			
06-06-10	16.34	De Martino Salvatore	2	2	9	38.58	15.38		common			
07-06-10	10.10	De Martino Salvatore	2	1	1	39.01	13.13		stenella			
07-06-10	11.07	De Martino Salvatore	2	1	2	38.8	13.47		common			
07-06-10	11.12	De Martino Salvatore	2	1	2	38.95	13.46		common			
07-06-10	11.47	De Martino Salvatore	2	1	2	39.85	13.44	shining	BFT	800	150000	
07-06-10	13.47	De Martino Salvatore	2	1	3	39.74	13.74		common			
07-06-10	13.54	De Martino Salvatore	2	1	3	39.63	13.78	ripples	BFT	1700	227000	
07-06-10	15.22	De Martino Salvatore	2	1	4	38.51	14	ripples	BFT	1100	40000	
07-06-10	15.35	De Martino Salvatore	2	1	4	38.89	14.01	ripples	BFT	800	48000	
07-06-10	17.13	De Martino Salvatore	2	1	5	38.41	14.28		common			
07-06-10	17.22	De Martino Salvatore	2	1	5	38.21	14.28		SWO	2		
08-06-10	10.02	De Martino Salvatore	2	1	7	38.82	14.86		common			
08-06-10	14.14	De Martino Salvatore	2	1	9	39.28	15.36		common			
27-06-10	17.01	De Martino Salvatore	2	3	off effort	39.67	15.58	ripples	BFT	1500	150000	

PAGE 2		Photo No		Notes						
					School Components					
Break track?	**Photos taken?**	**1st**	**Last**	**School heading**	**% small**	**% medium**	**% large**	**% giant**	**Cetaceans**	**Seabirds**
FALSO	FALSO					100				
FALSO	FALSO					100				
VERO	VERO	124	142	Large			100			
VERO	VERO	143	189	Large		40	50	10		1 Larus michahellis
FALSO	VERO	190	200	Medium		90	10			
FALSO	VERO	201	211	Medium		100				
FALSO	VERO	230	237	Medium		67	33			

27 September 2010

ABFT Task II data from BB Bay of Biscay

SHORT-TERM DATA RECOVERY CONTRACT

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (ICCAT/GBYP – 2010)

FINAL REPORT (Draft)

azti tecnalia

ICCAT GBYP Call for Tenders – 02/2010 Data Recovery Plan

11 June: CALL FOR TENDERS

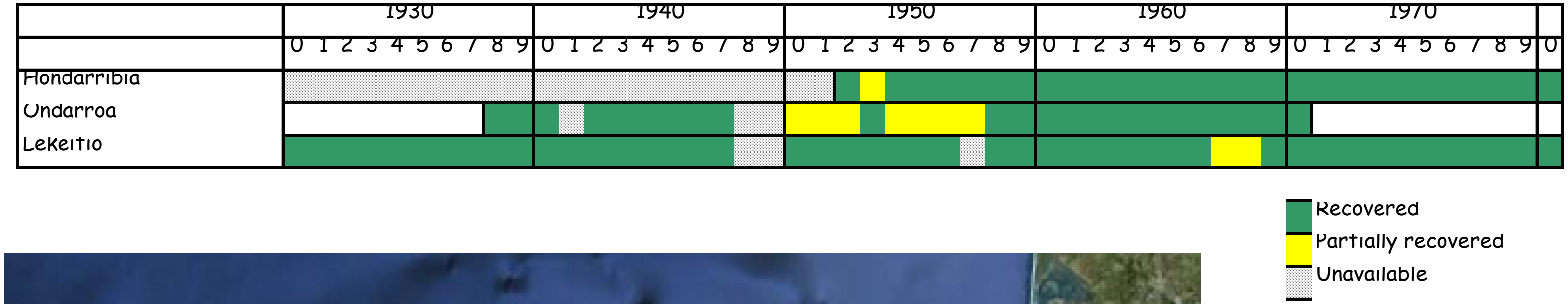
30 July Signature of the contract

- ✓ *"The deadline for the submission of the preliminary short report to ICCAT shall be September 6, 2010."*
- ✓ *"The deadline for the submission of the **draft final report** together with a short PowerPoint presentation shall be September 27, 2010, at the latest."*
- ✓ *"The ICCAT GBYP Steering Committee and the ICCAT Secretariat may make suggestions for additions or improvements to the draft, which shall be given to the Contractor to take into account in a definitive final version, to be submitted before October 4, 2010."*

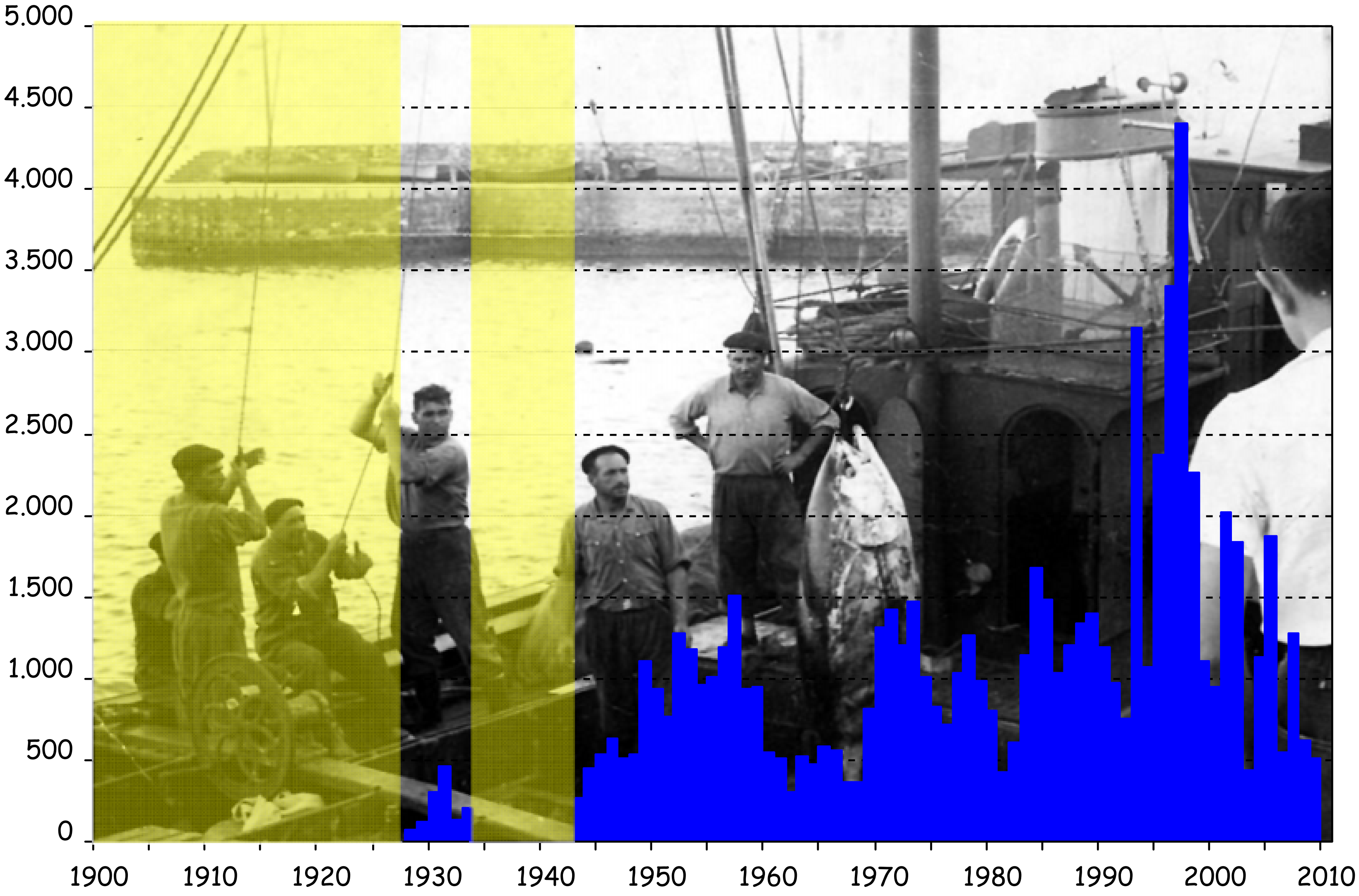
Data to be recovered

- Type of information:
  - Daily landings per vessel of BFT and other tunas.
  - Vessel characteristics: name, GRT, length, year of construction.
- Source: Official Registry Books of the fishermen associations.
- Ports: Hondarribia, Lekeitio and Ondarroa.
- Periods: 1952-1980 (Hondarribia) and 1930-1980 (Lekeitio and Ondarroa).

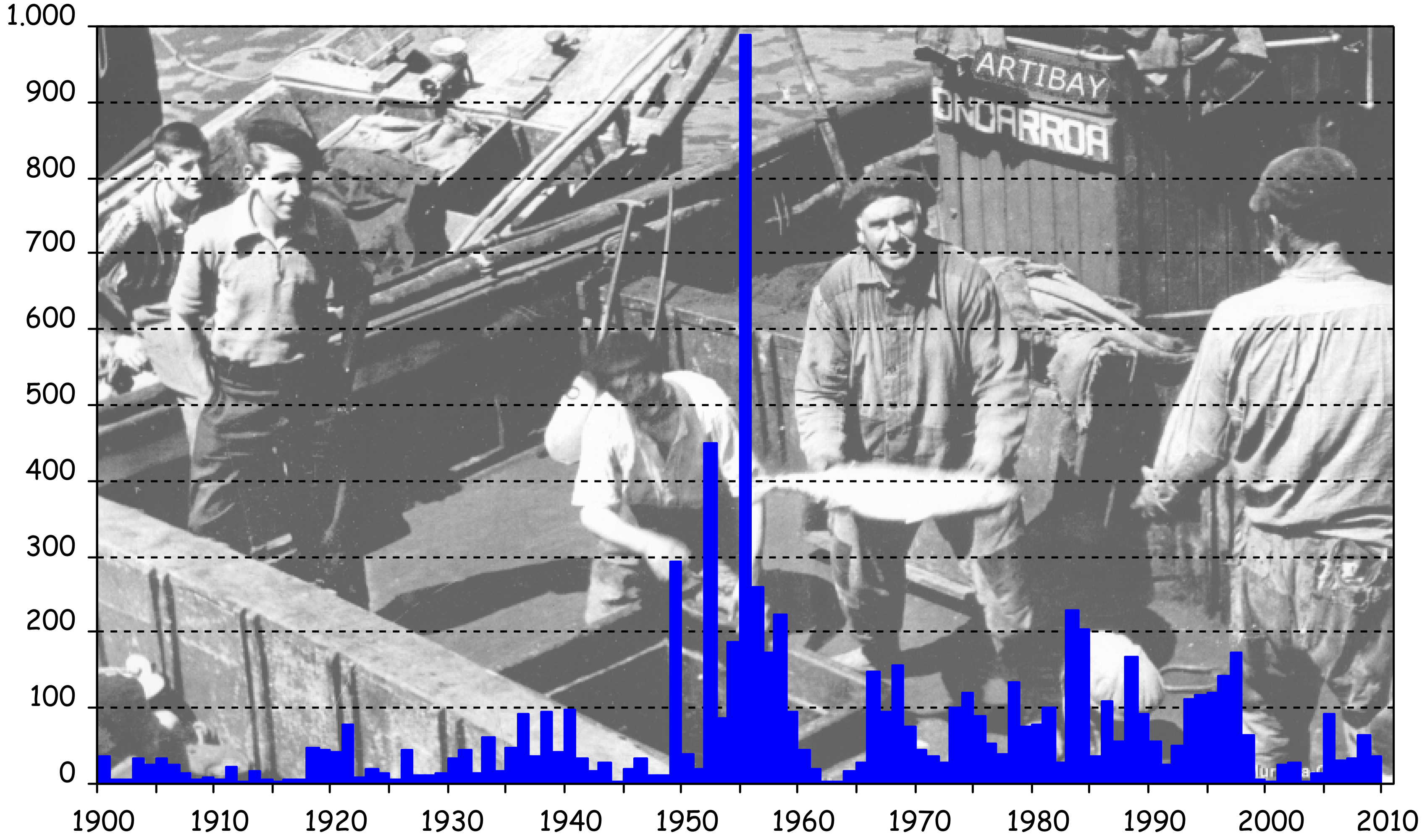
Data to be recovered



Hondarribia

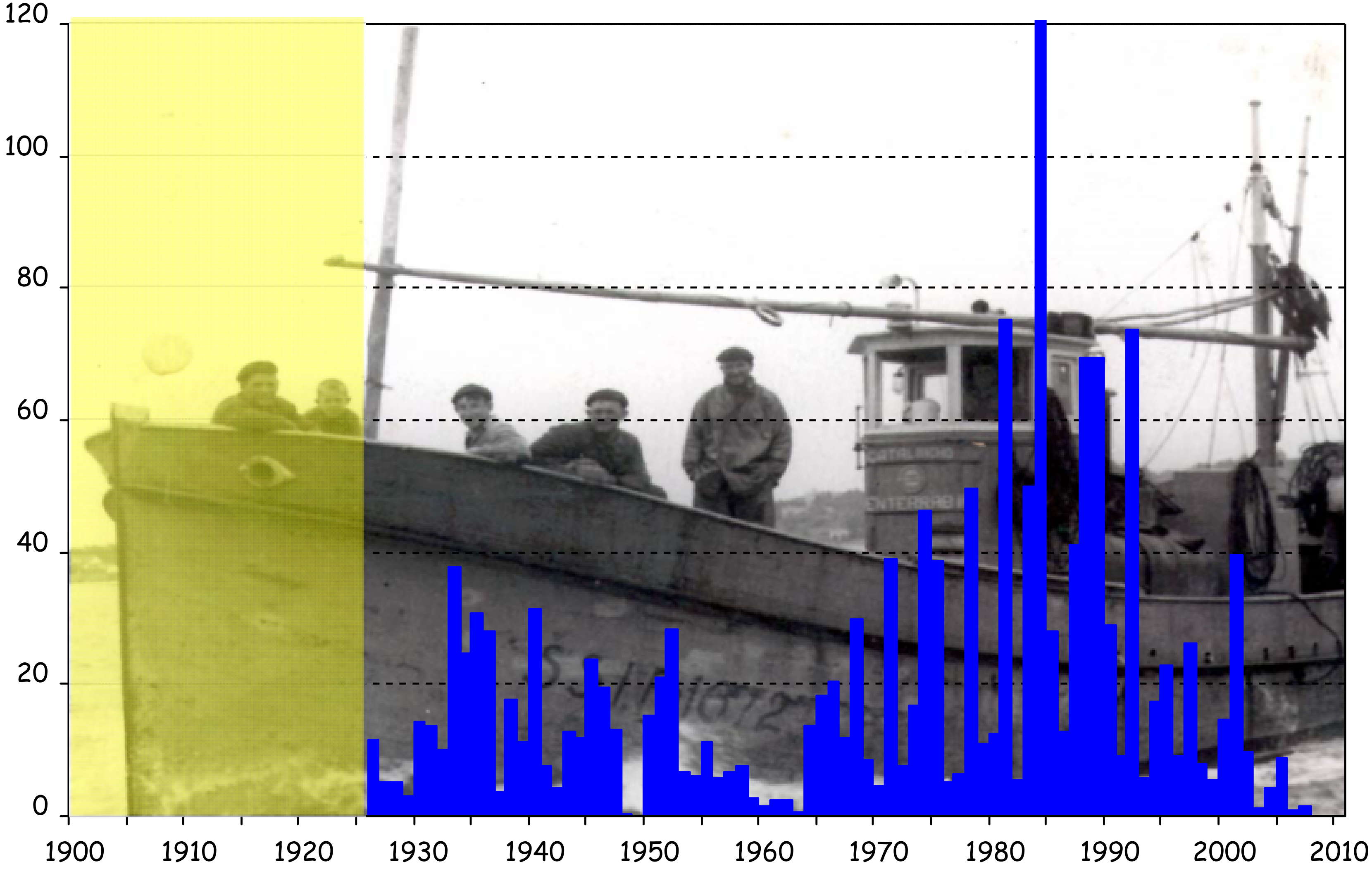


Ondarroa



1.000
900
800
700
600
500
400
300
200
100
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
ARTIBAY
ONDARROA

Lekeitio

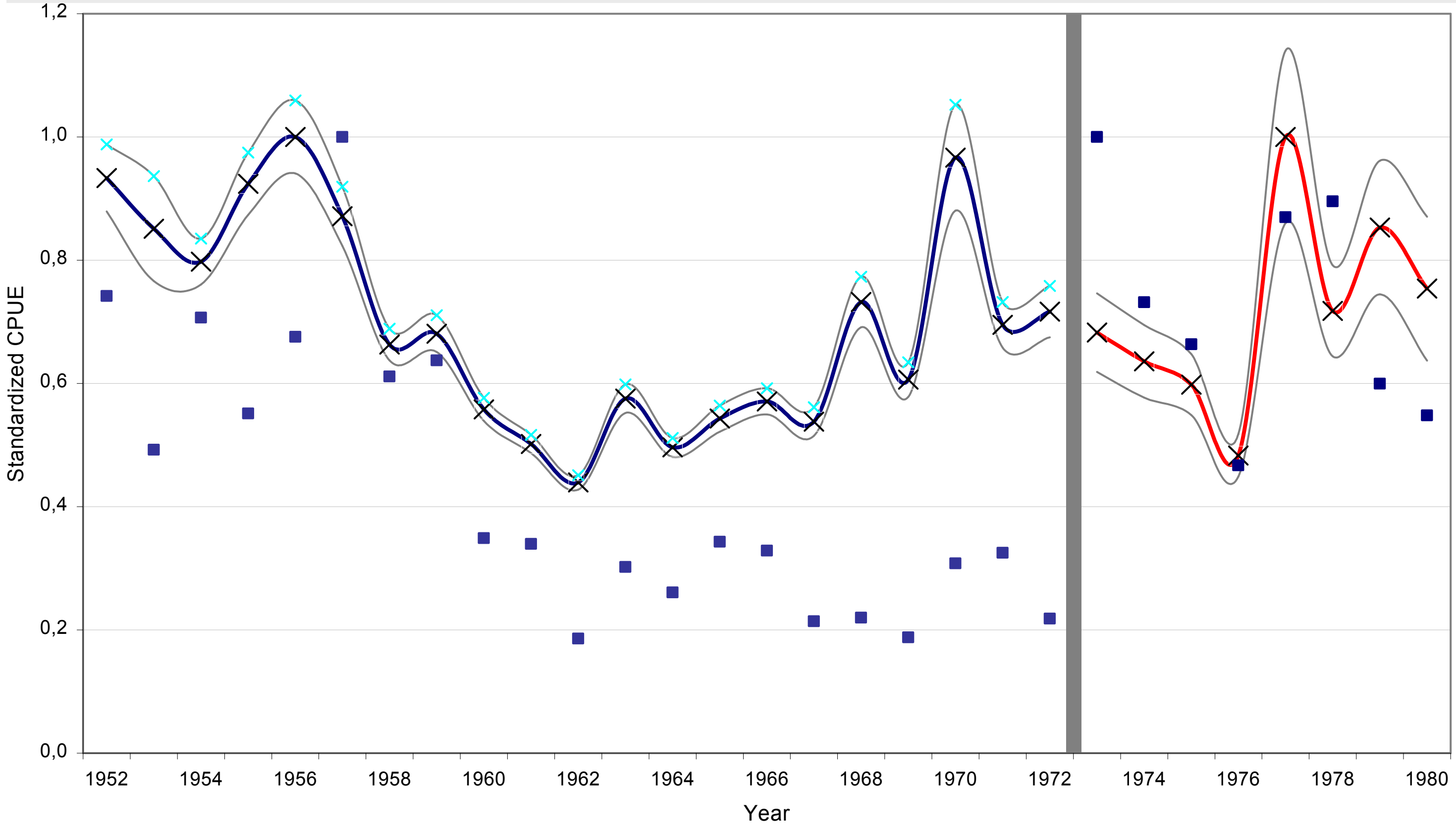


120
100
80
60
40
20
0
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010

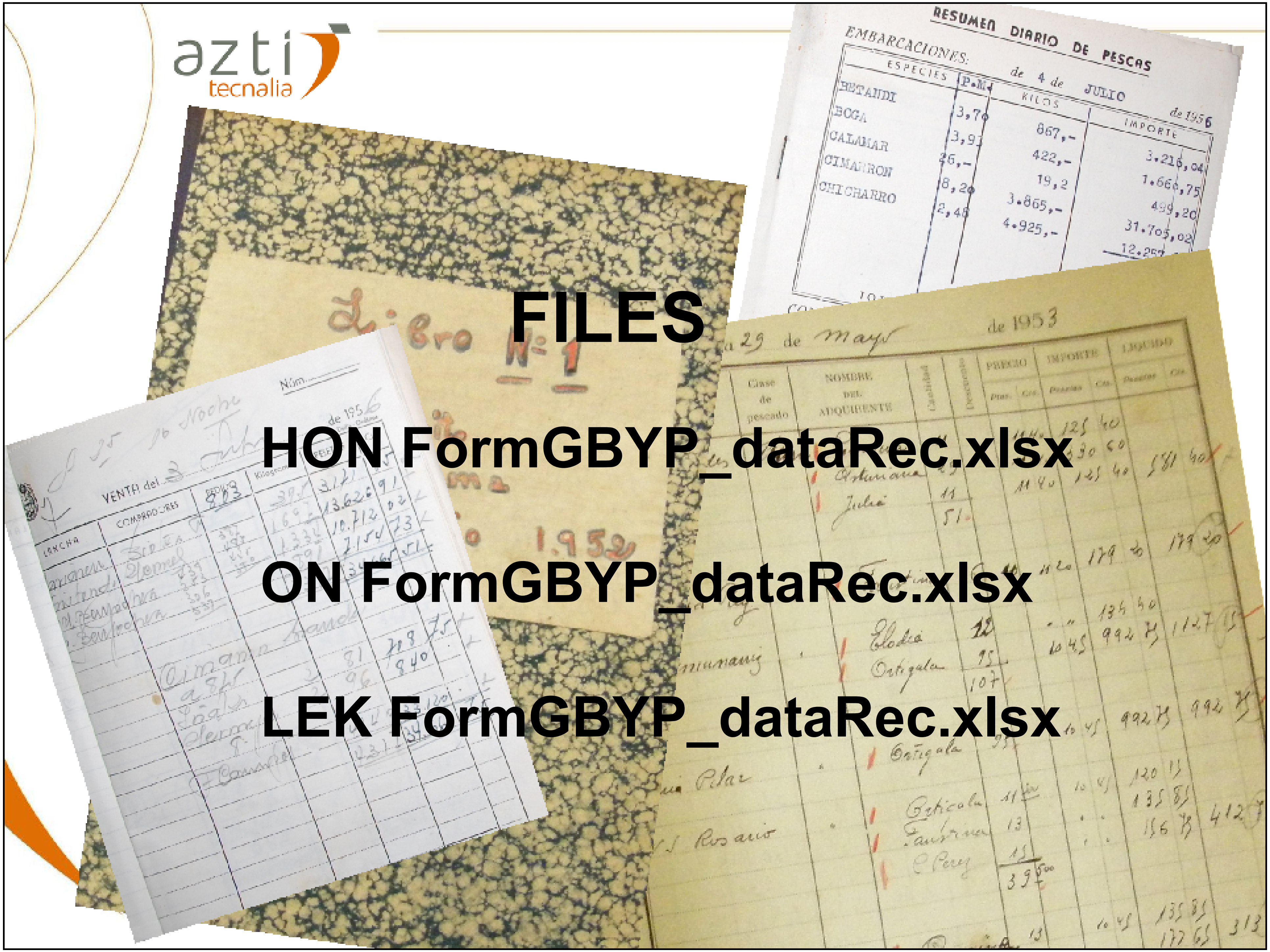
Data recovered

- HONDARRIBIA:
  - Number of records recovered represents 45,258 trips conducted by 373 vessels during 29 years.
  - SCRS 2010/079: standardized index for BB for the period 1952-1972 and 1973-1980. The index corresponding to the first period was used in the BFT 2010 assessment.
- ONDARROA:
  - Number of records recovered (48,511): 14.182 trips conducted by 186 vessels.
  - Information regarding vessel characteristics has not been available so far.
- LEKEITIO:
  - Number of records recovered (>50,000) : 28.176 trips by 151 vessels.

CPUE index (Hondarribia)



Standardized BFT CPUE indices and their 95% confidence intervals for the 1952-1972 and the 1973-1980 periods. (SCRS/2010/079) azti tecnalia



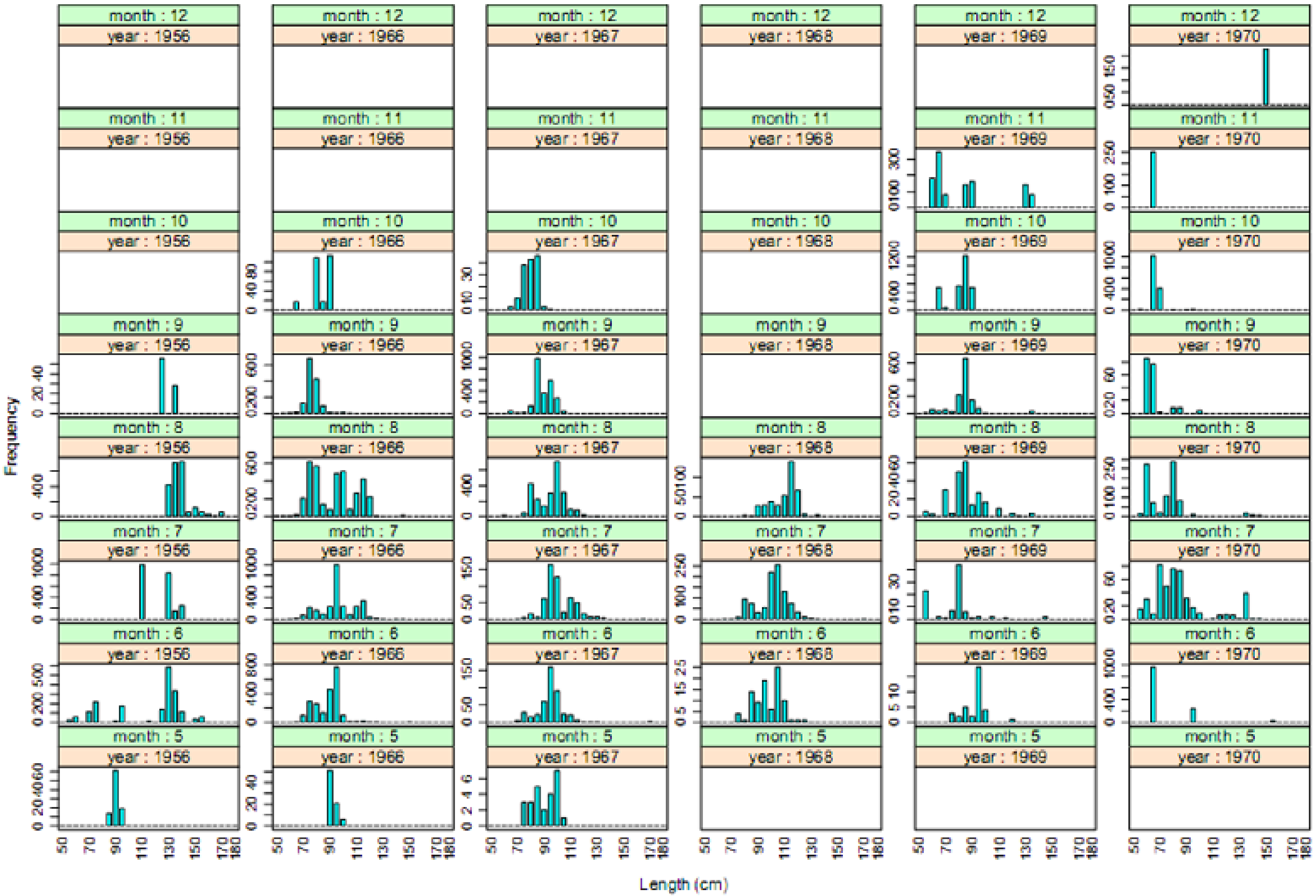
FILES

HON FormGBYP_dataRec.xlsx

ON FormGBYP_dataRec.xlsx

LEK FormGBYP_dataRec.xlsx

Example of future work: Length distribution (Ondarroa)



ICCAT GBYP Call for Tenders – 02/2010 Data Recovery Plan

- ✓ *"The deadline for the submission of the **preliminary short report** to ICCAT shall be **September 6, 2010**."*
- ✓ *"The deadline for the submission of the draft final report together with a short PowerPoint presentation shall be September 27, 2010, at the latest."*
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Future actions [2011]:

- fulfill the gaps and cover the complete XX century
- recover fleet characteristics of the fleet of Ondarroa
- recover length information from Ondarroa
- recover from other ports (Bermeo, Getaria)

République du Sénégal

Un Peuple - Un But - Une Foi

MINISTERE DE L'ECONOMIE MARITIME

DIRECTION DES PECHES MARITIMES

ICCAT Atlantic-wide Research Programme for the Bluefin Tuna (GBYP-2010)

Bluefin Tuna catches landed in Senegal in 2010

Introduction

Atlantic bluefin tuna inhabit the pelagic ecosystem of the entire North Atlantic and its adjacent seas, including the Mediterranean Sea. Among the tuna, bluefin tuna is the only large pelagic fish living permanently in temperate Atlantic waters (Bard et al. 1998; Fromentin and Fonteneau 2001).
In East Atlantic, the southern theorical ecologic limit of Bluefin tuna is the Cap Blanc (21° N). Bluefin tuna catches are always very uncommon in the south of the Canary Islands.

In Senegal, there was no bluefin tuna catch since the beginning of the years Fifties. The tuna baitboats fishing operating in Senegal coastal area between 12 to 21° N (West Africa) target primarily three species of tropical tunas yellowfin, Skipjack and Bigeye.

In 2010, a catch of certain number of bluefin Tuna by Spanish baitboats based in Dakar were announced. These catches were marketed at the same price as Bigeye / Yellowfin tuna towards Spain. It is in this context that this note is produced in order to confirm and give the relative information to these catches carried out by Spanish baitboats based in Dakar. The data are the landing day, the fishing period, the geographic area, the total landings, and the size composition.

This data collection was carried out with a partial financial support by ICCAT Atlantic-wide Research Programme for Bluefin Tuna (GBYP).

Methodology adopted

Following the information collected, the Centre de Recherches Océanographiques de Dakar/Thiaroye (CRODT) and the Direction des Pêches Maritimes of Senegal conducted jointly the investigations in order to compile documents and information relative on bluefin catches in 2010. Meetings were held between the Administration, the Research and the Professionals of tuna fisheries to investigate the catches of bluefin tuna. Later on, Scientists and the fisheries Administration started to discuss the method to adopt in order to collect the maximum information and documents. Thus, many sources were collected.
This paper is based upon:

- Logbooks data collected on the baitboats,
- Statistical sheet and reports filled by the observers of the Direction de la Protection et de la Surveillance des pêches (DPSP) embarked on these spanish baitboats ;
- Trade declarations of fishing societies ;
- Information received from the companies trustees ;
- Documents from the customs office ;
- Sampling in port done by the technicians from the Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT).

All the fishery data corresponding were selected to be analyzed. For calculation we used the equation relationship between L- W;

$W=2.95.10^{-5}*FL^{2.899}$ (Anon. 1984)

Results and Discussion

The exploitation of the various documents and information emphasized that Spanish baitboats based in Dakar captured and unloaded bluefin tuna during the first quarter of 2010. The unloading took place precisely in February. Those tunas were fresh fishes. The state of unloaded fishes (fresh) supposes that the fish was caught during the most recent sets fishing carried out by these baitboats. In February 2010, 19 specimens were unloaded in Dakar port. The total catches were 4350 kg **Table 1**. The mean size is around 229 cm and the mean weight 224 kg. These measurements indicate that the captured individuals were adults. It should be also emphasize the fact that these specimens had first dorsal length (LD1) except standards which the samplers could not measure with a caliper.

Table 2 shows that bluefin tuna catches were carried out in the latitudes 16°- 17° and longitude 17° and 18°. They are the fishing zones between Senegal and Mauritania. The **figure 1** indicates the fishing areas of the baitboat fleet based in Dakar in February 2010 (12-21° N).

The Figure 2 shows the size distribution of bluefin and bigeye caught by these boats at the same period fishing and area. We note that sizes of bluefin landed were bigger than bigeye sizes. But, it might possible that bluefin tuna smaller are sampled like bigeye.

Conclusion and Recommendation

All documents analyzed confirm that fishes caught by Spanish baitboats and landed at Dakar in February 2010 are Bluefin tuna. The presence of bluefin in this southern area could be linked to trophic migration of bait and environmental changes. More attention should be devoted by the samplers.

REFERENCES

ANNYMOUS. 1984. Report of the bluefin tuna workshop, Japan September 1983. Collect. Vol. Sci. Pap, ICCAT, 19:1- 282.

BARD, F. X., P. Bach and E. Josse. 1998. Habitat et écophysiologie des thons : Quoi de neuf depuis 15 ans? Collect. Vol. Sci. Pap, ICCAT,50: 319-342.

FROMENTIN, J.-M. and A. Fonteneau. 2001. Fishing effects and life history traits: a case-study comparing tropical versus temperate tunas. Fisheries Research 53: 133-150.

Table 1. Landings of Bluefin in Dakar

Vessel	Landing day	Total Bluefin landings (kg)	Total Number	Mean length (cm)	Mean weight (Kg)
Baitboat 1	2 3 /02/2010	474	2	213	237
Baitboat 2	25 /02/2010	3089	13	235	238
Baitboat 3	28 /02/ 2010	787	4	255	197
Total		4350	19	229	224

Table2. Size composition of bluefin tuna caught by geographical area and boat

Vessel	Fishing day	Landing day	Latitude	Longitude	Weight (kg)	Size (cm)	Numbers	Depth (m)	Sea surface Temperatures (Celsius)
Baitboat 1	16 /02/2010	2 3 /02/2010	16° 55 N	17° 39 W	252	206	1	2600	22
					222	182	1		
Baitboat 2	19/02/ 2010	25 /02/2010	17° 19 N	17° 31 W	299	261	1	2500	21,4
					273	253	2		
					270	252	1		
					264	250	2		
					236	241	1		
					224	236	1		
					212	232	1		
					211	231	1		
					197	226	1		
					195	225	1		
					171	215	1		
Baitboat 3	27 /02/2010	28 /02/ 2010	17° 50 N	17° 40 W	212	232	1	2600	23
					192	224	2		
					162	211	1		

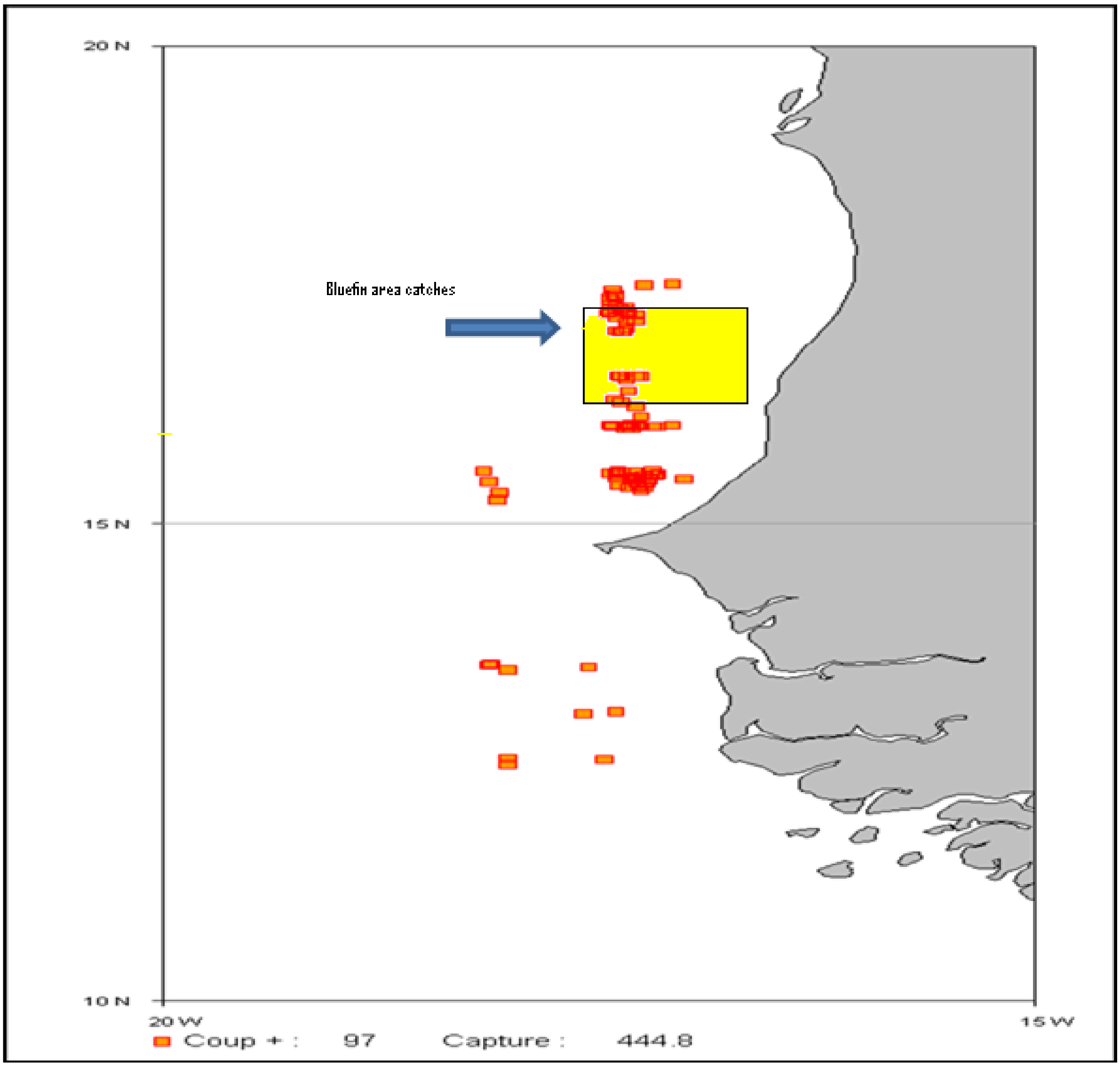
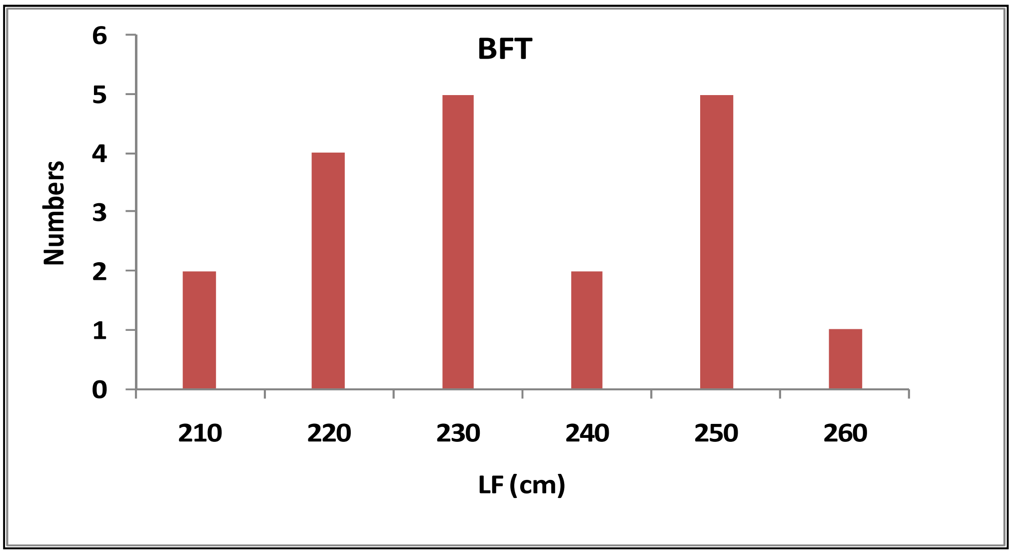
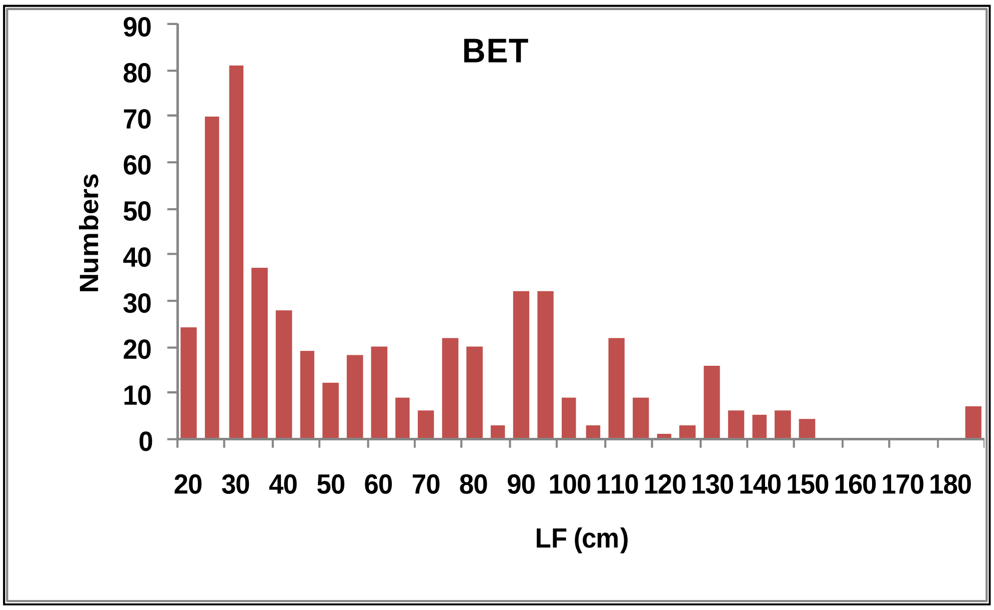


Figure 1. - Fishing areas of the baitboat fleet based in Dakar in February 2010.



a



b

Figure 2. Size frequencies distribution:
a : Bluefin Tuna
b : Bigeye

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Data Recovery Plan – Elaboration of 2010 Data from the Aerial Survey on Spawning Aggregations

Final Report

27 September 2010

Ana Cañadas , Philip Hammond & José Antonio Vázquez

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Background

The comprehensive ICCAT Atlantic Wide Research Programme on Bluefin Tuna (GBYP) aims to improve basic data collection, understanding of key biological and ecological processes, and assessment models and management. An important element of this programme is to carry out aerial line transect surveys of the spawning population in the Mediterranean when and where schools can traditionally be sighted close to the surface to support development of fishery-independent indices. This report describes the analysis for those aerial surveys.

Objectives

To summarise the original design with any subsequent modifications

To summarise the first year's results including: maps of transects with sightings; analysis of data including estimation of detection probability with covariates; generation of preliminary estimates of density and abundance with CVs in each of the survey areas, including both indices and spatial temporal distributions.

To review the survey design including: its use in providing a fishery-independent index, e.g. absolute estimate *vs* index; a power analysis to investigate the effect of increasing precision.

To make recommendations related to: changes to the design in order to better meet scientific and management objectives; use in assessment and management.

To inform the design for a Future Survey Work Plan.

Data

Survey design

The data for analysis were collected on aerial surveys designed by the proposers as a line transect sampling survey using software DISTANCE http://www.ruwpa.st-and.ac.uk/distance/, the "industry standard" software for line and point transect distance sampling (Hammond, Cañadas & Vázquez 2010).

Surveys were designed based on the expected available aircraft time, target survey speed, and estimated time for circling over detected schools to estimate their size. Aircraft time was allocated to each sub-area in proportion to its area. Transect lines were placed in a north-south direction to be approximately perpendicular to the coast in most blocks and to give shorter transects.

Surveys were designed as equal spaced parallel lines and so that the whole sub-area could be surveyed in two days and then repeated multiple times. The number of 2-day surveys planned for each sub-area was based on the size of the sub-area.

Some changes were made to the original design for logistical reasons. In particular, permission was not given to fly surveys in most of sub-area 4 and this survey effort was redistributed into two new survey sub-areas (7 and 8). Surveys in sub-areas 7 and 8 were designed at ICCAT.

Survey coverage

Figure 1 shows the original designed survey transects for sub-areas 1, 2, 3, 4 and 6 (sub-area 5 was withdrawn). Figures 2, 3 and 4 show the realised transects, the sightings made on and off effort and the effort and sightings together. Figures 5-10 show the planned and realised effort and sightings for each sub-area.

Coverage of sub-areas 1 and 2 was comprehensive. Sub-area 3 was well covered in the north but the southern part (south of 34° 20') was not surveyed. Sub-area 4 had only a very small amount of survey effort and no results are possible from this area. Sub-area 5 was not surveyed at all. Sub-area 6 was generally well covered but some waters in the north and to the east could not be surveyed. New sub-areas 7 and 8 were well covered. No post-stratification has been undertaken so it is assumed that in sub-areas 3 and 6, the sample density from analysis is representative of the whole area. Analysis with post-stratification for these sub-areas so that estimated density of schools is only extrapolated to the area actually surveyed can readily be undertaken.

Data provided

Draft data collection forms were proposed by Hammond, Cañadas & Vázquez (2010) and modified and generated by ICCAT. The completed data forms were provided electronically to ICCAT and passed on for analysis.

Data processing

There were a number of issues with the data forms that needed to be clarified and/or resolved prior to organising the data into an appropriate form for analysis. These included minor errors/inconsistencies and missing data. Minor errors, etc due to typographical errors were checked with the survey teams, noted and corrected. More significant problems are described below.

Generally, it was clear that there were a number of misunderstandings or differences in interpretation in what was required in several of the data fields. It will be important to resolve these issues prior to conducting another survey.

The most serious problem was with the data on declination angle of each detected school (the angle to a sighted school measured from the horizontal when the school was abeam of (at 90° to) the transect line). These data are necessary to calculate the perpendicular distance data that are used to estimate detection probability. No survey team collected these data as intended. However, after discussion with each survey team, direct measurements of perpendicular distance for all BFT sightings for all sub-areas were able to be provided from the difference between the GPS positions on the transect line and over the school. The accuracy of these data is unknown and some were estimated (when the track was not broken). But the data seem to be adequate for analysis. This issue requires further discussion before more surveys are conducted.

When these data were collated, the result of observers not being able to see underneath the aircraft became apparent. As expected, there were few sightings close to the transect line (the width of this gap in the data depended on the sub-area), with the exception of some exactly on the line at zero perpendicular distance. This is not a desirable feature of the data but has been dealt with in analysis, as described below.

The data on school size were not collected consistently on all surveys. This was recorded in some sub-areas as Small, Medium or Large (sub-areas 4, 6, 7 and 8), in another as the estimated size of individual fish (sub-area 1), and in others as the estimated number of fish (sub-areas 2 and 3). Consequently, these data could not be used as a measure of school size in analysis. Data on estimated weight of schools, which were recorded consistently, were used as a measure of school size in analysis.

Data on the identity of which observer(s) was searching on which side of the aircraft were not always complete. After some discussion with the relevant survey teams, these data were able to be completed.

Based on these data, observer levels were created that characterised unique combinations of observers; observer level was used in analysis to investigate the effect of observer on detection probability.

More generally on observer issues, it is understood that the Spotter (main observer) sat in the co-pilot's seat in the front on the right, that (s)he searched on both sides but had a clearer view to the right, and that the Scientist sat in the rear of the aircraft on the left. Thus both sides of the aircraft were searched but not necessarily with equal intensity. This issue requires confirmation and further discussion before more surveys are conducted.

One survey team recorded data on glare only when BFT sightings were made rather than for all searching effort. As a result it was not possible to model detection probability as a function of glare.

Sightings made while the aircraft was transiting to and from the survey area or between transects were mostly attributed to a transect in the data, even though they were not seen on transect. These sightings could be identified as off-effort from the times and were not included in analysis.

In sub-area 8, two preliminary "essai" surveys were undertaken before the main surveys. Three of the six transects in these surveys were outside the defined area so a decision was taken not to include them in analysis. In the same sub-area, four designed transects continued south of the sub-area as defined, including one sighting on effort. This was discovered too late to modify analyses presented here.

Following these investigations and modifications to the data, a combined dataset was created that was consistent across as many data fields as possible. This dataset was entered into software DISTANCE for analysis.

Data analysis

Analysis of the data followed standard line transect methodology (Buckland *et al.* 2001).

Density of schools was estimated from the number of schools sighted, the length of transect searched and the estimated *esw* (reciprocal of the probability of detecting a school within a strip defined by the data). The equation that relates density to the collected data is:

$$\hat{D} = \frac{n\,\bar{s}}{2\;esw\;L}$$

where $\hat{D}$ is density (the hat indicates an estimated quantity), *n* is the number of separate sightings of schools, $\bar{s}$ is mean school size (see below), *L* is the total length of transect searched, and *esw* is the estimated effective strip half-width. The quantity 2 *esw L* is thus the area of the strip that has been searched. The effective strip half-width is estimated from the perpendicular distance data for all the detected animals. It is effectively the width at which the number of animals detected outside the strip equals the number of animals missed inside the strip, assuming that everything is seen at a perpendicular distance of zero. To calculate the effective strip half-width, we fitted a detection function (see below and Buckland *et al.* 2001 for further details).

Abundance was estimated as:

$$\hat{N} = A\,\hat{D}$$

where A is the size of the survey area.

Because school size was measured in tonnes, the final estimate of abundance is the total estimated weight of tunas in the surveyed areas.

All analysis was undertaken in software DISTANCE http://www.ruwpa.st-and.ac.uk/distance/, which estimates all quantities and their uncertainties.

Fitting the detection function

Detection functions were fitted to the perpendicular distance data to estimate the effective strip half-width, *esw*. Multi-Covariate Distance Sampling (MCDS) methods were used to allow detection probability to be modelled as a function of covariates additional to perpendicular distance from the transect line. These covariates were defined in the survey design phase and included sea state, air haziness, water turbidity, observers searching, cue and estimated weight of the school. Table 1 shows the covariates tested in the models.

Analysis could not be done for each sub-area independently because of insufficient sample size. Instead, they were stratified into two sets based on differences and similarities in the data from survey aircraft /teams. One set comprised sub-areas 1 and 3, and the other sub-area comprised sub-areas 2, 4, 6, 7 and 8.

All off effort sightings were discarded for the analysis.

It is common practice to right truncate perpendicular distance data to eliminate sightings at large distances that have no influence on the fit of the detection function close to the transect line (the quantity of interest) but may adversely affect the fit. After initial exploration of the data, different right truncation distances were chosen for each dataset: 7.5 km for sub-areas 1 and 3; and 4.0 km for sub-areas 2, 4, 6, 7 and 8.

In these surveys, lack of downward visibility beneath the aircraft meant that left truncation of the data was also necessary. Left truncation eliminates the area that has not been searched from analysis. For sub-areas 1 and 3, there were several sightings recorded exactly on the transect line (zero perpendicular distance) but then no sightings until > 1 km. Consequently, two analyses are explored: one with no left truncation, and one with truncation at 1.25 km to investigate the effect on results. For sub-areas 2, 4, 6, 7 and 8, the left truncation distance chosen was 0.3 km.

Model diagnostics and selection

The best functional form (Half Normal or Hazard Rate model) of the detection function and the covariates retained by the best fitting models were selected based on model fitting diagnostics: AIC, goodness of fit tests, Q-Q plots, and inspection of plots of fitted functions.

Q-Q plots (quantile-quantile plots) compare the distribution of two variables; if they follow the same distribution, a plot of the quantiles of the first variable against the quantiles of the second should follow a straight line. To compare the fit of a detection function model to the data, we used a Q-Q plot of the fitted cumulative distribution function (cdf) against the empirical distribution function (edf).

For goodness of fit tests, we used the Kolmogorov-Smirnov statistic (a goodness of fit test that focuses on the largest difference between the cdf and the edf), Cramer-von Mises statistics (that focus on the sum of squared differences between cdf and edf) and the Chi-square goodness of fit statistic (that compares observed with expected frequencies of observations in each selected range of perpendicular distances).

Results

Table 2 shows the area of each survey sub-area, the number and length of searched transects, the number of sightings of bluefin tuna schools and the left and right truncation distances used for analysis.

Sub-areas 1 and 3 without left truncation

The final model selected was a null model (no covariates) with a Hazard-rate key function and no adjustment terms. The Kolmogorov-Smirnov test and the Cramer-von Mises tests performed well and overall there were no significant differences between the cdf and the edf. Nevertheless, the Q-Q plot shows a large disagreement between the cdf and the edf in the first 20% of the data closer to the transect line, also shown by the plot of the detection function, where there is a big gap in detections between close to the transect line and 1.25 km from the transect line. Table 3 shows the main parameters for the detection function and the results of the diagnostics tests. Figure 11 shows the fitted detection function and Figure 12 shows the Q-Q plot.

Table 4 shows the estimates of density of schools, mean school size and total weight of bluefin tuna in each sub-area.

Sub-areas 1 and 3 with left truncation

The final model selected was a null model (no covariates) with a Hazard-rate key function and no adjustment terms. The Kolmogorov-Smirnov test and the Cramer-von Mises tests performed well, better than with no left truncation, and overall there were no significant differences between the cdf and the edf.

The Q-Q plot shows a much better agreement between the cdf and the edf in 20% of the data closer to the transect line. Table 3 shows the main parameters for this detection function and the results of the diagnostics tests. Figure 13 shows the fitted detection function and Figure 14 shows the Q-Q plot.

Table 5 shows the estimates of density of schools, mean school size and total weight of bluefin tuna in each sub-area.

Based on the better fit of the detection function, we selected these results as the best estimates for sub-areas 1 and 3.

Sub-areas 2, 4, 6, 7 and 8

The final model selected was a null model (no covariates) with a Hazard-rate key function and no adjustment terms. The Kolmogorov-Smirnov test and the Cramer-von Mises tests performed very well, and overall there were no significant differences between the cdf and the edf. The Q-Q plot shows a very good fit between the cdf and the edf. Table 3 shows the main parameters for this detection function and the results of the diagnostics tests. Figure 15 shows the fitted detection function and Figure 16 shows the Q-Q plot.

Table 6 shows the estimates of density of schools and total weight of bluefin tuna in each sub-area.

All sub-areas

Table 7 pulls together the results for all sub-areas and shows results for all sub-areas combined. Overall, a total of 18,158 (CV = 33%) tonnes of bluefin tuna was estimated in the six sub-areas.

Discussion

Survey logistics

The survey design generally seemed to function as planned. Evenly spaced north-south transects seemed to work well as a design configuration. Completing a survey over 2 days also seems effective. Further discussion of logistical issues relating to the survey will best be achieved with ICCAT and the survey teams.

Precision of estimates

The CV of abundance is determined by the CVs of estimated density of schools and mean school sizes in each sub-area. The CV of estimated density of schools is determined by the CVs of encounter rate (number of schools seen per survey km) and effective strip half width (*esw*). All of these quantities are functions of the number of schools seen, as well as the distribution of the data.

The achieved precision (CV) of the estimates for each sub-area are summarised in Table 8.

The number of schools seen in sub-areas 1, 2, 7 and 8 was small (<10) which lead to CVs for density of schools of >50%. However, even where sample size was higher in sub-areas 3 and 6 (around 20-30 schools), the CV of density of schools was still no better than 40%. The precision of mean school size was generally smaller (CV of 6-25% in sub-areas 1, 2, 3 and 6) but greater than 50% in sub-areas 7 and 8, where there were few sightings. CVs for estimates of total abundance in each sub-area were high: 40-60% in sub-areas 1, 2, 3 and 6; and greater than 90% in sub-areas 7 and 8. Summing over all sub-areas surveyed, the CV of total abundance was 33%.

The number of schools seen in several sub-areas was insufficient to estimate an independent *esw* so data from sub-areas surveyed by the same team were pooled. This is acceptable as long as differences in conditions in each sub-area (such as sea state, air haziness, water turbidity, observers) can be investigated as a covariate in fitting the detection function. Using the same *esw* for multiple sub-areas generates correlation in the estimates which was taken into account (in software DISTANCE) in estimating the CV of total abundance.

Inspection of Figures 5-10 shows that in most sub-areas the distribution of sightings was quite aggregated, which increases the CV of estimated density of schools. Incorporating the CV of mean school size made relatively little difference to the CV of estimated abundance.

The main way to reduce the estimated CVs in future surveys is to increase the number of sightings. This can be achieved partly by more efficient searching (for example, using aircraft with good downward visibility) and partly by increasing the amount of searching effort (transect length). Using aircraft with bubble windows would increase sample size and also avoid the need to left truncate the perpendicular distance data.

Increasing searching effort will lead to a decrease in CV of abundance but it is not possible to make exact predictions about how much. CV should improve approximately as a function of the square root of sample size, as shown in Hammond, Cañadas & Vázquez (2010). As a rough idea of the effect, if total sample size were doubled from 72 sightings to 144 sightings by improving efficiency of searching beneath the aircraft and/or increasing searching effort, we might expect the CV of total abundance to decrease from 0.33 to about 0.24.

Relative estimates of abundance

Line transect sampling assumes that detection on the transect line itself is certain. On aerial surveys, in general, it is not possible to assume this because the speed of flight means that some schools available to be sampled will inevitably not be detected (so-called perception bias). In addition, tuna spend much of their time beneath the surface and unavailable to be detected (so-called availability bias). Estimates of abundance from these surveys are thus underestimates (minimum estimates) even though a detection function has been fitted to correct for animals missed within the survey strip.

The appropriateness of these estimates as indices of abundance for the future depends on a number of factors including: timing of surveys; areas surveyed; and stability of availability and perception biases. Availability and perception bias can reasonably be assumed to be stable over time but knowledge of the distribution in time and space of bluefin tuna throughout the Mediterranean Sea is incomplete. To minimise natural variation in using survey estimates as indices of abundance over time, surveys in future years should ideally occur in the same areas at the same time of year.

Power to detect trends

The power of the data to detect trends in abundance depends on a number of factors: the number of years of surveying; the CV of the abundance estimates; the direction and magnitude of the trend; and the probability of a Type I error (rejecting the null hypothesis when it is actually true). Power is defined as one minus the probability of a Type II error (accepting the null hypothesis when it is actually false). The probability of a Type I error is usually referred to as α. The probability of a Type II error is usually referred to as β; hence power = $1 - \beta$. The conventional value for acceptable power is 0.8.

We used software TRENDS (Gerrodette, 1987) to investigate the relationship between power, the estimated CV of total abundance, the number of survey years, and rate of population change per year. Specifically, the following were investigated:

(a) the power of the data to detect a trend (annual rate of population change) of given magnitude as a function of the number of survey years;

(b) the annual rate of population change detectable if CV of abundance were improved as a function of the number of survey years;

(c) the CV of abundance needed in future surveys to detect a trend of given magnitude as a function of the number of survey years.

Results are given in Tables 9, 10 and 11. Table 9 shows that the power of the data (CV of abundance of 0.33) from these surveys to detect a declining trend of 5% per year is very low, even after 10 years. Power to detect a declining trend of 10% per year reaches 0.8 after 9 years of surveys and after only 6 years if the trend is a decline of 20% per year.

The magnitude of the trend detectable declines as the CV of abundance decreases and the number of survey years increases (Table 10), but this result is not particularly sensitive to the size of the CV. For example, after 7 years of survey, the trend detectable is -0.14 with CV=0.33, -0.11 with CV=0.25, and -0.09 with CV=0.20. Or, considered another way, to detect an annual trend of 10% would take 9 years with CV=0.33, 8 years with CV=0.25, and 7 years with CV=0.20.

With the current CV of 0.33, a 5% annual decline would take 14 years to detect, a 10% annual decline 9 years, and a 20% annual decline 6 years (Table 11). The CV of abundance necessary to detect a trend of given magnitude declines fairly linearly with the number of survey years.

Recommendations

Future survey design

Parallel, equal spaced, N-S transects on surveys run over two days generally seems a good design. Other features that would improve the effectiveness of the surveys include:

- Use aircraft with good downward visibility (including bubble windows for rear observers);
- Review data collection forms and tighten up the descriptions of data required;
- Hold a training workshop with all survey teams to ensure consistent understanding of data collection;
- Observers to use declinometers to measure declination angle of schools when abeam;

Data analysis

- If data on other species (cetaceans, turtles) could be collected with the same rigour as those on bluefin tuna, this would be extremely cost-efficient and would contribute greatly to cetacean and turtle research and conservation issues in the Mediterranean Sea;
- If a greater amount of more rigorously collected data can be obtained, there is a possibility of using habitat modelling to predict abundance as a function of environment features such as sea surface temperature and chlorophyll concentration.

References

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Gerrodette, T (1987). A power analysis for detecting trends. Ecology 68: 1364-72. Software TRENDS available from http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=228&id=4740.

Hammond, Cañadas & Vázquez (2010). Atlantic-wide research programme on bluefin tuna (GBYP - 2010) - Design for aerial line transect survey in the Mediterranean Sea. Final Report to ICCAT. May 2010.

Table 1. Areas, number and total length of transects and number of sightings of bluefin tuna for each survey sub-area. Truncation distances are shown for each set of sub-areas.

Sub-area	Area (km^2)	Number of transects	Length of transects (km)	Number of observations (after truncation)	Left truncation (km)	Right truncation (km)
1 & 3					0	7.5
1	62,263	52	6,301.4	11		
3	90,796	42	5,288.4	23		
Subtotal 1 & 3	163,059	94	11,589.8	34		
1 & 3					1.25	7.5
1	62,263	52	6,301.4	7		
3	90,796	42	5,288.4	19		
Subtotal 1 & 3	163,059	94	11,589.8	26		
2, 4, 6, 7 & 8					0.3	4.0
2	52,461	45	8,702.6	6		
4	74,313					
6	55,248	55	3,482.0	31		
7	19,863	29	2,994.6	3		
8	16,842	22	4,109.9	6		
Subtotal 2, 4, 6, 7 & 8	218,513	157	19,289.1	46		
Total	**381,572**	**251**	**30,878.9**	**72**		

Table 2. Covariates tested in the models and their ranges or factor levels

Covariate	Type	Range	Levels
Sighting related			
Cue	factor		ripples shining splash travelling other
School size	continuous	8 -750 tonnes	
Effort related			
Beaufort sea state	factor		0 to 4
Air haziness	factor		clear slight medium heavy
Water turbidity	factor		clear slight medium heavy
Observer level	factor		1 to 7

Table 3. Parameters and diagnostics of the detection functions.

Sub-areas	Average probability of detection (p)	Effective strip width (esw) (km)	K-S test (p)	Cramer-von Mises test (uniform weighting) (p)	Cramer-von Mises test (cosine weighting) (p)
1 and 3 with left truncation	0.644	4.8301	0.112	0.150 < p <= 0.200	0.100 < p <= 0.150
1 and 3 without left truncation	0.471	3.5343	0.198	0.200 < p <= 0.300	0.200 < p <= 0.300
2, 4, 6, 7 and 8	0.364	1.4577	0.900	0.900 < p <= 1.000	0.900 < p <= 1.000

Table 4. Mean school size, density of schools and total weight of bluefin tuna in sub-areas 1 and 3, using the detection function without left truncation.

No left truncation		Sub-area 1	Sub-area 3	Sub-area 1 and 3
Number of transects		52	42	**94**
Transect length (km) (L)		6,301.4	5,288.4	**11,589.8**
Number of sightings (n)		11	23	**34**
School size (tonnes)	**Mean school size**	129.1	41.8	
	CV (%)	8.45	26.3	
Density of schools (km^{-2})	**Density of schools**	0.00018	0.00045	**0.00034**
	CV (%)	47.3	38.3	**32.7**
	Lower 95% CL	0.00007	0.00021	**0.00018**
	Upper 95% CL	0.00044	0.00095	**0.00064**
Total weight (tonnes)	**Total weight**	1,453	1,709	**3,162**
	CV (%)	48	47	**35**
	Lower 95% CL	584	708	**1,620**
	Upper 95% CL	3,610	4,125	**6,170**
Encounter rate of schools (1,000 km^{-1})	**n/L**	1.75	4.35	**2.93**
	CV (%)	45.2	35.7	

Table 5. Mean school size, density of schools and total weight of bluefin tuna in sub-areas 1 and 3, using the detection function with left truncation.

Left truncation		Sub-area 1	Sub-area 3	Sub-area 1 and 3
Number of transects		52	42	**94**
Transect length (km) (L)		6,301.4	5,288.4	**11,589.8**
Number of sightings (n)		11	23	**34**
School size (tonnes)	**Mean school size**	127.1	50.6	
	CV (%)	8.00	24.6	
Density of schools (km^{-2})	**Density of schools**	0.00016	0.00051	**0.00037**
	CV (%)	55.0	44.1	**39.2**
	Lower 95% CL	0.00006	0.00022	**0.00017**
	Upper 95% CL	0.00044	0.00118	**0.00078**
Total weight (tonnes)	**Total weight**	1,244	2,335	**3,579**
	CV (%)	55.6	50.5	**40.6**
	Lower 95% CL	442	905	**1,652**
	Upper 95% CL	3,506	6,030	**7,759**
Encounter rate of schools (1,000 km^{-1})	**n/L**	1.11	3.59	**2.24**
	CV (%)	51.1	39.0	

Table 6. Mean school size, density of schools and total weight of bluefin tuna in sub-areas 2, 6, 7 and 8.

		Sub-area				
		2	**6**	**7**	**8**	**2, 6, 7, 8**
Number of transects		45	55	29	22	**151**
Transect length (km) (L)		8,702.6	3,482.0	2,994.6	4,109.9	**19,289.1**
Number of sightings (n)		6	31	3	6	**46**
School size (tonnes)	**Mean school size**	124.2	62.1	19.2	293.3	
	CV (%)	5.6	12.9	67.5	50.6	
Density of schools (km^{-2})	**Density of schools**	0.00024	0.00305	0.00034	0.00050	**0.00136**
	CV (%)	52.6	39.8	61.9	77.6	**38.0**
	Lower 95% CL	0.00009	0.00142	0.00011	0.00012	**0.00065**
	Upper 95% CL	0.00063	0.00655	0.00118	0.00204	**0.00282**
Total weight (tonnes)	**Total weight**	1,541	10,434	131	2,474	**14,579**
	CV (%)	52. 9	41.9	91.6	92.6	**40.1**
	Lower 95% CL	574	4,702	20	495	**6,777**
	Upper 95% CL	4,137	23,152	849	12,374	**31,362**
Encounter rate of schools (1,000 km^{-1})	**n/L**	0.69	8.90	1.00	1.46	**2.38**
	CV (%)	42.5	25.0	53.5	71.1	

Table 7. Summary of estimates for all sub-areas.

Sub-area	1	2	3	6	7	8	Total
Survey area (km^2)	62,264	52,461	90,796	55,034	19,863	16,842	**297,260**
Number of transects	52	45	42	55	29	22	**245**
Transect length (km)	6,301.4	8,702.6	5,288.4	3,482.0	2,994.6	4,109.9	**30,878.9**
Effective strip width x 2 (km)	7.069	2.915	7.069	2.915	2.915	2.915	
Area searched (km^2)	44,542.1	25,371.6	37,381.6	10,151.4	8,730.5	11,982.0	**138,159.1**
% coverage	71.5	48.4	41.2	18.4	44.0	71.1	
Number of schools	7	6	19	31	3	6	**72**
Density of schools (1000 km^{-2})	0.157	0.236	0.508	3.054	0.344	0.501	**0.521**
%CV density of schools	55.0	52.6	44.1	39.8	61.9	77.6	
Mean school size (t)	127.1	124.2	50.6	62.1	19.2	293.3	**88.0**
%CV school size	8.0	5.6	24.6	12.9	67.5	50.6	
Total weight (t)	**1,244**	**1,541**	**2,335**	**10,434**	**131**	**2,474**	**18,158**
%CV total weight	55.6	52.9	50.5	41.9	91.6	92.6	**33.0**

Table 8. CVs for density of schools, mean school size and total weight.

Sub-area	Number of schools	Density of schools (1000 km^{-2})	%CV density of schools	Mean school size (t)	%CV mean school size	Total weight (t)	%CV total weight
1	7	0.157	55.0	127.1	8.0	1,244	55.6
2	6	0.236	52.6	124.2	5.6	1,541	52.9
3	19	0.508	44.1	50.6	24.6	2,335	50.5
6	31	3.054	39.8	62.1	12.9	10,434	41.9
7	3	0.344	61.9	19.2	67.5	131	91.6
8	6	0.501	77.6	293.3	50.6	2,474	92.6
All	**72**	**0.521**		**88.0**		**18,158**	**33.0**

Table 9. Power of the data to detect a trend as a function of the magnitude of the trend (annual rate of population change) and the number of years of survey. $\alpha = 0.05$. CV of abundance = 0.33.

Annual rate of population change	Number of survey years	Power to detect trend (1 - β)
-0.05	4	0.09
	5	0.11
	6	0.14
	7	0.19
	8	0.25
	9	0.32
	10	0.42
-0.10	4	0.14
	5	0.21
	6	0.34
	7	0.50
	8	0.69
	9	0.86
	10	0.96
-0.20	4	0.30
	5	0.60
	6	0.90
	7	0.99
	8	1.00
	9	1.00
	10	1.00

Table 10. The annual rate of population change (trend) detectable as a function of the CV of abundance and the number of years of survey. $\alpha = 0.05$. Power $(1 - \beta) = 0.80$.

CV of abundance	Number of survey years	Annual rate of population change
0.33	4	-0.44
	5	-0.25
	6	-0.18
	7	-0.14
	8	-0.11
	9	-0.09
	10	-0.08
0.25	4	-0.32
	5	-0.20
	6	-0.15
	7	-0.11
	8	-0.09
	9	-0.07
	10	-0.06
0.20	4	-0.27
	5	-0.17
	6	-0.12
	7	-0.09
	8	-0.07
	9	-0.06
	10	-0.05

Table 11. The CV of abundance needed to detect a given annual rate of population change (trend) as a function of the number of survey years. $\alpha = 0.05$. Power $(1 - \beta) = 0.80$.

Annual rate of population change	Number of survey years	CV of abundance
-0.05	14	0.33
	13	0.30
	12	0.26
	11	0.21
	10	0.18
	9	0.15
-0.10	9	0.33
	8	0.28
	7	0.21
	6	0.15
-0.20	6	0.33
	5	0.24
	4	0.13

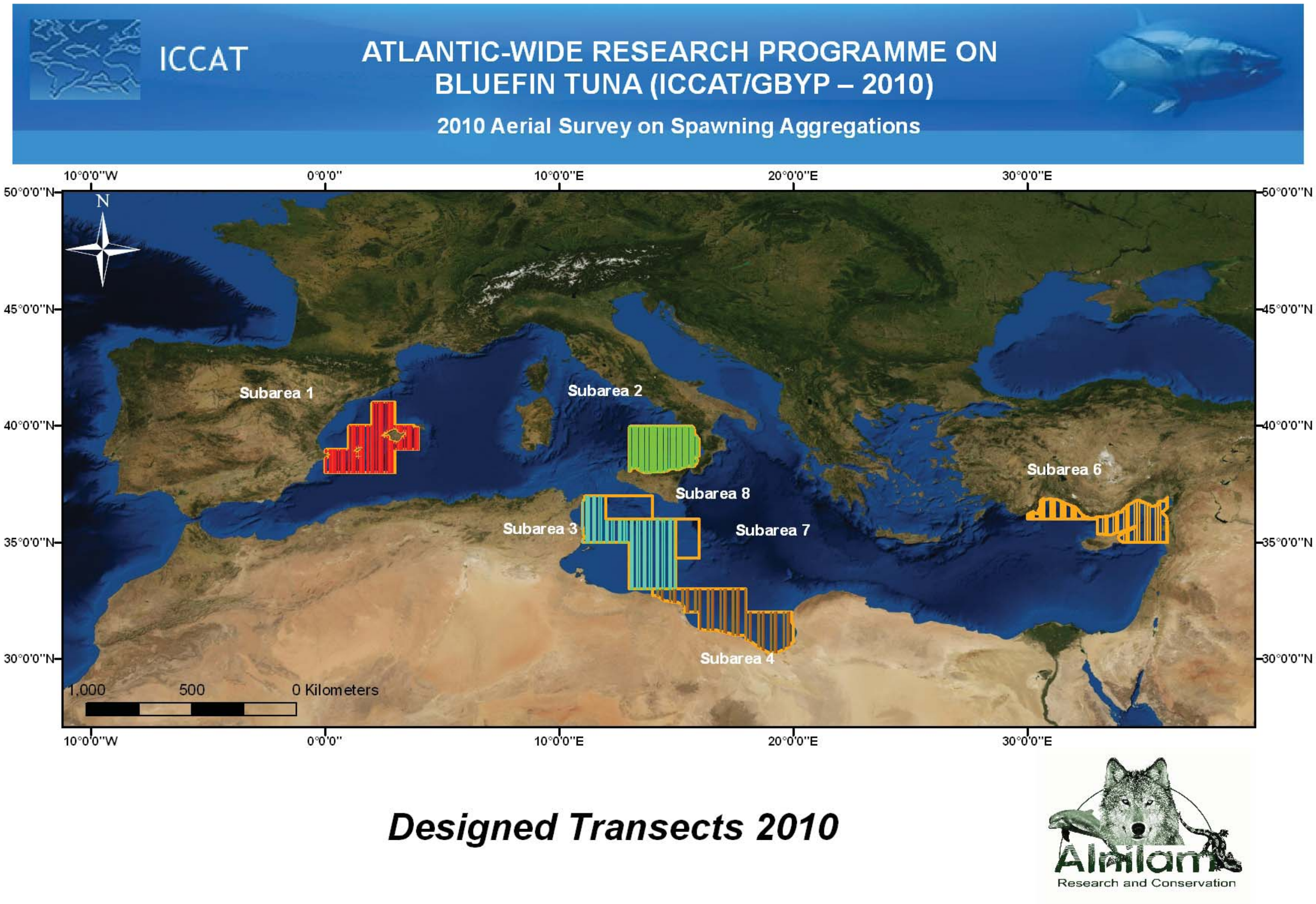

Figure 1. Originally designed transects for sub-areas 1, 2, 3, 4 and 6 (after Hammond *et al.* 2010).

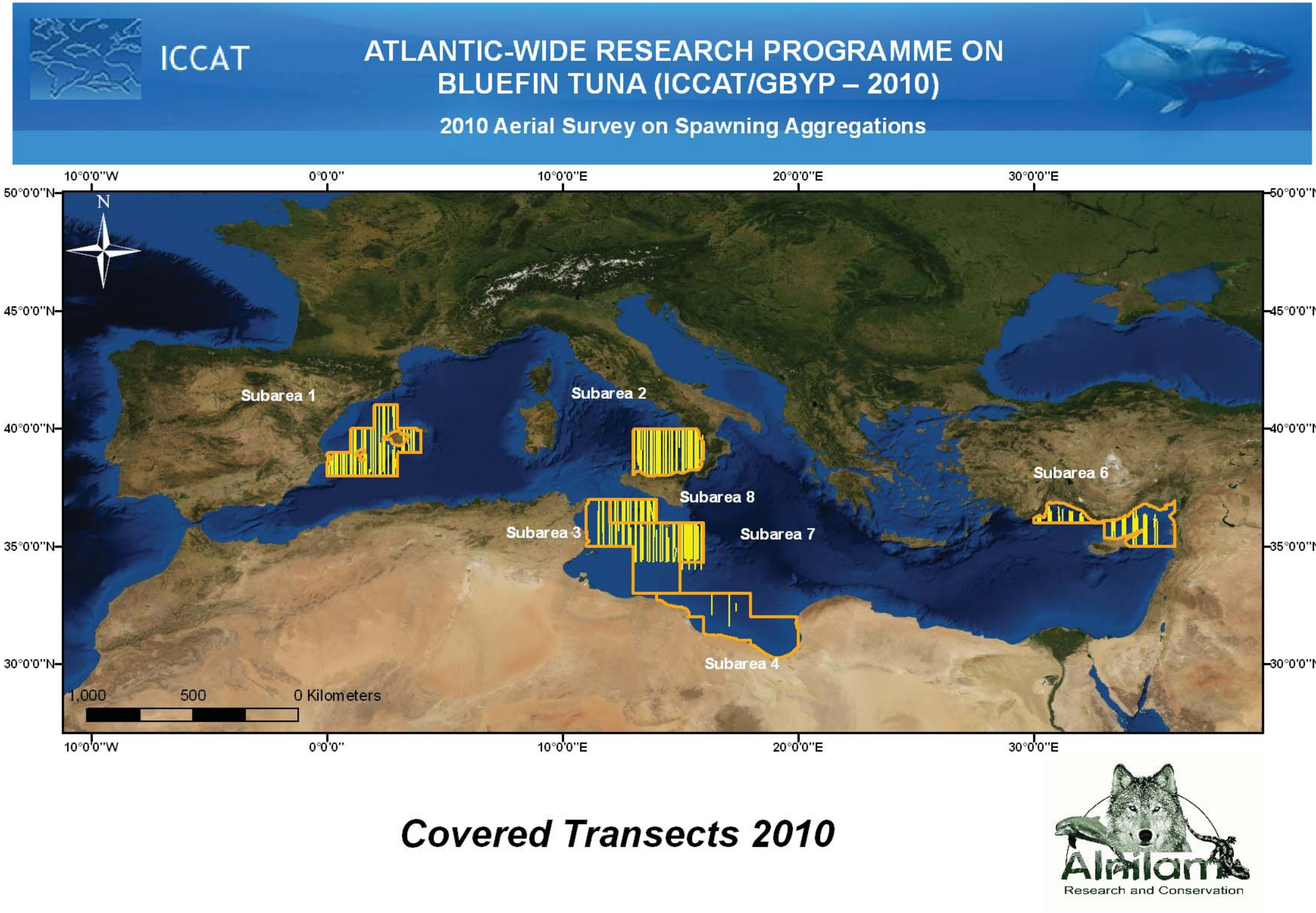

Figure 2. Transects flown on effort in sub-areas 1, 2, 3, 4, 6, 7 and 8.

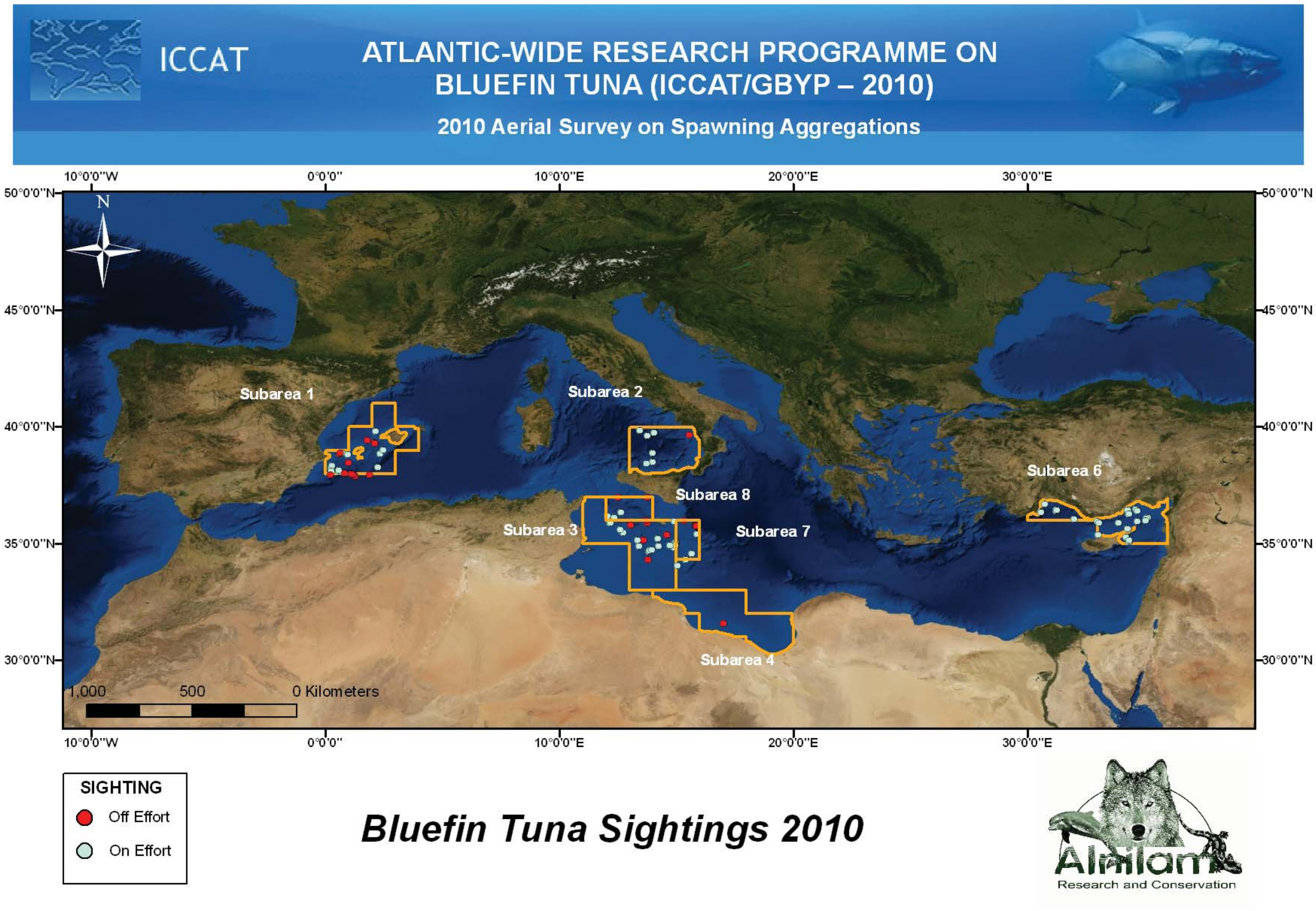

Figure 3. Sightings of bluefin tuna on and off effort in sub-areas 1, 2, 3, 4, 6, 7 and 8.

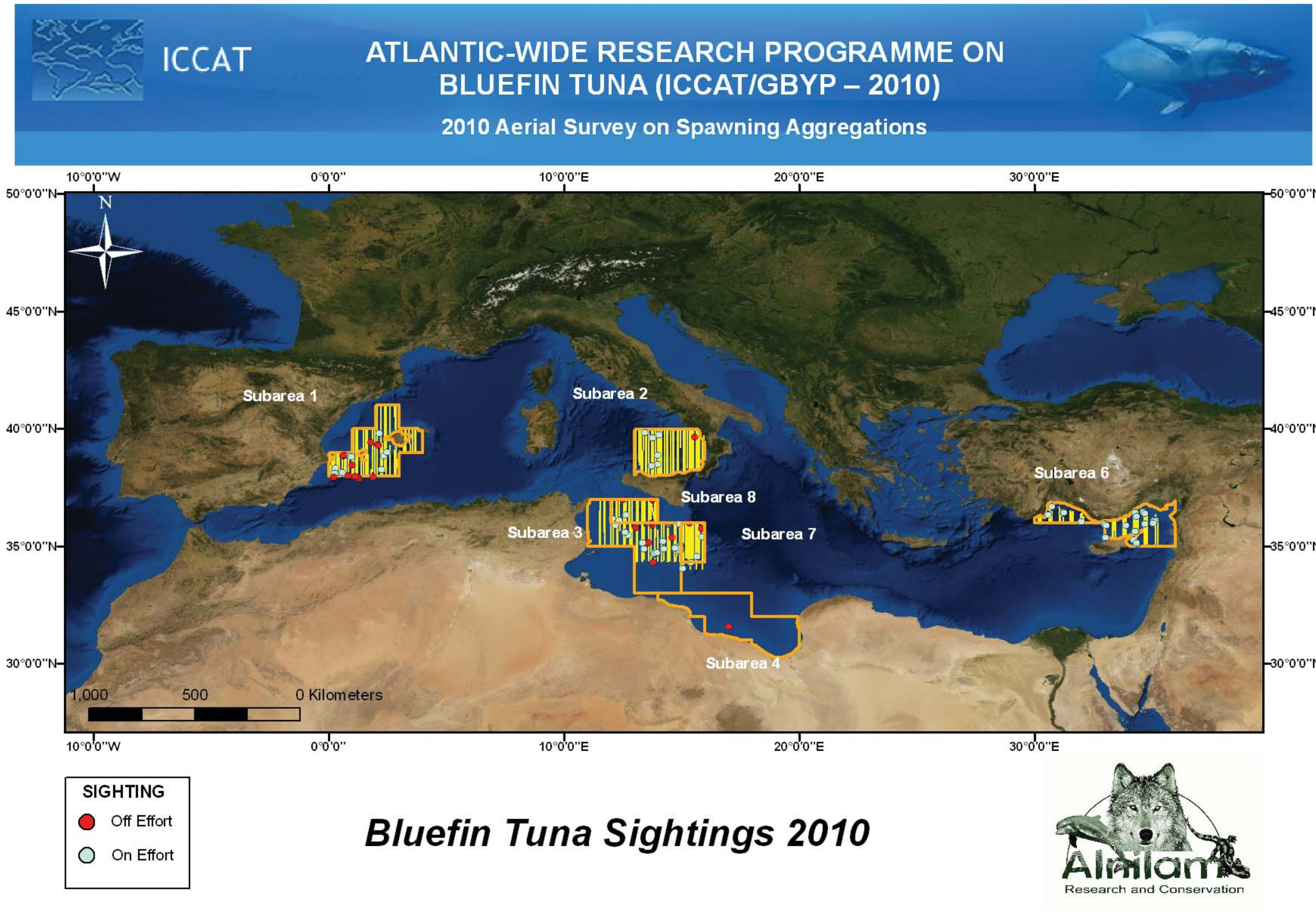

Figure 4. Transects flown and sightings of bluefin tuna on and off effort in sub-areas 1, 2, 3, 4, 6, 7 and 8.

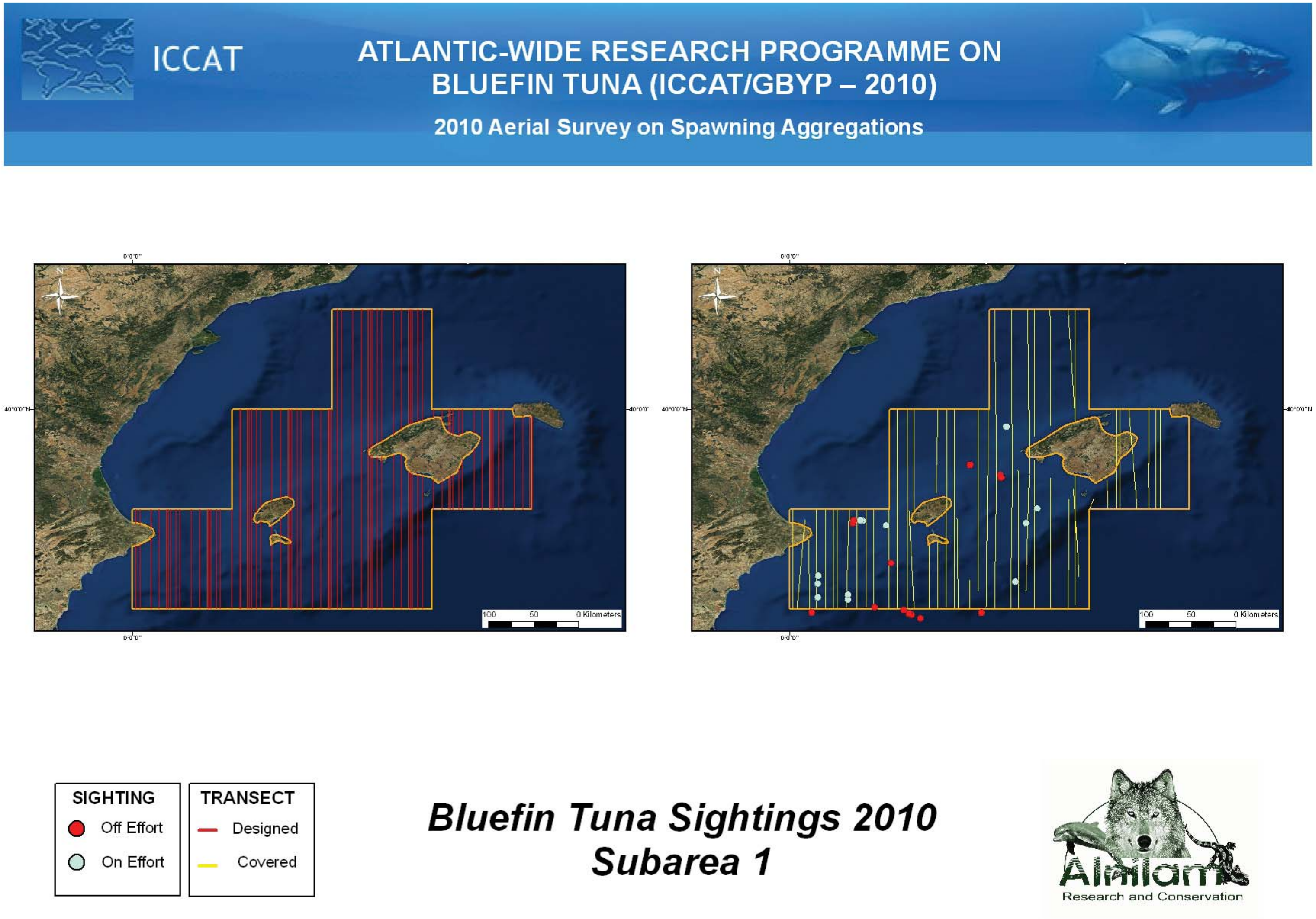

Figure 5. Transects designed and flown, and sightings of bluefin tuna on and off effort in sub-area 1.

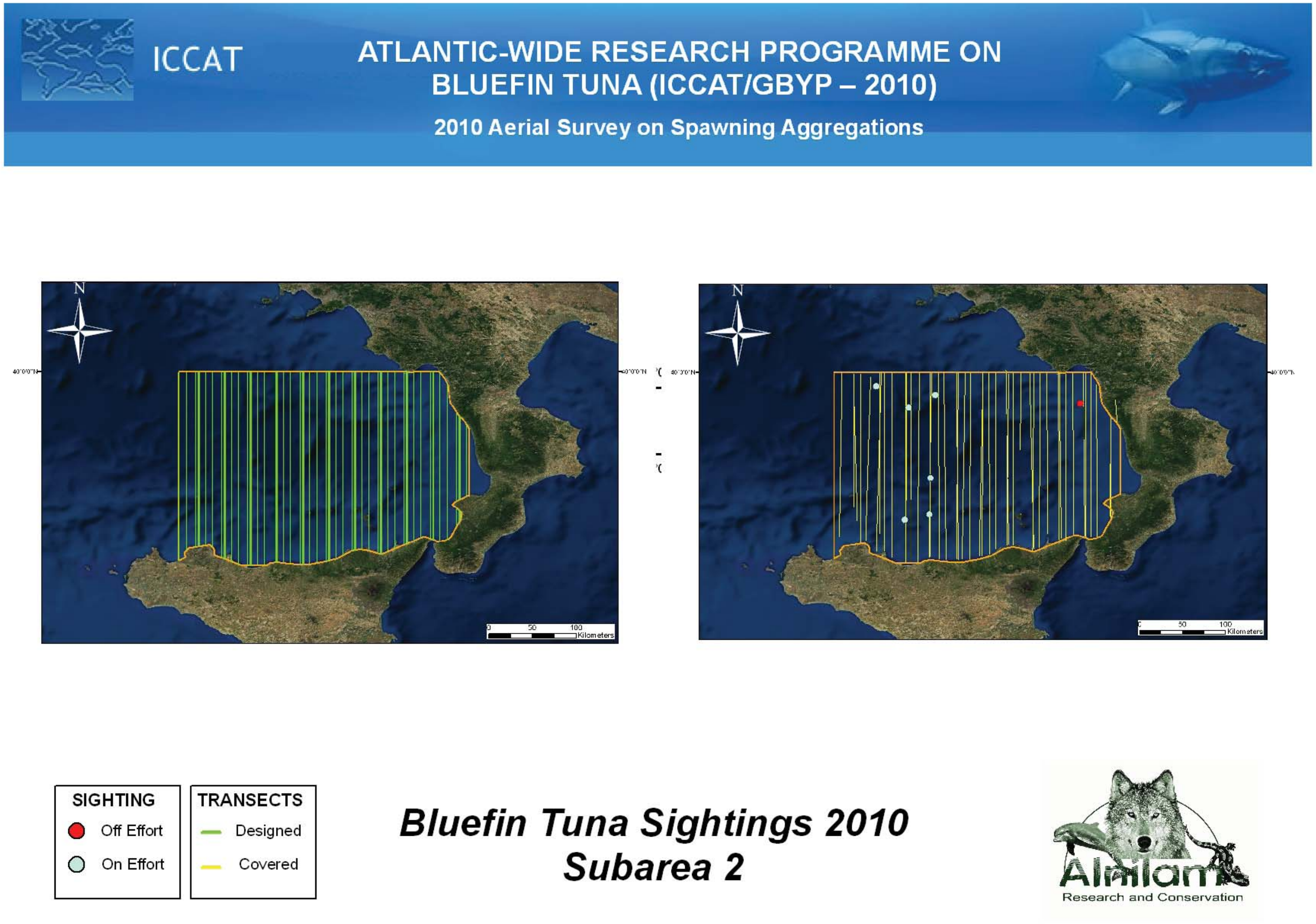

Figure 6. Transects designed and flown, and sightings of bluefin tuna on and off effort in sub-area 2.

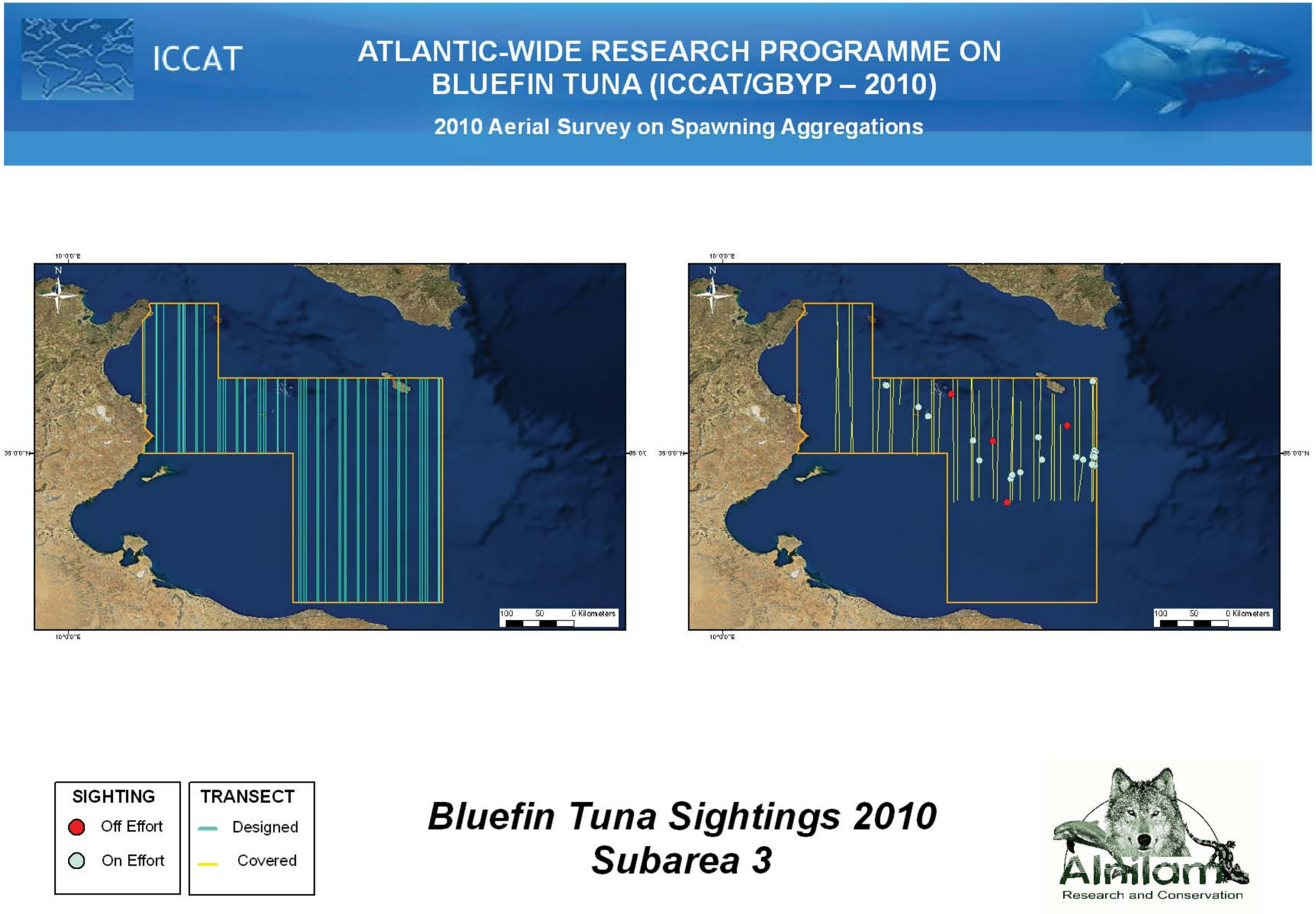

Figure 7. Transects designed and flown, and sightings of bluefin tuna on and off effort in sub-area 3.

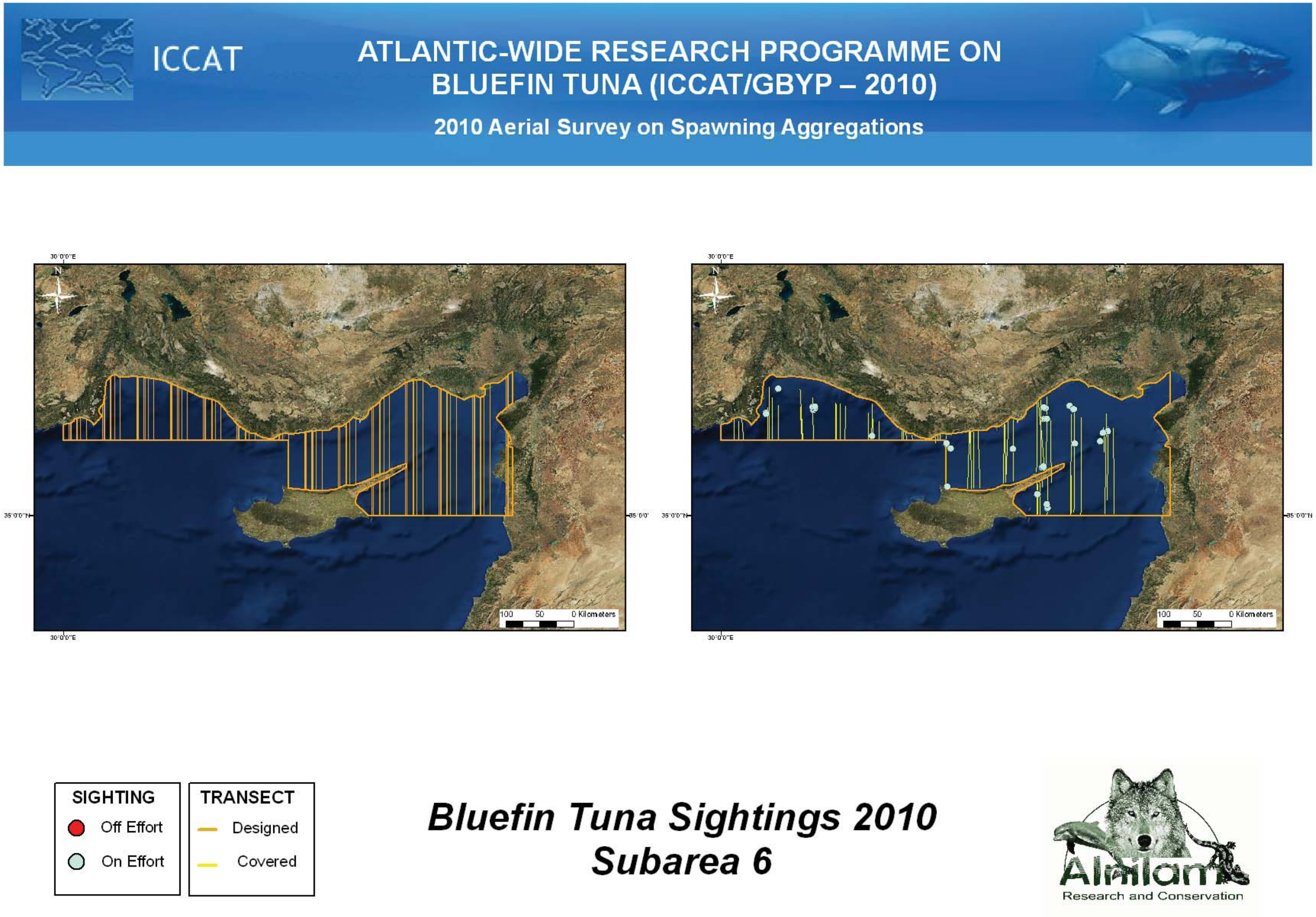

Figure 8. Transects designed and flown, and sightings of bluefin tuna on and off effort in sub-area 6.

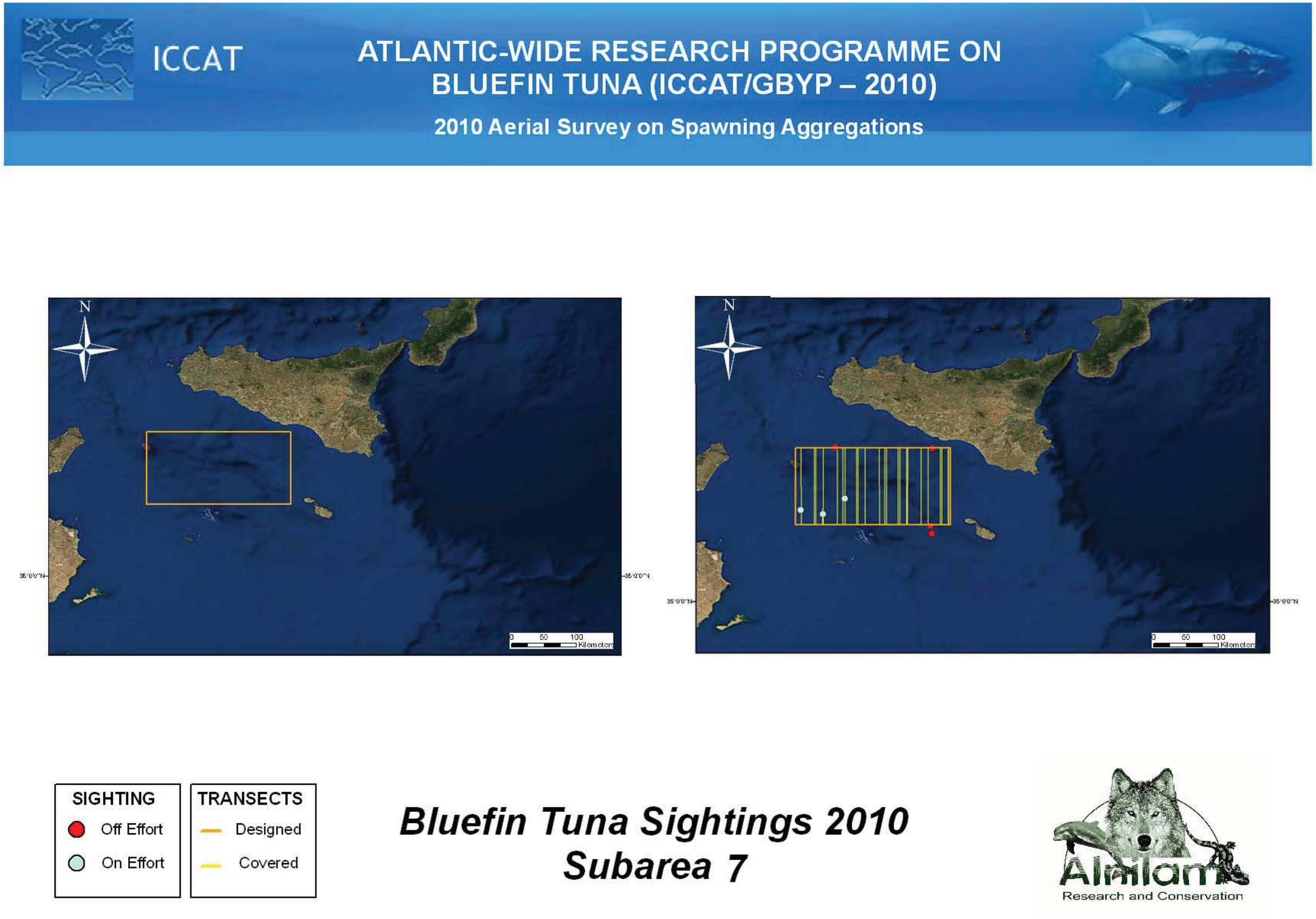

Figure 9. Transects designed and flown, and sightings of bluefin tuna on and off effort in sub-area 7.

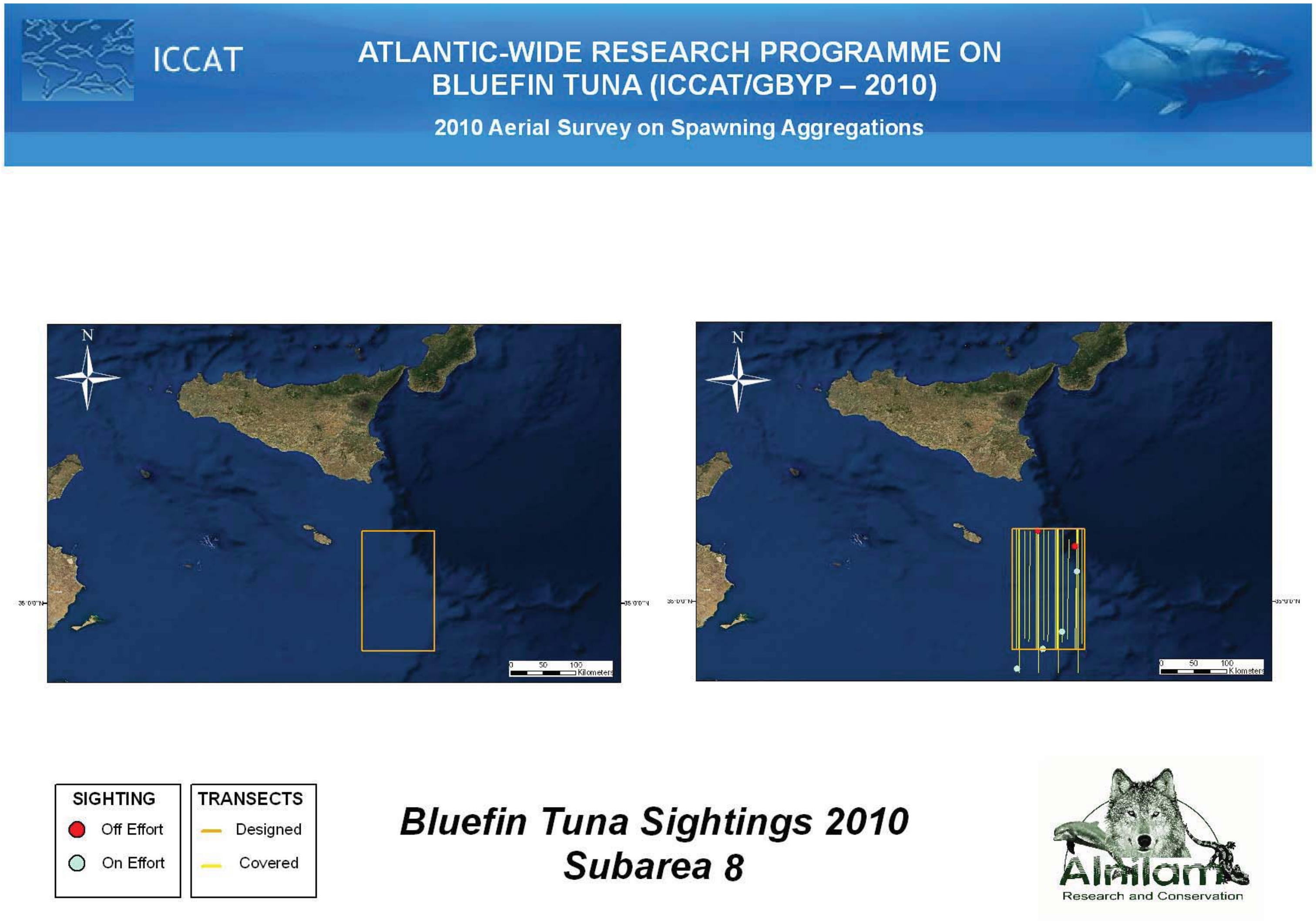

Figure 10. Transects designed and flown, and sightings of bluefin tuna on and off effort in sub-area 8.

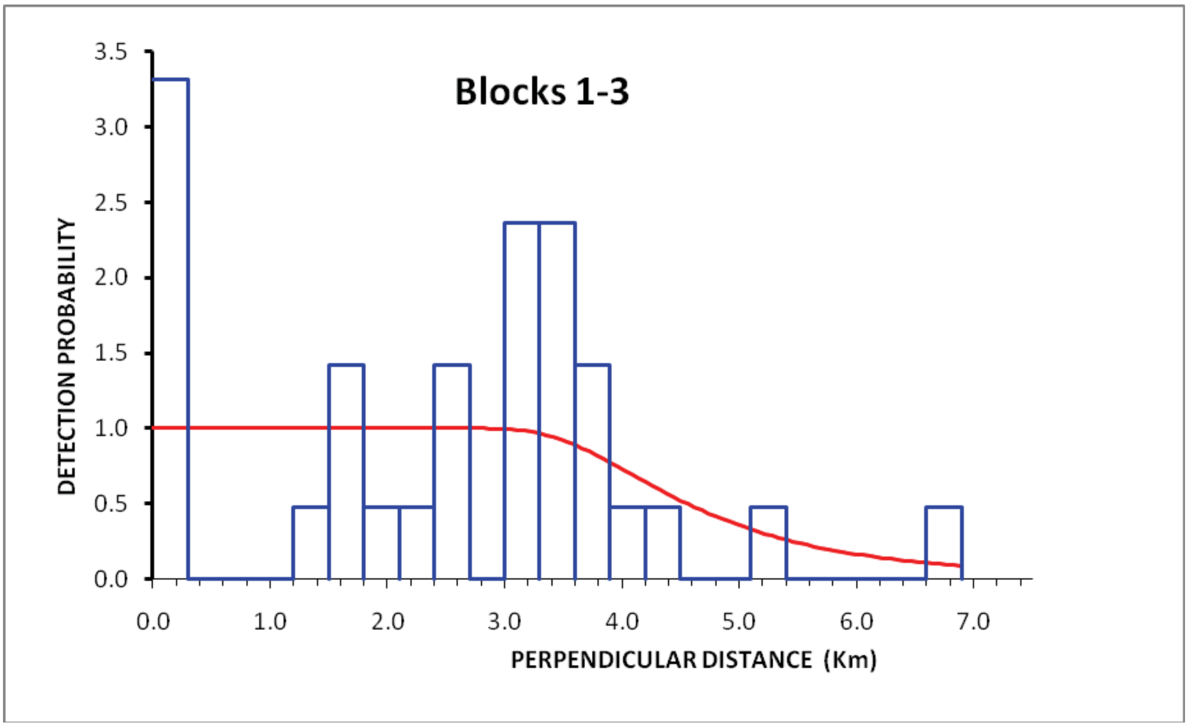

Figure 11. Detection function for sub-areas 1-3 without left truncation, scaled to 1.0 at zero perpendicular distance, and histograms of observed sightings.

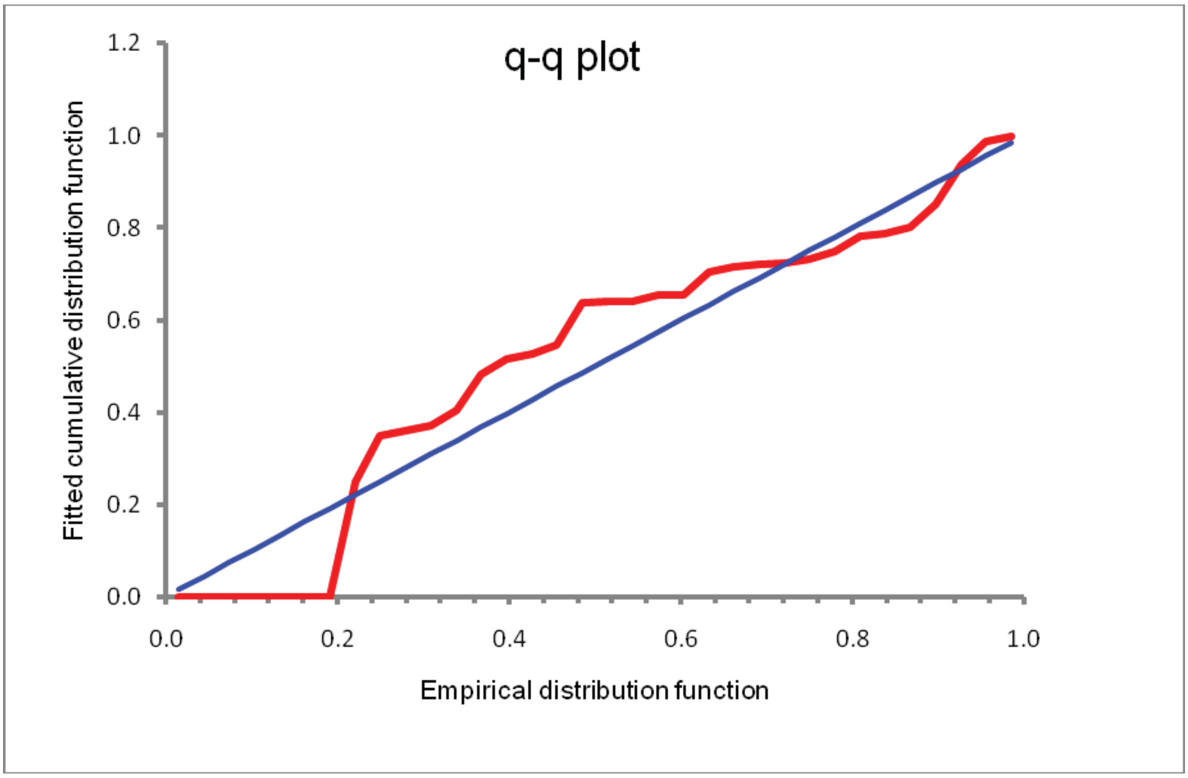

Figure 12. Q-Q plot for sub-areas 1-3 with no left truncation

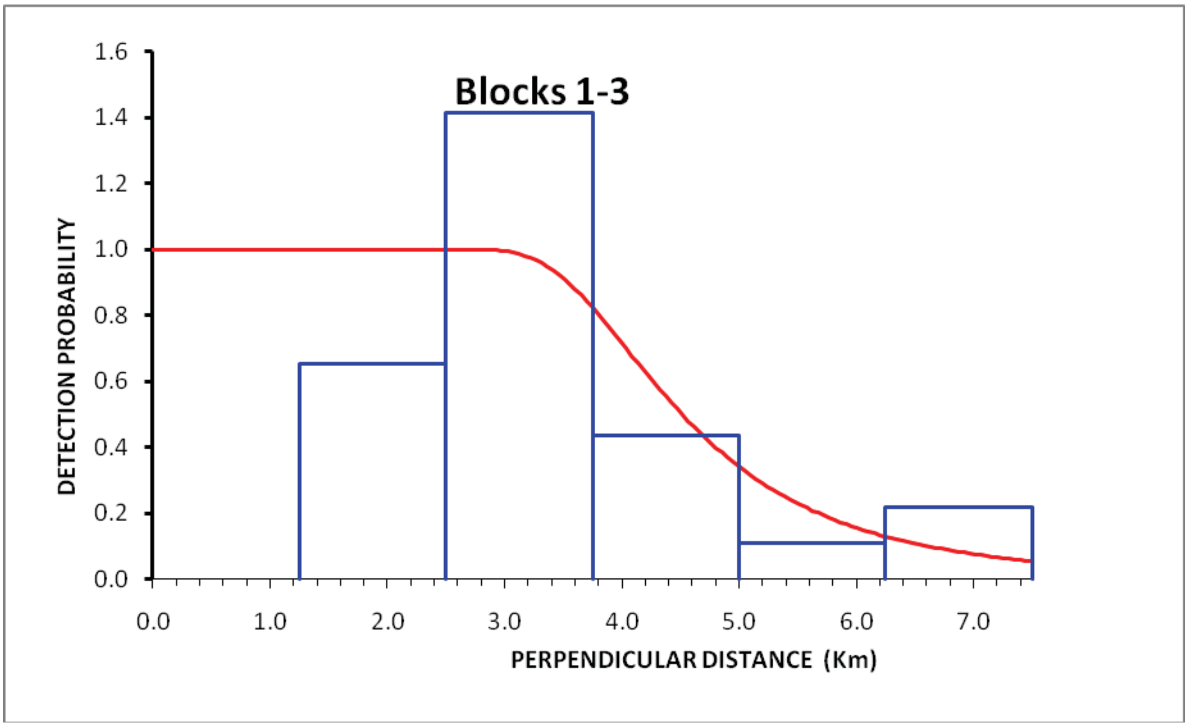

Figure 13. Detection function for sub-areas 1-3 with left truncation at 1.25km, scaled to 1.0 at zero perpendicular distance, and histograms of observed sightings.

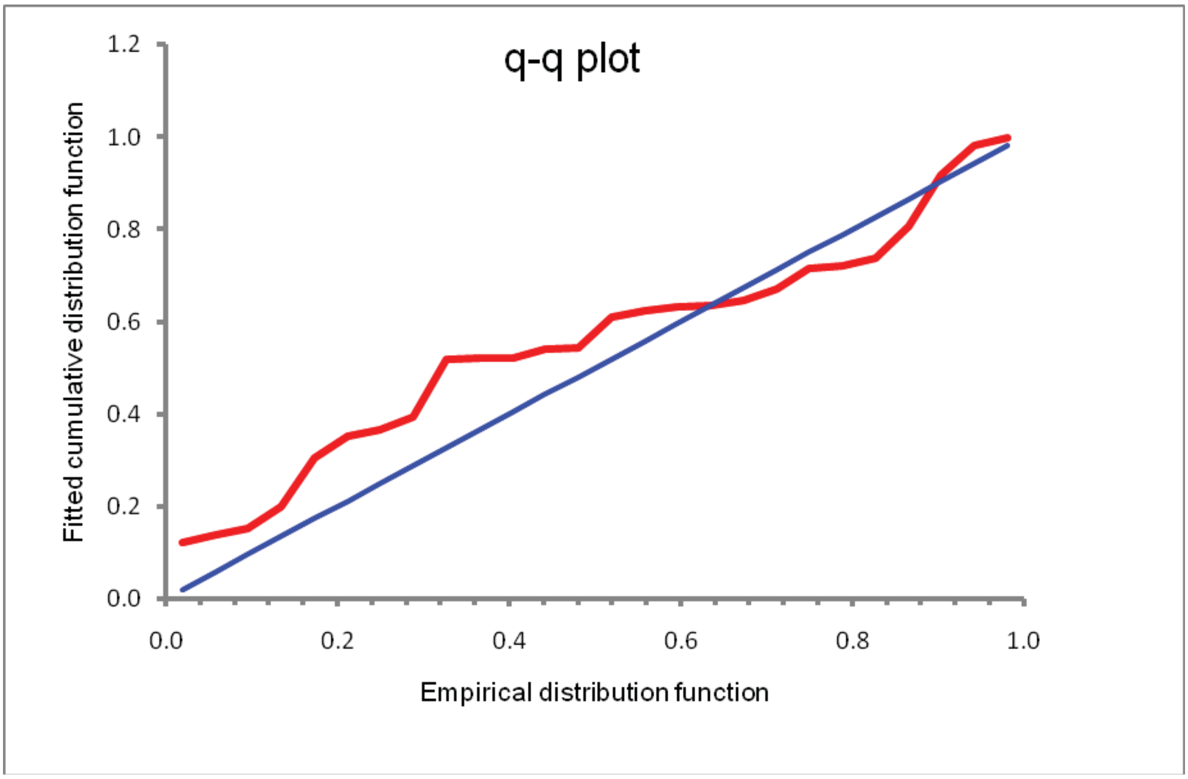

Figure 14. Q-Q plot for sub-areas 1-3 with left truncation

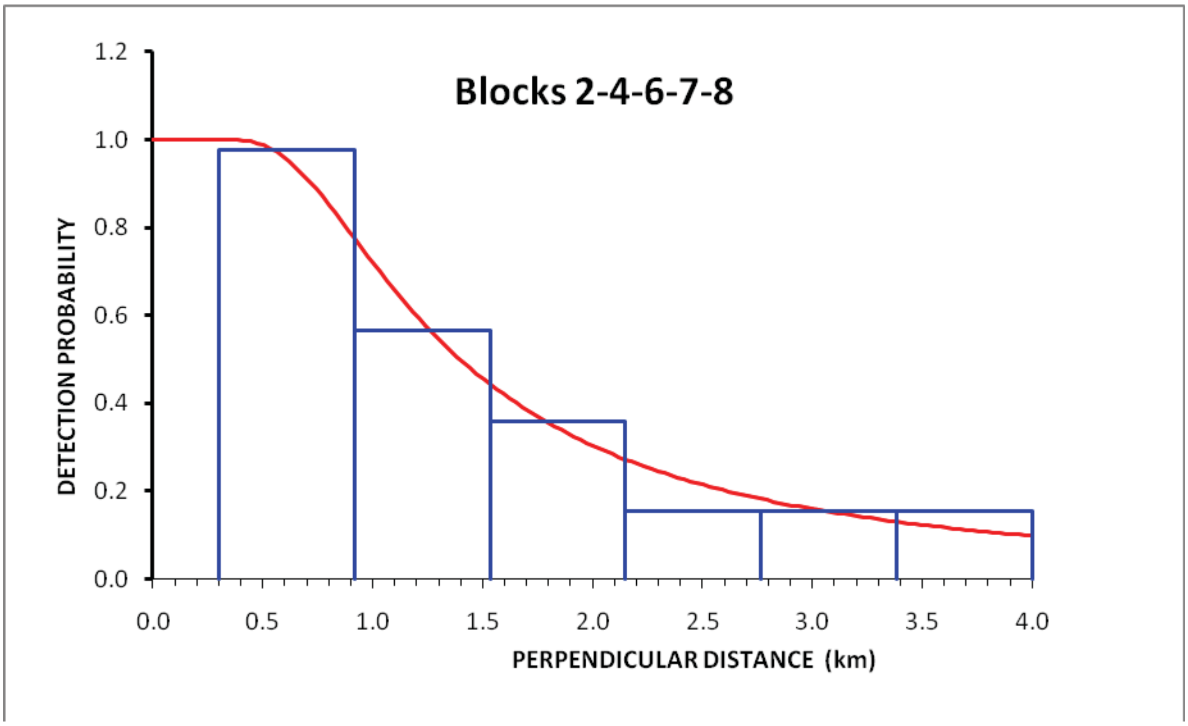

Figure 15. Detection function for sub-areas 2, 4, 6, 7 and 8, scaled to 1.0 at zero perpendicular distance, and histograms of observed sightings.

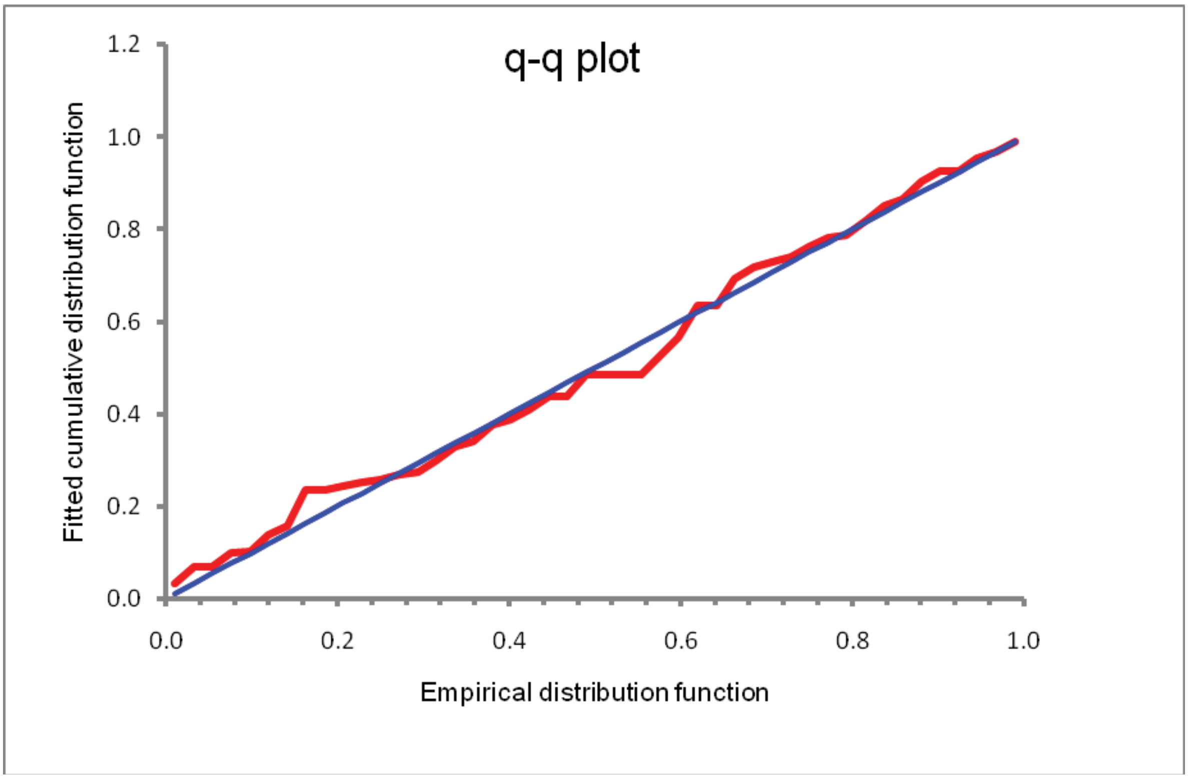

Figure 16. Q-Q plot for sub-areas 2, 4, 6, 7 and 8.

ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP - 2010)

Data Recovery Plan – Elaboration of 2010 Data from sst and the Aerial Survey on Spawning Aggregations

Final Report

03 December 2010

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Background

The comprehensive ICCAT Atlantic Wide Research Programme on Bluefin Tuna (GBYP) aims to improve basic data collection, understanding of key biological and ecological processes, and assessment models and management. An important element of this programme is to carry out aerial line transect surveys of the spawning population in the Mediterranean when and where schools can traditionally be sighted close to the surface to support development of fishery-independent indices.

Under the GBYP Data Recovery Framework it is desired to include an evaluation of the importance of environmental covariates, such as sea surface temperature data, in the aerial survey design. Density surface modelling is an approach that uses physical and environmental data to help explain variation in distribution and density and predict areas that are important for the focal species. When combined with line transect sampling (called the model-based method; Hedley et al. 1999), it is an alternative technique to conventional line transect sampling (design-based method; Hiby and Hammond 1989; Buckland et al. 2001).

Objectives

To fit spatial models, using methods (density surface modelling) described in Cañadas & Hammond (2006; 2008), to explore the relationship between bluefin tuna density and environmental covariates.

To provide maps of the predicted densities of bluefin tuna in the survey blocks.

Data

Data availability

The 2010 aerial survey data were already available to the authors from a previous contract with Hammond, Cañadas & Vázquez (2010). Sea surface temperature (sst) data were made available by ICCAT in electronic format at a resolution of 0.25°x0.25° for May, June and July 2010. Figure 1 shows the survey areas and the effort transects and Figure 2 shows the bluefin tuna sightings. Figures 10 to 20 (in Annex) show the mean sea surface temperature for the months of June and July and for each week in those months.

Data processing

Environmental data

A grid of cells was built for the whole Mediterranean with the same resolution as the sst data provided (0.25ºx0.25º). These cells were populated with the sst as well as other potential covariates available to the proposers (see Table 1 for a complete list).

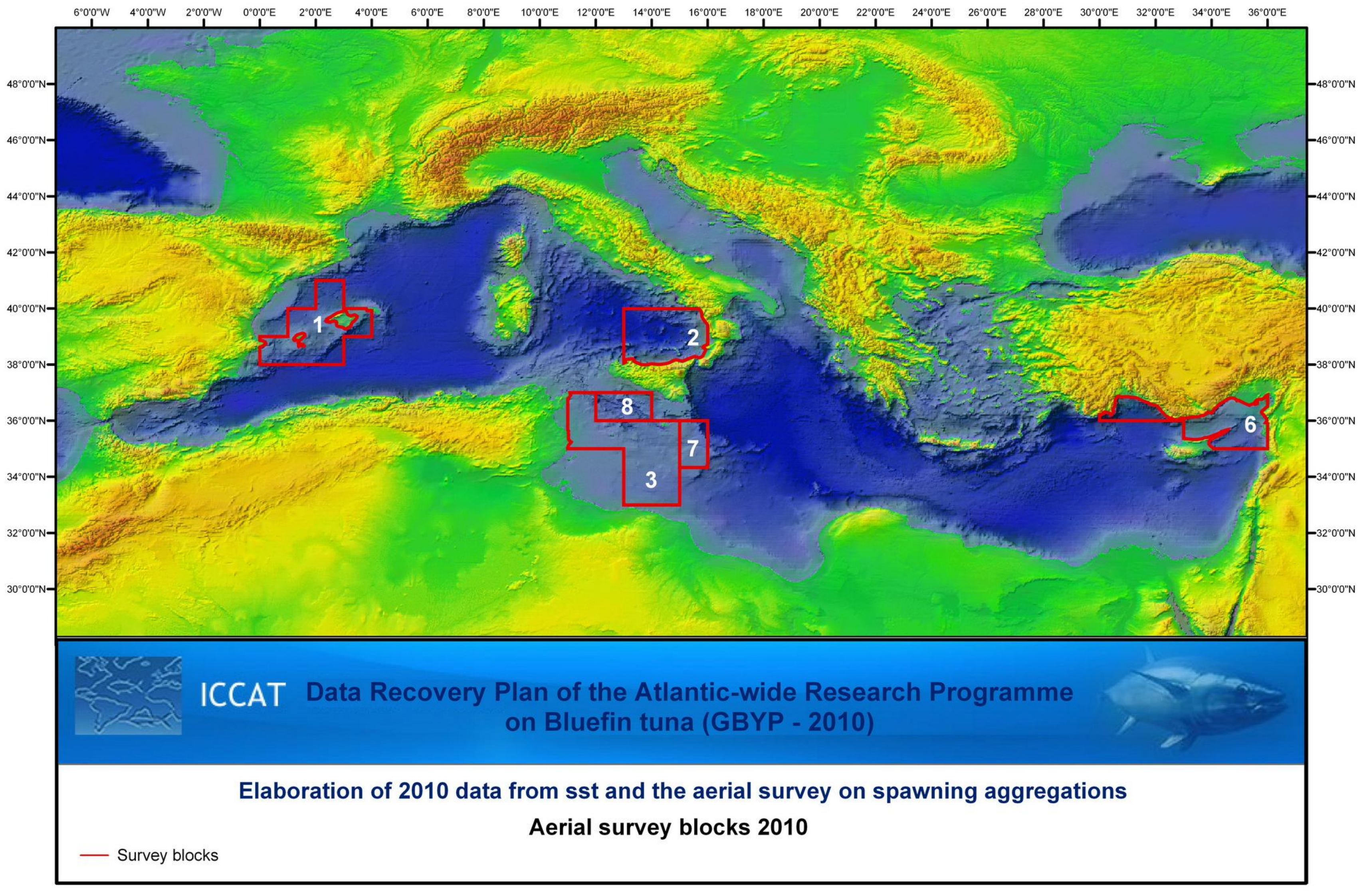


Figure 1a. Aerial survey blocks considered in the analysis

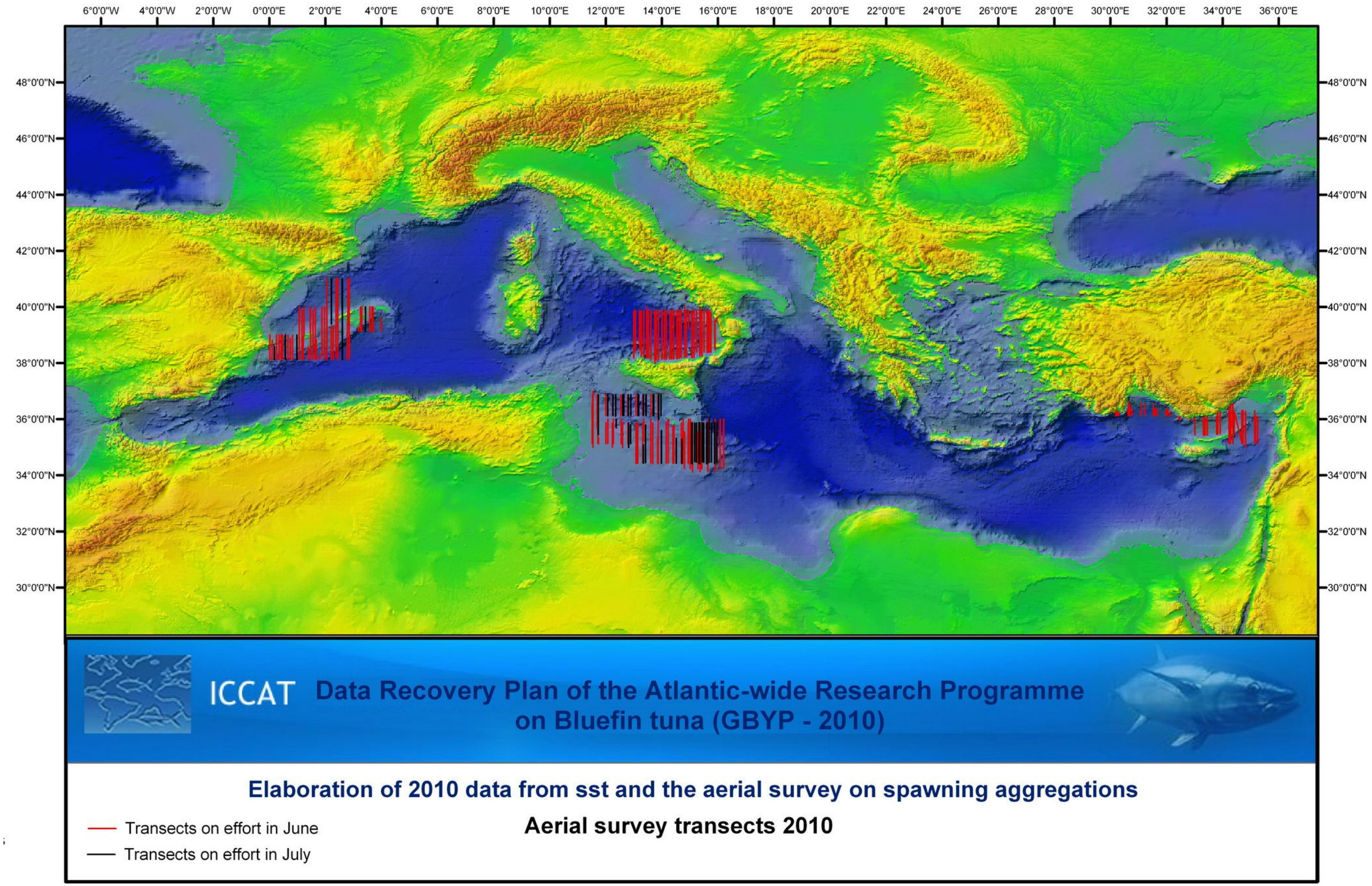


Figure 1b. Aerial survey transects. Transects in June are shown in red and transects in July are shown in black.

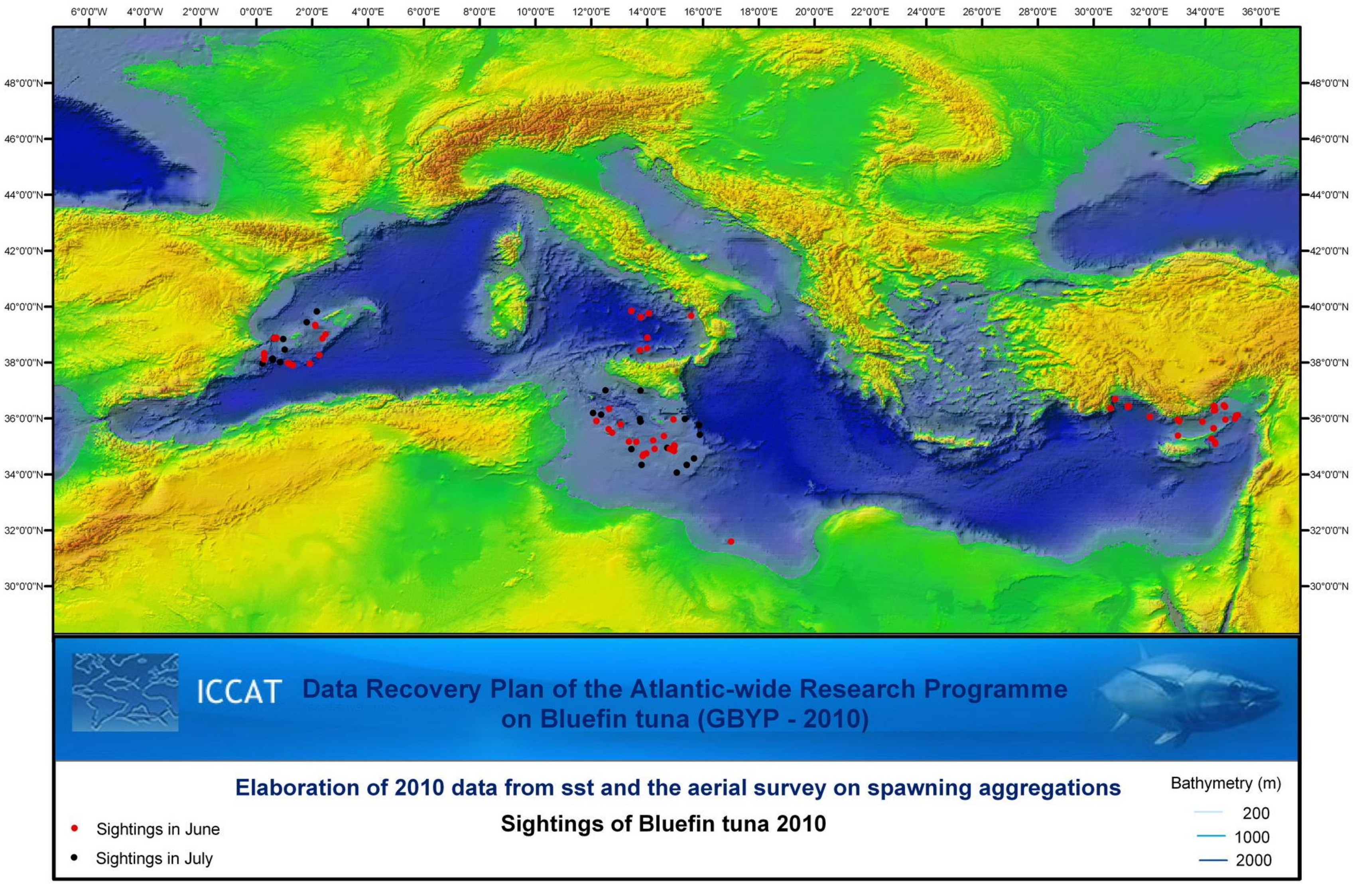


Figure 2. Sightings of bluefin tuna. Sightings in June are shown in red and sightings in July are shown in black.

Table 1. List of covariates tested in the spatial models for significance in their contribution to explain spatial distribution of sightings of bluefin tuna

Covariate	Description	Origin
Latitude	Latitude in decimal degrees	
Longitude	Longitude in decimal degrees	
Depth_mean	Mean depth within the grid cells	ETOPO 2v2 (http://www.ngdc.noaa.gov/mgg/fliers/01mgg04.html)
Depth_sd	Standard deviation of depth within the grid cells: measure of complexity of sea floor	Derived from ETOPO 2v2 data
Depth_CV	Coefficient of variation of depth within the grid cells: measure of complexity of sea floor	Derived from ETOPO 2v2 data
Ci	Contour Index: combined measure of depth and slope	(max_depth - min_depth)*100/max_depth
Dist200	Distance from the centre of the grid cell to the nearest point on the 200m depth contour	GIS
Dist1000	Distance from the centre of the grid cell to the nearest point on the 1000m depth contour	GIS
Dist2000	Distance from the centre of the grid cell to the nearest point on the 2000m depth contour	GIS
Aspect	Orientation of the sea floor relative to North	GIS
Sst_day	Sst in the grid cell on the day the segment of effort occurred	Derived from sst provided by ICCAT
Sst_week	Mean sst in the grid cell in the week the segment of effort occurred	Derived from sst provided by ICCAT
Sst_month	Mean sst in the grid cell in the month the segment of effort occurred	Derived from sst provided by ICCAT
Sst_mean2	Running average of sst on the day and the day before the segment of effort occurred	Derived from sst provided by ICCAT
Sst_mean3	Running average of sst on the day and the two days before the segment of effort occurred	Derived from sst provided by ICCAT
Sst_mean5	Running average of sst on the day and the four days before the segment of effort occurred	Derived from sst provided by ICCAT

Effort segments and sightings

Aerial survey effort data were organized into segments of similar length and searching conditions, which comprised the sampling units for spatial modelling. This process was done in a way so that each segment fit exactly inside one grid cell (not sharing grid cells). This process yielded a total of 1351 segments (i.e. sampling units) of average length 24 nmi.

All segments were associated with the covariates in Table 1, according to the grid cell in which they fell.

The estimated numbers of groups (obtained through the Horvitz-Thompson estimator, see equation 1) were associated to their corresponding segment of effort (assigning 0 to the remaining segments), and this value was used as response variable for the models. Of the 1351 segments of effort, 61 (4.5%) had associated bluefin tuna sightings, for a total of 110 sightings.

Data analysis

Initial exploration of data

The data were explored initially in two ways: (a) frequency distributions of the data for some covariates were produced for all segments and also only for segments containing sightings, and (b) the two-sample Kolmogorov-Smirnov non-parametric test was applied to all covariates comparing all segments with only those segments containing sightings, assuming the null hypothesis that the samples are drawn from the same distribution.

Spatial modelling

Generalised Additive Models (GAMs) were used to model bluefin tuna density as a function of the available covariates.

The response variable used to formulate a spatial model of abundance of groups was the estimated number of groups ($\hat{N}$) in each segment, rather than the actual counts (Hedley et al. 1999). They were estimated through the Horvitz-Thompson estimator (Horvitz & Thompson 1952), where the probability of detection was obtained from the detection function fitted to the data:

$$\hat{N}_i = \sum_{j=1}^{n_i} \frac{1}{\hat{p}_{ij}} \qquad (1)$$

where n_i is the number of detected groups in the i^{th} segment, and $\hat{p}_{ij}$ is the estimated probability of the j^{th} detected group in segment i, obtained from the detection function.

The abundance of groups was modeled using a Generalized Additive Model (GAM) with a logarithmic link function. A Poisson error distribution was not considered appropriate for the response variable due to over-dispersion. Therefore, a quasi-poisson family was used, with variance proportional to the mean. The general structure of the model was:

$$\hat{N}_i = \exp\left[\ln(a_i) + \theta_0 + \sum_k f_k(z_{ik})\right] \qquad (2)$$

where the offset a_i is the searched area for the i^{th} segment (calculated as the length of the segment multiplied by two times the truncation distance), θ_0 is the intercept, f_k are smoothed functions of the explanatory covariates, and z_{ik} is the value of the k^{th} explanatory covariate in the i^{th} segment.

Models were fitted using package 'mgcv' version 1.6-2 for R (Wood 2001). Automated model selection by a stepwise procedure was not yet implemented in the version of R used (2.11.1) (http://cran.r-project.org). Therefore, manual selection of the models was done using three indicators: (a) the GCV

(General Cross Validation score) which is in practice an approximation to AIC (Wood 2000) and in which smoothing parameters (in terms of number of knots and degrees of freedom) are chosen by the software to minimize the GCV score for the model, unless they are directly specified; (b) the percentage of deviance explained; and (c) the probability that each variable is included in the model by chance. The decision to drop a term from the model was adopted following the criteria proposed by Wood (2001). In all models, a visual inspection of the residuals was also made, especially to look for trends.

The best model was used to predict bluefin tuna distribution, in a stratified fashion, within all the survey blocks. As an exploratory "experiment", a prediction was also produced for the whole Mediterranean Sea. The final model was predicted for each week from 29 May to 1 August to show potential variability in the predicted densities as the sst changes with time in the Mediterranean.

Attempts were made also to model the weight of the schools as a function of the environmental covariates available, but no relationship could be found. Therefore, the estimated mean weight of bluefin tuna per block obtained from the distance sampling analysis was used.

To obtain the final prediction of bluefin tuna weight in the survey blocks, the predicted abundance of groups in each block was multiplied by the mean weight of the block. The same was done for the whole Mediterranean using the mean weight of all sightings across blocks.

The predictions produced by the spatial models were saved in the same grid of cells, and plotted in a G.I.S.

Results

Initial exploration of data

Visual inspection of the histograms showed the difference in frequency distribution between all segments and segments containing sightings for the sst covariates, and the lack of difference for depth-related covariates. As examples, Figure 3 shows histograms for covariates sst_day, depth_mean and dist2000.

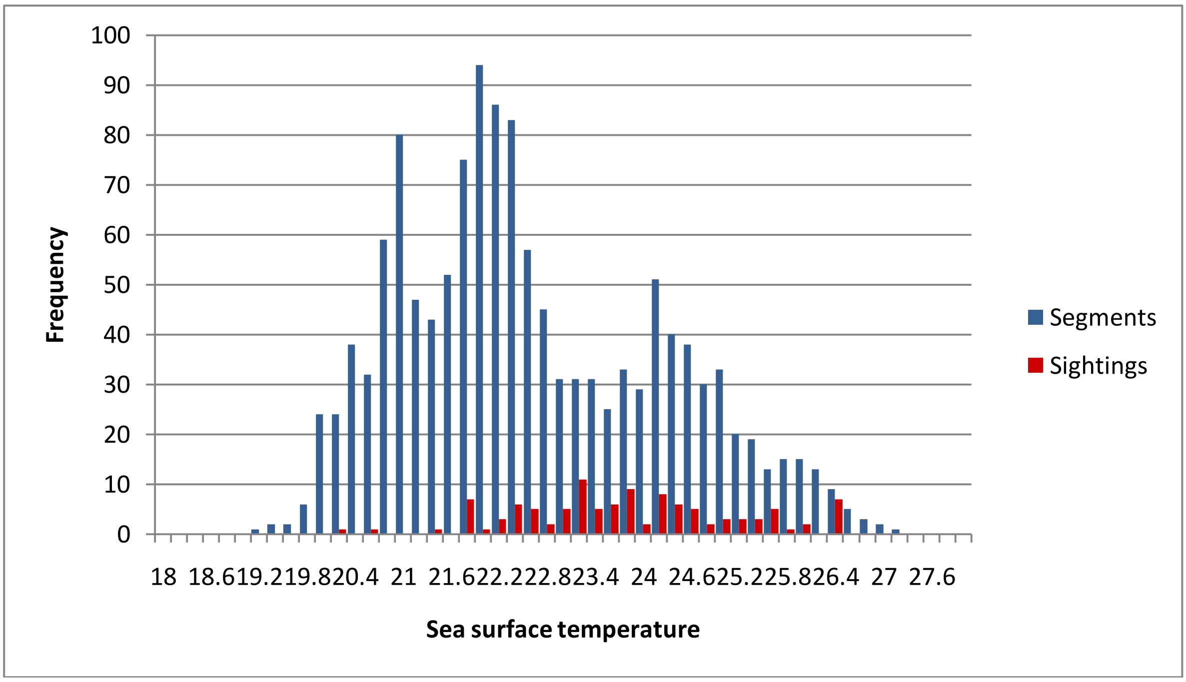


Figure 3a. Frequency distribution of daily sea surface temperature (sst_day) for all segments (in blue) and segments containing sightings (red).

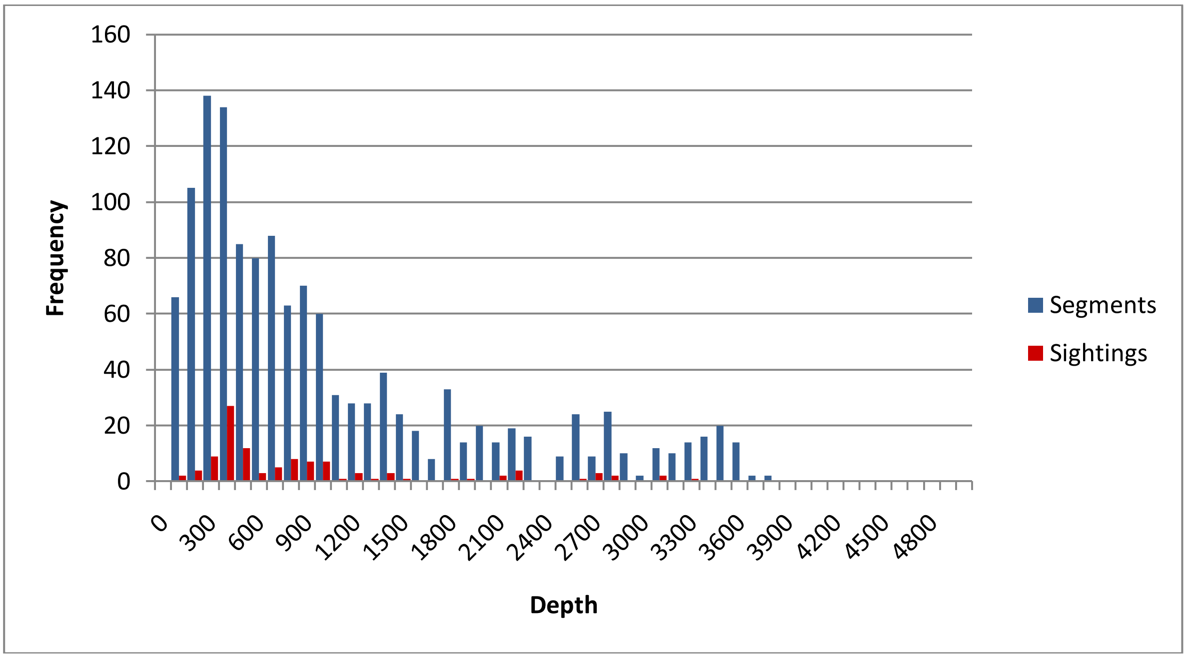


Figure 3b. Frequency distribution of mean depth (depth_mean) for all segments (in blue) and segments containing sightings (in red).

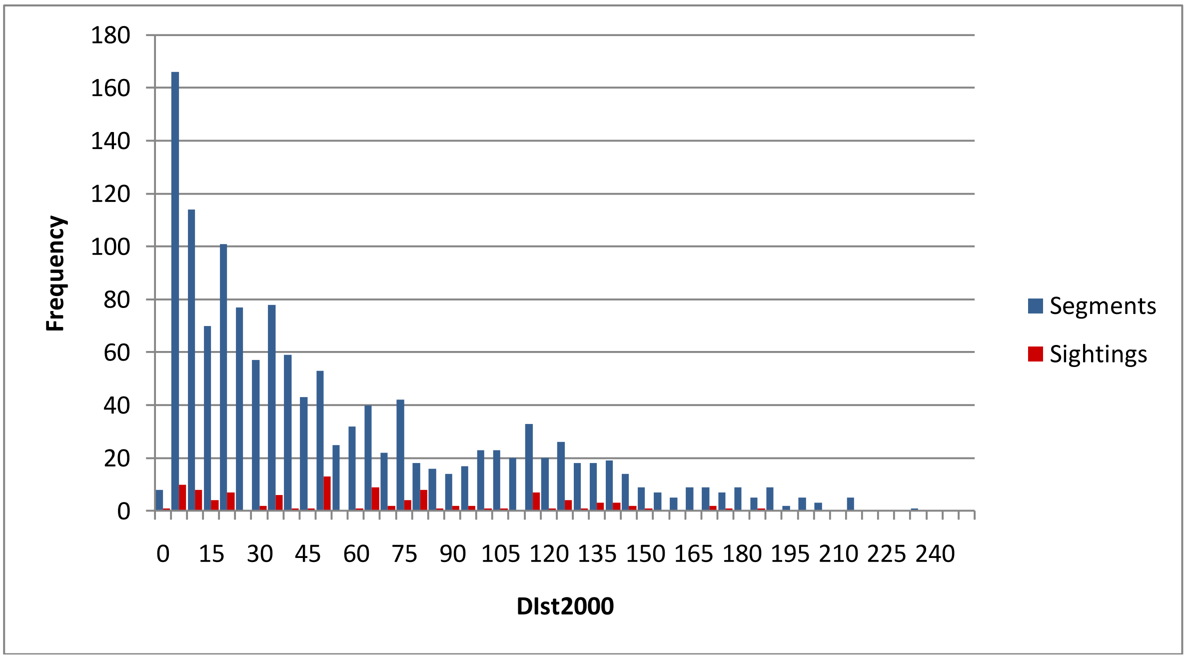


Figure 3c. Frequency distribution of distances to the 2000m depth contour (Dist2000) for all segments (in blue) and segments containing sightings (in red).

Table 2 shows the results of the Kolmogorov-Smirnov tests for all covariates. All the sst covariates were highly significant, but only two of the depth related covariates were significant (distance from the 1000m and the 2000m depth contours) and much less so than the sst covariates.

Table 2. Results of Kolmogorov-Smirnov tests to compare the distribution of all segments with that of only those segments with sightings. In bold, significant differences (rejection of null hypothesis) at α=0.01.

Covariate	Parameter D	P value
Depth_mean	0.1081	0.1856
Depth_sd	0.1164	0.1268
Depth_CV	0.1236	0.0896
Ci	0.1055	0.2074
Dist200	0.1169	0.1242
Dist1000	0.1792	**0.0029**
Dist2000	0.2085	**0.0003**
Aspect	0.1508	0.0195
Sst_day	0.4023	**<0.0001**
Sst_week	0.3236	**<0.0001**
Sst_month	0.2469	**<0.0001**
Sst_mean3	0.4005	**<0.0001**
Sst_mean5	0.3966	**<0.0001**

Spatial modelling

Figures 4 to 8 show the smooth functions for the individual sea surface temperature related covariates. The daily, 2-day running average and weekly means show a very similar pattern, while the 3-day and 5-day running averages show a different pattern. Nevertheless, in all cases the trend is for higher densities towards higher temperatures, although there is a high response also around 23º for the mean for 3 and 5 day running averages. All these covariates were highly significant, but the one that better fits the data is that of sst_day (deviance explained= 17.5%, GCV=0.992), closely followed by sst_mean5 (DE=16.7%, GCV=1.000), sst_mean3 (DE=16.0%; GCV=1.008), sst_mean2 (DE=15.9%, GCV=1.011), and sst_week (DE=14.3%, GCV=1.029).

The best model included two covariates: sst_day (sea surface temperature during the day the segments of effort were carried out) and depth_mean. This model explained 21.4% of the deviance and both covariates were highly significant. Figure 9 shows the smooth functions for these two covariates fitted in the same model.

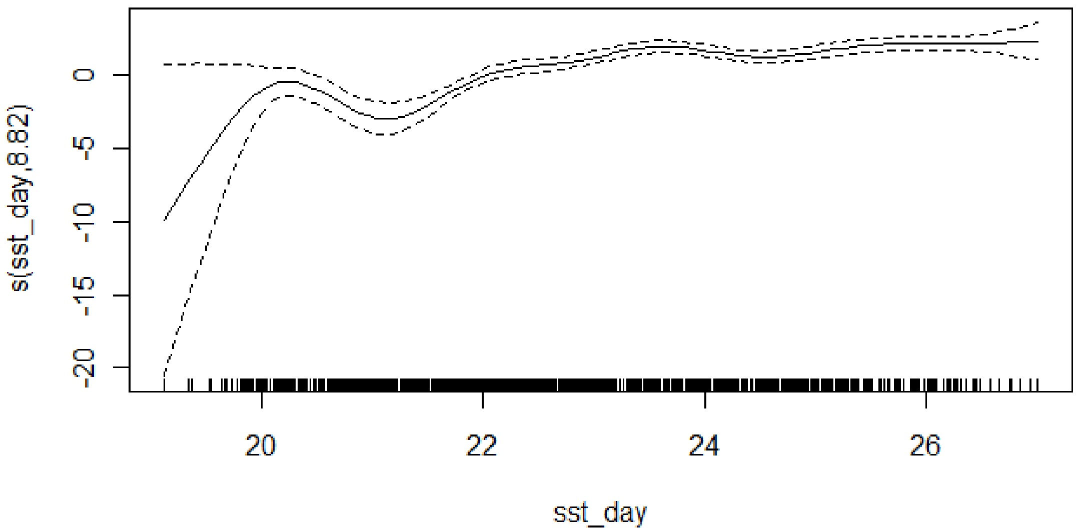


Figure 4. Smooth function for the daily sea surface temperature (sst_day). The ticks on the x axis show the distribution of the samples used in the model (the effort segments) for each covariate. The dashed lines represent ±1 se. When the line of the smooth function goes above 0 in the y axis (showing a relative index of density), it means that the covariate has a positive effect on the response variable (estimated number of groups), and *vice versa*.

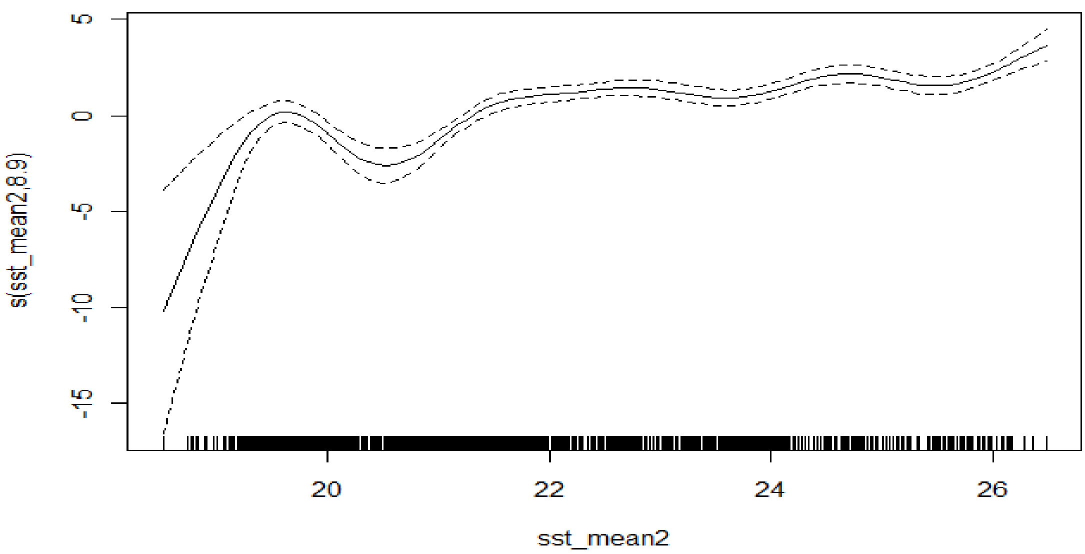


Figure 5. Smooth function for the 2-days running average of surface temperature (sst_mean2).

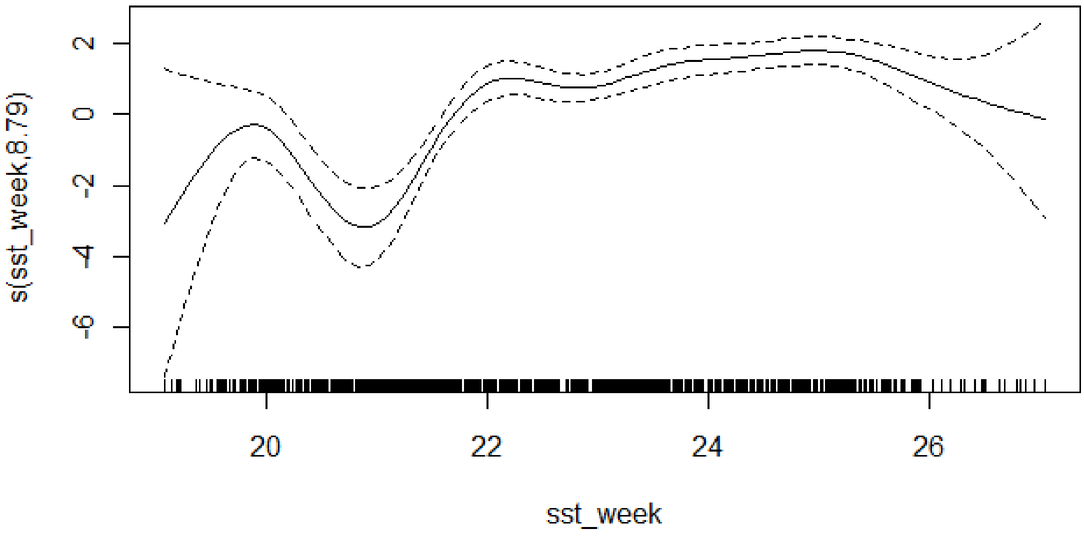


Figure 6. Smooth function for the weekly average of surface temperature (sst_week).

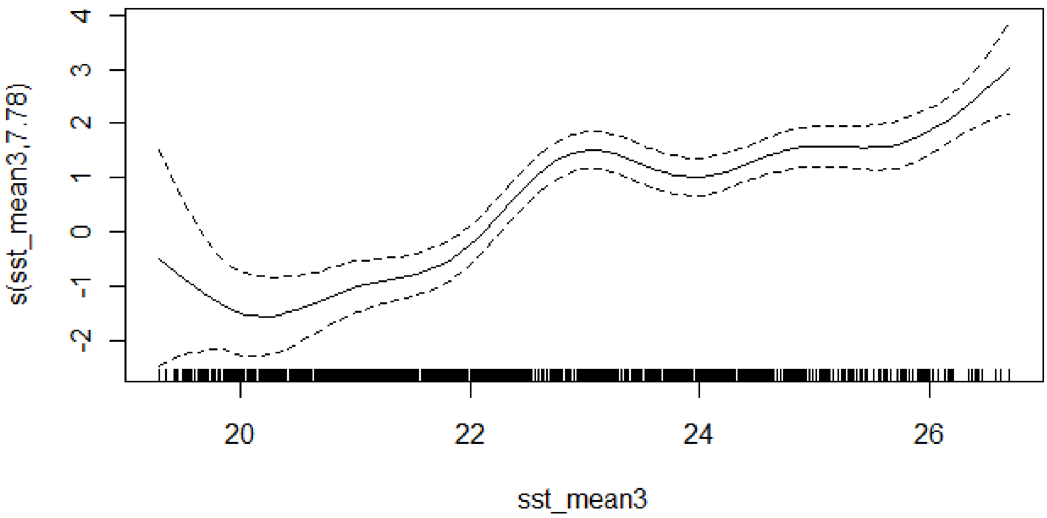


Figure 7. Smooth function for the 3-days running average of surface temperature (sst_mean3).

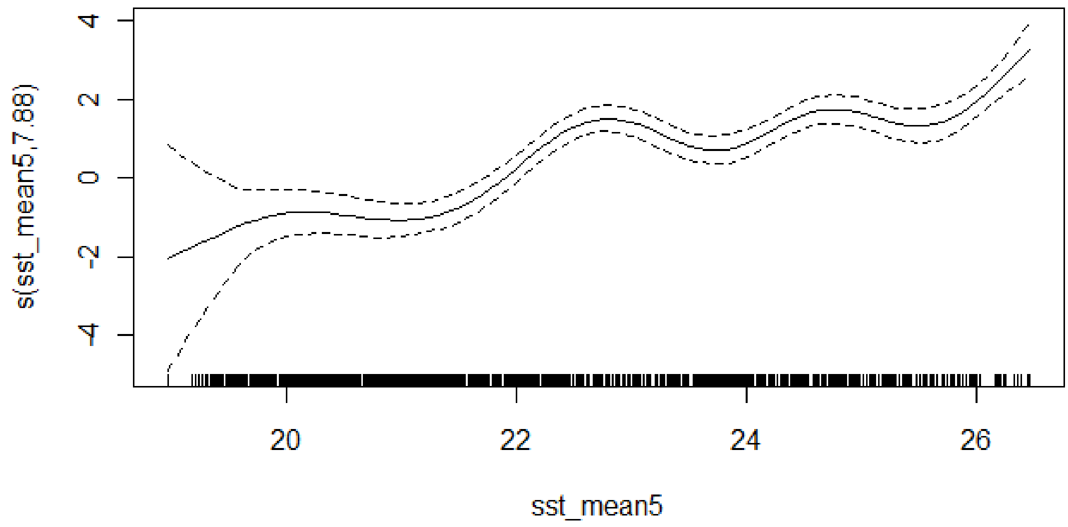
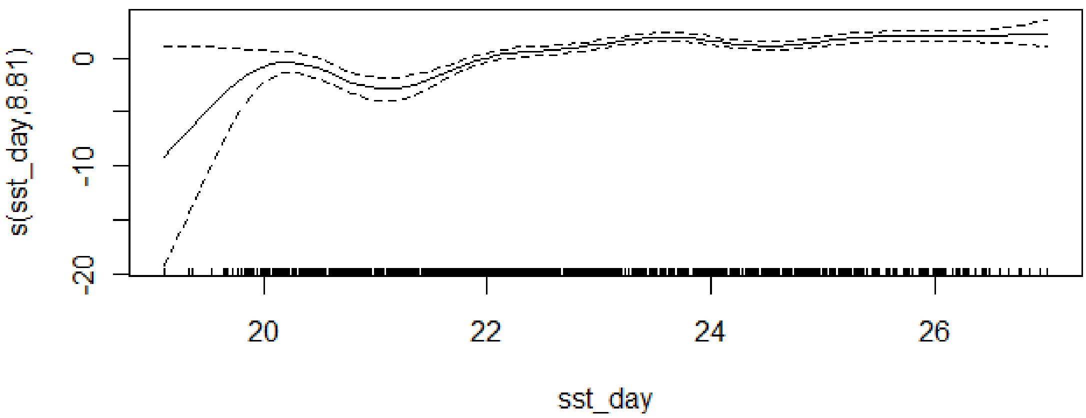


Figure 8. Smooth function for the 5-days running average of surface temperature (sst_mean5).



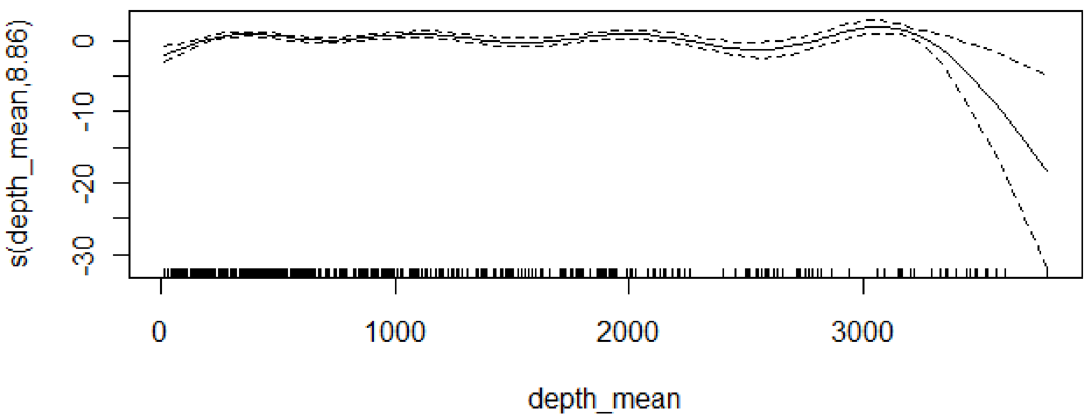


Figure 9. Smooth functions for the daily sea surface temperature (sst_day) and the depth of the sea floor (depth_mean) fitted in the same model.

Figures 21 to 31 show the predictions of density of weight from the fitted model for the 11 weeks comprising this study for the six blocks of the study area. Note that the density scale differs among these figures. Figures 32 to 42 (in Annex) show the exploratory predictions from the fitted model for these same 11 weeks for the whole Mediterranean Sea.

Table 3 show the estimated total weight of bluefin tuna in each of the survey blocks predicted from the models: mean weight for the whole period, for the months of June and July, and for each of the 9 weeks of the study period. For comparison, the estimated density per block from the conventional distance sampling analysis provided in the previous contract (Hammond, Cañadas & Vázquez 2010) is also given.

Table 3. Predicted total weight of bluefin tuna in each survey block from spatial modelling and from conventional distance sampling (CDS).

Block	June	July	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	**Mean**	CDS
1	227	14,781	639	296	254	721	13,445	12,331	18,061	18,910	19,165	**9,314**	1,244
2	946	17,363	1,068	2,846	8,939	530	12,134	13,938	20,481	30,753	17,470	**12,018**	1,540
3	240	5,243	187	194	752	806	3,657	4,680	6,898	8,466	5,298	**3,438**	2,336
6	5,841	11,405	4,965	7,020	6,665	5,280	6,671	9,692	13,356	18,302	18,408	**10,040**	10,434
7	18	923	26	15	251	169	808	591	1,120	1,722	830	**615**	131
8	1,000	12,088	0	969	401	514	2,838	9,498	11,556	13,133	10,733	**5,516**	2,474
Total	**8,271**	**61,804**	**6,885**	**11,341**	**17,261**	**8,019**	**39,553**	**50,730**	**71,471**	**91,287**	**71,905**	**40,939**	**18,158**

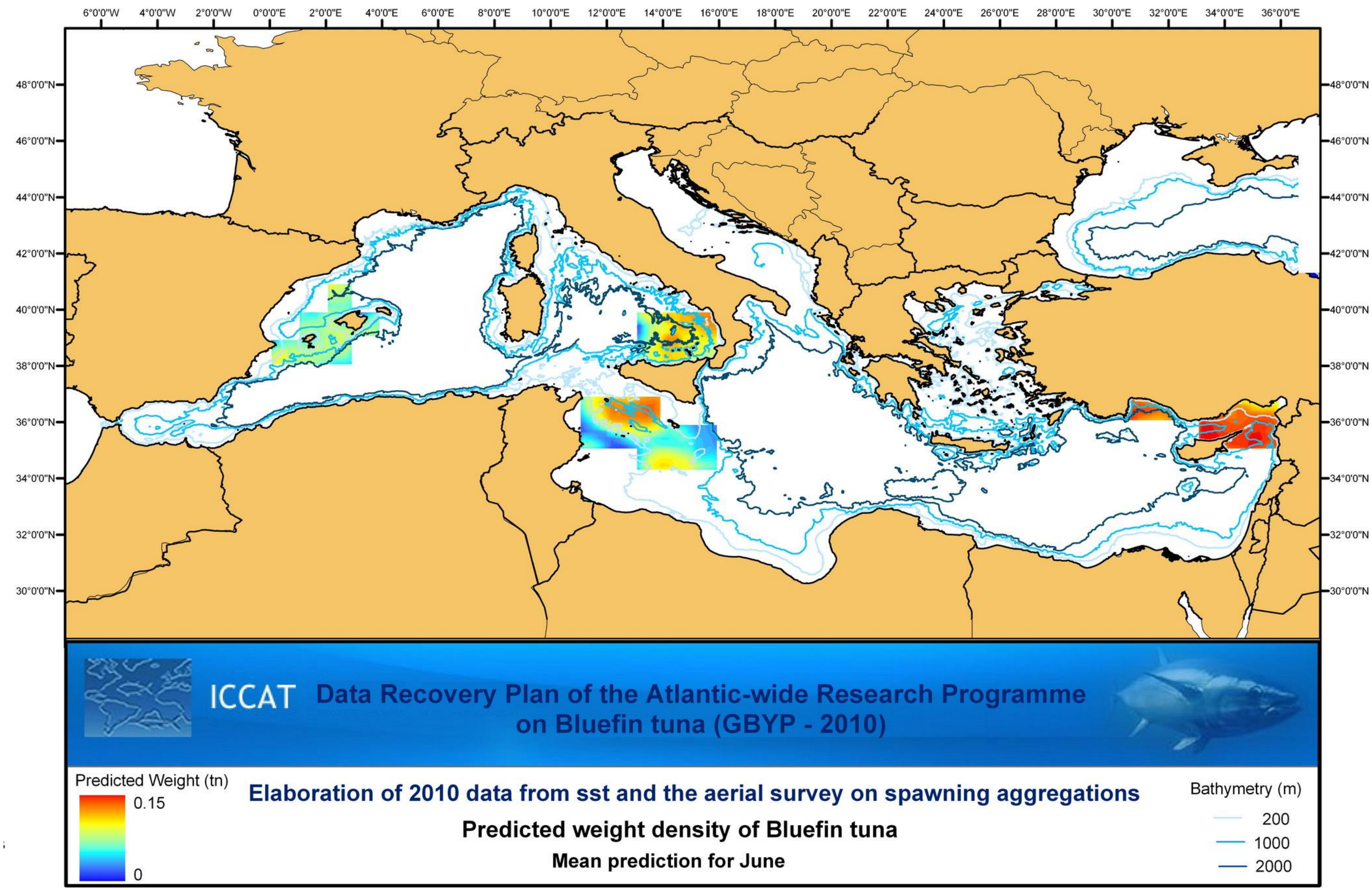


Figure 21. Predicted density of weight in tonnes of bluefin tuna in June 2010

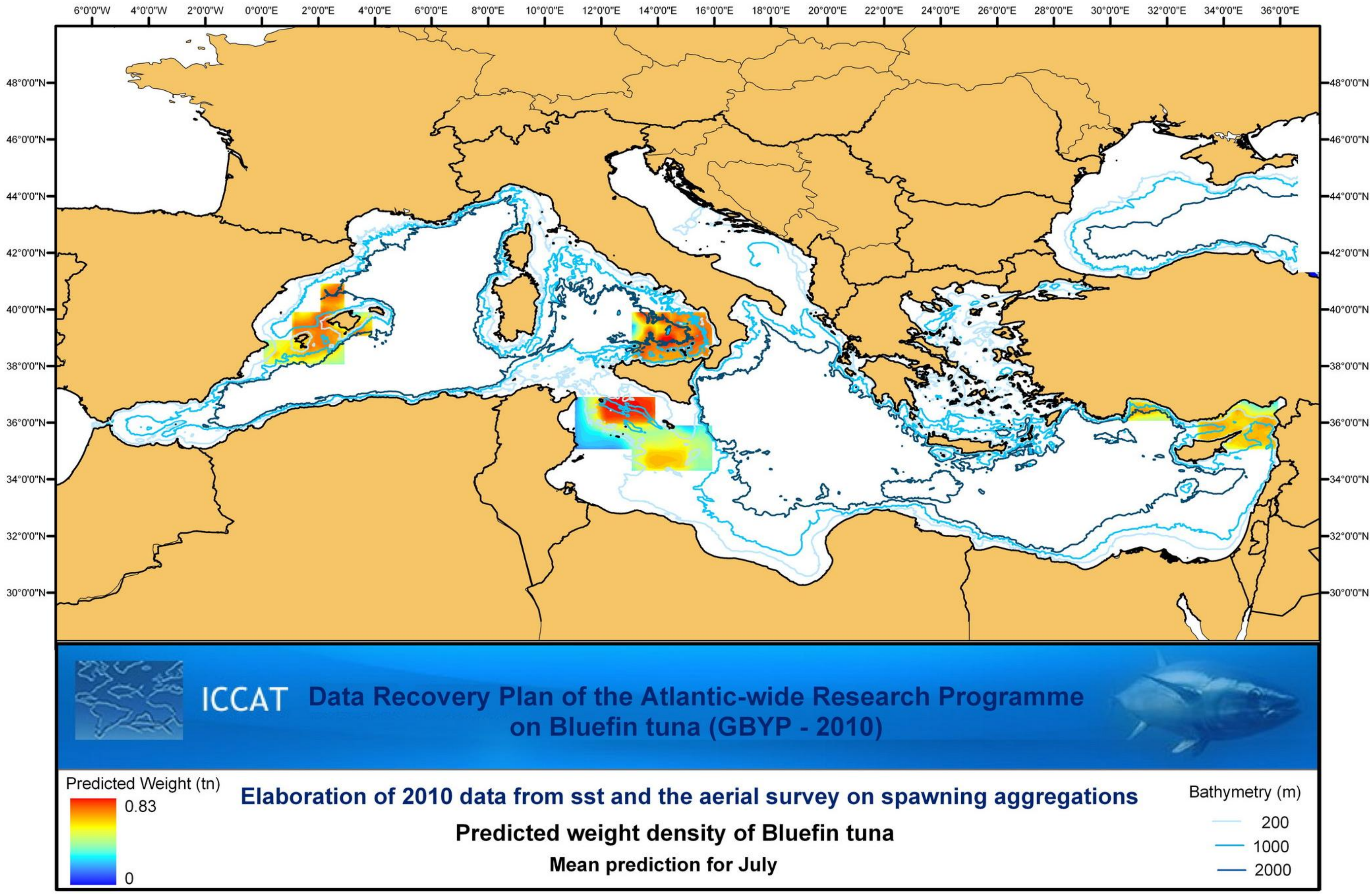


Figure 22. Predicted density of weight in tonnes of bluefin tuna in July 2010

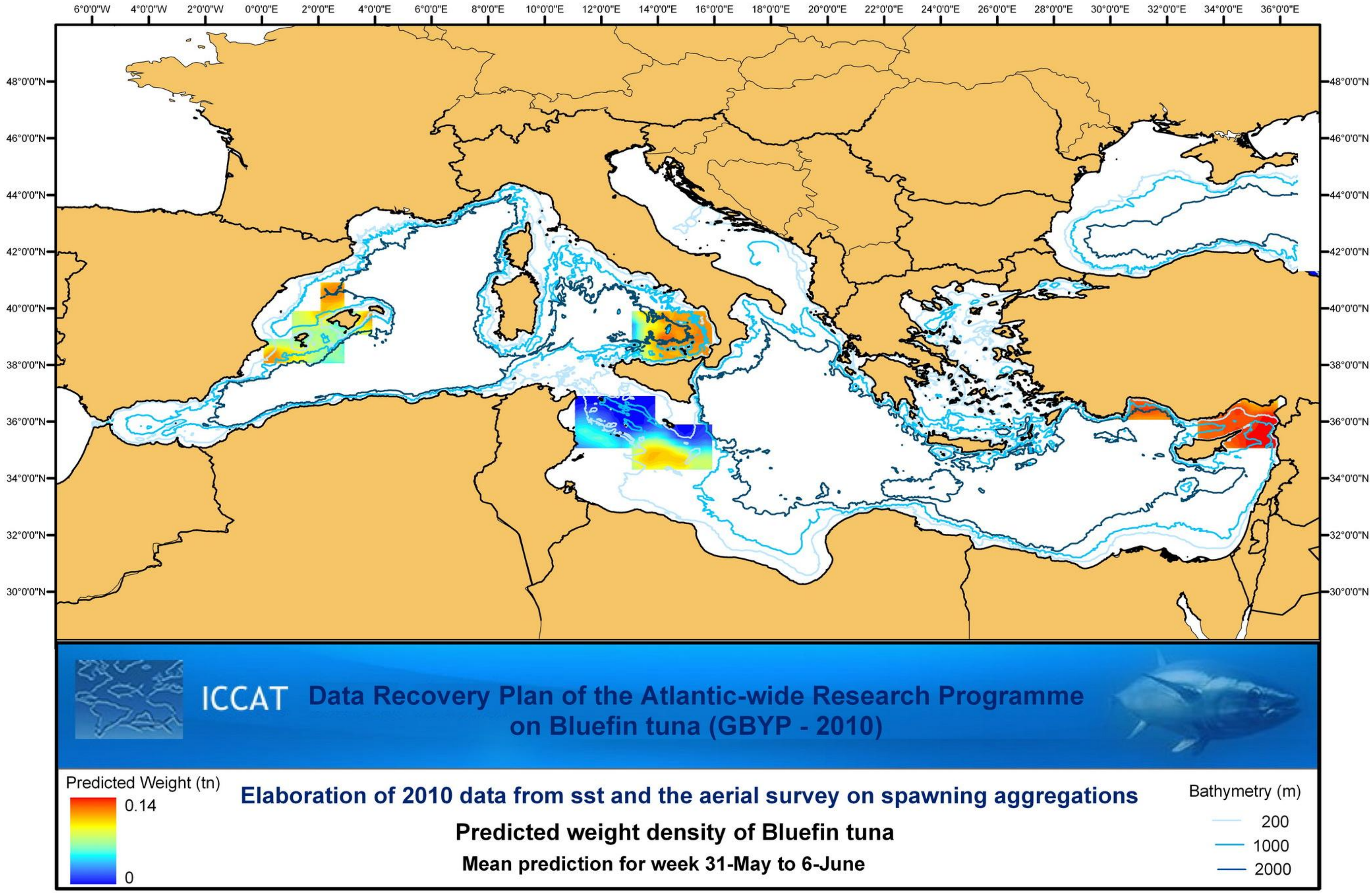


Figure 23. Predicted density of weight in tonnes of bluefin tuna for 31-May to 6-June 2010

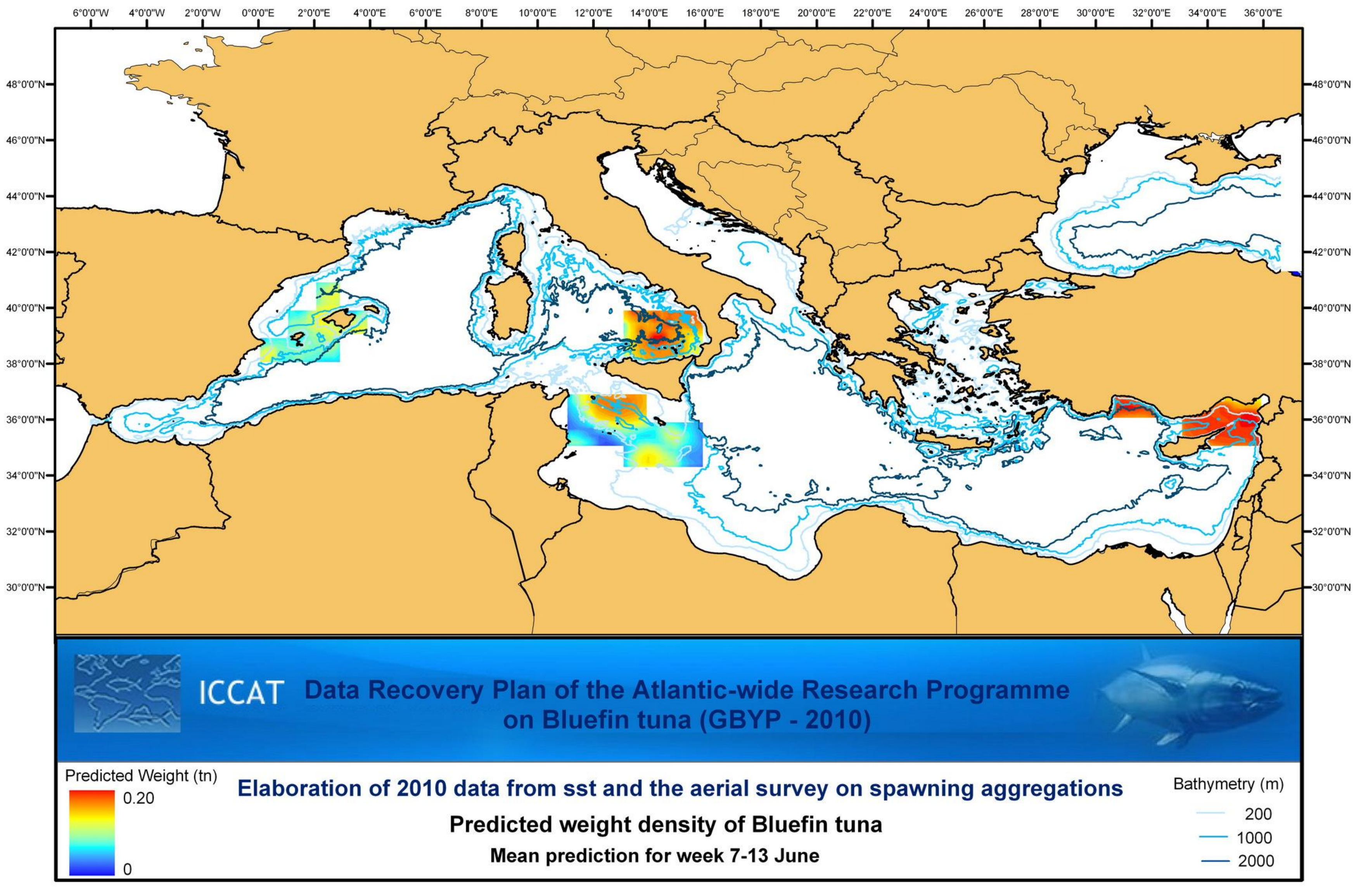


Figure 24. Predicted density of weight in tonnes of bluefin tuna for 7-13 June 2010

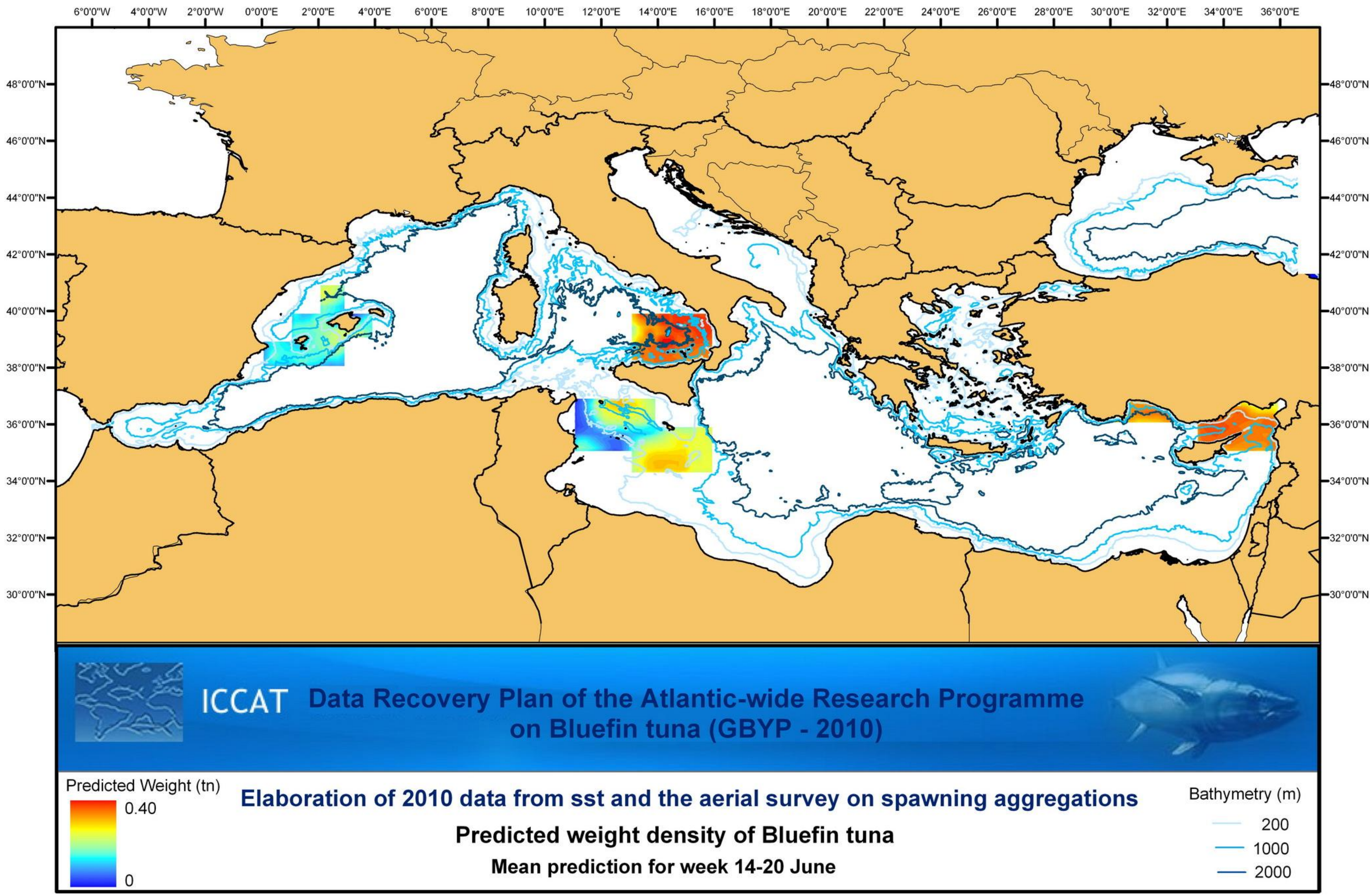


Figure 25. Predicted density of weight in tonnes of bluefin tuna for 14-20 June 2010

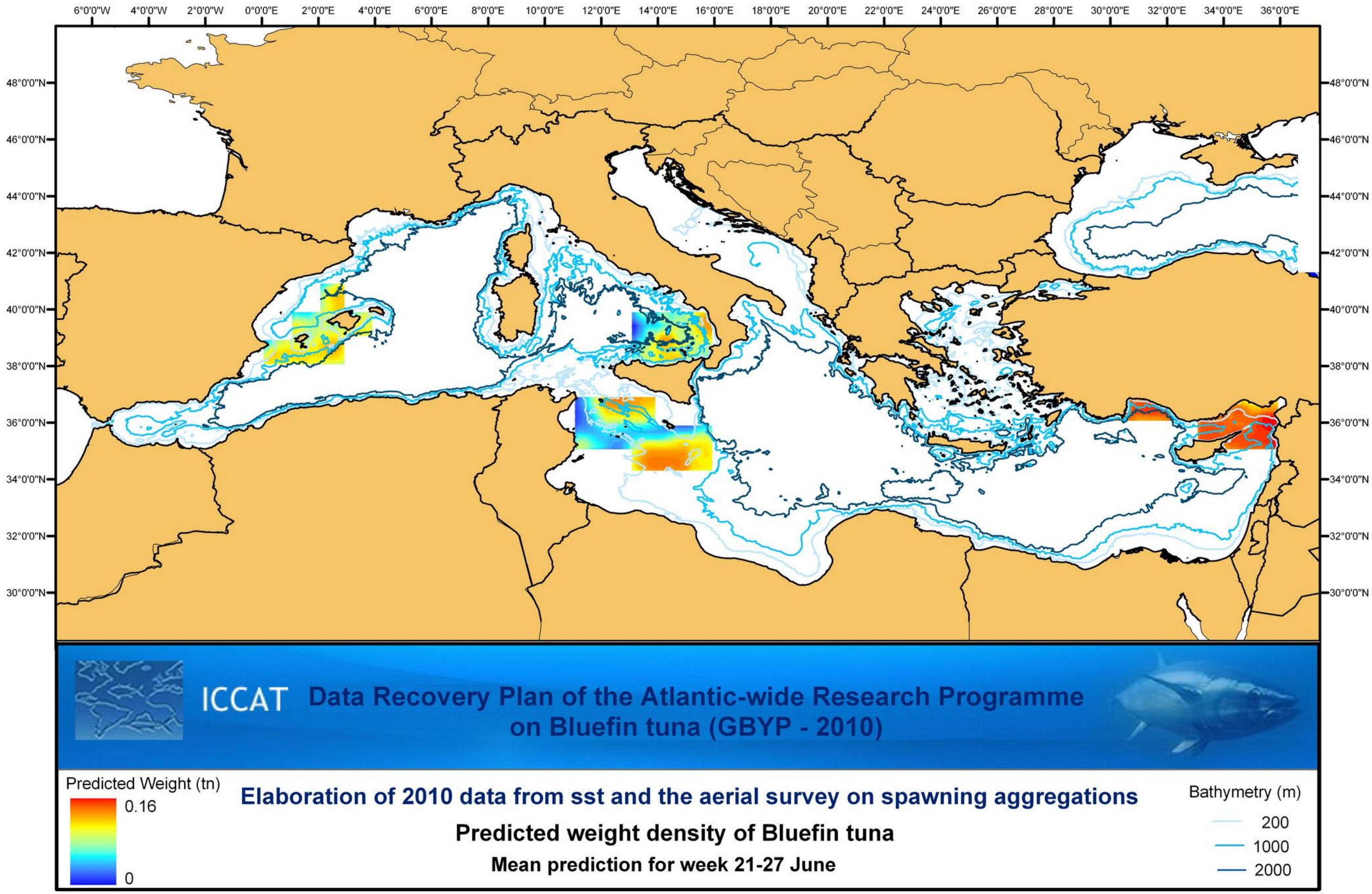


Figure 26. Predicted density of weight in tonnes of bluefin tuna for 21-27 June 2010

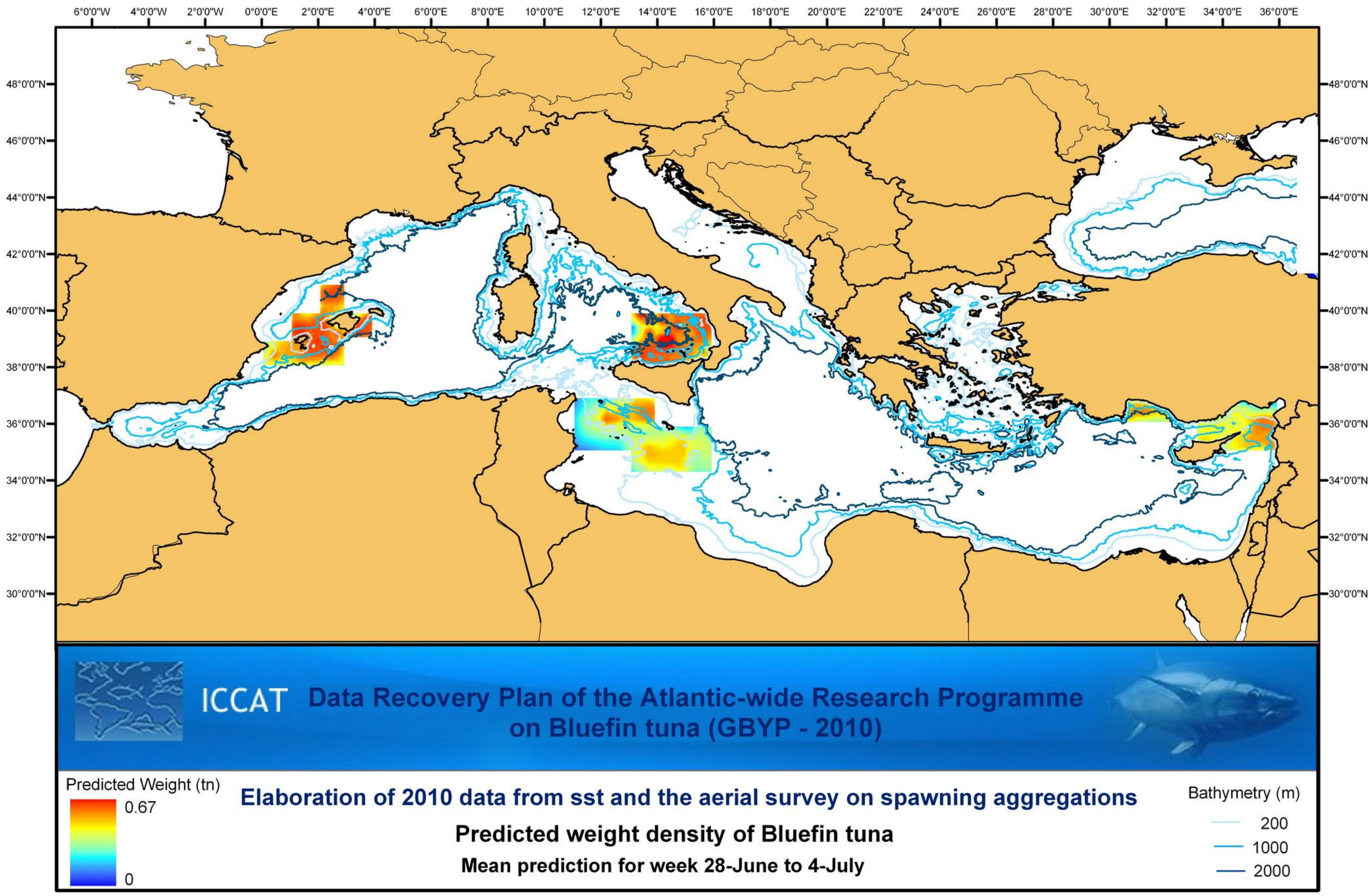


Figure 27. Predicted density of weight in tonnes of bluefin tuna for 28-June to 4 July 2010

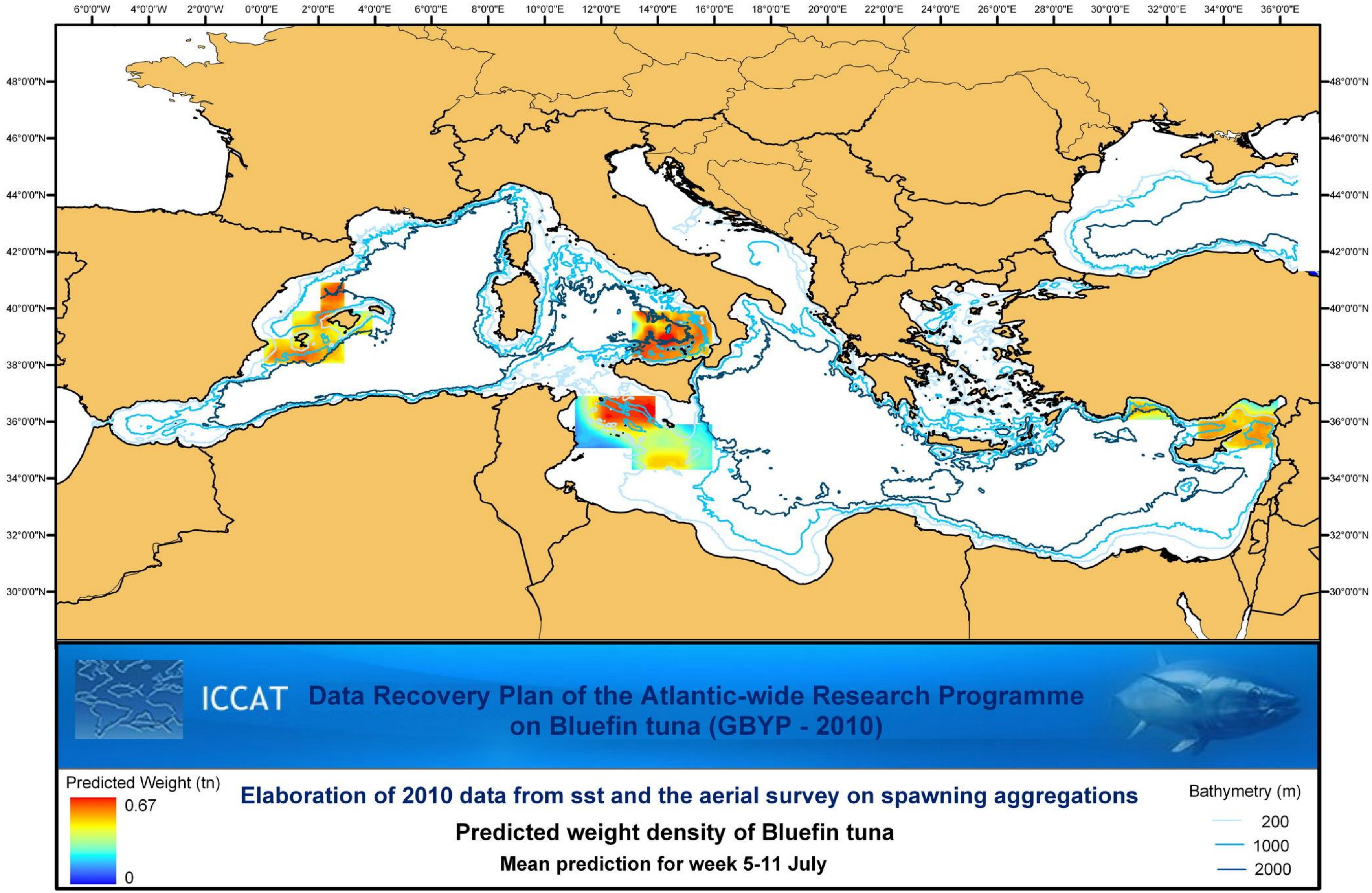


Figure 28. Predicted density of weight in tonnes of bluefin tuna for 5-11 July 2010

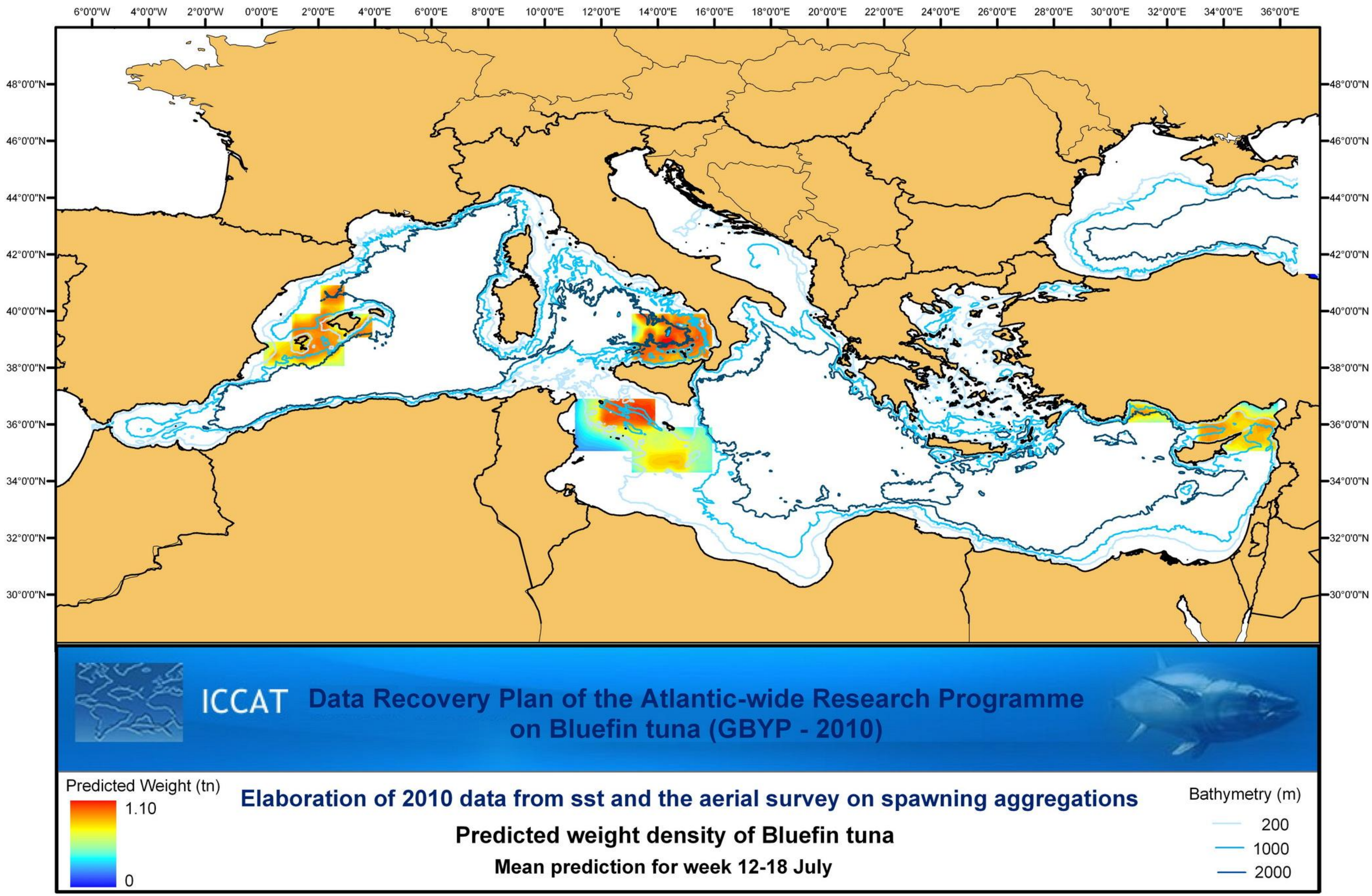


Figure 29. Predicted density of weight in tonnes of bluefin tuna for 12-18 July 2010

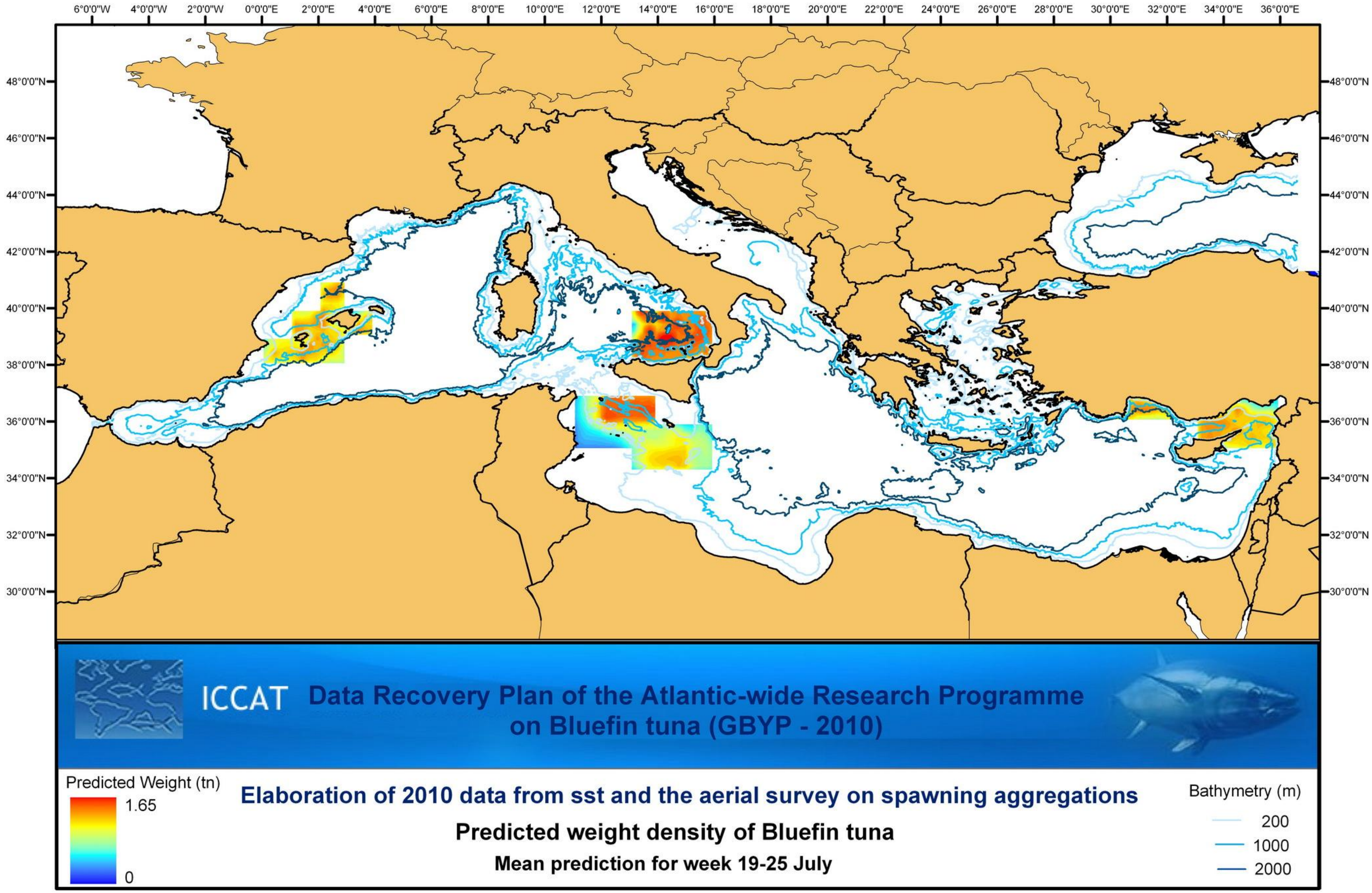


Figure 30. Predicted density of weight in tonnes of bluefin tuna for 19-25 July 2010

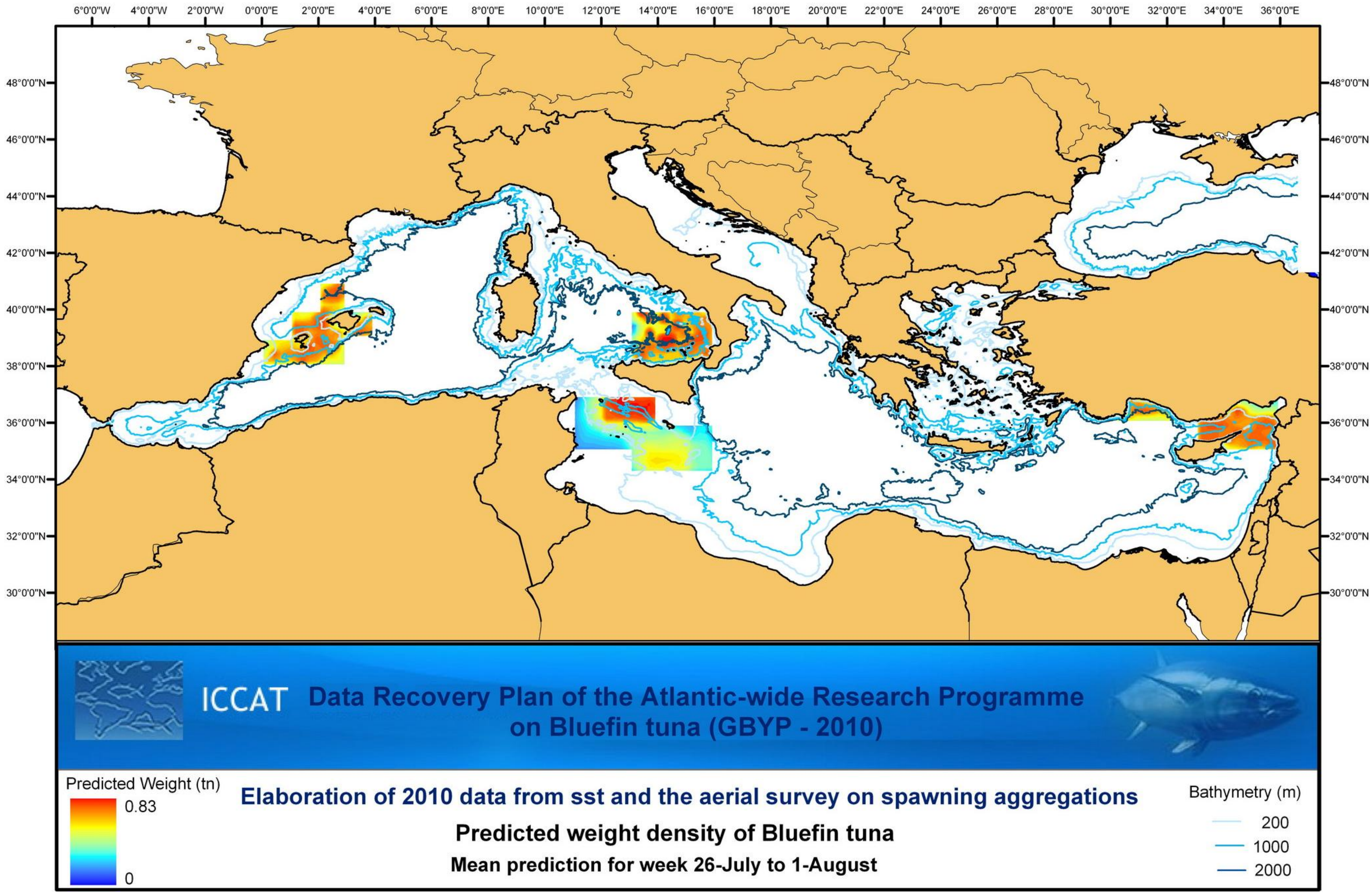


Figure 31. Predicted density of weight in tonnes of bluefin tuna for 26-July to 1-August 2010

Discussion

Spatial modelling to predict distribution and abundance is potentially a valuable analytical tool but its usefulness depends on the quality of the survey data. The more the survey data can be improved, the more value would be derived from the spatial modelling. For example, the only measure of school size we could use consistently was weight but it would be interesting to use number of fish (including of different size ranges) if these data could be collected consistently. Also, the greater the spatial coverage of the survey, the greater the reliability and applicability of the model results for the whole Mediterranean Sea.

All figures and Table 3 show a temporal pattern of an increase in density and total weight predicted from June to July, and in general from the earlier weeks to the later ones. This is driven by the general trend of increasing density with increasing sea surface temperature. Most of the survey (79%) was carried out in June, and this would explain the difference in predicted density between spatial modelling and conventional distance sampling (CDS), given that CDS does not take into account the spatial or temporal variation in density due to environmental covariates. This, and the higher proportion of survey effort in June, would also explain why the CDS estimates are closer to predicted density in June than in July.

A consistent pattern shown also by the maps is the shift of higher densities from the East to the West over the weeks, as sst increases in the western areas.

The results presented here do not include estimates of coefficients of variation (CV) or confidence limits. These need to be generated through non-parametric bootstrapping of the data and refitting the models; there has been insufficient time in this contract to accomplish this. Additionally, the limited quantity and quality of the available survey data do not warrant undertaking this task at this stage. Nevertheless, estimates of precision are essential if results are to be used for management and this should be done in future spatial modelling analyses of aerial survey data.

Abundance or weight can be predicted as an exploratory exercise over any area of the Mediterranean or over the whole basin, as shown in Figures 32 to 42. These predictions are an exploration and for illustration only. Nevertheless, they could be useful in comparison of predicted high density areas with, for example, fishing areas, and also to help direct the spatial coverage of future surveys. These Mediterranean-wide predictions should not be used for management advice.

In conclusion, although the results presented here are limited by the available data (coverage, quantity and quality), they are of value in indicating the kind of results that can be generated by spatial modelling of survey and environmental data and in helping to plan the survey for 2011 in terms of timing and areas.

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Annex

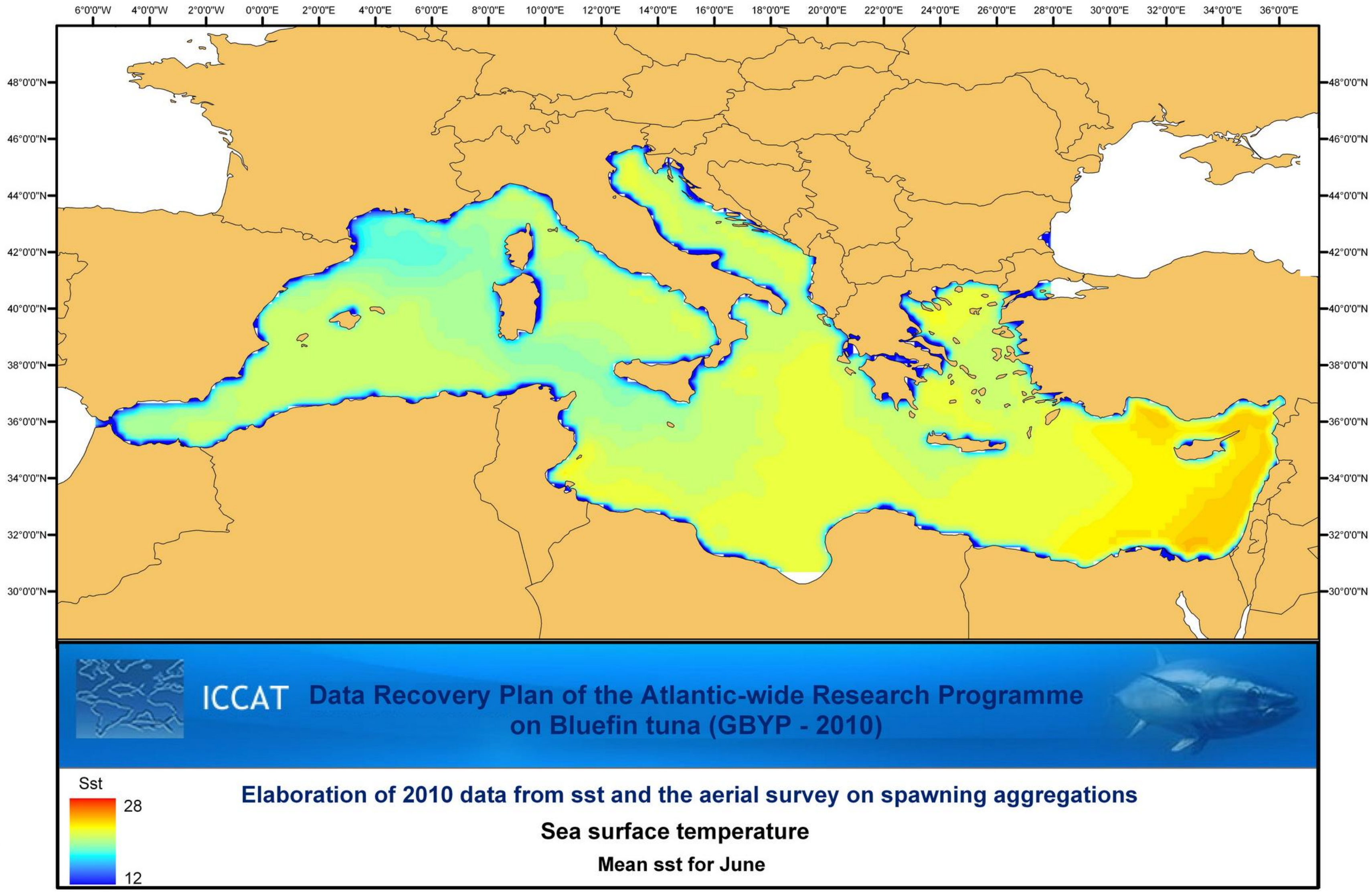

Figure 10. Mean sea surface temperature in June 2010

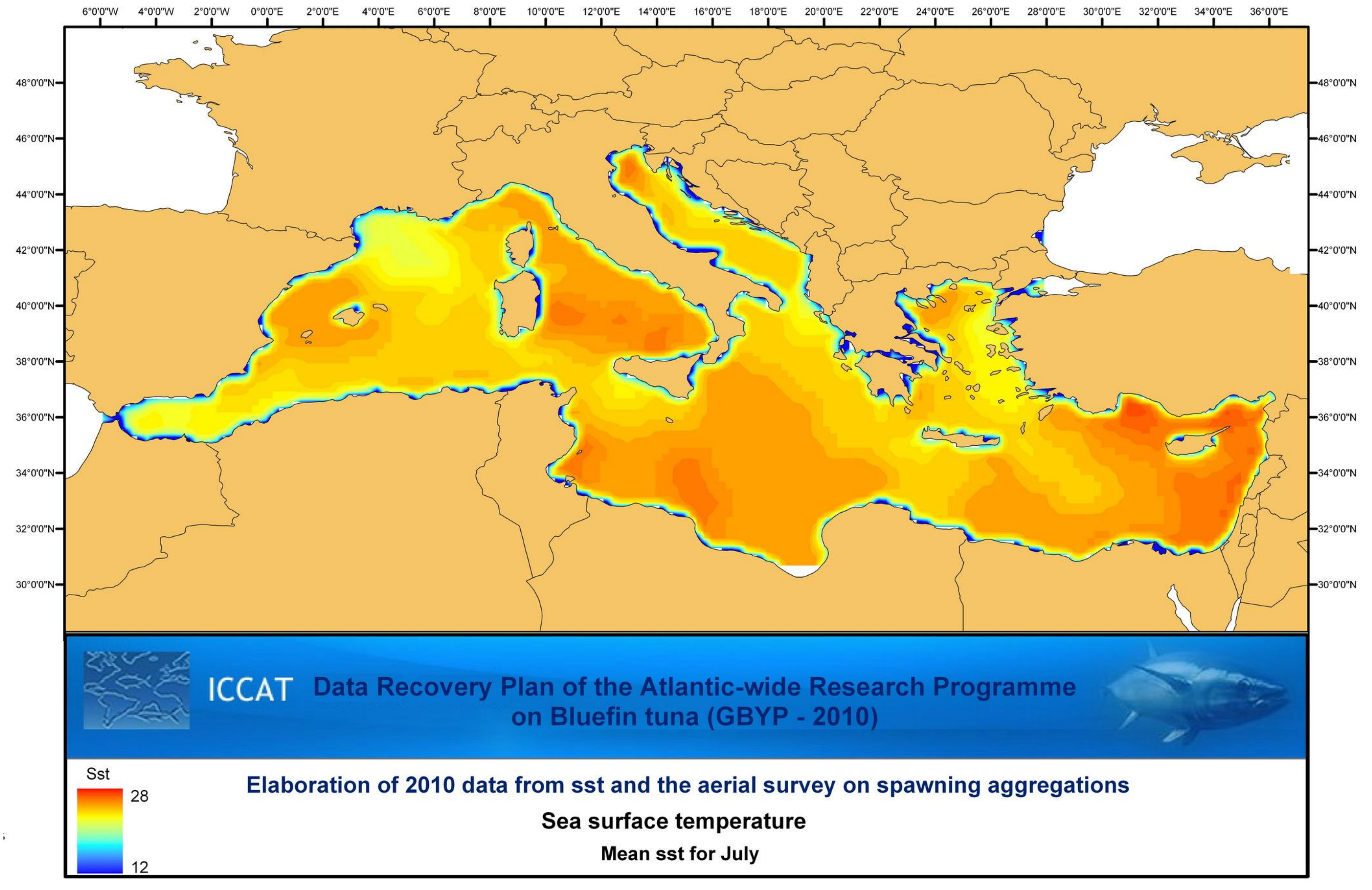

Figure 11. Mean sea surface temperature in July 2010

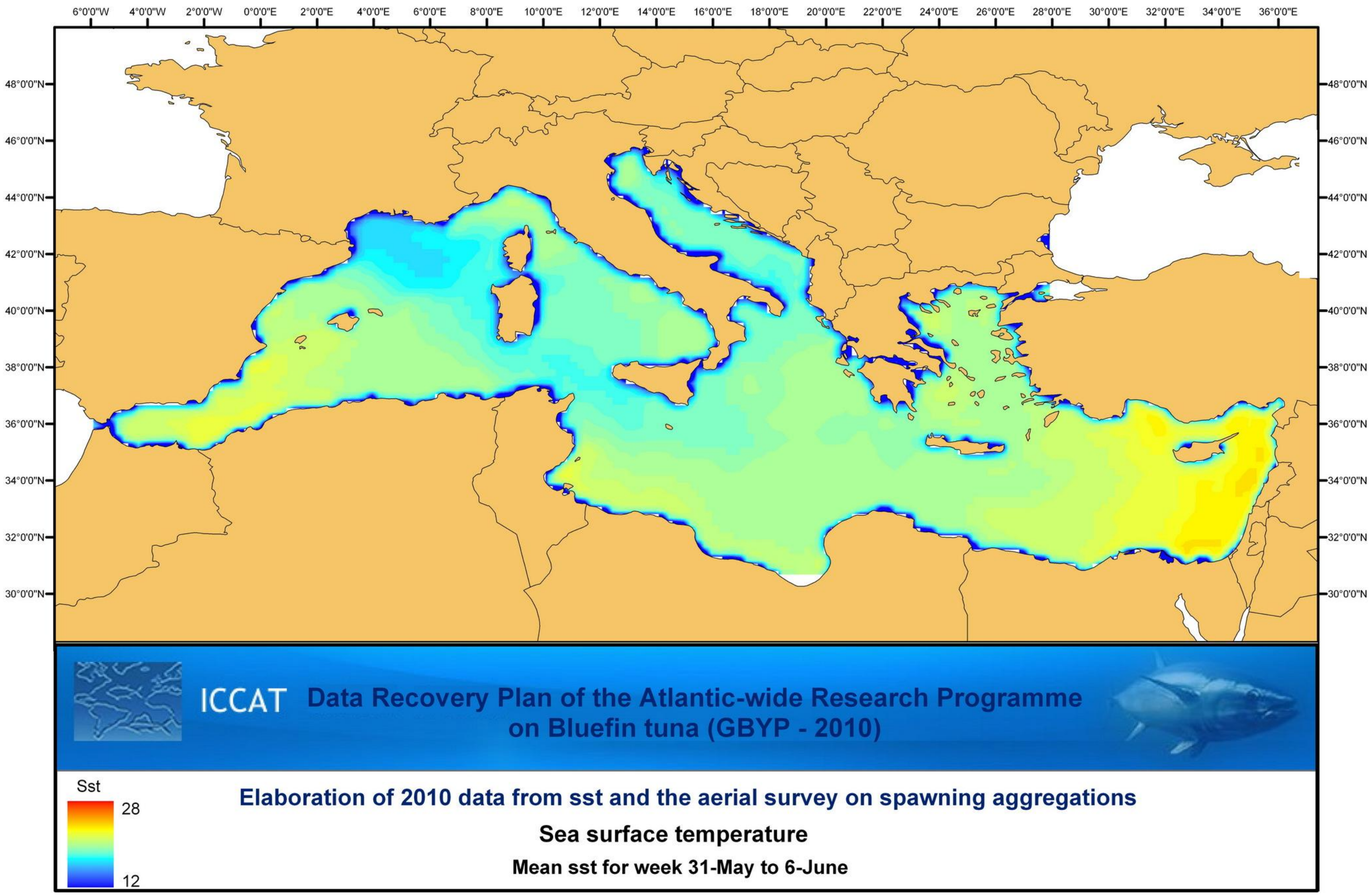

Figure 12. Mean sea surface temperature for 31-May to 6-June 2010

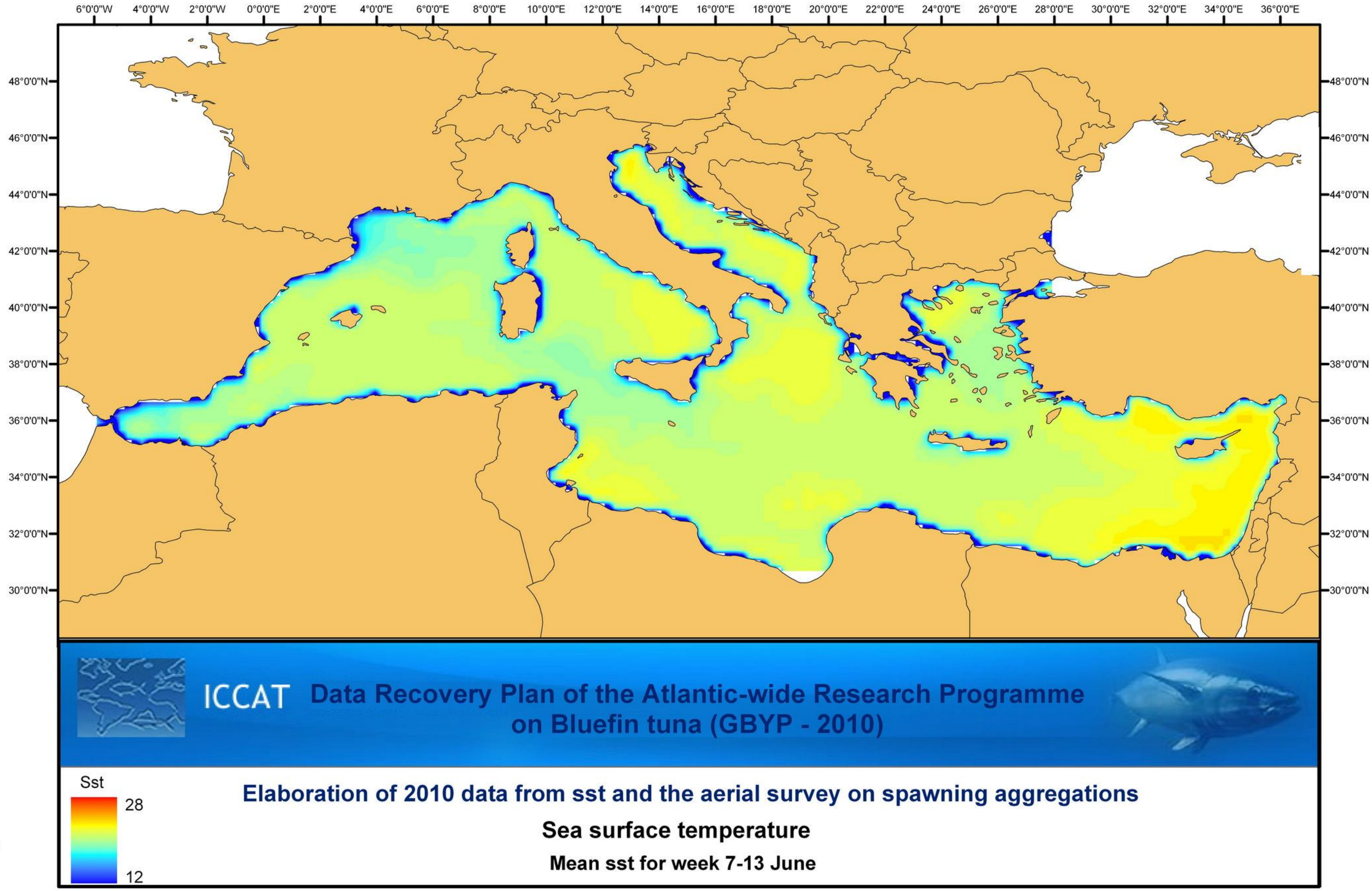

Figure 13. Mean sea surface temperature for 7-13 June 2010

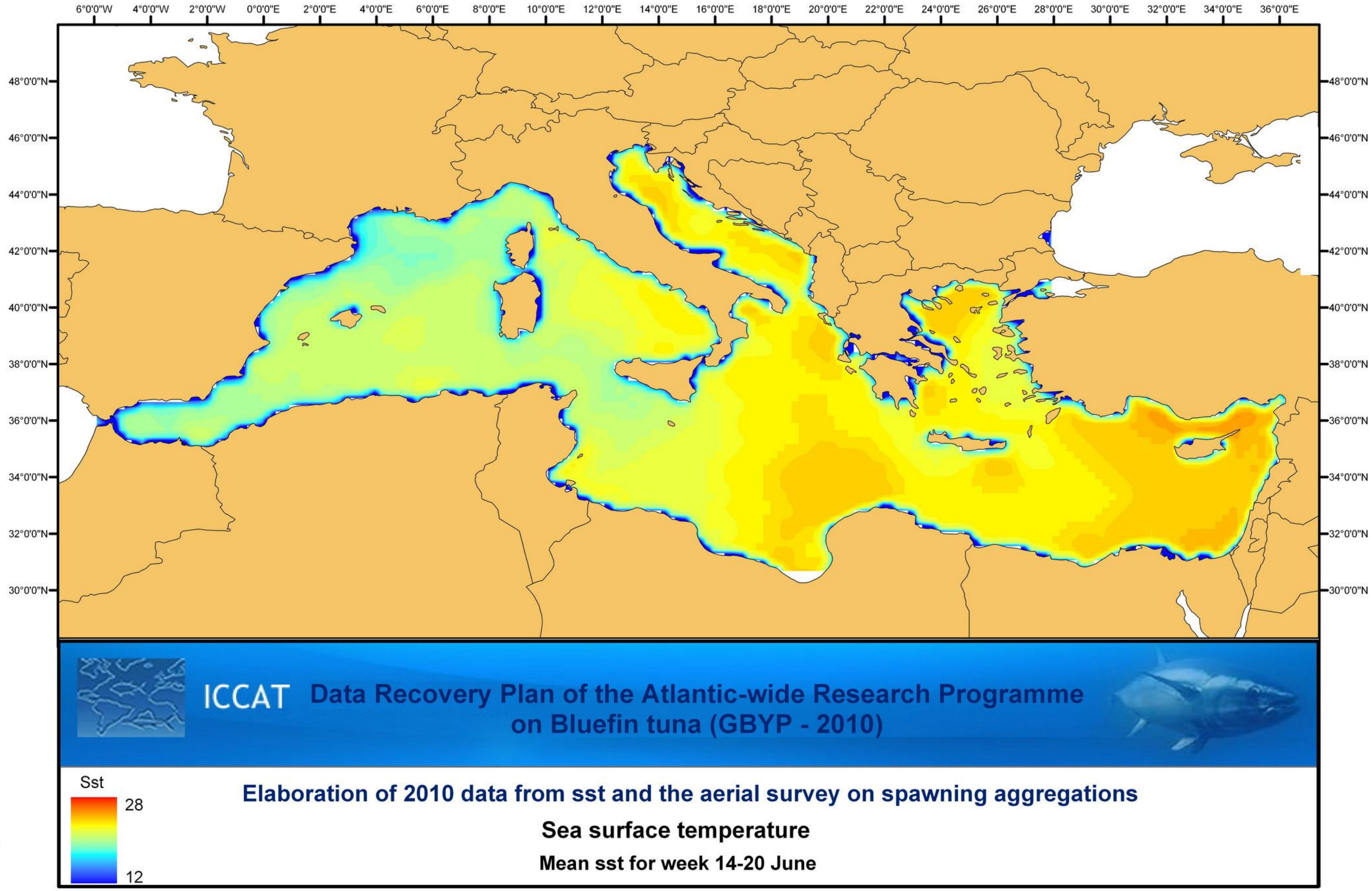

Figure 14. Mean sea surface temperature for 14-20 June 2010

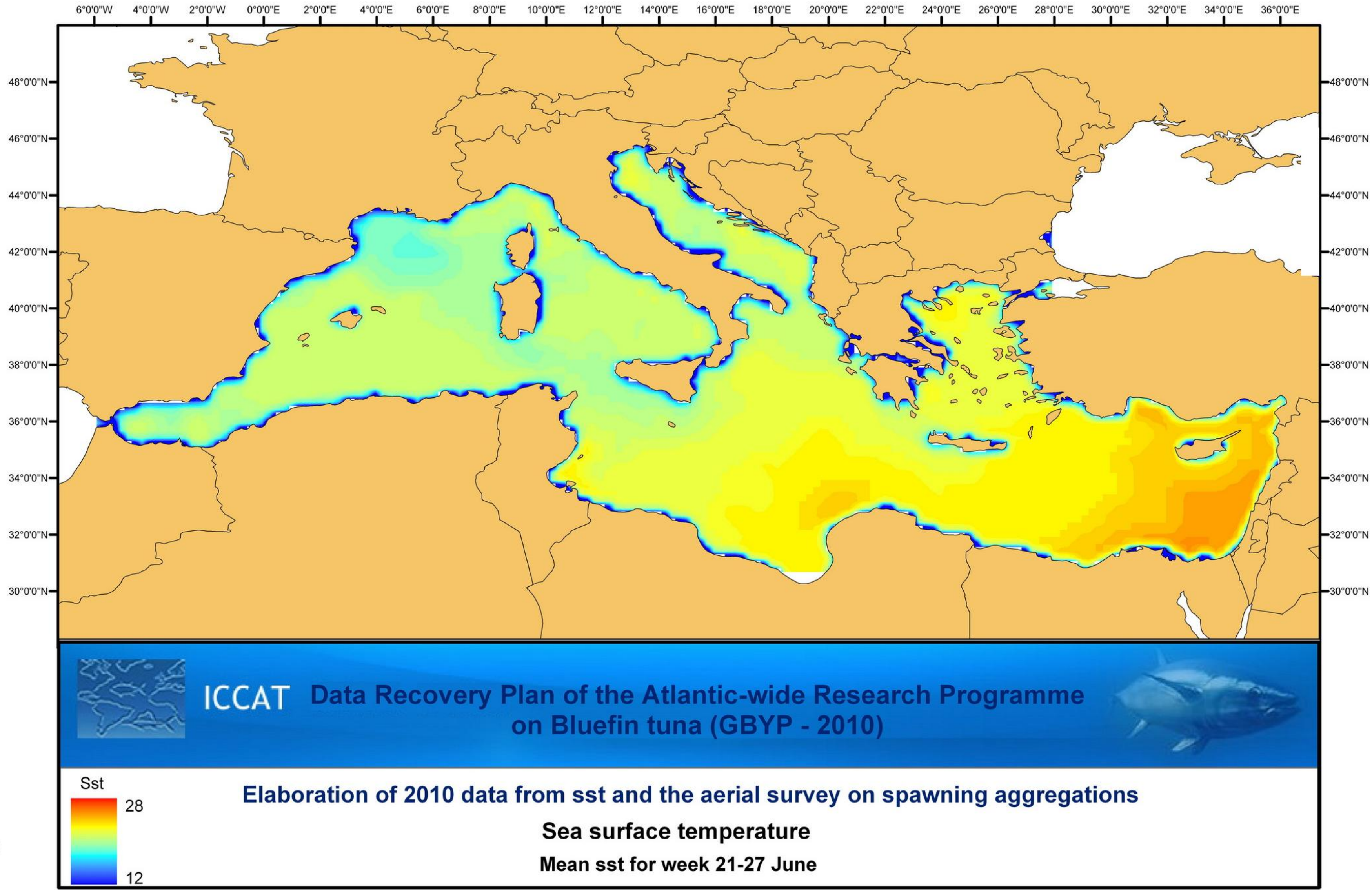

Figure 15. Mean sea surface temperature for 21-27 June 2010

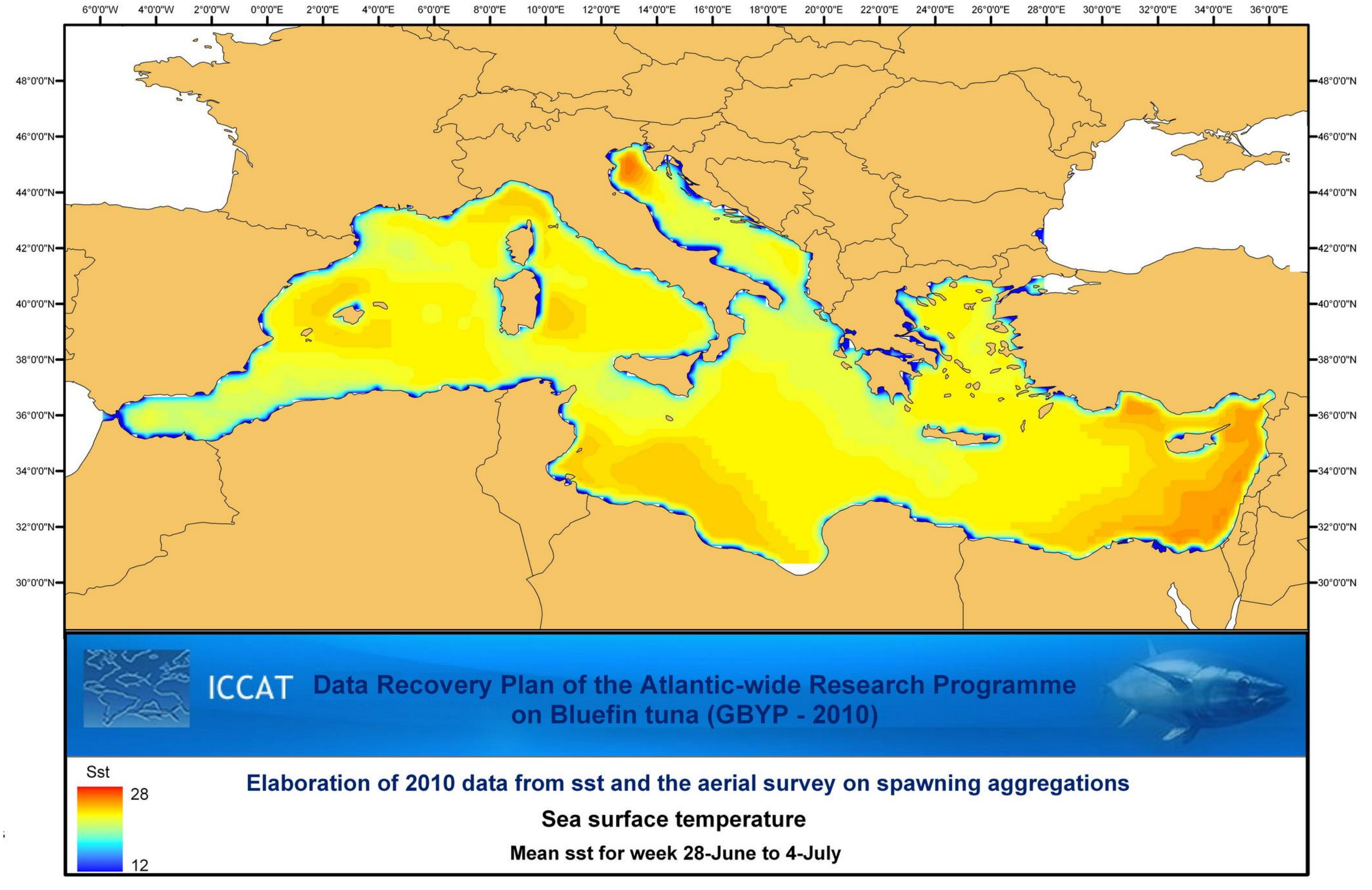

Figure 16. Mean sea surface temperature for 28-June to 4 July 2010

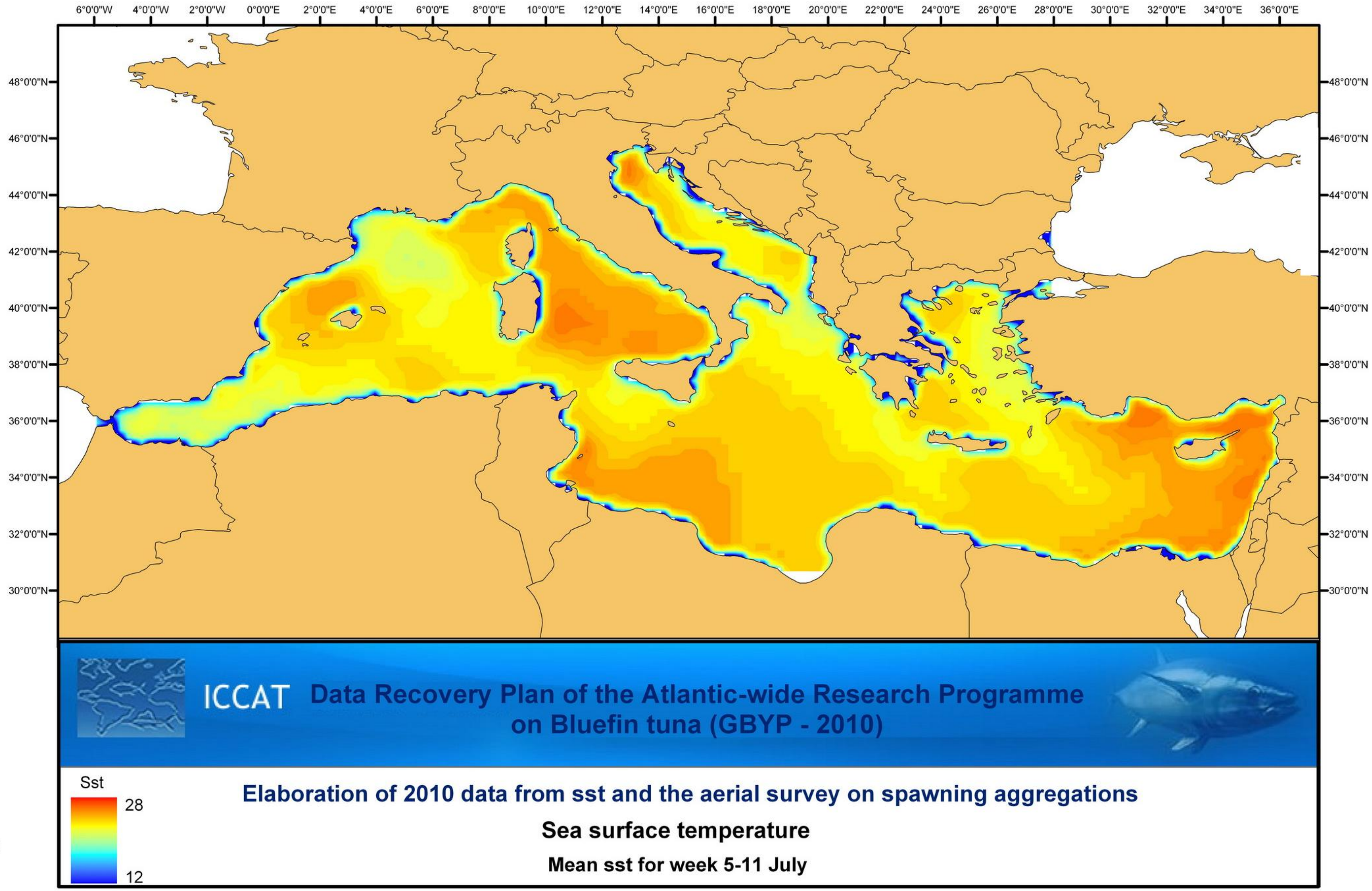

Figure 17. Mean sea surface temperature for 5-11 July 2010

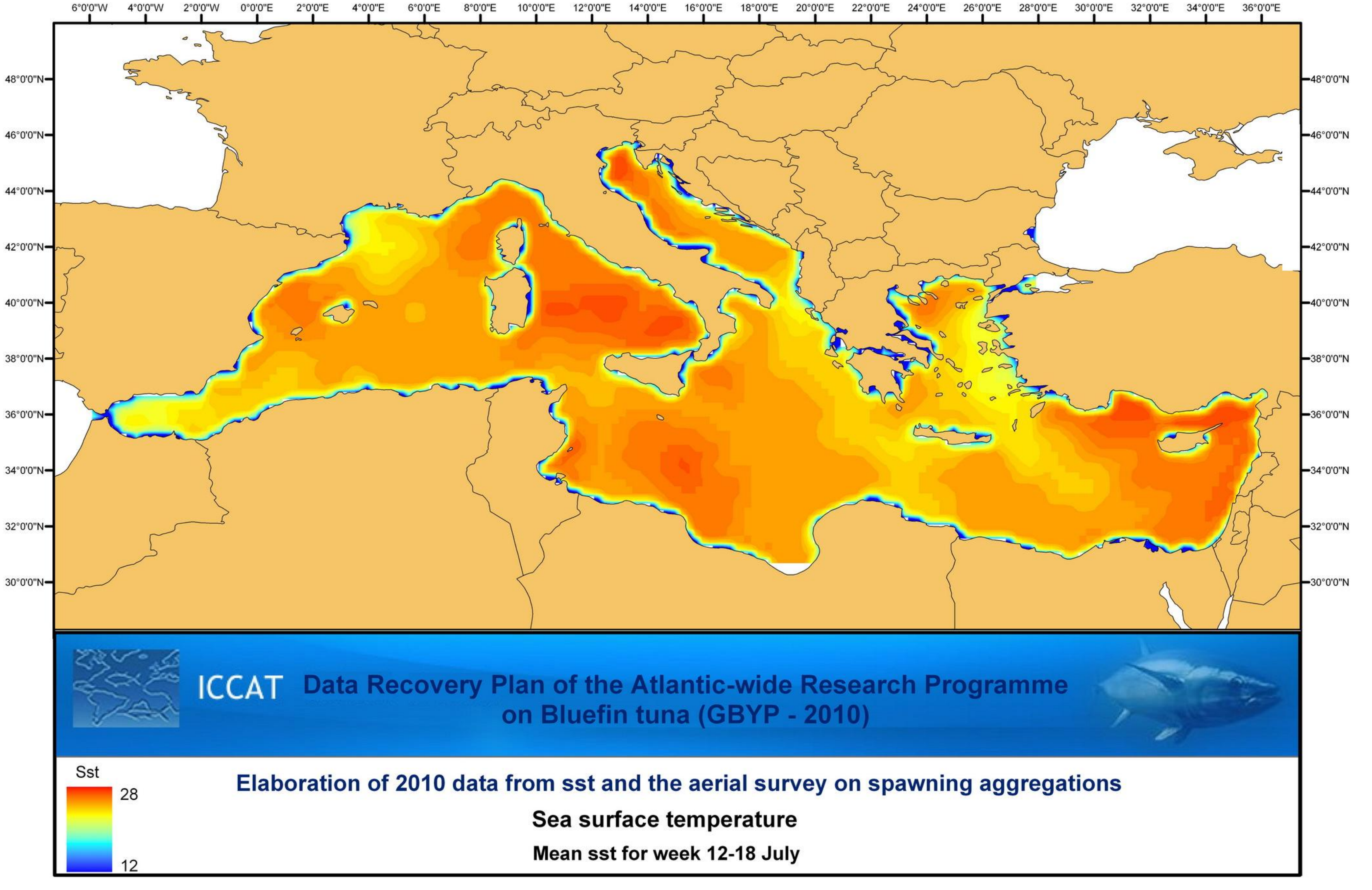

Figure 18. Mean sea surface temperature for 12-18 July 2010

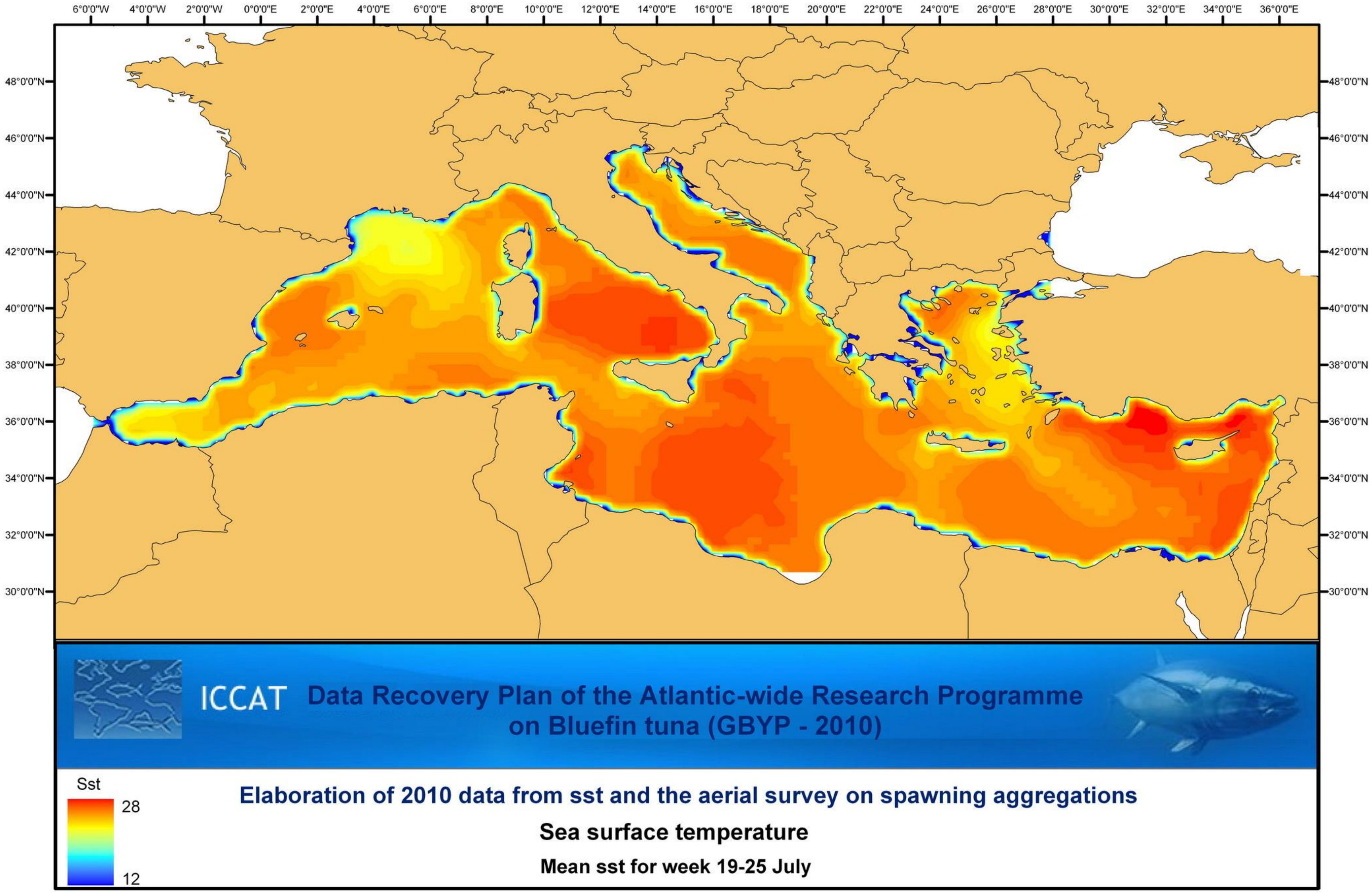

Figure 19. Mean sea surface temperature for 19-25 July 2010

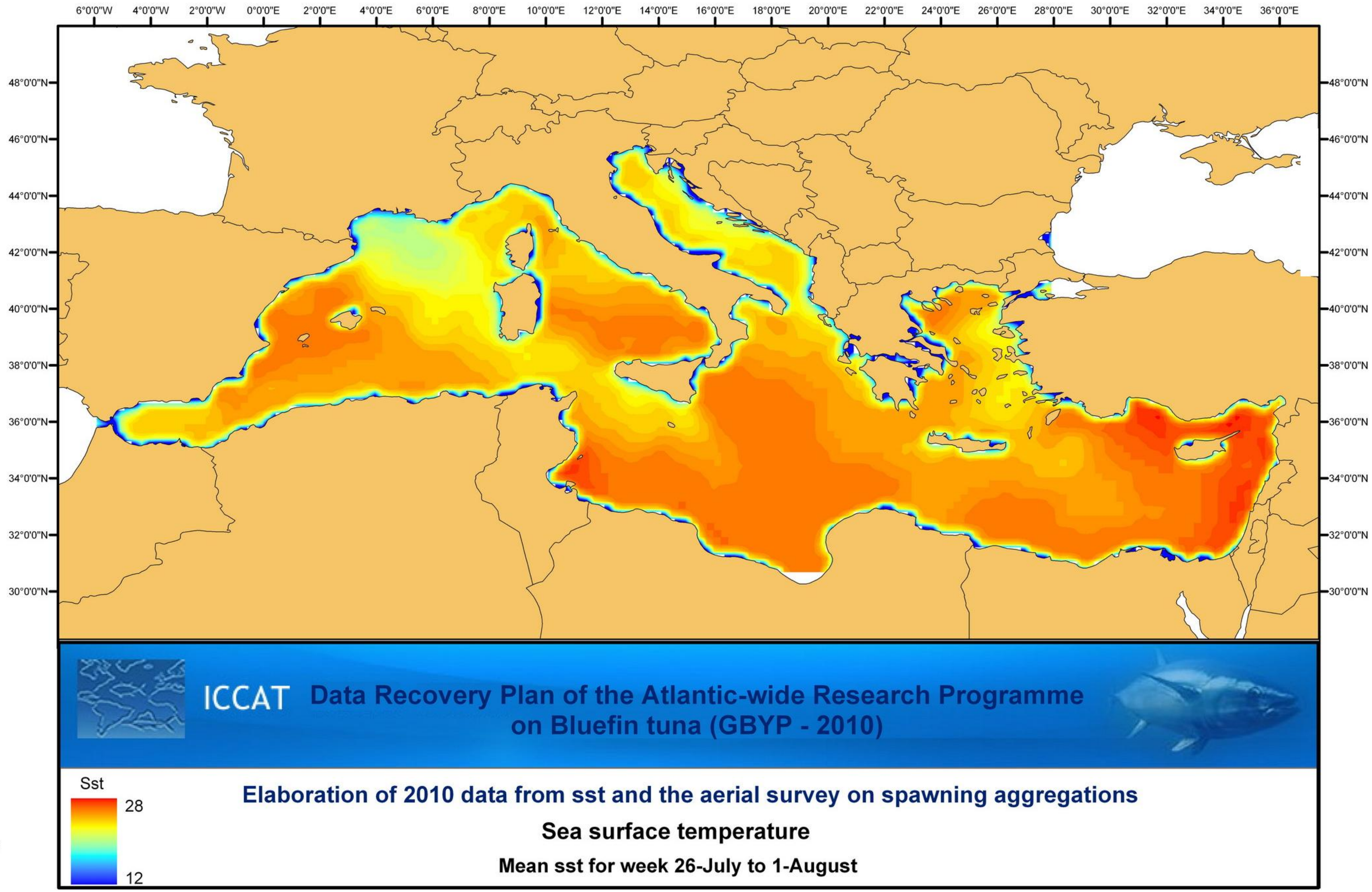

Figure 20. Mean sea surface temperature for 26-July to 1-August 2010

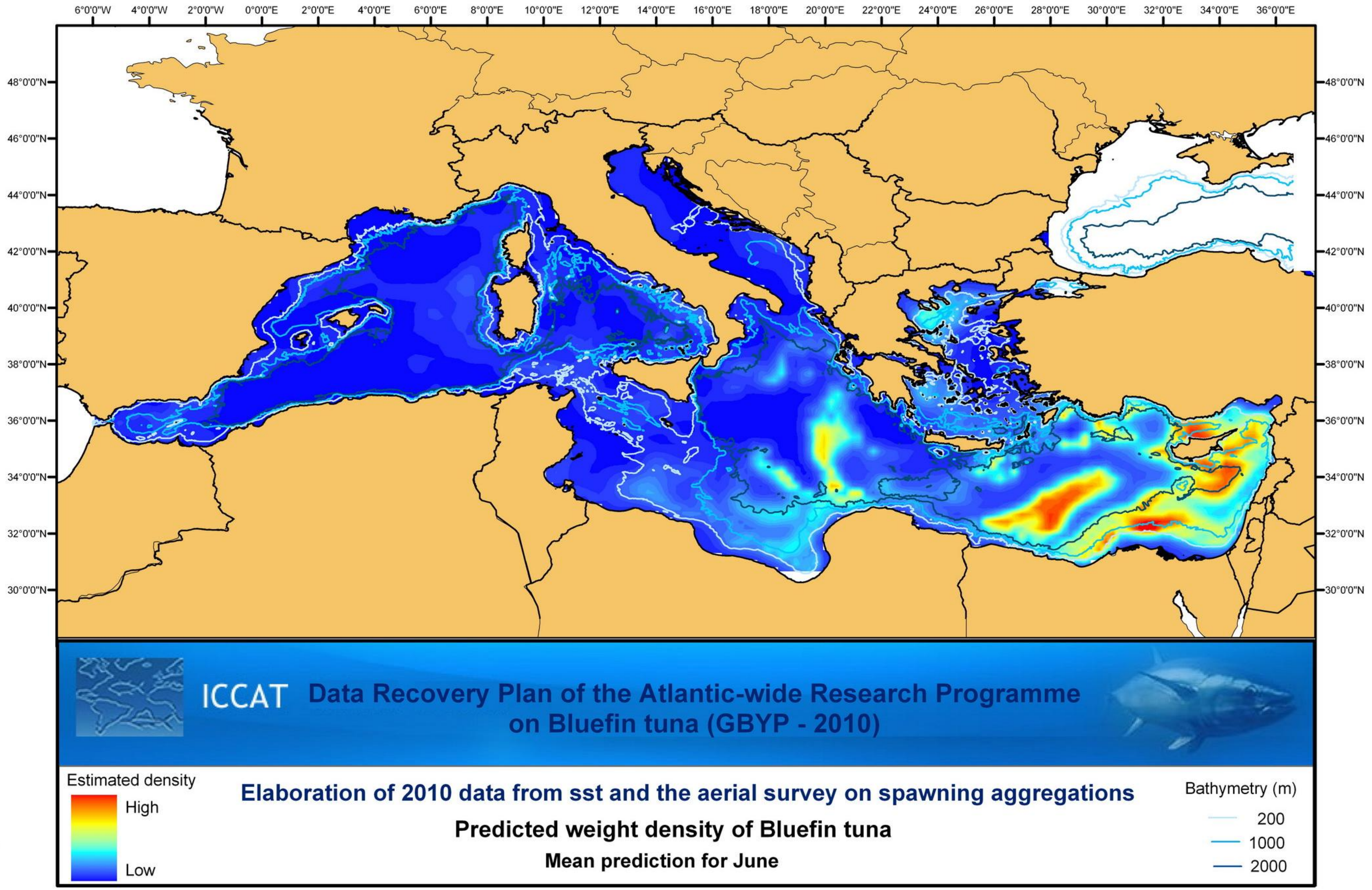

Figure 32. Predicted density of bluefin tuna in June 2010

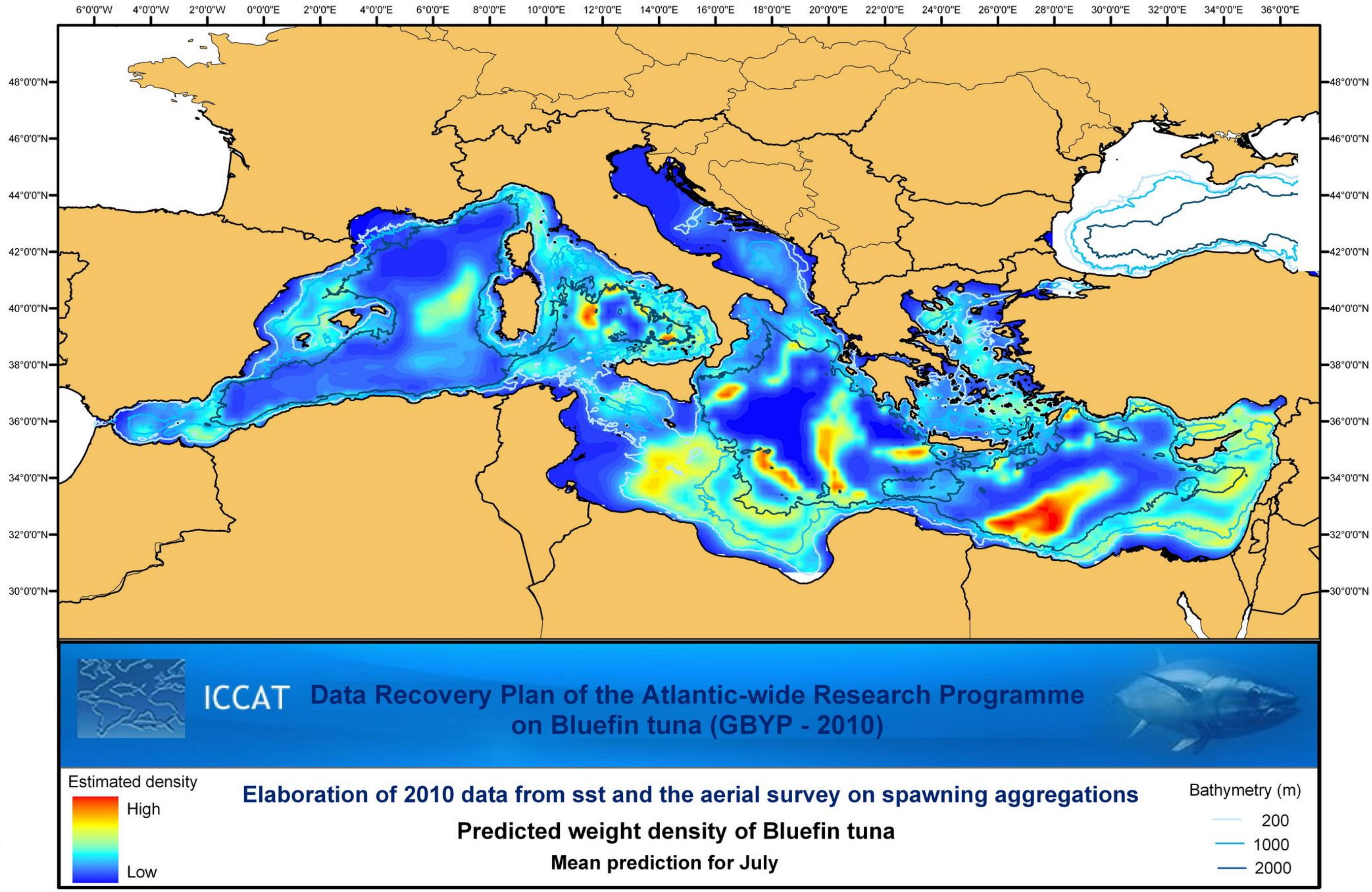

Figure 33. Predicted density of bluefin tuna in July 2010

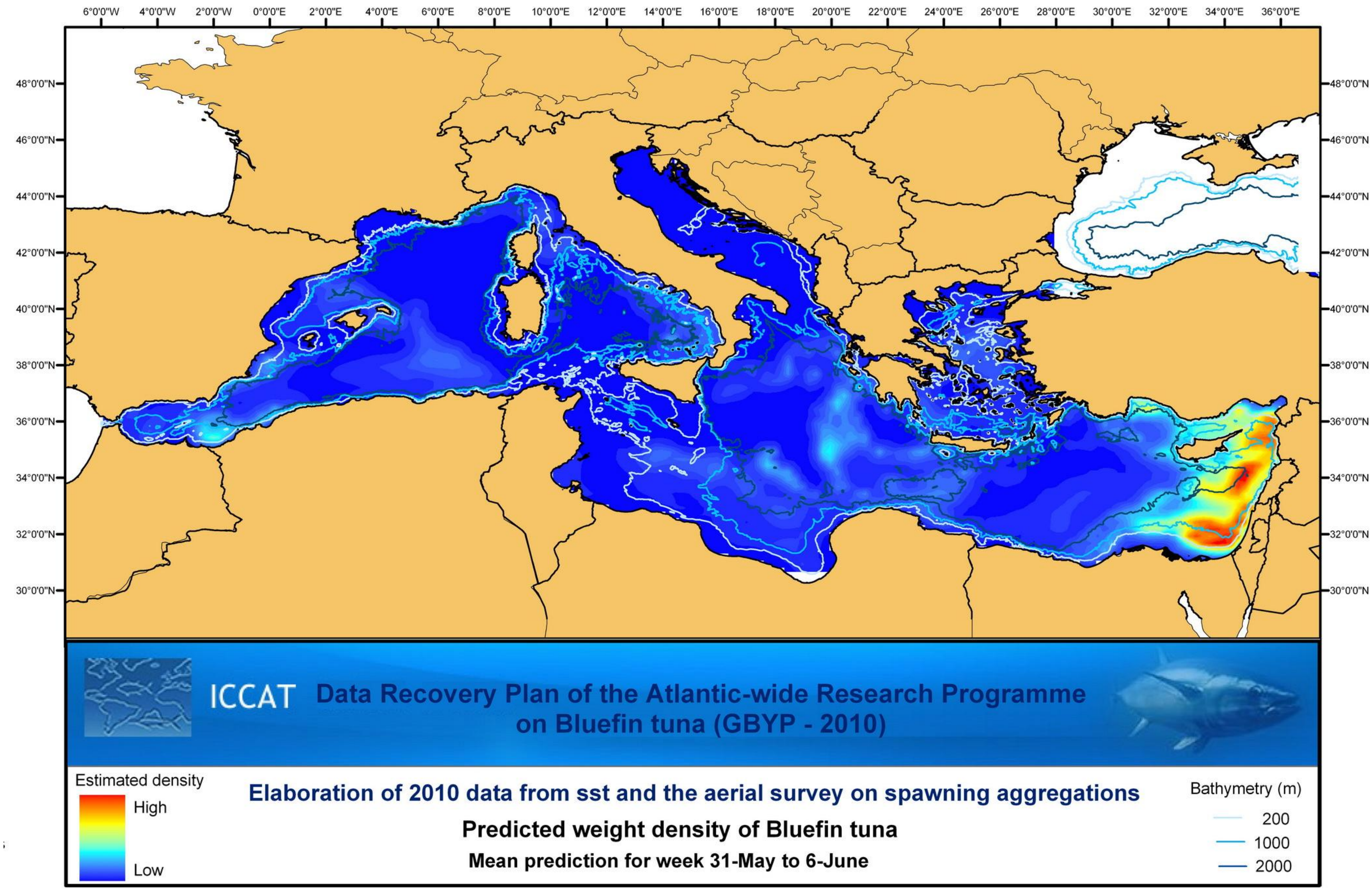

Figure 34. Predicted density of bluefin tuna for 31-May to 6-June 2010

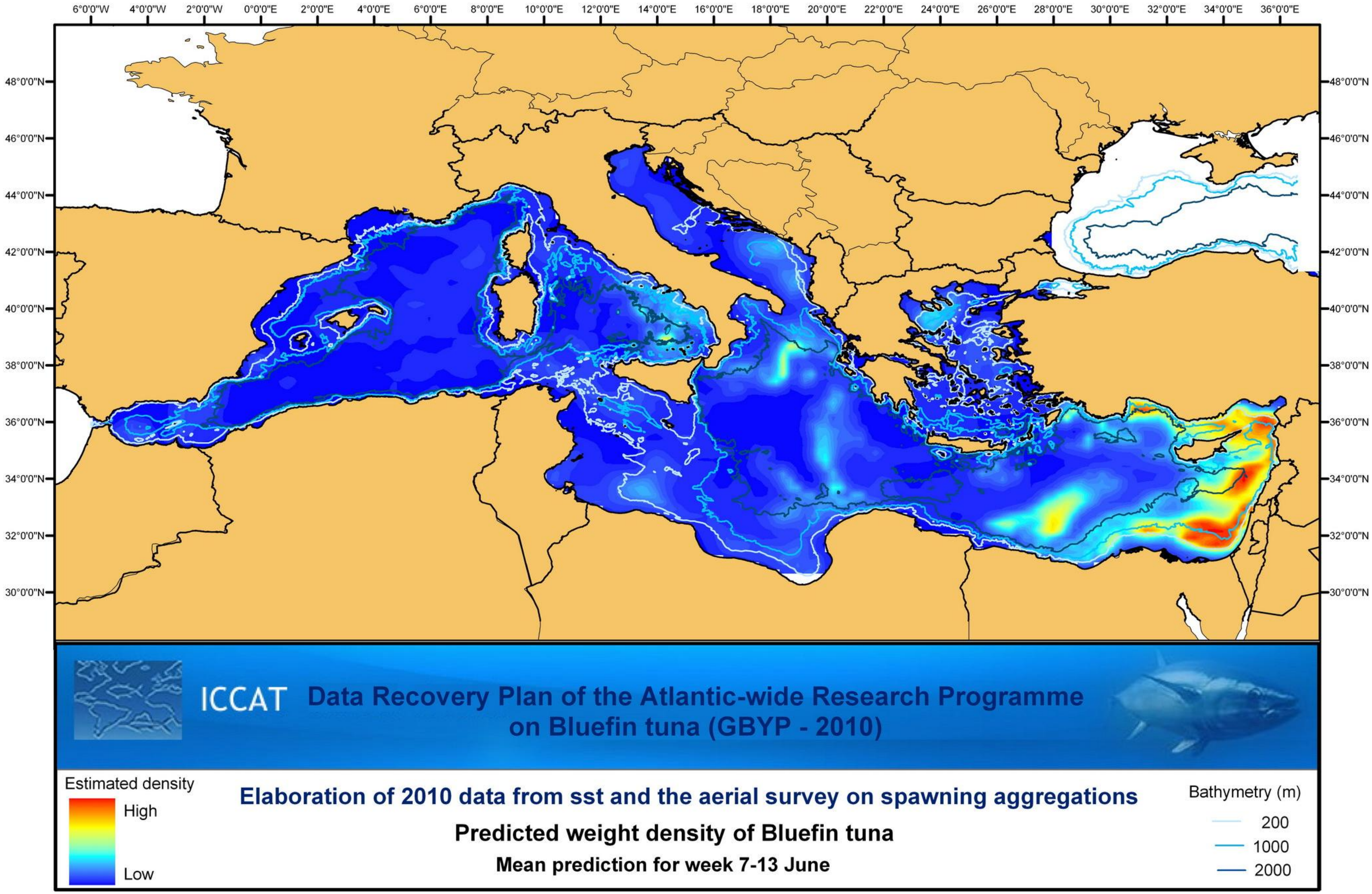

Figure 35. Predicted density of bluefin tuna for 7-13 June 2010

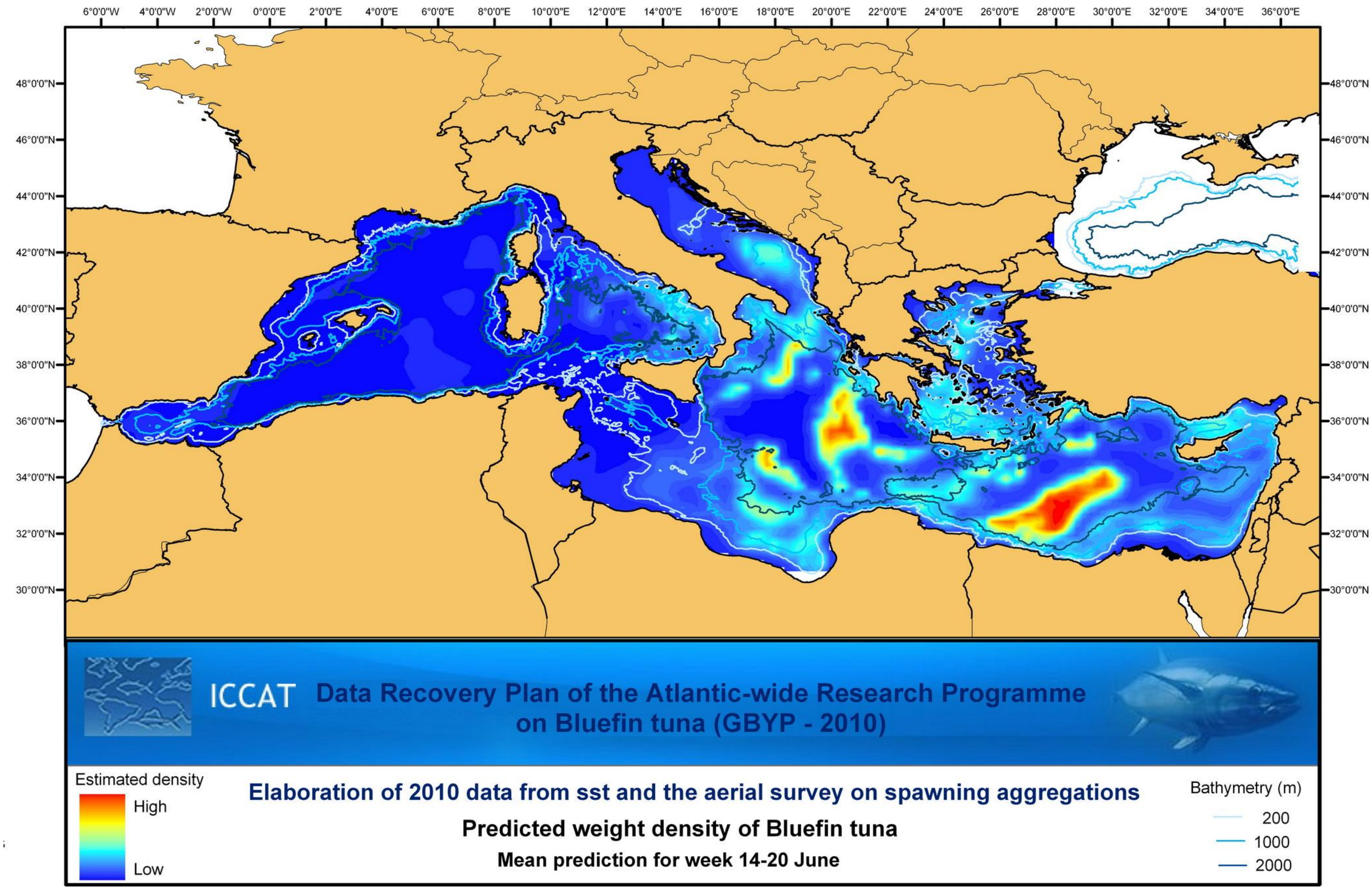

Figure 36. Predicted density of bluefin tuna for 14-20 June 2010

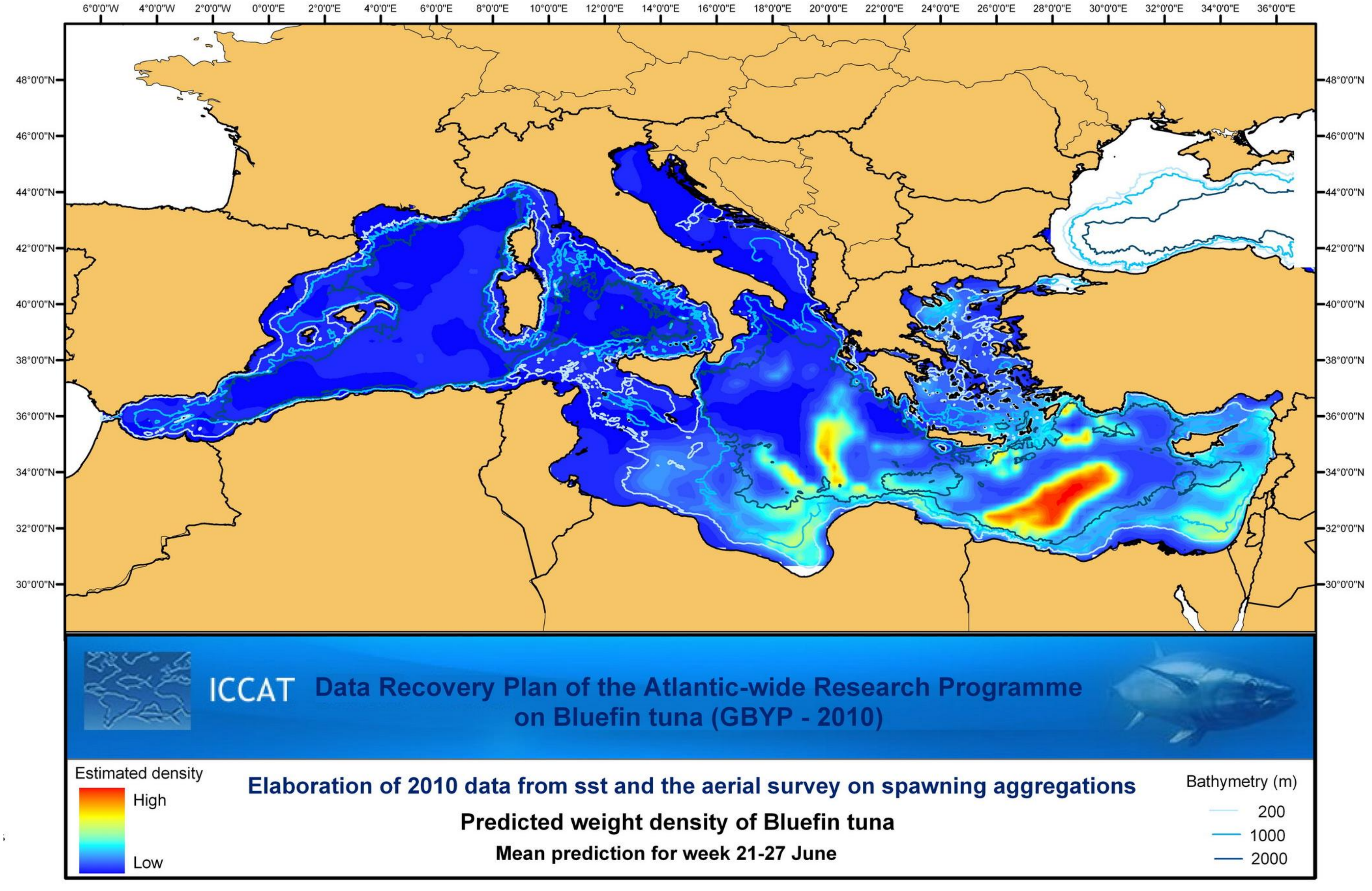

Figure 37. Predicted density of bluefin tuna for 21-27 June 2010

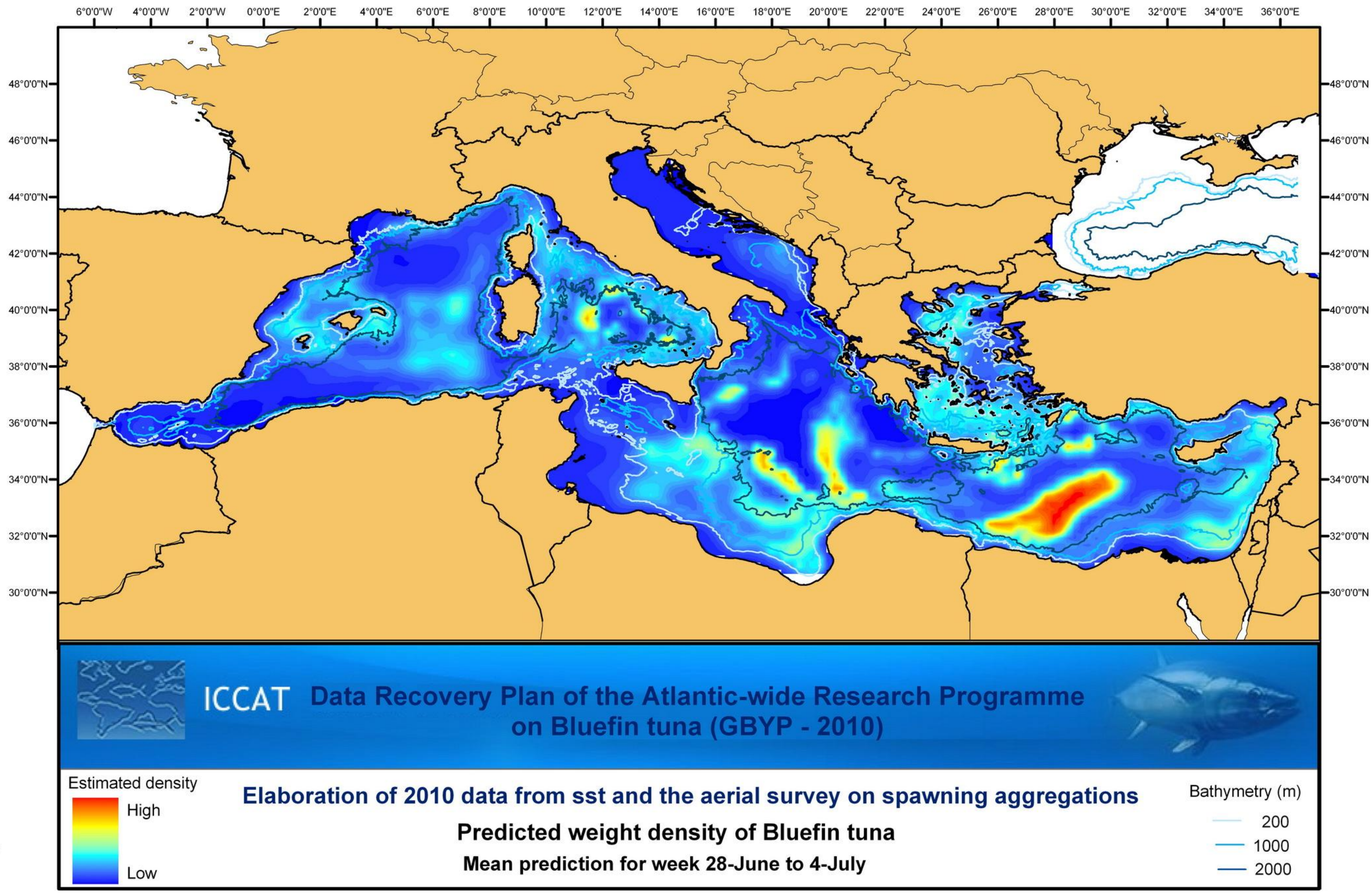

Figure 38. Predicted density of bluefin tuna for 28-June to 4 July 2010

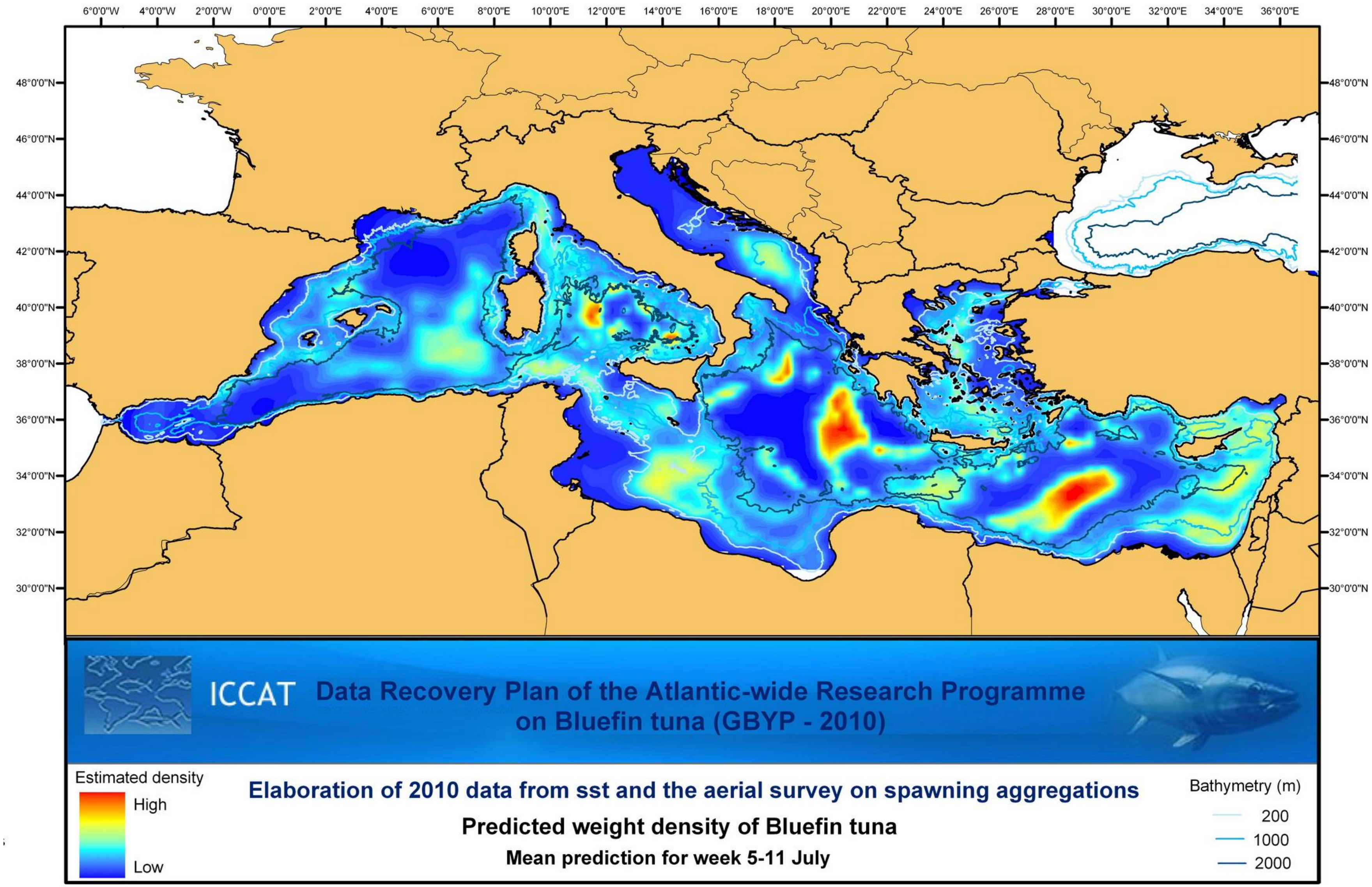

Figure 39. Predicted density of bluefin tuna for 5-11 July 2010

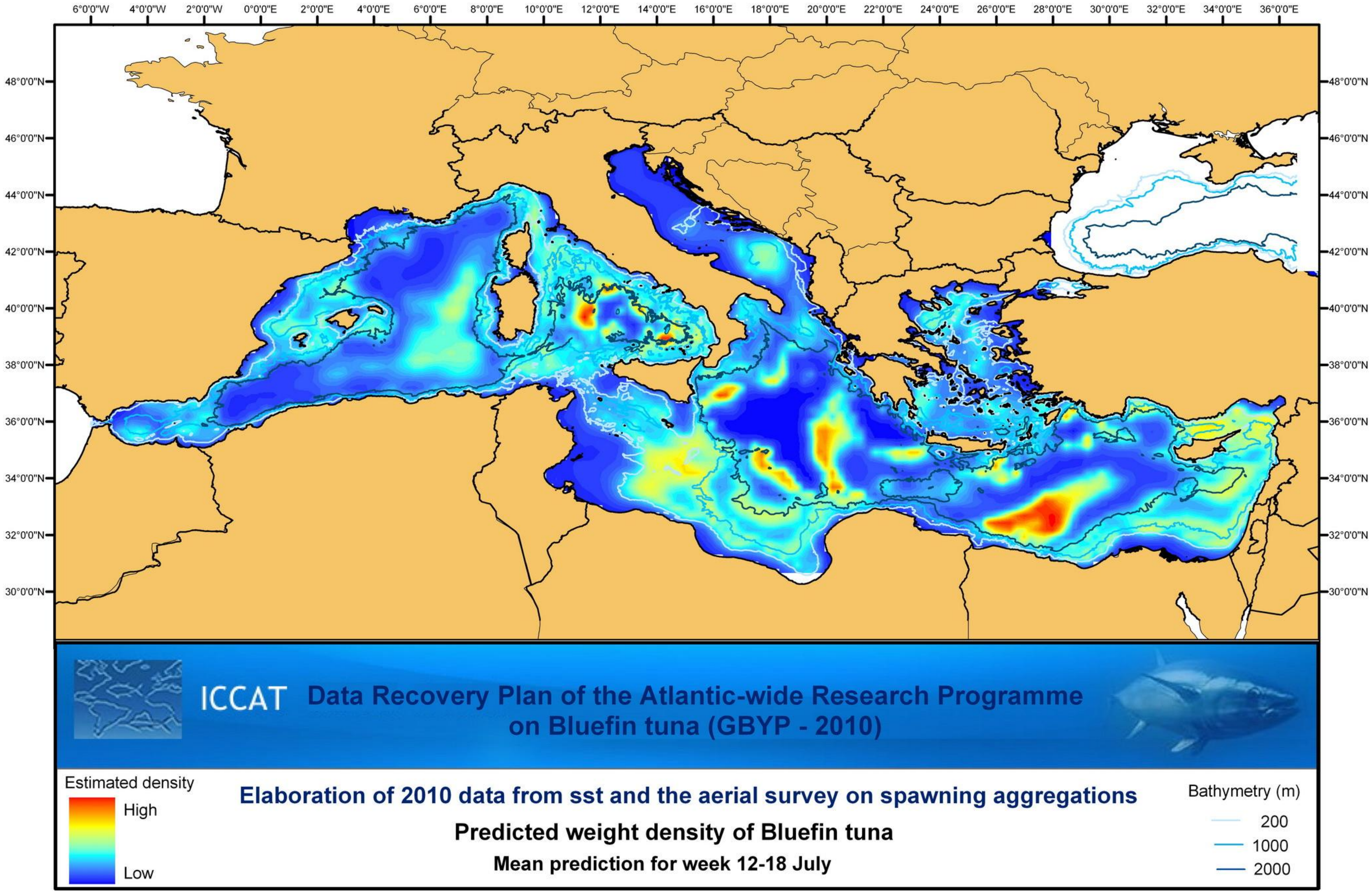

Figure 40. Predicted density of bluefin tuna for 12-18 July 2010

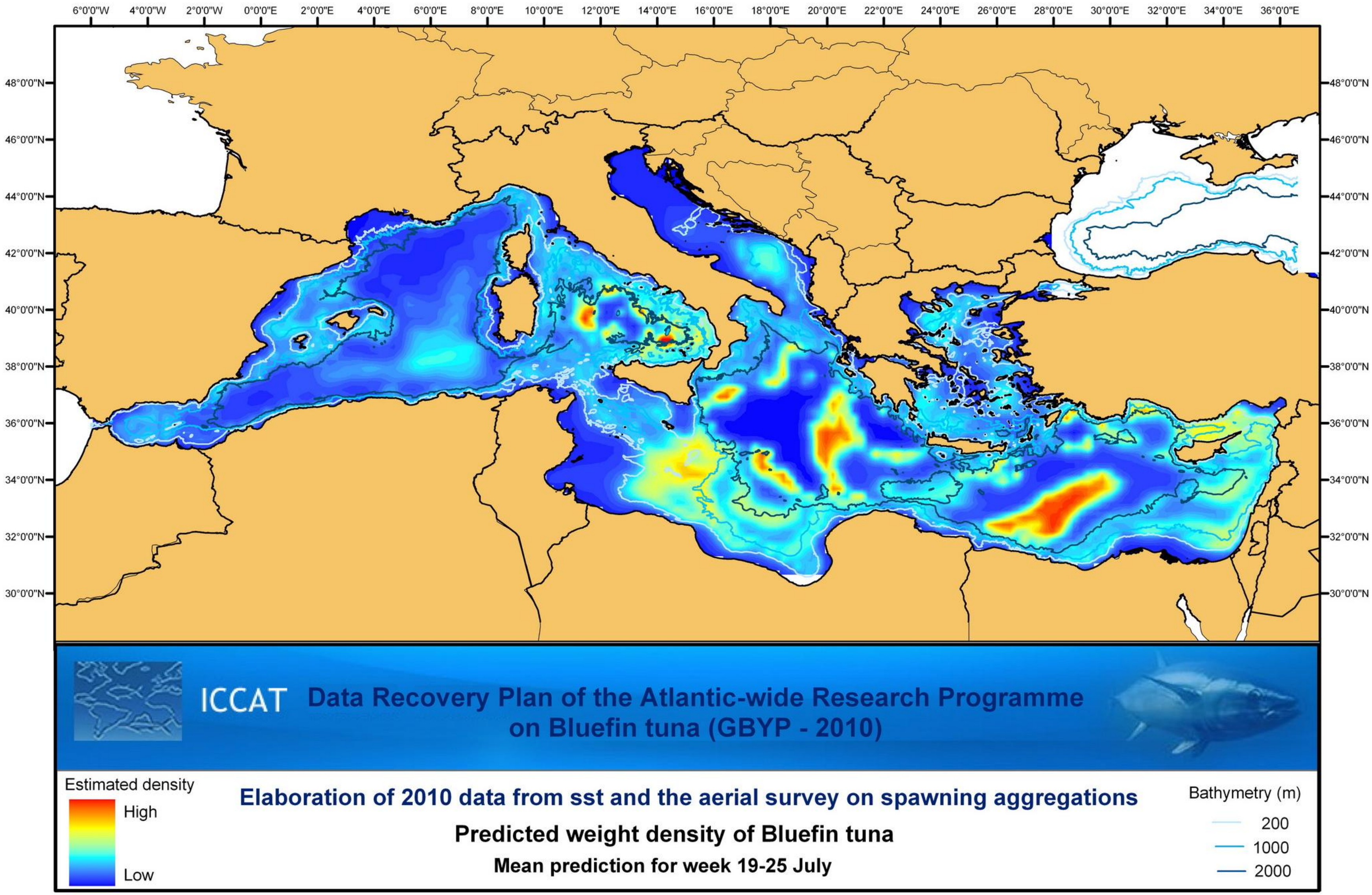

Figure 41. Predicted density of bluefin tuna for 19-25 July 2010

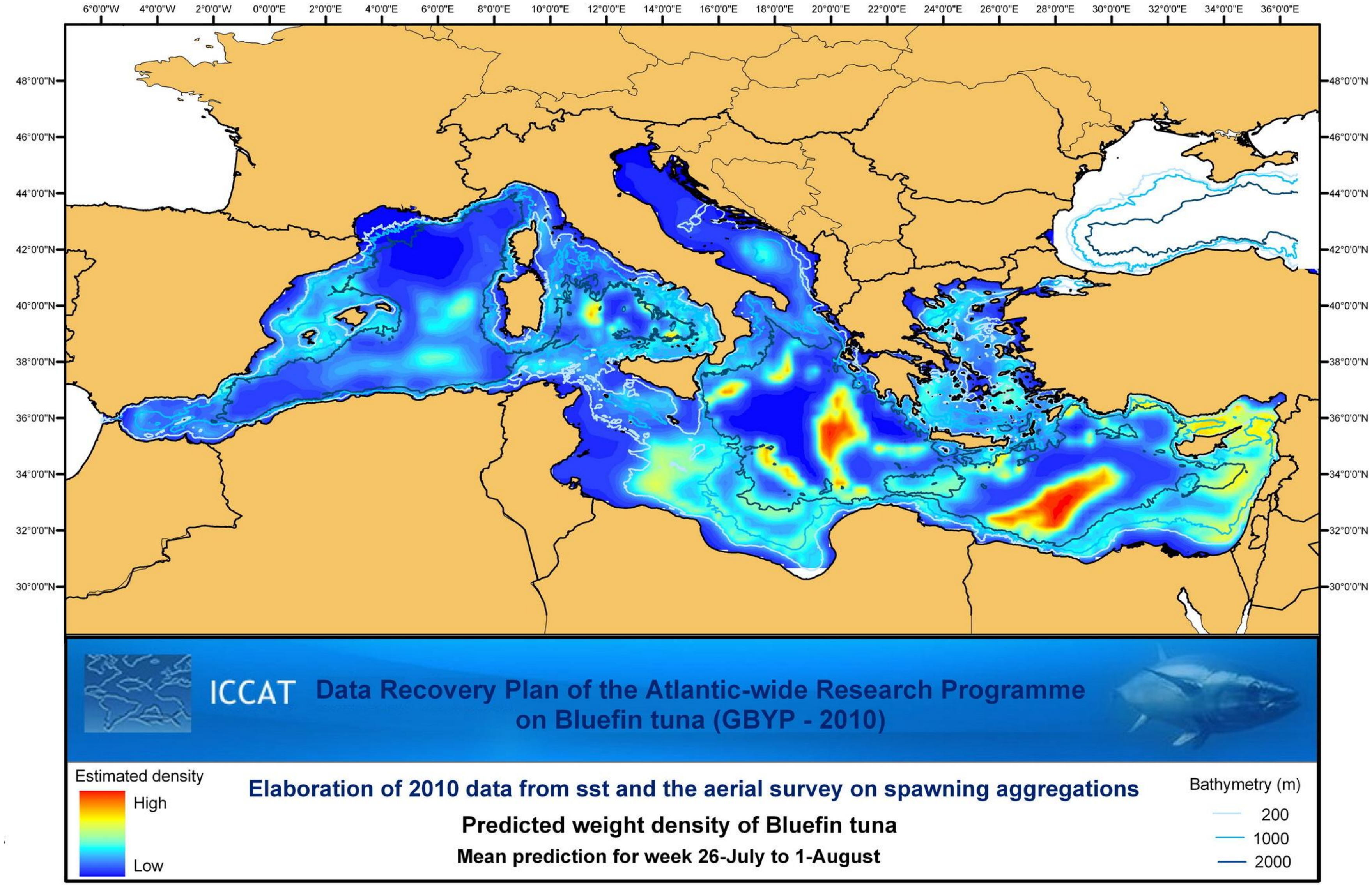

Figure 42. Predicted density of bluefin tuna for 26-July to 1-August 2010

ICCAT GBYP
ATLANTIC-WIDE BLUEFIN TUNA RESEARCH PROGRAMME 2010
GBYP COORDINATOR DETAILED ACTIVITY REPORT FOR 2009-2010

Antonio Di Natale[1]

SUMMARY

The Atlantic-wide research programme on bluefin tuna, conventionally GBYP, proposed by the SCRS and adopted by the Commission in 2008, officially begun on October 2009. The Coordinator was officially hired on March 2010 and the activity practically started on the same month. During this first period of activity, the Programme was set-up at the ICCAT Secretariat and several initiatives have been taken, following the guidelines included in the Programme. In particular, in this first phase the coordination become effective together with the GBYP Steering Committee, the aerial surveys have been properly designed, the first aerial survey on spawning aggregation was completed and the data have been elaborated. The data mining and data recovery exercise was started, and many data sets have been added to the ICCAT data base. It was also possible to organize the tagging design for the Eastern stock and to plan in detail the research initiatives for the next two phases. The GBYP publication policy, editorial and data rules have been defined and adopted at the early beginning of the activities. This first phase demonstrated the high relevance of the GBYP for providing fishery independent data and improving the current bluefin tuna assessment.

RÉSUMÉ

Le Programme de recherche sur le thon rouge englobant tout l'Atlantique, dénommé conventionnellement « GBYP », proposé par le SCRS et adopté par la Commission en 2008, a officiellement commencé en octobre 2009. Le coordinateur a été recruté au mois de mars 2010 et les activités pratiques ont démarré le même mois. Au cours de sa première période d'activité, le Programme a été établi au Secrétariat de l'ICCAT et plusieurs initiatives ont été prises, suivant les directives établies dans le Programme. La première phase a notamment porté sur la coordination effective avec le Comité de direction du GBYP, la conception adéquate des prospections aériennes, la première prospection aérienne de concentration de reproducteurs ayant été achevée et les données élaborées. L'exercice d'exploration des données et de récupération des données a démarré et de nombreux jeux de données ont été ajoutés à la base de données de l'ICCAT. Il a également été possible d'organiser la conception du marquage pour le stock de l'Est et de planifier dans le détail les initiatives de recherche pour les deux prochaines phases. La politique de publication ainsi que les règles éditoriales et en matière de données du GBYP ont été définies et adoptées au tout début des activités. La première phase a démontré que le GBYP était un programme très important pour fournir des données indépendantes des pêcheries et améliorer l'évaluation actuelle du thon rouge.

RESUMEN

El Programa de investigación sobre atún rojo para todo el Atlántico, denominado convencionalmente GBYP, propuesto por el SCRS y adoptado por la Comisión en 2008, y se inició oficialmente en octubre de 2009. El Coordinador fue contratado en marzo de 2010 y las actividades prácticas empezaron ese mismo mes. Durante este primer periodo de actividad, el Programa se estableció en la Secretaría de ICCAT y se han emprendido varias iniciativas siguiendo las directrices del Programa. En particular, en esta primera fase se ha hecho efectiva la coordinación a través del Comité directivo del GBYP, se han diseñado adecuadamente las prospecciones aéreas, se ha finalizado la primera prospección aérea sobre concentraciones de reproductores y se han elaborado los datos. Se han empezado los ejercicios de minería y recuperación de datos, y se han incorporado muchos conjuntos de datos a la base de datos de ICCAT. También fue posible organizar el diseño de marcado para el stock oriental y planificar detalladamente las iniciativas de investigación para las dos próximas fases. Al iniciar las actividades, se ha definido y adoptado la política de publicación y la normas editoriales y en cuanto a datos del GBYP. La primera fase ha demostrado la gran importancia del GBYP a la hora de proporcionar datos independientes de la pesquería y de mejorar la evaluación actual del atún rojo.

KEYWORDS

Bluefin tuna, large pelagic species, ICCAT, research aerial survey, data recovery, tagging, Mediterranean Sea, Atlantic Ocean.

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1.0 Introduction

The Atlantic-wide research programme for bluefin tuna was officially adopted by SCRS and the ICCAT Commission in 2008, after a long process. In 2003, as an input of the Working Group established by Rec. 02-11, SCRS presented the Commission with a research plan to improve knowledge on bluefin tuna, with a special focus on mixing between the two stocks (ICCAT, 2004, Col. Vol. Sci. Pap.ICCAT, 56(3): 987-1003). The various research elements included in this first proposal are still pertinent today, even if some other activities have been included in the following years. During the Marrakech Commission meeting (2008), the SCRS chair met with all the scientists present at the meeting and a detailed proposal was forwarded to the Commission. The proposal was adopted by the Commission in plenary (ICCAT Report 2008-2009 (I), 1: 40) and resulted in a first official document, Res.08-06, which covered only the 2004 SCRS proposal but under a broader title. At the same time, the Commission approved the STACFAD Report (ICCAT Report 2008-2009 (I), 1: 42), which included the agreement to endorse the Atlantic-wide research programme (ICCAT Report 2008-2009, (I), 1, Appendix 10 to Annex 9: 284-287), establishing three priorities in 2009 (Coordinator, data mining and Aerial surveys), other action to be further discussed by SCRS in 2009 and the provision for the programme to be adjusted in the following years taking into account the evolution of its implementation and research needs. The total budget of the programme was estimated at about 19 million Euros in 6 years. The same document reports the engagement of the European Community and some other Contracting Parties to contribute to this programme in 2009 and in the following years.

The SCRS, in 2009, reviewed the updated research proposal submitted by SCRS chair, as it was discussed and presented to the Commission at its meeting in 2008 (ICCAT Report 2008-2009 (II), 1: 224 and ICCAT Report 2008-2009 (II), 2: 223-224). The SCRS indicated the priorities identified in the 2008 document, as follows:

a) <u>Improve basic data collection</u> through mining (including information from traps, observers, and VMS), developing methods to estimate sizes of fish caged, elaborating accurate CPUE indices for Mediterranean purse seine fleets, development of fisheries-independent information surveys and implementing a large scale well planned conventional and genetic tagging experiment;
b) <u>Improve understanding of key biological and ecological processes</u> through electronic tagging experiments to determine habitat and migration routes, broad scale biological sampling of live fish to be tagged and dead fish landed (e.g. gonads, liver, otoliths, spines, etc.), histological analyses to determine bluefin tuna reproductive state and potential, and biological and genetics analyses to investigate mixing and population structure; ecological processes, including predator-prey relationships;
c) <u>Improve assessment models and provision of scientific advice on stock status</u> trough improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and developing and use of biologically realistic operating models for more rigorous management option testing.

A number of Contracting Parties expressed a willingness to make extra-budgetary contributions to such a programme with a view towards initiation of activities in 2009 related to programme coordination, data mining, aerial surveys, and tagging design studies, with additional research activities to be undertaken in the following years.

The first phase costs were set at 750,000 Euro and voluntary contributions sufficient to initiate the year 1 activities were jointly committed by the European Community, United States, Japan, Canada, Norway, Croatia, Turkey and Chinese Taipei, while Morocco indicated its interest in future contributions. The provision to accept additional contributions from various entities and private institutions or companies was also agreed. In the same document, it was recommended to form a Steering Committee comprised by the SCRS Chair, the ICCAT Executive Secretary or his/her Assistant, bluefin tuna rapporteurs, and an outside expert with substantial experience in similar research undertakings for other tuna RFMOs, to guide and refine the Programme as necessary.

2.0 Coordination activities

The GBYP officially started on 12 October 2009, with the signature of the agreement between the European Community and the ICCAT Secretariat. The GBYP co-ordination full-time activity officially started on March 3, 2010, after hiring the Coordinator.

The very first period was devoted to set-up a detailed weekly workplan for 2010, to organise the coordination structure at the Secretariat, to set-up the Steering Committee and nominate its members (13/03/2010); the Steering Committee is now composed by the Chair of SCRS, Ph.D. Gerald Scott, the BFT-W Rapporteur, Ph.D. Clay Porch, the BFT-E Rapporteur, Ph.D. Jean-Marc Fromentin, the ICCAT Executive Secretary, Dr. Driss Meski, and an external expert, Ph.D. Tom Polacheck, who kindly accepted this duty. The ICCAT Secretariat set up the administrative structure and the administrative rules were agreed and established, accordingly with the ICCAT system and taking into account also the programme administrative needs.

The coordinator participated officially to the following meetings:

date	place	Meeting	motivation
12-14/04/2010	Malta	FEAP (Med tuna Industry)	Presentation of GBYP and request for cooperation
15/04/2010	Rome (IT)	Direction General for Fishery	Presentation of GBYP and discussion about the possibility to develop a national aerial survey programme on spawners and juveniles to enlarge the GBYP possibilities
19/04/2010	Madrid (SP)	Balfego Group	Presentation of GBYP and request for cooperation
21-23/04/2010	Madrid (SP)	ICCAT Working Group on Stock Assessment Methods	participation
31/5-4/6/2010	Madrid (SP)	ICCAT Intersessional Meeting of the Sub-Committee on Ecosystems	participation
30-31/05/2010	Barcelona (SP)	Tuna RFMOs	Informal meetings with scientists and CPCs to further support the GBYP initiatives
2-5/06/2010	Carloforte (IT)	Workshop on Tuna	Presentation of GBYP, workshop on tuna issues, contacts with the trap industries for cooperation
14-16/06/2010	Bonn (GE)	OSPAR Biodiversity Comm.	Presentation of GBYP and discussion on tuna problems
17-18/06/2010	Madrid (SP)	Bluefin Tuna Data Preparatory Meeting	Presentation of GBYP and participation to the meeting
19/06/2010	Madrid (SP)	Steering Committee Meeting	Discussion about strategies and agenda
24-25/06/2010	Bruxelles (BE)	EC-DG MARE	Discussions about the administrative duties of GBYP and future biannual funding
14/07/2010	Madrid (SP)	IEO national meeting on tuna research programmes	Presentation of GBYP and discussion about possible cooperation
4-5/09/2010	Madrid	GBYP Steering Committee	Review of the first year activities; planning for the next two years; budget
6-12/09/2010	Madrid	Bluefin tuna assessment meeting	Presentation of GBYP and participation to the meeting

Furthermore, the GBYP coordinator is providing a scientific support to all the national initiatives which are potentially able to increase the effectiveness of the GBYP and its objectives. For this reason, he was also asked to join the Steering Committee for the bluefin tuna programmes of the NOAA, together with other members of the GBYP Steering Committee.

In conformity with the Atlantic-Wide Bluefin Research Programme (GBYP) adopted by the SCRS and the Commission, the following research initiatives have been initiated (see also Table 1):

3.0 Aerial surveys

The aerial surveys have the scope to provide fishery independent indices, concerning various fractions of the stock. The aerial surveys targeting spawning aggregations can potentially provide indices for the spawning stock biomass, while aerial surveys targeting aggregations of juveniles can potentially provide indices for the recruitment. In every case, surveys shall be conducted with a statistically sound design and for several years in order to get reliable indices.

The GBYP set up general rules for standardising the aerial surveys to be conducted: all aircraft shall have upper wings, possibly two engines, should stay at an altitude between 300 to 330 m over the sea level, and shall have a GPS able to continuously recording the track and the related data. Each aircraft shall be identified by an ICCAT number in contrasting colour with the aircraft, on one lower side of the wings and on one side of the aircraft. Each team on board shall include an expert pilot, a professional tuna spotter and a scientific observer. All sightings shall be properly recorded on a common form in excel, to facilitate the data elaboration, and documented by photos.

The budget available (300,000 Euro) for the first phase was not enough to cover all areas and all needs (spawning aggregations and juvenile aggregations). After a discussion with the Steering Committee, it was decided to concentrate all efforts and resources only on bluefin tuna spawning aggregations, with the purpose to get a first minimal estimation of the spawning stock biomass and to develop and index. It was also agreed to postpone any eventual intercalibration exercise to the next years, because of time, budget organisation and administrative constrains. It was also agreed to support eventual additional activities of aerial surveys on juveniles and aerial surveys in other spawning areas, conducted with national funds, providing them common methodologies.

3.1 Aerial survey design

The preliminary work was devoted to identify the most relevant areas and it was carried out at the ICCAT Secretariat, by using the 2008 and 2009 VMS data from purse-seine vessels. It was agreed to concentrate the efforts only on areas where the PS fishing activity was more intense in these last two years, even if it was clear that the spawning areas were possibly much larger than those identified. It was established to define them by squares of 1°x1°.

The study revealed 6 sub-areas where the purse-seine fishing activity was more intense during the spawning period in 2008 and 2009 (figure 1), but it was necessary to exclude fishing activities not targeting spawners (e.g.: those in central-north Adriatic Sea).

Even if there was no mention on the budget or in the Programme, it was decided that a survey design, statistically sound, was absolutely necessary before beginning the survey activity and this item was considered as an essential preliminary part of the "Aerial Survey". The sampling design was required in a way that it should balance the available funds with the flight hours required.

The Call for Tenders was released on March 23, 2010 (ICCAT Circular 812/2010), receiving only one bid. The contract was awarded to Prof. Philip Hammond (UK) on April 5, 2010. Prof. Hammond provided a first version of the Aerial Survey Design on April 22, 2010, well in advance of the date established by the contract (May 15). This allowed some Members of the Steering Committee, during a meeting held at the ICCAT Secretariat on April 23, 2010, to directly discuss with Prof. Hammond and to require some modifications (e.g.: more distance between transects), with the purpose to have more replicates in each area.

The new adapted version of the sampling design, with all the necessary tables and figures, was provided on May 1, 2010 (figure 2).

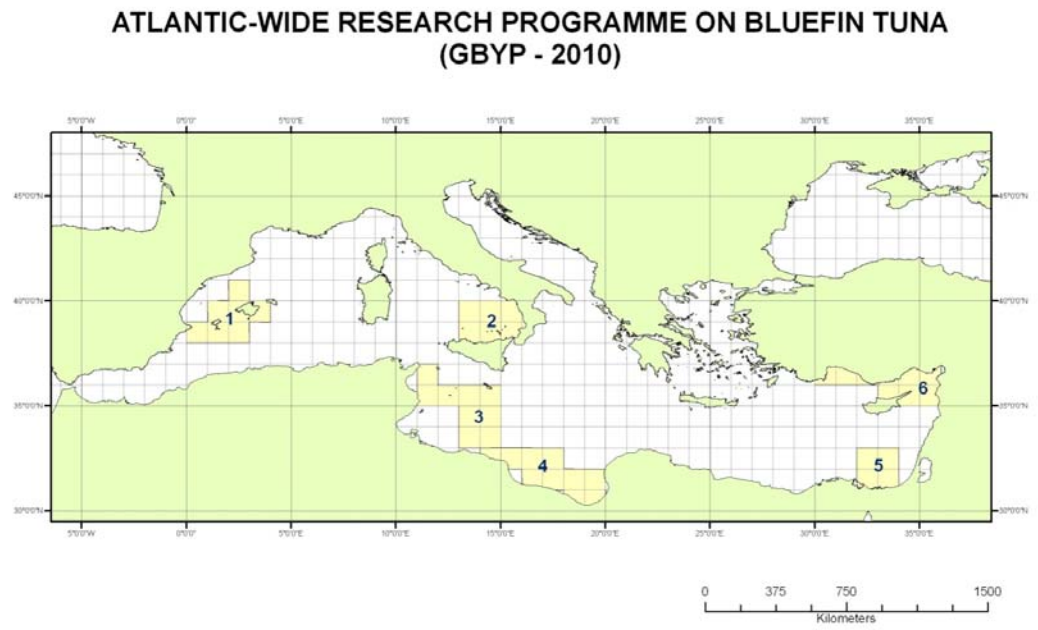


Figure 1 – The 6 sub-areas identified for conducting the aerial survey on spawning aggregations in 2010, based on the 2008-2009 purse-seine fishing activity.

Figure 2 – An example of the various aerial survey designs in all the sub-areas. First line, from left to right, tracks in sub-areas 1 to 3; second line, from left to right, tracks in subareas 4 to 6.

3.2 Aerial survey on spawning aggregations

In parallel with the sampling design activities, due to the lack of sufficient time, a Call for Tenders for the Aerial Survey on Spawning Aggregations was released on April 6, 2010 (ICCAT Circular n. 1000/2010). The Secretariat received 7 bids and 3 of these were awarded on April 29, 2010: Grup Air Med (SP) for sub-areas 1 and 3, Consorzio Unimar (IT) for sub-area 2 and Périgord Travail Aérien (FR) for sub-areas 4, 5 and 6. The contracts were discussed in three meetings at the Secretariat from 11 to 13 May 2010 and all were signed within a few days. The date for beginning the surveys was set on May 24, 2010, for all tenders. It was agreed that preliminary data should be delivered just before the 2010 BFT Assessment meeting. A common format to transmit the aerial survey data to the ICCAT Secretariat was provided to all the contractors, with the purpose to get the data "ready to use".

All tenders were able to get the flight permits from Spain, Italy, Malta, Cyprus and Turkey in due time. Both Grup Air Med and Périgord Travail Aérien had serious troubles for obtaining the flight permits from Egypt, Libya and Tunisia. Finally, with a lot of delay, Périgord Travail Aérien got the flight permit from Egypt. It was impossible to obtain the flight permits from Libya and Tunisia, despite of several interventions officially made by the ICCAT Executive Secretary and various diplomatic efforts. Another problem raised when one of the aircrafts belonging to Périgord Travail Aérien approached the airspace of Egypt, because the Egyptian Authorities changed the authorisation for the requested altitude (300 m), imposing a different one (1500 m), not suitable for the survey, and requested the aircraft to land in Alexandria to apply for a new permit, to be eventually released in the future. All these problems together imposed a revision of the contracts with Grup Air Med and Périgord Travail Aérien and, at the same time, a revision of the aerial sampling design.

Sub-area 4 (all inside the Libyan airspace) and sub-area 5 (all inside the Egyptian aerial space) were cancelled, creating a serious problem for the survey in general, because the biological information on bluefin tuna spawning and behaviour in these areas were almost nil, and then precious to be collected for a better understanding of the bluefin tuna in the Mediterranean. Sub-area 3 has been reduced in size (cutting off 18 miles in the southern part, because they were within the Libyan airspace, and cutting another section, till the eastern limit of the Tunisian airspace, on the western side).

In agreement with the Steering Committee, it was decided to define two additional sub-areas, where the fishing activity on spawners was anyway present in 2008 and 2009, even if it was apparently less intense. The two new sub-areas, 7 and 8 (figure 3), were given to Périgord Travail Aérien, in substitution of sub-areas 4 and 5. It was necessary to provide in emergency a new aerial survey design, following the same design made on near or similar sub-areas. Even in this case, it was necessary to adjust the design for sub-area 8, cutting off 18 miles from the southern limit, due to the Libyan airspace boundary. The amendment to the contract was provided to Périgord Travail Aérien on June 24, 2010.

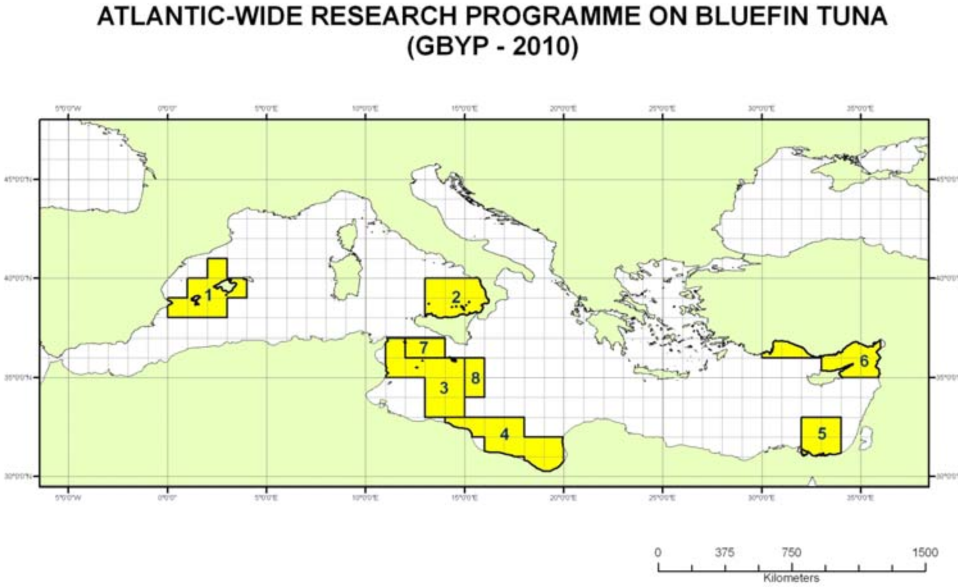


Figure 3 – The updated map of all the 8 sub-areas identified for the aerial survey on spawning aggregations in 2010. The sub-areas 3 and 8 are not showing the zones were the survey activity was excluded due to the lack of permits from the Tunisian and Libyan Aviation Authorities.

The same aerial survey design approach was applied by Italy, with national funds, in two additional zones close attached to sub-area 2 (figure 4). The survey was carried out testing the possibility to use a different type of aircraft (ATR 42 MP), much bigger that the aircrafts used by the GBYP Aerial Survey. The results of this additional survey should be reported to ICCAT-SCRS and ICCAT-GBYP by Italy, during one of the coming meetings.

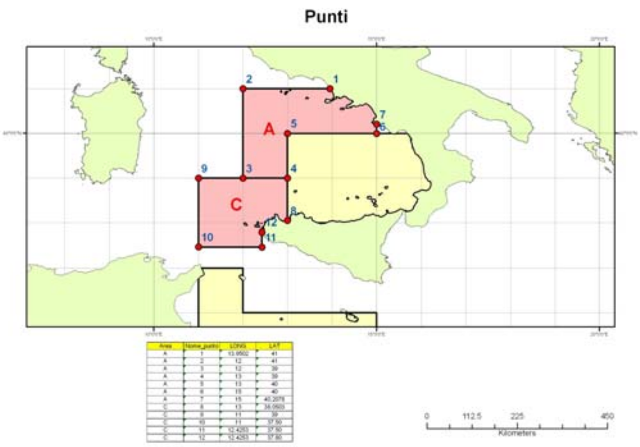


Figure 4 – The map of the two additional zones (A and C) attached to sub-area 2, where Italy decided to carry out an additional aerial survey in summer 2010.

It was decided to continuously monitor the sea surface temperatures and waves, with the purpose to have a better understanding of the various operative and environmental situations during the aerial survey campaign in 2010. The maps have been collected daily from http://gnoo.bo.ingv.it/mfs/Forecast/bulletin.htm?link=F for the sea surface temperatures and from http://isramar.ocean.org.il/isramar2009/wave_model/default.aspx?region=coarse&model=wam for the wave (figure 5).

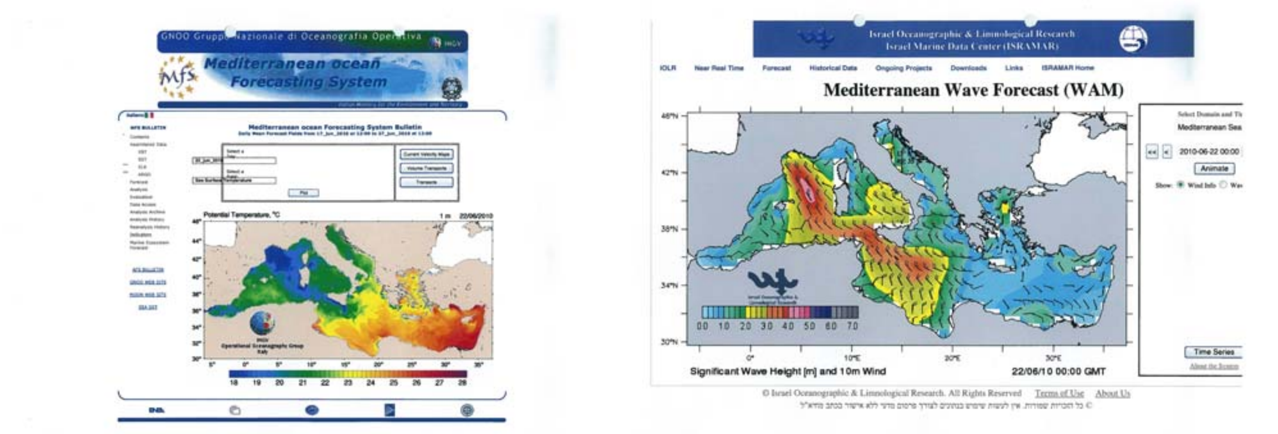


Figure 5 – An example (22 June 2010) of the daily maps for surface temperatures (left) and wave (right) collected by GBYP during the 2010 aerial survey campaign.

The aerial survey on spawning aggregation in 2010 was affected not only by the bureaucratic problems, but also by the unusual situation in terms of temperatures and winds. The surface temperature was unusually very cold in all the western and central Mediterranean till about mid-June, while even in the eastern Mediterranean the sea temperature was lower than usual in most of the areas till the last part of May. The strong winds and the bad weather conditions had a relevant presence in many days (figure 6), much more than the 20% considered when planning the activities and the budget. As a matter of fact, according to a preliminary estimate, the average of unsuitable conditions for aerial survey, taking into account both the sea surface temperature and the wind, was 37.5% among the various areas, with a better situation in sub-area 6 (only 23% of unsuitable conditions) and a worse situation in sub-area 8 (56.4% of unsuitable conditions), but local winds were able to further reduce the operative days.

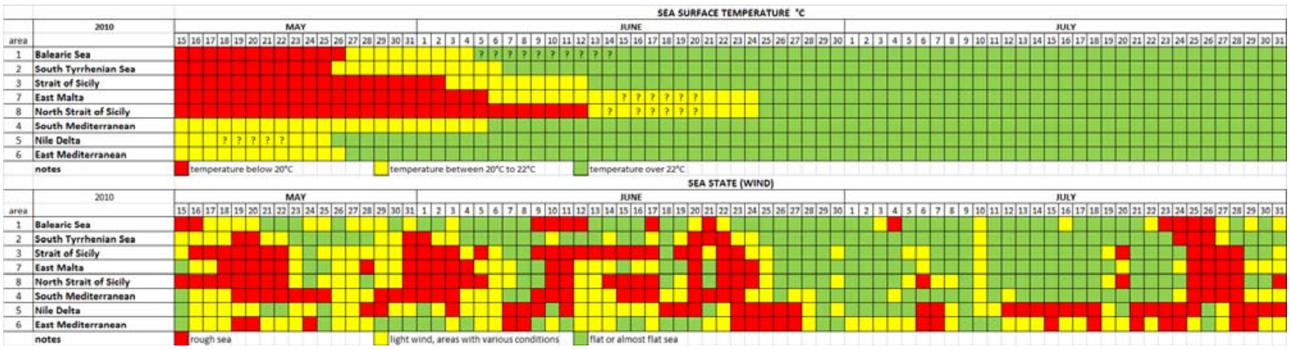


Figure 6 – A first estimate of the environmental conditions during the GBYP Aerial Survey in 2010 in the various sub-areas. The upper table shows the average surface temperatures, confirming the relevant delay for establishing the proper temperature for spawning in the western and central Mediterranean Sea. The lower table shows the sea state conditions, which clearly indicates the difficulties for carrying out the survey in many sub-areas, due to the strong winds during spring 2010.

It is possible that the wind, in presence of marginal optimum temperature for spawning (>20.5°C), prevented the thermocline to be established at the right depth in various areas during the first part of the season. These environmental facts implied a delay in the bluefin tuna spawning activities in most of the areas and prolonged the survey activities, even if full details should be available later. The aerial survey data have been provided on schedule by all teams and the individual reports are already available.

This first year activity of aerial surveys is considered essential and extremely useful to better plan and refines the aerial surveys in the following years of the Programme, including the necessary preliminary official contacts with all CPCs interested by the Aerial Survey activities, in order to inform the local Authorities and get flight permits on time.

4.0 Data mining and data recovery

The first preliminary activity was conducted at the ICCAT Secretariat. An analysis of the ICCAT data base on bluefin tuna was carried out, with the purpose to identify the most relevant gaps in the data series which are potentially useful for the stock assessment; this gap analysis was provided by GBYP to the SCRS Scientists and National statistical correspondents to help them in detecting the lacking data.

The first Call for Tender on this item was issued on April 13, 2010 (ICCAT Circular n. 1094/2010). Besides of the very large distribution of the Call, passed also to various national scientific networks, the ICCAT Secretariat received only one bid, which was not accepted after a cross-check with the bluefin tuna data base (May 28, 2010).

A second Call for Tenders was released immediately after, on June 11, 2010 (ICCAT Circular n. 2351/2010). This Call received 5 bids. After a cross-check of the bluefin tuna data base, an internal review of the bids, and in strict consultation with the Steering Committee, all bids were accepted and the award was provided on July 30, 2010, to Direction des Pêches Maritimes (SEN), Fundación AZTI (SP), Institute of Marine Research (NO), Necton S.C. (IT) and Ricerca Mare Pesca (IT), along with the related contracts. The various proposed data sets, actually missing from the bluefin tuna data base, concerns about 180,000 specimens and a wide range of years and should improve the knowledge on several fisheries in various areas. A common format for transmitting the data to the ICCAT Secretariat was provided to all the contractors, with the purpose to get the data "ready to use" and in a format allowing their immediate incorporation in the bluefin tuna data base. Many data sets have been already provided to the GBYP on due time. The final report must be submitted by October 4, 2010.

A third Call for Tenders was issued on June 30, 2010 (ICCAT Circular n.2668/2010), specifically focused on the "Elaboration of 2010 Data from the Aerial Survey on Spawning Aggregations" within the Data Recovery Plan. The purpose of this Call was to make immediately available for the SCRS all the data obtained during the aerial surveys carried out by GBYP in 2010. This Call received only one bid. The tender, Alnilam Investigación y Conservación SL (SP), was awarded on August 6, 2010 and the contract was delivered on the same date. The report was provided on due time and the results are considered very useful for improving the aerial survey activities in the following years.

5.0 Tagging design

This item was largely discussed, at first at the Secretariat level, and then with the Steering Committee, because of the various possible option of tagging techniques and their different possible use for the assessment. At the end of the discussion, which was very useful in scientific terms, it was decided to release a Call for Tenders for the Tagging Design on July 26, 2010 (ICCAT Circular 3122/2010). Besides of the very large distribution of the Call, passed also to various national scientific networks, the ICCAT Secretariat received only one bid. The Steering Committee, during its meeting on September 4 and 5, 2010, in agreement with the ICCAT Secretariat and the GBYP Coordinator, asked the tender to modify the proposal, in order to get a tagging design limited to the Eastern Atlantic and the Mediterranean, for conventional tags and PITs (and electronic tagging in Phase 3), asking to verify the practical tagging possibilities with tuna trap owners and purse-seine fishermen, and including a manual for tagging. The official request to modify the offer, also taking into accounts the revised and reduced budget adopted by the Steering Committee, was delivered on September 14, 2010 and the revised offer arrived on September 24, 2010 and it is under discussion.

This item is considered extremely relevant, because it should provide a better estimate of natural mortality rates (M) by age or age-groups and/or total mortality (Z); it should provide also updated tagging reporting rates by major fisheries and areas, and it should improve the knowledge on the habitat utilisation and movement patters of bluefin tuna in the various areas. It shall provide the base to carry out the tagging activities in the following years, with important implications on the GBYP budget.

Table 1 - Summary status of the various items included in the first year activity of the GBYP

Item	Award date	deliverables		
	or contract date	Preliminary report	Draft final report	Final report
Aerial survey design	05/04/2010	-	22/04/2010	01/05/2010
Aerial survey on spawning aggregations (1 to 6)	29/04/2010	20/06/2010	03/09/2010	22/09/2010
Aerial survey on spawning aggregations (7 and 8)	24/06/2010		03/09/2010	22/09/2010
Data recovery (5 contracts)	30/07/2010	06/09/2010	27/09/2010	04/10/2010
Data recovery – Elaboration of Aerial Survey Data	06/08/2010	06/09/2010	27/09/2010	04/10/2010
Tagging Design	tbd	tbd	tbd	tbd

6.0 Definition of GBYP Publication Policy, Editorial and Data Rules

The need to have a clear and defined publication policy, along with editorial and data use rules, was one the first issue tackled within the GBYP coordination. The discussion was carried out at the Secretariat level, taking into account the

ICCAT rules in this sector and the SCRS statements, and the final document was officially adopted on March 15, 2010 (see Annex 1).

7.0 Steering Committee Meetings

The Steering Committee meetings were not planned at the beginning of the activity, because of logistic difficulties. For this reason, it was a precise duty of the GBYP Coordinator to constantly inform by e-mail all the Members, about the detailed activities of the Programme and request their opinion when necessary. Apart from that, there was a continuous and productive contact with all Members, to better refine the various contents of the Programme.

The first informal meeting of the Steering Committee was hold at the ICCAT Secretariat on April 23 and 24, 2010, to discuss about the aerial survey design and the aerial survey strategies.

The second informal meeting was hold at the ICCAT Secretariat on June 19, 2010, to discuss about the Call for Tenders to be released and the various tagging options.

The third meeting, formal, was on September 4 and 5, at the ICCAT Secretariat. The draft agenda for the meeting was prepared by the GBYP Coordinator in consultation with the ICCAT Secretariat and distributed to the Steering Committee for comments. An annotated agenda, with all the necessary information was also distributed to the Steering Committee. The meeting report was produced in real time and it will be posted on the new GBYP page within the ICCAT web page.

A fourth meeting was convened *ad horas* at the ICCAT Secretariat on 10, 11 and 12 September 2010, due to the information received about the availability of a reduced budget for the next two phases of the GBYP and the consequent need to revise the various items within the budget. Furthermore, the Steering Committee discussed some proposals forwarded by the participants at the Bluefin Stock Assessment meeting. The meeting report was produced in real time and it will be posted on the new GBYP page within the ICCAT web page.

A fifth meeting was convened *ad horas* at the ICCAT Secretariat on September 30, 2010, to discuss the revised proposal for the tagging design and various additional issues. The Steering Committee decided to request some additional details to the tender, and approved various items. The meeting report was produced in real time and it will be posted on the new GBYP page within the ICCAT web page.

8.0 GBYP web page

The ICCAT Secretariat, in agreement with the GBYP Coordinator, decided to add a GBYP page to the official ICCAT web page, with the purpose to provide full and transparent information about all the activities carried out by the GBYP. The page was set-up by the Secretariat staff and the contents were provided by the GBYP Coordinator. The page will be regularly updated.

9.0 Following activities

According to the precise guidance of the GBYP Steering Committee, the next phases of the Atlantic-Wide Research Programme for Bluefin Tuna will include only activities able to provide fishery independent data and indices within the time-frame of the whole programme and in agreement with the GBYP general plan adopted by the SCRS and the ICCAT Commission. Due to the limited budget available for Phase 2 (2010-2011) some activities already included in the original general planning have been temporarily excluded (i.e.: eggs and larval survey, intercalibration of aerial surveys), others have been delayed (i.e.: electronic tagging), while others (i.e.: conventional and PITs tagging) have been considerably reduced.

The Steering Committee and the GBYP Coordinator agreed to keep only the activities already initiated or absolutely essential for the programme, but confirming the need to follow the original list and volume of activities whenever appropriate funds will be available (Steering Committee meeting report 4-5 September 2010). For this reason, GBYP Phase 2 is considered a contingency minimal programme, while a similar strategy is planned for Phase 3 (Steering Committee *ad horas* meeting report, 10, 11 and 12 September 2010).

GBYP Phase 2 (under the reduced minimum budget perspective) will include the following activities, for a total budget of 2,502,000 Euro (including 10,000 Euro for contingencies):

1) **Coordination**, reinforcing the coordination team with two additional staff (1 G2.1 and 1 P2), due to the workload, and with contracts for the external members of the Steering Committee, for a total cost of 443,000 Euro.

2) **Data mining, data retrieval and data elaboration**, including data collection on juveniles from small scale and recreational fisheries, elaboration of VMS, environmental and aerial survey data, and a Symposium on tuna trap data issues, for a total cost of 149,000 Euro.
3) **Aerial surveys,** including a workshop to refine the activity, the revision of the aerial survey design, a training course for pilots, spotters and observers, and the 2nd year survey on spawning aggregations, for a total cost of 465,000 Euro.
4) **Tagging**, including conventional and PITs tagging and activities to improve tag reporting and tag recovery, with related rewards, for a total amount of 890,000 Euro.
5) **Biological sampling**, including hard parts sampling for ageing and micro-constituent analysis, genetic sampling and related analysis, for a total cost of 505,000 Euro.
6) **Modelling**, including only a workshop on modelling approaches, for a total cost of 40,000 Euro.

GBYP Phase 3 (still under the reduced minimum budget perspective) will include the following activities, for a total budget of 2,534,060 Euro (including 13,000 Euro for contingencies):

1) **Coordination**, for a total cost of 448,980 Euro.
2) **Data mining, data retrieval and data elaboration**, including data collection on juveniles from small scale and recreational fisheries, elaboration of VMS, environmental and aerial survey data, for a total cost of 123,000 Euro.
3) **Aerial surveys,** including the revision of the aerial survey design and the 3nd year survey on spawning aggregations, for a total cost of 404,080 Euro.
4) **Tagging**, including conventional and PITs tagging, a limited electronic tagging and activities to improve tag reporting and tag recovery, with related rewards, for a total amount of 965,000 Euro.
5) **Biological sampling**, including hard parts sampling for ageing and micro-constituent analysis, genetic sampling and related analysis, for a total cost of 490,000 Euro.
6) **Modelling,** including modelling trials, for a total cost of 90,000 Euro.

GBYP Phase 3 budget and activities will be revised by the Steering Committee and SCRS in the last part of Phase 2, according to the updated budget perspectives and the research needs.

The provisional calendar for the meetings is the following:

- Symposium on Tuna Trap Fishery and data standardisation: May 2011 (in Italy, Morocco or Spain, 3 days);
- Training course for aerial survey staff: May 2011 (ICCAT Secretariat, 2 days)
- Modelling Workshop: July 2011 (ICCAT Secretariat, 5 days).

10.0 Recommendations

Following the first year experience, it is clear that the programme could better work if proper ICCAT rules will be in place, to provide the necessary support from all the CPCs concerned. Then, the following recommendations are suggested to SCRS, in view to ask the support of the ICCAT Commission:

a) A stable system to ensure the regular funding of the Atlantic-wide Research Programme for Bluefin Tuna (GBYP) should be adopted by STACFAD and forwarded to the ICCAT Commission, in order to avoid yearly incertitude, to support the regular follow-up of the programme and provide all CPCs concerned a methodology to calculate their voluntary contribution.
b) All CPCs concerned shall provide the necessary support to the Atlantic-wide Research Programme for Bluefin Tuna (GBYP) in order to:
   - support the ICCAT Secretariat initiatives in the framework of the Programme, particularly for contacts with the national Authorities concerned;
   - ensure assistance for the necessary permits concerning the GBYP activities in their territorial waters or airspace;
   - provide the necessary contacts in order to ensure the regular development of the programme.

11.0 Acknowledgments

The GBYP Coordinator would like to warmly acknowledge the very supporting efforts made by all the colleagues of the ICCAT Secretariat staff to allow the Atlantic-Wide Research Programme for Bluefin Tuna to stay on schedule, besides of the short time available to carry out all the necessary duties, sometimes under a very short notice.

The Coordinator also acknowledges the strong collaboration of the GBYP Steering Committee, who responded very often in real time, particularly on very difficult scientific and practical issues.

A particular thank is to be given to the ICCAT Executive Secretary, Mr. Driss Meski, for the continuous support, the time availability and the dedication in professionally helping to solve many practical problems, even at night time.

ANNEX 1

ICCAT ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (GBYP)

PUBLICATION POLICY, EDITORIAL AND DATA USE RULES

The ICCAT Atlantic Wide Research Programme for Bluefin Tuna (GBYP) is an international research, co-funded in its first Phase by the European Community (80%), Canada, Croatia, Japan, Norway, Turkey, United States, Chinese Taipei and ICCAT Secretariat.

The publication policy concerning the results obtained by the various researches carried out within this programme must follow the rules included in the contract between the ICCAT and the funders and those rules will be mandatory for all the participants to the GBYP. The acceptance of a contract provided by the GBYP will automatically imply the acceptance of the "Publication policy and Editorial rules" here detailed.

1) Ownership of the results of the Programme (GBYP), including industrial and intellectual property rights, and of the reports and other documents relating to it shall be vested by the ICCAT.

2) The result of each action carried out within the Programme (GBYP) and all the scientific results obtained by these actions shall be presented to the ICCAT-SCRS at the first opportunity.

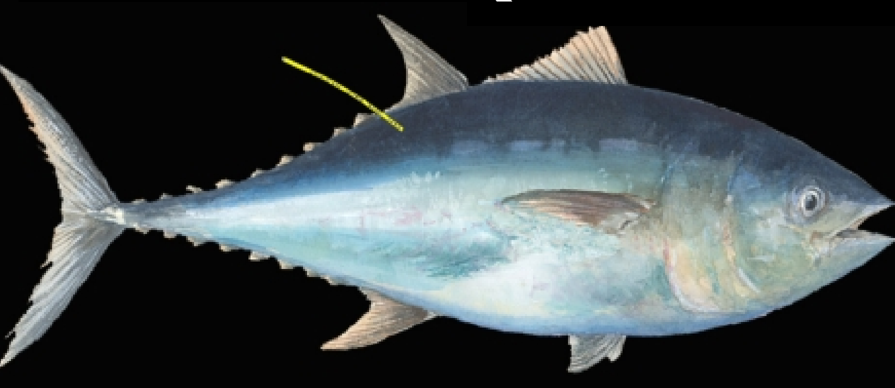
3) The scientific results of actions carried out within the Programme (GBYP), after the presentation to the ICCAT/SCRS, can be published, entirely or partly, on the ICCAT Collective Volume of Scientific Papers, the Aquatic Living Resources journal with which ICCAT has a special publication agreement or in other scientific journals. The Authors who wish to publish these results in other scientific journals shall previously require a permit to ICCAT. ICCAT, following the spirit of this scientific programme, encourages the Authors engaged in research action within the Programme (GBYP) to disseminate their results, particularly in international scientific journals.

4) Each report or article concerning the results obtained within the actions of the Programme (GBYP) must include the following sentence: "This work was carried out under the provision of the ICCAT Atlantic Wide Research Programme for Bluefin Tuna (GBYP), funded by the European Community (grant SI2/542789), Canada, Croatia, Japan, Norway, Turkey, United States, Chinese Taipei and the ICCAT Secretariat. The contents of this paper do not necessarily reflect the point of view of ICCAT or of the other funders, which have not responsibility about them. Neither does it necessarily reflect the views of the funders and in no ways anticipate the Commission's future policy in this area."

5) All the data collected under the Programme (GBYP) shall be used only for scientific purposes and according to the ICCAT rules (see also SCRS/09/122). Any other use of these data should be specifically authorised by ICCAT.

THE INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS (ICCAT)

ABFT TAGGING MANUAL OF THE ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP – 2010)



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ABFT TAGGING MANUAL OF THE ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (GBYP - 2010)

prepared by:

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INDEX

1. INTRODUCTION

There is currently a management plan in force for the eastern stock of the Atlantic bluefin tuna (ABFT), *Thunnus thynnus* (Linnaeus, 1758), with the objective of rebuilding the stock to the $SSB_{F0.1}$ level with a probability of at least 60% by 2022. However the SCRS noted that, there are considerable data limitations in respect of the assessment; so that, when taking into considerations all the degrees of uncertainty, the SCRS analysis could change the estimated rebuilding probabilities. For these reasons new approaches are required to improve scientific advice.

In order to reduce the uncertainty about the stock dynamics of ABFT, improve the ability to estimate stock status and reference points and to provide robust management advice, the SCRS has indicated several priorities identified in the ICCAT Report 2008-2009 (II), 1: 224 and ICCAT Report 2008-2009 (II), 2: 223-224).
Under the GBYP research programme for ABFT, tagging is one of the activities to be conducted. The priorities of GBYP are:

1. Improve basic data collection through data-mining (including information from traps, observers, and VMS), developing methods to estimate sizes of fish caged, elaborating accurate CPUE indices for Mediterranean purse seine fleets, development of fisheries-independent information surveys and implementing a large scale well planned conventional and genetic tagging experiment;
2. Improve understanding of key biological and ecological processes through electronic tagging experiments to determine habitat and migration routes, broad scale biological sampling of live fish to be tagged and dead fish landed (e.g. gonads, liver, otoliths, spines, etc.), histological analyses to determine ABFT reproductive state and potential, and biological and genetics analyses to investigate mixing and population structure; ecological processes, including predator-prey relationships;
3. Improve assessment models and provision of scientific advice on stock status trough improved modelling of key biological processes (including growth and stock-recruitment), further developing stock assessment models including mixing between various areas, and developing and use of biologically realistic operating models for more rigorous management option testing.

Tagging studies have the potential to reduce key uncertainties about important population parameters, e.g. natural mortality, to provide fishery independent data for stock assessments and to reduce uncertainty about stock structure that may invalidate current assessment assumptions. The specific objectives of the tagging design in relation to conventional and PIT tagging are:

- Validation of the current stocks status definitions for populations of ABFT in the Atlantic and Mediterranean Sea. It is particularly important to consider possible sub-stocks units and their mixing or population biomass exchange in the Mediterranean Sea.
- Estimation of natural (M) and total mortality (Z) rates of ABFT populations by age or age-groups.
- Estimation of reporting rates for conventional tags, by major fishery and area, using the observer programs currently deployed in the Mediterranean Sea.

For the potential use of electronic tags are:

- Evaluate habitat utilization and movement patterns (spatio-temporal) of the spawning population within the Mediterranean Sea, with emphasis on: (i) vertical and horizontal distribution patterns of the spawning stock, to help calibrate the aerial surveys and estimate sighting probabilities; (ii) investigating how mature specimens use the spawning grounds (e.g., do ABFT visit the same spawning grounds every year to the exclusion of all others, or do they visit several spawning sites and, if so, over what periods); (iii) validation of the current stocks status definitions for populations of ABFT and estimation of mixing rates between management areas.
- Similar to previous, but for the Gulf of Mexico spawning grounds.

1.1. Identification and physical description

Scientific name: *Thunnus thynnus* (Linnaeus, 1758)

ABFT (Fig. 1.1.1.) belongs to the *Scombridae* family. Long, fusiform and round body with small eyes considering its size, small conical teeth in a single row, short pectoral fins. It has two dorsal fins, the second of which (brown-brick red) is higher than the first (bluish/yellow). The finlets are yellow and the central caudal peduncle is black in adults and semi-transparent in juveniles. Dark blue in colour, tending to black on the dorsal side and in the upper area, silver lower sides with white and grey spots (which fade after death).

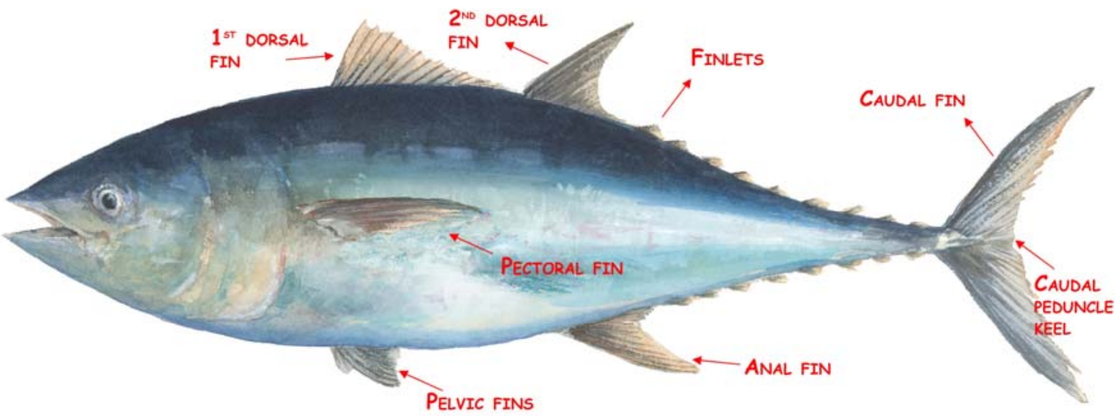


Fig. 1.1.1. Atlantic bluefin tuna © IEO

ABFT can reach a weight of over 600 kg, a length of over 3 m (Cort, 1990; Restrepo *et al*., 2009) and live for more than thirty years (Neilson & Campana, 2007). It feeds on fishes, cephalopods and small crustaceans such as pelagic crabs (Fig. 1.1.2.) and krill (Ortiz de Zárate & Cort, 1986).

Fig 1.1.2. Atlantic bluefin tuna eating pelagic crabs © IEO

1.2. Habitat

It is a fish with a highly evolved heat exchange system in its bloodstream and its internal temperature can be up to 21ºC higher than the surrounding water (Carey & Teal, 1969). This is one of the reasons for its wide oceanic distribution.

ABFT can appear in the warm waters of the Bahamas of around 30ºC (Rivas, 1954) and soon afterwards reappear in Norwegian waters (Mather III, 1962), where the water temperature is barely above 10ºC. De Metrio *et al.* (2002) cite its presence near the Arctic circle (75ºN) where temperatures of 5ºC are recorded.

Recent aerial surveys in the western Mediterranean (Bonhommeau *et al.*, 2010; Sorell Barón, 2010) reveal that ABFT frequent surface waters in both the spawning and trophic seasons, and electronic tagging surveys also show that they often dive to great depths, sometimes to over 1000m (Teo *et al*., 2007; Wilson & Block, 2009).

1.3. Geographical distribution and fishing areas

In the Atlantic Ocean, ABFT are found in waters between Labrador (Canada) and Brazil, including the Gulf of Mexico on the western side (Mather III *et al*., 1995), and on the eastern side from Norway (Tiews, 1963) to Senegal (Ngom Sow & Ndaw, 2010) and Cape Verde (De Metrio *et al*., 2002), including the Mediterranean and Black seas (Fromentin, 2006).

The evolution of ABFT fishing in the North Atlantic has passed through different phases over the last seven decades (ICCAT, 2010; Fig. 1.3.1.). The most outstanding of these was the development of Japanese longline in the 1960s and of purse seine in western fisheries; also the fall in fishing by the traps of the Strait of Gibraltar and the Mediterranean in the 1970s; in those years purse seine fishing began in the Mediterranean.

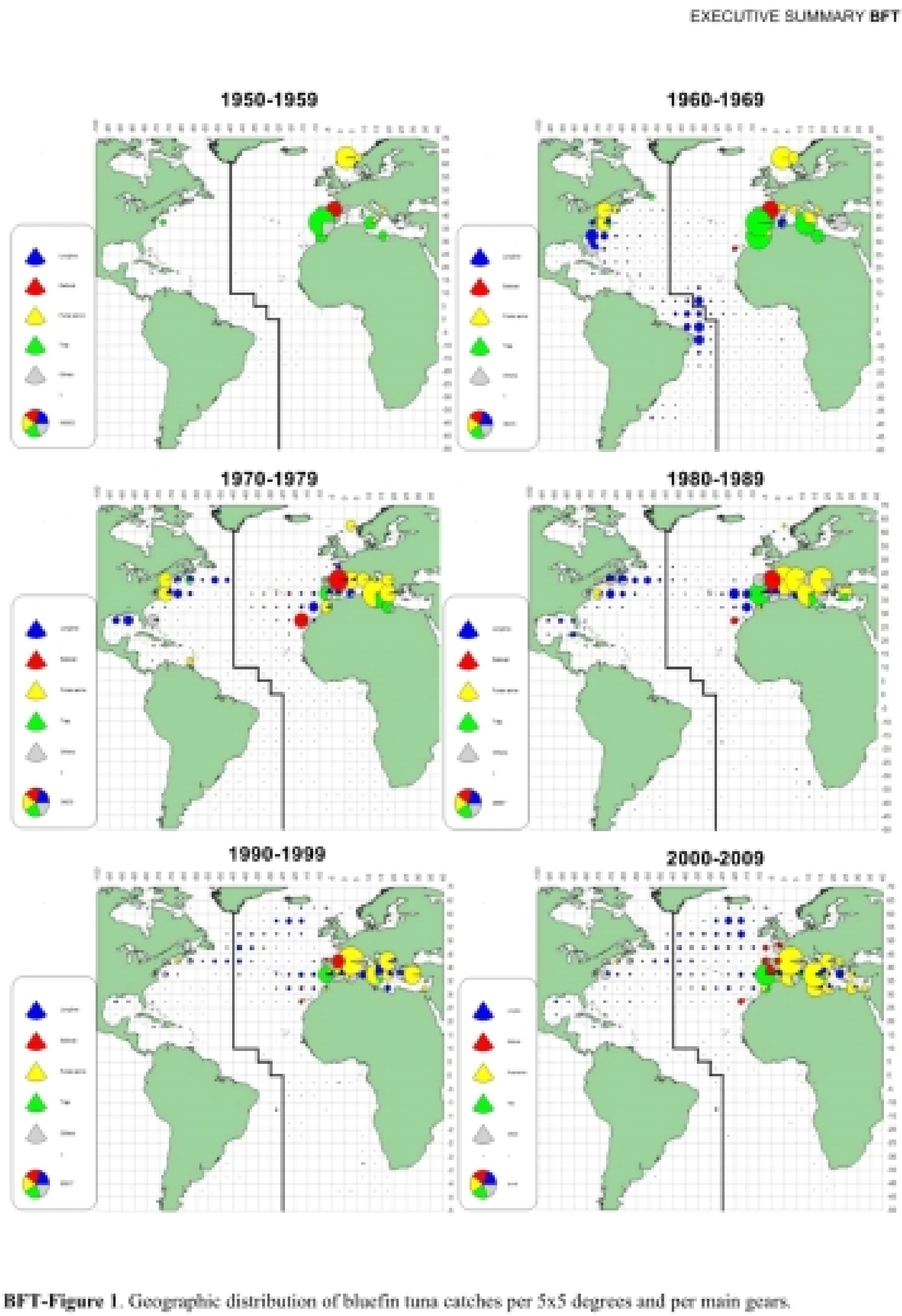


Fig 1.3.1. Distribution of the Atlantic bluefin tuna fishing (ICCAT, 2010)

In the 1980s the purse seine fishery disappeared in the north of Europe (Nøttestad & Graham, 2004). From the 1990s purse seine fishing in the western and eastern Mediterranean (Libya and Turkey) increased along with the Japanese longline in the central and eastern Atlantic. In more recent years new hook fisheries have been established in the Mediterranean (De la Serna, 2004).

1.4. The Atlantic population

For the purposes of resources management the North Atlantic population is split into two stocks: the Western and the Eastern, which includes that of the Mediterranean. There is mixing between the two with interannual variations (ICCAT, 2010). The separating line between the stocks (Fig. 1.4.1.) runs along the 45º W meridian of the northern hemisphere.

Fig 1.4.1. Dividing line of the Atlantic bluefin tuna stocks (45º W) © IEO

The separation of the eastern and western stocks is mainly based on the existence of two spawning areas, one in the Gulf of Mexico and the other in the Mediterranean Sea. Moreover, in the year in which this separation was adopted (1975) it was taken into account that most of the ABFT tagged were recovered in the same part of the ocean that they had been tagged in, and that there was no evidence of a spawning area in the central Atlantic (Mather III *et al*., 1995).

Fromentin & Powers (2005) describe the ABFT population as a set of local populations, denominated metapopulations, occupying different habitats and having a certain degree of influence over one another.

Electronic tagging shows that ABFT crosses the dividing line of 45º N without any difficulty (Block *et al*., 2005); nevertheless, when spawning they are faithful to their place of birth (spawning fidelity) (Fig. 1.4.2.).

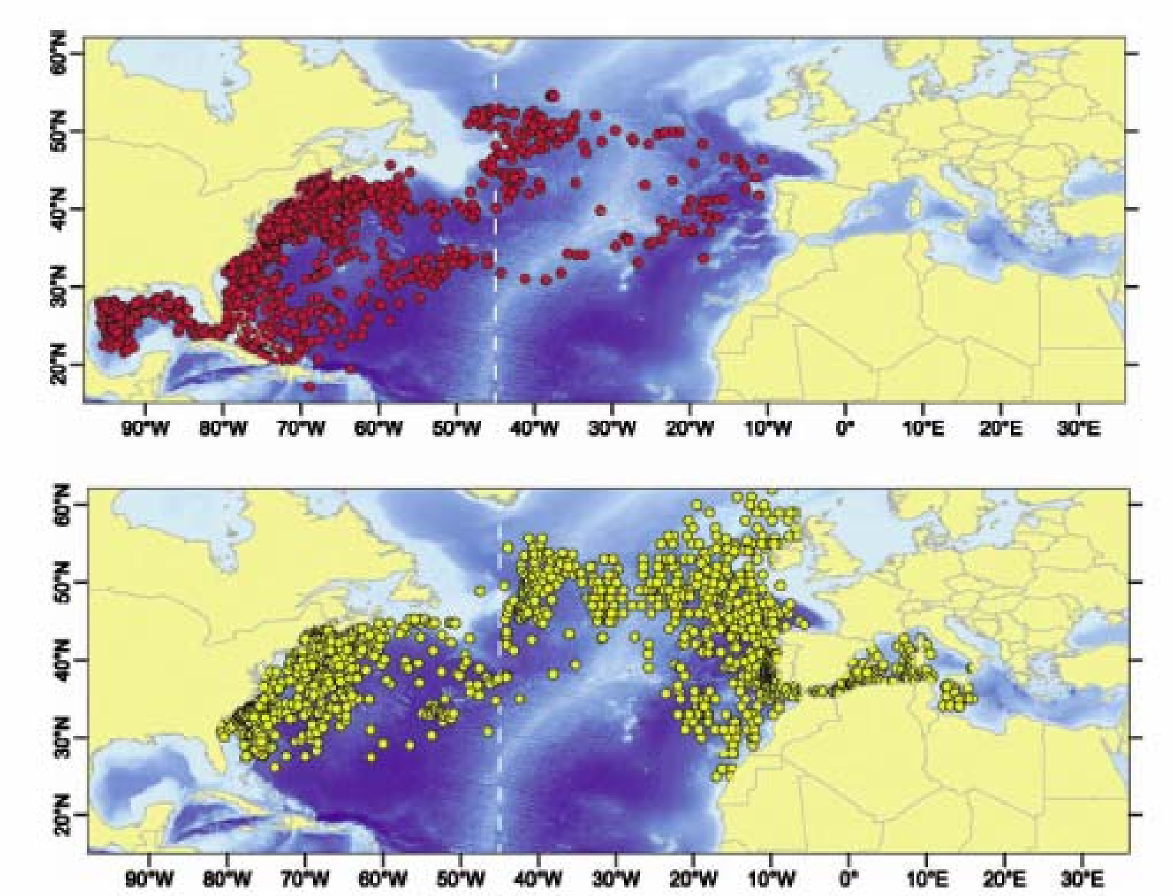


Fig. 1.4.2. Daily positions of adult ABFT differentiated as western (in red) and eastern (in yellow). The ABFT populations share the same feeding areas but return to the spawning areas in the Gulf of Mexico (in red) and the Mediterranean (in yellow) (Block *et al*., 2005; Rooker *et al.*, 2007).

De Metrio *et al.* (2002; 2004; 2005) and Fromentin (2010), from electronic tagging studies using pop-up tags, show the possible existence of resident populations in the Mediterranean since most of the fishes tagged remained on the side where they had been tagged (Fig. 1.4.3.).

Tudela *et al*., (2010), by electronically tagging fishes during the trophic season (August and September 2008) in the western Mediterranean, obtained results which support the residence of ABFT in the interior of the Mediterranean, as migrations towards the eastern part of the Mediterranean do not take place.

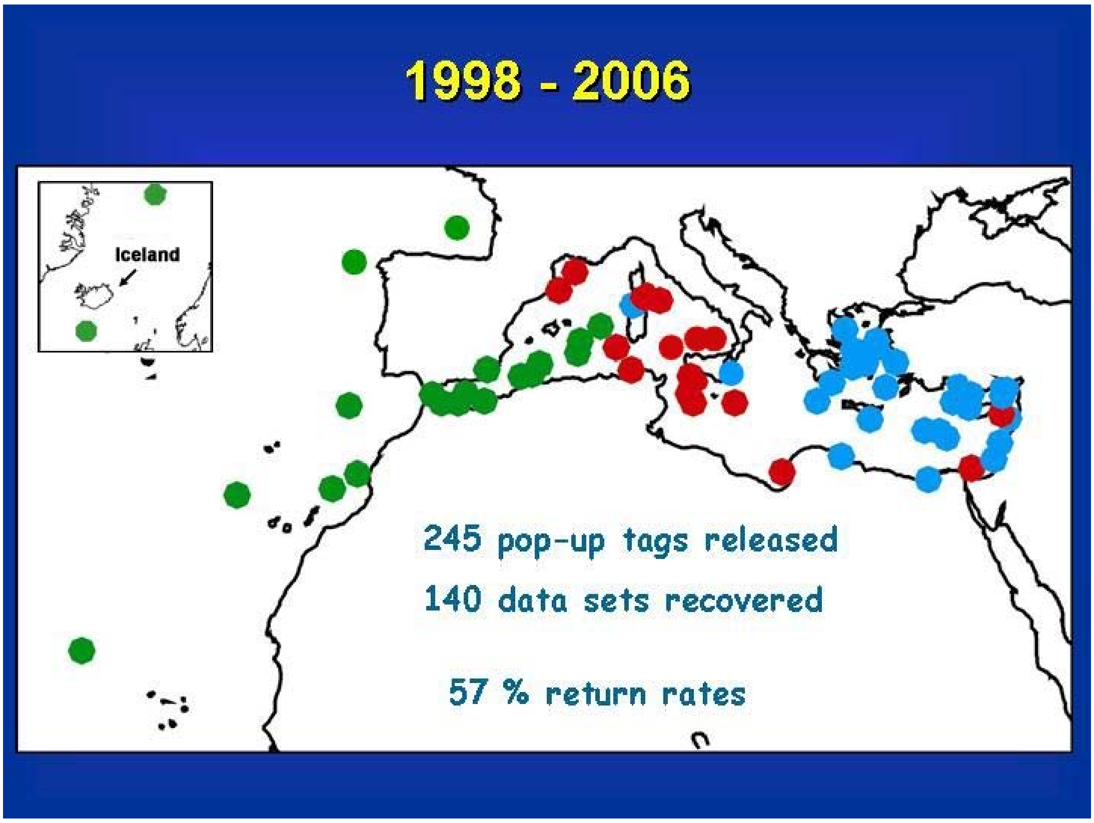


Fig. 1.4.3. Pop-up positions of satellite tags applied to ABFT released in the Mediterranean Sea and eastern Atlantic in the period 1998-2006 (De Metrio *et al.*, 2002; 2004; 2005). Light blue circles: tags deployed in the eastern Mediterranean; red circles: tags deployed in the central Mediterranean; green circles: tags deployed in the western Mediterranean.

The results of conventional tagging in the Mediterranean (Arena & Li Greci, 1970; Godoy *et al*., 2010) and the presence of ABFT larvae in the Levantine Sea (Karakulak *et al*., 2004; Oray & Karakulak, 2005) support the hypothesis of the resident populations in the Mediterranean.

1.5. Migrations

Migrations depend on fish age and size, which are mainly related to reproduction and the search for food.

The migrations of adult fishes towards spawning areas in the Mediterranean and their return to the ocean for feeding have been known since the time of Aristotle (384 B.C. - 322 B.C.).

Migrations to spawning areas (Fig. 1.5.1.) get longer as the ABFT increase in size.

Fig 1.5.1. Genetic migrations © IEO

Trophic migrations of spawning fishes (Fig. 1.5.2.) begin when the reproductive period has come to an end. Many of these ABFT return to the Atlantic ocean on a trophic migration (Mather III *et al*., 1995; Rodríguez-Roda, 1964; Medina *et al*., 2010). The dispersion of schools after passing through the Strait of Gibraltar occurs in a north-south direction (De Metrio *et al*., 2003) between June and December. Regarding the western stock, Mather III (1962) and Tiews (1963) were the first to publish evidence of transatlantic migrations of large spawning ABFT.

Fig 1.5.2. Trophic migrations © IEO

The migrations made by juvenile fish are generally shorter than those of the larger fish; nevertheless, transatlantic migrations have been reported since more than four decades ago, especially in certain years (Mather III *et al*., 1967; Mather III & Jones, 1973; Aloncle, 1973; Cort, 1990). Rooker *et al*. (2006), in studies into the chemical composition of fish hard parts, show that these migrations take place in certain years in highly significant quantities.

2. ABFT FISHERIES AND SUPPLYING FISH FOR TAGGING IN THE ATLANTIC AND THE MEDITERRANEAN SEA

To carry out the present ICCAT tagging programme, a large number (several tens of thousands) of ABFT will be caught and tagged.

ABFT can be caught using various techniques, mainly purse seines, traps, live-bait boats, longline, troll line. However, some fishing methods are not suitable for tuna tagging, because the fish are no longer in good enough physical condition to survive after tagging. Therefore, catch procedures must be rapid and harmless for the fish; moreover, they need to be able to provide large quantities of tagged fish.

Tunas caught by longline, a passive gear, spend some time on the hook and become stressed by fighting against it before being hauled on board for tagging; this lowers their survival rates. Moreover, only a small number of fish are caught at one time. Both methods are unsuitable for large-scale tagging programmes.

Other fishing methods mentioned, namely live-bait boats, purse seines, and traps, appear to be suitable for the requirements of tagging. In particular, troll-line fishing has been used successfully for small-scale tagging of ABFT.

2.1. Baitboat

Catching tunas by pole-and-line fishing is a rather ancient technique that has been and is used both in sport fisheries (angling) and in commercial fisheries. It consists of a hooked line attached to a pole that is made either of wood (including bamboo) or fibreglass. In modern times, this technique has been highly improved by equipping ad hoc medium-sized vessels, of up to around 40 meters, with several (10 to 20) fishermen handling poles almost all around the circumference of the boat. (Fig. 2.1.1.).

Fig. 2.1.1. Baitboat at the port of Tarife (Spain) (photo by M. Deflorio).

The boats carry live bait to entice the fish to aggregate around the boat by using bait and/or water spraying. Hooks at the line end are baited with live bait. When fishing starts, fishermen cast the hooks into the water and haul them back as soon as the fish bite, just a few seconds later. Tunas caught in this way are landed on the deck where they get free from the hook, due to the fact that the hook is barbless. In this way, several tons of tuna can be landed in just a few hours (FAO, 2006).

In order to catch tunas of over 10-15 kg, and up to 100 kg, fishermen still use one pole, fitted with a rope which is pulled through a pulley by another person. Baitboat fishing (Fig. 2.1.2.) is quite apt for large-scale tuna tagging programmes, where large numbers of tunas need to be caught within a short timeframe. Most importantly, pole-and-line caught tunas have proven to be in good condition for tagging purposes, since they are usually not stressed or injured.

Fig. 2.1.2. Baitboat fishing activities in the Strait of Gibraltar (photo by M. Deflorio).

When tagging tunas caught by live-bait boats, the hooked juvenile specimens are directly landed in the tagging cradle, whereas the larger ones are placed on tagging mattresses (Fig. 2.1.3.).

Fig. 2.1.3. Tuna specimen landed on a cradle (left) or on a mattress (right, photo by M. Deflorio).

2.2. Tuna purse seine

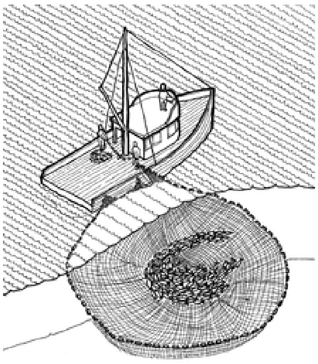
Purse seines for catching ABFT are operated by large ad hoc vessels (up to 42 m long), known as purse seiners. They go after fish which have aggregated and are swimming comparatively close to the sea surface (i.e. in the mixing zone above the thermocline) both in high-sea waters and in coastal areas. Aggregated tuna resources up to a maximum depth of 300 m – but mostly at depths of 60-70 m – are targeted.

Tuna purse seiners (Fig. 2.2.1.) are usually equipped with high-tech instruments that also enable the captain to identify the size of the fish in the school detected by echo-sounder. This makes it possible to target the fishing at a particular size of fish to be tagged.

Fig. 2.2.1. Turkish tuna purse seine in the Levant Sea (photo by M. Deflorio).

Currently, purse seiners catch ABFT over 30 kg in weight, except in the Adriatic Sea, where smaller fish may be caught by the Croatian fleet.

The purse seine gear is made up of a large net which encircles the tuna school and is closed at the bottom to entrap the fish. The net measures 1500 to 2000 m in length and 120 to 250 m in depth. The mesh size of purse seines used in the Mediterranean Sea to catch ABFT is up to 200 mm in the body and the bottom part of the net, dropping to around 120 mm in the bunt. The top of the net is mounted on a floatline and the bottom on a steel chain (leadline) with steel rings, which allow the net to be “pursed”.



When a school is detected, the vessel places itself on one side of the school; subsequently the skiff, a small high-powered boat, attached to one end of the purse seine, is released. The fishing vessel then encircles the school at maximum speed. Once the encirclement is finished (4-8 minutes), the end of the net attached to the skiff is transferred aboard the purse seiner and the two ends of the purse line cable are hauled in as quickly as possible in order to close the net at its bottom; this is called "pursing". In the case of large purse seines, these pursing operations may take around 15 to 20 minutes. The net is then pulled aboard the vessel. As a rule, this operation will take around one hour, provided there are no incidents. Subsequently, fish harvested from the purse seine are stored in the well, in brine, at 0°.

Recently, most of the fish are transferred to floating cages soon after the school capture (Fig. 2.2.2.) and the pens are transferred to a "tuna farm" for fattening activities (Ottolenghi et al., 2004).

Fig. 2.2.2. Fish transferring to a floating cage (photo by M. Deflorio).

For tagging purposes, at the end of pursing, the net is not fully drawn and is maintained at sea, so that the fish are left to dive in enough room, calculated according to the size of the school, so as to avoid injuries and reduce stress for the fish. In the case of schools made up of juvenile fish, up to 10-15 kg, they are caught one by one from the purse with a long handled scoop net and brought on board to be tagged. Soon after tagging, each fish is released into the sea keeping it away from the net. In the Mediterranean Sea, juvenile ABFT are generally sighted at sea and caught in spring and autumn. The highest concentrations of such fish generally occur in the Gulf of Lion and the Tyrrhenian Sea (Fromentin et al., 2003).

Adults ABFT, i.e. at least 5 years old and weighing an average of 35 kg (Santamaria et al., 2009), are too heavy to be brought on board by scoop net. Therefore, in order to be tagged with conventional tags, they are either:

a) individually seized and placed in a stretcher by a diver within the purse seine, brought to the side of the main vessel or of an auxiliary boat, tagged and then released away from the purse net; the fork length is estimated by comparison with a measuring pole (Fig. 2.2.3.);

b) or transferred from the purse-seine net into a towing pen (or floating cage) attached to the purse seine; once in the pen and, in any case, once they have calmed down (which could take several hours), they can be caught by pole-and-line or another technique and then tagged and released.

Fig. 2.2.3. Atlantic bluefin tuna transfer on a stretcher for tagging purposes (photo by V. Papadopoulos).

Although purse seiners catch tunas in very large numbers, they are all caught at once. By the time the fish have been concentrated into the net, many of them may result already stressed, exhausted and injured, if not already dead. For this reason, only a fraction of purse-seined fish is suitable for tagging.

Individual tunas must therefore be checked carefully before tagging and those too distressed rejected in order to keep survival rates to an adequate level. Both reducing cramping of tunas in the purse seine, by keeping the net volume sufficiently wide, and transferring the large tunas into a pen until they calm down, may greatly help in achieving satisfactory survival rates.

2.3. Traditional tuna traps

The traditional tuna trap, known as *almadraba* in Spanish, *tonnara* in Italian and *madrague* in French, is a fishing technique for catching migrating tunas dating back thousands of years. It is a system of large nets that intercepts schools and small groups of tunas along their route near the coast and traps them (Fig. 2.3.1.).

The overall trap scheme consists of a long standing vertical net (actually a set of nets) erected perpendicular to the coast to intercept the fish and convey them into the actual trap, which is made up of a maze of pools or chambers.

The last of these (the so-called "death chamber") is fitted with a liftable floor which, when raised, clusters the fish into a restricted space so that they are easily caught and slaughtered. This simple maze works because the tuna are unable to see the exit from the central pool, and so remain inside.

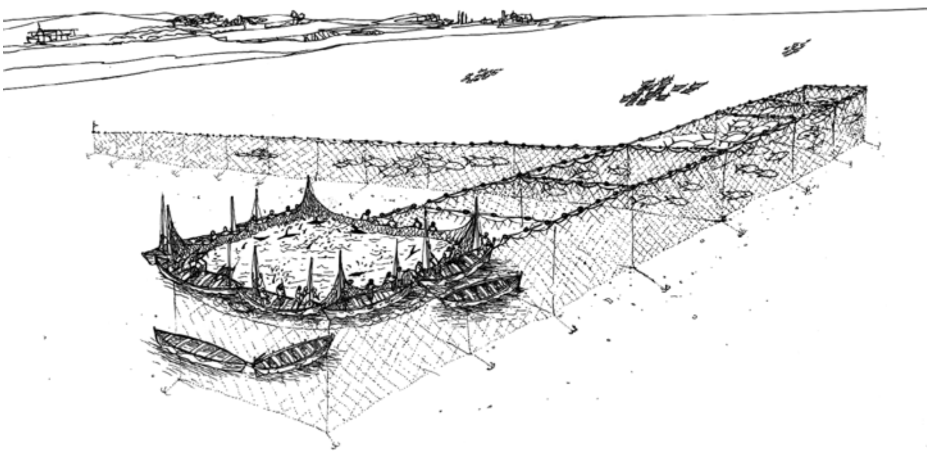


Fig. 2.3.1. A traditional tuna trap.
(http://www.photolib.noaa.gov/htmls/fish2059.htm)

The system of nets is connected to the shore, is anchored to the bottom and is kept perpendicular to the sea surface by a line of floats. The net mesh size is small enough not to let the tuna become entangled. The long intercepting net can be positioned so as to intercept tunas coming from either direction. For instance the Barbate (Spain) trap, close to the Straits of Gibraltar, is first positioned to intercept pre-spawning tunas entering the Mediterranean and, afterwards, is repositioned to intercept post-spawning tunas coming out of the Mediterranean (De Metrio et al., 2002; de la Serna et al., 2004). Other traps, such as the one in Carloforte (Sardinia, Italy), catch only migrating pre-spawning tunas (Corriero et al., 2003 and 2005).

In the last twenty years, traditional tuna traps have been used in Spain and Morocco, both on the Mediterranean and Atlantic coasts comparatively close to the Straits of Gibraltar, Tunisia and Italy. The traditional trap fishing season is adjusted to the tuna's biological cycle, in particular to their genetic migrations (Heinisch et al., 2008). The fishing season extends from spring to early autumn, according to the geographical location where the trap is set.

The traditional tuna trap has excellent potential for tagging adult ABFT. For the purposes of tagging, trapped tunas may be individually taken from the death chamber using either a scoop net (for smaller ones), pole-and-line (for small and medium-sized ones), or a stretcher handled by a diver. Hence, each fish to be tagged is brought on board a boat anchored alongside the trap.

3. TAGS DESCRIPTION AND TAGS INSERTION METHODS

3.1. Conventional tagging

3.1.1. Generalities

Conventional tagging is carried out by means of *conventional tags* also known as *dart tags* or *spaghetti tags* (Fig. 3.1.1.1.). These tags are simply designed, low cost and easy to insert into the fish. Conventional tags are typically used in large-scale tagging programmes, which is the present case with ABFT tagging.

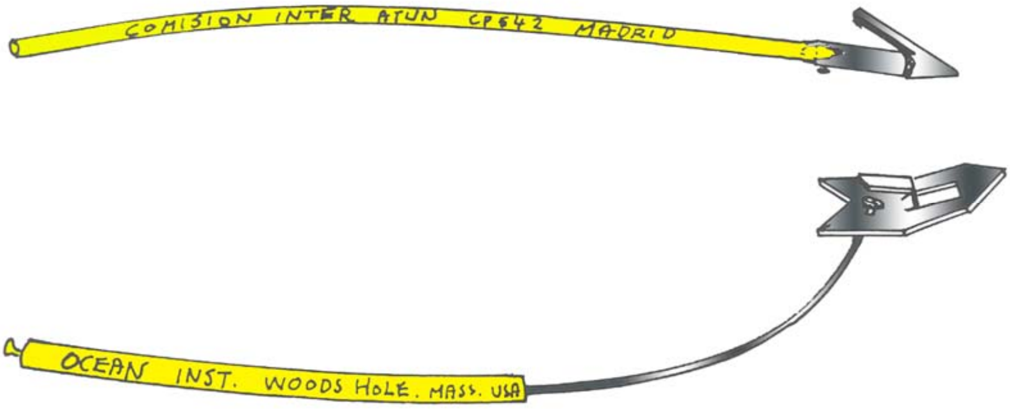


Fig. 3.1.1.1. - Spaghetti tags with different types of dart.

Indeed, the need to deploy a large number of conventional tags originates from the need to obtain a sufficient number of returned tags in order both to validate the current stock status definitions for ABFT populations in the Atlantic and the Mediterranean and to assess their mortality parameters (natural and fishing-related). The use of a large number of conventional tags is also justified by the current low rates of tag returns.
Since the aim of this type of tagging is to mark thousands of tunas, it derives that two requirements must be met:

a) catching many individuals in a comparatively short time;

b) tagging them rapidly and effectively.

A most important issue related to tuna tagging is the fish survival rate after tagging operations. Hence catching, handling, marking and releasing procedures must be as fast as possible, in order to reduce stress, and cause the least possible detriment to fish health.

3.1.2. Tagging equipment

The equipment required for tagging should be available to the tagging teams several days before the start of tagging fieldwork. Hence, orders to acquire equipment must be placed well in advance of tagging operations.

Tagging personnel must be acquainted with all the individual pieces that make up the equipment before embarking, especially with tags and their applicators, the cradle fitting, and the recording forms to be filled out.

- Tags: each team should be provided with at least 10% more tags than needed for each tagging trip to allow for breakages and losses.
- Tag applicators: for rapid tagging, a sufficiently large number of tags (i.e. equal to the potential number of tuna that will be tagged) must be prepared in their applicators before each fieldtrip. Each tagging team will be provided with a number of applicators matching each daily tagging trip needs. These will be placed in a ready to use container.
- Tags holders: tag-loaded applicators must be suitably stored before embarking. Two storage methods have been used. The preferred container in the case of large-scale tagging is made up of a wooden block with holes drilled into it. The loaded applicators are placed into these holes in an upright position, with the sharp end facing up. Suggested measurements for one-hundred-applicator boxes are: 38 cm in length, 12 cm in width and 7-10 cm in height (Kearney and Gillett, 1982) or 36.5 x 12 x 7 (Itano, unpublished in Hallier, 2004). In each box, 4 rows of 25 holes are drilled to a depth of 1.5 cm. This depth is regarded as a good compromise between overall compactness and handling, i.e. how easy it is for the tagger to get hold of the applicators. The top should be painted white and the holes numbered sequentially. Boxes should be made of a wood that will not swell with water and should be provided with a cover. The number of applicator-loaded boxes to prepare should be calculated on the basis of the number of tags expected to be used on each trip. Care must be exerted when handling the loaded boxes since the applicator tips can wound both the taggers and the fish; moreover, fishing lines may become entangled in a set of applicators. In fact, during tagging operations, the box should be placed close to the cradle within reach of the tagger’s hand. A safer way to store tag-loaded applicators is in plastic-canvas ‘aprons’, into which thin pockets are sewn to hold the applicators. These could be rolled up tightly when not in use (Anderson et al., 2004). The latter method is better for small-scale tagging.
- Cradle or tagging platform: these are the apparatuses where the fish is landed to be measured and tagged. A cradle consists of a working platform placed on top of a steel frame at a height which enables the tagger to work comfortably during large-scale tagging. The cradle frame is made from galvanised or stainless steel tubes in order to withstand the corrosiveness of sea water. Suggested measures are 160 cm in length, 108 cm in width and 95 cm in height (Kearney and Gillett, 1982). The cradle platform is made from tough but smooth vinyl material and is shaped like a large shallow spout, gradually sloping down towards one end.

The fish will be gently placed onto the platform and made slide down until the fish nose touches the platform stop. A drainage hole must be made at the lowest point of the platform. The tagging platform must incorporate a tape to measure fish length showing 0 at the end where the fish nose stops; otherwise centimetres should be marked on the platform surface with water resistant markers. In case of large-scale tagging, such as with live-bait boats, more than one cradle should be placed on board the vessel in order to take advantage of the fairly high catch rates.

- Tagging mattress: when dealing with tuna fish so big that use of the cradle is not advisable, a mattress filled with foam padding and covered with tough but smooth vinyl material can be used. Cm should be marked on the mattress surface with water resistant markers.
- Measuring tapes.
- Measuring boards.
- Plastic bucket to collect used applicators
- A piece of dark cloth (black, brown or red) to cover the tuna's eye to calm it down
- Cotton or rubber gloves for handling the fish, hat and protective glasses for protection from the hooks, boots and clothes suitable for the weather conditions on the fieldtrip.
- Recording forms (best if printed on plastic sheets suitable for writing) and tape recorder to record tagging and associated data.
- Waterproof boxes to store recording forms
- Writing tools: pencils, pens, pencil erasers, waterproof markers and alcohol to clean waterproof marks. Staplers.
- Bleach or and detergent to clean the applicators after use.
- Walkie-talkies to communicate between teams
- Binoculars
- Tuna fish identification sheets
- Spare parts

3.1.3. Tag size

Larger implanted tags are potentially more visible than smaller ones to fishermen and others who will be handling the fish, but the larger the tag the greater the disturbance to the fish. Hence, as a general rule, small fish are tagged with small tags and large fish with large ones.

Small tunas have been successfully tagged with dart tags 10 cm in length and 1.5 mm in diameter; larger tunas have been tagged with 12.5 cm x 2 mm dart tags.

3.1.4. Tagging team

A tagging team is usually made up of three people:

- The fish handler: he/she receives the fish from the fisherman, places it on the cradle, ensures that it reaches the right measuring position, measures it and calls out the measurement for the recorder (see below), holds the fish down while the tagger inserts the tag, and puts it back into the sea as soon as tagging operations have been completed.
- The tagger: he/she reads and calls out the fish length for the recorder, reads and calls out the tag number, inserts the tag into the fish.
- The recorder: a) during tagging operations, he/she fills out the recording form with the tagging data (sequential number, length, and tag number for each fish) and also records them on the tape recorder; b) before and after the tagging operations: he/she is responsible for recording and transcribing all the information required in the various recording forms; he/she must be familiar with all the recording forms and how to fill them out.

3.1.5. Tag implantation

The tag must be implanted a couple of cm below the insertion of the second dorsal fin, so that its head, after perforating the skin and muscle, crosses the fish's sagittal plane through the second dorsal fin pterygiophores (i.e. the bones that support the fin rays) and its barb becomes firmly anchored through them.

Insertion in other locations on the body, namely below the first dorsal fin or directly into the muscle, must be avoided. The direction of tag implantation is from the back at an angle with the body of less than 45° in order both to minimize the drag due to water resistance during swimming and to ensure that the barb gets firmly anchored in the pterygiophores. Higher angles of implantation would affect the fish's swimming efficiency due to water resistance; lower implantation angles would risk inserting the tag head into the muscle alone.

Tag insertion is carried out with an applicator, a stainless steel tube with a sharp end. The applicator is slightly longer and slightly larger than the tag; the tag is placed inside the applicator so that its head is at the applicator sharp end and the barb is housed in an indentation at the other end of the applicator.

The tagger holds the tag-loaded applicator firmly in his hand and inserts it into the fish body with a brisk and calibrated movement of the hand. Soon afterwards, the tagger retrieves the applicator with a gentle and continuous backward movement of the hand and then checks whether the tag is correctly placed and ensures that the fish has not been badly damaged.

It is most important that the tagger be experienced, so that he/she can work fast and correctly, otherwise either the tag will fall out or the fish will be harmed or both: in either case, the tagging would be a failure. Inexperienced taggers are strongly recommended to practice sufficiently on dead tuna fish of about the same size as those that are going to be tagged.

3.1.6. Tagging procedure

Differences are expected according to the fishing methods used for catching the tunas and according to their size. In general, large-scale tagging involves capturing large amounts of tunas over a short period of time, whatever the catching method (live-bait boats, purse seiners, traps). Therefore it is advisable that more than one tagging team should carry out the tagging on each boat. The number of teams depends on the boat size and the space available.

Juvenile tuna are caught in large quantities by live-bait boats. In such cases, the correct procedure begins by identifying the best location on board the vessel for the tagging station: the cradle must be securely fastened to the boat so as to support the tagging work even in rough seas; the cradle tilt and height should be adjusted so as to satisfy the tagging team's needs and make their work as comfortable as possible; all the tagging material and other equipment should be placed in such a position as to be readily available.

The cradle position as well as those of the team members must be chosen in order to make handling the tuna as easy as possible (both when receiving them from the fishermen and when putting them back to sea), as well as disturbing the fishermen as little as possible.

The tagging team members must wear gloves when handling the fish; this protects both the fish and the team members' hands.

The tagging platform and vessel deck in its vicinity, the fish handler's and tagger's gloves, and any equipment that may come into contact with the fish body (e.g. the dark cloth to cover the eye, rulers, and so on) must be kept wet at all times so as not to damage the fish.

When fishing starts and tuna are caught, the fisherman hauls in the fish and passes it to the tagging team's fish handler, or else lands it directly on the tagging platform as gently as possible.

If barbless hooks are used, the caught fish drops by itself when the line is slackened. If this does not happen, the fish handler can remove the hook with a simple swift movement of the line. If the hook does not come off easily (whether it is barbed or not) because it is too deep and its removal may either take too much time or injure the fish, the fish must be rejected. Likewise all injured tuna with seemingly lower probabilities of survival once put back into the sea will be rejected.

When the tuna handler receives the fish, he/she gently places it head-first onto the tagging platform of the cradle and slides it down until the fish reaches the platform stop (point 0).

The handler then reads and calls out the fish length (fork length), holding the fish firmly at all times until the tagger has inserted the tag, and puts it back into the sea. In the meanwhile, the tagging team's recorder must record all tagging data (fish size and tag number).

Speed when handling and tagging is crucial for the survival of tagged fish. Each tagging operation lasts just a few seconds overall if properly carried out. Tunas are best handled using both hands, one holding the caudal peduncle and the other sustaining the body, whereas holding the fish just by its tail may damage it. The tunas are always placed on the same side of their body when on the tagging platform, depending on the tagger's position and needs. The fish is put back into the water with its head pointing in the same direction as the boat.

3.1.7. Hygiene

Hygiene is required since there is the potential for tunas to become infected at the site of tag insertion, which in turn would affect their chances of survival and the results of the tagging programme. Before each tagging trip, the tag applicators should be sharpened, thoroughly cleaned and sterilised by boiling in water for at least 15 minutes. Tags should be kept in their plastic wrappers until the day they are to be used when they can be inserted in the applicators; any unused tags which have been kept outside their wrappers should be thoroughly rinsed with fresh water before use. If applicators need to be used a second time on the same day, they must be washed carefully with washing powder and then rinsed thoroughly in several changes of fresh seawater before reusing.

The tagging team members should take care of their personal hygiene, washing their hands before loading the applicators with tags. During both loading and tagging operations, tag heads and applicator sharp end must never be touched with dirty hands or dirty gloves. Moreover, tag boxes or aprons must be kept away from possible sources of contamination.

Gloves, which are necessary for the tagger and the fish handler to protect their hands both from the applicators during tag insertion and from fish spines and hooks, must be made of easy-to-clean material. Their cleanliness is very important for hygiene purposes, both for the tagged fish and for the tagger's skin. Particular care must be exerted in removing fish mucus remains off cotton gloves; for this reason, rubber gloves are preferable.

3.2. Archival tagging

3.2.1. Generalities

In recent times, tag and release technologies have been developed and new electronic devices are used nowadays. Archival tags are small data loggers that record dates, times, swim depths, water temperatures, body temperatures and light levels. Light levels are used to calculate an approximate daily position of the tagged animal based on the time of dawn and dusk and the angle of the sun. Reliable estimates of latitude, however, usually require the use of sea-surface temperature, which can also be recorded by the tag and subsequently matched with relevant data sets obtained by satellite.

Archival tags can be attached externally or internally, and must be retrieved for their data to be downloaded. They are used most commonly on species that have a high likelihood of recapture, including fish, seabirds, sea turtles and marine mammals. Archival tags can record data every few seconds for up to 10 years, depending on the tag sampling frequency and battery life, and provide information about post-release fish mortality rates, oceanic movements and preferred water temperature, clarity and currents to provide new insights into some of the aspects of marine animals' biology.

Archival tags have been used to track return migrations of juvenile Atlantic bluefin tuna from the Bay of Biscay (Goñi et al., 2009) and of juveniles southern bluefin tuna from the Great Australian Bight to the Indian Ocean (Willis et al., 2009), the latter including details of their diving patterns and feeding events (marked by sharp drops in body temperature as food and cold water enter the stomach). Archival tags have similarly revealed pan-oceanic migrations of adult ABFT between spawning grounds in the Gulf of Mexico and the Mediterranean Sea, and feeding grounds off the US and European coasts, as far north as Iceland (Block, et al., 2001, 2005). In shelf seas, archival tags have traced the migrations of demersal fish, such as plaice and cod (Turner et al., 2002; Hunter et al., 2004a and 2004b; Svedäng et al., 2009), and revealed new information on behaviour, temperature, population distribution and the likely effects of climate change. Presently, the most used archival tags are the Mk9 tag (Fig. 3.2.1.1.) by Wildlife Computers and the LAT series tag (Fig. 3.2.1.2.) by Lotek. These tags are design to study also fish. Generally, the tag is suitable for both external attachment and internal implantation. The tag measures depth, temperature, and light-level. Optionally, for implantable applications, the light level and/or a second temperature sensor can be mounted on a sensor stalk.

Fig. 3.2.1.1. Mk9 archival tag (source: Wildlife Computers web site).

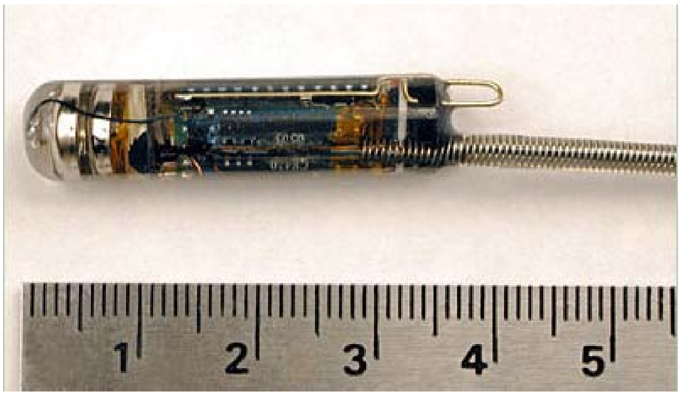


Fig. 3.2.1.2. LAT series archival tag (source: Lotek web site).

3.2.2. Tagging equipment

- Archival tags.
- Conventional tags: fish must also be tagged with green conventional tags with a legend specifying the presence of an archival tag inside the fish and the reward.
- Conventional tagging material (e.g., applicators, cradle, mattress, recording forms), as specified under the conventional tagging section.
- Needle-holders.
- Scissors.
- Atraumatic needled sutures: the needle should have cutting edges, so that it can be held in the needle-holder. The size and curve of the needle will depend on the size of the fish (e.g. B Braun Silkam DS 30, size 0; Ethicon PDS II cp-1, size 0).
- Scalpel and disposable blades.
- Surgical gloves.
- 10% Povidone-iodine solution (e.g. Betadine).
- Rigid-framed net of knotless webbing: it can be useful for brailing small fish from the side of the vessel.
- Lift to take the fish onboard.
- Camera and/or videocamera.

3.2.3. Tagging team

A tagging team is usually made up of four people:

- The fish handler, who receives the fish from the fisherman, places it on the mattress, measures its length and calls out the measurement for the recorder (see below), holds the fish down while the tagger inserts the tag and covers the fish eye with a piece of dark cloth if necessary, and takes care of putting it back into the sea as soon as tagging operations have been completed. In the case of very large fish that cannot be handled by just one person and are taken onboard by a lift, the fish handler will be supported by one or more fishermen.

- The tagger, who accomplishes the whole surgical operation to implant the tag inside the abdominal cavity (see paragraph 3.2.4), from cutting an incision in the abdominal wall to closing it.
- The tagger assistant, who takes care of all the surgical instrumentation, the archival tags and conventional tags and their applicators, and sterilize all pieces; he/she hands the surgical and tagging instruments and devices to the tagger upon his/her requests; he/she besides takes care of the hygiene of all devices that will get into contact with the fish to be tagged, e.g. mattress, parts of the deck close to the mattress, and so on.
- The recorder: a) before each tagging operation starts activates the archival tags; b) during tagging operations fills out the recording form with the tagging data (sequential number, length, and tag number for each fish); c) takes photographs and/or videos of the fish and tagging operation; d) before and after the tagging operations is responsible for recording and transcribing all the information required in the various recording forms; must be familiar with all the recording forms and how to fill them out.

3.2.4. Tag implantation

Once the fish is hauled onboard and placed in the tagging cradle or on the tagging mattress, tags are implanted into the abdominal cavity of the fish. An incision about 2 cm long will be made with a sterile surgical scalpel blade in the abdominal wall about 1/3 the distance from the anus toward the base of the pelvic fins, and about 2 cm to the left of the centerline of the fish. Special care will be taken to cut through the dermis only and partially through the muscle, but not into the peritoneal cavity. A gloved finger will be inserted into the incision and forced through the muscle into the peritoneal cavity (Schaefer et al., 2007).

Next, a small amount of amoxicillin (15 mg of amoxicillin per kg of body weight) will be injected into the wound from a syringe without a needle (e.g. 0.1 ml of Betamox or Clamoxyl LA per kg). The tag, previously sterilized in 10% Povidone-iodine solution, will be inserted through the incision into the peritoneal cavity, with the stalk protruding outside. The incision will be closed with two surgeon's knots using a sterile needle and suture materials (Fig. 3.2.4.1.; Fig. 3.2.4.2.).

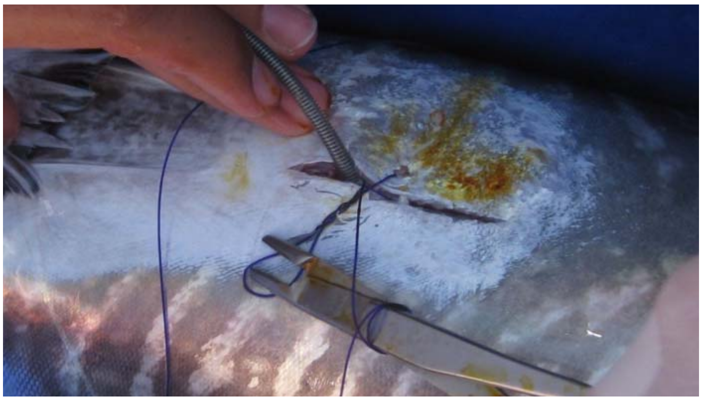


Fig. 3.2.4.1. Closing the incision where the archival tag has been placed (photo by G. Aranda).

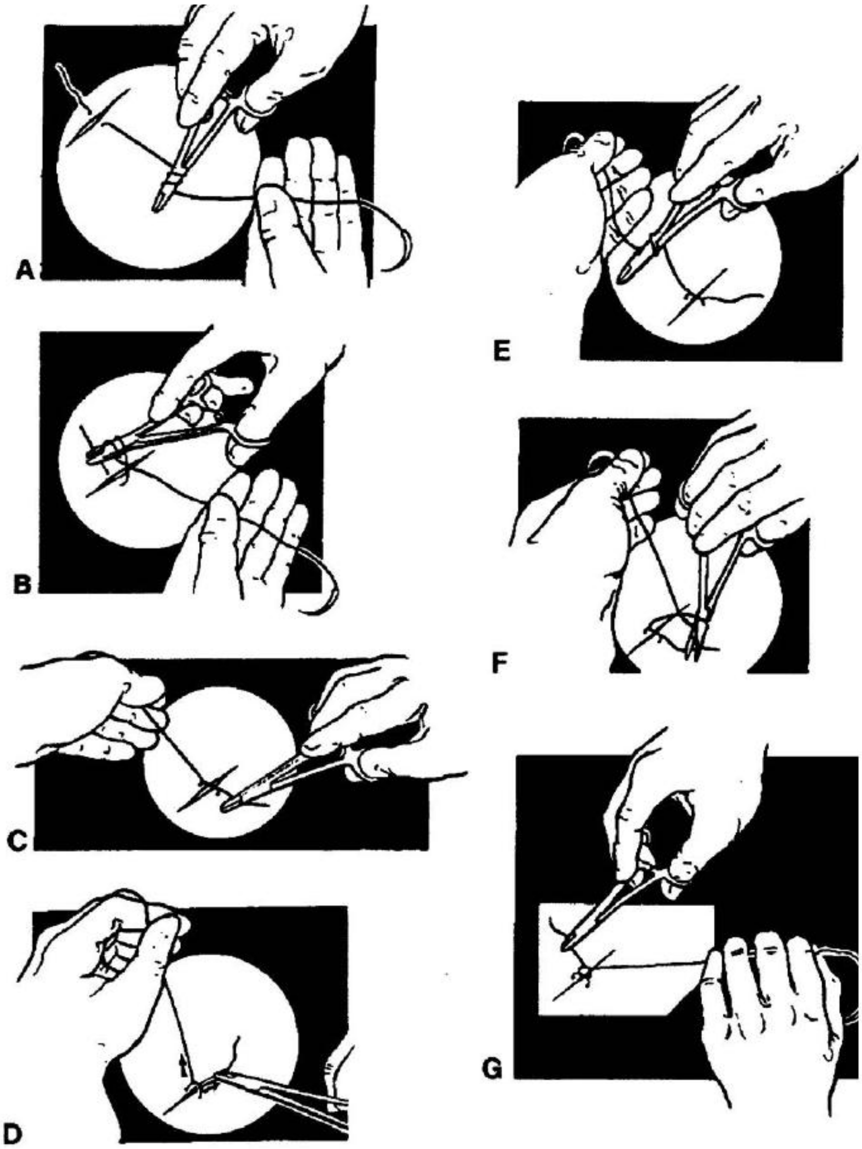


Fig. 3.2.4.2. Surgeon’s knot tying (source: U.S. Army Medical Department Center and School).

3.2.5. Tagging procedure

ABFT to be tagged with archival tags will be caught with one of the fishing methods causing least stress for the fish (see chapter 2).

It is essential that the fish is not out of the water for more than 2-3 minutes. Therefore, all the material must be ready for use before the fishing operations begin and the archival tags activated. It is advisable to activate several tags in advance in order to have more than one ready; this will be useful in the case some tags do not work properly or one fish already tagged is rejected because deemed to have lowered survival chances.

The tagging team members in contact with the fish must wear sterile gloves; all the tags and surgical material must be sterilized between tagging operations.

Once the fish is hauled onboard, the fisherman will place it gently on the tagging mattress or, if the size of the fish allows it, it will be placed in the tagging cradle ventral side up and measured to the nearest cm. The eyes will be covered with a wet synthetic dark cloth as soon as possible to keep the fish calmed down. Hence, the archival tag is implanted as described above (3.2.4.).

The fish must be in excellent condition (not bleeding and with no apparent damage in eyes, gills, fins or skin).

Each fish will also be tagged with a conventional spaghetti tag.

Data on position, date, time, fork length, weight (if available), archival tag no., conventional tag no., duration of the whole operation and any other relevant information must be accurately recorded.

The fish is put back into the water with the head pointing in the same direction as the boat.

Refer also to conventional tagging procedure for further advice.

3.2.5. Hygiene

In addition to the recommendations detailed for conventional tagging, all the tags and surgical material must be sterilized in 10 % Povidone-iodine solution.

3.3 Pop-up tagging

3.3.1. Generalities

In addition to the archival tags and as an evolution of them, a more refined type of tag and release technologies have been developed with the pop-up archival transmitting (PAT) satellite tags. Through GPS locating technology and release or 'pop-up' devices, satellite tags gather information about post-release mortality rates, oceanic movements and preferred water temperature, clarity and currents to provide new insights into some of the ocean planet's least understood pelagic fish.

PAT satellite tags are placed externally and are pre-set to detach from the fish body, rise to the surface and radio-transmit data summaries to the Argos satellite network. This network collects, processes and disseminates environmental data, and has a special channel dedicated to wildlife telemetry. PAT tags provide a means of collecting fishery-independent data, and have been deployed on animals such as tuna, marlin, sharks, swordfish, halibut, eels and sea turtles. Although satellite tags are obviously the more expensive option, they remain by far the best option for gathering relevant information on marine animals' biology.

Pop-up tags, from the tagging standpoint, consist of two parts: the active electronic apparatus on one hand, which is tethered to the implanting device. The latter is provided with a metallic or plastic dart to be inserted into the fish (Fig. 3.3.1.1.).

Fig. 3.3.1.1. Mk10-PAT tag equipped with a metallic dart (photo by M. Deflorio)

Much longer (5x) retention times and cleaner insertion sites (no ulceration or open wounds) using nylon darts over metal ones have been shown (Musyl, unpub. results). The tether is generally a monofilament. Because regular (i.e. nylon) monofilament hydrates and becomes brittle over time, fluorocarbon line (123 kg) is preferred for the tether. The length of the tether should be about 16-20 cm.

Probably one of the commonest ways for tags to become loose is through continual movement of the dart in the flesh, which inflames the surrounding tissue thereby providing a site of secondary infection. Over time, the surrounding tissue becomes necrotic and the dart simply rots out. To reduce or alleviate these vitiating forces, a swivel is placed halfway along the tether to reduce torque and precession.

This type of tag has already been used to tag ABFT (Block et al., 2001 and 2005; Lutcavage et al., 1999; De Metrio et al., 2002, 2004 and 2005) and have repeatedly proven to be a powerful tool to improve understanding of migration patterns in this fish. Nevertheless, some aspects of ABFT population structures and migrations (e.g. reproductive site fidelity) need to be further investigated.

Commercially available PAT tags vary according to their size, shape, assemblage, and, most important, performance (memory power, working time endurance, transmission power, service satellite technology, operating mode, depth resistance, and so on), as well as according to their price and the costs of satellite connection, data recovery and processing. PAT tags have also evolved since they became available on the market and are expected to continue to evolve.

Presently, the most used pop-up archival satellite tags are:

- the Mk10-PAT tag (Fig. 3.3.1.2.) and the MiniPAT tag (Fig. 3.3.1.3.) by Wildlife Computers;
- the PTT-100 tag (Fig. 3.3.1.4.) and the X-tag (Fig. 3.3.1.5.) by Microwave Telemetry:
- the PSAT tag series (Fig. 3.3.1.6.) by Lotek.

They are designed to track the large-scale movements and behaviour of fish. The tag is attached to the animal via a tether. A buoyant body and a corrodible pin allows the release of the tag from the fish so data can be transmitted to ARGOS satellite system.

Fig. 3.3.1.2. Mk10-PAT tag (source: Wildlife Computers web site)

Fig. 3.3.1.3. MiniPAT tag (source: Wildlife Computers web site)

Fig. 3.3.1.4. PTT-100 archival pop-up tag (photo by M. Deflorio)

Fig. 3.3.1.5. X-tag (source: Microwave Telemetry web site)

Fig. 3.3.1.6. PSAT tag series (source: Lotek web site)

3.3.2. Tagging equipment

- Pop-up tags.
- Conventional tags: fish must also be tagged with green conventional tags with a legend specifying the presence of an archival tag inside the fish and the reward.
- Conventional tagging material (e.g., applicators, cradle, mattress, recording forms), as specified under the conventional tagging section.
- Surgical gloves.
- 10% Povidone-iodine solution (e.g. Betadine).
- Rigid-framed net of knotless webbing: it can be useful for brailing small fish from the side of the vessel.
- Lift to take the fish onboard.
- Camera and/or videocamera.

3.3.3. Tagging team

Refer to archival tags tagging team (3.2.3.).

3.3.4. Tag implantation and tagging procedure

Pop-up tags are rather expensive, so only a small number of tags are generally used in tagging programmes. Therefore, great care will be exerted in all steps of the tagging procedure. Otherwise the pop-up tagging procedure is very similar to the conventional tagging procedure. The technical requirements for each pop-up tag, which vary according to each brand and model, must be respected (e.g. temperature to keep the tag at before deployment, switching it from stand-by to on mode, checking whether it works, and so on). Before embarking, the taggers will check all the material needed for the operation, especially the tag. As a caution, it is assumed that the "fully" equipped tag (with tether and dart) will float (i.e. can tell "shed" from "dead"). Therefore, it is critical that scientists test this assumption before tag deployment.

The fish to be tagged must be at least 30-40 kg in weight (or about 120-140 cm), since smaller specimens would suffer because of the comparatively high drag caused by the tag. ABFT of such a size will be caught with one of the fishing methods causing least stress for the fish (see chapter 2).

Note that in the case of tagging with pop-up tags, there is no need to catch larger numbers of fish as in conventional and PIT tagging, but rather to ensure good fish condition. Indeed, whatever the fishing method, the physical condition of the fish to be tagged must be carefully checked before tagging.

Once the fish is taken on board, it is placed on a mattress (see paragraph 3.1.) to be tagged. The dart will be inserted using the applicator at the base of the second dorsal fin (Fig. 3.3.4.1., a), so that it becomes anchored in the pterygiophores (i.e. the bones that support the fin rays) (Fig. 3.3.4.1., c). In order to improve the tagging procedure, a large soaked mattress (or sponge) will be placed on the fish body to restrain it whilst it is being tagged instead of placing hands on the animal, which might cause abrasions and/or bruising to the epithelium.

In addition to the pop-up tag, a conventional tag should also be inserted into the fish, also at the base of the second dorsal fin. This "double-tagging" strategy would provide information on PAT tag shedding rates should a double-tagged specimen be re-captured.

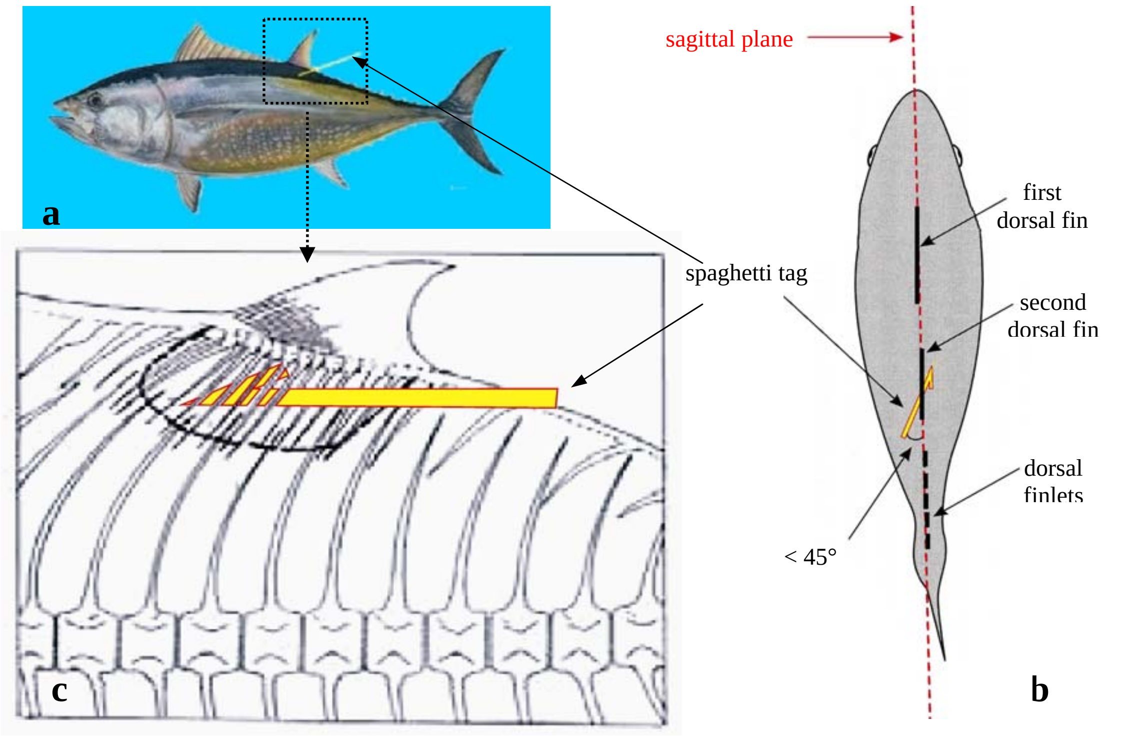


Fig. 3.3.4.1. Insertion point of the anchor (i.e. spaghetti tag or dart of a pop-up tag) into the fish (illustration by S. Gelao; *c*: source from Kearney and Gillett, 1982)

If, after tagging has been carried out, it is found that the tagged fish is somehow injured or too stressed, the pop-up tag will be retrieved. The tag will also be removed from the fish when its implantation is not fully satisfactory, when insertion in a way that may threaten fish survival or cause the modification of its behaviour (e.g. by producing too much drag), or cause tag shedding. In either case, the tag will be extracted by cutting the fish's flesh around the dart, rather than by pulling it with force, so that it can be used with another fish.

The fish is immediately put back into the water, as soon as the tagging is completed.

3.3.5. Hygiene

A broad-spectrum bactericide must be used in the pop-up tagging procedure.

The dart, tether and applicator tips should be liberally bathed in Betadine solution (a 10% solution of Povidone-iodine) immediately before insertion in order to lessen the risk of infections.

As for all other hygienic recommendations, refer to the conventional tagging chapter.

3.4. PIT tagging

3.4.1. Generalities

Passive integrated transponder (PIT) tags exploit radio frequency identification technology, which remotely identifies objects through the use of radio frequencies. Most of the tagging devices used in animals are passive.

A PIT tag consists of a small, glass-encapsulated electromagnetic coil and microchip with a unique alpha-numeric code. Other encapsulating media are also available in the PIT tag market (Fig. 3.4.1.1.).

The tag is inactive until energized by an electronic tag reader. The scanner sends a low-frequency signal to the microchip within the tag providing the power needed to send its unique code back to the scanner and positively identify the animal. Therefore, these tags can last many years, providing a long-term identification method.

PIT tags are relatively inexpensive, easy to implant, and are thought to have long retention times. However, tags implanted in the peritoneal cavity may also invoke tissue reactions that result in their encapsulation by connective tissue and migration away from the point of injection (Gheorghiua et al., 2010). In order to prevent such adverse events, especially where PIT tags are to be used in longer-term studies, as is the case for the ABFT, PIT tags should be implanted into the muscle tissue of the fish.

The main advantage of this type of tag is that they may provide quantitative estimates of conventional tagging reporting rates among different fisheries, which is the main uncertainty affecting the use of conventional tagging in estimating natural and fishing mortality values.

Fig. 3.4.1.1. Several models of PIT tags. (source: Biomark, Inc.)

3.4.2. Tagging equipment

- PIT tags
- PIT tag applicators
- Conventional tags and conventional tagging material (e.g., applicators, cradle, recording forms), as specified under the conventional tagging section.
- Disinfecting material.

PIT tags implanted into fish require the use of a scanner to be used when potential tag-bearing fish are caught. As in the choice of PIT tags, the read distance dictates the selection of the scanner, which should also be related to the tags to be used (as an example, FS2001F-ISO reader from Biomark provide an excellent read range, but is not compatible with food-safe HDX tags from Hallprint Pty Ltd.).

3.4.3. Tag size

The size of PIT tags to be used is not expected to be a constraint in the case of the ABFT. Hence the size should be chosen so as to maximize the detection range.

As an example, 23 mm BIO23.B FDX tags from Biomark inc., and 22 mm HDX tags from Hallprint Pty Ltd., provide the maximum reading distance among the models available.

It must be noted that PIT tags are not easy to detect, and therefore they might be accidentally ingested by man. On this account, it may be interesting to consider the use of tags encapsulated in surgical plastic and food-grade resin (e.g., ENSID Technologies Ltd, Fig. 3.4.3.1.), rather than glass-encapsulated tags.

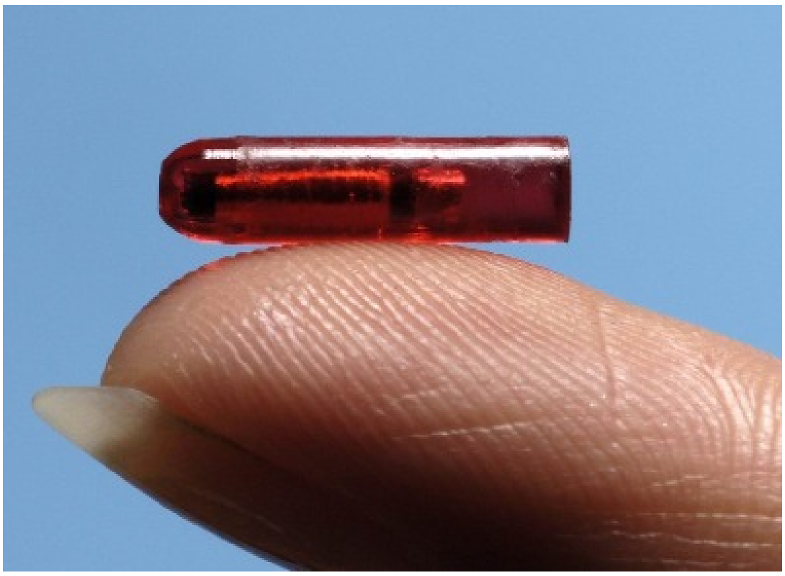


Fig. 3.4.3.1. Food-safe PIT tag (source: Hallprint Pty Ltd).

3.4.4. Tagging team

A comparatively large number of fish will be tagged with PIT tags and, moreover, each tagging operation takes longer than conventional tagging. To be carried out properly, this type of tagging requires a three-person tagging team, similarly to conventional tagging: a fish handler, a tagger, a recorder. The latter will also be responsible for verifying whether the implanted PIT tag works properly; he will also help the tagger in disinfecting the tags and implanting instruments. The person in charge of fish handling will also help the tagger to calm down the fish in the cradle.

3.4.5. Tag implantation

PIT tags are typically injected subcutaneously using a hypodermic syringe-like applicator (Fig. 3.4.5.1.).

Fig. 3.4.5.1. NJ Phillips Polymer PIT Tag Applicator (source: Hallprint Pty Ltd).

Implant location varies depending on the studied species. In the case of tunas, no information is available on tag migration within the fish body or tag shedding according to different tag insertion locations. However, because of both the limited detection range of this type of tag and the size of the fish to be tagged, PIT tags will be inserted on one side of the fish, just below the derma layers.

Taking into account the details of tagging procedures, the preferred fish side is the left one, and the place of insertion will be just in front of the distal extremity of the left pectoral fin, perpendicular to the fish's longitudinal axis, so that the longitudinal axis of the tag is oriented as far as possible in the same direction as the muscle myomers. In this way, the PIT tag will be placed in the central part of the fish body, which more or less corresponds to the point of maximum body convexity. This PIT tag location is also good for subsequent scanning procedures on caught fish.

3.4.6. Tagging procedure

All the instruments are prepared before starting tagging activities, and needles must be disinfected opportunely.

The PIT tags, whose codes are previously recorded, are arranged in order in multicell distributors so they can be taken out sequentially, inserted into the needle and be ready for the implantation.

Load PIT tag syringe needles with PIT tags (one PIT tag per needle), load up at least enough needles with tags to get through a batch of fish.

Once the fish is hauled onboard, it is gently put onto a tagging cradle or tagging mattress on its right side, with the head facing the closed side of the cradle and measured.

The exposed eye will be covered with a wet synthetic dark cloth as soon as possible in order to sedate the fish. A right handed tagger will have the fish belly towards him and will handle the fish with his left hand and the syringe and needle with tag with his right hand.

The proper technique for tagging is to insert the needle at approximately a 45° degree angle with respect to the body surface, more or less perpendicular to the fish's longitudinal axis, so that the longitudinal axis of the tag is oriented as far as possible in the same direction as the muscle myomers, just in front of the distal extremity of the left pectoral fin (Fig. 3.4.6.1.).

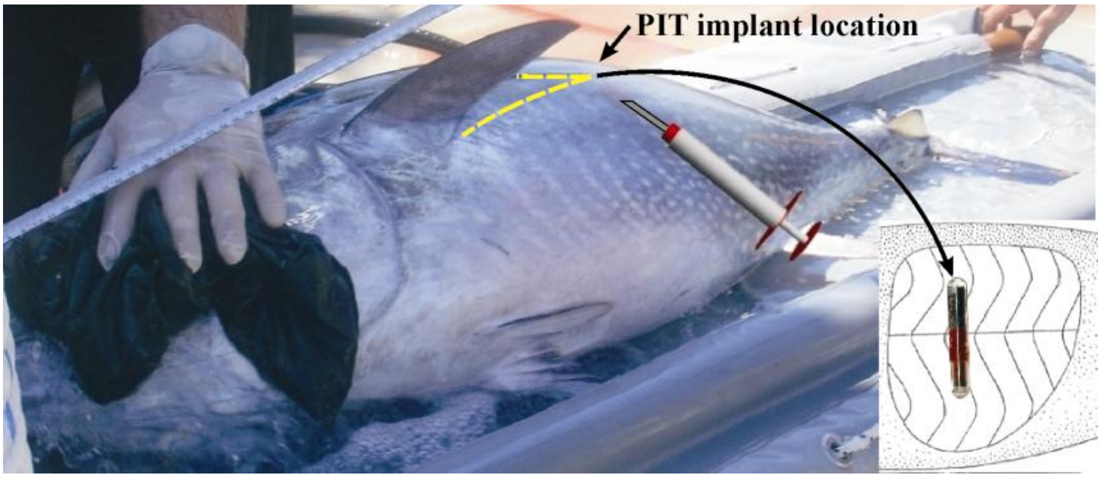


Fig. 3.4.6.1. PIT implant location (tip of the pectoral fin) and particular of the position of the PIT within the muscle myomers. (photo by M. Deflorio; illustration by S. Gelao).

Once the tip of the needle has just broke the surface of the fish's skin, the needle should be flattened out almost parallel to the fish's body and inserted only far enough to insert the tag. In this way the tag will be inserted just below the derma layers.

The plunger on the syringe is then pushed forward to insert the tag. Immediately after tag insertion has occurred gently pull the needle out of the fish. Gently rub the insertion point with a finger to ensure the tag is completely inserted.

Each fish will also be tagged with a conventional spaghetti tag.

Data on position, date, time, fork length, weight (if available), PIT tag no., conventional tag no. and any other relevant information must be accurately recorded.

The recorder will then scan the fish surface by the portable reader/scanner device to check whether the tag works properly and will register the PIT tag number.

The whole of the operation area is then covered in a disinfecting solution and after the fish immediately returns free to the sea water, head first. The used needle is then placed in a container of alcohol for sterilization and disinfection purposes.

3.4.7. Hygiene

In order to avoid infections and disease transfer, PIT tags and PIT tag injectors will be disinfected in a 70-80% ethyl-alcohol or 60-80% isopropyl-alcohol solution for a minimum of 10 minutes.

4. ABFT TAGGING IN THE ICCAT PROGRAMME

ICCAT's eastern ABFT stock tagging programme expects to tag 36,000 individuals over a three-year period, from 2011 to 2013. Immature fish will make up the majority of the tagged fish. The programme will involve various types of tagging and ABFT individuals of different ages, over a three-year period, according to the plan summarized in Table 4.1.

Area	Methods to be decided	Age1	Age2	Age3	Total
Bay of Biscay	Bait Boat	500-600	800	600	2000
Gibraltar/Atlantic	Bait Boat/Trap	500-600	800	600	2000
Balearic Islands/Gulf of Lions	PS	500-600	800	600	2000
Western-Central Mediterranean	PS/Trap	800-900	1000	800-900	3000
Eastern Mediterranean	PS	800-900	1000	800-900	3000

Tab. 4.1. Numbers of ABFT to be tagged each year (2011-2013).

4.1. Juvenile conventional tagging

ICCAT's current ABFT tagging programme requires a significant number of juvenile individuals (age: 1 to 3 years; Corriero *et al.*, 2005) to be tagged with conventional tags and released. The data gathered from juvenile tagging is expected to provide satisfactory estimates of natural mortality rates in ABFT during pre-adult life stages, a most important parameter for managing their stocks.

In all, the tagging programme requires the conventional tagging (i.e. with dart or spaghetti tags) of 12,000 ABFT specimens per year, from 2011 to 2013, in the Eastern Atlantic/Mediterranean area. The return of a significant number of tags is expected in order to estimate mortality rates among the Eastern stock. According to the programme, ABFT in the age range from 1 to 3 years - i.e. juveniles - will be tagged with conventional tags.

Based on current knowledge of Eastern Atlantic/Mediterranean ABFT fisheries, it appears that the best method for catching juvenile tunas, for tagging purposes, is by live-bait boats.

This method is especially suitable for tagging small tunas, since it is quite difficult to catch larger animals by pole-and-line, as well as to land them in the cradle without harming them. Tagging from live-bait boats is carried out mainly in the Bay of Biscay, where the highest catches of juveniles occur. Hence this is where tagging and release operations will be carried out.

Some 12,000 ABFT individuals in the approximately 4 to 15 kg weight range (Santamaria et al., 2009) will thus be tagged and released each year, from 2011 to 2013.

Juvenile ABFT are not subject to any genetic migrations, so they may be caught regardless of the spawning season. This concern apart, tagging operations will be carried out during the regular fishing season in the Bay of Biscay.

Tagging should be conducted in as many areas as possible. Spatial heterogeneity and incomplete mixing need to be considered within the tagging experiment. This can be addressed partly through tagging in different areas.

5. LIST OF ACRONYMS

ABFT	Atlantic Bluefin Tuna
CPUE	Capture Per Unit of Effort
F	Fishing mortality rate
FL	Fork length
GBYP	ICCAT Atlantic Wide Research Programme for Bluefin Tuna
HDX	Half-duplex system
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
M	Natural mortality rate
PAT	Pop-up Archival Transmitting
PIT	Passive Integrated Transponder
PS	Purse Seine
PTT	Pop-up Terminal Transmitter1
SCRS	Standing Committee on Research and Statistics
SSB	Spawning Stock Biomass ($SSB_{F0.1}$ is the equilibrium of SSB with fishing mortality rate F = 0.1)
VMS	Vessel Monitoring Systems
Z	Total mortality rate

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SWOT analysis to evaluate different tagging strategies

Belda, E.J. and Cort, J.L.

(to be included within the tagging design chapter of the tagging manual)

In order to estimate fishing mortality form capture-recovery data, one important aspect to consider is non-mixing rates. Therefore, particular attention needs be put into spatial stratification of sampling areas and be focused on juvenile areas. The group was in consensus that tagging should take place over as broad a spatial area as possible across the range for ages 1-3. Two different options or strategies were considered:

Strategy 1: Commission a bait boat from Bay of Biscay for use in the W. Med., and transit from area to area using same crew and captain

Strategy 2: Use local purse seiners (Bait boat in Bay of Biscay) with local captains and crew for spatially explicit sampling areas.

A SWOT analysis is presented to evaluate each of these two strategies. Startegy 2 seems to be most favoured.

In addition the high costs of strategy 1 suggest the second strategy as the best one (see Annex 1).

Strategy 1

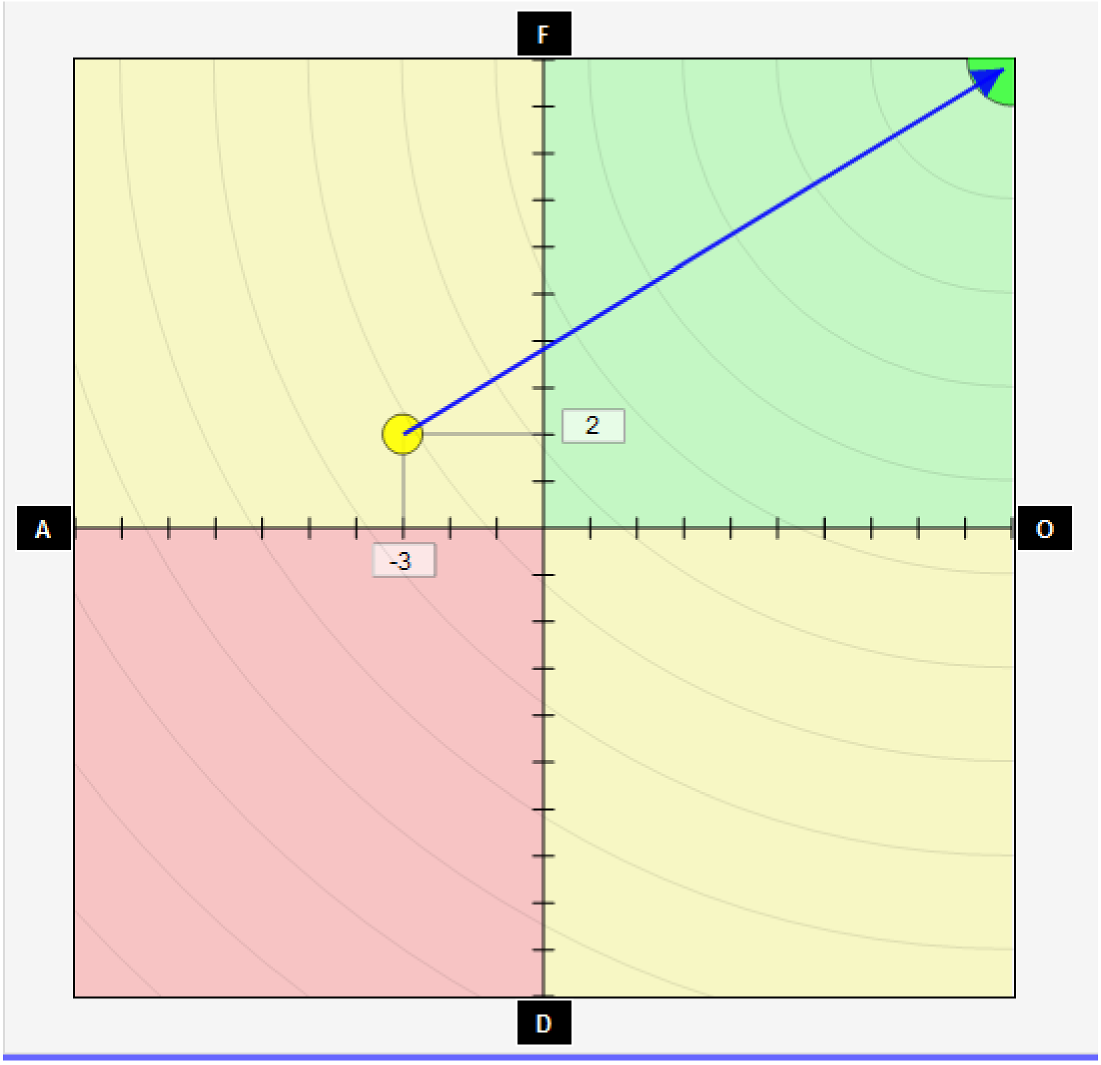
Commission a bait boat from Bay of Biscay for use in the W. Med., and transit from area to area using same crew and captain

Fortalezas	Peso
Experience of tagging team	10
Relationship between tagging team and vessel	5
Difference in tag shedding and moratlity rates between operations	5
Reduction of tagging mortality	4
Handling of calls	2
Total	**26**

Debilidades	Peso
Cost of renting the vessel	3
Cost of traveling to different areas	9
Total	**12**

Oportunidades	Peso
Experience from other experiments	2
Total	**2**

Amenazas	Peso
Knowledge of local areas for fishing	7
Weather conditions	5
Knowledge of sea conditions	3
Need for local authorizations	6
Implication of local people	1
Effect on reporting rates	1
Total	**23**



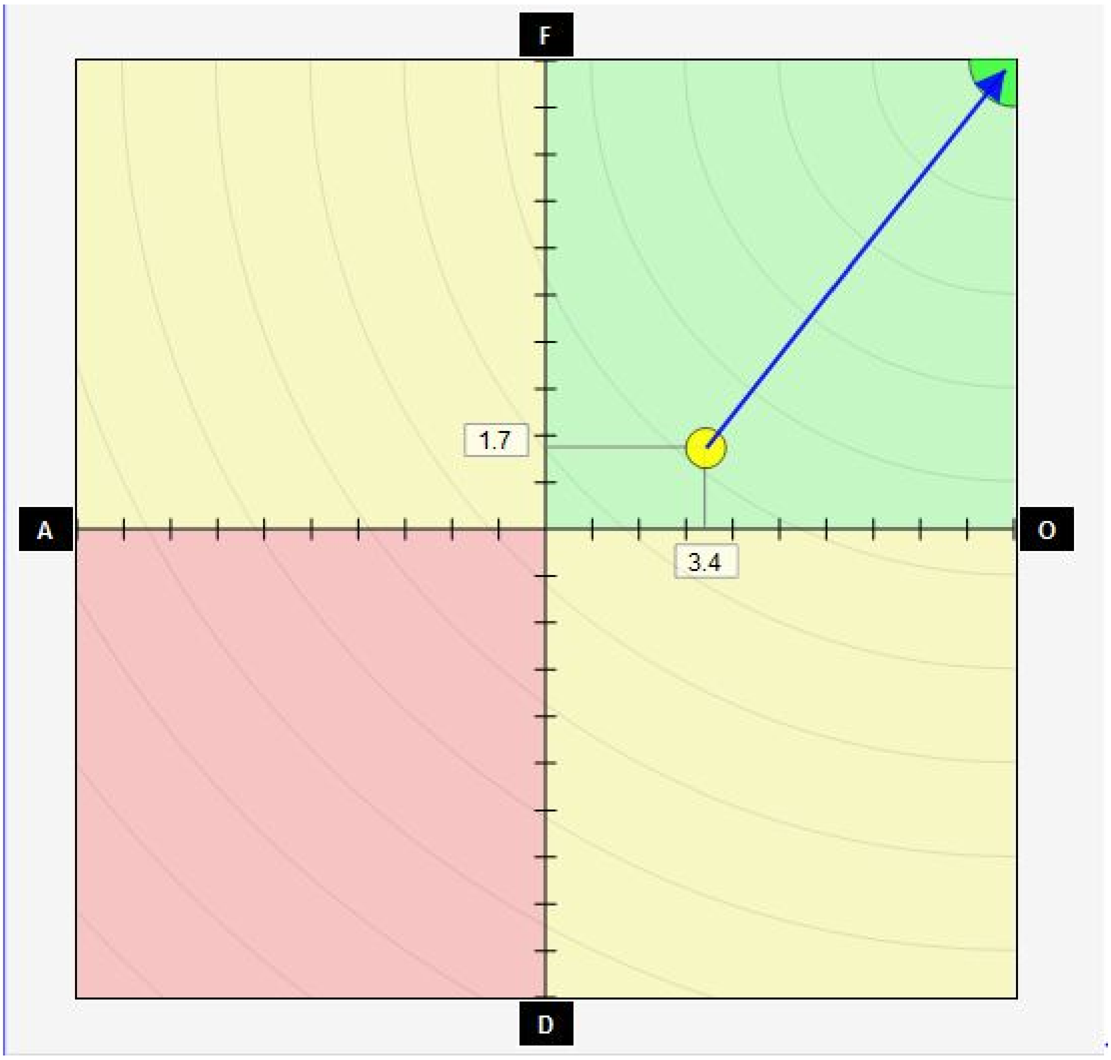
Strategy 2. Use local purse seiners (Bait boat in Bay of Biscay) with local captains and crew for spatially explicit sampling areas.

Fortalezas	Peso
Relationship between tagging team and vessel	2
Experience of tagging team	5
Cost of renting the vessel	5
Cost of traveling to different areas	5
Total	**17**

Debilidades	Peso
Difference in tag shedding and moratlity rates between operations	2
Handling of calls	2
Reduction of tagging mortality	1
Total	**5**

Oportunidades	Peso
Knowledge of local areas for fishing	9
Knowledge of sea conditions	9
Weather conditions	3
Need for local authorizations	3
Implication of local people	3
Effect on reporting rates	2
Total	**29**

Amenazas	Peso
Experience from other experiments	5
Total	**5**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Annex I

		MARCADO CONVENCIONAL					
ZONA			SISTEMA DE PESCA	Nº MARCAS	Nº DÍAS	IMPORTE/DIA (€)	IMPORTE TOTAL
		OPCIÓN 1					
MAR CANTÁBRICO	Golfo de Vizcaya		CEBO VIVO	2000	21	8000	168000
MAR MEDITERRANEO OCCIDENTAL	Mar Catalán, G. León y G. Génova		CERQUERO 1	6000	45	5000	225000
MAR MEDITERRANEO CENTRAL	Mar Adriático y G. de Gabes		CERQUERO 2	4000	30	5000	150000
						TOTAL OPCION 1	543,000 €
		OPCIÓN 2 (A)					
MAR CANTÁBRICO	Golfo de Vizcaya		CEBO VIVO	2000	21	8000	168000
Viaje (2 barcos)			CEBO VIVO (DAKAR) *		15*2 (barcos)=30	4000	120000
MAR MEDITERRANEO OCCIDENTAL	Mar Catalán, G. León y G. Génova	Pesca	CEBO VIVO (DAKAR)	6000	30	8000	240000
MAR MEDITERRANEO CENTRAL	Mar Adriático y G. de Gabes	Pesca	CEBO VIVO (DAKAR)	4000	30	8000	240000
						TOTAL OPCION 2 (A)	768,000 €
		(B)					
MAR CANTÁBRICO	Golfo de Vizcaya		CEBO VIVO	2000	21	8000	168000
Viaje (2 barcos)			CEBO VIVO (DAKAR) *		15*2 (barcos)=30	3000	90000
MAR MEDITERRANEO OCCIDENTAL	Mar Catalán, G. León y G. Génova	Pesca	CEBO VIVO (DAKAR)	6000	30	7000	210000
MAR MEDITERRANEO CENTRAL	Mar Adriático, Golfo de Gabes	Pesca	CEBO VIVO (DAKAR)	4000	30	7000	210000
						TOTAL OPCIÓN 2 (B)	678,000 €

* Dos cañeros españoles con base en Dakar que hicieron la campaña de marcado convencional en el Océano Indico

ANNEX 1

TAGGING DESIGN REPORT

1. Introduction

Multiple-year tagging experiments are a fundamental tool to estimating fishing and natural mortality rates and abundance in fisheries. These are the main parameters needed in stock assessments. The use of appropriate tagging experiments and a framework for modelling such data has the potential to reduce uncertainty in stock assessments, and in particular those based on catch at age data (Polacheck *et al*. 2006).

Most of the statistical frameworks used to analyse this type of multiple year tagging studies are based on the so called "Brownie models" (Brownie *et al*. 1985, Hoening 1998). Recent development in the use of this models include incorporating catch at age data to estimate abundance (e.g. Polacheck *et al*. 2006, Evenson *et al*. 2007, 2009) and the use of telemetry data to combine data from dead and live returns (Pollock *et al*. 2004). This last approach has the advantage that natural and fishing mortalities can be estimated directly from the data, which is not possible with the so called Brownie models, which depend of independent estimation of reporting rates.

At present, regulations of the ABFT tuna fishery may imply that not enough recoveries are achieved even if large numbers of tunas are tagged. The mean recovery rate for the period 2007-2009 was estimated as 0.16 % (see Fig 1) The two main problems may arise due to a low harvest rates (present TAC for 2011 is 12,900 tonnes) and limitations in the harvest of juvenile tuna. An analysis of variation in recovery rates for the period 1954-2009 is shown in Fig. 1.

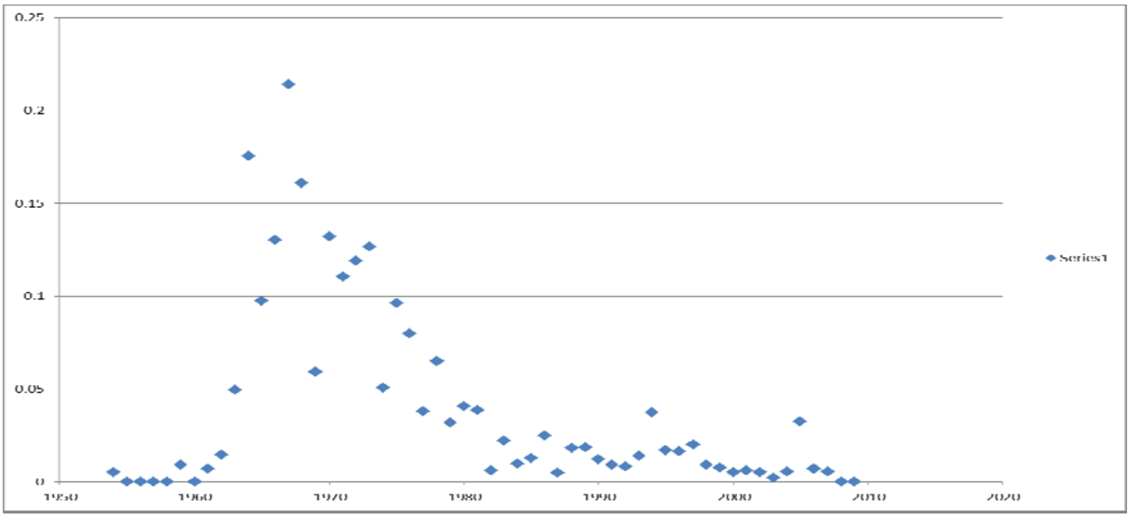


Fig. 1. Variation in recovery rates of tagged ABFT for the period 1954-2009. Mean recovery rate was 0.03 ± 0.07. Mean recovery rates period 2007-2009 was = 0.0016± 0.0017.

A preliminary step in the design of a tagging experiment is the use simulation studies to evaluate precision of parameter estimates. These simulations studies consist in simulate capture-recovery data assuming values for survival and recovery rates. Manipulating the number of releases, or the reporting rates, allow exploring whether the objectives can be met with the available resources and establish expectations for the study results. In addition particular questions about the tagging experiments can be tested, specifically the number of tag releases needed in order to obtain a given precision in estimates.

In summary, the aim of the simulations was to establish the number of releases of different age or age groups needed to achieve relative precise and unbiased estimates of mortality. We have also considered the potential use and benefits of electronical tags, even though it was not asked in the present call.

2. Simulation methods

In a preliminary step we reviewed the literature and previous design of experiments dealing with pelagic fisheries. The best approach to estimate natural and fishing mortalities is the use of multiyear tagging of a single cohort (Polacheck et al 2006a, 2006b). If individuals of known age are tagged, then long term studies may provide information of age specific mortality rates (e.g. Orell and Belda 2006).

An important question is the need for an adequate framework to modelling data provided by such experiments. In this sense Polacheck *et al*. (2006a) deal with the study of the southern bluefin tuna (*Thunnus maccoyii*). That approach is an excellent framework for the analysis of tag recovery studies as the one aimed by the GBYP programme (see also Polacheck *et al*. 2006b, 2010; Evenson et al. 2007; Evenson *et al*. 2009). The base of this framework is the so called "integrated Brownie-Petersen approach" (review in Polacheck *et al*. 2010). They provide estimates of abundance and mortality rates even when reporting rates are not known (through the estimation of recovery rates, see below). Information is required for obtaining independent reporting rate estimates. A potential problem of this method is that estimates natural mortality rates indirectly because natural deaths are not observable. One potential solution is the use of combined information from dead recoveries and live recaptures obtained from telemetry studies. This approach will have the advantage of estimating directly fishing and natural mortalities (Pollock *et al*. 2004). The combined use of Pop-up archival tags (live recaptures and dead recoveries) and conventional tags (dead recoveries) is thus a promising approach that needs to be considered.
The "integrated Brownie-Petersen approach" provides also estimate of initial population abundance of the tagged cohorts (see review in Polacheck et al 2010).

At present we have focussed on estimation of mortality, thus we conducted simulations using the Brownie approach. In Brownie models the number of expected recoveries is modelled using the annual survival rates (S_i), and the recovery rate (f_i). The recovery rate depends on three parameters: tag shedding(tag retaining rate) and tagging mortality rates (φ_i); harvest rate (u_i); and reporting rate (λ_i).

$$S_i = \exp(-F_i,-M_i)$$

$$f_i = \varphi_i \, u_i \, \lambda_i$$

$$u_i = 1- \exp(-F_i)$$

harvest rate type I fishery sensu Ricker 1975 -Amstrup et al 2005

Thus, the expected numbers of recoveries per year may be estimated as:

year marked	*number marked*	1	2	3	$l = 4$
1	N_1	$N_1 f_1$	$N_1 S_1 f_2$	$N_1 S_1 S_2 f_3$	$N_1 S_1 S_2 S_3 f_4$
2	N_2		$N_2 f_2$	$N_2 S_2 f_3$	$N_2 S_2 S_3 f_4$
3	N_3			$N_3 f_3$	$N_3 S_3 f_4$
$k = 4$	N_4				$N_4 f_4$

This model assumes that:

1. The tagged sample is representative of the target population or the target animals are mixed completely with the untagged ones (complete mixing assumption).

2. All marked fish alive on the study at time *i* have the same survival and recovery probability to the next time.

3. Survival rates are not affected by tagging and there is no tag loss (i.e. need to consider tag shedding experiments).

If ϕ_i and λ_i can be estimated (i.e through double tagging experiments and observer programmes) then the recovery parameter can be used to estimate the explotation rate, and thus instantaneosu fishing mortality and natural mortality rates may be derived (Hoening et al 1998a). This implies that in the tagging design both double tagging experiments and the collection of tag recovery by observers should be implemented.

In addition, Archival and “Pop-up” archival tags may provide information where a fish has been between time of release and recovery. This has the potential of providing information on mixing of the population, which is an important assumption of tagging models. It also can be used for estimating reporting rates (Pollock *et al*. 2001) and to get simultaneously information on mixing of tagged and untagged individuals in addition to movements of tuna. We therefore considered the use of “high reward” option and use it to tag tunas with archival tags (*pop-up archival tags were not considered here because of the high cost of this type of marks*).

In many tagging experiments the number of tagging years (*k*) is less than the number of years in which recoveries are collected (*l*). This is because getting recoveries is relatively unexpensive whn compared with tagging. However this imposes some restrictions in the number of estimable parameters using Brownie models. Basically, in models with time variation in the parameters it is not possible to estimate parameters for periods $l > k$. Thus for a three year tagging experiemnts only is possible to estimate parameters for the first and second years. Alternatively we need to impose constraints on recovery or survival rates in order to estime any parameter for the third year or later. Thus a detailed search in the related bibliography suggest that a period of 5 years of tagging. At present the tagging recommendation from ICCAT only consider three years of tagging and recoveveies to be collected from 2011 to 2023.

Tagging strategies

As suggested by the preliminary review of the literature we considered tagging at least three cohorts of individuals of different age. The tagging experiment should be conducted on the same cohort in different years thus tagging of juveniles where age can be inferred from size more accurately is desired. The model assumes that ages at tagging are known without error. Otherwise, bias may be introduced in the parameter estimates. For the ABFT, we consider the following age groups in which aging error are lower:

i) Age 1: 1 year old tuna

ii) Age 2: 2 year old tuna

iii) Age 3: year old tuna

We simulated different scenarios and strategies. In order to simulated different possible scenarios we considered the expected change in fishing mortality rates due to the recovery plan for a constant quota of 11,900t. Estimated values used for simulations are in Appendix 1. Models considered three cohorts and age and time dependent effects. These impose limitations to the numbers of parameters that can be estimated using the Brownie approach. Models with a constrained recovery rate may provide estimation of more parameters but because in Brownie models fishing mortality is included in both terms, the survival and the recovery rate, these constrains will influence the precision of mortality rates. Appropiate methods to estimate tag shedding, tagging mortality and reporting rates are considered below.

Simulations consider tagging to be carried out in 2011, 2012 and 2013, and data gathered until 2023. Number of releases considered was at least 10,000 fish per year. Simulations were conducted using software MARK 6.0 (White *et al*. 1999).

In order to measure precision we used the relative standard error (RSE) estimated as the standard error of 500 simulations divided by the mean estimate (RSE= SE/estimate). Bias of the estimates was obtained from the difference between the mean estimate of survival and the real value of that parameter used to generate the 500 data sets used in simulations. We consider precise estimates if RSE < 0.15 and unbiased if Bias < 0.02.

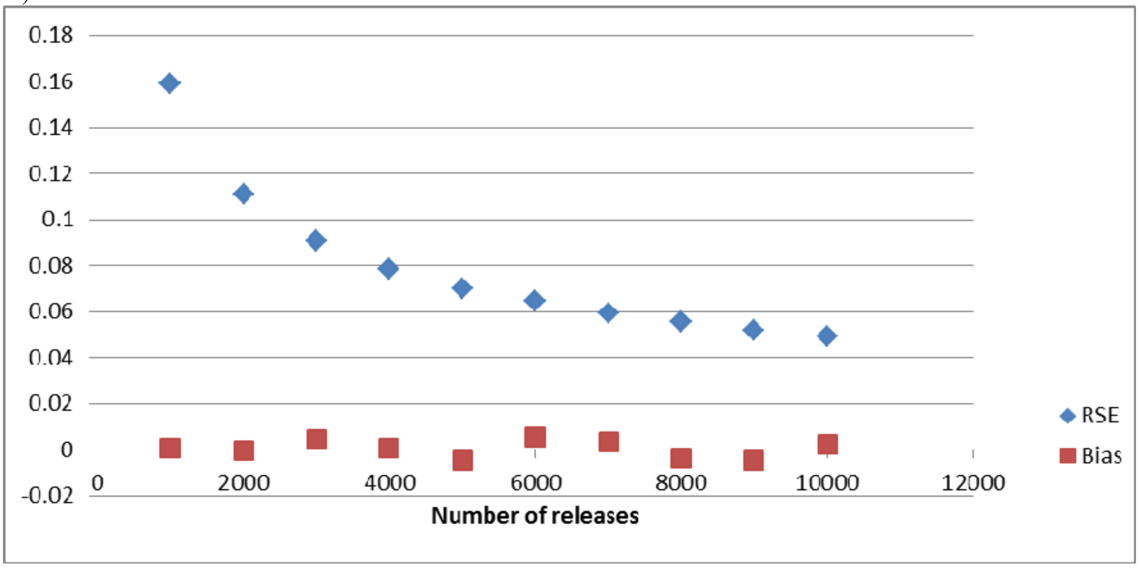
3. Main results of the simulations

3.1 Effect of the number of releases on precision and bias of estimates.

Precision on estimators and power of test depend not only on the number of animal marked and released but also on the numbers surviving and the number recovered. Lower survival (natural mortality) will imply lower number of recoveries. Thus we used the survival of one year old individuasl (the one with the highest natural mortality) to check how the number of releases and reporting rates affected bias and precission.

First we considered an scenario with high reporting rates and low losses at tagging (either due to tag shedding or to tagging mortality $\varphi_i u_i = 0.57$). The values used are similar to those resented in Polacheck *et al* 2006 for the southern Bluefin tuna. As expected the precision and bias of the estimates increased as the number of releases increase (Fig. 2). In general, estimates are quite precise and unbiased. However the improvement in precision seems to be asymptotic, i.e. increasing the number of releases did not yield a linear increase in precission but it increases linearly the costs. An optimum relation is found between 3000 and 5000 releases per year and age class.

A)



B)

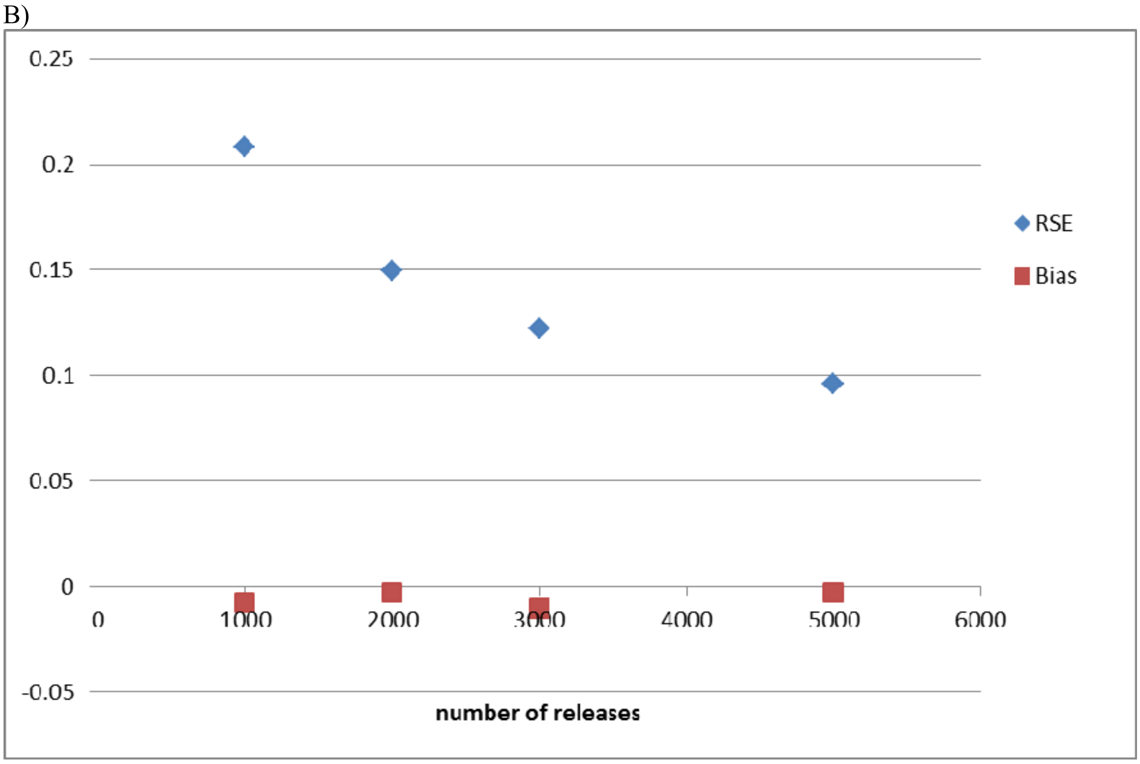


Fig. 2. *Effect of the number of releases on precision (blue diamonds) and bias (red squares) of estimates of mortality in the ABFT. Presented data is for survival of age 1 tunnas (the lowest survival). Simulation considered total mortality (appendix 1) with a reporting rate constant through time (60%) and tag shedding rate + tagging mortality of 5%. In Figure B a situation with low reporting rates = (30%) and higher tag shedding + tagging mortality (20%)60% and tag retaining rates+ tagging survival = .095.*

We also considered a scenario with lower recovery rates due to either higher tagging mortality, low rate of tag retention or lower reporting rates ($\varphi_i u_i$ = 0.24). The bias of the estimates is similar to previous simulation but precision of the estimates is lower. More than 2000 releases are required to have a precision with RSE < 0.15, and 5000 for RSE < 0.1.

3.2 Integrating catch at age data with tag recovery data

Because of the limitations associated with a low number of years of tagging it is possible oinly to estimate parameters the parameters for two years for at best three cohorts (cohorts of 2009, 2010, 2011 see table X) if the Brownie approach is used. An alternative is to use catch at age data together with recovery data. There are different approaches for this type of analyses. One was presented by Polacheck *et al* 2006 (see also a review in Polacheck et al 2010). This approach also suffers from similar limitations as mentioned above. This so called Brownie-Petersen approach permits the estimation of natural and fishing mortality and initial population size. Thus we understand that in this case the estimation of population abundance will be limited to a few years and it will not be valid to evaluate how the tagging experiment may help to evaluate the achieving of the rebuilding target.

A second approach is to incorporate tagging d and recovery data within stock assessment. This provides the most rigorous method available so far (Anon. 2007).This can be done for example using softwareVPA-2BOX. Of course this approach also has some limitations. Among several problesm this models are over-parametirized and several contraints must be impose to the data to estimate N and F. First it assumes that natural mortality is known and it is constant. However this is not the case for the ABFT, because natural mortality has not been estimated yet. Indeed estimation of natural mortality is one of the possible output from this tagging experiment. Second, it assumes that catch at age is known withour error and therefore estimates obtained will be biased is this iis not the case. Finally, some index of abundance is required to be able to estimate abundance (N) and fishing mortality (F) for each age and year. We did not have such index of abundance, though it is possible to estimate catch at age data from the projected Fs and Ns. We asked advice to ICCAT personal for such data (index of abundance) but we get not answer. Therefore we cannot estimate whether stock has recovered to the SSBF0.1 level by 2022 nor whether fishing mortality is consistent with achieving the 2022 rebuilding target. Data used for the VPA is in Appendix III.

Nonetheless, the main goal of incorporating tagging data within stock assessment is the improvement in Fs and Ns estimates. The solution we used was to build an hypothetical scenario using projected Fs and Ns for a fixed quota of 11,900tn. We used catch at age data since 1975 under scenario 13 (run13) conducted in the 2010 ABFT eastern stock assessment (ICCAT2010). We used VPA-2BOX vs 3.05. We compared how the estimates of this analyses changed by the use of different tagging strategies.

Coon et al (2009) proposed also an alternative method to estimate abundance and catch at age data using a Bayesian approach. This method differs in the fact that it does not use abundance indexes. We did not explore this methodology but it worths considering it as an alternative.

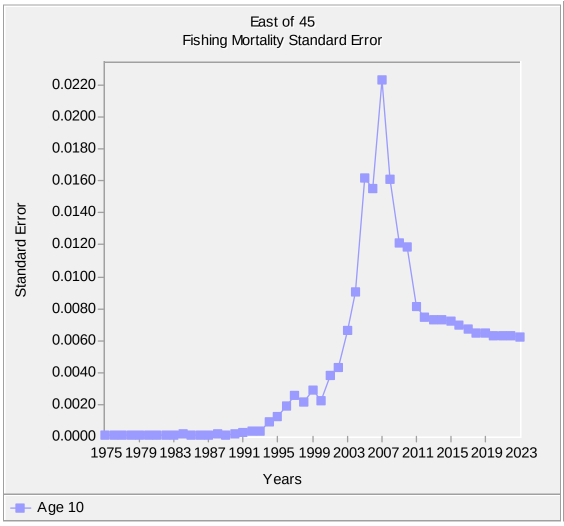
We consider different strategies for a multiyear tagging of a single cohort. In a three year experiment, between 1 to 3 different cohorts may be tagged in at least two different years (minimum requirement to obtain an estimate for survival for that cohort). This may be check in Table 1.

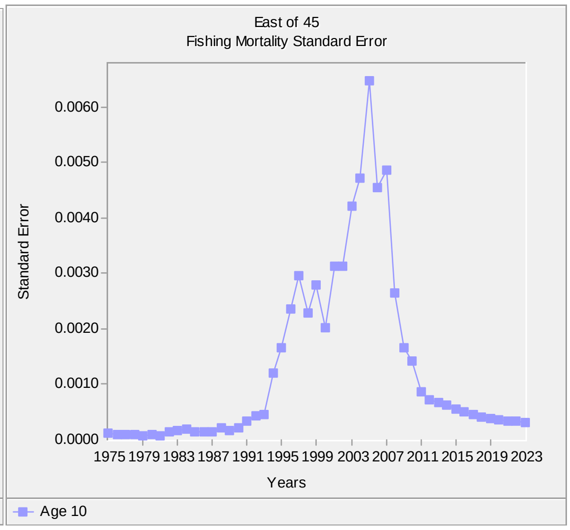
The simulations showed clearly that the use of tags recoveries may improve the precision of fishing mortalities (Figs 3, and 4). In Figure 4, it is showed not only the change in precision, but also the change in precision with time. For a VPA models without tagging data, RSE was higher than for any of the other scenarios. Thus a better possibility to discriminate the trends in Fc expected in the rebuilding plan for the ABFT. In addition, models with tagging data had a more or less constant RSE through the period 2011-2023.

Cohort	tag year	age	Strategy1	Strategy2	Strategy3
2008	2011	3			4000
2009	2011	2		5000	3500
2010	2011	1	10000	5000	2500
2009	2012	3		3000	3500
2010	2012	2	5000	3000	3000
2011	2012	1	5000	4000	3500
2010	2013	3	5000	5000	2000
2011	2013	2	5000	5000	3000
2012	2013	1			5000

Table 1. Number of releases for a tagging experiment with tagging of a cohort in multiple years. Minimum number of total releases considered was 10000.

In Appendix III-VII the detailed results for each of the scenarios (strategies) considered is presented. In Fig. 4 we can see more clearly how all the models of the different tagging strategies provides more precise fishing mortalities than the base model without tagging data.



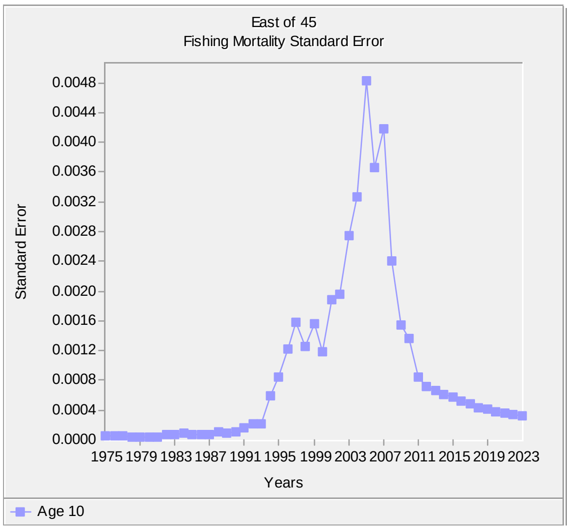


SE for F10 base model (no tag recoveries)

SE for F10 with Tagging strategy1

SE for F10 with Tagging strategy2

SE for F10 with Tagging strategy 3



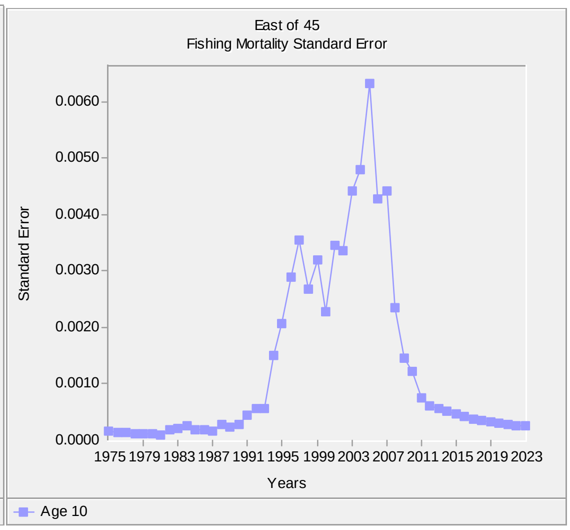


Fig. 3. *Changes in RSE under different tagging strategies (Table1) and with a VPA model without tag recoveries. Presented data is for fihing instantaneous mortality at age 10.*

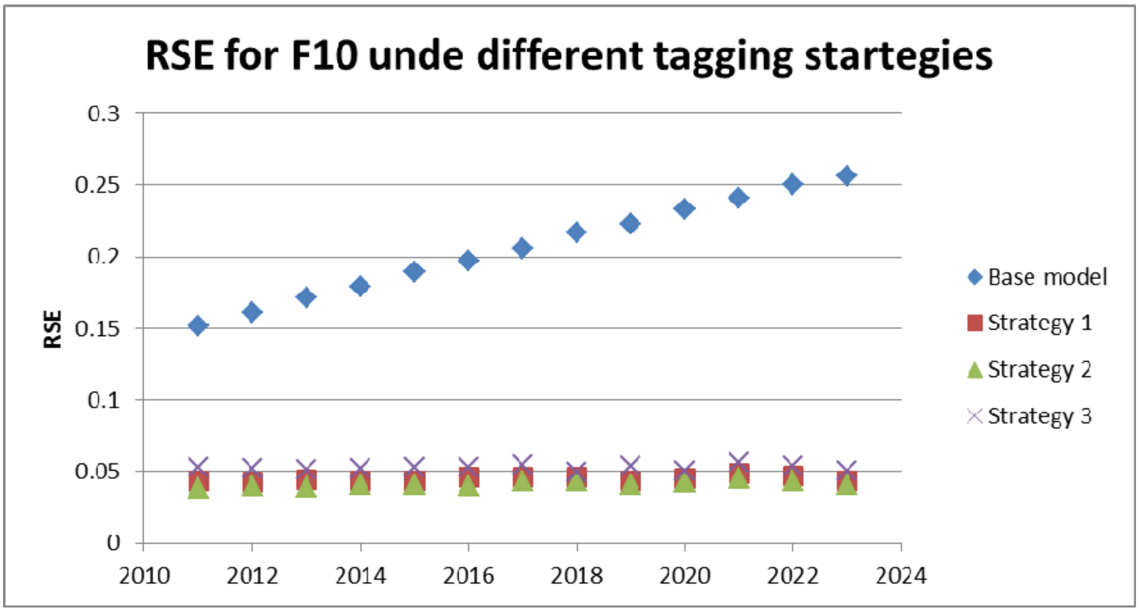


Fig. 4. *RSE for F_{10} with different tagging strategies and without tagging data (base model).*

3.5 Spatial models

It has been suggested that there are at least two subpopulations within the Mediterranean, may be even more (De Metrio *et al.* 2002; 2004; 2005). In a preliminary set of simulations considering constant fishing mortality and recovery rate, we suggested that more tags were needed to achieve similar precision in the mortality estimates in the case of the existence of two subpopulations. Models used to simulate this option were multistate models with dead recoveries (Barker *et al.* 2005). We used a transition probability between populations for juveniles of 30% and 20% for adults. In addition we considered differences in harvest rates between the two stocks (lower harvest rate in the eastern Mediterranean population). The main results from the simulations is that the precision of the estimates worsens (Fig. 5), and thus an increase in the number of tag releases needs to be considered.

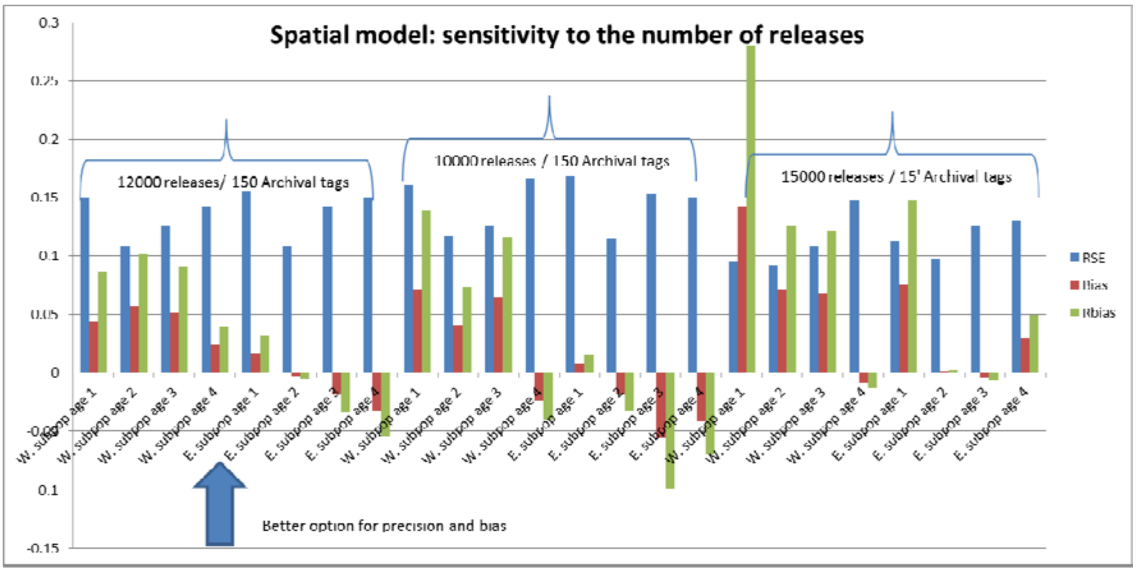


Fig. 5. Changes in RSE, Bias and RBias by age and subpopulation (western Mediterranean-W; eastern Mediterranean-E) with the number of releases. Archival tags are simulated as "high reward" tags with 100% reporting rate.

Against our expectation the model was not sensitive to changes in transition probabilities between population and ages (fig 6). Nonetheless many combinations were possible and we did not simulate all of them. Similarly, assuming differences in harvesting rates produced higher bias in the subpopulation with higher harvesting rates.

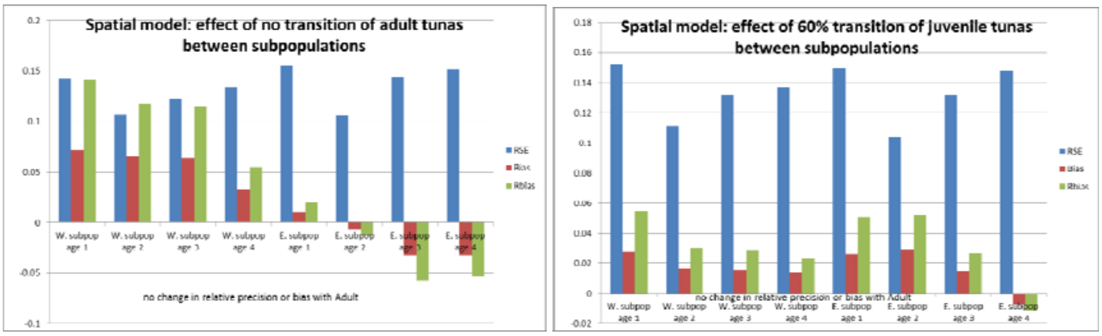


Fig 6. Sensitivity of survival RSE, Bias and RBias to changes in transition probabilities.

By increasing moderately the number of releases to 12,000 it is possible to improve the precision of survival estimates. Within the set of scenarios, which included either similar number of releases in each strata, or to tag more ABFT in one of the strata, we considered the best option was to divide the tags between the two subpopulations (western and eastern Mediterranean).

3.6 Uncomplete mixing

One of the assumptions that will be most likely violated is the fact that Brownie based models assumed complete mixing. Williams et al (2002; Amstrup et al 2005) suggest that inorder to cope and check for incomplete mixing 8or to the existence of different subpopulations) it is recommended to tag in different areas. Later models can be fit considering the effect of the area of release. These models can be compared with models without an area effect, which will support the idea of one population or that incomplete mixing is low.

Pollock *et* al. 2001 showed that tagged animals should be released in small batches in as many locations as possible rather than in large batches at a few locations. ABFT tuna should take place in different areas and at least covering eastern Mediterranean and the western Mediterranean and Eastern Atlantic areas.

3.7 Tag shedding experiments

In order to estimate fishing and natural mortality we need to estimate tagging mortality and tag retention rates. This is usually undertaken through the use of double tagging experiments (Williams *et al* 2002). A note should be considered because the loss of one tag may not necesessarily be independent of the loss of both tags. Double tagging should be conducted for all tagging teams because of possible differences in tag retention rates.

The use of PIT tags have been considered as a possibility to increase the reporting rates through the use of the program of observers of ICCAT. There are no previous experiences in using this type of tags with this species. The use of PIT tags can be use to estimate reporting rates and also as a substitute for double tagging experiments.

We recommend double tagging (or PIT + conventional tag) at least 500 tuna or 30% of tuna tagged per area. See the manual for further details.

3.8. Tag reporting rates, the ICCAT observers programme and the use of high reward tags

The use of tag-recovery models allow the estimation of natural and fishing mortality if reporting rates are known (Hoening *et al*. 1998; Pollock *et al*. 2001, 2002). This is possible if tag shedding and tag reporting rates are known. A fraction of the catches can be checked by obsservers in order to estimate reporting rates (e.g. Williams et al 2002). In the case of the ABFT the ROP programme suits this aspect and can the reporting rates from the observers can be used to estimate reporting rates.

One of the main problems in tag-recovery studies is to achieve a sufficient number of recoveries. This dependent on fishing mortality, but also depends on reporting rates. An appropriate programme to encourage the report of tags recovered should be implemented. The use of rewards and the value of each can be explored using the approach presented by Pollock *et al.* (2001, 2002). Pollock et al (2002) showed that the combined used of both, observers and high reward tags improve the estimation of reporting rates. In this sense we recommend:

- A campaign to increase reporting rate should be implemented. Additionally it is important the use of high reward tags in at least all the years of the experiment. The value of high rewards tags used in other tuna studies is around 300 euros (the objective is to obtain a reporting rate of 100% for the high reward tags). The number of high reward tags its constrained by the budget available for it in the first year. For the other two years, the ratio of high reward versus low reward tags should be adjusted considering estimated reporting rates during the first year (Pollock et al 2001 provides a method to estimate this ratio).
- Although most of the tags will be recovered during the first five years of the study, the simulations show that a number of recoveries can be obtained for a long period. Thus the budget for rewards must take this into account.
- High reward tags should be of a different colour than standard tags. If possible, the colour to be used for high reward tags should be similar to the colour used in other studies, thus the fisherman will identify the colour with a high reward.
- When high-reward tags did not produce a 100% reporting rate or when the observer component in a multiple component fishery did not have a 100% reporting rate, the combination of methods provided better estimates (Pollock *et al* 2002).
- In addition, PIT tags may be also be used to estimate reporting rates.
- A fraction of the catch should be checked by observers carefully to obtain estimation of reporting rates (the fraction should be stated together with the observer programme) If reporting rate data are not independent of the tag-recovery and catch data, such as when observers are placed on a portion of fishing vessels, then the likelihoods for the tag-recovery and catch data need to be modified (see Eveson et al. 2007).
- We consider that a reward for all the tags reported of this tagging experiment should be given. This is because of the expected low recovery rates in the light of the rebuilding plan of the ABFT. If finally electronical tags are used, this should have a high reward. A high reward should be established for tuna with electronic tags (300-500 Euros; if it is 300 Euros, there is need at maximum 45,000 euros only for this type of reward). A minimum of 100,000 Euros is available. Therefore, a reward of 30-45 euros might be offered for each tag (conventional) reported.

4. Proposal for a tagging strategy
4.1 Number of releases by area

We have considerd the different resultsof the simulations and we suggest to tag every year betten 10,000 – 12,000 tunnas of ages 1,2,3 in each of the year of the experiment. The best scenario was obtained with the "strategy 2". Nonethelless considering that the tunnas of 2-3 ages will tend to occur together we recommend the "strategy 3". The reulst also showed that a precise estimate is obtained releasing between 2000 - 3000 tags / year/ each class.

Area	Methods to be decided	Age1	Age2	Age3	Total
Bay of Biscay	Bait Boat	500-600	800	600	2000
Gibraltar/Atlantic	Bait Boat/Trap	500-600	800	600	2000
Balearic Islands/Gulf of Lions	PS	500-600	800	600	2000
Central Mediterranean	PS/Trap	800-900	1000	800-900	3000
Eastern Mediterranean	PS	800-900	1000	800-900	3000

4.2. Cost evaluation
An evaluation of the cost of tagging in different areas and gear is found in Appendix II.

4.3.Seguimiento
Afer the 2011 fishery campaign, the reporting rate should be evaluated and the nu,ber of releases for 2012 revised. Depending on the resultsof the"reporting rate experiment" we will have information of the repoting rates for high reward tags and PIT tags and the ratio of each type of tags to be released in 2012 revised.

After the 2012 fishing campaign, data should be analysed (number of expected returns, reporting rates, tag shedding rates, returns from archival tags and new knowledge got about the spatial movements of ABFT), and results from the PIT tagging experiment in order to consider possible changes in the strategy. After the third year, data should be analysed to consider possible changes in the tagging strategy.

References (not included in the manula)

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Conn. P.B., White, G.C. and Laake, J.L. 2009. Simulation performance of Bayesian Estimators of Abundance Employing Age-at-harvest and Mark-Recovey-Data. In: Thomson et al (eds.) Modeling Demographic Processes in Marked Populations. Series: Environmental and Ecological Statistics. ISBN:978-0-387-38150-1.

APPENDIX I

F	instantaneus fishing mortality rates												
edad	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	0.00197863	0.00178811	0.00165901	0.00156853	0.00147871	0.00139796	0.0012606	0.00114451	0.00105532	0.0009737	0.00091447	0.00085805	0.00081742
2	0.0805935	0.07302408	0.06726191	0.06406341	0.05977464	0.05659299	0.05086513	0.04656326	0.04230691	0.03934464	0.03691931	0.03435494	0.03266024
3	0.04205939	0.03833483	0.03569422	0.03346779	0.03169959	0.029559	0.02650122	0.02407115	0.02210982	0.02063813	0.0191207	0.01802234	0.01710251
4	0.07064103	0.06424975	0.05949734	0.05571709	0.05282229	0.04956133	0.04432909	0.04007022	0.03686873	0.03416992	0.0318303	0.02980661	0.02836585
5	0.03351703	0.0302324	0.02814012	0.02629629	0.0248334	0.02325668	0.02076995	0.01901571	0.01753104	0.01623816	0.01507598	0.01430704	0.01338916
6	0.02868192	0.02613011	0.02431056	0.02278877	0.02163701	0.02022099	0.01815145	0.01643698	0.01516987	0.01405866	0.01318805	0.01244365	0.01182412
7	0.04008484	0.03659	0.0340007	0.03238847	0.03041364	0.02815078	0.02536728	0.02330459	0.02146004	0.01984708	0.01854433	0.0174606	0.01671592
8	0.04168341	0.03752082	0.03494151	0.03315671	0.03099057	0.02879437	0.0259876	0.02370216	0.02192299	0.02011147	0.01910104	0.01789571	0.01710484
9	0.05411093	0.04861976	0.04483104	0.04296683	0.04021811	0.03750458	0.0338227	0.03070958	0.02827034	0.02620502	0.02456559	0.02314194	0.02193856
10	0.06493311	0.05834372	0.05379725	0.0515602	0.04826173	0.0450055	0.04058724	0.03685149	0.03392441	0.03144602	0.02947871	0.02777032	0.02632627
U	= 1-exp(-F); harvest rate type I fishery sensu Ricker 1975 -Amstrup et al 2005												
edad													
1	0.00197667	0.00178651	0.00165764	0.0015673	0.00147762	0.00139698	0.0012598	0.00114385	0.00105476	0.00097323	0.00091406	0.00085768	0.00081709
2	0.07743136	0.07042155	0.06504971	0.06205448	0.0580232	0.05502139	0.04959316	0.04549583	0.04142446	0.03858069	0.03624611	0.03377151	0.03213265
3	0.04118717	0.03760935	0.03506469	0.03291394	0.03120243	0.0291264	0.02615315	0.02378375	0.02186719	0.02042662	0.01893905	0.01786091	0.01695709
4	0.06820368	0.06222924	0.05776196	0.05419333	0.05145143	0.04835321	0.04336092	0.03927802	0.03619735	0.03359272	0.03132905	0.02936677	0.02796732
5	0.03296155	0.02977998	0.02774787	0.02595355	0.02452759	0.02298833	0.02055574	0.01883605	0.01737827	0.01610703	0.0149629	0.01420518	0.01329993
6	0.02827449	0.02579167	0.02401744	0.02253106	0.02140461	0.02001792	0.0179877	0.01630263	0.01505539	0.0139603	0.01310147	0.01236655	0.01175449
7	0.03929207	0.03592867	0.03342917	0.03186958	0.0299558	0.02775824	0.02504824	0.02303513	0.02123141	0.01965142	0.01837345	0.01730905	0.01657698
8	0.0408266	0.03682563	0.0343381	0.03261305	0.03051528	0.02838377	0.02565282	0.02342347	0.02168442	0.01991058	0.01891977	0.01773653	0.01695938
9	0.05267298	0.04745675	0.04384098	0.04205684	0.0394201	0.03681	0.03325711	0.03024283	0.02787448	0.02586464	0.02426631	0.02287621	0.02169966
10	0.06286986	0.05667434	0.05237578	0.05025353	0.04711565	0.04400777	0.03977461	0.03618074	0.03335543	0.03095673	0.02904845	0.02738827	0.02598275
M	instantaneus natural mortality rates from ICCAT												
1	0.49												
2	0.24												
3	0.24												
4	0.24												
5	0.24												
6	0.2												
7	0.175												
8	0.15												
9	0.125												
10	0.1												
S	Survival = exp(-F-M)												
1	0.6114	0.6115	0.6116	0.6117	0.6117	0.6118	0.6119	0.6119	0.6120	0.6120	0.6121	0.6121	0.6121
2	0.7257	0.7312	0.7355	0.7378	0.7410	0.7433	0.7476	0.7508	0.7540	0.7563	0.7581	0.7601	0.7614
3	0.7542	0.7570	0.7590	0.7607	0.7621	0.7637	0.7661	0.7679	0.7694	0.7706	0.7717	0.7726	0.7733
4	0.7330	0.7377	0.7412	0.7440	0.7462	0.7486	0.7525	0.7557	0.7582	0.7602	0.7620	0.7635	0.7646
5	0.7607	0.7632	0.7648	0.7662	0.7673	0.7685	0.7705	0.7718	0.7730	0.7740	0.7749	0.7755	0.7762
6	0.7956	0.7976	0.7991	0.8003	0.8012	0.8023	0.8040	0.8054	0.8064	0.8073	0.8080	0.8086	0.8091
7	0.8065	0.8093	0.8114	0.8127	0.8143	0.8162	0.8184	0.8201	0.8216	0.8230	0.8240	0.8249	0.8255
8	0.8256	0.8290	0.8312	0.8326	0.8344	0.8363	0.8386	0.8405	0.8420	0.8436	0.8444	0.8454	0.8461
9	0.8360	0.8406	0.8438	0.8454	0.8477	0.8500	0.8531	0.8558	0.8579	0.8597	0.8611	0.8623	0.8633
10	0.8480	0.8536	0.8574	0.8594	0.8622	0.8650	0.8688	0.8721	0.8747	0.8768	0.8786	0.8801	0.8813
f	recovery rate = tag rettaining rate*HARVEST RATE*tag reporting rate=øuλ; ø= (ø=							0.95	λ=	0.6			
1	0.0011	0.0010	0.0009	0.0009	0.0008	0.0008	0.0007	0.0007	0.0006	0.0006	0.0005	0.0005	0.0005
2	0.0441	0.0401	0.0371	0.0354	0.0331	0.0314	0.0283	0.0259	0.0236	0.0220	0.0207	0.0192	0.0183
3	0.0235	0.0214	0.0200	0.0188	0.0178	0.0166	0.0149	0.0136	0.0125	0.0116	0.0108	0.0102	0.0097
4	0.0389	0.0355	0.0329	0.0309	0.0293	0.0276	0.0247	0.0224	0.0206	0.0191	0.0179	0.0167	0.0159
5	0.0188	0.0170	0.0158	0.0148	0.0140	0.0131	0.0117	0.0107	0.0099	0.0092	0.0085	0.0081	0.0076
6	0.0161	0.0147	0.0137	0.0128	0.0122	0.0114	0.0103	0.0093	0.0086	0.0080	0.0075	0.0070	0.0067
7	0.0224	0.0205	0.0191	0.0182	0.0171	0.0158	0.0143	0.0131	0.0121	0.0112	0.0105	0.0099	0.0094
8	0.0233	0.0210	0.0196	0.0186	0.0174	0.0162	0.0146	0.0134	0.0124	0.0113	0.0108	0.0101	0.0097
9	0.0300	0.0271	0.0250	0.0240	0.0225	0.0210	0.0190	0.0172	0.0159	0.0147	0.0138	0.0130	0.0124
10	0.0358	0.0323	0.0299	0.0286	0.0269	0.0251	0.0227	0.0206	0.0190	0.0176	0.0166	0.0156	0.0148

Recovery rates values for a low reporting rate situation and higher tag sheeding rate.

f	recovery rate = tag rettaining rate*HARVEST RATE*tag reporting rate=øuλ; ø= (ø=							0.8	λ=	0.3			
1	0.0005	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002
2	0.0186	0.0169	0.0156	0.0149	0.0139	0.0132	0.0119	0.0109	0.0099	0.0093	0.0087	0.0081	0.0077
3	0.0099	0.0090	0.0084	0.0079	0.0075	0.0070	0.0063	0.0057	0.0052	0.0049	0.0045	0.0043	0.0041
4	0.0164	0.0149	0.0139	0.0130	0.0123	0.0116	0.0104	0.0094	0.0087	0.0081	0.0075	0.0070	0.0067
5	0.0079	0.0071	0.0067	0.0062	0.0059	0.0055	0.0049	0.0045	0.0042	0.0039	0.0036	0.0034	0.0032
6	0.0068	0.0062	0.0058	0.0054	0.0051	0.0048	0.0043	0.0039	0.0036	0.0034	0.0031	0.0030	0.0028
7	0.0094	0.0086	0.0080	0.0076	0.0072	0.0067	0.0060	0.0055	0.0051	0.0047	0.0044	0.0042	0.0040
8	0.0098	0.0088	0.0082	0.0078	0.0073	0.0068	0.0062	0.0056	0.0052	0.0048	0.0045	0.0043	0.0041
9	0.0126	0.0114	0.0105	0.0101	0.0095	0.0088	0.0080	0.0073	0.0067	0.0062	0.0058	0.0055	0.0052
10	0.0151	0.0136	0.0126	0.0121	0.0113	0.0106	0.0095	0.0087	0.0080	0.0074	0.0070	0.0066	0.0062

Appendix II

Edad atún	Edad 1 a cuatro años < 30 kg	Edad > 4 años, 30+kg	Edad 1 a cuatro años < 30 kg	Edad > 4 años, 30+kg	Edad 1 a cuatro años < 30 kg			
Método	**Almadraba, España**	**Almadraba, España**	**Almadraba, Marruecos**	**Almadraba, Marruecos**	**Cebo vivo, estrecho de Gibraltar**	**Cebo vivo, golfo de Vizcaya**	**Cerco, Mediterráneo occidental**	Cerco, Mediterráneo oriental
Tipo marca	Convencional	Electrónica	convencional	electrónica	convencional	convencional	convencional	convencional
nº operaciones día	2	2	2	2	3	3	3	3
nº atunes operación	100	20	100	20	200	200	200	200
atunes /día	200	40	200	40	600	600	600	600
Precio/día	7030	7030	4700	4700	4000	6000	5000	15000
Precio marcar atún	35.15	175.75	23.5	117.5	6.66	12	8.33	25
Equipo marcado investigador/día (4 personas)	560	420	420	420	420	420	420	420
Precio investigador /atún marcado	2.8	10.5	2.1	10.5	0.7	0.7	0.7	0.7
Precio medio atún /día	37.95	186.25	25.6	128	7.36	12.7	9.03	25.7

APPENDIX III

VPA results for the Base model. VPA analysis for ABFT for the period 1975 – 2023. Data for 2011 – 2023 ws simulated using projected Fs and Ns from the 2010 stock assessment.

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          ****************************************
                    VPA-2BOX
           SUMMARY STATISTICS AND DIAGNOSTIC OUTPUT
           ****************************************

Basic model
22:12, 17  February 2011

=====================================================================
Total objective function =      25.72
    (with constants)   =      181.94
Number of parameters (P) =          17
Number of data points (D)=         170
AIC : 2*objective+2P    =      397.89
AICc: 2*objective+2P(...)=      401.91
BIC : 2*objective+Plog(D)=      451.20
Chi-square discrepancy   =      113.38

Loglikelihoods (deviance)=      -26.42 (      170.06)
  effort data          =      -26.42 (      170.06)

Log-posteriors          =        0.00
  catchability         =        0.00
  f-ratio              =        0.00
  natural mortality    =        0.00
  mixing coeff.        =        0.00

Constraints             =        0.69
  terminal F           =        0.00
  stock-rec./sex ratio  =        0.69

Out of bounds penalty   =        0.00
=====================================================================
```

TABLE 1. FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.067	0.360	0.146	0.093	0.043	0.104	0.054	0.046	0.060	0.060
1976	0.009	0.269	0.470	0.122	0.098	0.031	0.067	0.031	0.048	0.048
1977	0.072	0.238	0.177	0.156	0.024	0.034	0.026	0.063	0.047	0.047
1978	0.136	0.356	0.179	0.085	0.041	0.011	0.025	0.013	0.037	0.037
1979	0.017	0.105	0.284	0.093	0.038	0.024	0.017	0.052	0.034	0.034
1980	0.112	0.243	0.412	0.190	0.031	0.035	0.030	0.016	0.036	0.036
1981	0.076	0.443	0.336	0.103	0.089	0.021	0.031	0.047	0.027	0.027
1982	0.244	0.395	0.487	0.175	0.068	0.042	0.022	0.078	0.055	0.055
1983	0.246	0.202	0.327	0.136	0.081	0.061	0.120	0.034	0.058	0.058
1984	0.110	0.456	0.124	0.133	0.132	0.096	0.087	0.119	0.064	0.064
1985	0.093	0.412	0.405	0.117	0.072	0.070	0.037	0.055	0.077	0.046
1986	0.279	0.322	0.248	0.152	0.033	0.047	0.042	0.033	0.073	0.044
1987	0.144	0.399	0.297	0.121	0.048	0.030	0.085	0.064	0.067	0.040

1988	0.344	0.215	0.393	0.166	0.059	0.042	0.050	0.077	0.101	0.061
1989	0.190	0.373	0.172	0.154	0.143	0.033	0.054	0.038	0.079	0.048
1990	0.175	0.247	0.321	0.132	0.167	0.056	0.055	0.076	0.095	0.057
1991	0.077	0.295	0.225	0.139	0.140	0.047	0.049	0.061	0.138	0.083
1992	0.079	0.291	0.363	0.091	0.072	0.063	0.106	0.131	0.161	0.097
1993	0.090	0.492	0.348	0.137	0.062	0.067	0.074	0.098	0.152	0.091
1994	0.121	0.280	0.206	0.087	0.124	0.095	0.189	0.210	0.356	0.213
1995	0.155	0.220	0.278	0.118	0.116	0.176	0.098	0.171	0.203	0.243
1996	0.177	0.459	0.359	0.267	0.131	0.066	0.113	0.088	0.235	0.282
1997	0.173	0.358	0.236	0.210	0.164	0.157	0.098	0.236	0.242	0.290
1998	0.125	0.551	0.399	0.284	0.134	0.297	0.047	0.053	0.160	0.192
1999	0.129	0.165	0.317	0.225	0.119	0.055	0.058	0.075	0.174	0.209
2000	0.342	0.313	0.178	0.196	0.218	0.161	0.064	0.100	0.116	0.139
2001	0.008	0.378	0.176	0.122	0.144	0.121	0.207	0.143	0.166	0.200
2002	0.031	0.429	0.297	0.127	0.059	0.133	0.084	0.140	0.154	0.185
2003	0.014	0.166	0.104	0.076	0.120	0.058	0.203	0.150	0.196	0.235
2004	0.050	0.166	0.195	0.067	0.039	0.086	0.090	0.127	0.209	0.251
2005	0.214	0.217	0.131	0.112	0.069	0.073	0.088	0.058	0.282	0.338
2006	0.223	0.197	0.208	0.066	0.031	0.102	0.053	0.072	0.202	0.243
2007	0.003	0.168	0.075	0.175	0.129	0.087	0.102	0.086	0.228	0.273
2008	0.000	0.174	0.105	0.170	0.094	0.077	0.088	0.111	0.132	0.159
2009	0.001	0.019	0.082	0.197	0.091	0.077	0.126	0.113	0.087	0.104
2010	0.001	0.018	0.022	0.326	0.138	0.160	0.109	0.096	0.077	0.093
2011	0.002	0.080	0.041	0.067	0.032	0.026	0.037	0.037	0.049	0.059
2012	0.002	0.073	0.038	0.062	0.028	0.024	0.033	0.034	0.042	0.051
2013	0.002	0.069	0.035	0.058	0.027	0.022	0.031	0.031	0.040	0.047
2014	0.002	0.065	0.034	0.055	0.025	0.021	0.029	0.030	0.038	0.045
2015	0.002	0.062	0.033	0.054	0.025	0.020	0.028	0.028	0.035	0.042
2016	0.001	0.061	0.031	0.051	0.024	0.020	0.026	0.026	0.033	0.039
2017	0.009	0.028	0.028	0.046	0.021	0.018	0.025	0.024	0.030	0.036
2018	0.006	0.349	0.013	0.043	0.020	0.017	0.023	0.023	0.028	0.033
2019	0.000	0.200	0.214	0.019	0.019	0.016	0.022	0.021	0.027	0.032
2020	0.001	0.003	0.110	0.438	0.008	0.015	0.020	0.020	0.025	0.030
2021	0.004	0.023	0.001	0.193	0.267	0.006	0.019	0.020	0.024	0.029
2022	0.002	0.138	0.011	0.002	0.099	0.279	0.008	0.018	0.023	0.028
2023	0.002	0.056	0.074	0.018	0.001	0.087	0.542	0.008	0.022	0.027

==

TABLE 2. ABUNDANCE AT THE BEGINNING OF THE YEAR [BY AREA] FOR East of 45

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	1	2	3	4	5	6	7	8	9	10
1975	1628424.	1299960.	681971.	303855.	314374.	88142.	97006.	81568.	81302.	985190.
1976	2408628.	932869.	713344.	463692.	217778.	236809.	65012.	77167.	67019.	906794.
1977	1231130.	1462029.	560547.	350763.	322824.	155250.	188021.	51013.	64393.	838565.
1978	972733.	702127.	906604.	369473.	236162.	248036.	122830.	153845.	41219.	778189.
1979	1203485.	519956.	386994.	596253.	267009.	178223.	200756.	100599.	130702.	713796.

1980	1824014.	724923.	368087.	229212.	427368.	202254.	142484.	165637.	82233.	736156.
1981	1575374.	999208.	447334.	191703.	149108.	326065.	159862.	116019.	140253.	712790.
1982	2512699.	894496.	504776.	251348.	136030.	107282.	261347.	130048.	95285.	748184.
1983	3831150.	1205456.	474012.	244094.	165979.	99935.	84234.	214546.	103565.	720041.
1984	1969982.	1835529.	774680.	268761.	167614.	120371.	77002.	62726.	178431.	701176.
1985	1783801.	1081252.	915265.	538308.	185051.	115504.	89506.	59250.	47930.	742756.
1986	3115214.	995275.	563405.	480143.	376725.	135457.	88190.	72380.	48258.	680980.
1987	2190808.	1444437.	567275.	345911.	324347.	286760.	105814.	70963.	60285.	629292.
1988	3378410.	1162013.	762640.	331556.	241095.	243189.	227758.	81574.	57306.	596844.
1989	3318804.	1467958.	737162.	405117.	220952.	178820.	190876.	181808.	65015.	553853.
1990	3416656.	1681599.	795260.	488289.	273277.	150722.	141582.	151876.	150631.	530829.
1991	4126509.	1756886.	1033369.	453722.	336591.	181993.	116677.	112509.	121125.	574673.
1992	3792756.	2340093.	1028458.	648966.	310725.	230133.	142176.	93245.	91129.	571641.
1993	4110883.	2146398.	1376397.	562951.	465981.	227558.	176991.	107380.	70371.	538035.
1994	3374614.	2301838.	1032740.	764552.	386264.	344492.	174212.	137955.	83802.	497657.
1995	3870433.	1832300.	1368740.	660873.	551326.	268426.	256570.	121073.	96272.	415622.
1996	3431902.	2029934.	1156986.	815723.	461997.	386312.	184347.	195183.	87837.	364202.
1997	2419486.	1760557.	1009450.	635687.	491516.	318715.	296077.	138243.	153825.	309704.
1998	3714981.	1246310.	968290.	627325.	405251.	328031.	222921.	225273.	93988.	316228.
1999	3013636.	2009375.	565102.	510970.	371487.	278748.	199483.	178474.	183905.	306855.
2000	3833458.	1622364.	1340156.	323728.	320923.	259375.	215974.	158035.	142505.	361679.
2001	2581545.	1668538.	933274.	881924.	209306.	203007.	180708.	170076.	123024.	396623.
2002	2444360.	1569144.	899797.	615613.	614254.	142625.	147297.	123272.	126831.	385905.
2003	2844553.	1451183.	803360.	525975.	426498.	455315.	102270.	113675.	92281.	386083.
2004	4131399.	1718610.	966559.	569631.	383585.	297626.	351624.	70087.	84217.	343182.
2005	2057916.	2408295.	1145617.	625632.	418843.	290316.	223660.	269878.	53148.	301772.
2006	1436687.	1018165.	1525273.	790324.	439794.	307583.	220913.	171930.	219227.	230082.
2007	724835.	704360.	657711.	974640.	581963.	335378.	227452.	175886.	137676.	321315.

2008	2208381.	442881.	468533.	480222.	643668.	402450.	251720.	172484.	138957.	318054.
2009	2355807.	1352323.	292729.	331691.	318634.	460761.	304981.	193586.	132804.	352893.
2010	2517216.	1442177.	1043766.	212169.	214323.	228949.	349448.	225782.	148832.	395110.
2011	2366007.	1541073.	1114448.	802935.	120423.	146916.	159695.	263102.	176540.	447469.
2012	2440010.	1446278.	1119380.	841558.	590786.	91788.	117181.	129224.	218162.	530024.
2013	2459089.	1491751.	1058046.	848121.	622236.	451882.	73366.	95179.	107541.	640342.
2014	2477361.	1503626.	1095651.	803481.	629554.	476499.	361861.	59720.	79416.	643740.
2015	2388404.	1514936.	1107815.	832750.	598075.	482773.	381907.	295013.	49905.	624309.
2016	4515929.	1460595.	1120218.	843446.	620390.	458955.	387248.	311749.	247021.	584061.
2017	384606.	2764182.	1081186.	854691.	630479.	476434.	368345.	316662.	261423.	719292.
2018	575545.	233462.	2115128.	826677.	642100.	485479.	383036.	301657.	266099.	851627.
2019	38234017.	350611.	129570.	1643015.	622921.	495135.	390926.	314235.	253803.	973573.
2020	3564951.	23421234.	225857.	82305.	1268570.	480818.	399072.	321182.	264748.	1071352.
2021	728419.	2182465.	18375960.	159084.	41771.	989987.	387873.	328236.	270970.	1168578.
2022	1432656.	444496.	1677061.	14437026.	103151.	25150.	805487.	319382.	277045.	1260775.
2023	1433324.	876252.	304538.	1304293.	11334972.	73525.	15579.	670722.	269881.	1347910.
2024		876735.	651859.	222517.	1007868.	8908846.	55199.	7609.	572832.	1420366.

TABLE 3. CATCH OF East of 45

	1	2	3	4	5	6	7	8	9	10
1975	83784.	352022.	82482.	24055.	11863.	7932.	4665.	3441.	4480.	54950.
1976	17501.	196886.	239994.	47505.	18187.	6492.	3896.	2187.	2948.	40376.
1977	67420.	276479.	81061.	45074.	6677.	4738.	4363.	2903.	2778.	36620.
1978	98571.	188169.	132603.	26750.	8539.	2569.	2746.	1850.	1398.	26717.
1979	15968.	46352.	85484.	47174.	8803.	3802.	3158.	4700.	4051.	22395.
1980	153268.	139588.	111494.	35392.	11439.	6346.	3925.	2495.	2715.	24603.

1981	91413.	320656.	114393.	16726.	11334.	6214.	4537.	4938.	3506.	18037.
1982	435146.	261565.	174574.	35996.	8002.	3990.	5295.	9037.	4835.	38429.
1983	666700.	196954.	118435.	27650.	11539.	5339.	8741.	6724.	5468.	38481.
1984	162819.	602874.	80533.	29876.	18523.	10029.	5897.	6546.	10420.	41447.
1985	126331.	327195.	273250.	52930.	11441.	7067.	3014.	2958.	3329.	31801.
1986	605591.	245280.	110492.	60475.	10838.	5638.	3356.	2173.	3201.	27826.
1987	233815.	425594.	130379.	35130.	13521.	7777.	7936.	4073.	3661.	23513.
1988	787367.	200806.	221887.	45198.	12256.	9116.	10264.	5612.	5200.	33542.
1989	457214.	409308.	103865.	51467.	26166.	5342.	9140.	6317.	4674.	24558.
1990	436998.	328718.	195472.	53837.	37392.	7450.	6938.	10362.	12813.	27930.
1991	243244.	401949.	186084.	52344.	39257.	7563.	5140.	6163.	14736.	43603.
1992	229346.	527897.	280116.	50401.	19089.	12662.	13102.	10683.	12770.	50171.
1993	280527.	748303.	362086.	64110.	24965.	13406.	11620.	9313.	9358.	44738.
1994	304847.	502294.	171942.	56713.	40131.	28248.	27583.	24303.	23658.	91143.
1995	443084.	322790.	296579.	65551.	53670.	39327.	22103.	17701.	16646.	85605.
1996	444406.	669904.	312384.	170612.	50658.	22396.	18070.	15305.	17362.	85496.
1997	306609.	474221.	189334.	107589.	66458.	42200.	25467.	27051.	31144.	74425.
1998	345669.	474502.	285613.	138652.	45367.	76858.	9470.	10785.	13079.	52631.
1999	290410.	272684.	137390.	91981.	37213.	13567.	10306.	11996.	27670.	55145.
2000	889625.	389997.	195408.	51453.	56121.	35131.	12280.	14041.	14718.	44863.
2001	15982.	469971.	134430.	90060.	24959.	20977.	31157.	21135.	17744.	68378.
2002	59817.	491266.	206724.	65445.	31542.	16089.	10914.	14936.	17076.	62174.
2003	31034.	198423.	70574.	34139.	42902.	23442.	17278.	14727.	15451.	77055.
2004	158681.	233924.	152822.	33095.	12919.	22189.	27680.	7756.	14995.	72743.
2005	315743.	419028.	125613.	59295.	24776.	18596.	17314.	14100.	12307.	82641.
2006	228908.	162488.	255561.	44959.	11960.	27029.	10456.	11129.	37839.	47308.
2007	1510.	96996.	42050.	139516.	62706.	25349.	20195.	13425.	26398.	73222.
2008	755.	63119.	41758.	67048.	51597.	27174.	19392.	16913.	16230.	44546.

2009	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2010	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2011	4138.	105125.	39701.	46206.	3325.	3438.	5285.	8951.	7954.	24372.
2012	3954.	90136.	36666.	44991.	14528.	1976.	3487.	3976.	8529.	25066.
2013	3706.	88052.	32583.	42548.	14664.	8980.	2041.	2705.	3922.	28258.
2014	3572.	84855.	32934.	38430.	14078.	9098.	9572.	1616.	2753.	27008.
2015	3367.	80876.	31654.	39230.	13011.	8875.	9671.	7446.	1625.	24609.
2016	3087.	76677.	29974.	37334.	13095.	8212.	9202.	7449.	7445.	21315.
2017	2785.	67016.	26931.	34188.	11842.	7790.	8258.	6966.	7282.	24267.
2018	2557.	61544.	23521.	30957.	11261.	7252.	7989.	6298.	6867.	26624.
2019	2416.	56673.	22267.	26995.	10388.	6986.	7633.	6170.	6276.	29168.
2020	1970.	54101.	21047.	26191.	8932.	6407.	7399.	5907.	6183.	30319.
2021	2261.	44913.	20328.	24947.	8758.	5588.	6798.	5902.	6089.	31823.
2022	1846.	51129.	16883.	24464.	8626.	5574.	5955.	5410.	6038.	33302.
2023	1752.	42345.	19288.	20493.	8543.	5541.	6024.	4816.	5594.	33865.

TABLE 4. SPAWNING STOCK FECUNDITY AND RECRUITMENT OF East of 45

year	spawning biomass	recruits from VPA
1975	293928.	1628424.
1976	291518.	2408628.
1977	281635.	1231130.
1978	269648.	972733.
1979	258181.	1203485.
1980	253967.	1824014.
1981	236345.	1575374.
1982	233983.	2512699.
1983	210591.	3831150.
1984	203143.	1969982.
1985	212903.	1783801.
1986	209334.	3115214.
1987	202809.	2190808.
1988	200718.	3378410.
1989	201538.	3318804.
1990	186849.	3416656.
1991	183590.	4126509.
1992	187137.	3792756.

1993	196232.	4110883.
1994	185904.	3374614.
1995	181845.	3870433.
1996	174610.	3431902.
1997	162849.	2419486.
1998	160236.	3714981.
1999	161198.	3013636.
2000	159621.	3833458.
2001	150675.	2581545.
2002	161752.	2444360.
2003	160632.	2844553.
2004	155306.	4131399.
2005	151224.	2057916.
2006	155131.	1436687.
2007	170212.	724835.
2008	182592.	2208381.
2009	182142.	2355807.
2010	177704.	2517216.
2011	184200.	2366007.
2012	208319.	2440010.
2013	235548.	2459089.
2014	255689.	2477361.
2015	261761.	2388404.
2016	294111.	4515929.
2017	324256.	384606.
2018	349448.	575545.
2019	374204.	38234017.
2020	408521.	3564951.
2021	407484.	728419.
2022	646476.	1432656.
2023	929311.	1433324.

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TABLE 5. FITS TO INDEX DATA FOR East of 45

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5.1 ESP

Lognormal dist.
average numbers
Ages 6 - 10
log-likelihood = 2.92
deviance = 14.16
Chi-sq. discrepancy= 8.14

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1981	0.179	0.358	-0.179	0.708	0.415E-02	3145.860	3763.036	0.187
1982	0.457	0.346	0.111	0.708	0.415E-02	4151.930	3716.304	0.026
1983	0.515	0.313	0.202	0.708	0.415E-02	4402.080	3595.170	0.003
1984	0.613	0.273	0.340	0.708	0.415E-02	4854.680	3457.037	0.013
1985	0.223	0.218	0.005	0.708	0.415E-02	3288.160	3270.940	0.073
1986	-0.525	0.156	-0.680	0.708	0.415E-02	1556.120	3072.713	0.563
1987	-0.428	0.137	-0.566	0.708	0.415E-02	1713.630	3017.086	0.478

1988	0.426	0.123	0.303	0.708	0.415E-02	4026.800	2973.266	0.004
1989	-0.229	0.116	-0.345	0.708	0.415E-02	2091.120	2953.620	0.310
1990	-0.078	0.122	-0.200	0.708	0.415E-02	2433.100	2972.220	0.202
1991	0.088	0.114	-0.026	0.708	0.415E-02	2871.900	2946.981	0.090
1992	-0.739	0.078	-0.817	0.708	0.415E-02	1256.650	2844.527	0.661
1993	-0.757	0.037	-0.794	0.708	0.415E-02	1233.910	2729.200	0.645
1994	-0.652	-0.018	-0.634	0.708	0.415E-02	1370.230	2582.764	0.529
1995	-1.085	-0.120	-0.965	0.708	0.415E-02	888.940	2333.315	0.760
1996	-0.498	-0.157	-0.341	0.708	0.415E-02	1598.010	2247.574	0.306
1997	0.356	-0.189	0.544	0.708	0.415E-02	3754.010	2178.239	0.178
1998	0.407	-0.176	0.583	0.708	0.415E-02	3950.270	2205.350	0.238
1999	0.529	-0.139	0.668	0.708	0.415E-02	4463.560	2288.177	0.411
2000	0.260	-0.099	0.360	0.708	0.415E-02	3411.810	2381.186	0.020
2001	0.809	-0.116	0.925	0.708	0.415E-02	5907.800	2342.680	1.421
2002	0.478	-0.184	0.662	0.708	0.415E-02	4240.520	2187.422	0.397
2003	-0.084	-0.189	0.105	0.708	0.415E-02	2417.060	2177.223	0.028
2004	-0.690	-0.236	-0.454	0.708	0.415E-02	1319.610	2077.017	0.392
2005	-0.012	-0.258	0.246	0.708	0.415E-02	2598.590	2031.888	0.000
2006	-0.068	-0.218	0.150	0.708	0.415E-02	2456.740	2114.857	0.014
2007	0.339	-0.171	0.510	0.708	0.415E-02	3690.980	2217.144	0.134
2008	-0.069	-0.115	0.046	0.708	0.415E-02	2455.050	2344.513	0.053
2009	0.236	-0.005	0.241	0.708	0.415E-02	3330.170	2616.150	0.000

Selectivities by age

Year	6	7	8	9	10
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1981	0.164	0.274	0.478	0.769	1.000
1982	0.164	0.274	0.478	0.769	1.000
1983	0.164	0.274	0.478	0.769	1.000
1984	0.164	0.274	0.478	0.769	1.000
1985	0.164	0.274	0.478	0.769	1.000
1986	0.164	0.274	0.478	0.769	1.000
1987	0.164	0.274	0.478	0.769	1.000
1988	0.164	0.274	0.478	0.769	1.000
1989	0.164	0.274	0.478	0.769	1.000
1990	0.164	0.274	0.478	0.769	1.000
1991	0.164	0.274	0.478	0.769	1.000
1992	0.164	0.274	0.478	0.769	1.000
1993	0.164	0.274	0.478	0.769	1.000
1994	0.164	0.274	0.478	0.769	1.000
1995	0.164	0.274	0.478	0.769	1.000
1996	0.164	0.274	0.478	0.769	1.000
1997	0.164	0.274	0.478	0.769	1.000
1998	0.164	0.274	0.478	0.769	1.000
1999	0.164	0.274	0.478	0.769	1.000
2000	0.164	0.274	0.478	0.769	1.000
2001	0.164	0.274	0.478	0.769	1.000
2002	0.164	0.274	0.478	0.769	1.000
2003	0.164	0.274	0.478	0.769	1.000
2004	0.164	0.274	0.478	0.769	1.000
2005	0.164	0.274	0.478	0.769	1.000
2006	0.164	0.274	0.478	0.769	1.000
2007	0.164	0.274	0.478	0.769	1.000
2008	0.164	0.274	0.478	0.769	1.000
2009	0.164	0.274	0.478	0.769	1.000

5.2 ESP1

Not used

5.3 ESP2

Lognormal dist.
average numbers
Ages 2 - 2
log-likelihood = -22.97
deviance = 68.69
Chi-sq. discrepancy= 36.15

Year	Observed	Residuals Predicted	Standard (Obs-pred)	Q Deviation	Untransfrmd Catchabil.	Untransfrmd Observed	Chi-square Predicted	Discrepancy
----	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------
1975	0.593	-0.069	0.661	0.708	0.113E-03	213.720	110.315	0.395
1976	0.214	-0.359	0.573	0.708	0.113E-03	146.320	82.494	0.222
1977	0.599	0.104	0.495	0.708	0.113E-03	215.130	131.170	0.117
1978	-0.453	-0.683	0.230	0.708	0.113E-03	75.110	59.702	0.001
1979	-1.226	-0.868	-0.358	0.708	0.113E-03	34.670	49.618	0.320
1980	-0.532	-0.599	0.067	0.708	0.113E-03	69.410	64.893	0.043
1981	-0.219	-0.369	0.150	0.708	0.113E-03	94.950	81.716	0.014
1982	0.081	-0.458	0.539	0.708	0.113E-03	128.090	74.728	0.171
1983	0.006	-0.072	0.078	0.708	0.113E-03	118.830	109.949	0.039
1984	1.413	0.234	1.180	0.708	0.113E-03	485.620	149.247	3.600
1985	1.174	-0.276	1.450	0.708	0.113E-03	382.160	89.652	8.236
1986	-0.302	-0.319	0.017	0.708	0.113E-03	87.360	85.920	0.067
1987	1.269	0.019	1.250	0.708	0.113E-03	420.300	120.473	4.511
1988	-0.825	-0.115	-0.710	0.708	0.113E-03	51.800	105.354	0.585
1989	1.419	0.047	1.371	0.708	0.113E-03	488.140	123.855	6.554
1990	-0.083	0.240	-0.323	0.708	0.113E-03	108.780	150.243	0.293
1991	0.370	0.262	0.108	0.708	0.113E-03	171.110	153.520	0.027
1992	0.768	0.551	0.217	0.708	0.113E-03	254.590	204.926	0.002
1993	1.297	0.374	0.923	0.708	0.113E-03	432.270	171.797	1.408
1994	-1.221	0.539	-1.760	0.708	0.113E-03	34.840	202.582	1.151
1995	0.500	0.339	0.161	0.708	0.113E-03	194.750	165.769	0.011
1996	0.349	0.333	0.016	0.708	0.113E-03	167.510	164.855	0.067
1997	0.075	0.236	-0.160	0.708	0.113E-03	127.410	149.555	0.174
1998	-0.620	-0.195	-0.425	0.708	0.113E-03	63.560	97.199	0.370
1999	-3.557	0.456	-4.013	0.708	0.113E-03	3.370	186.465	1.492
2000	-0.979	0.174	-1.153	0.708	0.113E-03	44.400	140.644	0.873
2001	1.047	0.173	0.874	0.708	0.113E-03	336.760	140.489	1.148
2002	1.114	0.088	1.025	0.708	0.113E-03	359.870	129.090	2.097
2003	-0.351	0.130	-0.481	0.708	0.113E-03	83.220	134.581	0.413
2004	-0.299	0.300	-0.598	0.708	0.113E-03	87.650	159.443	0.502
2005	0.129	0.613	-0.484	0.708	0.113E-03	134.470	218.183	0.416
2006	-0.119	-0.238	0.119	0.708	0.113E-03	104.880	93.089	0.023
2007	-1.631	-0.593	-1.038	0.708	0.113E-03	23.120	65.282	0.805

Selectivities by age

Year	2
----	-----
1975	1.000
1976	1.000

1977 1.000
1978 1.000
1979 1.000
1980 1.000
1981 1.000
1982 1.000
1983 1.000
1984 1.000
1985 1.000
1986 1.000
1987 1.000
1988 1.000
1989 1.000
1990 1.000
1991 1.000
1992 1.000
1993 1.000
1994 1.000
1995 1.000
1996 1.000
1997 1.000
1998 1.000
1999 1.000
2000 1.000
2001 1.000
2002 1.000
2003 1.000
2004 1.000
2005 1.000
2006 1.000
2007 1.000

5.4 ESP3

Lognormal dist.
average numbers
Ages 3 - 3
log-likelihood = -20.17
deviance = 63.10
Chi-sq. discrepancy= 54.06

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1975	0.331	-0.096	0.427	0.708	0.562E-04	48.740	31.789	0.057
1976	0.588	-0.199	0.787	0.708	0.562E-04	63.040	28.696	0.772
1977	1.056	-0.307	1.363	0.708	0.562E-04	100.630	25.753	6.388
1978	-0.870	0.173	-1.043	0.708	0.562E-04	14.670	41.609	0.808
1979	0.720	-0.727	1.447	0.708	0.562E-04	71.910	16.924	8.160
1980	-0.252	-0.835	0.583	0.708	0.562E-04	27.200	15.190	0.237
1981	-1.856	-0.606	-1.250	0.708	0.562E-04	5.470	19.100	0.927
1982	0.198	-0.552	0.750	0.708	0.562E-04	42.670	20.157	0.643
1983	-0.874	-0.544	-0.331	0.708	0.562E-04	14.600	20.322	0.298
1984	1.284	0.041	1.243	0.708	0.562E-04	126.380	36.480	4.411
1985	1.149	0.079	1.070	0.708	0.562E-04	110.430	37.892	2.466

1986	-0.364	-0.335	-0.030	0.708	0.562E-04	24.320	25.048	0.092
1987	-1.176	-0.350	-0.826	0.708	0.562E-04	10.800	24.659	0.667
1988	-1.614	-0.098	-1.516	0.708	0.562E-04	6.970	31.751	1.055
1989	-1.444	-0.031	-1.413	0.708	0.562E-04	8.260	33.945	1.008
1990	0.150	-0.023	0.174	0.708	0.562E-04	40.680	34.192	0.008
1991	-0.382	0.282	-0.665	0.708	0.562E-04	23.880	46.423	0.552
1992	-1.067	0.215	-1.282	0.708	0.562E-04	12.040	43.398	0.943
1993	1.670	0.513	1.157	0.708	0.562E-04	185.980	58.466	3.339
1994	0.250	0.290	-0.041	0.708	0.562E-04	44.930	46.800	0.098
1995	0.588	0.539	0.049	0.708	0.562E-04	63.030	60.028	0.051
1996	1.306	0.334	0.972	0.708	0.562E-04	129.240	48.904	1.712
1997	1.727	0.254	1.473	0.708	0.562E-04	196.790	45.130	8.786
1998	0.359	0.138	0.220	0.708	0.562E-04	50.100	40.194	0.001
1999	-0.974	-0.363	-0.611	0.708	0.562E-04	13.210	24.341	0.512
2000	-0.010	0.564	-0.574	0.708	0.562E-04	34.650	61.524	0.484
2001	0.610	0.203	0.407	0.708	0.562E-04	64.420	42.892	0.044
2002	1.481	0.111	1.370	0.708	0.562E-04	153.960	39.115	6.528
2003	-1.012	0.087	-1.099	0.708	0.562E-04	12.730	38.192	0.842
2004	-1.184	0.229	-1.414	0.708	0.562E-04	10.710	44.033	1.009
2005	0.609	0.429	0.180	0.708	0.562E-04	64.340	53.765	0.007
2006	-1.040	0.680	-1.720	0.708	0.562E-04	12.370	69.073	1.137
2007	0.045	-0.099	0.144	0.708	0.562E-04	36.620	31.704	0.016

Selectivities by age

Year	3
----	-----
1975	1.000
1976	1.000
1977	1.000
1978	1.000
1979	1.000
1980	1.000
1981	1.000
1982	1.000
1983	1.000
1984	1.000
1985	1.000
1986	1.000
1987	1.000
1988	1.000
1989	1.000
1990	1.000
1991	1.000
1992	1.000
1993	1.000
1994	1.000
1995	1.000
1996	1.000
1997	1.000
1998	1.000
1999	1.000
2000	1.000
2001	1.000
2002	1.000
2003	1.000
2004	1.000
2005	1.000

2006 1.000
2007 1.000

5.5 ESP4

Not used

5.6 ESP5

Not used

5.7 JJL

Lognormal dist.
average numbers
Ages 6 - 10
log-likelihood = 7.29
deviance = 9.54
Chi-sq. discrepancy= 7.10

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1975	0.361	0.388	-0.027	0.708	0.183E-05	1.900	1.952	0.090
1976	0.485	0.322	0.162	0.708	0.183E-05	2.150	1.828	0.011
1977	0.981	0.263	0.718	0.708	0.183E-05	3.530	1.722	0.543
1978	0.125	0.259	-0.134	0.708	0.183E-05	1.500	1.715	0.157
1979	0.713	0.240	0.472	0.708	0.183E-05	2.700	1.684	0.094
1980	0.244	0.257	-0.013	0.708	0.183E-05	1.690	1.712	0.083
1981	0.208	0.270	-0.062	0.708	0.183E-05	1.630	1.734	0.111
1982	0.919	0.266	0.653	0.708	0.183E-05	3.320	1.728	0.376
1983	0.471	0.248	0.222	0.708	0.183E-05	2.120	1.697	0.001
1984	0.202	0.170	0.032	0.708	0.183E-05	1.620	1.570	0.060
1985	0.279	0.112	0.167	0.708	0.183E-05	1.750	1.481	0.010
1986	-0.003	0.056	-0.059	0.708	0.183E-05	1.320	1.400	0.109
1987	0.489	0.038	0.452	0.708	0.183E-05	2.160	1.375	0.076
1988	0.019	0.036	-0.016	0.708	0.183E-05	1.350	1.372	0.084
1989	-0.232	0.060	-0.292	0.708	0.183E-05	1.050	1.407	0.270
1990	0.063	0.056	0.007	0.708	0.183E-05	1.410	1.400	0.072
1991	-0.090	0.032	-0.122	0.708	0.183E-05	1.210	1.368	0.149
1992	-0.251	-0.009	-0.242	0.708	0.183E-05	1.030	1.313	0.233
1993	-0.241	-0.041	-0.201	0.708	0.183E-05	1.040	1.271	0.202
1994	-0.167	-0.086	-0.081	0.708	0.183E-05	1.120	1.215	0.123
1995	0.070	-0.178	0.248	0.708	0.183E-05	1.420	1.108	0.000
1996	-0.974	-0.188	-0.786	0.708	0.183E-05	0.500	1.097	0.639
1997	-0.916	-0.231	-0.685	0.708	0.183E-05	0.530	1.051	0.567
1998	-0.623	-0.187	-0.437	0.708	0.183E-05	0.710	1.099	0.379
1999	-0.727	-0.171	-0.556	0.708	0.183E-05	0.640	1.116	0.470
2000	-0.582	-0.144	-0.438	0.708	0.183E-05	0.740	1.147	0.380
2001	-0.322	-0.160	-0.161	0.708	0.183E-05	0.960	1.128	0.175
2002	0.437	-0.243	0.680	0.708	0.183E-05	2.050	1.038	0.442
2003	0.250	-0.260	0.510	0.708	0.183E-05	1.700	1.020	0.135
2004	-0.479	-0.298	-0.181	0.708	0.183E-05	0.820	0.982	0.189

2005	-0.409	-0.242	-0.166	0.708	0.183E-05	0.880	1.039	0.178
2006	0.366	-0.242	0.608	0.708	0.183E-05	1.910	1.040	0.283
2007	-0.343	-0.202	-0.141	0.708	0.183E-05	0.940	1.082	0.161
2008	-0.082	-0.151	0.069	0.708	0.183E-05	1.220	1.138	0.042
2009	-0.241	-0.041	-0.201	0.708	0.183E-05	1.040	1.271	0.203

Selectivities by age

Year	6	7	8	9	10
----	-----	-----	-----	-----	-----
1975	0.160	0.332	0.748	0.800	1.000
1976	0.160	0.332	0.748	0.800	1.000
1977	0.160	0.332	0.748	0.800	1.000
1978	0.160	0.332	0.748	0.800	1.000
1979	0.160	0.332	0.748	0.800	1.000
1980	0.160	0.332	0.748	0.800	1.000
1981	0.160	0.332	0.748	0.800	1.000
1982	0.160	0.332	0.748	0.800	1.000
1983	0.160	0.332	0.748	0.800	1.000
1984	0.160	0.332	0.748	0.800	1.000
1985	0.160	0.332	0.748	0.800	1.000
1986	0.160	0.332	0.748	0.800	1.000
1987	0.160	0.332	0.748	0.800	1.000
1988	0.160	0.332	0.748	0.800	1.000
1989	0.160	0.332	0.748	0.800	1.000
1990	0.160	0.332	0.748	0.800	1.000
1991	0.160	0.332	0.748	0.800	1.000
1992	0.160	0.332	0.748	0.800	1.000
1993	0.160	0.332	0.748	0.800	1.000
1994	0.160	0.332	0.748	0.800	1.000
1995	0.160	0.332	0.748	0.800	1.000
1996	0.160	0.332	0.748	0.800	1.000
1997	0.160	0.332	0.748	0.800	1.000
1998	0.160	0.332	0.748	0.800	1.000
1999	0.160	0.332	0.748	0.800	1.000
2000	0.160	0.332	0.748	0.800	1.000
2001	0.160	0.332	0.748	0.800	1.000
2002	0.160	0.332	0.748	0.800	1.000
2003	0.160	0.332	0.748	0.800	1.000
2004	0.160	0.332	0.748	0.800	1.000
2005	0.160	0.332	0.748	0.800	1.000
2006	0.160	0.332	0.748	0.800	1.000
2007	0.160	0.332	0.748	0.800	1.000
2008	0.160	0.332	0.748	0.800	1.000
2009	0.160	0.332	0.748	0.800	1.000

5.8 MAR

Not used

5.9 ESPT

Not used

5.10 ESPH

Lognormal dist.
average biomass
Ages 2 - 3
log-likelihood = 0.00
deviance = 0.00
Chi-sq. discrepancy= 0.00

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy

Selectivities by age

Year	2	3

5.11 NOR

Lognormal dist.
average biomass
Ages 10 - 10
log-likelihood = -1.16
deviance = 6.46
Chi-sq. discrepancy= 2.54

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1975	0.759	0.145	0.614	0.708	0.853E-07	38.000	20.570	0.294
1976	0.174	0.123	0.051	0.708	0.853E-07	21.160	20.111	0.050
1977	0.870	0.057	0.813	0.708	0.853E-07	42.444	18.829	0.872
1978	-0.371	-0.024	-0.346	0.708	0.853E-07	12.278	17.360	0.310
1979	-1.557	-0.142	-1.415	0.708	0.853E-07	3.750	15.436	1.009
1980	0.124	-0.159	0.284	0.708	0.853E-07	20.143	15.164	0.002

Selectivities by age

Year	10
1975	1.000
1976	1.000
1977	1.000
1978	1.000
1979	1.000
1980	1.000

5.12 JAP

Lognormal dist.
month 1 numbers
Ages 4 - 10
log-likelihood = 7.67
deviance = 8.10

Chi-sq. discrepancy= 5.40

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1990	-1.363	-0.349	-1.014	0.708	0.132E-05	0.350	0.965	0.790
1991	-1.134	-0.390	-0.744	0.708	0.132E-05	0.440	0.926	0.610
1992	-0.574	-0.354	-0.220	0.708	0.132E-05	0.770	0.960	0.217
1993	-0.601	-0.334	-0.267	0.708	0.132E-05	0.750	0.979	0.250
1994	-0.418	-0.181	-0.237	0.708	0.132E-05	0.900	1.141	0.229
1995	-0.364	-0.205	-0.159	0.708	0.132E-05	0.950	1.114	0.174
1996	0.615	-0.119	0.734	0.708	0.132E-05	2.530	1.214	0.592
1997	0.170	-0.086	0.256	0.708	0.132E-05	1.620	1.254	0.000
1998	-0.475	-0.145	-0.330	0.708	0.132E-05	0.850	1.182	0.298
1999	-0.139	-0.162	0.023	0.708	0.132E-05	1.190	1.163	0.064
2000	-0.114	-0.220	0.106	0.708	0.132E-05	1.220	1.097	0.028
2001	0.052	-0.319	0.371	0.708	0.132E-05	1.440	0.994	0.025
2002	-0.209	-0.452	0.243	0.708	0.132E-05	1.110	0.870	0.000
2003	-0.182	-0.183	0.001	0.708	0.132E-05	1.140	1.138	0.075
2004	-0.283	-0.176	-0.108	0.708	0.132E-05	1.030	1.147	0.139
2005	-0.614	-0.196	-0.418	0.708	0.132E-05	0.740	1.124	0.365
2006	-0.452	-0.096	-0.356	0.708	0.132E-05	0.870	1.242	0.318
2007	-0.429	-0.096	-0.333	0.708	0.132E-05	0.890	1.242	0.300
2008	-0.255	-0.018	-0.237	0.708	0.132E-05	1.060	1.343	0.228
2009	0.119	0.071	0.048	0.708	0.132E-05	1.540	1.467	0.052
2010	0.157	-0.066	0.223	0.708	0.132E-05	1.600	1.280	0.001
2011	0.177	-0.240	0.417	0.708	0.132E-05	1.632	1.076	0.050
2012	0.235	-0.339	0.574	0.708	0.132E-05	1.730	0.974	0.224
2013	0.293	-0.083	0.376	0.708	0.132E-05	1.834	1.259	0.027
2014	0.352	0.122	0.229	0.708	0.132E-05	1.944	1.545	0.001
2015	0.410	0.242	0.168	0.708	0.132E-05	2.060	1.742	0.010
2016	0.468	0.367	0.101	0.708	0.132E-05	2.184	1.974	0.030
2017	0.526	0.410	0.116	0.708	0.132E-05	2.315	2.061	0.024
2018	0.585	0.449	0.136	0.708	0.132E-05	2.454	2.142	0.018
2019	0.643	0.494	0.149	0.708	0.132E-05	2.601	2.240	0.014
2020	0.701	0.522	0.179	0.708	0.132E-05	2.757	2.305	0.007
2021	0.699	0.745	-0.047	0.708	0.132E-05	2.750	2.881	0.102
2022	0.702	0.666	0.036	0.708	0.132E-05	2.760	2.662	0.057
2023	0.702	0.722	-0.019	0.708	0.132E-05	2.760	2.814	0.086

Selectivities by age

Year	4	5	6	7	8	9	10
1990	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1991	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1992	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1993	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1994	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1995	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1996	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1997	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1998	0.026	0.074	0.977	0.867	0.706	1.000	0.349
1999	0.026	0.074	0.977	0.867	0.706	1.000	0.349
2000	0.026	0.074	0.977	0.867	0.706	1.000	0.349
2001	0.026	0.074	0.977	0.867	0.706	1.000	0.349
2002	0.026	0.074	0.977	0.867	0.706	1.000	0.349
2003	0.026	0.074	0.977	0.867	0.706	1.000	0.349

```
  2004   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2005   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2006   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2007   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2008   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2009   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2010   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2011   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2012   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2013   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2014   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2015   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2016   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2017   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2018   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2019   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2020   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2021   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2022   0.026  0.074  0.977  0.867  0.706  1.000  0.349
  2023   0.026  0.074  0.977  0.867  0.706  1.000  0.349

=========================================================================

TOTAL NUMBER OF FUNCTION EVALUATIONS =       3654
TOTAL NUMBER OF FUNCTION EVALUATIONS =       3654
# terminal age structure of population
 0.0000D+00  0.1547D-02  0.5000D+01    1.0  0.4000D+01    1
 0.0000D+00  0.5582D-01  0.5000D+01    1.0  0.4000D+01    2
 0.0000D+00  0.7379D-01  0.5000D+01    1.0  0.4000D+01    3   3  *****
 0.0000D+00  0.1782D-01  0.5000D+01    1.0  0.3000D+01    4
 0.0000D+00  0.8481D-03  0.5000D+01    1.0  0.3000D+01    5
 0.0000D+00  0.8668D-01  0.5000D+01    1.0  0.1000D+00    6
 0.0000D+00  0.5416D+00  0.3000D+01    1.0  0.6000D+01    7
 0.0000D+00  0.7762D-02  0.5000D+01    1.0  0.1000D+00    8
 0.0000D+00  0.2229D-01  0.3000D+01    1.0  0.8000D+01    9
# terminal-age f-ratios
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   10
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   11
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   12
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   13
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   14
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   15
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   16
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   17
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   18
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   19
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   20
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   21
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   22
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   23
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   24
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   25
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   26
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   27
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   28
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   29
```

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 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   30
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   31
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   32
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   33
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   34
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   35
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   36
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   37
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   38
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   39
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   40
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   41
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   42
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   43
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   44
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   45
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   46
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   47
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   48
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   49
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   50
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   51
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   52
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   53
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   54
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   55
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   56
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   57
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   58
# natural mortality
 0.0000D+00  0.4900D+00  0.1000D+01    0.0  0.1000D+00   59
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   60
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   61
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   62
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   63
 0.0000D+00  0.2000D+00  0.1000D+01    0.0  0.1000D+00   64
 0.0000D+00  0.1750D+00  0.1000D+01    0.0  0.1000D+00   65
 0.0000D+00  0.1500D+00  0.1000D+01    0.0  0.1000D+00   66
 0.0000D+00  0.1250D+00  0.1000D+01    0.0  0.1000D+00   67
 0.0000D+00  0.1000D+00  0.1000D+01    0.0  0.1000D+00   68
# transfer coefficients
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   69
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   70
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   71
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   72
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   73
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   74
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   75
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   76
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   77
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   78
# Stock recruitment relationship
 0.0000D+00  0.2507D+06  0.1000D+21    0.0  0.4000D+00   79
 0.0000D+00  0.1660D+05  0.1000D+21    0.0  0.0000D+00   80
 0.0000D+00  0.1580D+00  0.9000D+00    0.0  0.0000D+00   81
 0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   82
 0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   83
```

Variance scaling parameters

0.0000D+00	0.8509D+00	0.1000D+21	1.0	0.4000D+00	84
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	85
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	86
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	87
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	88
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	89
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	90
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	91
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	92
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	93
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	94
0.0000D+00	0.8509D+00	0.1000D+21	-0.1	0.4000D+00	95

Number of parameters = 95

****

VPA-2BOX

BOOTSTRAP ESTIMATES OF BIAS AND VARIANCE

****

Basic model

22:12, 17 February 2011

****

BIAS AND STANDARD ERROR ESTIMATES

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TABLE 1A. BIAS OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1976	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1978	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1981	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1982	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1983	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1984	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1985	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1986	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1989	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1994	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1995	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1996	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1998	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

1999	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2001	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2002	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001
2005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001
2006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2009	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
2010	0.000	0.000	0.000	0.002	0.001	0.001	0.001	0.001	0.000	0.001
2011	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
2012	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
2013	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001
2014	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001
2015	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001
2016	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001
2017	-0.003	0.044	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001
2018	0.003	-0.123	0.026	0.001	0.001	0.000	0.001	0.001	0.001	0.001
2019	0.003	0.138	-0.079	0.052	0.001	0.000	0.001	0.001	0.001	0.001
2020	-0.007	0.123	0.099	-0.168	0.031	0.000	0.001	0.001	0.001	0.001
2021	0.005	-0.299	0.087	0.246	-0.101	0.032	0.001	0.001	0.001	0.001
2022	-0.001	0.251	-0.214	0.252	0.206	-0.091	0.063	0.001	0.001	0.001
2023	-0.001	-0.047	0.381	-0.178	0.881	0.413	0.311	0.256	0.001	0.001

TABLE 1B. STANDARD ERROR OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.645E-04	0.272E-03	0.211E-03	0.130E-03	0.674E-04	0.149E-03	0.829E-04	0.688E-04	0.917E-04	0.917E-04
1976	0.106E-04	0.309E-03	0.536E-03	0.201E-03	0.152E-03	0.516E-04	0.105E-03	0.501E-04	0.767E-04	0.767E-04
1977	0.467E-04	0.313E-03	0.254E-03	0.242E-03	0.417E-04	0.570E-04	0.441E-04	0.105E-03	0.789E-04	0.789E-04
1978	0.125E-03	0.292E-03	0.290E-03	0.138E-03	0.724E-04	0.205E-04	0.419E-04	0.226E-04	0.641E-04	0.641E-04
1979	0.153E-04	0.108E-03	0.320E-03	0.172E-03	0.666E-04	0.422E-04	0.314E-04	0.912E-04	0.602E-04	0.602E-04
1980	0.697E-04	0.252E-03	0.552E-03	0.271E-03	0.608E-04	0.642E-04	0.559E-04	0.302E-04	0.659E-04	0.659E-04
1981	0.660E-04	0.364E-03	0.465E-03	0.178E-03	0.146E-03	0.430E-04	0.590E-04	0.871E-04	0.513E-04	0.513E-04
1982	0.343E-03	0.428E-03	0.633E-03	0.312E-03	0.128E-03	0.740E-04	0.462E-04	0.153E-03	0.110E-03	0.110E-03
1983	0.193E-03	0.356E-03	0.507E-03	0.240E-03	0.165E-03	0.122E-03	0.228E-03	0.740E-04	0.122E-03	0.122E-03
1984	0.128E-03	0.510E-03	0.257E-03	0.259E-03	0.267E-03	0.213E-03	0.188E-03	0.254E-03	0.144E-03	0.144E-03
1985	0.102E-03	0.622E-03	0.693E-03	0.273E-03	0.155E-03	0.156E-03	0.889E-04	0.128E-03	0.181E-03	0.109E-03
1986	0.240E-03	0.433E-03	0.519E-03	0.343E-03	0.801E-04	0.107E-03	0.100E-03	0.812E-04	0.181E-03	0.108E-03

1987 0.258E-03 0.483E-03 0.543E-03 0.304E-03 0.121E-03 0.793E-04 0.208E-03 0.159E-03 0.172E-03 0.103E-03
1988 0.514E-03 0.463E-03 0.704E-03 0.382E-03 0.162E-03 0.109E-03 0.136E-03 0.204E-03 0.275E-03 0.165E-03
1989 0.617E-03 0.801E-03 0.448E-03 0.361E-03 0.383E-03 0.975E-04 0.147E-03 0.109E-03 0.228E-03 0.137E-03
1990 0.443E-03 0.100E-02 0.973E-03 0.401E-03 0.459E-03 0.166E-03 0.165E-03 0.222E-03 0.286E-03 0.172E-03
1991 0.364E-03 0.946E-03 0.115E-02 0.527E-03 0.487E-03 0.143E-03 0.154E-03 0.194E-03 0.449E-03 0.270E-03
1992 0.384E-03 0.164E-02 0.161E-02 0.547E-03 0.302E-03 0.241E-03 0.350E-03 0.449E-03 0.575E-03 0.345E-03
1993 0.402E-03 0.317E-02 0.270E-02 0.777E-03 0.402E-03 0.304E-03 0.306E-03 0.359E-03 0.600E-03 0.360E-03
1994 0.832E-03 0.150E-02 0.187E-02 0.837E-03 0.802E-03 0.663E-03 0.972E-03 0.995E-03 0.164E-02 0.981E-03
1995 0.835E-03 0.180E-02 0.196E-02 0.126E-02 0.123E-02 0.132E-02 0.759E-03 0.105E-02 0.118E-02 0.142E-02
1996 0.125E-02 0.335E-02 0.391E-02 0.247E-02 0.158E-02 0.769E-03 0.978E-03 0.745E-03 0.177E-02 0.213E-02
1997 0.141E-02 0.330E-02 0.242E-02 0.303E-02 0.189E-02 0.219E-02 0.124E-02 0.243E-02 0.241E-02 0.289E-02
1998 0.360E-02 0.644E-02 0.534E-02 0.377E-02 0.229E-02 0.429E-02 0.730E-03 0.721E-03 0.201E-02 0.241E-02
1999 0.368E-02 0.552E-02 0.566E-02 0.409E-02 0.193E-02 0.104E-02 0.996E-03 0.123E-02 0.266E-02 0.319E-02
2000 0.111E-01 0.111E-01 0.706E-02 0.450E-02 0.493E-02 0.301E-02 0.127E-02 0.187E-02 0.209E-02 0.251E-02
2001 0.356E-03 0.175E-01 0.793E-02 0.559E-02 0.390E-02 0.323E-02 0.464E-02 0.316E-02 0.353E-02 0.423E-02
2002 0.187E-02 0.240E-01 0.191E-01 0.665E-02 0.298E-02 0.413E-02 0.249E-02 0.371E-02 0.394E-02 0.473E-02
2003 0.911E-03 0.109E-01 0.755E-02 0.587E-02 0.708E-02 0.311E-02 0.745E-02 0.498E-02 0.613E-02 0.736E-02
2004 0.299E-02 0.118E-01 0.153E-01 0.535E-02 0.317E-02 0.561E-02 0.513E-02 0.547E-02 0.831E-02 0.997E-02
2005 0.144E-01 0.149E-01 0.109E-01 0.103E-01 0.583E-02 0.636E-02 0.628E-02 0.356E-02 0.149E-01 0.179E-01
2006 0.167E-01 0.164E-01 0.176E-01 0.605E-02 0.306E-02 0.940E-02 0.490E-02 0.558E-02 0.142E-01 0.170E-01
2007 0.233E-03 0.154E-01 0.710E-02 0.180E-01 0.130E-01 0.908E-02 0.104E-01 0.850E-02 0.204E-01 0.245E-01
2008 0.654E-04 0.167E-01 0.111E-01 0.184E-01 0.111E-01 0.869E-02 0.100E-01 0.127E-01 0.147E-01 0.176E-01
2009 0.114E-03 0.291E-02 0.898E-02 0.242E-01 0.112E-01 0.987E-02 0.157E-01 0.143E-01 0.110E-01 0.132E-01
2010 0.106E-03 0.282E-02 0.350E-02 0.442E-01 0.202E-01 0.226E-01 0.155E-01 0.135E-01 0.108E-01 0.130E-01
2011 0.361E-03 0.128E-01 0.667E-02 0.110E-01 0.518E-02 0.420E-02 0.575E-02 0.574E-02 0.745E-02 0.894E-02
2012 0.350E-03 0.123E-01 0.646E-02 0.107E-01 0.486E-02 0.407E-02 0.546E-02 0.549E-02 0.683E-02 0.820E-02
2013 0.343E-03 0.122E-01 0.635E-02 0.105E-01 0.489E-02 0.396E-02 0.538E-02 0.534E-02 0.671E-02 0.805E-02
2014 0.345E-03 0.122E-01 0.647E-02 0.105E-01 0.485E-02 0.398E-02 0.538E-02 0.535E-02 0.671E-02 0.805E-02

2015	0.352E-03	0.121E-01	0.645E-02	0.108E-01	0.493E-02	0.401E-02	0.539E-02	0.523E-02	0.661E-02	0.794E-02
2016	0.281E-02	0.124E-01	0.631E-02	0.106E-01	0.499E-02	0.407E-02	0.528E-02	0.518E-02	0.641E-02	0.769E-02
2017	0.395E-02	0.106E+00	0.613E-02	0.996E-02	0.463E-02	0.388E-02	0.519E-02	0.497E-02	0.618E-02	0.742E-02
2018	0.395E-02	0.157E+00	0.646E-01	0.970E-02	0.450E-02	0.369E-02	0.503E-02	0.491E-02	0.596E-02	0.715E-02
2019	0.469E-02	0.159E+00	0.105E+00	0.132E+00	0.444E-02	0.362E-02	0.489E-02	0.480E-02	0.594E-02	0.712E-02
2020	0.553E-02	0.193E+00	0.111E+00	0.246E+00	0.825E-01	0.355E-02	0.482E-02	0.467E-02	0.582E-02	0.699E-02
2021	0.723E-02	0.240E+00	0.145E+00	0.274E+00	0.181E+00	0.876E-01	0.473E-02	0.474E-02	0.581E-02	0.698E-02
2022	0.256E-02	0.362E+00	0.199E+00	0.459E+00	0.245E+00	0.238E+00	0.181E+00	0.463E-02	0.585E-02	0.702E-02
2023	0.243E-02	0.126E+00	0.748E+00	0.159E+01	0.184E+01	0.748E+00	0.126E+01	0.930E+00	0.576E-02	0.692E-02

TABLE 1C. BIAS OF ABUNDANCE (BY AREA) OF East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.106E+03	0.804E+02	0.157E+02	0.247E+02	0.498E+02	0.108E+02	0.148E+02	0.161E+02	0.180E+02	0.218E+03
1976	0.280E+03	0.616E+02	0.598E+02	0.103E+02	0.188E+02	0.383E+02	0.877E+01	0.122E+02	0.136E+02	0.185E+03
1977	0.704E+02	0.172E+03	0.509E+02	0.465E+02	0.698E+01	0.146E+02	0.313E+02	0.719E+01	0.105E+02	0.137E+03
1978	0.922E+02	0.450E+02	0.133E+03	0.385E+02	0.367E+02	0.549E+01	0.119E+02	0.263E+02	0.624E+01	0.118E+03
1979	0.139E+03	0.579E+02	0.367E+02	0.103E+03	0.308E+02	0.289E+02	0.449E+01	0.100E+02	0.226E+02	0.124E+03
1980	0.137E+03	0.854E+02	0.445E+02	0.278E+02	0.811E+02	0.243E+02	0.237E+02	0.377E+01	0.871E+01	0.780E+02
1981	0.154E+03	0.811E+02	0.663E+02	0.355E+02	0.220E+02	0.638E+02	0.199E+02	0.199E+02	0.325E+01	0.165E+02
1982	0.323E+03	0.938E+02	0.622E+02	0.513E+02	0.277E+02	0.172E+02	0.522E+02	0.167E+02	0.167E+02	0.131E+03
1983	0.277E+03	0.203E+03	0.760E+02	0.472E+02	0.403E+02	0.218E+02	0.140E+02	0.438E+02	0.146E+02	0.101E+03
1984	0.233E+03	0.178E+03	0.161E+03	0.598E+02	0.364E+02	0.314E+02	0.179E+02	0.120E+02	0.377E+02	0.148E+03
1985	0.183E+03	0.142E+03	0.138E+03	0.125E+03	0.472E+02	0.287E+02	0.258E+02	0.151E+02	0.102E+02	0.161E+03
1986	0.232E+03	0.113E+03	0.108E+03	0.107E+03	0.982E+02	0.377E+02	0.233E+02	0.216E+02	0.129E+02	0.184E+03
1987	0.364E+03	0.140E+03	0.895E+02	0.841E+02	0.854E+02	0.765E+02	0.306E+02	0.195E+02	0.186E+02	0.197E+03
1988	0.419E+03	0.223E+03	0.114E+03	0.709E+02	0.665E+02	0.673E+02	0.626E+02	0.255E+02	0.165E+02	0.176E+03
1989	0.969E+03	0.262E+03	0.174E+03	0.885E+02	0.559E+02	0.527E+02	0.558E+02	0.525E+02	0.218E+02	0.189E+03

1990 0.767E+03 0.590E+03 0.205E+03 0.136E+03 0.697E+02 0.432E+02 0.431E+02 0.464E+02
0.451E+02 0.162E+03
1991 0.183E+04 0.473E+03 0.466E+03 0.162E+03 0.108E+03 0.550E+02 0.355E+02 0.363E+02
0.401E+02 0.195E+03
1992 0.172E+04 0.113E+04 0.373E+03 0.369E+03 0.127E+03 0.857E+02 0.457E+02 0.301E+02
0.312E+02 0.202E+03
1993 0.171E+04 0.104E+04 0.887E+03 0.290E+03 0.290E+03 0.101E+03 0.701E+02 0.384E+02
0.259E+02 0.204E+03
1994 0.212E+04 0.105E+04 0.825E+03 0.695E+03 0.228E+03 0.229E+03 0.832E+02 0.585E+02
0.329E+02 0.210E+03
1995 0.188E+04 0.130E+04 0.816E+03 0.650E+03 0.546E+03 0.179E+03 0.187E+03 0.694E+02
0.507E+02 0.214E+03
1996 0.213E+04 0.115E+04 0.102E+04 0.643E+03 0.512E+03 0.428E+03 0.147E+03 0.156E+03
0.594E+02 0.240E+03
1997 0.175E+04 0.131E+04 0.895E+03 0.799E+03 0.503E+03 0.402E+03 0.350E+03 0.124E+03
0.135E+03 0.264E+03
1998 0.990E+04 0.107E+04 0.103E+04 0.703E+03 0.630E+03 0.395E+03 0.329E+03 0.294E+03
0.106E+03 0.352E+03
1999 0.786E+04 0.606E+04 0.837E+03 0.808E+03 0.550E+03 0.497E+03 0.323E+03 0.276E+03
0.253E+03 0.415E+03
2000 0.103E+05 0.481E+04 0.477E+04 0.657E+03 0.636E+03 0.432E+03 0.407E+03 0.271E+03
0.238E+03 0.596E+03
2001 0.114E+05 0.629E+04 0.378E+04 0.375E+04 0.517E+03 0.499E+03 0.354E+03 0.341E+03
0.233E+03 0.739E+03
2002 0.141E+05 0.700E+04 0.494E+04 0.297E+04 0.295E+04 0.407E+03 0.409E+03 0.297E+03
0.293E+03 0.879E+03
2003 0.184E+05 0.865E+04 0.549E+04 0.388E+04 0.234E+04 0.232E+04 0.333E+03 0.343E+03
0.256E+03 0.105E+04
2004 0.241E+05 0.113E+05 0.681E+04 0.432E+04 0.306E+04 0.184E+04 0.190E+04 0.279E+03
0.294E+03 0.117E+04
2005 0.124E+05 0.148E+05 0.885E+04 0.535E+04 0.340E+04 0.240E+04 0.151E+04 0.159E+04
0.240E+03 0.133E+04
2006 0.962E+04 0.760E+04 0.116E+05 0.696E+04 0.421E+04 0.267E+04 0.197E+04 0.126E+04
0.137E+04 0.141E+04
2007 0.631E+04 0.589E+04 0.597E+04 0.913E+04 0.548E+04 0.331E+04 0.219E+04 0.165E+04
0.109E+04 0.248E+04
2008 0.325E+05 0.387E+04 0.463E+04 0.470E+04 0.719E+04 0.431E+04 0.271E+04 0.184E+04
0.142E+04 0.321E+04
2009 0.355E+05 0.199E+05 0.304E+04 0.364E+04 0.370E+04 0.565E+04 0.352E+04 0.228E+04
0.158E+04 0.417E+04
2010 0.376E+05 0.218E+05 0.157E+05 0.239E+04 0.287E+04 0.291E+04 0.463E+04 0.296E+04
0.196E+04 0.516E+04
2011 0.372E+05 0.230E+05 0.171E+05 0.123E+05 0.188E+04 0.226E+04 0.238E+04 0.389E+04
0.255E+04 0.643E+04
2012 0.399E+05 0.228E+05 0.181E+05 0.135E+05 0.969E+04 0.148E+04 0.185E+04 0.200E+04
0.334E+04 0.809E+04
2013 0.417E+05 0.244E+05 0.179E+05 0.142E+05 0.106E+05 0.762E+04 0.121E+04 0.155E+04
0.172E+04 0.102E+05
2014 0.435E+05 0.255E+05 0.192E+05 0.141E+05 0.112E+05 0.834E+04 0.624E+04 0.102E+04
0.133E+04 0.108E+05
2015 0.436E+05 0.266E+05 0.201E+05 0.151E+05 0.111E+05 0.881E+04 0.683E+04 0.524E+04
0.877E+03 0.109E+05
2016 0.285E+06 0.267E+05 0.210E+05 0.158E+05 0.119E+05 0.872E+04 0.721E+04 0.573E+04
0.451E+04 0.106E+05
2017 0.124E+07 0.174E+06 0.210E+05 0.165E+05 0.124E+05 0.935E+04 0.714E+04 0.605E+04
0.493E+04 0.135E+05

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 2018  0.216E+06  0.759E+06  0.137E+06  0.165E+05  0.130E+05  0.978E+04  0.766E+04  0.599E+04
0.521E+04  0.166E+05
 2019 -0.348E+07  0.132E+06  0.597E+06  0.108E+06  0.130E+05  0.102E+05  0.801E+04  0.643E+04
0.516E+04  0.197E+05
 2020  0.492E+08 -0.213E+07  0.104E+06  0.470E+06  0.850E+05  0.102E+05  0.835E+04  0.673E+04
0.553E+04  0.223E+05
 2021  0.409E+10  0.301E+08 -0.167E+07  0.821E+05  0.369E+06  0.669E+05  0.838E+04  0.701E+04
0.579E+04  0.249E+05
 2022  0.437E+09  0.251E+10  0.237E+08 -0.132E+07  0.647E+05  0.291E+06  0.547E+05  0.703E+04
0.604E+04  0.274E+05
 2023  0.437E+09  0.268E+09  0.197E+10  0.186E+08 -0.104E+07  0.509E+05  0.238E+06  0.460E+05
0.605E+04  0.302E+05
 2024           0.267E+09  0.211E+09  0.155E+10  0.147E+08 -0.815E+06  0.417E+05  0.200E+06
0.396E+05  0.326E+05
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TABLE 1D. STANDARD ERROR OF ABUNDANCE (BY AREA) OF East of 45

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        1        2        3        4        5        6        7        8        9       10
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 1975  0.154E+04  0.823E+03  0.916E+03  0.408E+03  0.497E+03  0.120E+03  0.147E+03  0.122E+03
0.120E+03  0.145E+04
 1976  0.281E+04  0.940E+03  0.646E+03  0.721E+03  0.321E+03  0.391E+03  0.979E+02  0.123E+03
0.105E+03  0.142E+04
 1977  0.792E+03  0.172E+04  0.738E+03  0.506E+03  0.567E+03  0.252E+03  0.320E+03  0.822E+02
0.106E+03  0.138E+04
 1978  0.834E+03  0.485E+03  0.135E+04  0.580E+03  0.398E+03  0.446E+03  0.207E+03  0.268E+03
0.707E+02  0.134E+04
 1979  0.109E+04  0.511E+03  0.380E+03  0.106E+04  0.456E+03  0.313E+03  0.365E+03  0.173E+03
0.231E+03  0.126E+04
 1980  0.107E+04  0.667E+03  0.402E+03  0.299E+03  0.834E+03  0.359E+03  0.256E+03  0.306E+03
0.149E+03  0.134E+04
 1981  0.130E+04  0.658E+03  0.525E+03  0.315E+03  0.235E+03  0.656E+03  0.294E+03  0.215E+03
0.264E+03  0.134E+04
 1982  0.315E+04  0.798E+03  0.516E+03  0.412E+03  0.248E+03  0.185E+03  0.537E+03  0.247E+03
0.185E+03  0.145E+04
 1983  0.268E+04  0.192E+04  0.626E+03  0.404E+03  0.324E+03  0.195E+03  0.151E+03  0.451E+03
0.213E+03  0.148E+04
 1984  0.218E+04  0.164E+04  0.151E+04  0.491E+03  0.318E+03  0.255E+03  0.160E+03  0.127E+03
0.388E+03  0.153E+04
 1985  0.187E+04  0.134E+04  0.128E+04  0.119E+04  0.386E+03  0.250E+03  0.208E+03  0.134E+03
0.109E+03  0.172E+04
 1986  0.236E+04  0.114E+04  0.105E+04  0.101E+04  0.935E+03  0.304E+03  0.205E+03  0.175E+03
0.115E+03  0.165E+04
 1987  0.368E+04  0.144E+04  0.898E+03  0.823E+03  0.792E+03  0.735E+03  0.249E+03  0.172E+03
0.151E+03  0.159E+04
 1988  0.431E+04  0.225E+04  0.113E+04  0.705E+03  0.647E+03  0.623E+03  0.602E+03  0.209E+03
0.148E+03  0.157E+04
 1989  0.991E+04  0.263E+04  0.177E+04  0.885E+03  0.554E+03  0.509E+03  0.510E+03  0.505E+03
0.180E+03  0.155E+04
 1990  0.798E+04  0.606E+04  0.206E+04  0.139E+04  0.696E+03  0.436E+03  0.417E+03  0.428E+03
0.435E+03  0.156E+04
 1991  0.188E+05  0.488E+04  0.476E+04  0.162E+04  0.110E+04  0.547E+03  0.357E+03  0.350E+03
0.368E+03  0.180E+04
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1992 0.178E+05 0.115E+05 0.383E+04 0.374E+04 0.127E+04 0.861E+03 0.448E+03 0.300E+03
0.301E+03 0.195E+04
1993 0.177E+05 0.109E+05 0.905E+04 0.301E+04 0.294E+04 0.100E+04 0.705E+03 0.376E+03
0.258E+03 0.203E+04
1994 0.221E+05 0.108E+05 0.852E+04 0.710E+04 0.237E+04 0.231E+04 0.820E+03 0.592E+03
0.323E+03 0.206E+04
1995 0.194E+05 0.135E+05 0.850E+04 0.670E+04 0.559E+04 0.186E+04 0.189E+04 0.688E+03
0.509E+03 0.215E+04
1996 0.224E+05 0.119E+05 0.106E+05 0.668E+04 0.527E+04 0.439E+04 0.152E+04 0.159E+04
0.592E+03 0.239E+04
1997 0.182E+05 0.137E+05 0.931E+04 0.834E+04 0.524E+04 0.414E+04 0.360E+04 0.128E+04
0.137E+04 0.269E+04
1998 0.103E+06 0.112E+05 0.107E+05 0.732E+04 0.656E+04 0.412E+04 0.339E+04 0.302E+04
0.110E+04 0.364E+04
1999 0.821E+05 0.632E+05 0.873E+04 0.842E+04 0.575E+04 0.515E+04 0.337E+04 0.285E+04
0.260E+04 0.426E+04
2000 0.108E+06 0.503E+05 0.497E+05 0.685E+04 0.662E+04 0.452E+04 0.422E+04 0.283E+04
0.245E+04 0.614E+04
2001 0.119E+06 0.656E+05 0.395E+05 0.390E+05 0.539E+04 0.520E+04 0.370E+04 0.354E+04
0.244E+04 0.772E+04
2002 0.147E+06 0.729E+05 0.515E+05 0.310E+05 0.307E+05 0.424E+04 0.426E+04 0.310E+04
0.305E+04 0.913E+04
2003 0.190E+06 0.901E+05 0.571E+05 0.404E+05 0.244E+05 0.242E+05 0.347E+04 0.357E+04
0.267E+04 0.109E+05
2004 0.249E+06 0.117E+06 0.709E+05 0.449E+05 0.318E+05 0.192E+05 0.198E+05 0.291E+04
0.307E+04 0.123E+05
2005 0.129E+06 0.153E+06 0.917E+05 0.557E+05 0.353E+05 0.250E+05 0.157E+05 0.166E+05
0.250E+04 0.138E+05
2006 0.100E+06 0.791E+05 0.120E+06 0.721E+05 0.438E+05 0.278E+05 0.205E+05 0.132E+05
0.143E+05 0.147E+05
2007 0.656E+05 0.612E+05 0.621E+05 0.944E+05 0.567E+05 0.345E+05 0.228E+05 0.172E+05
0.114E+05 0.259E+05
2008 0.338E+06 0.402E+05 0.481E+05 0.489E+05 0.742E+05 0.446E+05 0.282E+05 0.191E+05
0.148E+05 0.334E+05
2009 0.371E+06 0.207E+06 0.316E+05 0.378E+05 0.384E+05 0.584E+05 0.365E+05 0.237E+05
0.164E+05 0.433E+05
2010 0.391E+06 0.227E+06 0.163E+06 0.249E+05 0.297E+05 0.302E+05 0.478E+05 0.307E+05
0.204E+05 0.537E+05
2011 0.386E+06 0.240E+06 0.179E+06 0.128E+06 0.195E+05 0.234E+05 0.247E+05 0.401E+05
0.264E+05 0.665E+05
2012 0.415E+06 0.236E+06 0.189E+06 0.141E+06 0.101E+06 0.154E+05 0.191E+05 0.208E+05
0.345E+05 0.835E+05
2013 0.437E+06 0.254E+06 0.186E+06 0.148E+06 0.111E+06 0.792E+05 0.126E+05 0.161E+05
0.179E+05 0.106E+06
2014 0.460E+06 0.268E+06 0.200E+06 0.146E+06 0.117E+06 0.871E+05 0.649E+05 0.106E+05
0.138E+05 0.112E+06
2015 0.461E+06 0.282E+06 0.211E+06 0.157E+06 0.115E+06 0.918E+05 0.713E+05 0.545E+05
0.908E+04 0.113E+06
2016 0.291E+07 0.282E+06 0.222E+06 0.166E+06 0.124E+06 0.905E+05 0.752E+05 0.598E+05
0.469E+05 0.110E+06
2017 0.268E+07 0.178E+07 0.222E+06 0.174E+06 0.130E+06 0.973E+05 0.741E+05 0.631E+05
0.515E+05 0.141E+06
2018 0.178E+07 0.164E+07 0.140E+07 0.175E+06 0.137E+06 0.103E+06 0.797E+05 0.622E+05
0.543E+05 0.173E+06
2019 0.561E+08 0.109E+07 0.129E+07 0.110E+07 0.137E+06 0.108E+06 0.840E+05 0.669E+05
0.535E+05 0.205E+06

2020 0.843E+08 0.343E+08 0.858E+06 0.101E+07 0.868E+06 0.108E+06 0.883E+05 0.705E+05
0.576E+05 0.232E+06
2021 0.172E+11 0.516E+08 0.270E+08 0.675E+06 0.798E+06 0.683E+06 0.885E+05 0.742E+05
0.607E+05 0.261E+06
2022 0.414E+10 0.105E+11 0.406E+08 0.213E+08 0.531E+06 0.628E+06 0.559E+06 0.743E+05
0.638E+05 0.290E+06
2023 0.414E+10 0.254E+10 0.827E+10 0.320E+08 0.167E+08 0.418E+06 0.514E+06 0.469E+06
0.639E+05 0.319E+06
2024 0.253E+10 0.200E+10 0.650E+10 0.251E+08 0.132E+08 0.342E+06 0.431E+06
0.404E+06 0.345E+06

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TABLE 1E. PARAMETER ESTIMATES FOR East of 45

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TERMINAL AGE STRUCTURE OF POPULATION ABUNDANCE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
2	0.877E+06	0.268E+09	0.267E+09	0.253E+10	946.4
3	0.652E+06	0.211E+09	0.211E+09	0.200E+10	946.7
4	0.223E+06	0.155E+10	0.155E+10	0.650E+10	418.9
5	0.101E+07	0.147E+08	0.147E+08	0.251E+08	171.4
6	0.891E+07	0.942E+07	-0.815E+06	0.132E+08	139.6
7	0.552E+05	0.201E+06	0.417E+05	0.342E+06	169.8
8	0.761E+04	0.204E+06	0.200E+06	0.431E+06	211.3
9	0.573E+06	0.570E+06	0.396E+05	0.404E+06	70.8
10	0.142E+07	0.145E+07	0.326E+05	0.345E+06	23.7

TERMINAL AGE STRUCTURE OF FISHING MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.155E-02	0.212E-02	-0.137E-02	0.243E-02	114.5
2	0.558E-01	0.835E-01	-0.469E-01	0.126E+00	151.3
3	0.738E-01	0.409E+00	0.381E+00	0.748E+00	182.6
4	0.178E-01	0.867E+00	-0.178E+00	0.159E+01	183.9
5	0.848E-03	0.882E+00	0.881E+00	0.184E+01	208.2
6	0.867E-01	0.444E+00	0.413E+00	0.748E+00	168.4
7	0.542E+00	0.111E+01	0.311E+00	0.126E+01	113.0
8	0.776E-02	0.264E+00	0.256E+00	0.930E+00	351.7
9	0.223E-01	0.231E-01	0.774E-03	0.576E-02	25.0
10	0.267E-01	0.277E-01	0.929E-03	0.692E-02	25.0

RATIO OF FISHING MORTALITY RATE ON LAST TWO AGES (F-RATIO)

Year	MLE	Average of bootstraps	Bias	Std. Error	% CV
1975	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1976	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1977	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1978	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1979	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1980	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1981	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0

1982	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1983	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1984	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1985	0.600E+00	0.600E+00	0.000E+00	0.236E-07	0.0
1986	0.600E+00	0.600E+00	0.000E+00	0.246E-07	0.0
1987	0.600E+00	0.600E+00	0.000E+00	0.277E-07	0.0
1988	0.600E+00	0.600E+00	0.000E+00	0.166E-07	0.0
1989	0.600E+00	0.600E+00	0.000E+00	0.232E-07	0.0
1990	0.600E+00	0.600E+00	0.000E+00	0.192E-07	0.0
1991	0.600E+00	0.600E+00	0.000E+00	0.234E-07	0.0
1992	0.600E+00	0.600E+00	0.000E+00	0.221E-07	0.0
1993	0.600E+00	0.600E+00	0.000E+00	0.230E-07	0.0
1994	0.600E+00	0.600E+00	0.000E+00	0.186E-07	0.0
1995	0.120E+01	0.120E+01	0.000E+00	0.327E-07	0.0
1996	0.120E+01	0.120E+01	0.000E+00	0.440E-07	0.0
1997	0.120E+01	0.120E+01	0.000E+00	0.422E-07	0.0
1998	0.120E+01	0.120E+01	0.000E+00	0.436E-07	0.0
1999	0.120E+01	0.120E+01	0.000E+00	0.349E-07	0.0
2000	0.120E+01	0.120E+01	0.000E+00	0.423E-07	0.0
2001	0.120E+01	0.120E+01	0.000E+00	0.435E-07	0.0
2002	0.120E+01	0.120E+01	0.000E+00	0.447E-07	0.0
2003	0.120E+01	0.120E+01	0.000E+00	0.325E-07	0.0
2004	0.120E+01	0.120E+01	0.000E+00	0.390E-07	0.0
2005	0.120E+01	0.120E+01	0.000E+00	0.501E-07	0.0
2006	0.120E+01	0.120E+01	0.000E+00	0.427E-07	0.0
2007	0.120E+01	0.120E+01	0.000E+00	0.440E-07	0.0
2008	0.120E+01	0.120E+01	0.000E+00	0.474E-07	0.0
2009	0.120E+01	0.120E+01	0.000E+00	0.413E-07	0.0
2010	0.120E+01	0.120E+01	0.000E+00	0.415E-07	0.0
2011	0.120E+01	0.120E+01	0.000E+00	0.401E-07	0.0
2012	0.120E+01	0.120E+01	0.000E+00	0.437E-07	0.0
2013	0.120E+01	0.120E+01	0.000E+00	0.399E-07	0.0
2014	0.120E+01	0.120E+01	0.000E+00	0.401E-07	0.0
2015	0.120E+01	0.120E+01	0.000E+00	0.394E-07	0.0
2016	0.120E+01	0.120E+01	0.000E+00	0.427E-07	0.0
2017	0.120E+01	0.120E+01	0.000E+00	0.424E-07	0.0
2018	0.120E+01	0.120E+01	0.000E+00	0.438E-07	0.0
2019	0.120E+01	0.120E+01	0.000E+00	0.411E-07	0.0
2020	0.120E+01	0.120E+01	0.000E+00	0.382E-07	0.0
2021	0.120E+01	0.120E+01	0.000E+00	0.392E-07	0.0
2022	0.120E+01	0.120E+01	0.000E+00	0.443E-07	0.0
2023	0.120E+01	0.120E+01	0.000E+00	0.409E-07	0.0

NATURAL MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.490E+00	0.490E+00	0.000E+00	0.000E+00	0.0
2	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
3	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
4	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
5	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
6	0.200E+00	0.200E+00	0.000E+00	0.000E+00	0.0
7	0.175E+00	0.175E+00	0.000E+00	0.000E+00	0.0
8	0.150E+00	0.150E+00	0.000E+00	0.000E+00	0.0
9	0.125E+00	0.125E+00	0.000E+00	0.000E+00	0.0
10	0.100E+00	0.100E+00	0.000E+00	0.000E+00	0.0

TRANSFER COEFFICIENTS

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

VARIANCE SCALING PARAMETERS

Index	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
2	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
3	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
4	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
5	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
6	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
7	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
8	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
9	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
10	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
11	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5
12	0.851E+00	0.836E+00	-0.152E-01	0.714E-01	8.5

CATCHABILITY COEFFICIENTS

Index	Year	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	1975	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1976	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1977	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1978	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1979	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1980	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1981	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1982	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1983	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1984	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1985	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1986	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1987	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1988	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1989	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1990	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1991	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1992	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1993	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0

1	1994	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1995	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1996	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1997	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1998	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	1999	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2000	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2001	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2002	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2003	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2004	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2005	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2006	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2007	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2008	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2009	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2010	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2011	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2012	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2013	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2014	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2015	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2016	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2017	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2018	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2019	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2020	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2021	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2022	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
1	2023	0.158E-05	0.161E-05	-0.194E-06	0.161E-06	10.0
2	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

2	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	1975	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1976	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1977	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1978	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1979	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1980	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1981	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1982	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1983	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1984	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1985	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1986	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1987	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1988	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1989	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1990	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1991	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1992	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1993	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1994	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1995	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1996	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1997	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1998	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	1999	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2000	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2001	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2002	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2003	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2004	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2005	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2006	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2007	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2008	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2009	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0

3	2010	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2011	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2012	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2013	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2014	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2015	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2016	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2017	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2018	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2019	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2020	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2021	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2022	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
3	2023	0.955E-06	0.988E-06	-0.391E-06	0.177E-06	18.0
4	1975	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1976	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1977	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1978	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1979	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1980	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1981	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1982	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1983	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1984	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1985	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1986	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1987	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1988	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1989	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1990	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1991	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1992	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1993	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1994	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1995	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1996	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1997	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1998	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	1999	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2000	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2001	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2002	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2003	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2004	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2005	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2006	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2007	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2008	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2009	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2010	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2011	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2012	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2013	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2014	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2015	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2016	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2017	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5

4	2018	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2019	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2020	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2021	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2022	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
4	2023	0.160E-05	0.165E-05	-0.863E-06	0.290E-06	17.5
5	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

6	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	1975	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1976	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1977	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1978	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1979	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1980	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1981	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1982	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1983	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1984	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8

7	1985	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1986	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1987	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1988	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1989	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1990	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1991	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1992	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1993	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1994	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1995	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1996	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1997	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1998	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	1999	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2000	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2001	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2002	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2003	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2004	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2005	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2006	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2007	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2008	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2009	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2010	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2011	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2012	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2013	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2014	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2015	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2016	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2017	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2018	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2019	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2020	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2021	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2022	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
7	2023	0.138E-05	0.139E-05	-0.103E-06	0.813E-07	5.8
8	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

8	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

9	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

10	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
11	1975	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1976	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1977	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1978	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1979	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1980	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1981	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1982	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1983	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1984	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1985	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1986	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1987	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1988	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1989	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1990	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1991	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1992	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1993	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1994	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1995	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1996	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1997	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1998	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	1999	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2000	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2001	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2002	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2003	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2004	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2005	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2006	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2007	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2008	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2009	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2010	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2011	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2012	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2013	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2014	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2015	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2016	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9

11	2017	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2018	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2019	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2020	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2021	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2022	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
11	2023	0.480E-08	0.513E-08	-0.105E-08	0.174E-08	33.9
12	1975	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1976	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1977	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1978	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1979	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1980	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1981	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1982	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1983	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1984	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1985	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1986	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1987	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1988	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1989	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1990	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1991	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1992	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1993	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1994	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1995	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1996	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1997	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1998	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	1999	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2000	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2001	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2002	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2003	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2004	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2005	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2006	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2007	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2008	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2009	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2010	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2011	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2012	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2013	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2014	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2015	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2016	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2017	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2018	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2019	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2020	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2021	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2022	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9
12	2023	0.963E-06	0.134E-05	0.342E-06	0.307E-06	22.9

****

CORRELATION AND COVARIANCE MATRICES OF PARAMETERS

****

TABLE 2A. CORRELATION MATRIX

==

	1	2	3	4	5	6	7	8	9	10
1 :	1.0									
2 :	1.0	1.0								
3 :	0.0	0.0	1.0							
4 :	0.1	0.1	0.2	1.0						
5 :	-0.1	-0.1	0.3	0.1	1.0					
6 :	0.0	0.0	-0.1	-0.2	-0.1	1.0				
7 :	0.0	0.0	0.1	0.0	-0.2	0.2	1.0			
8 :	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	1.0		
9 :	-0.1	-0.1	-0.1	0.1	0.0	-0.1	0.1	-0.1	1.0	
10 :	-0.1	-0.1	-0.1	0.1	0.0	0.0	0.1	0.1	0.3	1.0

TABLE 2B. COVARIANCE MATRIX

==

	1	2	3	4	5	6	7	8	9	10
1 :	0.5889D-05									
2 :	0.3012D-03	0.1594D-01								
3 :	0.1130D-04	0.4708D-02	0.5590D+00							
4 :	0.5127D-03	0.2837D-01	0.2131D+00	0.2540D+01						
5 :	-0.3803D-03	-0.1740D-01	0.3849D+00	0.2936D+00	0.3367D+01					
6 :	0.6105D-04	0.2144D-02	-0.5193D-01	-0.1914D+00	-0.2008D+00	0.5600D+00				
7 :	0.1062D-03	-0.2491D-03	0.8466D-01	0.9493D-01	-0.4466D+00	0.1449D+00	0.1580D+01			
8 :	-0.5606D-04	-0.2286D-02	-0.3674D-01	-0.1041D+00	-0.2140D+00	-0.6832D-01	-0.1483D+00	0.8642D+00		
9 :	-0.1622D-05	-0.8850D-04	-0.5182D-03	0.4669D-03	0.3425D-03	-0.2172D-03	0.1058D-02	-0.6684D-03	0.3321D-04	
10 :	-0.9489D-05	-0.6866D-03	-0.4450D-02	0.8867D-02	0.2670D-02	0.1685D-02	0.6558D-02	0.5209D-02	0.1041D-03	0.5097D-02

APPENDIX IV

VPA results for the strategy 1.. VPA analysis for ABFT for the period 1975 – 2023. Data for 2011 – 2023 ws simulated using projected Fs and Ns from the 2010 stock assessment

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****************************************
                    VPA-2BOX
          SUMMARY STATISTICS AND DIAGNOSTIC OUTPUT
          ****************************************

Strategy 1 Model        tagvpa1.co2
12:01, 17  February 2011

======================================================================
Total objective function =      714.55
    (with constants)   =   -18339.85
Number of parameters (P) =         42
Number of data points (D)=        234
AIC : 2*objective+2P    =   -36595.71
AICc: 2*objective+2P(...)=   -36576.80
BIC : 2*objective+Plog(D)=   -36450.58
Chi-square discrepancy   =      107.60

Loglikelihoods (deviance)=     -750.77 (     682.95)
  effort data          =     -43.10 (     169.97)
  tagging data         =    -707.66 (     512.98)

Log-posteriors          =       35.53
  catchability          =       0.00
  f-ratio               =       0.00
  natural mortality     =       0.00
  mixing coeff.         =       0.00
  initial tag survival  =       0.00
  tag shedding rate     =      17.00
  tag reporting rate    =      18.53
  tag nomixing factor   =       0.00

Constraints             =       0.69
  terminal F            =       0.00
  stock-rec./sex ratio  =       0.69

Out of bounds penalty   =       0.00
======================================================================
```

TABLE 1. FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.066	0.357	0.143	0.091	0.042	0.103	0.053	0.046	0.059	0.059
1976	0.009	0.265	0.463	0.120	0.097	0.030	0.066	0.030	0.047	0.047
1977	0.071	0.234	0.174	0.153	0.023	0.034	0.025	0.062	0.046	0.046
1978	0.135	0.352	0.175	0.083	0.041	0.011	0.024	0.013	0.036	0.036
1979	0.017	0.104	0.280	0.091	0.037	0.023	0.017	0.050	0.033	0.033
1980	0.111	0.240	0.405	0.187	0.030	0.034	0.030	0.016	0.035	0.035
1981	0.075	0.438	0.331	0.101	0.087	0.021	0.031	0.046	0.026	0.026
1982	0.240	0.390	0.479	0.171	0.067	0.041	0.022	0.076	0.054	0.054
1983	0.243	0.198	0.321	0.133	0.079	0.059	0.117	0.033	0.056	0.056

1984	0.108	0.449	0.121	0.130	0.129	0.094	0.085	0.116	0.062	0.062
1985	0.092	0.404	0.397	0.114	0.070	0.068	0.036	0.054	0.074	0.045
1986	0.276	0.317	0.241	0.148	0.032	0.046	0.041	0.032	0.071	0.043
1987	0.141	0.393	0.290	0.117	0.047	0.029	0.083	0.062	0.065	0.039
1988	0.337	0.209	0.384	0.161	0.057	0.041	0.049	0.074	0.098	0.059
1989	0.182	0.363	0.166	0.149	0.138	0.032	0.052	0.037	0.077	0.046
1990	0.170	0.235	0.309	0.127	0.161	0.054	0.053	0.073	0.091	0.055
1991	0.073	0.284	0.211	0.132	0.134	0.045	0.047	0.058	0.133	0.080
1992	0.075	0.271	0.343	0.085	0.068	0.060	0.101	0.126	0.154	0.092
1993	0.085	0.454	0.317	0.127	0.057	0.063	0.070	0.094	0.145	0.087
1994	0.111	0.262	0.185	0.077	0.114	0.087	0.177	0.198	0.336	0.202
1995	0.145	0.199	0.255	0.104	0.102	0.160	0.090	0.158	0.189	0.227
1996	0.163	0.420	0.315	0.238	0.114	0.057	0.102	0.080	0.215	0.258
1997	0.157	0.320	0.208	0.177	0.143	0.134	0.085	0.208	0.215	0.257
1998	0.091	0.480	0.341	0.243	0.110	0.251	0.040	0.045	0.138	0.165
1999	0.095	0.115	0.258	0.183	0.099	0.044	0.047	0.062	0.146	0.175
2000	0.241	0.215	0.118	0.151	0.169	0.130	0.051	0.081	0.094	0.113
2001	0.005	0.236	0.111	0.076	0.106	0.090	0.161	0.112	0.131	0.157
2002	0.018	0.249	0.162	0.076	0.036	0.095	0.061	0.104	0.116	0.139
2003	0.007	0.090	0.053	0.038	0.068	0.035	0.138	0.105	0.139	0.167
2004	0.028	0.086	0.096	0.033	0.019	0.046	0.051	0.081	0.138	0.166
2005	0.114	0.114	0.063	0.051	0.033	0.034	0.046	0.032	0.167	0.201
2006	0.113	0.095	0.099	0.030	0.014	0.046	0.024	0.036	0.106	0.127
2007	0.001	0.076	0.033	0.075	0.056	0.037	0.044	0.037	0.105	0.126
2008	0.000	0.077	0.044	0.071	0.037	0.031	0.035	0.045	0.054	0.065
2009	0.000	0.006	0.034	0.076	0.035	0.029	0.048	0.043	0.033	0.040
2010	0.000	0.006	0.007	0.119	0.048	0.057	0.038	0.034	0.028	0.033
2011	0.001	0.026	0.013	0.022	0.010	0.009	0.012	0.013	0.017	0.020
2012	0.001	0.023	0.012	0.019	0.009	0.008	0.011	0.011	0.014	0.017
2013	0.001	0.021	0.011	0.018	0.008	0.007	0.010	0.010	0.013	0.015
2014	0.001	0.020	0.010	0.016	0.008	0.006	0.009	0.009	0.012	0.014
2015	0.001	0.018	0.009	0.016	0.007	0.006	0.008	0.008	0.011	0.013
2016	0.004	0.017	0.009	0.014	0.007	0.006	0.007	0.008	0.009	0.011
2017	0.004	0.144	0.008	0.013	0.006	0.005	0.007	0.007	0.008	0.010
2018	0.009	0.123	0.072	0.011	0.005	0.004	0.006	0.006	0.008	0.009
2019	0.000	0.360	0.062	0.114	0.005	0.004	0.006	0.006	0.007	0.009
2020	0.000	0.007	0.230	0.101	0.052	0.004	0.005	0.005	0.007	0.008
2021	0.001	0.002	0.003	0.489	0.046	0.043	0.005	0.005	0.006	0.007
2022	0.001	0.042	0.001	0.005	0.326	0.038	0.058	0.005	0.006	0.007
2023	0.001	0.024	0.021	0.001	0.002	0.369	0.052	0.059	0.006	0.007

TABLE 2. ABUNDANCE AT THE BEGINNING OF THE YEAR [BY AREA] FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	1647812.	1310362.	693631.	309047.	320645.	89633.	98828.	83092.	82807.	1003416.
1976	2443979.	944741.	721506.	472859.	221860.	241742.	66233.	78697.	68331.	924544.
1977	1241120.	1483696.	569872.	357156.	330033.	158461.	192060.	52038.	65708.	855699.

1978	983314.	708249.	923623.	376803.	241189.	253709.	125459.	157236.	42101.	794834.
1979	1217362.	526436.	391801.	609632.	272775.	182176.	205399.	102806.	133620.	729730.
1980	1837705.	733423.	373182.	232987.	437890.	206790.	145721.	169534.	84132.	753154.
1981	1591899.	1007588.	454011.	195699.	152075.	334340.	163576.	118736.	143607.	729836.
1982	2552599.	904614.	511342.	256586.	139173.	109616.	268124.	133165.	97623.	766544.
1983	3865235.	1229850.	481948.	249235.	170097.	102406.	86144.	220234.	106247.	738686.
1984	1997715.	1856361.	793858.	274991.	171656.	123609.	79025.	64329.	183327.	720412.
1985	1807518.	1098235.	931582.	553387.	189950.	118682.	92157.	60949.	49310.	764461.
1986	3145123.	1009801.	576717.	492937.	388584.	139311.	90792.	74605.	49719.	701907.
1987	2237559.	1462705.	578678.	356368.	334407.	296089.	108969.	73148.	62200.	649543.
1988	3433153.	1190626.	776971.	340511.	249319.	251100.	235394.	84222.	59186.	616817.
1989	3444540.	1501343.	759646.	416355.	227992.	185290.	197354.	188218.	67293.	573569.
1990	3517900.	1758514.	821447.	505964.	282114.	156256.	146879.	157313.	156148.	550635.
1991	4365415.	1818844.	1093810.	474281.	350493.	188940.	121208.	116955.	125806.	597495.
1992	4018385.	2486427.	1077117.	696468.	326892.	241066.	147864.	97049.	94956.	596424.
1993	4335174.	2284576.	1491323.	601130.	503342.	240276.	185942.	112153.	73644.	563826.
1994	3655053.	2439210.	1140962.	854754.	416285.	373879.	184624.	145468.	87909.	523864.
1995	4116868.	2004008.	1476644.	745941.	622273.	292035.	280625.	129809.	102735.	442945.
1996	3715443.	2180759.	1291935.	900481.	528898.	442106.	203668.	215374.	95354.	394616.
1997	2650591.	1934065.	1127635.	741604.	558102.	371324.	341753.	154460.	171203.	343825.
1998	5024177.	1387728.	1104469.	720204.	488509.	380387.	265980.	263613.	107938.	362402.
1999	4054961.	2811062.	675767.	617805.	444446.	344223.	242295.	214618.	216902.	360939.
2000	5196280.	2259993.	1970542.	410640.	404894.	316752.	269580.	193972.	173613.	439704.
2001	4089991.	2500692.	1434176.	1377595.	277632.	269013.	227668.	215072.	153952.	494656.
2002	4311754.	2493256.	1553233.	1009485.	1004094.	196357.	201328.	162674.	165552.	501885.
2003	5262661.	2595171.	1528753.	1039495.	736272.	761963.	146253.	159029.	126189.	525147.
2004	7297551.	3200017.	1866180.	1140186.	787514.	541263.	602677.	106994.	123246.	498874.
2005	3698018.	4347831.	2310606.	1333034.	867641.	608056.	423120.	480611.	84909.	477042.

2006	2706476.	2021948.	3050228.	1706582.	996192.	660601.	481045.	339360.	400601.	416603.
2007	1558677.	1481475.	1447024.	2173726.	1302694.	773056.	516459.	394254.	281779.	650065.
2008	6505731.	953715.	1079677.	1101090.	1586662.	969319.	610041.	415077.	326900.	742573.
2009	7078303.	3984994.	694459.	812391.	806911.	1202490.	769080.	494367.	341593.	902892.
2010	7494309.	4335316.	3114686.	528161.	592342.	613015.	956701.	615337.	407703.	1077053.
2011	7272560.	4590171.	3390256.	2431963.	368801.	444235.	474094.	772833.	511818.	1293118.
2012	7718710.	4452177.	3517780.	2631752.	1872185.	287166.	360603.	393148.	656886.	1591380.
2013	8017440.	4725635.	3422507.	2734749.	2030415.	1459863.	233327.	299520.	334702.	1987602.
2014	8323548.	4908829.	3639436.	2663428.	2113590.	1584209.	1187127.	194001.	255291.	2064030.
2015	8245297.	5096457.	3786374.	2833737.	2061145.	1650152.	1288829.	987785.	165481.	2065084.
2016	920265.	5048675.	3937480.	2950474.	2194393.	1609845.	1343009.	1073067.	843292.	1989303.
2017	973817.	561389.	3903619.	3070810.	2287909.	1714591.	1310612.	1118974.	916690.	2516803.
2018	344976.	594428.	382480.	3046881.	2385346.	1789264.	1396748.	1092651.	956655.	3055534.
2019	15109971.	209361.	413274.	280088.	2369367.	1866424.	1458382.	1165202.	934617.	3578174.
2020	51198152.	9254901.	114903.	305416.	196495.	1854612.	1521784.	1217266.	997180.	4027814.
2021	2297106.	31363704.	7232303.	71849.	217121.	146674.	1512640.	1270705.	1042236.	4486675.
2022	3252433.	1405514.	24631759.	5671120.	34658.	163052.	115043.	1263581.	1088231.	4943655.
2023	3252262.	1991105.	1060411.	19361008.	4439434.	19680.	128463.	91129.	1082557.	5397732.
2024		1991064.	1528810.	817090.	15211776.	3484624.	11138.	102331.	73975.	5801974.

TABLE 3. CATCH OF East of 45

	1	2	3	4	5	6	7	8	9	10
1975	83784.	352022.	82482.	24055.	11863.	7932.	4665.	3441.	4480.	54950.
1976	17501.	196886.	239994.	47505.	18187.	6492.	3896.	2187.	2948.	40376.
1977	67420.	276479.	81061.	45074.	6677.	4738.	4363.	2903.	2778.	36620.
1978	98571.	188169.	132603.	26750.	8539.	2569.	2746.	1850.	1398.	26717.

1979	15968.	46352.	85484.	47174.	8803.	3802.	3158.	4700.	4051.	22395.
1980	153268.	139588.	111494.	35392.	11439.	6346.	3925.	2495.	2715.	24603.
1981	91413.	320656.	114393.	16726.	11334.	6214.	4537.	4938.	3506.	18037.
1982	435146.	261565.	174574.	35996.	8002.	3990.	5295.	9037.	4835.	38429.
1983	666700.	196954.	118435.	27650.	11539.	5339.	8741.	6724.	5468.	38481.
1984	162819.	602874.	80533.	29876.	18523.	10029.	5897.	6546.	10420.	41447.
1985	126331.	327195.	273250.	52930.	11441.	7067.	3014.	2958.	3329.	31801.
1986	605591.	245280.	110492.	60475.	10838.	5638.	3356.	2173.	3201.	27826.
1987	233815.	425594.	130379.	35130.	13521.	7777.	7936.	4073.	3661.	23513.
1988	787367.	200806.	221887.	45198.	12256.	9116.	10264.	5612.	5200.	33542.
1989	457214.	409308.	103865.	51467.	26166.	5342.	9140.	6317.	4674.	24558.
1990	436998.	328718.	195472.	53837.	37392.	7450.	6938.	10362.	12813.	27930.
1991	243244.	401949.	186084.	52344.	39257.	7563.	5140.	6163.	14736.	43603.
1992	229346.	527897.	280116.	50401.	19089.	12662.	13102.	10683.	12770.	50171.
1993	280527.	748303.	362086.	64110.	24965.	13406.	11620.	9313.	9358.	44738.
1994	304847.	502294.	171942.	56713.	40131.	28248.	27583.	24303.	23658.	91143.
1995	443084.	322790.	296579.	65551.	53670.	39327.	22103.	17701.	16646.	85605.
1996	444406.	669904.	312384.	170612.	50658.	22396.	18070.	15305.	17362.	85496.
1997	306609.	474221.	189334.	107589.	66458.	42200.	25467.	27051.	31144.	74425.
1998	345669.	474502.	285613.	138652.	45367.	76858.	9470.	10785.	13079.	52631.
1999	290410.	272684.	137390.	91981.	37213.	13567.	10306.	11996.	27670.	55145.
2000	889625.	389997.	195408.	51453.	56121.	35131.	12280.	14041.	14718.	44863.
2001	15982.	469971.	134430.	90060.	24959.	20977.	31157.	21135.	17744.	68378.
2002	59817.	491266.	206724.	65445.	31542.	16089.	10914.	14936.	17076.	62174.
2003	31034.	198423.	70574.	34139.	42902.	23442.	17278.	14727.	15451.	77055.
2004	158681.	233924.	152822.	33095.	12919.	22189.	27680.	7756.	14995.	72743.
2005	315743.	419028.	125613.	59295.	24776.	18596.	17314.	14100.	12307.	82641.
2006	228908.	162488.	255561.	44959.	11960.	27029.	10456.	11129.	37839.	47308.

2007	1510.	96996.	42050.	139516.	62706.	25349.	20195.	13425.	26398.	73222.
2008	755.	63119.	41758.	67048.	51597.	27174.	19392.	16913.	16230.	44546.
2009	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2010	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2011	4138.	105125.	39701.	46206.	3325.	3438.	5285.	8951.	7954.	24372.
2012	3954.	90136.	36666.	44991.	14528.	1976.	3487.	3976.	8529.	25066.
2013	3706.	88052.	32583.	42548.	14664.	8980.	2041.	2705.	3922.	28258.
2014	3572.	84855.	32934.	38430.	14078.	9098.	9572.	1616.	2753.	27008.
2015	3367.	80876.	31654.	39230.	13011.	8875.	9671.	7446.	1625.	24609.
2016	3087.	76677.	29974.	37334.	13095.	8212.	9202.	7449.	7445.	21315.
2017	2785.	67016.	26931.	34188.	11842.	7790.	8258.	6966.	7282.	24267.
2018	2557.	61544.	23521.	30957.	11261.	7252.	7989.	6298.	6867.	26624.
2019	2416.	56673.	22267.	26995.	10388.	6986.	7633.	6170.	6276.	29168.
2020	1970.	54101.	21047.	26191.	8932.	6407.	7399.	5907.	6183.	30319.
2021	2261.	44913.	20328.	24947.	8758.	5588.	6798.	5902.	6089.	31823.
2022	1846.	51129.	16883.	24464.	8626.	5574.	5955.	5410.	6038.	33302.
2023	1752.	42345.	19288.	20493.	8543.	5541.	6024.	4816.	5594.	33865.

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TABLE 4. SPAWNING STOCK FECUNDITY AND RECRUITMENT OF East of 45

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year	spawning biomass	recruits from VPA
1975	299539.	1647812.
1976	297378.	2443979.
1977	287558.	1241120.
1978	275539.	983314.
1979	264044.	1217362.
1980	259938.	1837705.
1981	242061.	1591899.
1982	239864.	2552599.
1983	216162.	3865235.
1984	208847.	1997715.
1985	219233.	1807518.
1986	215868.	3145123.
1987	209425.	2237559.
1988	207591.	3433153.

1989	208794.	3444540.
1990	193957.	3517900.
1991	191223.	4365415.
1992	196050.	4018385.
1993	207063.	4335174.
1994	198723.	3655053.
1995	198397.	4116868.
1996	194544.	3715443.
1997	186384.	2650591.
1998	188519.	5024177.
1999	194718.	4054961.
2000	198373.	5196280.
2001	197478.	4089991.
2002	228786.	4311754.
2003	247385.	5262661.
2004	262940.	7297551.
2005	284287.	3698018.
2006	319970.	2706476.
2007	384507.	1558677.
2008	450468.	6505731.
2009	480514.	7078303.
2010	500062.	7494309.
2011	547690.	7272560.
2012	642998.	7718710.
2013	752109.	8017440.
2014	842760.	8323548.
2015	888222.	8245297.
2016	1024852.	920265.
2017	1158627.	973817.
2018	1278026.	344976.
2019	1320222.	15109971.
2020	1348637.	51198152.
2021	1344218.	2297106.
2022	1491450.	3252433.
2023	1788569.	3252262.

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TABLE 5. FITS TO INDEX DATA FOR East of 45

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5.1 ESP

Lognormal dist.
average numbers
Ages 6 - 10
log-likelihood = 1.53
deviance = 11.23
Chi-sq. discrepancy= 6.56

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1981	0.179	0.145	0.034	0.782	0.320E-02	3145.860	3040.714	0.067
1982	0.457	0.131	0.325	0.782	0.320E-02	4151.930	2999.426	0.000
1983	0.515	0.099	0.416	0.782	0.320E-02	4402.080	2904.627	0.016

1984	0.613	0.060	0.553	0.782	0.320E-02	4854.680	2793.243	0.093
1985	0.223	0.000	0.224	0.782	0.320E-02	3288.160	2629.473	0.007
1986	-0.525	-0.060	-0.465	0.782	0.320E-02	1556.120	2477.611	0.343
1987	-0.428	-0.073	-0.356	0.782	0.320E-02	1713.630	2445.758	0.278
1988	0.426	-0.082	0.508	0.782	0.320E-02	4026.800	2422.915	0.060
1989	-0.229	-0.083	-0.146	0.782	0.320E-02	2091.120	2419.728	0.157
1990	-0.078	-0.074	-0.004	0.782	0.320E-02	2433.100	2443.677	0.084
1991	0.088	-0.083	0.171	0.782	0.320E-02	2871.900	2420.024	0.019
1992	-0.739	-0.116	-0.623	0.782	0.320E-02	1256.650	2343.112	0.434
1993	-0.757	-0.151	-0.606	0.782	0.320E-02	1233.910	2262.325	0.425
1994	-0.652	-0.190	-0.462	0.782	0.320E-02	1370.230	2174.009	0.341
1995	-1.085	-0.271	-0.814	0.782	0.320E-02	888.940	2005.731	0.539
1996	-0.498	-0.279	-0.219	0.782	0.320E-02	1598.010	1989.088	0.198
1997	0.356	-0.277	0.633	0.782	0.320E-02	3754.010	1993.909	0.178
1998	0.407	-0.238	0.645	0.782	0.320E-02	3950.270	2072.408	0.194
1999	0.529	-0.171	0.700	0.782	0.320E-02	4463.560	2216.081	0.278
2000	0.260	-0.111	0.372	0.782	0.320E-02	3411.810	2352.977	0.006
2001	0.809	-0.096	0.905	0.782	0.320E-02	5907.800	2389.117	0.802
2002	0.478	-0.123	0.601	0.782	0.320E-02	4240.520	2325.798	0.140
2003	-0.084	-0.046	-0.038	0.782	0.320E-02	2417.060	2510.673	0.100
2004	-0.690	0.004	-0.694	0.782	0.320E-02	1319.610	2640.255	0.474
2005	-0.012	0.104	-0.116	0.782	0.320E-02	2598.590	2917.900	0.140
2006	-0.068	0.258	-0.326	0.782	0.320E-02	2456.740	3404.351	0.260
2007	0.339	0.410	-0.071	0.782	0.320E-02	3690.980	3963.524	0.117
2008	-0.069	0.566	-0.635	0.782	0.320E-02	2455.050	4630.953	0.441
2009	0.236	0.748	-0.512	0.782	0.320E-02	3330.170	5555.789	0.370

Selectivities by age

Year	6	7	8	9	10
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1981	0.178	0.300	0.517	0.822	1.000
1982	0.178	0.300	0.517	0.822	1.000
1983	0.178	0.300	0.517	0.822	1.000
1984	0.178	0.300	0.517	0.822	1.000
1985	0.178	0.300	0.517	0.822	1.000
1986	0.178	0.300	0.517	0.822	1.000
1987	0.178	0.300	0.517	0.822	1.000
1988	0.178	0.300	0.517	0.822	1.000
1989	0.178	0.300	0.517	0.822	1.000
1990	0.178	0.300	0.517	0.822	1.000
1991	0.178	0.300	0.517	0.822	1.000
1992	0.178	0.300	0.517	0.822	1.000
1993	0.178	0.300	0.517	0.822	1.000
1994	0.178	0.300	0.517	0.822	1.000
1995	0.178	0.300	0.517	0.822	1.000
1996	0.178	0.300	0.517	0.822	1.000
1997	0.178	0.300	0.517	0.822	1.000
1998	0.178	0.300	0.517	0.822	1.000
1999	0.178	0.300	0.517	0.822	1.000
2000	0.178	0.300	0.517	0.822	1.000
2001	0.178	0.300	0.517	0.822	1.000
2002	0.178	0.300	0.517	0.822	1.000
2003	0.178	0.300	0.517	0.822	1.000
2004	0.178	0.300	0.517	0.822	1.000
2005	0.178	0.300	0.517	0.822	1.000
2006	0.178	0.300	0.517	0.822	1.000
2007	0.178	0.300	0.517	0.822	1.000

2008	0.178	0.300	0.517	0.822	1.000
2009	0.178	0.300	0.517	0.822	1.000

5.2 ESP1

Not used

5.3 ESP2

Lognormal dist.
average numbers
Ages 2 - 2
log-likelihood = -26.08
deviance = 68.42
Chi-sq. discrepancy= 34.97

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1975	0.593	-0.246	0.839	0.782	0.936E-04	213.720	92.379	0.589
1976	0.214	-0.532	0.746	0.782	0.936E-04	146.320	69.421	0.363
1977	0.599	-0.066	0.665	0.782	0.936E-04	215.130	110.615	0.223
1978	-0.453	-0.859	0.406	0.782	0.936E-04	75.110	50.036	0.013
1979	-1.226	-1.042	-0.185	0.782	0.936E-04	34.670	41.697	0.178
1980	-0.532	-0.773	0.241	0.782	0.936E-04	69.410	54.538	0.005
1981	-0.219	-0.545	0.327	0.782	0.936E-04	94.950	68.490	0.001
1982	0.081	-0.631	0.712	0.782	0.936E-04	128.090	62.837	0.299
1983	0.006	-0.237	0.243	0.782	0.936E-04	118.830	93.238	0.004
1984	1.413	0.061	1.353	0.782	0.936E-04	485.620	125.558	4.062
1985	1.174	-0.444	1.618	0.782	0.936E-04	382.160	75.796	8.751
1986	-0.302	-0.489	0.187	0.782	0.936E-04	87.360	72.488	0.015
1987	1.269	-0.152	1.421	0.782	0.936E-04	420.300	101.469	4.999
1988	-0.825	-0.275	-0.550	0.782	0.936E-04	51.800	89.779	0.392
1989	1.419	-0.113	1.531	0.782	0.936E-04	488.140	105.542	6.883
1990	-0.083	0.104	-0.186	0.782	0.936E-04	108.780	131.054	0.179
1991	0.370	0.115	0.255	0.782	0.936E-04	171.110	132.532	0.003
1992	0.768	0.433	0.334	0.782	0.936E-04	254.590	182.233	0.001
1993	1.297	0.266	1.031	0.782	0.936E-04	432.270	154.192	1.348
1994	-1.221	0.418	-1.640	0.782	0.936E-04	34.840	179.534	0.872
1995	0.500	0.251	0.249	0.782	0.936E-04	194.750	151.840	0.004
1996	0.349	0.235	0.114	0.782	0.936E-04	167.510	149.474	0.036
1997	0.075	0.160	-0.084	0.782	0.936E-04	127.410	138.616	0.124
1998	-0.620	-0.243	-0.377	0.782	0.936E-04	63.560	92.622	0.290
1999	-3.557	0.628	-4.185	0.782	0.936E-04	3.370	221.485	1.161
2000	-0.979	0.364	-1.343	0.782	0.936E-04	44.400	169.991	0.774
2001	1.047	0.455	0.592	0.782	0.936E-04	336.760	186.243	0.131
2002	1.114	0.446	0.668	0.782	0.936E-04	359.870	184.590	0.226
2003	-0.351	0.560	-0.911	0.782	0.936E-04	83.220	206.948	0.588
2004	-0.299	0.772	-1.071	0.782	0.936E-04	87.650	255.677	0.663
2005	0.129	1.065	-0.936	0.782	0.936E-04	134.470	342.695	0.600
2006	-0.119	0.309	-0.428	0.782	0.936E-04	104.880	160.872	0.321
2007	-1.631	0.006	-1.637	0.782	0.936E-04	23.120	118.888	0.871

Selectivities by age

Year	2
1975	1.000
1976	1.000
1977	1.000
1978	1.000
1979	1.000
1980	1.000
1981	1.000
1982	1.000
1983	1.000
1984	1.000
1985	1.000
1986	1.000
1987	1.000
1988	1.000
1989	1.000
1990	1.000
1991	1.000
1992	1.000
1993	1.000
1994	1.000
1995	1.000
1996	1.000
1997	1.000
1998	1.000
1999	1.000
2000	1.000
2001	1.000
2002	1.000
2003	1.000
2004	1.000
2005	1.000
2006	1.000
2007	1.000

5.4 ESP3

Lognormal dist.
average numbers
Ages 3 - 3
log-likelihood = -22.55
deviance = 61.37
Chi-sq. discrepancy= 47.98

Year	Observed	Residuals Predicted	Standard (Obs-pred)	Q Deviation	Untransfrmd Catchabil.	Untransfrmd Observed	Chi-square Predicted	Discrepancy
1975	0.331	-0.275	0.606	0.782	0.461E-04	48.740	26.577	0.146
1976	0.588	-0.382	0.970	0.782	0.461E-04	63.040	23.899	1.057
1977	1.056	-0.486	1.542	0.782	0.461E-04	100.630	21.526	7.094
1978	-0.870	-0.004	-0.866	0.782	0.461E-04	14.670	34.859	0.565
1979	0.720	-0.910	1.630	0.782	0.461E-04	71.910	14.093	9.042
1980	-0.252	-1.015	0.763	0.782	0.461E-04	27.200	12.682	0.400
1981	-1.856	-0.786	-1.071	0.782	0.461E-04	5.470	15.957	0.663

1982	0.198	-0.733	0.931	0.782	0.461E-04	42.670	16.822	0.896
1983	-0.874	-0.722	-0.153	0.782	0.461E-04	14.600	17.012	0.161
1984	1.284	-0.130	1.414	0.782	0.461E-04	126.380	30.737	4.890
1985	1.149	-0.096	1.245	0.782	0.461E-04	110.430	31.786	2.888
1986	-0.364	-0.506	0.141	0.782	0.461E-04	24.320	21.112	0.027
1987	-1.176	-0.525	-0.651	0.782	0.461E-04	10.800	20.715	0.450
1988	-1.614	-0.272	-1.342	0.782	0.461E-04	6.970	26.661	0.774
1989	-1.444	-0.195	-1.249	0.782	0.461E-04	8.260	28.792	0.738
1990	0.150	-0.183	0.333	0.782	0.461E-04	40.680	29.152	0.001
1991	-0.382	0.148	-0.531	0.782	0.461E-04	23.880	40.599	0.381
1992	-1.067	0.073	-1.140	0.782	0.461E-04	12.040	37.642	0.694
1993	1.670	0.410	1.260	0.782	0.461E-04	185.980	52.749	3.031
1994	0.250	0.203	0.047	0.782	0.461E-04	44.930	42.871	0.062
1995	0.588	0.428	0.160	0.782	0.461E-04	63.030	53.729	0.022
1996	1.306	0.267	1.039	0.782	0.461E-04	129.240	45.728	1.391
1997	1.727	0.180	1.547	0.782	0.461E-04	196.790	41.914	7.181
1998	0.359	0.099	0.260	0.782	0.461E-04	50.100	38.638	0.002
1999	-0.974	-0.355	-0.620	0.782	0.461E-04	13.210	24.549	0.433
2000	-0.010	0.781	-0.791	0.782	0.461E-04	34.650	76.399	0.526
2001	0.610	0.466	0.144	0.782	0.461E-04	64.420	55.782	0.026
2002	1.481	0.522	0.959	0.782	0.461E-04	153.960	59.001	1.011
2003	-1.012	0.557	-1.569	0.782	0.461E-04	12.730	61.112	0.851
2004	-1.184	0.736	-1.921	0.782	0.461E-04	10.710	73.090	0.945
2005	0.609	0.966	-0.357	0.782	0.461E-04	64.340	91.940	0.279
2006	-1.040	1.226	-2.267	0.782	0.461E-04	12.370	119.333	1.013
2007	0.045	0.512	-0.467	0.782	0.461E-04	36.620	58.400	0.344

Selectivities by age

Year	3
----	-----
1975	1.000
1976	1.000
1977	1.000
1978	1.000
1979	1.000
1980	1.000
1981	1.000
1982	1.000
1983	1.000
1984	1.000
1985	1.000
1986	1.000
1987	1.000
1988	1.000
1989	1.000
1990	1.000
1991	1.000
1992	1.000
1993	1.000
1994	1.000
1995	1.000
1996	1.000
1997	1.000
1998	1.000
1999	1.000
2000	1.000
2001	1.000

2002	1.000
2003	1.000
2004	1.000
2005	1.000
2006	1.000
2007	1.000

5.5 ESP4

Not used

5.6 ESP5

Not used

5.7 JJL

Lognormal dist.
average numbers
Ages 6 - 10
log-likelihood = 2.36
deviance = 12.52
Chi-sq. discrepancy= 7.13

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1975	0.361	0.199	0.162	0.782	0.147E-05	1.900	1.615	0.021
1976	0.485	0.135	0.350	0.782	0.147E-05	2.150	1.515	0.002
1977	0.981	0.077	0.904	0.782	0.147E-05	3.530	1.430	0.797
1978	0.125	0.078	0.047	0.782	0.147E-05	1.500	1.432	0.062
1979	0.713	0.062	0.650	0.782	0.147E-05	2.700	1.409	0.201
1980	0.244	0.080	0.164	0.782	0.147E-05	1.690	1.434	0.021
1981	0.208	0.095	0.113	0.782	0.147E-05	1.630	1.456	0.037
1982	0.919	0.091	0.829	0.782	0.147E-05	3.320	1.450	0.561
1983	0.471	0.076	0.395	0.782	0.147E-05	2.120	1.428	0.010
1984	0.202	-0.004	0.206	0.782	0.147E-05	1.620	1.318	0.011
1985	0.279	-0.067	0.345	0.782	0.147E-05	1.750	1.239	0.002
1986	-0.003	-0.120	0.117	0.782	0.147E-05	1.320	1.174	0.035
1987	0.489	-0.133	0.623	0.782	0.147E-05	2.160	1.159	0.166
1988	0.019	-0.131	0.151	0.782	0.147E-05	1.350	1.161	0.024
1989	-0.232	-0.100	-0.132	0.782	0.147E-05	1.050	1.198	0.149
1990	0.063	-0.101	0.164	0.782	0.147E-05	1.410	1.196	0.021
1991	-0.090	-0.126	0.036	0.782	0.147E-05	1.210	1.168	0.066
1992	-0.251	-0.164	-0.087	0.782	0.147E-05	1.030	1.124	0.125
1993	-0.241	-0.190	-0.051	0.782	0.147E-05	1.040	1.095	0.107
1994	-0.167	-0.220	0.053	0.782	0.147E-05	1.120	1.062	0.059
1995	0.070	-0.292	0.362	0.782	0.147E-05	1.420	0.989	0.004
1996	-0.974	-0.273	-0.701	0.782	0.147E-05	0.500	1.008	0.478
1997	-0.916	-0.284	-0.631	0.782	0.147E-05	0.530	0.996	0.439
1998	-0.623	-0.211	-0.412	0.782	0.147E-05	0.710	1.072	0.311
1999	-0.727	-0.167	-0.560	0.782	0.147E-05	0.640	1.121	0.398
2000	-0.582	-0.119	-0.463	0.782	0.147E-05	0.740	1.176	0.342

2001	-0.322	-0.102	-0.219	0.782	0.147E-05	0.960	1.195	0.198
2002	0.437	-0.144	0.581	0.782	0.147E-05	2.050	1.147	0.119
2003	0.250	-0.082	0.332	0.782	0.147E-05	1.700	1.220	0.001
2004	-0.479	-0.023	-0.456	0.782	0.147E-05	0.820	1.294	0.338
2005	-0.409	0.159	-0.567	0.782	0.147E-05	0.880	1.552	0.402
2006	0.366	0.271	0.096	0.782	0.147E-05	1.910	1.736	0.043
2007	-0.343	0.418	-0.760	0.782	0.147E-05	0.940	2.011	0.510
2008	-0.082	0.566	-0.648	0.782	0.147E-05	1.220	2.332	0.448
2009	-0.241	0.748	-0.989	0.782	0.147E-05	1.040	2.796	0.626

Selectivities by age

Year	6	7	8	9	10
----	-----	-----	-----	-----	-----
1975	0.172	0.351	0.802	0.849	1.000
1976	0.172	0.351	0.802	0.849	1.000
1977	0.172	0.351	0.802	0.849	1.000
1978	0.172	0.351	0.802	0.849	1.000
1979	0.172	0.351	0.802	0.849	1.000
1980	0.172	0.351	0.802	0.849	1.000
1981	0.172	0.351	0.802	0.849	1.000
1982	0.172	0.351	0.802	0.849	1.000
1983	0.172	0.351	0.802	0.849	1.000
1984	0.172	0.351	0.802	0.849	1.000
1985	0.172	0.351	0.802	0.849	1.000
1986	0.172	0.351	0.802	0.849	1.000
1987	0.172	0.351	0.802	0.849	1.000
1988	0.172	0.351	0.802	0.849	1.000
1989	0.172	0.351	0.802	0.849	1.000
1990	0.172	0.351	0.802	0.849	1.000
1991	0.172	0.351	0.802	0.849	1.000
1992	0.172	0.351	0.802	0.849	1.000
1993	0.172	0.351	0.802	0.849	1.000
1994	0.172	0.351	0.802	0.849	1.000
1995	0.172	0.351	0.802	0.849	1.000
1996	0.172	0.351	0.802	0.849	1.000
1997	0.172	0.351	0.802	0.849	1.000
1998	0.172	0.351	0.802	0.849	1.000
1999	0.172	0.351	0.802	0.849	1.000
2000	0.172	0.351	0.802	0.849	1.000
2001	0.172	0.351	0.802	0.849	1.000
2002	0.172	0.351	0.802	0.849	1.000
2003	0.172	0.351	0.802	0.849	1.000
2004	0.172	0.351	0.802	0.849	1.000
2005	0.172	0.351	0.802	0.849	1.000
2006	0.172	0.351	0.802	0.849	1.000
2007	0.172	0.351	0.802	0.849	1.000
2008	0.172	0.351	0.802	0.849	1.000
2009	0.172	0.351	0.802	0.849	1.000

5.8 MAR

Not used

5.9 ESPT

Not used

5.10 ESPH

Lognormal dist.
average biomass
Ages 2 - 3
log-likelihood = 0.00
deviance = 0.00
Chi-sq. discrepancy= 0.00

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy

Selectivities by age

Year	2	3

5.11 NOR

Lognormal dist.
average biomass
Ages 10 - 10
log-likelihood = -1.18
deviance = 5.32
Chi-sq. discrepancy= 1.81

Year	Observed	Predicted	Residuals (Obs-pred)	Standard Deviation	Q Catchabil.	Untransfrmd Observed	Untransfrmd Predicted	Chi-square Discrepancy
1975	0.759	0.143	0.616	0.782	0.835E-07	38.000	20.524	0.157
1976	0.174	0.122	0.052	0.782	0.835E-07	21.160	20.085	0.059
1977	0.870	0.057	0.813	0.782	0.835E-07	42.444	18.821	0.520
1978	-0.371	-0.024	-0.347	0.782	0.835E-07	12.278	17.368	0.273
1979	-1.557	-0.140	-1.416	0.782	0.835E-07	3.750	15.457	0.801
1980	0.124	-0.157	0.282	0.782	0.835E-07	20.143	15.197	0.001

Selectivities by age

Year	10
1975	1.000
1976	1.000
1977	1.000
1978	1.000
1979	1.000
1980	1.000

5.12 JAP

Lognormal dist.

month 1 numbers
Ages 4 - 10
log-likelihood = 2.82
deviance = 11.12
Chi-sq. discrepancy= 9.14

Year	Observed	Residuals Predicted	Standard (Obs-pred)	Q Deviation	Untransfrmd Catchabil.	Untransfrmd Observed	Chi-square Predicted	Discrepancy
1990	-1.363	-0.971	-0.392	0.782	0.844E-06	0.350	0.518	0.299
1991	-1.134	-0.982	-0.152	0.782	0.844E-06	0.440	0.512	0.160
1992	-0.574	-0.932	0.358	0.782	0.844E-06	0.770	0.538	0.003
1993	-0.601	-0.918	0.318	0.782	0.844E-06	0.750	0.546	0.000
1994	-0.418	-0.720	0.302	0.782	0.844E-06	0.900	0.666	0.000
1995	-0.364	-0.784	0.420	0.782	0.844E-06	0.950	0.624	0.017
1996	0.615	-0.611	1.226	0.782	0.844E-06	2.530	0.743	2.709
1997	0.170	-0.618	0.788	0.782	0.844E-06	1.620	0.737	0.456
1998	-0.475	-0.630	0.155	0.782	0.844E-06	0.850	0.728	0.023
1999	-0.139	-0.621	0.482	0.782	0.844E-06	1.190	0.735	0.044
2000	-0.114	-0.672	0.558	0.782	0.844E-06	1.220	0.698	0.098
2001	0.052	-0.722	0.773	0.782	0.844E-06	1.440	0.665	0.422
2002	-0.209	-0.800	0.591	0.782	0.844E-06	1.110	0.615	0.130
2003	-0.182	-0.286	0.104	0.782	0.844E-06	1.140	1.028	0.040
2004	-0.283	-0.327	0.044	0.782	0.844E-06	1.030	0.986	0.063
2005	-0.614	-0.192	-0.422	0.782	0.844E-06	0.740	1.128	0.317
2006	-0.452	-0.033	-0.419	0.782	0.844E-06	0.870	1.323	0.315
2007	-0.429	0.069	-0.498	0.782	0.844E-06	0.890	1.465	0.362
2008	-0.255	0.230	-0.485	0.782	0.844E-06	1.060	1.722	0.354
2009	0.119	0.386	-0.268	0.782	0.844E-06	1.540	2.013	0.226
2010	0.157	0.228	-0.071	0.782	0.844E-06	1.600	1.718	0.117
2011	0.177	0.169	0.008	0.782	0.844E-06	1.632	1.619	0.079
2012	0.235	0.108	0.127	0.782	0.844E-06	1.730	1.524	0.032
2013	0.293	0.527	-0.233	0.782	0.844E-06	1.834	2.315	0.206
2014	0.352	0.679	-0.327	0.782	0.844E-06	1.944	2.695	0.261
2015	0.410	0.820	-0.410	0.782	0.844E-06	2.060	3.104	0.310
2016	0.468	0.953	-0.484	0.782	0.844E-06	2.184	3.545	0.354
2017	0.526	1.030	-0.503	0.782	0.844E-06	2.315	3.829	0.365
2018	0.585	1.093	-0.508	0.782	0.844E-06	2.454	4.078	0.368
2019	0.643	1.138	-0.495	0.782	0.844E-06	2.601	4.267	0.360
2020	0.701	1.155	-0.453	0.782	0.844E-06	2.757	4.338	0.336
2021	0.699	0.813	-0.115	0.782	0.844E-06	2.750	3.084	0.140
2022	0.702	0.721	-0.019	0.782	0.844E-06	2.760	2.813	0.091
2023	0.702	0.701	0.002	0.782	0.844E-06	2.760	2.755	0.081

Selectivities by age

Year	4	5	6	7	8	9	10
1990	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1991	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1992	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1993	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1994	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1995	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1996	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1997	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1998	0.022	0.067	1.000	0.446	0.562	0.751	0.304
1999	0.022	0.067	1.000	0.446	0.562	0.751	0.304

2000	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2001	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2002	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2003	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2004	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2005	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2006	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2007	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2008	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2009	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2010	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2011	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2012	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2013	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2014	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2015	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2016	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2017	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2018	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2019	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2020	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2021	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2022	0.022	0.067	1.000	0.446	0.562	0.751	0.304
2023	0.022	0.067	1.000	0.446	0.562	0.751	0.304

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TABLE 6. FITS TO TAGS RELEASED IN HOME RANGE OF East of 45
Multinomial dist.
log-likelihood = -707.66
deviance = 512.98

```
 Release  Recapture        Recaptures by year following release
 Year  Age   Area   Type     1    2    3    4    5    6    7    8    9    10    11    12    13    14
15  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32
33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49
==========================================================================
 2011   1    1    obsd    0.00   0.00   0.00   0.00  30.00   0.00   0.00   0.00   0.00   0.00   0.00
0.00   0.00
                pred    0.49  15.50   4.37   4.24   1.64   0.67   0.54   0.33   0.27   0.21   0.18   0.10
0.07
 2012   1    1    obsd    0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
2.00
                pred    0.18   6.99   2.15   2.93   0.63   0.30   0.25   0.15   0.12   0.12   0.07   0.05
 2012   2    1    obsd    0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
10.00
                pred    6.88   4.25   4.28   1.72   0.73   0.61   0.39   0.32   0.26   0.23   0.13   0.10
 2013   2    1    obsd    0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00  15.00   0.00   0.00
                pred    6.20   4.18   5.91   1.33   0.66   0.56   0.36   0.30   0.31   0.18   0.14
 2013   3    1    obsd    0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   8.00   0.00   0.00
                pred    3.12   6.38   2.44   0.99   0.79   0.48   0.38   0.29   0.25   0.13   0.10
==========================================================================
```

TOTAL NUMBER OF FUNCTION EVALUATIONS = 71014
terminal age structure of population

```
 0.0000D+00  0.6816D-03  0.5000D+01    1.0  0.4000D+01    1
 0.0000D+00  0.2420D-01  0.5000D+01    1.0  0.4000D+01    2
 0.0000D+00  0.2066D-01  0.5000D+01    1.0  0.4000D+01    3
 0.0000D+00  0.1191D-02  0.5000D+01    1.0  0.3000D+01    4
 0.0000D+00  0.2167D-02  0.5000D+01    1.0  0.3000D+01    5
 0.0000D+00  0.3692D+00  0.5000D+01    1.0  0.1000D+00    6
 0.0000D+00  0.5243D-01  0.3000D+01    1.0  0.6000D+01    7
 0.0000D+00  0.5855D-01  0.5000D+01    1.0  0.1000D+00    8
 0.0000D+00  0.5512D-02  0.3000D+01    1.0  0.8000D+01    9
# terminal-age f-ratios
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   10
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   11
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   12
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   13
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   14
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   15
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   16
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   17
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   18
 0.1000D+00  0.1000D+01  0.5000D+01    0.0  0.2000D+00   19
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   20
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   21
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   22
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   23
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   24
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   25
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   26
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   27
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   28
 0.1000D+00  0.6000D+00  0.5000D+01    0.0  0.2000D+00   29
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   30
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   31
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   32
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   33
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   34
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   35
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   36
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   37
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   38
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   39
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   40
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   41
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   42
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   43
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   44
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   45
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   46
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   47
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   48
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   49
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   50
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   51
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   52
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   53
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   54
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   55
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   56
```

```
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   57
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   58
# natural mortality
 0.0000D+00  0.4900D+00  0.1000D+01    0.0  0.1000D+00   59
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   60
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   61
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   62
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   63
 0.0000D+00  0.2000D+00  0.1000D+01    0.0  0.1000D+00   64
 0.0000D+00  0.1750D+00  0.1000D+01    0.0  0.1000D+00   65
 0.0000D+00  0.1500D+00  0.1000D+01    0.0  0.1000D+00   66
 0.0000D+00  0.1250D+00  0.1000D+01    0.0  0.1000D+00   67
 0.0000D+00  0.1000D+00  0.1000D+01    0.0  0.1000D+00   68
# transfer coefficients
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   69
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   70
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   71
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   72
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   73
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   74
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   75
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   76
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   77
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   78
# Stock recruitment relationship
 0.0000D+00  0.2507D+06  0.1000D+21    0.0  0.4000D+00   79
 0.0000D+00  0.1660D+05  0.1000D+21    0.0  0.0000D+00   80
 0.0000D+00  0.1580D+00  0.9000D+00    0.0  0.0000D+00   81
 0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   82
 0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   83
# Variance scaling parameters
 0.0000D+00  0.9388D+00  0.1000D+21    1.0  0.4000D+00   84
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   85
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   86
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   87
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   88
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   89
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   90
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   91
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   92
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   93
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   94
 0.0000D+00  0.9388D+00  0.1000D+21   -0.1  0.4000D+00   95
# fraction surviving the intial tagging process
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   96
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   97
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   98
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   99
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  100
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  101
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  102
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  103
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  104
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  105
# tag shedding rate
 0.0000D+00  0.2282D+00  0.1000D+01    2.0  0.1000D+00  106
 0.0000D+00  0.1908D+00  0.1000D+01    2.0  0.1000D+00  107
```

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 0.0000D+00  0.2382D+00  0.1000D+01    2.0  0.1000D+00  108
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  109
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  110
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  111
 0.0000D+00  0.2599D+00  0.1000D+01    2.0  0.1000D+00  112
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  113
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  114
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  115
# tag reporting rate
 0.0000D+00  0.2533D+00  0.1000D+01    1.0  0.1000D+00  116
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  117
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  118
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  119
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  120
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  121
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  122
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  123
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  124
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  125
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  126
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  127
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  128
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  129
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  130
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  131
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  132
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  133
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  134
 0.0000D+00  0.2533D+00  0.1000D+01   -0.1  0.1000D+00  135
 0.0000D+00  0.3179D+00  0.1000D+01    1.0  0.1000D+00  136   22  *****
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  137
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  138
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  139
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  140
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  141
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  142
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  143
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  144
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  145
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  146
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  147
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  148
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  149
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  150
 0.0000D+00  0.3179D+00  0.1000D+01   -0.1  0.1000D+00  151
 0.0000D+00  0.1991D+00  0.1000D+01    2.0  0.1000D+00  152
 0.0000D+00  0.1620D+00  0.1000D+01    2.0  0.1000D+00  153
 0.0000D+00  0.1588D+00  0.1000D+01    2.0  0.1000D+00  154
 0.0000D+00  0.1643D+00  0.1000D+01    2.0  0.1000D+00  155
 0.0000D+00  0.2358D+00  0.1000D+01    2.0  0.1000D+00  156
 0.0000D+00  0.1921D+00  0.1000D+01    2.0  0.1000D+00  157
 0.0000D+00  0.1947D+00  0.1000D+01    2.0  0.1000D+00  158
 0.0000D+00  0.1963D+00  0.1000D+01    2.0  0.1000D+00  159
 0.0000D+00  0.1973D+00  0.1000D+01    2.0  0.1000D+00  160
 0.0000D+00  0.1978D+00  0.1000D+01    2.0  0.1000D+00  161
 0.0000D+00  0.2492D+00  0.1000D+01    2.0  0.1000D+00  162
 0.0000D+00  0.1989D+00  0.1000D+01    2.0  0.1000D+00  163
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0.0000D+00 0.2245D+00 0.1000D+01 2.0 0.1000D+00 164
tag nonmixing factor for first year
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 165 1975 1
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 166 1975 2
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 167 1975 3
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 168 1975 4
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 169 1975 5
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 170 1975 6
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 171 1975 7
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 172 1975 8
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 173 1975 9
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 174 1975 10
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 175 1976 1
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 176 1976 2
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 177 1976 3
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 178 1976 4
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 179 1976 5
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 180 1976 6
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 181 1976 7
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 182 1976 8
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 183 1976 9
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 184 1976 10
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 185 1977 1
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 186 1977 2
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 187 1977 3
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 188 1977 4
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 189 1977 5
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 190 1977 6
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 191 1977 7
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 192 1977 8
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 193 1977 9
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 194 1977 10
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 195 1978 1
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 196 1978 2
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 197 1978 3
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 198 1978 4
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 199 1978 5
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 200 1978 6
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 201 1978 7
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 202 1978 8
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 203 1978 9
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 204 1978 10
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 205 1979 1
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 206 1979 2
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 207 1979 3
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 208 1979 4
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 209 1979 5
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 210 1979 6
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 211 1979 7
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 212 1979 8
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 213 1979 9
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 214 1979 10
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 215 1980 1
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 216 1980 2
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 217 1980 3
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 218 1980 4
0.0000D+00 0.7863D+00 0.5000D+01 0.0 0.1000D+00 219 1980 5

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	220	1980	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	221	1980	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	222	1980	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	223	1980	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	224	1980	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	225	1981	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	226	1981	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	227	1981	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	228	1981	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	229	1981	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	230	1981	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	231	1981	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	232	1981	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	233	1981	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	234	1981	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	235	1982	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	236	1982	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	237	1982	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	238	1982	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	239	1982	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	240	1982	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	241	1982	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	242	1982	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	243	1982	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	244	1982	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	245	1983	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	246	1983	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	247	1983	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	248	1983	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	249	1983	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	250	1983	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	251	1983	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	252	1983	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	253	1983	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	254	1983	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	255	1984	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	256	1984	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	257	1984	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	258	1984	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	259	1984	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	260	1984	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	261	1984	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	262	1984	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	263	1984	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	264	1984	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	265	1985	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	266	1985	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	267	1985	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	268	1985	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	269	1985	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	270	1985	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	271	1985	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	272	1985	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	273	1985	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	274	1985	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	275	1986	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	276	1986	2

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	277	1986	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	278	1986	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	279	1986	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	280	1986	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	281	1986	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	282	1986	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	283	1986	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	284	1986	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	285	1987	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	286	1987	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	287	1987	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	288	1987	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	289	1987	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	290	1987	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	291	1987	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	292	1987	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	293	1987	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	294	1987	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	295	1988	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	296	1988	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	297	1988	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	298	1988	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	299	1988	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	300	1988	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	301	1988	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	302	1988	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	303	1988	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	304	1988	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	305	1989	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	306	1989	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	307	1989	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	308	1989	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	309	1989	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	310	1989	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	311	1989	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	312	1989	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	313	1989	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	314	1989	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	315	1990	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	316	1990	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	317	1990	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	318	1990	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	319	1990	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	320	1990	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	321	1990	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	322	1990	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	323	1990	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	324	1990	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	325	1991	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	326	1991	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	327	1991	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	328	1991	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	329	1991	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	330	1991	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	331	1991	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	332	1991	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	333	1991	9

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	334	1991	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	335	1992	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	336	1992	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	337	1992	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	338	1992	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	339	1992	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	340	1992	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	341	1992	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	342	1992	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	343	1992	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	344	1992	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	345	1993	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	346	1993	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	347	1993	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	348	1993	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	349	1993	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	350	1993	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	351	1993	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	352	1993	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	353	1993	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	354	1993	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	355	1994	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	356	1994	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	357	1994	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	358	1994	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	359	1994	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	360	1994	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	361	1994	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	362	1994	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	363	1994	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	364	1994	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	365	1995	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	366	1995	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	367	1995	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	368	1995	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	369	1995	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	370	1995	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	371	1995	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	372	1995	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	373	1995	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	374	1995	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	375	1996	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	376	1996	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	377	1996	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	378	1996	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	379	1996	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	380	1996	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	381	1996	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	382	1996	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	383	1996	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	384	1996	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	385	1997	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	386	1997	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	387	1997	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	388	1997	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	389	1997	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	390	1997	6

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	391	1997	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	392	1997	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	393	1997	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	394	1997	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	395	1998	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	396	1998	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	397	1998	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	398	1998	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	399	1998	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	400	1998	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	401	1998	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	402	1998	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	403	1998	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	404	1998	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	405	1999	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	406	1999	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	407	1999	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	408	1999	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	409	1999	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	410	1999	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	411	1999	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	412	1999	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	413	1999	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	414	1999	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	415	2000	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	416	2000	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	417	2000	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	418	2000	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	419	2000	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	420	2000	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	421	2000	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	422	2000	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	423	2000	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	424	2000	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	425	2001	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	426	2001	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	427	2001	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	428	2001	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	429	2001	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	430	2001	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	431	2001	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	432	2001	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	433	2001	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	434	2001	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	435	2002	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	436	2002	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	437	2002	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	438	2002	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	439	2002	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	440	2002	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	441	2002	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	442	2002	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	443	2002	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	444	2002	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	445	2003	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	446	2003	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	447	2003	3

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	448	2003	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	449	2003	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	450	2003	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	451	2003	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	452	2003	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	453	2003	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	454	2003	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	455	2004	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	456	2004	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	457	2004	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	458	2004	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	459	2004	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	460	2004	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	461	2004	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	462	2004	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	463	2004	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	464	2004	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	465	2005	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	466	2005	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	467	2005	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	468	2005	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	469	2005	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	470	2005	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	471	2005	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	472	2005	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	473	2005	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	474	2005	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	475	2006	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	476	2006	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	477	2006	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	478	2006	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	479	2006	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	480	2006	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	481	2006	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	482	2006	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	483	2006	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	484	2006	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	485	2007	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	486	2007	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	487	2007	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	488	2007	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	489	2007	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	490	2007	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	491	2007	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	492	2007	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	493	2007	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	494	2007	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	495	2008	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	496	2008	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	497	2008	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	498	2008	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	499	2008	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	500	2008	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	501	2008	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	502	2008	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	503	2008	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	504	2008	10

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	505	2009	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	506	2009	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	507	2009	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	508	2009	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	509	2009	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	510	2009	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	511	2009	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	512	2009	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	513	2009	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	514	2009	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	515	2010	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	516	2010	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	517	2010	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	518	2010	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	519	2010	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	520	2010	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	521	2010	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	522	2010	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	523	2010	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	524	2010	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	525	2011	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	526	2011	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	527	2011	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	528	2011	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	529	2011	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	530	2011	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	531	2011	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	532	2011	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	533	2011	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	534	2011	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	535	2012	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	536	2012	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	537	2012	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	538	2012	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	539	2012	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	540	2012	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	541	2012	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	542	2012	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	543	2012	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	544	2012	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	545	2013	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	546	2013	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	547	2013	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	548	2013	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	549	2013	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	550	2013	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	551	2013	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	552	2013	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	553	2013	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	554	2013	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	555	2014	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	556	2014	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	557	2014	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	558	2014	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	559	2014	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	560	2014	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	561	2014	7

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	562	2014	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	563	2014	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	564	2014	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	565	2015	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	566	2015	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	567	2015	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	568	2015	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	569	2015	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	570	2015	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	571	2015	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	572	2015	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	573	2015	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	574	2015	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	575	2016	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	576	2016	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	577	2016	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	578	2016	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	579	2016	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	580	2016	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	581	2016	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	582	2016	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	583	2016	9
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0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	585	2017	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	586	2017	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	587	2017	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	588	2017	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	589	2017	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	590	2017	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	591	2017	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	592	2017	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	593	2017	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	594	2017	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	595	2018	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	596	2018	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	597	2018	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	598	2018	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	599	2018	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	600	2018	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	601	2018	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	602	2018	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	603	2018	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	604	2018	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	605	2019	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	606	2019	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	607	2019	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	608	2019	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	609	2019	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	610	2019	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	611	2019	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	612	2019	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	613	2019	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	614	2019	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	615	2020	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	616	2020	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	617	2020	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	618	2020	4

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0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	622	2020	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	623	2020	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	624	2020	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	625	2021	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	626	2021	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	627	2021	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	628	2021	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	629	2021	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	630	2021	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	631	2021	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	632	2021	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	633	2021	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	634	2021	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	635	2022	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	636	2022	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	637	2022	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	638	2022	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	639	2022	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	640	2022	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	641	2022	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	642	2022	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	643	2022	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	644	2022	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	645	2023	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	646	2023	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	647	2023	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	648	2023	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	649	2023	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	650	2023	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	651	2023	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	652	2023	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	653	2023	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	654	2023	10

tag nonmixing factor for second year

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	655	2024	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	656	2024	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	657	2024	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	658	2024	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	659	2024	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	660	2024	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	661	2024	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	662	2024	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	663	2024	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	664	2024	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	665	2025	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	666	2025	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	667	2025	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	668	2025	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	669	2025	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	670	2025	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	671	2025	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	672	2025	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	673	2025	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	674	2025	10

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	675	2026	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	676	2026	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	677	2026	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	678	2026	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	679	2026	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	680	2026	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	681	2026	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	682	2026	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	683	2026	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	684	2026	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	685	2027	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	686	2027	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	687	2027	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	688	2027	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	689	2027	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	690	2027	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	691	2027	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	692	2027	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	693	2027	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	694	2027	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	695	2028	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	696	2028	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	697	2028	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	698	2028	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	699	2028	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	700	2028	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	701	2028	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	702	2028	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	703	2028	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	704	2028	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	705	2029	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	706	2029	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	707	2029	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	708	2029	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	709	2029	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	710	2029	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	711	2029	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	712	2029	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	713	2029	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	714	2029	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	715	2030	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	716	2030	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	717	2030	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	718	2030	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	719	2030	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	720	2030	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	721	2030	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	722	2030	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	723	2030	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	724	2030	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	725	2031	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	726	2031	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	727	2031	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	728	2031	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	729	2031	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	730	2031	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	731	2031	7

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	732	2031	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	733	2031	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	734	2031	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	735	2032	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	736	2032	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	737	2032	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	738	2032	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	739	2032	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	740	2032	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	741	2032	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	742	2032	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	743	2032	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	744	2032	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	745	2033	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	746	2033	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	747	2033	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	748	2033	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	749	2033	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	750	2033	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	751	2033	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	752	2033	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	753	2033	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	754	2033	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	755	2034	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	756	2034	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	757	2034	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	758	2034	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	759	2034	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	760	2034	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	761	2034	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	762	2034	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	763	2034	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	764	2034	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	765	2035	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	766	2035	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	767	2035	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	768	2035	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	769	2035	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	770	2035	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	771	2035	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	772	2035	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	773	2035	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	774	2035	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	775	2036	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	776	2036	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	777	2036	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	778	2036	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	779	2036	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	780	2036	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	781	2036	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	782	2036	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	783	2036	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	784	2036	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	785	2037	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	786	2037	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	787	2037	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	788	2037	4

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	789	2037	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	790	2037	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	791	2037	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	792	2037	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	793	2037	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	794	2037	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	795	2038	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	796	2038	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	797	2038	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	798	2038	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	799	2038	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	800	2038	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	801	2038	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	802	2038	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	803	2038	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	804	2038	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	805	2039	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	806	2039	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	807	2039	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	808	2039	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	809	2039	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	810	2039	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	811	2039	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	812	2039	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	813	2039	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	814	2039	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	815	2040	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	816	2040	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	817	2040	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	818	2040	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	819	2040	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	820	2040	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	821	2040	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	822	2040	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	823	2040	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	824	2040	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	825	2041	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	826	2041	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	827	2041	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	828	2041	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	829	2041	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	830	2041	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	831	2041	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	832	2041	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	833	2041	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	834	2041	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	835	2042	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	836	2042	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	837	2042	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	838	2042	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	839	2042	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	840	2042	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	841	2042	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	842	2042	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	843	2042	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	844	2042	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	845	2043	1

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	846	2043	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	847	2043	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	848	2043	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	849	2043	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	850	2043	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	851	2043	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	852	2043	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	853	2043	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	854	2043	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	855	2044	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	856	2044	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	857	2044	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	858	2044	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	859	2044	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	860	2044	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	861	2044	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	862	2044	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	863	2044	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	864	2044	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	865	2045	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	866	2045	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	867	2045	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	868	2045	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	869	2045	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	870	2045	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	871	2045	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	872	2045	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	873	2045	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	874	2045	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	875	2046	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	876	2046	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	877	2046	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	878	2046	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	879	2046	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	880	2046	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	881	2046	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	882	2046	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	883	2046	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	884	2046	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	885	2047	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	886	2047	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	887	2047	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	888	2047	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	889	2047	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	890	2047	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	891	2047	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	892	2047	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	893	2047	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	894	2047	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	895	2048	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	896	2048	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	897	2048	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	898	2048	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	899	2048	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	900	2048	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	901	2048	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	902	2048	8

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	903	2048	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	904	2048	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	905	2049	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	906	2049	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	907	2049	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	908	2049	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	909	2049	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	910	2049	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	911	2049	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	912	2049	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	913	2049	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	914	2049	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	915	2050	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	916	2050	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	917	2050	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	918	2050	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	919	2050	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	920	2050	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	921	2050	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	922	2050	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	923	2050	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	924	2050	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	925	2051	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	926	2051	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	927	2051	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	928	2051	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	929	2051	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	930	2051	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	931	2051	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	932	2051	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	933	2051	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	934	2051	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	935	2052	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	936	2052	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	937	2052	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	938	2052	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	939	2052	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	940	2052	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	941	2052	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	942	2052	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	943	2052	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	944	2052	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	945	2053	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	946	2053	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	947	2053	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	948	2053	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	949	2053	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	950	2053	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	951	2053	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	952	2053	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	953	2053	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	954	2053	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	955	2054	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	956	2054	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	957	2054	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	958	2054	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	959	2054	5

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	960	2054	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	961	2054	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	962	2054	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	963	2054	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	964	2054	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	965	2055	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	966	2055	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	967	2055	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	968	2055	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	969	2055	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	970	2055	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	971	2055	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	972	2055	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	973	2055	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	974	2055	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	975	2056	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	976	2056	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	977	2056	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	978	2056	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	979	2056	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	980	2056	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	981	2056	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	982	2056	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	983	2056	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	984	2056	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	985	2057	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	986	2057	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	987	2057	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	988	2057	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	989	2057	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	990	2057	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	991	2057	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	992	2057	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	993	2057	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	994	2057	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	995	2058	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	996	2058	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	997	2058	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	998	2058	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	999	2058	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1000	2058	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1001	2058	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1002	2058	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1003	2058	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1004	2058	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1005	2059	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1006	2059	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1007	2059	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1008	2059	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1009	2059	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1010	2059	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1011	2059	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1012	2059	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1013	2059	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1014	2059	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1015	2060	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1016	2060	2

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1017	2060	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1018	2060	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1019	2060	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1020	2060	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1021	2060	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1022	2060	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1023	2060	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1024	2060	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1025	2061	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1026	2061	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1027	2061	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1028	2061	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1029	2061	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1030	2061	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1031	2061	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1032	2061	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1033	2061	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1034	2061	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1035	2062	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1036	2062	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1037	2062	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1038	2062	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1039	2062	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1040	2062	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1041	2062	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1042	2062	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1043	2062	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1044	2062	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1045	2063	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1046	2063	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1047	2063	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1048	2063	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1049	2063	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1050	2063	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1051	2063	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1052	2063	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1053	2063	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1054	2063	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1055	2064	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1056	2064	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1057	2064	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1058	2064	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1059	2064	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1060	2064	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1061	2064	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1062	2064	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1063	2064	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1064	2064	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1065	2065	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1066	2065	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1067	2065	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1068	2065	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1069	2065	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1070	2065	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1071	2065	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1072	2065	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1073	2065	9

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1074	2065	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1075	2066	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1076	2066	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1077	2066	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1078	2066	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1079	2066	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1080	2066	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1081	2066	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1082	2066	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1083	2066	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1084	2066	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1085	2067	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1086	2067	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1087	2067	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1088	2067	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1089	2067	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1090	2067	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1091	2067	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1092	2067	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1093	2067	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1094	2067	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1095	2068	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1096	2068	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1097	2068	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1098	2068	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1099	2068	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1100	2068	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1101	2068	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1102	2068	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1103	2068	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1104	2068	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1105	2069	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1106	2069	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1107	2069	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1108	2069	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1109	2069	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1110	2069	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1111	2069	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1112	2069	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1113	2069	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1114	2069	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1115	2070	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1116	2070	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1117	2070	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1118	2070	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1119	2070	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1120	2070	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1121	2070	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1122	2070	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1123	2070	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1124	2070	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1125	2071	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1126	2071	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1127	2071	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1128	2071	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1129	2071	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1130	2071	6

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1131	2071	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1132	2071	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1133	2071	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1134	2071	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1135	2072	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1136	2072	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1137	2072	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1138	2072	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1139	2072	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1140	2072	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1141	2072	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1142	2072	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1143	2072	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1144	2072	10

Number of parameters = 1144

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VPA-2BOX

BOOTSTRAP ESTIMATES OF BIAS AND VARIANCE

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Basic model

12:01, 17 February 2011

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BIAS AND STANDARD ERROR ESTIMATES

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TABLE 1A. BIAS OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.000	-0.002	-0.001	-0.001	0.000	-0.001	0.000	0.000	0.000	0.000
1976	0.000	-0.002	-0.003	-0.001	-0.001	0.000	-0.001	0.000	0.000	0.000
1977	0.000	-0.002	-0.001	-0.001	0.000	0.000	0.000	-0.001	0.000	0.000
1978	-0.001	-0.002	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1979	0.000	-0.001	-0.002	-0.001	0.000	0.000	0.000	-0.001	0.000	0.000
1980	0.000	-0.001	-0.003	-0.002	0.000	0.000	0.000	0.000	0.000	0.000
1981	0.000	-0.002	-0.003	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000
1982	-0.002	-0.002	-0.004	-0.002	-0.001	0.000	0.000	-0.001	-0.001	-0.001
1983	-0.001	-0.002	-0.003	-0.001	-0.001	-0.001	-0.001	0.000	-0.001	-0.001
1984	-0.001	-0.003	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
1985	-0.001	-0.004	-0.004	-0.002	-0.001	-0.001	0.000	-0.001	-0.001	-0.001
1986	-0.001	-0.002	-0.003	-0.002	0.000	-0.001	-0.001	0.000	-0.001	-0.001
1987	-0.001	-0.003	-0.003	-0.002	-0.001	0.000	-0.001	-0.001	-0.001	-0.001
1988	-0.003	-0.003	-0.004	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
1989	-0.003	-0.004	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
1990	-0.002	-0.005	-0.005	-0.002	-0.003	-0.001	-0.001	-0.001	-0.002	-0.001
1991	-0.002	-0.005	-0.006	-0.003	-0.003	-0.001	-0.001	-0.001	-0.002	-0.001
1992	-0.002	-0.008	-0.008	-0.003	-0.002	-0.001	-0.002	-0.002	-0.003	-0.002
1993	-0.002	-0.015	-0.013	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.002
1994	-0.004	-0.008	-0.009	-0.004	-0.004	-0.003	-0.005	-0.005	-0.008	-0.005
1995	-0.004	-0.008	-0.009	-0.006	-0.005	-0.006	-0.004	-0.005	-0.006	-0.007
1996	-0.006	-0.016	-0.017	-0.011	-0.007	-0.003	-0.005	-0.003	-0.008	-0.010
1997	-0.007	-0.015	-0.011	-0.012	-0.008	-0.009	-0.005	-0.011	-0.011	-0.013

1998	-0.010	-0.027	-0.022	-0.015	-0.009	-0.017	-0.003	-0.003	-0.008	-0.010
1999	-0.011	-0.014	-0.021	-0.015	-0.007	-0.004	-0.004	-0.005	-0.010	-0.012
2000	-0.029	-0.027	-0.016	-0.015	-0.016	-0.011	-0.004	-0.007	-0.008	-0.009
2001	-0.001	-0.035	-0.016	-0.011	-0.011	-0.010	-0.015	-0.010	-0.012	-0.014
2002	-0.003	-0.041	-0.028	-0.012	-0.006	-0.011	-0.007	-0.011	-0.012	-0.014
2003	-0.001	-0.016	-0.010	-0.007	-0.011	-0.006	-0.018	-0.013	-0.016	-0.020
2004	-0.005	-0.016	-0.018	-0.006	-0.004	-0.008	-0.009	-0.012	-0.019	-0.023
2005	-0.020	-0.021	-0.012	-0.010	-0.006	-0.007	-0.008	-0.006	-0.027	-0.032
2006	-0.021	-0.018	-0.019	-0.006	-0.003	-0.009	-0.005	-0.007	-0.019	-0.023
2007	0.000	-0.015	-0.007	-0.016	-0.012	-0.008	-0.009	-0.008	-0.021	-0.025
2008	0.000	-0.016	-0.009	-0.015	-0.008	-0.007	-0.008	-0.010	-0.012	-0.014
2009	0.000	-0.002	-0.007	-0.017	-0.008	-0.006	-0.011	-0.010	-0.007	-0.009
2010	0.000	-0.001	-0.002	-0.027	-0.011	-0.013	-0.009	-0.008	-0.006	-0.008
2011	0.000	-0.006	-0.003	-0.005	-0.002	-0.002	-0.003	-0.003	-0.004	-0.005
2012	0.000	-0.006	-0.003	-0.005	-0.002	-0.002	-0.003	-0.003	-0.003	-0.004
2013	0.000	-0.005	-0.003	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.004
2014	0.000	-0.005	-0.003	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003
2015	0.000	-0.005	-0.002	-0.004	-0.002	-0.001	-0.002	-0.002	-0.003	-0.003
2016	-0.003	-0.004	-0.002	-0.004	-0.002	-0.001	-0.002	-0.002	-0.002	-0.003
2017	0.003	-0.116	-0.002	-0.003	-0.001	-0.001	-0.002	-0.002	-0.002	-0.003
2018	-0.001	0.118	-0.067	-0.003	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
2019	0.003	-0.036	0.076	-0.121	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002
2020	0.002	0.119	-0.015	0.167	-0.060	-0.001	-0.001	-0.001	-0.002	-0.002
2021	0.000	0.076	0.083	0.011	0.114	-0.048	-0.001	-0.001	-0.002	-0.002
2022	0.000	0.005	0.056	0.232	0.083	0.137	-0.042	-0.001	-0.002	-0.002
2023	0.000	-0.008	0.004	0.277	0.742	0.441	0.552	0.490	-0.001	-0.002

TABLE 1B. STANDARD ERROR OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.907E-04	0.377E-03	0.284E-03	0.179E-03	0.963E-04	0.204E-03	0.114E-03	0.967E-04	0.127E-03	0.127E-03
1976	0.145E-04	0.426E-03	0.733E-03	0.270E-03	0.208E-03	0.698E-04	0.143E-03	0.688E-04	0.105E-03	0.105E-03
1977	0.658E-04	0.428E-03	0.346E-03	0.324E-03	0.557E-04	0.777E-04	0.595E-04	0.141E-03	0.108E-03	0.108E-03
1978	0.173E-03	0.408E-03	0.391E-03	0.188E-03	0.951E-04	0.273E-04	0.570E-04	0.304E-04	0.867E-04	0.867E-04
1979	0.213E-04	0.151E-03	0.441E-03	0.231E-03	0.864E-04	0.563E-04	0.448E-04	0.124E-03	0.810E-04	0.810E-04
1980	0.981E-04	0.349E-03	0.754E-03	0.371E-03	0.810E-04	0.864E-04	0.744E-04	0.432E-04	0.893E-04	0.893E-04
1981	0.908E-04	0.508E-03	0.636E-03	0.240E-03	0.198E-03	0.571E-04	0.792E-04	0.119E-03	0.685E-04	0.685E-04
1982	0.469E-03	0.590E-03	0.871E-03	0.421E-03	0.173E-03	0.969E-04	0.613E-04	0.205E-03	0.147E-03	0.147E-03
1983	0.270E-03	0.480E-03	0.688E-03	0.326E-03	0.221E-03	0.163E-03	0.306E-03	0.979E-04	0.162E-03	0.162E-03
1984	0.176E-03	0.703E-03	0.344E-03	0.348E-03	0.359E-03	0.284E-03	0.250E-03	0.339E-03	0.190E-03	0.190E-03
1985	0.141E-03	0.846E-03	0.937E-03	0.362E-03	0.207E-03	0.209E-03	0.118E-03	0.170E-03	0.239E-03	0.143E-03

1986 0.335E-03 0.592E-03 0.692E-03 0.454E-03 0.108E-03 0.144E-03 0.131E-03 0.107E-03 0.238E-03 0.143E-03
1987 0.349E-03 0.665E-03 0.731E-03 0.399E-03 0.157E-03 0.104E-03 0.274E-03 0.210E-03 0.226E-03 0.136E-03
1988 0.699E-03 0.616E-03 0.949E-03 0.504E-03 0.211E-03 0.146E-03 0.178E-03 0.268E-03 0.360E-03 0.216E-03
1989 0.790E-03 0.107E-02 0.586E-03 0.478E-03 0.498E-03 0.126E-03 0.191E-03 0.140E-03 0.296E-03 0.178E-03
1990 0.581E-03 0.125E-02 0.125E-02 0.516E-03 0.597E-03 0.215E-03 0.213E-03 0.289E-03 0.370E-03 0.222E-03
1991 0.442E-03 0.121E-02 0.138E-02 0.663E-03 0.619E-03 0.185E-03 0.198E-03 0.249E-03 0.575E-03 0.345E-03
1992 0.466E-03 0.194E-02 0.197E-02 0.638E-03 0.375E-03 0.301E-03 0.448E-03 0.571E-03 0.727E-03 0.436E-03
1993 0.493E-03 0.362E-02 0.296E-02 0.914E-03 0.461E-03 0.373E-03 0.378E-03 0.453E-03 0.748E-03 0.449E-03
1994 0.940E-03 0.179E-02 0.197E-02 0.868E-03 0.920E-03 0.747E-03 0.117E-02 0.121E-02 0.200E-02 0.120E-02
1995 0.991E-03 0.195E-02 0.221E-02 0.126E-02 0.124E-02 0.146E-02 0.836E-03 0.122E-02 0.138E-02 0.166E-02
1996 0.140E-02 0.372E-02 0.388E-02 0.258E-02 0.152E-02 0.748E-03 0.105E-02 0.802E-03 0.196E-02 0.236E-02
1997 0.152E-02 0.344E-02 0.245E-02 0.271E-02 0.184E-02 0.199E-02 0.117E-02 0.246E-02 0.247E-02 0.296E-02
1998 0.218E-02 0.620E-02 0.491E-02 0.348E-02 0.190E-02 0.383E-02 0.636E-03 0.661E-03 0.190E-02 0.228E-02
1999 0.225E-02 0.300E-02 0.457E-02 0.328E-02 0.164E-02 0.818E-03 0.823E-03 0.104E-02 0.232E-02 0.278E-02
2000 0.615E-02 0.575E-02 0.335E-02 0.317E-02 0.350E-02 0.238E-02 0.974E-03 0.148E-02 0.169E-02 0.203E-02
2001 0.150E-03 0.717E-02 0.335E-02 0.232E-02 0.247E-02 0.207E-02 0.332E-02 0.229E-02 0.261E-02 0.313E-02
2002 0.597E-03 0.818E-02 0.561E-02 0.243E-02 0.114E-02 0.237E-02 0.149E-02 0.238E-02 0.260E-02 0.312E-02
2003 0.263E-03 0.314E-02 0.193E-02 0.139E-02 0.228E-02 0.112E-02 0.376E-02 0.272E-02 0.351E-02 0.421E-02
2004 0.946E-03 0.309E-02 0.358E-02 0.124E-02 0.702E-03 0.162E-02 0.171E-02 0.240E-02 0.393E-02 0.472E-02
2005 0.401E-02 0.406E-02 0.238E-02 0.199E-02 0.124E-02 0.131E-02 0.165E-02 0.110E-02 0.539E-02 0.646E-02
2006 0.412E-02 0.357E-02 0.375E-02 0.117E-02 0.538E-03 0.180E-02 0.935E-03 0.133E-02 0.379E-02 0.455E-02
2007 0.458E-04 0.296E-02 0.130E-02 0.299E-02 0.221E-02 0.148E-02 0.174E-02 0.148E-02 0.405E-02 0.486E-02
2008 0.617E-05 0.303E-02 0.179E-02 0.286E-02 0.154E-02 0.128E-02 0.145E-02 0.184E-02 0.221E-02 0.265E-02
2009 0.102E-04 0.277E-03 0.137E-02 0.316E-02 0.145E-02 0.120E-02 0.201E-02 0.179E-02 0.138E-02 0.166E-02
2010 0.959E-05 0.255E-03 0.322E-03 0.504E-02 0.205E-02 0.243E-02 0.165E-02 0.146E-02 0.118E-02 0.141E-02
2011 0.306E-04 0.113E-02 0.579E-03 0.944E-03 0.447E-03 0.375E-03 0.532E-03 0.544E-03 0.722E-03 0.866E-03
2012 0.277E-04 0.101E-02 0.518E-03 0.854E-03 0.386E-03 0.335E-03 0.465E-03 0.479E-03 0.608E-03 0.729E-03
2013 0.252E-04 0.936E-03 0.477E-03 0.782E-03 0.361E-03 0.301E-03 0.423E-03 0.432E-03 0.552E-03 0.663E-03

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 2014 0.235E-04 0.874E-03 0.456E-03 0.729E-03 0.335E-03 0.283E-03 0.392E-03 0.400E-03 0.512E-
03 0.614E-03
 2015 0.251E-04 0.806E-03 0.423E-03 0.704E-03 0.320E-03 0.266E-03 0.367E-03 0.363E-03 0.469E-
03 0.562E-03
 2016 0.343E-02 0.774E-03 0.387E-03 0.646E-03 0.303E-03 0.254E-03 0.336E-03 0.336E-03 0.423E-
03 0.508E-03
 2017 0.393E-02 0.132E+00 0.353E-03 0.570E-03 0.265E-03 0.227E-03 0.310E-03 0.304E-03 0.382E-
03 0.458E-03
 2018 0.365E-02 0.153E+00 0.831E-01 0.521E-03 0.243E-03 0.204E-03 0.283E-03 0.282E-03 0.346E-
03 0.416E-03
 2019 0.447E-02 0.149E+00 0.995E-01 0.176E+00 0.226E-03 0.189E-03 0.261E-03 0.260E-03
0.326E-03 0.391E-03
 2020 0.407E-02 0.184E+00 0.107E+00 0.225E+00 0.113E+00 0.175E-03 0.243E-03 0.239E-03
0.302E-03 0.362E-03
 2021 0.138E-02 0.173E+00 0.138E+00 0.278E+00 0.160E+00 0.123E+00 0.225E-03 0.230E-03
0.286E-03 0.343E-03
 2022 0.907E-04 0.534E-01 0.137E+00 0.429E+00 0.266E+00 0.205E+00 0.262E+00 0.212E-03
0.272E-03 0.326E-03
 2023 0.851E-04 0.307E-02 0.351E-01 0.885E+00 0.170E+01 0.837E+00 0.101E+01 0.154E+01
0.254E-03 0.305E-03
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TABLE 1C. BIAS OF ABUNDANCE (BY AREA) OF East of 45

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===================================================================================
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      1      2      3      4      5      6      7      8      9      10
----------------------------------------------------------------------------------------------------------------------
 1975 0.893E+04 0.478E+04 0.541E+04 0.241E+04 0.290E+04 0.698E+03 0.843E+03 0.698E+03
0.679E+03 0.822E+04
 1976 0.164E+05 0.547E+04 0.375E+04 0.426E+04 0.189E+04 0.228E+04 0.571E+03 0.708E+03
0.601E+03 0.813E+04
 1977 0.466E+04 0.100E+05 0.430E+04 0.294E+04 0.335E+04 0.149E+04 0.187E+04 0.480E+03
0.610E+03 0.794E+04
 1978 0.490E+04 0.285E+04 0.789E+04 0.338E+04 0.231E+04 0.263E+04 0.122E+04 0.157E+04
0.413E+03 0.779E+04
 1979 0.640E+04 0.300E+04 0.224E+04 0.621E+04 0.266E+04 0.182E+04 0.216E+04 0.102E+04
0.135E+04 0.737E+04
 1980 0.635E+04 0.392E+04 0.236E+04 0.176E+04 0.488E+04 0.209E+04 0.149E+04 0.181E+04
0.881E+03 0.789E+04
 1981 0.766E+04 0.389E+04 0.308E+04 0.185E+04 0.138E+04 0.384E+04 0.171E+04 0.125E+04
0.156E+04 0.792E+04
 1982 0.186E+05 0.470E+04 0.305E+04 0.242E+04 0.145E+04 0.109E+04 0.314E+04 0.144E+04
0.108E+04 0.844E+04
 1983 0.159E+05 0.114E+05 0.368E+04 0.239E+04 0.190E+04 0.114E+04 0.891E+03 0.264E+04
0.124E+04 0.860E+04
 1984 0.129E+05 0.972E+04 0.894E+04 0.289E+04 0.188E+04 0.150E+04 0.937E+03 0.748E+03
0.227E+04 0.893E+04
 1985 0.111E+05 0.792E+04 0.762E+04 0.704E+04 0.227E+04 0.148E+04 0.122E+04 0.786E+03
0.643E+03 0.101E+05
 1986 0.140E+05 0.678E+04 0.621E+04 0.597E+04 0.553E+04 0.179E+04 0.121E+04 0.103E+04
0.677E+03 0.968E+04
 1987 0.218E+05 0.854E+04 0.533E+04 0.488E+04 0.470E+04 0.435E+04 0.146E+04 0.101E+04
0.885E+03 0.936E+04
 1988 0.255E+05 0.134E+05 0.670E+04 0.418E+04 0.384E+04 0.369E+04 0.356E+04 0.123E+04
0.874E+03 0.928E+04
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1989 0.587E+05 0.156E+05 0.105E+05 0.525E+04 0.329E+04 0.302E+04 0.302E+04 0.299E+04
0.106E+04 0.915E+04
1990 0.472E+05 0.359E+05 0.122E+05 0.826E+04 0.413E+04 0.259E+04 0.247E+04 0.254E+04
0.257E+04 0.924E+04
1991 0.111E+06 0.289E+05 0.282E+05 0.959E+04 0.649E+04 0.324E+04 0.212E+04 0.207E+04
0.218E+04 0.106E+05
1992 0.105E+06 0.682E+05 0.227E+05 0.222E+05 0.754E+04 0.510E+04 0.266E+04 0.178E+04
0.179E+04 0.116E+05
1993 0.105E+06 0.645E+05 0.536E+05 0.178E+05 0.174E+05 0.593E+04 0.418E+04 0.223E+04
0.153E+04 0.120E+05
1994 0.131E+06 0.641E+05 0.505E+05 0.421E+05 0.140E+05 0.137E+05 0.486E+04 0.351E+04
0.192E+04 0.122E+05
1995 0.115E+06 0.801E+05 0.503E+05 0.397E+05 0.331E+05 0.110E+05 0.112E+05 0.408E+04
0.302E+04 0.128E+05
1996 0.132E+06 0.703E+05 0.630E+05 0.395E+05 0.312E+05 0.260E+05 0.902E+04 0.942E+04
0.351E+04 0.142E+05
1997 0.108E+06 0.809E+05 0.551E+05 0.494E+05 0.311E+05 0.246E+05 0.213E+05 0.757E+04
0.811E+04 0.159E+05
1998 0.611E+06 0.659E+05 0.635E+05 0.433E+05 0.389E+05 0.244E+05 0.201E+05 0.179E+05
0.651E+04 0.216E+05
1999 0.485E+06 0.374E+06 0.516E+05 0.498E+05 0.340E+05 0.306E+05 0.200E+05 0.169E+05
0.154E+05 0.252E+05
2000 0.635E+06 0.297E+06 0.294E+06 0.405E+05 0.392E+05 0.268E+05 0.250E+05 0.168E+05
0.145E+05 0.364E+05
2001 0.703E+06 0.388E+06 0.234E+06 0.231E+06 0.319E+05 0.308E+05 0.219E+05 0.210E+05
0.144E+05 0.458E+05
2002 0.871E+06 0.431E+06 0.305E+06 0.184E+06 0.182E+06 0.251E+05 0.252E+05 0.184E+05
0.181E+05 0.542E+05
2003 0.113E+07 0.533E+06 0.339E+06 0.240E+06 0.145E+06 0.143E+06 0.205E+05 0.212E+05
0.158E+05 0.649E+05
2004 0.147E+07 0.690E+06 0.420E+06 0.266E+06 0.189E+06 0.114E+06 0.117E+06 0.172E+05
0.182E+05 0.727E+05
2005 0.764E+06 0.903E+06 0.543E+06 0.330E+06 0.209E+06 0.148E+06 0.931E+05 0.984E+05
0.148E+05 0.819E+05
2006 0.592E+06 0.468E+06 0.710E+06 0.427E+06 0.260E+06 0.165E+06 0.121E+06 0.782E+05
0.847E+05 0.871E+05
2007 0.389E+06 0.362E+06 0.368E+06 0.558E+06 0.336E+06 0.204E+06 0.135E+06 0.102E+06
0.673E+05 0.154E+06
2008 0.201E+07 0.238E+06 0.285E+06 0.289E+06 0.439E+06 0.264E+06 0.167E+06 0.113E+06
0.878E+05 0.198E+06
2009 0.221E+07 0.123E+07 0.187E+06 0.224E+06 0.228E+06 0.346E+06 0.216E+06 0.140E+06
0.975E+05 0.257E+06
2010 0.233E+07 0.135E+07 0.967E+06 0.147E+06 0.176E+06 0.179E+06 0.283E+06 0.182E+06
0.121E+06 0.318E+06
2011 0.230E+07 0.143E+07 0.106E+07 0.761E+06 0.116E+06 0.139E+06 0.147E+06 0.237E+06
0.156E+06 0.394E+06
2012 0.248E+07 0.141E+07 0.112E+07 0.837E+06 0.598E+06 0.911E+05 0.114E+06 0.123E+06
0.204E+06 0.494E+06
2013 0.261E+07 0.152E+07 0.111E+07 0.885E+06 0.659E+06 0.471E+06 0.746E+05 0.953E+05
0.106E+06 0.628E+06
2014 0.274E+07 0.160E+07 0.120E+07 0.872E+06 0.696E+06 0.518E+06 0.385E+06 0.626E+05
0.820E+05 0.662E+06
2015 0.274E+07 0.168E+07 0.126E+07 0.940E+06 0.686E+06 0.547E+06 0.424E+06 0.323E+06
0.539E+05 0.672E+06
2016 0.156E+07 0.168E+07 0.132E+07 0.988E+06 0.740E+06 0.540E+06 0.448E+06 0.356E+06
0.278E+06 0.656E+06

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 2017  0.281E+07  0.958E+06  0.132E+07  0.104E+07  0.777E+06  0.582E+06  0.442E+06  0.376E+06
0.306E+06  0.841E+06
 2018  0.381E+06  0.172E+07  0.753E+06  0.104E+07  0.817E+06  0.611E+06  0.476E+06  0.371E+06
0.324E+06  0.103E+07
 2019  0.478E+08  0.233E+06  0.136E+07  0.592E+06  0.817E+06  0.642E+06  0.500E+06  0.400E+06
0.319E+06  0.122E+07
 2020  0.203E+09  0.293E+08  0.183E+06  0.107E+07  0.466E+06  0.643E+06  0.526E+06  0.420E+06
0.344E+06  0.139E+07
 2021  0.853E+07  0.125E+09  0.231E+08  0.144E+06  0.840E+06  0.367E+06  0.526E+06  0.442E+06
0.362E+06  0.156E+07
 2022  0.749E+06  0.523E+07  0.980E+08  0.181E+08  0.113E+06  0.660E+06  0.300E+06  0.442E+06
0.380E+06  0.173E+07
 2023  0.767E+06  0.459E+06  0.411E+07  0.771E+08  0.143E+08  0.893E+05  0.541E+06  0.252E+06
0.380E+06  0.189E+07
 2024           0.470E+06  0.361E+06  0.324E+07  0.606E+08  0.112E+08  0.731E+05  0.454E+06
0.217E+06  0.205E+07
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TABLE 1D. STANDARD ERROR OF ABUNDANCE (BY AREA) OF East of 45

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==========================================================================================
==============================
        1       2       3       4       5       6       7       8       9      10
--------------------------------------------------------------------------------------------
 1975  0.221E+04  0.117E+04  0.131E+04  0.590E+03  0.713E+03  0.172E+03  0.212E+03  0.177E+03
0.175E+03  0.212E+04
 1976  0.402E+04  0.135E+04  0.920E+03  0.103E+04  0.464E+03  0.561E+03  0.141E+03  0.178E+03
0.152E+03  0.206E+04
 1977  0.114E+04  0.246E+04  0.106E+04  0.721E+03  0.809E+03  0.365E+03  0.460E+03  0.118E+03
0.153E+03  0.200E+04
 1978  0.120E+04  0.697E+03  0.193E+04  0.835E+03  0.566E+03  0.637E+03  0.299E+03  0.386E+03
0.102E+03  0.192E+04
 1979  0.157E+04  0.735E+03  0.547E+03  0.152E+04  0.657E+03  0.446E+03  0.521E+03  0.251E+03
0.332E+03  0.181E+04
 1980  0.155E+04  0.963E+03  0.578E+03  0.429E+03  0.119E+04  0.516E+03  0.365E+03  0.438E+03
0.216E+03  0.193E+04
 1981  0.187E+04  0.952E+03  0.757E+03  0.453E+03  0.338E+03  0.940E+03  0.423E+03  0.306E+03
0.377E+03  0.192E+04
 1982  0.454E+04  0.115E+04  0.746E+03  0.594E+03  0.356E+03  0.266E+03  0.770E+03  0.355E+03
0.264E+03  0.207E+04
 1983  0.385E+04  0.277E+04  0.899E+03  0.584E+03  0.467E+03  0.280E+03  0.217E+03  0.646E+03
0.306E+03  0.212E+04
 1984  0.314E+04  0.236E+04  0.218E+04  0.706E+03  0.459E+03  0.367E+03  0.230E+03  0.182E+03
0.556E+03  0.218E+04
 1985  0.268E+04  0.192E+04  0.185E+04  0.171E+04  0.555E+03  0.361E+03  0.301E+03  0.193E+03
0.157E+03  0.247E+04
 1986  0.339E+04  0.164E+04  0.151E+04  0.145E+04  0.135E+04  0.437E+03  0.296E+03  0.252E+03
0.166E+03  0.237E+04
 1987  0.530E+04  0.207E+04  0.129E+04  0.118E+04  0.114E+04  0.106E+04  0.358E+03  0.248E+03
0.217E+03  0.230E+04
 1988  0.620E+04  0.324E+04  0.162E+04  0.101E+04  0.930E+03  0.896E+03  0.868E+03  0.300E+03
0.214E+03  0.227E+04
 1989  0.143E+05  0.378E+04  0.255E+04  0.127E+04  0.797E+03  0.731E+03  0.734E+03  0.729E+03
0.259E+03  0.224E+04
 1990  0.115E+05  0.872E+04  0.297E+04  0.200E+04  0.100E+04  0.626E+03  0.599E+03  0.616E+03
0.627E+03  0.225E+04
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1991 0.271E+05 0.703E+04 0.685E+04 0.233E+04 0.158E+04 0.788E+03 0.513E+03 0.503E+03
0.530E+03 0.258E+04
1992 0.256E+05 0.166E+05 0.552E+04 0.539E+04 0.183E+04 0.124E+04 0.645E+03 0.431E+03
0.433E+03 0.280E+04
1993 0.254E+05 0.157E+05 0.130E+05 0.433E+04 0.424E+04 0.144E+04 0.101E+04 0.541E+03
0.370E+03 0.292E+04
1994 0.318E+05 0.156E+05 0.123E+05 0.102E+05 0.341E+04 0.333E+04 0.118E+04 0.852E+03
0.466E+03 0.297E+04
1995 0.279E+05 0.195E+05 0.122E+05 0.965E+04 0.805E+04 0.268E+04 0.273E+04 0.990E+03
0.733E+03 0.310E+04
1996 0.321E+05 0.171E+05 0.153E+05 0.961E+04 0.759E+04 0.633E+04 0.219E+04 0.229E+04
0.852E+03 0.345E+04
1997 0.261E+05 0.196E+05 0.134E+05 0.120E+05 0.755E+04 0.597E+04 0.518E+04 0.184E+04
0.197E+04 0.387E+04
1998 0.148E+06 0.160E+05 0.154E+05 0.105E+05 0.945E+04 0.594E+04 0.489E+04 0.435E+04
0.158E+04 0.524E+04
1999 0.118E+06 0.909E+05 0.125E+05 0.121E+05 0.827E+04 0.743E+04 0.486E+04 0.410E+04
0.374E+04 0.614E+04
2000 0.154E+06 0.723E+05 0.715E+05 0.985E+04 0.952E+04 0.651E+04 0.608E+04 0.408E+04
0.353E+04 0.885E+04
2001 0.171E+06 0.943E+05 0.568E+05 0.562E+05 0.774E+04 0.749E+04 0.533E+04 0.510E+04
0.351E+04 0.111E+05
2002 0.212E+06 0.105E+06 0.741E+05 0.447E+05 0.442E+05 0.609E+04 0.613E+04 0.447E+04
0.439E+04 0.132E+05
2003 0.274E+06 0.130E+06 0.823E+05 0.583E+05 0.351E+05 0.348E+05 0.499E+04 0.515E+04
0.385E+04 0.158E+05
2004 0.358E+06 0.168E+06 0.102E+06 0.647E+05 0.458E+05 0.276E+05 0.285E+05 0.418E+04
0.443E+04 0.177E+05
2005 0.186E+06 0.220E+06 0.132E+06 0.802E+05 0.509E+05 0.361E+05 0.226E+05 0.239E+05
0.360E+04 0.199E+05
2006 0.144E+06 0.114E+06 0.173E+06 0.104E+06 0.631E+05 0.401E+05 0.295E+05 0.190E+05
0.206E+05 0.212E+05
2007 0.942E+05 0.879E+05 0.894E+05 0.136E+06 0.817E+05 0.496E+05 0.328E+05 0.248E+05
0.163E+05 0.373E+05
2008 0.486E+06 0.577E+05 0.691E+05 0.703E+05 0.107E+06 0.643E+05 0.406E+05 0.275E+05
0.213E+05 0.482E+05
2009 0.533E+06 0.297E+06 0.454E+05 0.544E+05 0.553E+05 0.840E+05 0.526E+05 0.341E+05
0.237E+05 0.624E+05
2010 0.562E+06 0.327E+06 0.234E+06 0.357E+05 0.428E+05 0.435E+05 0.688E+05 0.442E+05
0.294E+05 0.774E+05
2011 0.555E+06 0.344E+06 0.257E+06 0.184E+06 0.281E+05 0.336E+05 0.356E+05 0.578E+05
0.380E+05 0.959E+05
2012 0.597E+06 0.340E+06 0.271E+06 0.202E+06 0.145E+06 0.221E+05 0.275E+05 0.299E+05
0.497E+05 0.120E+06
2013 0.631E+06 0.366E+06 0.267E+06 0.213E+06 0.159E+06 0.114E+06 0.181E+05 0.231E+05
0.257E+05 0.153E+06
2014 0.662E+06 0.386E+06 0.288E+06 0.210E+06 0.168E+06 0.125E+06 0.933E+05 0.152E+05
0.199E+05 0.161E+06
2015 0.662E+06 0.405E+06 0.304E+06 0.226E+06 0.165E+06 0.132E+06 0.102E+06 0.783E+05
0.131E+05 0.163E+06
2016 0.289E+07 0.406E+06 0.319E+06 0.239E+06 0.178E+06 0.130E+06 0.108E+06 0.860E+05
0.674E+05 0.159E+06
2017 0.808E+07 0.177E+07 0.319E+06 0.251E+06 0.188E+06 0.140E+06 0.107E+06 0.906E+05
0.740E+05 0.203E+06
2018 0.904E+06 0.495E+07 0.139E+07 0.251E+06 0.197E+06 0.148E+06 0.115E+06 0.894E+05
0.780E+05 0.249E+06

2019	0.150E+09	0.554E+06	0.389E+07	0.110E+07	0.198E+06	0.155E+06	0.121E+06	0.963E+05	0.770E+05	0.295E+06
2020	0.457E+09	0.918E+08	0.435E+06	0.306E+07	0.862E+06	0.155E+06	0.127E+06	0.102E+06	0.829E+05	0.334E+06
2021	0.677E+08	0.280E+09	0.722E+08	0.342E+06	0.241E+07	0.678E+06	0.127E+06	0.107E+06	0.875E+05	0.376E+06
2022	0.365E+06	0.415E+08	0.220E+09	0.568E+08	0.269E+06	0.189E+07	0.555E+06	0.107E+06	0.918E+05	0.417E+06
2023	0.365E+06	0.223E+06	0.326E+08	0.173E+09	0.447E+08	0.212E+06	0.155E+07	0.466E+06	0.919E+05	0.458E+06
2024		0.224E+06	0.176E+06	0.257E+08	0.136E+09	0.352E+08	0.173E+06	0.130E+07	0.401E+06	0.496E+06

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TABLE 1E. PARAMETER ESTIMATES FOR East of 45

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TERMINAL AGE STRUCTURE OF POPULATION ABUNDANCE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
2	0.199E+07	0.191E+07	0.470E+06	0.224E+06	11.7
3	0.153E+07	0.146E+07	0.361E+06	0.176E+06	12.0
4	0.817E+06	0.394E+07	0.324E+07	0.257E+08	652.5
5	0.152E+08	0.897E+08	0.606E+08	0.136E+09	151.9
6	0.348E+07	0.167E+08	0.112E+08	0.352E+08	210.2
7	0.111E+05	0.857E+05	0.731E+05	0.173E+06	202.3
8	0.102E+06	0.761E+06	0.454E+06	0.130E+07	171.0
9	0.740E+05	0.229E+06	0.217E+06	0.401E+06	175.0
10	0.580E+07	0.780E+07	0.205E+07	0.496E+06	6.4

TERMINAL AGE STRUCTURE OF FISHING MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.682E-03	0.721E-03	-0.223E-03	0.851E-04	11.8
2	0.242E-01	0.256E-01	-0.779E-02	0.307E-02	12.0
3	0.207E-01	0.281E-01	0.402E-02	0.351E-01	124.9
4	0.119E-02	0.278E+00	0.277E+00	0.885E+00	318.5
5	0.217E-02	0.744E+00	0.742E+00	0.170E+01	228.8
6	0.369E+00	0.774E+00	0.441E+00	0.837E+00	108.2
7	0.524E-01	0.570E+00	0.552E+00	0.101E+01	176.8
8	0.586E-01	0.799E+00	0.490E+00	0.154E+01	192.2
9	0.551E-02	0.412E-02	-0.144E-02	0.254E-03	6.2
10	0.661E-02	0.494E-02	-0.173E-02	0.305E-03	6.2

RATIO OF FISHING MORTALITY RATE ON LAST TWO AGES (F-RATIO)

Year	MLE	Average of bootstraps	Bias	Std. Error	% CV
1975	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1976	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1977	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1978	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1979	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0

1980	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1981	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1982	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1983	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1984	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1985	0.600E+00	0.600E+00	0.000E+00	0.211E-07	0.0
1986	0.600E+00	0.600E+00	0.000E+00	0.245E-07	0.0
1987	0.600E+00	0.600E+00	0.000E+00	0.225E-07	0.0
1988	0.600E+00	0.600E+00	0.000E+00	0.185E-07	0.0
1989	0.600E+00	0.600E+00	0.000E+00	0.216E-07	0.0
1990	0.600E+00	0.600E+00	0.000E+00	0.203E-07	0.0
1991	0.600E+00	0.600E+00	0.000E+00	0.247E-07	0.0
1992	0.600E+00	0.600E+00	0.000E+00	0.211E-07	0.0
1993	0.600E+00	0.600E+00	0.000E+00	0.228E-07	0.0
1994	0.600E+00	0.600E+00	0.000E+00	0.215E-07	0.0
1995	0.120E+01	0.120E+01	0.000E+00	0.352E-07	0.0
1996	0.120E+01	0.120E+01	0.000E+00	0.332E-07	0.0
1997	0.120E+01	0.120E+01	0.000E+00	0.315E-07	0.0
1998	0.120E+01	0.120E+01	0.000E+00	0.524E-07	0.0
1999	0.120E+01	0.120E+01	0.000E+00	0.449E-07	0.0
2000	0.120E+01	0.120E+01	0.000E+00	0.388E-07	0.0
2001	0.120E+01	0.120E+01	0.000E+00	0.415E-07	0.0
2002	0.120E+01	0.120E+01	0.000E+00	0.442E-07	0.0
2003	0.120E+01	0.120E+01	0.000E+00	0.417E-07	0.0
2004	0.120E+01	0.120E+01	0.000E+00	0.403E-07	0.0
2005	0.120E+01	0.120E+01	0.000E+00	0.476E-07	0.0
2006	0.120E+01	0.120E+01	0.000E+00	0.380E-07	0.0
2007	0.120E+01	0.120E+01	0.000E+00	0.396E-07	0.0
2008	0.120E+01	0.120E+01	0.000E+00	0.409E-07	0.0
2009	0.120E+01	0.120E+01	0.000E+00	0.402E-07	0.0
2010	0.120E+01	0.120E+01	0.000E+00	0.392E-07	0.0
2011	0.120E+01	0.120E+01	0.000E+00	0.391E-07	0.0
2012	0.120E+01	0.120E+01	0.000E+00	0.353E-07	0.0
2013	0.120E+01	0.120E+01	0.000E+00	0.408E-07	0.0
2014	0.120E+01	0.120E+01	0.000E+00	0.490E-07	0.0
2015	0.120E+01	0.120E+01	0.000E+00	0.440E-07	0.0
2016	0.120E+01	0.120E+01	0.000E+00	0.376E-07	0.0
2017	0.120E+01	0.120E+01	0.000E+00	0.399E-07	0.0
2018	0.120E+01	0.120E+01	0.000E+00	0.356E-07	0.0
2019	0.120E+01	0.120E+01	0.000E+00	0.388E-07	0.0
2020	0.120E+01	0.120E+01	0.000E+00	0.418E-07	0.0
2021	0.120E+01	0.120E+01	0.000E+00	0.456E-07	0.0
2022	0.120E+01	0.120E+01	0.000E+00	0.415E-07	0.0
2023	0.120E+01	0.120E+01	0.000E+00	0.417E-07	0.0

NATURAL MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.490E+00	0.490E+00	0.000E+00	0.000E+00	0.0
2	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
3	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
4	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
5	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
6	0.200E+00	0.200E+00	0.000E+00	0.000E+00	0.0
7	0.175E+00	0.175E+00	0.000E+00	0.000E+00	0.0
8	0.150E+00	0.150E+00	0.000E+00	0.000E+00	0.0

9	0.125E+00	0.125E+00	0.000E+00	0.000E+00	0.0
10	0.100E+00	0.100E+00	0.000E+00	0.000E+00	0.0

TRANSFER COEFFICIENTS

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

VARIANCE SCALING PARAMETERS

Index	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
2	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
3	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
4	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
5	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
6	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
7	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
8	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
9	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
10	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
11	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2
12	0.939E+00	0.917E+00	-0.214E-01	0.755E-01	8.2

CATCHABILITY COEFFICIENTS

Index	Year	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	1975	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1976	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1977	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1978	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1979	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1980	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1981	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1982	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1983	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1984	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1985	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1986	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1987	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1988	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1989	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1990	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1991	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0

1	1992	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1993	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1994	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1995	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1996	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1997	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1998	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	1999	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2000	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2001	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2002	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2003	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2004	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2005	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2006	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2007	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2008	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2009	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2010	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2011	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2012	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2013	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2014	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2015	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2016	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2017	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2018	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2019	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2020	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2021	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2022	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
1	2023	0.122E-05	0.112E-05	-0.248E-06	0.101E-06	9.0
2	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

2	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	1975	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1976	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1977	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1978	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1979	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1980	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1981	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1982	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1983	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1984	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1985	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1986	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1987	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1988	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1989	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1990	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1991	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1992	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1993	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1994	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1995	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1996	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1997	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1998	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	1999	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2000	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2001	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2002	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2003	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2004	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2005	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2006	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2007	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0

3	2008	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2009	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2010	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2011	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2012	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2013	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2014	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2015	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2016	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2017	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2018	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2019	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2020	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2021	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2022	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
3	2023	0.792E-06	0.777E-06	-0.441E-06	0.148E-06	19.0
4	1975	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1976	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1977	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1978	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1979	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1980	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1981	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1982	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1983	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1984	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1985	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1986	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1987	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1988	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1989	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1990	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1991	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1992	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1993	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1994	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1995	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1996	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1997	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1998	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	1999	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2000	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2001	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2002	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2003	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2004	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2005	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2006	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2007	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2008	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2009	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2010	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2011	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2012	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2013	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2014	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2015	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7

4	2016	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2017	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2018	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2019	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2020	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2021	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2022	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
4	2023	0.132E-05	0.129E-05	-0.941E-06	0.253E-06	19.7
5	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

6	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	1975	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1976	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1977	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1978	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1979	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1980	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1981	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1982	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6

7	1983	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1984	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1985	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1986	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1987	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1988	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1989	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1990	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1991	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1992	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1993	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1994	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1995	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1996	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1997	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1998	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	1999	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2000	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2001	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2002	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2003	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2004	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2005	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2006	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2007	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2008	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2009	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2010	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2011	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2012	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2013	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2014	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2015	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2016	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2017	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2018	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2019	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2020	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2021	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2022	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
7	2023	0.111E-05	0.104E-05	-0.198E-06	0.787E-07	7.6
8	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

8	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

9	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

10	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
11	1975	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1976	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1977	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1978	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1979	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1980	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1981	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1982	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1983	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1984	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1985	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1986	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1987	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1988	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1989	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1990	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1991	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1992	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1993	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1994	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1995	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1996	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1997	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1998	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	1999	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2000	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2001	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2002	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2003	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2004	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2005	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2006	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2007	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2008	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2009	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2010	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2011	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2012	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2013	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2014	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3

11	2015	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2016	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2017	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2018	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2019	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2020	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2021	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2022	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
11	2023	0.470E-08	0.499E-08	-0.112E-08	0.151E-08	30.3
12	1975	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1976	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1977	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1978	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1979	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1980	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1981	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1982	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1983	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1984	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1985	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1986	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1987	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1988	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1989	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1990	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1991	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1992	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1993	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1994	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1995	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1996	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1997	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1998	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	1999	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2000	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2001	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2002	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2003	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2004	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2005	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2006	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2007	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2008	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2009	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2010	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2011	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2012	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2013	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2014	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2015	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2016	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2017	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2018	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2019	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2020	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2021	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9
12	2022	0.617E-06	0.700E-06	0.242E-07	0.202E-06	28.9

12 2023 0.617E-06 0.700E-06 0.242E-07 0.202E-06 28.9

****
CORRELATION AND COVARIANCE MATRICES OF PARAMETERS
****

TABLE 2A. CORRELATION MATRIX

==

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 :	1.0																			
2 :	1.0	1.0																		
3 :	0.1	0.1	1.0																	
4 :	0.1	0.1	-0.1	1.0																
5 :	0.1	0.1	0.0	0.3	1.0															
6 :	0.0	0.0	0.1	-0.1	-0.2	1.0														
7 :	0.1	0.1	0.1	-0.1	0.0	-0.1	1.0													
8 :	0.1	0.1	0.2	-0.1	-0.2	0.0	0.1	1.0												
9 :	-0.1	-0.1	-0.1	0.0	0.1	-0.1	0.0	0.0	1.0											
10 :	0.1	0.1	0.2	0.1	0.0	0.0	0.0	-0.1	-0.2	1.0										
11 :	-0.1	-0.1	-0.1	0.0	0.1	-0.1	0.0	0.0	1.0	-0.2	1.0									
12 :	-0.1	-0.1	-0.1	0.0	0.1	-0.1	0.0	0.0	1.0	-0.2	1.0	1.0								
13 :	-0.1	-0.1	-0.1	0.0	0.1	-0.1	0.0	0.0	1.0	-0.2	1.0	1.0	1.0							
14 :	0.0	0.0	0.1	0.0	0.0	-0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	1.0						
15 :	0.0	0.0	0.1	0.1	0.0	0.0	-0.3	0.1	0.2	-0.2	0.2	0.2	0.2	0.2	1.0					
16 :	0.0	0.0	0.0	0.0	0.0	-0.2	0.1	-0.1	0.3	0.0	0.3	0.3	0.3	0.1	0.1	1.0				
17 :	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.1	-0.1	0.1	-0.1	-0.1	-0.1	0.2	0.0	0.1	1.0			
18 :	0.1	0.1	0.0	0.2	0.0	0.0	0.1	0.0	0.2	0.0	0.2	0.2	0.2	-0.2	-0.1	0.1	0.0	1.0		
19 :	0.0	0.0	-0.1	0.1	0.0	-0.1	0.1	-0.1	0.0	0.1	0.0	0.0	0.0	0.1	-0.1	0.1	-0.2	-0.1	1.0	
20 :	0.1	0.1	-0.1	0.1	0.0	0.1	-0.3	0.1	0.1	-0.1	0.1	0.1	0.1	-0.1	0.3	0.0	0.0	0.2	-0.1	1.0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35																				
21 :	0.0	0.0	-0.1	-0.1	0.2	-0.1	-0.1	-0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.1	-0.2	0.0	0.0	0.0
22 :	-0.1	-0.1	-0.1	0.0	0.1	-0.2	0.1	0.0	-0.1	0.1	-0.1	-0.1	-0.1	0.1	-0.1	0.1	0.0	-0.1	0.2	-0.1
23 :	0.1	0.1	0.0	-0.1	-0.2	0.1	0.3	0.1	-0.5	0.2	-0.5	-0.5	-0.5	0.0	-0.3	-0.1	0.0	0.0	0.1	-0.2
24 :	0.1	0.1	0.1	0.0	-0.1	0.1	0.0	0.0	-1.0	0.2	-1.0	-1.0	-1.0	-0.1	-0.2	-0.3	0.1	-0.2	0.0	-0.1
25 :	0.1	0.1	0.1	0.0	-0.1	0.1	0.0	0.0	-1.0	0.2	-1.0	-1.0	-1.0	-0.1	-0.2	-0.3	0.1	-0.2	0.0	-0.1
26 :	0.1	0.1	0.1	0.0	-0.1	0.1	0.0	0.0	-1.0	0.2	-1.0	-1.0	-1.0	-0.1	-0.2	-0.3	0.1	-0.2	0.0	-0.1
27 :	0.1	0.1	0.1	0.0	-0.1	0.1	0.0	0.0	-1.0	0.2	-1.0	-1.0	-1.0	-0.1	-0.2	-0.3	0.1	-0.2	0.0	-0.1
28 :	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	-1.0	0.2	-1.0	-1.0	-1.0	0.0	-0.2	-0.3	0.1	-0.2	0.0	-0.1
29 :	0.1	0.1	0.1	0.0	-0.1	0.1	0.0	0.0	-0.9	0.2	-0.9	-0.9	-0.9	-0.1	-0.2	-0.3	0.1	-0.2	0.0	-0.1
30 :	0.1	0.1	0.1	-0.1	-0.1	0.1	0.0	0.0	-0.9	0.2	-0.9	-0.9	-0.8	-0.1	-0.2	-0.3	0.1	-0.1	0.1	-0.2
31 :	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	-0.8	0.2	-0.8	-0.8	-0.8	-0.1	-0.2	-0.3	0.1	0.0	-0.1	-0.1
32 :	0.0	0.0	0.1	-0.1	-0.1	0.0	0.0	0.0	-0.7	0.1	-0.7	-0.7	-0.7	0.0	-0.1	-0.2	0.0	-0.1	0.2	-0.1
33 :	0.1	0.1	0.0	0.0	0.1	0.2	0.0	0.0	-0.6	0.0	-0.6	-0.6	-0.6	0.1	-0.2	-0.2	0.0	-0.1	-0.1	0.0
34 :	0.0	0.0	0.0	0.1	0.1	0.1	-0.1	0.0	-0.4	0.0	-0.4	-0.4	-0.4	-0.2	-0.1	-0.2	-0.2	0.1	0.1	0.1
35 :	-0.1	-0.1	-0.1	0.0	0.1	-0.1	0.0	-0.2	-0.4	0.1	-0.4	-0.4	-0.4	0.1	0.0	-0.1	-0.1	-0.2	0.1	-0.1

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
21 :	1.0														
22 :	0.0	1.0													
23 :	-0.1	0.1	1.0												

24 : 0.0 0.1 0.5 1.0
25 : 0.0 0.1 0.5 1.0 1.0
26 : 0.0 0.1 0.5 1.0 1.0 1.0
27 : 0.0 0.1 0.5 1.0 1.0 1.0 1.0
28 : 0.0 0.1 0.5 1.0 1.0 1.0 1.0 1.0
29 : 0.0 0.1 0.5 0.9 0.9 0.9 0.9 0.9 1.0
30 : 0.0 0.0 0.5 0.9 0.9 0.9 0.9 0.8 0.8 1.0
31 : 0.0 0.1 0.3 0.8 0.8 0.8 0.8 0.7 0.7 0.7 1.0
32 : -0.1 0.1 0.3 0.7 0.7 0.7 0.7 0.7 0.6 0.6 0.5 1.0
33 : 0.1 0.1 0.3 0.6 0.6 0.6 0.6 0.6 0.6 0.5 0.5 0.3 1.0
34 : 0.1 -0.1 0.1 0.4 0.4 0.4 0.4 0.4 0.3 0.3 0.3 0.4 0.3 1.0
35 : -0.1 0.1 0.1 0.4 0.4 0.4 0.4 0.4 0.4 0.3 0.3 0.2 0.2 0.2 1.0

TABLE 2B. COVARIANCE MATRIX

==

1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 18 19 20

1 : 0.7241D-08
2 : 0.2614D-06 0.9437D-05
3 : 0.3431D-06 0.1236D-04 0.1232D-02
4 : 0.8101D-05 0.2866D-03 -0.1599D-02 0.7834D+00
5 : 0.9899D-05 0.3371D-03 -0.1348D-02 0.4278D+00 0.2894D+01
6 : 0.2241D-05 0.7845D-04 0.2578D-02 -0.8209D-01 -0.3124D+00 0.7010D+00
7 : 0.1069D-04 0.3769D-03 0.5175D-02 -0.8878D-01 0.2282D-01 -0.1208D+00 0.1015D+01
8 : 0.1478D-04 0.5522D-03 0.9487D-02 -0.1352D+00 -0.4473D+00 0.3656D-01 0.7859D-01
0.2361D+01
9 : -0.1507D-08 -0.5524D-07 -0.9352D-06 0.4380D-05 0.3114D-04 -0.1973D-04 0.5860D-05 -
0.7298D-05 0.6448D-07
10 : 0.3400D-06 0.1230D-04 0.4437D-03 0.7011D-02 0.1110D-02 -0.9159D-03 0.2369D-02 -
0.1630D-01 -0.4314D-05 0.5700D-02
11 : -0.8711D-08 -0.3187D-06 -0.5184D-05 0.2297D-04 0.1946D-03 -0.1110D-03 0.2809D-04 -
0.5033D-04 0.3509D-06 -0.2275D-04 0.1918D-05
12 : -0.4415D-08 -0.1621D-06 -0.2660D-05 0.1659D-04 0.7422D-04 -0.5581D-04 0.6001D-05 -
0.3650D-04 0.1842D-06 -0.1205D-04 0.1003D-05 0.5315D-06
13 : -0.3670D-08 -0.1337D-06 -0.2666D-05 0.9041D-05 0.5101D-04 -0.4018D-04 0.1291D-05 -
0.1108D-04 0.1443D-06 -0.1014D-04 0.7873D-06 0.4135D-06 0.3343D-06
14 : -0.3600D-09 -0.1341D-07 0.2702D-06 -0.8942D-06 -0.2017D-05 -0.1103D-04 0.5710D-05 -
0.3987D-05 0.1759D-08 0.5929D-06 0.9705D-08 0.4892D-08 0.4157D-08 0.9512D-08
15 : -0.4596D-09 -0.1494D-07 0.2441D-06 0.1064D-04 -0.4745D-05 0.7220D-06 -0.4227D-04
0.1785D-04 0.5796D-08 -0.1974D-05 0.3240D-07 0.1553D-07 0.1337D-07 0.1985D-08 0.1795D-
07
16 : -0.1882D-10 -0.5498D-09 -0.1737D-06 0.1975D-05 0.9979D-05 -0.1667D-04 0.6735D-05 -
0.1232D-04 0.8910D-08 -0.4350D-06 0.4942D-07 0.2555D-07 0.2058D-07 0.1682D-08 0.1053D-
08 0.1423D-07
17 : 0.4905D-09 0.1740D-07 0.3228D-06 -0.3397D-05 -0.9463D-05 0.2214D-04 -0.7757D-06
0.2582D-04 -0.1537D-08 0.1096D-05 -0.9606D-08 -0.5495D-08 -0.5115D-08 0.1710D-08 0.2765D-
09 0.9927D-09 0.1340D-07
18 : 0.9967D-09 0.3530D-07 0.6174D-07 0.2660D-04 0.8115D-05 0.1171D-05 0.8177D-05
0.2555D-05 0.5700D-08 -0.3342D-06 0.2994D-07 0.1752D-07 0.1325D-07 -0.2601D-08 -0.8948D-
09 0.9513D-09 -0.6822D-09 0.1451D-07
19 : 0.5006D-10 0.2611D-08 -0.5419D-06 0.7341D-05 0.8506D-05 -0.1087D-04 0.1157D-04 -
0.1352D-04 -0.5043D-09 0.4509D-06 -0.4026D-08 -0.2961D-08 -0.1507D-08 0.9030D-09 -0.1502D-
08 0.1109D-08 -0.2274D-08 -0.9463D-09 0.1348D-07

20 : 0.1133D-08 0.4157D-07 -0.4451D-06 0.1158D-04 0.1289D-04 0.8540D-05 -0.4609D-04 0.2246D-04 0.3770D-08 -0.7415D-06 0.1966D-07 0.1251D-07 0.8593D-08 -0.9011D-09 0.5341D-08 0.2678D-09 -0.7653D-09 0.2833D-08 -0.2421D-08 0.2436D-07

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
21 : -0.2618D-06 -0.6865D-05 -0.6788D-03 -0.9202D-02 0.4988D-01 -0.1562D-01 -0.9716D-02 -0.3008D-01 0.1467D-05 0.1252D-02 0.9426D-05 0.4276D-05 0.3728D-05 0.2437D-05 0.3017D-06 0.1450D-05 -0.3148D-05 -0.7494D-06 -0.1875D-06 0.1154D-05
22 : -0.1779D-05 -0.6553D-04 -0.4389D-03 -0.2843D-02 0.4125D-01 -0.3107D-01 0.1404D-01 -0.3450D-02 -0.5269D-05 0.1683D-02 -0.2716D-04 -0.1672D-04 -0.1274D-04 0.9158D-06 -0.3601D-05 0.1811D-05 0.2889D-06 -0.2818D-05 0.3636D-05 -0.2238D-05
23 : 0.1077D-08 0.3883D-07 -0.1132D-06 -0.6005D-05 -0.3809D-04 0.1077D-04 0.3235D-04 0.1126D-04 -0.1455D-07 0.1247D-05 -0.8020D-07 -0.4183D-07 -0.3218D-07 -0.1328D-09 -0.4004D-08 -0.1457D-08 0.1425D-09 -0.6298D-09 0.9005D-09 -0.3102D-08
24 : 0.7262D-08 0.2674D-06 0.4626D-05 -0.2279D-04 -0.1669D-03 0.1173D-03 -0.4308D-04 0.2209D-04 -0.3506D-06 0.2182D-04 -0.1910D-05 -0.1003D-05 -0.7864D-06 -0.1039D-07 -0.3228D-07 -0.4900D-07 0.9281D-08 -0.3082D-07 0.3981D-08 -0.2010D-07
25 : 0.7702D-08 0.2830D-06 0.5156D-05 -0.3602D-04 -0.1911D-03 0.1197D-03 -0.3081D-04 0.3906D-04 -0.3769D-06 0.2379D-04 -0.2052D-05 -0.1078D-05 -0.8439D-06 -0.1106D-07 -0.3419D-07 -0.5497D-07 0.9178D-08 -0.3470D-07 0.2376D-08 -0.2513D-07
26 : 0.7758D-08 0.2836D-06 0.4443D-05 -0.2575D-04 -0.1451D-03 0.1071D-03 -0.1065D-04 -0.5032D-05 -0.3338D-06 0.2211D-04 -0.1818D-05 -0.9545D-06 -0.7493D-06 -0.9640D-08 -0.3047D-07 -0.4746D-07 0.8266D-08 -0.3061D-07 0.1549D-08 -0.1842D-07
27 : 0.6695D-08 0.2456D-06 0.4088D-05 -0.1985D-04 -0.1588D-03 0.1083D-03 -0.4311D-04 0.1650D-04 -0.3283D-06 0.2144D-04 -0.1788D-05 -0.9400D-06 -0.7364D-06 -0.9128D-08 -0.2921D-07 -0.4716D-07 0.1088D-07 -0.3059D-07 0.2993D-08 -0.2169D-07
28 : 0.1926D-08 0.7073D-07 0.1191D-05 -0.2419D-05 -0.7059D-05 0.2807D-04 -0.1250D-04 -0.1527D-04 -0.8105D-07 0.5539D-05 -0.4420D-06 -0.2332D-06 -0.1823D-06 -0.9059D-09 -0.7831D-08 -0.1128D-07 0.4899D-08 -0.6441D-08 0.8918D-09 -0.5559D-08
29 : 0.1261D-08 0.4578D-07 0.8651D-06 -0.8419D-05 -0.3891D-04 0.2622D-04 0.1965D-05 -0.1928D-06 -0.5703D-07 0.3676D-05 -0.3099D-06 -0.1620D-06 -0.1275D-06 -0.2014D-08 -0.7167D-08 -0.7675D-08 0.2500D-08 -0.6961D-08 -0.8036D-09 -0.3656D-08
30 : 0.1335D-08 0.4941D-07 0.5783D-06 -0.1679D-04 -0.3750D-04 0.1834D-04 -0.1099D-05 0.1159D-04 -0.3840D-07 0.2307D-05 -0.2095D-06 -0.1109D-06 -0.8474D-07 -0.1379D-08 -0.3874D-08 -0.6323D-08 0.1034D-08 -0.2727D-08 0.1149D-08 -0.5103D-08
31 : 0.1059D-08 0.3840D-07 0.9071D-07 0.1477D-05 -0.3604D-05 0.8758D-05 0.2211D-05 -0.3100D-05 -0.3001D-07 0.2707D-05 -0.1621D-06 -0.8548D-07 -0.6887D-07 -0.8811D-09 -0.4281D-08 -0.5625D-08 0.1563D-08 0.4080D-09 -0.1379D-08 -0.1427D-08
32 : -0.2252D-09 -0.7724D-08 0.4313D-06 -0.9323D-05 -0.3023D-04 -0.3929D-06 -0.6658D-05 0.1612D-05 -0.2461D-07 0.1087D-05 -0.1359D-06 -0.7040D-07 -0.5569D-07 -0.2576D-09 -0.1241D-08 -0.3162D-08 0.2803D-09 -0.1941D-08 0.2998D-08 -0.1647D-08
33 : 0.7507D-09 0.2620D-07 -0.1516D-06 -0.6363D-06 0.1342D-04 0.2225D-04 0.9520D-06 0.2988D-05 -0.2193D-07 0.3563D-07 -0.1182D-06 -0.6169D-07 -0.4770D-07 0.8351D-09 -0.4150D-08 -0.3192D-08 -0.5287D-09 -0.9387D-09 -0.1218D-08 -0.8755D-09
34 : -0.2443D-09 -0.8938D-08 0.1516D-06 0.1266D-04 0.2775D-04 0.7328D-05 -0.1292D-04 0.6649D-05 -0.1088D-07 0.6982D-08 -0.6061D-07 -0.2929D-07 -0.2334D-07 -0.1670D-08 -0.1673D-08 -0.2702D-08 -0.2184D-08 0.8194D-09 0.1523D-08 0.2311D-08
35 : -0.1132D-08 -0.4172D-07 -0.3930D-06 -0.4381D-05 0.1738D-04 -0.9367D-05 -0.8893D-07 -0.3862D-04 -0.1108D-07 0.1222D-05 -0.5877D-07 -0.3050D-07 -0.2473D-07 0.5904D-09 0.2929D-09 -0.9921D-09 -0.9811D-09 -0.3028D-08 0.1123D-08 -0.1126D-08

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

21 : 0.2556D-01
22 : -0.8888D-03 0.3434D-01
23 : -0.1688D-05 0.1756D-05 0.1195D-07
24 : -0.6395D-05 0.2831D-04 0.7881D-07 0.1914D-05
25 : -0.8654D-05 0.2988D-04 0.8554D-07 0.2052D-05 0.2210D-05
26 : -0.7321D-05 0.2761D-04 0.7503D-07 0.1817D-05 0.1954D-05 0.1736D-05
27 : -0.9208D-05 0.2890D-04 0.7351D-07 0.1789D-05 0.1922D-05 0.1702D-05 0.1685D-05
28 : 0.1163D-05 0.5558D-05 0.1679D-07 0.4428D-06 0.4748D-06 0.4208D-06 0.4146D-06 0.1094D-06
29 : -0.9303D-06 0.3180D-05 0.1392D-07 0.3104D-06 0.3341D-06 0.2969D-06 0.2909D-06 0.7102D-07 0.5708D-07
30 : 0.5028D-06 0.6158D-06 0.9732D-08 0.2096D-06 0.2254D-06 0.1988D-06 0.1976D-06 0.4940D-07 0.3355D-07 0.3117D-07
31 : 0.2484D-06 0.3427D-05 0.5400D-08 0.1633D-06 0.1743D-06 0.1553D-06 0.1541D-06 0.3839D-07 0.2629D-07 0.1810D-07 0.2399D-07
32 : -0.3213D-05 0.2012D-05 0.3963D-08 0.1344D-06 0.1452D-06 0.1283D-06 0.1269D-06 0.3130D-07 0.2158D-07 0.1436D-07 0.1126D-07 0.2011D-07
33 : 0.2371D-05 0.2115D-05 0.4667D-08 0.1198D-06 0.1277D-06 0.1134D-06 0.1129D-06 0.2834D-07 0.2071D-07 0.1276D-07 0.1165D-07 0.6924D-08 0.2100D-07
34 : 0.1042D-05 -0.1719D-05 0.1152D-08 0.5938D-07 0.6293D-07 0.5550D-07 0.5340D-07 0.1460D-07 0.8948D-08 0.4914D-08 0.5114D-08 0.6123D-08 0.4855D-08 0.1202D-07
35 : -0.1477D-05 0.2387D-05 0.1841D-08 0.5872D-07 0.6464D-07 0.5864D-07 0.5519D-07 0.1399D-07 0.1048D-07 0.5956D-08 0.4641D-08 0.2644D-08 0.4103D-08 0.1974D-08 0.1365D-07

APPENDIX V

VPA results for the strategy 2.. VPA analysis for ABFT for the period 1975 – 2023. Data for 2011 – 2023 ws simulated using projected Fs and Ns from the 2010 stock assessment

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    **************************************
                            VPA-2BOX
             SUMMARY STATISTICS AND DIAGNOSTIC OUTPUT
             ***************************************

Model for strategy 2
14:40, 17  February 2011

=====================================================================
Total objective function =      982.47
     (with constants)   =   -19846.30
Number of parameters (P) =         42
Number of data points (D)=        261
AIC : 2*objective+2P    =   -39608.60
AICc: 2*objective+2P(...)=   -39592.03
BIC : 2*objective+Plog(D)=   -39458.89
Chi-square discrepancy   =      112.79

Loglikelihoods (deviance)=     -989.71 (      758.44)
   effort data          =      -36.17 (      170.01)
   tagging data         =     -953.53 (      588.43)

Log-posteriors          =        6.54
   catchability         =        0.00
   f-ratio              =        0.00
   natural mortality    =        0.00
   mixing coeff.        =        0.00
   initial tag survival =        0.00
   tag shedding rate    =       17.18
   tag reporting rate   =      -10.64
   tag nomixing factor  =        0.00

Constraints             =        0.69
   terminal F           =        0.00
   stock-rec./sex ratio =        0.69

Out of bounds penalty   =        0.00
=====================================================================
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TABLE 1. FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.067	0.358	0.144	0.092	0.043	0.103	0.053	0.046	0.060	0.060
1976	0.009	0.267	0.466	0.121	0.097	0.030	0.067	0.031	0.047	0.047
1977	0.071	0.235	0.175	0.154	0.023	0.034	0.025	0.062	0.046	0.046
1978	0.135	0.353	0.177	0.084	0.041	0.011	0.024	0.013	0.036	0.036
1979	0.017	0.105	0.281	0.092	0.037	0.023	0.017	0.051	0.033	0.033
1980	0.111	0.241	0.408	0.188	0.030	0.035	0.030	0.016	0.035	0.035
1981	0.075	0.440	0.333	0.102	0.088	0.021	0.031	0.046	0.027	0.027
1982	0.242	0.392	0.481	0.172	0.067	0.041	0.022	0.076	0.055	0.055
1983	0.244	0.199	0.323	0.134	0.080	0.060	0.118	0.034	0.057	0.057

1984	0.109	0.452	0.122	0.131	0.130	0.095	0.086	0.117	0.063	0.063
1985	0.093	0.407	0.400	0.115	0.071	0.069	0.037	0.054	0.075	0.045
1986	0.277	0.319	0.244	0.149	0.032	0.046	0.042	0.032	0.072	0.043
1987	0.142	0.395	0.293	0.119	0.047	0.030	0.083	0.062	0.065	0.039
1988	0.339	0.211	0.387	0.163	0.058	0.041	0.049	0.075	0.099	0.060
1989	0.185	0.366	0.168	0.151	0.139	0.033	0.052	0.037	0.078	0.047
1990	0.172	0.239	0.313	0.129	0.163	0.055	0.054	0.074	0.092	0.055
1991	0.074	0.288	0.216	0.134	0.136	0.046	0.048	0.059	0.135	0.081
1992	0.076	0.278	0.350	0.087	0.069	0.061	0.103	0.128	0.157	0.094
1993	0.087	0.467	0.327	0.131	0.059	0.065	0.072	0.095	0.147	0.088
1994	0.114	0.268	0.192	0.081	0.118	0.090	0.181	0.202	0.343	0.206
1995	0.149	0.206	0.262	0.108	0.106	0.165	0.093	0.163	0.193	0.232
1996	0.168	0.433	0.329	0.248	0.119	0.060	0.105	0.082	0.222	0.266
1997	0.162	0.333	0.217	0.188	0.150	0.141	0.089	0.217	0.223	0.268
1998	0.100	0.502	0.359	0.256	0.118	0.266	0.042	0.048	0.145	0.174
1999	0.104	0.129	0.276	0.196	0.105	0.048	0.051	0.066	0.155	0.185
2000	0.269	0.241	0.134	0.165	0.183	0.140	0.055	0.087	0.101	0.121
2001	0.006	0.272	0.128	0.088	0.117	0.099	0.175	0.121	0.141	0.170
2002	0.021	0.292	0.193	0.088	0.042	0.105	0.067	0.114	0.127	0.153
2003	0.009	0.107	0.064	0.046	0.080	0.040	0.155	0.117	0.155	0.186
2004	0.033	0.103	0.117	0.040	0.023	0.055	0.060	0.093	0.157	0.189
2005	0.136	0.137	0.077	0.063	0.040	0.042	0.055	0.038	0.195	0.234
2006	0.136	0.116	0.121	0.037	0.017	0.057	0.030	0.044	0.127	0.153
2007	0.002	0.095	0.041	0.094	0.070	0.046	0.055	0.047	0.129	0.155
2008	0.000	0.096	0.056	0.089	0.047	0.040	0.045	0.057	0.069	0.082
2009	0.000	0.008	0.043	0.097	0.044	0.037	0.061	0.055	0.042	0.051
2010	0.000	0.008	0.010	0.154	0.062	0.074	0.050	0.044	0.036	0.043
2011	0.001	0.034	0.017	0.028	0.013	0.011	0.016	0.016	0.022	0.026
2012	0.001	0.030	0.016	0.026	0.012	0.010	0.014	0.014	0.018	0.022
2013	0.001	0.028	0.014	0.023	0.011	0.009	0.013	0.013	0.017	0.020
2014	0.001	0.026	0.014	0.022	0.010	0.008	0.012	0.012	0.015	0.018
2015	0.001	0.024	0.013	0.021	0.010	0.008	0.011	0.011	0.014	0.017
2016	0.004	0.023	0.012	0.019	0.009	0.008	0.010	0.010	0.013	0.015
2017	0.003	0.148	0.010	0.017	0.008	0.007	0.009	0.009	0.011	0.014
2018	0.009	0.098	0.074	0.016	0.007	0.006	0.008	0.008	0.010	0.012
2019	0.000	0.347	0.049	0.119	0.007	0.006	0.008	0.008	0.010	0.012
2020	0.000	0.007	0.219	0.077	0.055	0.005	0.007	0.007	0.009	0.011
2021	0.000	0.002	0.003	0.456	0.035	0.045	0.007	0.007	0.008	0.010
2022	0.001	0.002	0.001	0.005	0.294	0.029	0.061	0.006	0.008	0.010
2023	0.001	0.029	0.001	0.001	0.002	0.321	0.039	0.062	0.008	0.009

TABLE 2. ABUNDANCE AT THE BEGINNING OF THE YEAR [BY AREA] FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	1640896.	1306625.	689303.	307117.	318292.	89086.	98166.	82543.	82260.	996794.
1976	2431348.	940503.	718572.	469456.	220342.	239889.	65785.	78141.	67858.	918149.
1977	1237566.	1475945.	566546.	354855.	327355.	157267.	190543.	51662.	65230.	849472.

1978	979553.	706073.	917541.	374188.	239380.	251600.	124483.	155962.	41777.	788727.
1979	1212444.	524135.	390092.	604852.	270718.	180754.	203673.	101986.	132524.	723745.
1980	1832896.	730410.	371372.	231644.	434129.	205171.	144556.	168085.	83427.	746842.
1981	1586091.	1004646.	451645.	194279.	151020.	331385.	162250.	117759.	142360.	723498.
1982	2538566.	901063.	509036.	254729.	138057.	108786.	265702.	132051.	96782.	759940.
1983	3853210.	1221265.	479163.	247429.	168638.	101529.	85465.	218202.	105289.	732026.
1984	1987913.	1849011.	787112.	272806.	170235.	122462.	78307.	63759.	181579.	713543.
1985	1799123.	1092233.	925828.	548081.	188232.	117565.	91218.	60346.	48820.	756749.
1986	3134562.	1004661.	572009.	488424.	384412.	137960.	89877.	73817.	49200.	694477.
1987	2221038.	1456251.	574643.	352670.	330858.	292806.	107863.	72379.	61522.	642368.
1988	3413817.	1180518.	771904.	337343.	246412.	248311.	232708.	83293.	58525.	609788.
1989	3400145.	1489552.	751701.	412381.	225501.	183003.	195071.	185962.	66495.	566657.
1990	3482179.	1731355.	812198.	499716.	278990.	154299.	145008.	155397.	154207.	543668.
1991	4281074.	1796986.	1072467.	467020.	345580.	186484.	119606.	115384.	124157.	589453.
1992	3938760.	2434779.	1059944.	679691.	321182.	237202.	145854.	95704.	93603.	587666.
1993	4256001.	2235809.	1450757.	587656.	490148.	235784.	182779.	110467.	72487.	554704.
1994	3556054.	2390714.	1102756.	822911.	405690.	363502.	180946.	142814.	86458.	514608.
1995	4029891.	1943384.	1438533.	715904.	597227.	283702.	272131.	126723.	100452.	433290.
1996	3615378.	2127524.	1244282.	870545.	505276.	422408.	196847.	208244.	92699.	383871.
1997	2569068.	1872830.	1085912.	704196.	534583.	352748.	325628.	148736.	165066.	331775.
1998	4561878.	1337838.	1056402.	687409.	459100.	361893.	250774.	250078.	103013.	346100.
1999	3687476.	2527943.	636712.	580088.	418680.	321094.	227171.	201854.	205253.	341844.
2000	4715563.	2034944.	1747900.	379959.	375247.	296489.	250642.	181276.	162627.	412147.
2001	3557474.	2206961.	1257328.	1202515.	253511.	245706.	211083.	199176.	143026.	460018.
2002	3651891.	2167014.	1322477.	870409.	866386.	177386.	182249.	148758.	151872.	460905.
2003	4408089.	2190931.	1272488.	858089.	626884.	653642.	130723.	143013.	114213.	476019.
2004	6178876.	2676477.	1548264.	938612.	644820.	455223.	513994.	93962.	109462.	443875.
2005	3119248.	3662526.	1898837.	1083007.	709079.	495810.	352680.	406170.	73693.	415118.

2006	2257945.	1667606.	2511315.	1382712.	799525.	535880.	389146.	280230.	336532.	350697.
2007	1263945.	1206871.	1168351.	1749892.	1047927.	618350.	414348.	317109.	230886.	533917.
2008	4986327.	773153.	863698.	881886.	1253298.	768922.	483382.	329363.	260502.	592577.
2009	5410170.	3054172.	552442.	642505.	634498.	940274.	605008.	388043.	267819.	708544.
2010	5737488.	3313379.	2382496.	416452.	458725.	477398.	742023.	477613.	316191.	835974.
2011	5539148.	3513901.	2586391.	1856007.	280958.	339137.	363066.	592626.	393283.	994140.
2012	5854092.	3390225.	2671188.	1999421.	1419129.	218069.	274557.	299943.	501784.	1216154.
2013	6057035.	3583303.	2587149.	2068793.	1533008.	1103472.	176755.	227288.	254479.	1511806.
2014	6259842.	3707815.	2740869.	2006307.	1589735.	1192930.	895339.	146511.	193122.	1561974.
2015	6177954.	3832195.	2841621.	2126921.	1544231.	1238079.	968475.	742839.	124605.	1555525.
2016	893583.	3782183.	2942977.	2207301.	1638396.	1203230.	1005633.	804149.	632468.	1492449.
2017	1208957.	545040.	2907372.	2288504.	1703301.	1277218.	977702.	835767.	685234.	1881875.
2018	355722.	738483.	369623.	2263196.	1769963.	1329394.	1038664.	813182.	712897.	2277578.
2019	14126115.	215943.	526564.	269976.	1752905.	1382342.	1081863.	864607.	694076.	2657929.
2020	52617549.	8652167.	120068.	394528.	188543.	1369697.	1125454.	901194.	738455.	2983467.
2021	37698713.	32233260.	6758170.	75908.	287209.	140419.	1115625.	938001.	770188.	3316284.
2022	2764770.	23093411.	25315748.	5298183.	37837.	218182.	109921.	930300.	801877.	3643567.
2023	2769575.	1692338.	18120668.	19899229.	4146060.	22176.	173599.	86830.	795704.	3968247.
2024		1695357.	1293795.	14237157.	15635156.	3253848.	13177.	140220.	70275.	4255376.

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TABLE 3. CATCH OF East of 45

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	1	2	3	4	5	6	7	8	9	10
1975	83784.	352022.	82482.	24055.	11863.	7932.	4665.	3441.	4480.	54950.
1976	17501.	196886.	239994.	47505.	18187.	6492.	3896.	2187.	2948.	40376.
1977	67420.	276479.	81061.	45074.	6677.	4738.	4363.	2903.	2778.	36620.
1978	98571.	188169.	132603.	26750.	8539.	2569.	2746.	1850.	1398.	26717.

1979	15968.	46352.	85484.	47174.	8803.	3802.	3158.	4700.	4051.	22395.
1980	153268.	139588.	111494.	35392.	11439.	6346.	3925.	2495.	2715.	24603.
1981	91413.	320656.	114393.	16726.	11334.	6214.	4537.	4938.	3506.	18037.
1982	435146.	261565.	174574.	35996.	8002.	3990.	5295.	9037.	4835.	38429.
1983	666700.	196954.	118435.	27650.	11539.	5339.	8741.	6724.	5468.	38481.
1984	162819.	602874.	80533.	29876.	18523.	10029.	5897.	6546.	10420.	41447.
1985	126331.	327195.	273250.	52930.	11441.	7067.	3014.	2958.	3329.	31801.
1986	605591.	245280.	110492.	60475.	10838.	5638.	3356.	2173.	3201.	27826.
1987	233815.	425594.	130379.	35130.	13521.	7777.	7936.	4073.	3661.	23513.
1988	787367.	200806.	221887.	45198.	12256.	9116.	10264.	5612.	5200.	33542.
1989	457214.	409308.	103865.	51467.	26166.	5342.	9140.	6317.	4674.	24558.
1990	436998.	328718.	195472.	53837.	37392.	7450.	6938.	10362.	12813.	27930.
1991	243244.	401949.	186084.	52344.	39257.	7563.	5140.	6163.	14736.	43603.
1992	229346.	527897.	280116.	50401.	19089.	12662.	13102.	10683.	12770.	50171.
1993	280527.	748303.	362086.	64110.	24965.	13406.	11620.	9313.	9358.	44738.
1994	304847.	502294.	171942.	56713.	40131.	28248.	27583.	24303.	23658.	91143.
1995	443084.	322790.	296579.	65551.	53670.	39327.	22103.	17701.	16646.	85605.
1996	444406.	669904.	312384.	170612.	50658.	22396.	18070.	15305.	17362.	85496.
1997	306609.	474221.	189334.	107589.	66458.	42200.	25467.	27051.	31144.	74425.
1998	345669.	474502.	285613.	138652.	45367.	76858.	9470.	10785.	13079.	52631.
1999	290410.	272684.	137390.	91981.	37213.	13567.	10306.	11996.	27670.	55145.
2000	889625.	389997.	195408.	51453.	56121.	35131.	12280.	14041.	14718.	44863.
2001	15982.	469971.	134430.	90060.	24959.	20977.	31157.	21135.	17744.	68378.
2002	59817.	491266.	206724.	65445.	31542.	16089.	10914.	14936.	17076.	62174.
2003	31034.	198423.	70574.	34139.	42902.	23442.	17278.	14727.	15451.	77055.
2004	158681.	233924.	152822.	33095.	12919.	22189.	27680.	7756.	14995.	72743.
2005	315743.	419028.	125613.	59295.	24776.	18596.	17314.	14100.	12307.	82641.
2006	228908.	162488.	255561.	44959.	11960.	27029.	10456.	11129.	37839.	47308.

2007	1510.	96996.	42050.	139516.	62706.	25349.	20195.	13425.	26398.	73222.
2008	755.	63119.	41758.	67048.	51597.	27174.	19392.	16913.	16230.	44546.
2009	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2010	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2011	4138.	105125.	39701.	46206.	3325.	3438.	5285.	8951.	7954.	24372.
2012	3954.	90136.	36666.	44991.	14528.	1976.	3487.	3976.	8529.	25066.
2013	3706.	88052.	32583.	42548.	14664.	8980.	2041.	2705.	3922.	28258.
2014	3572.	84855.	32934.	38430.	14078.	9098.	9572.	1616.	2753.	27008.
2015	3367.	80876.	31654.	39230.	13011.	8875.	9671.	7446.	1625.	24609.
2016	3087.	76677.	29974.	37334.	13095.	8212.	9202.	7449.	7445.	21315.
2017	2785.	67016.	26931.	34188.	11842.	7790.	8258.	6966.	7282.	24267.
2018	2557.	61544.	23521.	30957.	11261.	7252.	7989.	6298.	6867.	26624.
2019	2416.	56673.	22267.	26995.	10388.	6986.	7633.	6170.	6276.	29168.
2020	1970.	54101.	21047.	26191.	8932.	6407.	7399.	5907.	6183.	30319.
2021	2261.	44913.	20328.	24947.	8758.	5588.	6798.	5902.	6089.	31823.
2022	1846.	51129.	16883.	24464.	8626.	5574.	5955.	5410.	6038.	33302.
2023	1752.	42345.	19288.	20493.	8543.	5541.	6024.	4816.	5594.	33865.

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TABLE 4. SPAWNING STOCK FECUNDITY AND RECRUITMENT OF East of 45

year	spawning biomass	recruits from VPA
1975	297497.	1640896.
1976	295256.	2431348.
1977	285396.	1237566.
1978	273375.	979553.
1979	261857.	1212444.
1980	257736.	1832896.
1981	239955.	1586091.
1982	237753.	2538566.
1983	214174.	3853210.
1984	206813.	1987913.
1985	216987.	1799123.
1986	213552.	3134562.
1987	207085.	2221038.
1988	205171.	3413817.

1989	206246.	3400145.
1990	191453.	3482179.
1991	188531.	4281074.
1992	192900.	3938760.
1993	203235.	4256001.
1994	194197.	3556054.
1995	192552.	4029891.
1996	187505.	3615378.
1997	178075.	2569068.
1998	178534.	4561878.
1999	182883.	3687476.
2000	184689.	4715563.
2001	180949.	3557474.
2002	205112.	3651891.
2003	216752.	4408089.
2004	224933.	6178876.

terminal age structure of population

0.0000D+00	0.8005D-03	0.5000D+01	1.0	0.4000D+01	1
0.0000D+00	0.2853D-01	0.5000D+01	1.0	0.4000D+01	2
0.0000D+00	0.1198D-02	0.5000D+01	1.0	0.4000D+01	3
0.0000D+00	0.1159D-02	0.5000D+01	1.0	0.3000D+01	4
0.0000D+00	0.2320D-02	0.5000D+01	1.0	0.3000D+01	5
0.0000D+00	0.3205D+00	0.5000D+01	1.0	0.1000D+00	6
0.0000D+00	0.3854D-01	0.3000D+01	1.0	0.6000D+01	7
0.0000D+00	0.6154D-01	0.5000D+01	1.0	0.1000D+00	8
0.0000D+00	0.7506D-02	0.3000D+01	1.0	0.8000D+01	9

terminal-age f-ratios

0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	10
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	11
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	12
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	13
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	14
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	15
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	16
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	17
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	18
0.1000D+00	0.1000D+01	0.5000D+01	0.0	0.2000D+00	19
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	20
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	21
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	22
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	23
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	24
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	25
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	26
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	27
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	28
0.1000D+00	0.6000D+00	0.5000D+01	0.0	0.2000D+00	29
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	30
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	31
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	32
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	33
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	34
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	35
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	36
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	37
0.1000D+00	0.1200D+01	0.5000D+01	0.0	0.2000D+00	38

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  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   39
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   40
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   41
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   42
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   43
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   44
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   45
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   46
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   47
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   48
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   49
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   50
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   51
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   52
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   53
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   54
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   55
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   56
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   57
  0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   58
# natural mortality
  0.0000D+00  0.4900D+00  0.1000D+01    0.0  0.1000D+00   59
  0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   60
  0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   61
  0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   62
  0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   63
  0.0000D+00  0.2000D+00  0.1000D+01    0.0  0.1000D+00   64
  0.0000D+00  0.1750D+00  0.1000D+01    0.0  0.1000D+00   65
  0.0000D+00  0.1500D+00  0.1000D+01    0.0  0.1000D+00   66
  0.0000D+00  0.1250D+00  0.1000D+01    0.0  0.1000D+00   67
  0.0000D+00  0.1000D+00  0.1000D+01    0.0  0.1000D+00   68
# transfer coefficients
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   69
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   70
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   71
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   72
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   73
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   74
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   75
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   76
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   77
  0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   78
# Stock recruitment relationship
  0.0000D+00  0.2507D+06  0.1000D+21    0.0  0.4000D+00   79
  0.0000D+00  0.1660D+05  0.1000D+21    0.0  0.0000D+00   80
  0.0000D+00  0.1580D+00  0.9000D+00    0.0  0.0000D+00   81
  0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   82
  0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   83
# Variance scaling parameters
  0.0000D+00  0.9012D+00  0.1000D+21    1.0  0.4000D+00   84
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   85
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   86
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   87
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   88
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   89
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   90
  0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   91
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 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   92
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   93
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   94
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   95
# fraction surviving the intial tagging process
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   96
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   97
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   98
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00   99
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  100
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  101
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  102
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  103
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  104
 0.0000D+00  0.8000D+00  0.1000D+01    0.0  0.1000D+00  105
# tag shedding rate
 0.0000D+00  0.2335D+00  0.1000D+01    2.0  0.1000D+00  106
 0.0000D+00  0.1918D+00  0.1000D+01    2.0  0.1000D+00  107
 0.0000D+00  0.2322D+00  0.1000D+01    2.0  0.1000D+00  108
 0.0000D+00  0.2601D+00  0.1000D+01    2.0  0.1000D+00  109
 0.0000D+00  0.2599D+00  0.1000D+01    2.0  0.1000D+00  110
 0.0000D+00  0.2603D+00  0.1000D+01    2.0  0.1000D+00  111
 0.0000D+00  0.2600D+00  0.1000D+01    2.0  0.1000D+00  112
 0.0000D+00  0.2599D+00  0.1000D+01    2.0  0.1000D+00  113
 0.0000D+00  0.2599D+00  0.1000D+01    2.0  0.1000D+00  114
 0.0000D+00  0.2599D+00  0.1000D+01    2.0  0.1000D+00  115
# tag reporting rate
 0.0000D+00  0.8905D-01  0.1000D+01    1.0  0.1000D+00  116
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  117
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  118
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  119
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  120
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  121
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  122
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  123
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  124
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  125
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  126
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  127
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  128
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  129
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  130
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  131
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  132
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  133
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  134
 0.0000D+00  0.8905D-01  0.1000D+01   -0.1  0.1000D+00  135
 0.0000D+00  0.1802D+00  0.1000D+01    1.0  0.1000D+00  136   22  *****
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  137
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  138
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  139
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  140
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  141
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  142
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  143
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  144
 0.0000D+00  0.1802D+00  0.1000D+01   -0.1  0.1000D+00  145
```

0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	146		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	147		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	148		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	149		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	150		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	151		
0.0000D+00	0.1775D+00	0.1000D+01	2.0	0.1000D+00	152		
0.0000D+00	0.1594D+00	0.1000D+01	2.0	0.1000D+00	153		
0.0000D+00	0.1458D+00	0.1000D+01	2.0	0.1000D+00	154		
0.0000D+00	0.1606D+00	0.1000D+01	2.0	0.1000D+00	155		
0.0000D+00	0.1767D+00	0.1000D+01	2.0	0.1000D+00	156		
0.0000D+00	0.4223D+00	0.1000D+01	2.0	0.1000D+00	157		
0.0000D+00	0.1930D+00	0.1000D+01	2.0	0.1000D+00	158		
0.0000D+00	0.1949D+00	0.1000D+01	2.0	0.1000D+00	159		
0.0000D+00	0.1962D+00	0.1000D+01	2.0	0.1000D+00	160		
0.0000D+00	0.1971D+00	0.1000D+01	2.0	0.1000D+00	161		
0.0000D+00	0.1980D+00	0.1000D+01	2.0	0.1000D+00	162		
0.0000D+00	0.1985D+00	0.1000D+01	2.0	0.1000D+00	163		
0.0000D+00	0.2309D+00	0.1000D+01	2.0	0.1000D+00	164		

tag nonmixing factor for first year

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	165	1975	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	166	1975	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	167	1975	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	168	1975	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	169	1975	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	170	1975	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	171	1975	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	172	1975	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	173	1975	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	174	1975	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	175	1976	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	176	1976	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	177	1976	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	178	1976	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	179	1976	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	180	1976	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	181	1976	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	182	1976	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	183	1976	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	184	1976	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	185	1977	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	186	1977	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	187	1977	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	188	1977	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	189	1977	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	190	1977	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	191	1977	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	192	1977	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	193	1977	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	194	1977	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	195	1978	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	196	1978	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	197	1978	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	198	1978	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	199	1978	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	200	1978	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	201	1978	7

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	202	1978	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	203	1978	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	204	1978	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	205	1979	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	206	1979	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	207	1979	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	208	1979	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	209	1979	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	210	1979	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	211	1979	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	212	1979	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	213	1979	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	214	1979	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	215	1980	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	216	1980	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	217	1980	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	218	1980	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	219	1980	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	220	1980	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	221	1980	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	222	1980	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	223	1980	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	224	1980	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	225	1981	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	226	1981	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	227	1981	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	228	1981	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	229	1981	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	230	1981	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	231	1981	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	232	1981	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	233	1981	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	234	1981	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	235	1982	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	236	1982	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	237	1982	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	238	1982	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	239	1982	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	240	1982	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	241	1982	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	242	1982	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	243	1982	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	244	1982	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	245	1983	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	246	1983	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	247	1983	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	248	1983	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	249	1983	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	250	1983	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	251	1983	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	252	1983	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	253	1983	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	254	1983	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	255	1984	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	256	1984	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	257	1984	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	258	1984	4

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	259	1984	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	260	1984	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	261	1984	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	262	1984	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	263	1984	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	264	1984	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	265	1985	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	266	1985	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	267	1985	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	268	1985	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	269	1985	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	270	1985	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	271	1985	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	272	1985	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	273	1985	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	274	1985	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	275	1986	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	276	1986	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	277	1986	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	278	1986	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	279	1986	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	280	1986	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	281	1986	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	282	1986	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	283	1986	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	284	1986	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	285	1987	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	286	1987	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	287	1987	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	288	1987	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	289	1987	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	290	1987	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	291	1987	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	292	1987	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	293	1987	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	294	1987	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	295	1988	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	296	1988	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	297	1988	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	298	1988	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	299	1988	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	300	1988	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	301	1988	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	302	1988	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	303	1988	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	304	1988	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	305	1989	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	306	1989	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	307	1989	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	308	1989	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	309	1989	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	310	1989	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	311	1989	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	312	1989	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	313	1989	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	314	1989	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	315	1990	1

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	316	1990	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	317	1990	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	318	1990	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	319	1990	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	320	1990	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	321	1990	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	322	1990	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	323	1990	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	324	1990	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	325	1991	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	326	1991	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	327	1991	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	328	1991	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	329	1991	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	330	1991	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	331	1991	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	332	1991	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	333	1991	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	334	1991	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	335	1992	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	336	1992	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	337	1992	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	338	1992	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	339	1992	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	340	1992	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	341	1992	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	342	1992	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	343	1992	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	344	1992	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	345	1993	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	346	1993	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	347	1993	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	348	1993	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	349	1993	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	350	1993	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	351	1993	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	352	1993	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	353	1993	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	354	1993	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	355	1994	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	356	1994	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	357	1994	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	358	1994	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	359	1994	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	360	1994	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	361	1994	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	362	1994	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	363	1994	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	364	1994	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	365	1995	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	366	1995	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	367	1995	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	368	1995	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	369	1995	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	370	1995	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	371	1995	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	372	1995	8

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	373	1995	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	374	1995	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	375	1996	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	376	1996	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	377	1996	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	378	1996	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	379	1996	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	380	1996	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	381	1996	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	382	1996	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	383	1996	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	384	1996	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	385	1997	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	386	1997	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	387	1997	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	388	1997	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	389	1997	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	390	1997	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	391	1997	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	392	1997	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	393	1997	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	394	1997	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	395	1998	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	396	1998	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	397	1998	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	398	1998	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	399	1998	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	400	1998	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	401	1998	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	402	1998	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	403	1998	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	404	1998	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	405	1999	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	406	1999	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	407	1999	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	408	1999	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	409	1999	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	410	1999	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	411	1999	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	412	1999	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	413	1999	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	414	1999	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	415	2000	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	416	2000	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	417	2000	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	418	2000	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	419	2000	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	420	2000	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	421	2000	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	422	2000	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	423	2000	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	424	2000	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	425	2001	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	426	2001	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	427	2001	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	428	2001	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	429	2001	5

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	430	2001	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	431	2001	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	432	2001	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	433	2001	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	434	2001	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	435	2002	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	436	2002	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	437	2002	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	438	2002	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	439	2002	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	440	2002	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	441	2002	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	442	2002	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	443	2002	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	444	2002	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	445	2003	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	446	2003	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	447	2003	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	448	2003	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	449	2003	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	450	2003	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	451	2003	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	452	2003	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	453	2003	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	454	2003	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	455	2004	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	456	2004	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	457	2004	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	458	2004	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	459	2004	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	460	2004	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	461	2004	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	462	2004	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	463	2004	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	464	2004	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	465	2005	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	466	2005	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	467	2005	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	468	2005	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	469	2005	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	470	2005	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	471	2005	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	472	2005	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	473	2005	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	474	2005	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	475	2006	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	476	2006	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	477	2006	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	478	2006	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	479	2006	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	480	2006	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	481	2006	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	482	2006	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	483	2006	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	484	2006	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	485	2007	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	486	2007	2

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	487	2007	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	488	2007	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	489	2007	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	490	2007	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	491	2007	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	492	2007	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	493	2007	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	494	2007	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	495	2008	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	496	2008	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	497	2008	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	498	2008	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	499	2008	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	500	2008	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	501	2008	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	502	2008	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	503	2008	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	504	2008	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	505	2009	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	506	2009	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	507	2009	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	508	2009	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	509	2009	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	510	2009	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	511	2009	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	512	2009	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	513	2009	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	514	2009	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	515	2010	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	516	2010	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	517	2010	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	518	2010	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	519	2010	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	520	2010	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	521	2010	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	522	2010	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	523	2010	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	524	2010	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	525	2011	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	526	2011	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	527	2011	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	528	2011	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	529	2011	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	530	2011	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	531	2011	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	532	2011	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	533	2011	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	534	2011	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	535	2012	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	536	2012	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	537	2012	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	538	2012	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	539	2012	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	540	2012	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	541	2012	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	542	2012	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	543	2012	9

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	544	2012	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	545	2013	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	546	2013	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	547	2013	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	548	2013	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	549	2013	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	550	2013	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	551	2013	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	552	2013	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	553	2013	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	554	2013	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	555	2014	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	556	2014	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	557	2014	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	558	2014	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	559	2014	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	560	2014	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	561	2014	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	562	2014	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	563	2014	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	564	2014	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	565	2015	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	566	2015	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	567	2015	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	568	2015	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	569	2015	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	570	2015	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	571	2015	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	572	2015	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	573	2015	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	574	2015	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	575	2016	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	576	2016	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	577	2016	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	578	2016	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	579	2016	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	580	2016	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	581	2016	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	582	2016	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	583	2016	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	584	2016	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	585	2017	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	586	2017	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	587	2017	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	588	2017	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	589	2017	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	590	2017	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	591	2017	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	592	2017	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	593	2017	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	594	2017	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	595	2018	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	596	2018	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	597	2018	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	598	2018	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	599	2018	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	600	2018	6

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	601	2018	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	602	2018	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	603	2018	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	604	2018	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	605	2019	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	606	2019	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	607	2019	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	608	2019	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	609	2019	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	610	2019	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	611	2019	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	612	2019	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	613	2019	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	614	2019	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	615	2020	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	616	2020	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	617	2020	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	618	2020	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	619	2020	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	620	2020	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	621	2020	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	622	2020	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	623	2020	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	624	2020	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	625	2021	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	626	2021	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	627	2021	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	628	2021	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	629	2021	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	630	2021	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	631	2021	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	632	2021	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	633	2021	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	634	2021	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	635	2022	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	636	2022	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	637	2022	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	638	2022	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	639	2022	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	640	2022	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	641	2022	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	642	2022	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	643	2022	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	644	2022	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	645	2023	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	646	2023	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	647	2023	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	648	2023	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	649	2023	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	650	2023	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	651	2023	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	652	2023	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	653	2023	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	654	2023	10

tag nonmixing factor for second year

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	655	2024	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	656	2024	2

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	657	2024	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	658	2024	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	659	2024	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	660	2024	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	661	2024	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	662	2024	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	663	2024	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	664	2024	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	665	2025	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	666	2025	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	667	2025	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	668	2025	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	669	2025	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	670	2025	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	671	2025	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	672	2025	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	673	2025	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	674	2025	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	675	2026	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	676	2026	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	677	2026	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	678	2026	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	679	2026	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	680	2026	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	681	2026	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	682	2026	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	683	2026	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	684	2026	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	685	2027	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	686	2027	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	687	2027	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	688	2027	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	689	2027	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	690	2027	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	691	2027	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	692	2027	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	693	2027	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	694	2027	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	695	2028	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	696	2028	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	697	2028	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	698	2028	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	699	2028	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	700	2028	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	701	2028	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	702	2028	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	703	2028	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	704	2028	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	705	2029	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	706	2029	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	707	2029	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	708	2029	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	709	2029	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	710	2029	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	711	2029	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	712	2029	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	713	2029	9

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	714	2029	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	715	2030	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	716	2030	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	717	2030	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	718	2030	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	719	2030	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	720	2030	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	721	2030	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	722	2030	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	723	2030	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	724	2030	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	725	2031	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	726	2031	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	727	2031	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	728	2031	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	729	2031	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	730	2031	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	731	2031	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	732	2031	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	733	2031	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	734	2031	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	735	2032	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	736	2032	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	737	2032	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	738	2032	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	739	2032	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	740	2032	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	741	2032	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	742	2032	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	743	2032	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	744	2032	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	745	2033	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	746	2033	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	747	2033	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	748	2033	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	749	2033	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	750	2033	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	751	2033	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	752	2033	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	753	2033	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	754	2033	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	755	2034	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	756	2034	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	757	2034	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	758	2034	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	759	2034	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	760	2034	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	761	2034	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	762	2034	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	763	2034	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	764	2034	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	765	2035	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	766	2035	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	767	2035	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	768	2035	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	769	2035	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	770	2035	6

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	771	2035	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	772	2035	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	773	2035	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	774	2035	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	775	2036	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	776	2036	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	777	2036	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	778	2036	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	779	2036	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	780	2036	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	781	2036	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	782	2036	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	783	2036	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	784	2036	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	785	2037	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	786	2037	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	787	2037	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	788	2037	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	789	2037	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	790	2037	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	791	2037	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	792	2037	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	793	2037	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	794	2037	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	795	2038	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	796	2038	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	797	2038	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	798	2038	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	799	2038	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	800	2038	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	801	2038	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	802	2038	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	803	2038	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	804	2038	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	805	2039	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	806	2039	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	807	2039	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	808	2039	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	809	2039	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	810	2039	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	811	2039	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	812	2039	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	813	2039	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	814	2039	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	815	2040	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	816	2040	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	817	2040	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	818	2040	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	819	2040	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	820	2040	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	821	2040	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	822	2040	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	823	2040	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	824	2040	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	825	2041	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	826	2041	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	827	2041	3

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	828	2041	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	829	2041	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	830	2041	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	831	2041	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	832	2041	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	833	2041	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	834	2041	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	835	2042	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	836	2042	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	837	2042	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	838	2042	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	839	2042	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	840	2042	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	841	2042	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	842	2042	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	843	2042	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	844	2042	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	845	2043	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	846	2043	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	847	2043	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	848	2043	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	849	2043	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	850	2043	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	851	2043	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	852	2043	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	853	2043	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	854	2043	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	855	2044	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	856	2044	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	857	2044	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	858	2044	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	859	2044	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	860	2044	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	861	2044	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	862	2044	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	863	2044	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	864	2044	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	865	2045	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	866	2045	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	867	2045	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	868	2045	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	869	2045	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	870	2045	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	871	2045	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	872	2045	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	873	2045	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	874	2045	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	875	2046	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	876	2046	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	877	2046	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	878	2046	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	879	2046	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	880	2046	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	881	2046	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	882	2046	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	883	2046	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	884	2046	10

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	885	2047	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	886	2047	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	887	2047	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	888	2047	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	889	2047	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	890	2047	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	891	2047	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	892	2047	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	893	2047	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	894	2047	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	895	2048	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	896	2048	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	897	2048	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	898	2048	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	899	2048	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	900	2048	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	901	2048	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	902	2048	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	903	2048	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	904	2048	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	905	2049	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	906	2049	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	907	2049	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	908	2049	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	909	2049	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	910	2049	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	911	2049	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	912	2049	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	913	2049	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	914	2049	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	915	2050	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	916	2050	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	917	2050	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	918	2050	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	919	2050	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	920	2050	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	921	2050	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	922	2050	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	923	2050	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	924	2050	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	925	2051	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	926	2051	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	927	2051	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	928	2051	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	929	2051	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	930	2051	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	931	2051	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	932	2051	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	933	2051	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	934	2051	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	935	2052	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	936	2052	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	937	2052	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	938	2052	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	939	2052	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	940	2052	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	941	2052	7

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	942	2052	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	943	2052	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	944	2052	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	945	2053	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	946	2053	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	947	2053	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	948	2053	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	949	2053	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	950	2053	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	951	2053	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	952	2053	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	953	2053	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	954	2053	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	955	2054	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	956	2054	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	957	2054	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	958	2054	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	959	2054	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	960	2054	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	961	2054	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	962	2054	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	963	2054	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	964	2054	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	965	2055	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	966	2055	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	967	2055	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	968	2055	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	969	2055	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	970	2055	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	971	2055	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	972	2055	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	973	2055	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	974	2055	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	975	2056	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	976	2056	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	977	2056	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	978	2056	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	979	2056	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	980	2056	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	981	2056	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	982	2056	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	983	2056	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	984	2056	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	985	2057	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	986	2057	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	987	2057	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	988	2057	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	989	2057	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	990	2057	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	991	2057	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	992	2057	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	993	2057	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	994	2057	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	995	2058	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	996	2058	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	997	2058	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	998	2058	4

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	999	2058	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1000	2058	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1001	2058	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1002	2058	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1003	2058	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1004	2058	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1005	2059	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1006	2059	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1007	2059	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1008	2059	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1009	2059	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1010	2059	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1011	2059	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1012	2059	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1013	2059	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1014	2059	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1015	2060	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1016	2060	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1017	2060	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1018	2060	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1019	2060	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1020	2060	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1021	2060	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1022	2060	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1023	2060	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1024	2060	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1025	2061	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1026	2061	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1027	2061	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1028	2061	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1029	2061	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1030	2061	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1031	2061	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1032	2061	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1033	2061	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1034	2061	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1035	2062	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1036	2062	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1037	2062	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1038	2062	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1039	2062	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1040	2062	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1041	2062	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1042	2062	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1043	2062	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1044	2062	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1045	2063	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1046	2063	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1047	2063	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1048	2063	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1049	2063	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1050	2063	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1051	2063	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1052	2063	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1053	2063	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1054	2063	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1055	2064	1

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1056	2064	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1057	2064	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1058	2064	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1059	2064	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1060	2064	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1061	2064	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1062	2064	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1063	2064	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1064	2064	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1065	2065	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1066	2065	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1067	2065	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1068	2065	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1069	2065	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1070	2065	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1071	2065	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1072	2065	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1073	2065	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1074	2065	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1075	2066	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1076	2066	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1077	2066	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1078	2066	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1079	2066	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1080	2066	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1081	2066	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1082	2066	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1083	2066	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1084	2066	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1085	2067	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1086	2067	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1087	2067	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1088	2067	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1089	2067	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1090	2067	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1091	2067	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1092	2067	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1093	2067	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1094	2067	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1095	2068	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1096	2068	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1097	2068	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1098	2068	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1099	2068	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1100	2068	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1101	2068	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1102	2068	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1103	2068	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1104	2068	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1105	2069	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1106	2069	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1107	2069	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1108	2069	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1109	2069	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1110	2069	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1111	2069	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1112	2069	8

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1113	2069	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1114	2069	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1115	2070	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1116	2070	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1117	2070	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1118	2070	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1119	2070	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1120	2070	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1121	2070	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1122	2070	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1123	2070	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1124	2070	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1125	2071	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1126	2071	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1127	2071	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1128	2071	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1129	2071	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1130	2071	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1131	2071	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1132	2071	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1133	2071	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1134	2071	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1135	2072	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1136	2072	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1137	2072	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1138	2072	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1139	2072	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1140	2072	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1141	2072	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1142	2072	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1143	2072	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1144	2072	10

Number of parameters = 1144

VPA-2BOX
BOOTSTRAP ESTIMATES OF BIAS AND VARIANCE
****

Strategy 2
14:40, 17 February 2011

****
BIAS AND STANDARD ERROR ESTIMATES
****

TABLE 1A. BIAS OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1976	0.000	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1977	0.000	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1978	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000

1980	0.000	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1981	0.000	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1982	-0.001	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1983	-0.001	-0.001	-0.002	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000
1984	0.000	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000
1985	0.000	-0.002	-0.002	-0.001	0.000	0.000	0.000	0.000	-0.001	0.000
1986	-0.001	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	-0.001	0.000
1987	-0.001	-0.001	-0.002	-0.001	0.000	0.000	-0.001	0.000	-0.001	0.000
1988	-0.002	-0.001	-0.002	-0.001	0.000	0.000	0.000	-0.001	-0.001	0.000
1989	-0.002	-0.002	-0.001	-0.001	-0.001	0.000	0.000	0.000	-0.001	0.000
1990	-0.001	-0.003	-0.003	-0.001	-0.001	0.000	0.000	-0.001	-0.001	-0.001
1991	-0.001	-0.003	-0.003	-0.002	-0.001	0.000	0.000	-0.001	-0.001	-0.001
1992	-0.001	-0.005	-0.005	-0.002	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001
1993	-0.001	-0.009	-0.007	-0.002	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001
1994	-0.002	-0.004	-0.005	-0.002	-0.002	-0.002	-0.003	-0.003	-0.005	-0.003
1995	-0.002	-0.005	-0.005	-0.003	-0.003	-0.004	-0.002	-0.003	-0.003	-0.004
1996	-0.003	-0.009	-0.010	-0.006	-0.004	-0.002	-0.003	-0.002	-0.005	-0.006
1997	-0.004	-0.009	-0.006	-0.007	-0.005	-0.005	-0.003	-0.006	-0.006	-0.008
1998	-0.007	-0.016	-0.013	-0.009	-0.005	-0.010	-0.002	-0.002	-0.005	-0.006
1999	-0.007	-0.010	-0.013	-0.009	-0.005	-0.002	-0.002	-0.003	-0.006	-0.008
2000	-0.020	-0.019	-0.012	-0.009	-0.010	-0.007	-0.003	-0.004	-0.005	-0.006
2001	-0.001	-0.026	-0.012	-0.008	-0.008	-0.006	-0.010	-0.007	-0.008	-0.009
2002	-0.002	-0.032	-0.023	-0.009	-0.004	-0.008	-0.005	-0.007	-0.008	-0.010
2003	-0.001	-0.013	-0.008	-0.006	-0.009	-0.004	-0.013	-0.009	-0.011	-0.014
2004	-0.004	-0.013	-0.016	-0.005	-0.003	-0.007	-0.007	-0.009	-0.014	-0.016
2005	-0.017	-0.017	-0.011	-0.009	-0.006	-0.006	-0.007	-0.004	-0.021	-0.025
2006	-0.018	-0.016	-0.017	-0.005	-0.003	-0.008	-0.004	-0.006	-0.016	-0.019
2007	0.000	-0.014	-0.006	-0.014	-0.011	-0.007	-0.008	-0.007	-0.019	-0.022
2008	0.000	-0.014	-0.009	-0.014	-0.008	-0.006	-0.007	-0.009	-0.011	-0.013
2009	0.000	-0.002	-0.007	-0.016	-0.007	-0.006	-0.010	-0.009	-0.007	-0.008
2010	0.000	-0.001	-0.002	-0.026	-0.011	-0.013	-0.009	-0.008	-0.006	-0.007
2011	0.000	-0.006	-0.003	-0.005	-0.002	-0.002	-0.003	-0.003	-0.004	-0.005
2012	0.000	-0.006	-0.003	-0.005	-0.002	-0.002	-0.003	-0.003	-0.003	-0.004
2013	0.000	-0.005	-0.003	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.004
2014	0.000	-0.005	-0.003	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003
2015	0.000	-0.005	-0.002	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003
2016	0.000	-0.005	-0.002	-0.004	-0.002	-0.001	-0.002	-0.002	-0.002	-0.003
2017	0.002	0.005	-0.002	-0.003	-0.002	-0.001	-0.002	-0.002	-0.002	-0.003
2018	-0.001	0.087	0.010	-0.003	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
2019	0.004	-0.020	0.054	0.034	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
2020	0.002	0.162	-0.008	0.112	0.030	-0.001	-0.001	-0.001	-0.002	-0.002
2021	0.000	0.084	0.113	0.010	0.070	0.037	-0.001	-0.001	-0.002	-0.002
2022	0.000	-0.010	0.061	0.323	0.056	0.076	0.088	-0.001	-0.002	-0.002
2023	0.000	-0.012	-0.005	0.315	1.111	0.256	0.200	0.491	-0.002	-0.002

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TABLE 1B. STANDARD ERROR OF FISHING MORTALITY RATE FOR East of 45

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	1	2	3	4	5	6	7	8	9	10
1975	0.406E-04	0.178E-03	0.136E-03	0.857E-04	0.465E-04	0.948E-04	0.531E-04	0.459E-04	0.582E-04	0.582E-04
1976	0.789E-05	0.198E-03	0.347E-03	0.131E-03	0.987E-04	0.337E-04	0.665E-04	0.318E-04	0.489E-04	0.489E-04

1977 0.324E-04 0.201E-03 0.162E-03 0.155E-03 0.282E-04 0.372E-04 0.287E-04 0.653E-04 0.497E-
04 0.497E-04
1978 0.813E-04 0.191E-03 0.185E-03 0.882E-04 0.455E-04 0.132E-04 0.273E-04 0.147E-04 0.404E-
04 0.404E-04
1979 0.100E-04 0.714E-04 0.208E-03 0.110E-03 0.422E-04 0.269E-04 0.202E-04 0.599E-04 0.392E-
04 0.392E-04
1980 0.471E-04 0.166E-03 0.358E-03 0.175E-03 0.350E-04 0.406E-04 0.356E-04 0.194E-04 0.428E-
04 0.428E-04
1981 0.439E-04 0.241E-03 0.303E-03 0.115E-03 0.944E-04 0.277E-04 0.373E-04 0.566E-04 0.330E-
04 0.330E-04
1982 0.225E-03 0.281E-03 0.415E-03 0.202E-03 0.833E-04 0.466E-04 0.291E-04 0.967E-04 0.703E-
04 0.703E-04
1983 0.128E-03 0.231E-03 0.331E-03 0.156E-03 0.106E-03 0.775E-04 0.145E-03 0.451E-04 0.767E-
04 0.767E-04
1984 0.842E-04 0.334E-03 0.165E-03 0.167E-03 0.173E-03 0.136E-03 0.120E-03 0.162E-03 0.903E-
04 0.903E-04
1985 0.667E-04 0.403E-03 0.447E-03 0.175E-03 0.995E-04 0.997E-04 0.542E-04 0.809E-04 0.115E-
03 0.688E-04
1986 0.158E-03 0.282E-03 0.334E-03 0.219E-03 0.533E-04 0.703E-04 0.650E-04 0.516E-04 0.115E-
03 0.688E-04
1987 0.167E-03 0.314E-03 0.350E-03 0.194E-03 0.775E-04 0.477E-04 0.133E-03 0.101E-03 0.109E-
03 0.655E-04
1988 0.332E-03 0.295E-03 0.452E-03 0.243E-03 0.102E-03 0.697E-04 0.852E-04 0.130E-03 0.175E-
03 0.105E-03
1989 0.385E-03 0.511E-03 0.284E-03 0.230E-03 0.242E-03 0.604E-04 0.934E-04 0.680E-04 0.145E-
03 0.868E-04
1990 0.280E-03 0.613E-03 0.610E-03 0.252E-03 0.289E-03 0.104E-03 0.104E-03 0.141E-03 0.181E-
03 0.108E-03
1991 0.221E-03 0.592E-03 0.693E-03 0.326E-03 0.303E-03 0.919E-04 0.972E-04 0.122E-03 0.282E-
03 0.169E-03
1992 0.231E-03 0.976E-03 0.980E-03 0.323E-03 0.185E-03 0.148E-03 0.219E-03 0.281E-03 0.358E-
03 0.215E-03
1993 0.244E-03 0.185E-02 0.154E-02 0.461E-03 0.235E-03 0.185E-03 0.187E-03 0.223E-03 0.370E-
03 0.222E-03
1994 0.482E-03 0.897E-03 0.104E-02 0.461E-03 0.468E-03 0.383E-03 0.584E-03 0.602E-03 0.994E-
03 0.596E-03
1995 0.498E-03 0.101E-02 0.113E-02 0.677E-03 0.663E-03 0.756E-03 0.433E-03 0.619E-03 0.700E-
03 0.840E-03
1996 0.721E-03 0.192E-02 0.209E-02 0.137E-02 0.829E-03 0.406E-03 0.548E-03 0.420E-03 0.102E-
02 0.122E-02
1997 0.795E-03 0.182E-02 0.131E-02 0.152E-02 0.100E-02 0.111E-02 0.644E-03 0.132E-02 0.132E-
02 0.158E-02
1998 0.140E-02 0.338E-02 0.272E-02 0.193E-02 0.109E-02 0.215E-02 0.360E-03 0.368E-03 0.104E-
02 0.125E-02
1999 0.144E-02 0.199E-02 0.266E-02 0.191E-02 0.938E-03 0.480E-03 0.474E-03 0.595E-03 0.131E-
02 0.157E-02
2000 0.404E-02 0.387E-02 0.231E-02 0.193E-02 0.213E-02 0.140E-02 0.578E-03 0.868E-03 0.983E-
03 0.118E-02
2001 0.108E-03 0.516E-02 0.239E-02 0.167E-02 0.156E-02 0.130E-02 0.202E-02 0.138E-02 0.156E-
02 0.188E-02
2002 0.462E-03 0.619E-02 0.441E-02 0.181E-02 0.837E-03 0.155E-02 0.958E-03 0.150E-02 0.162E-
02 0.195E-02
2003 0.208E-03 0.249E-02 0.157E-02 0.115E-02 0.175E-02 0.837E-03 0.255E-02 0.180E-02 0.229E-
02 0.275E-02
2004 0.732E-03 0.250E-02 0.297E-02 0.103E-02 0.590E-03 0.128E-02 0.130E-02 0.170E-02 0.272E-
02 0.326E-02

2005	0.320E-02	0.325E-02	0.201E-02	0.172E-02	0.105E-02	0.112E-02	0.133E-02	0.855E-03	0.402E-02	0.482E-02
2006	0.337E-02	0.301E-02	0.318E-02	0.101E-02	0.474E-03	0.156E-02	0.811E-03	0.110E-02	0.305E-02	0.366E-02
2007	0.392E-04	0.256E-02	0.114E-02	0.266E-02	0.197E-02	0.133E-02	0.155E-02	0.131E-02	0.348E-02	0.418E-02
2008	0.603E-05	0.265E-02	0.160E-02	0.258E-02	0.142E-02	0.117E-02	0.132E-02	0.168E-02	0.201E-02	0.241E-02
2009	0.100E-04	0.271E-03	0.124E-02	0.293E-02	0.135E-02	0.114E-02	0.188E-02	0.168E-02	0.130E-02	0.155E-02
2010	0.940E-05	0.252E-03	0.316E-03	0.478E-02	0.199E-02	0.234E-02	0.159E-02	0.140E-02	0.113E-02	0.136E-02
2011	0.305E-04	0.112E-02	0.574E-03	0.940E-03	0.443E-03	0.370E-03	0.523E-03	0.535E-03	0.706E-03	0.847E-03
2012	0.315E-04	0.101E-02	0.520E-03	0.858E-03	0.388E-03	0.335E-03	0.461E-03	0.475E-03	0.602E-03	0.722E-03
2013	0.261E-04	0.946E-03	0.482E-03	0.792E-03	0.367E-03	0.303E-03	0.425E-03	0.432E-03	0.553E-03	0.663E-03
2014	0.240E-04	0.887E-03	0.465E-03	0.743E-03	0.343E-03	0.288E-03	0.398E-03	0.404E-03	0.516E-03	0.619E-03
2015	0.231E-04	0.826E-03	0.435E-03	0.725E-03	0.328E-03	0.274E-03	0.376E-03	0.372E-03	0.477E-03	0.573E-03
2016	0.313E-02	0.798E-03	0.401E-03	0.670E-03	0.315E-03	0.263E-03	0.348E-03	0.347E-03	0.435E-03	0.522E-03
2017	0.331E-02	0.120E+00	0.366E-03	0.595E-03	0.276E-03	0.237E-03	0.323E-03	0.315E-03	0.397E-03	0.476E-03
2018	0.280E-02	0.127E+00	0.744E-01	0.547E-03	0.255E-03	0.214E-03	0.298E-03	0.294E-03	0.362E-03	0.434E-03
2019	0.484E-02	0.115E+00	0.797E-01	0.155E+00	0.238E-03	0.199E-03	0.275E-03	0.274E-03	0.341E-03	0.410E-03
2020	0.412E-02	0.200E+00	0.839E-01	0.171E+00	0.990E-01	0.184E-03	0.258E-03	0.253E-03	0.319E-03	0.383E-03
2021	0.628E-04	0.175E+00	0.152E+00	0.221E+00	0.114E+00	0.107E+00	0.239E-03	0.244E-03	0.303E-03	0.364E-03
2022	0.832E-04	0.211E-02	0.139E+00	0.484E+00	0.211E+00	0.136E+00	0.227E+00	0.226E-03	0.290E-03	0.348E-03
2023	0.808E-04	0.290E-02	0.102E-02	0.964E+00	0.201E+01	0.579E+00	0.480E+00	0.130E+01	0.272E-03	0.326E-03

TABLE 1C. BIAS OF ABUNDANCE (BY AREA) OF East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.467E+04	0.252E+04	0.283E+04	0.126E+04	0.154E+04	0.377E+03	0.467E+03	0.396E+03	0.389E+03	0.471E+04
1976	0.848E+04	0.286E+04	0.197E+04	0.223E+04	0.994E+03	0.122E+04	0.309E+03	0.392E+03	0.341E+03	0.462E+04
1977	0.241E+04	0.520E+04	0.225E+04	0.155E+04	0.175E+04	0.781E+03	0.996E+03	0.259E+03	0.338E+03	0.440E+04
1978	0.256E+04	0.147E+04	0.408E+04	0.177E+04	0.122E+04	0.138E+04	0.639E+03	0.836E+03	0.223E+03	0.421E+04
1979	0.338E+04	0.156E+04	0.116E+04	0.321E+04	0.139E+04	0.958E+03	0.113E+04	0.536E+03	0.719E+03	0.393E+04

1980 0.335E+04 0.207E+04 0.123E+04 0.910E+03 0.252E+04 0.110E+04 0.785E+03 0.947E+03
0.462E+03 0.413E+04
1981 0.407E+04 0.205E+04 0.163E+04 0.966E+03 0.715E+03 0.198E+04 0.898E+03 0.659E+03
0.815E+03 0.414E+04
1982 0.980E+04 0.249E+04 0.160E+04 0.128E+04 0.760E+03 0.562E+03 0.163E+04 0.754E+03
0.567E+03 0.445E+04
1983 0.838E+04 0.599E+04 0.195E+04 0.126E+04 0.100E+04 0.598E+03 0.460E+03 0.136E+04
0.649E+03 0.451E+04
1984 0.680E+04 0.511E+04 0.471E+04 0.153E+04 0.989E+03 0.788E+03 0.489E+03 0.386E+03
0.117E+04 0.462E+04
1985 0.579E+04 0.416E+04 0.400E+04 0.371E+04 0.121E+04 0.777E+03 0.645E+03 0.411E+03
0.332E+03 0.522E+04
1986 0.732E+04 0.355E+04 0.327E+04 0.314E+04 0.292E+04 0.948E+03 0.636E+03 0.542E+03
0.353E+03 0.506E+04
1987 0.114E+05 0.447E+04 0.279E+04 0.257E+04 0.247E+04 0.229E+04 0.776E+03 0.534E+03
0.466E+03 0.493E+04
1988 0.134E+05 0.699E+04 0.351E+04 0.219E+04 0.202E+04 0.194E+04 0.188E+04 0.652E+03
0.460E+03 0.489E+04
1989 0.307E+05 0.814E+04 0.549E+04 0.275E+04 0.172E+04 0.159E+04 0.159E+04 0.158E+04
0.561E+03 0.485E+04
1990 0.247E+05 0.188E+05 0.639E+04 0.432E+04 0.216E+04 0.135E+04 0.130E+04 0.133E+04
0.136E+04 0.487E+04
1991 0.583E+05 0.151E+05 0.148E+05 0.502E+04 0.339E+04 0.170E+04 0.111E+04 0.109E+04
0.115E+04 0.559E+04
1992 0.551E+05 0.357E+05 0.119E+05 0.116E+05 0.395E+04 0.267E+04 0.139E+04 0.930E+03
0.938E+03 0.608E+04
1993 0.547E+05 0.338E+05 0.281E+05 0.932E+04 0.912E+04 0.310E+04 0.219E+04 0.117E+04
0.801E+03 0.631E+04
1994 0.684E+05 0.335E+05 0.264E+05 0.220E+05 0.733E+04 0.717E+04 0.254E+04 0.183E+04
0.100E+04 0.640E+04
1995 0.601E+05 0.419E+05 0.263E+05 0.208E+05 0.173E+05 0.576E+04 0.587E+04 0.213E+04
0.158E+04 0.667E+04
1996 0.692E+05 0.368E+05 0.329E+05 0.207E+05 0.163E+05 0.136E+05 0.472E+04 0.493E+04
0.183E+04 0.743E+04
1997 0.563E+05 0.423E+05 0.288E+05 0.258E+05 0.163E+05 0.129E+05 0.112E+05 0.396E+04
0.424E+04 0.833E+04
1998 0.319E+06 0.345E+05 0.332E+05 0.227E+05 0.203E+05 0.128E+05 0.105E+05 0.936E+04
0.341E+04 0.113E+05
1999 0.254E+06 0.196E+06 0.270E+05 0.261E+05 0.178E+05 0.160E+05 0.105E+05 0.883E+04
0.806E+04 0.132E+05
2000 0.332E+06 0.156E+06 0.154E+06 0.212E+05 0.205E+05 0.140E+05 0.131E+05 0.878E+04
0.760E+04 0.191E+05
2001 0.368E+06 0.203E+06 0.122E+06 0.121E+06 0.167E+05 0.161E+05 0.115E+05 0.110E+05
0.755E+04 0.239E+05
2002 0.455E+06 0.225E+06 0.159E+06 0.961E+05 0.951E+05 0.131E+05 0.132E+05 0.962E+04
0.945E+04 0.283E+05
2003 0.589E+06 0.279E+06 0.177E+06 0.125E+06 0.756E+05 0.748E+05 0.107E+05 0.111E+05
0.828E+04 0.339E+05
2004 0.772E+06 0.361E+06 0.219E+06 0.139E+06 0.986E+05 0.594E+05 0.613E+05 0.900E+04
0.952E+04 0.380E+05
2005 0.400E+06 0.473E+06 0.284E+06 0.173E+06 0.110E+06 0.776E+05 0.487E+05 0.514E+05
0.775E+04 0.428E+05
2006 0.309E+06 0.245E+06 0.372E+06 0.223E+06 0.136E+06 0.861E+05 0.635E+05 0.409E+05
0.443E+05 0.455E+05
2007 0.203E+06 0.189E+06 0.193E+06 0.292E+06 0.176E+06 0.107E+06 0.705E+05 0.533E+05
0.352E+05 0.802E+05

	1	2	3	4	5	6	7	8	9	10
2008	0.105E+07	0.124E+06	0.149E+06	0.151E+06	0.230E+06	0.138E+06	0.874E+05	0.592E+05	0.459E+05	0.104E+06
2009	0.115E+07	0.641E+06	0.978E+05	0.117E+06	0.119E+06	0.181E+06	0.113E+06	0.734E+05	0.510E+05	0.134E+06
2010	0.121E+07	0.705E+06	0.504E+06	0.769E+05	0.921E+05	0.937E+05	0.148E+06	0.950E+05	0.631E+05	0.166E+06
2011	0.120E+07	0.742E+06	0.555E+06	0.397E+06	0.605E+05	0.725E+05	0.767E+05	0.124E+06	0.817E+05	0.206E+06
2012	0.129E+07	0.733E+06	0.584E+06	0.436E+06	0.312E+06	0.476E+05	0.593E+05	0.644E+05	0.107E+06	0.259E+06
2013	0.136E+07	0.789E+06	0.576E+06	0.459E+06	0.343E+06	0.245E+06	0.389E+05	0.498E+05	0.554E+05	0.329E+06
2014	0.143E+07	0.833E+06	0.621E+06	0.453E+06	0.361E+06	0.270E+06	0.201E+06	0.327E+05	0.429E+05	0.346E+06
2015	0.143E+07	0.878E+06	0.655E+06	0.488E+06	0.357E+06	0.284E+06	0.221E+06	0.169E+06	0.281E+05	0.351E+06
2016	0.118E+07	0.878E+06	0.690E+06	0.515E+06	0.384E+06	0.281E+06	0.233E+06	0.186E+06	0.145E+06	0.342E+06
2017	0.117E+07	0.723E+06	0.690E+06	0.543E+06	0.405E+06	0.302E+06	0.230E+06	0.195E+06	0.160E+06	0.438E+06
2018	0.496E+06	0.716E+06	0.569E+06	0.543E+06	0.427E+06	0.319E+06	0.247E+06	0.193E+06	0.168E+06	0.536E+06
2019	0.104E+08	0.304E+06	0.563E+06	0.447E+06	0.427E+06	0.336E+06	0.261E+06	0.208E+06	0.166E+06	0.635E+06
2020	0.916E+08	0.637E+07	0.239E+06	0.443E+06	0.352E+06	0.336E+06	0.275E+06	0.219E+06	0.179E+06	0.722E+06
2021	0.125E+09	0.561E+08	0.501E+07	0.188E+06	0.349E+06	0.277E+06	0.275E+06	0.231E+06	0.189E+06	0.812E+06
2022	0.779E+06	0.763E+08	0.441E+08	0.394E+07	0.148E+06	0.274E+06	0.227E+06	0.231E+06	0.199E+06	0.902E+06
2023	0.776E+06	0.477E+06	0.600E+08	0.347E+08	0.310E+07	0.116E+06	0.225E+06	0.190E+06	0.199E+06	0.991E+06
2024		0.475E+06	0.375E+06	0.472E+08	0.273E+08	0.244E+07	0.952E+05	0.189E+06	0.164E+06	0.107E+07

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TABLE 1D. STANDARD ERROR OF ABUNDANCE (BY AREA) OF East of 45

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	1	2	3	4	5	6	7	8	9	10
1975	0.101E+04	0.546E+03	0.612E+03	0.275E+03	0.335E+03	0.782E+02	0.955E+02	0.803E+02	0.786E+02	0.953E+03
1976	0.185E+04	0.618E+03	0.429E+03	0.481E+03	0.217E+03	0.264E+03	0.640E+02	0.802E+02	0.691E+02	0.935E+03
1977	0.525E+03	0.113E+04	0.485E+03	0.336E+03	0.379E+03	0.170E+03	0.216E+03	0.537E+02	0.690E+02	0.899E+03
1978	0.557E+03	0.323E+03	0.891E+03	0.382E+03	0.264E+03	0.298E+03	0.139E+03	0.181E+03	0.462E+02	0.872E+03
1979	0.731E+03	0.341E+03	0.253E+03	0.700E+03	0.300E+03	0.208E+03	0.244E+03	0.117E+03	0.156E+03	0.853E+03
1980	0.723E+03	0.447E+03	0.268E+03	0.199E+03	0.551E+03	0.236E+03	0.170E+03	0.205E+03	0.101E+03	0.902E+03
1981	0.876E+03	0.444E+03	0.352E+03	0.210E+03	0.156E+03	0.432E+03	0.193E+03	0.143E+03	0.176E+03	0.897E+03

1982 0.212E+04 0.537E+03 0.348E+03 0.276E+03 0.166E+03 0.123E+03 0.354E+03 0.162E+03 0.123E+03 0.964E+03
1983 0.179E+04 0.130E+04 0.421E+03 0.273E+03 0.217E+03 0.130E+03 0.101E+03 0.297E+03 0.140E+03 0.972E+03
1984 0.146E+04 0.110E+04 0.102E+04 0.331E+03 0.214E+03 0.171E+03 0.107E+03 0.843E+02 0.256E+03 0.100E+04
1985 0.125E+04 0.897E+03 0.861E+03 0.801E+03 0.260E+03 0.169E+03 0.140E+03 0.895E+02 0.726E+02 0.114E+04
1986 0.157E+04 0.765E+03 0.702E+03 0.674E+03 0.630E+03 0.204E+03 0.138E+03 0.117E+03 0.770E+02 0.110E+04
1987 0.246E+04 0.962E+03 0.601E+03 0.552E+03 0.530E+03 0.496E+03 0.168E+03 0.116E+03 0.101E+03 0.107E+04
1988 0.288E+04 0.151E+04 0.754E+03 0.472E+03 0.434E+03 0.417E+03 0.405E+03 0.141E+03 0.997E+02 0.106E+04
1989 0.661E+04 0.176E+04 0.118E+04 0.591E+03 0.371E+03 0.341E+03 0.342E+03 0.340E+03 0.121E+03 0.105E+04
1990 0.533E+04 0.405E+04 0.138E+04 0.931E+03 0.465E+03 0.292E+03 0.279E+03 0.287E+03 0.293E+03 0.105E+04
1991 0.126E+05 0.326E+04 0.318E+04 0.108E+04 0.732E+03 0.366E+03 0.239E+03 0.234E+03 0.247E+03 0.120E+04
1992 0.119E+05 0.769E+04 0.256E+04 0.250E+04 0.850E+03 0.576E+03 0.300E+03 0.200E+03 0.202E+03 0.131E+04
1993 0.118E+05 0.727E+04 0.604E+04 0.201E+04 0.197E+04 0.669E+03 0.471E+03 0.251E+03 0.173E+03 0.136E+04
1994 0.147E+05 0.723E+04 0.570E+04 0.474E+04 0.158E+04 0.155E+04 0.548E+03 0.395E+03 0.216E+03 0.138E+04
1995 0.130E+05 0.903E+04 0.567E+04 0.448E+04 0.373E+04 0.124E+04 0.127E+04 0.460E+03 0.340E+03 0.144E+04
1996 0.149E+05 0.793E+04 0.710E+04 0.446E+04 0.352E+04 0.293E+04 0.102E+04 0.106E+04 0.395E+03 0.160E+04
1997 0.121E+05 0.912E+04 0.622E+04 0.557E+04 0.350E+04 0.277E+04 0.240E+04 0.853E+03 0.914E+03 0.180E+04
1998 0.689E+05 0.743E+04 0.716E+04 0.489E+04 0.438E+04 0.275E+04 0.227E+04 0.202E+04 0.734E+03 0.243E+04
1999 0.548E+05 0.422E+05 0.582E+04 0.562E+04 0.384E+04 0.345E+04 0.225E+04 0.190E+04 0.174E+04 0.285E+04
2000 0.716E+05 0.335E+05 0.332E+05 0.457E+04 0.442E+04 0.302E+04 0.282E+04 0.189E+04 0.164E+04 0.411E+04
2001 0.793E+05 0.437E+05 0.264E+05 0.261E+05 0.359E+04 0.347E+04 0.247E+04 0.237E+04 0.163E+04 0.516E+04
2002 0.983E+05 0.486E+05 0.344E+05 0.207E+05 0.205E+05 0.283E+04 0.284E+04 0.207E+04 0.204E+04 0.610E+04
2003 0.127E+06 0.602E+05 0.382E+05 0.270E+05 0.163E+05 0.161E+05 0.231E+04 0.239E+04 0.178E+04 0.732E+04
2004 0.166E+06 0.780E+05 0.474E+05 0.300E+05 0.213E+05 0.128E+05 0.132E+05 0.194E+04 0.205E+04 0.820E+04
2005 0.861E+05 0.102E+06 0.613E+05 0.373E+05 0.236E+05 0.167E+05 0.105E+05 0.111E+05 0.167E+04 0.923E+04
2006 0.665E+05 0.527E+05 0.802E+05 0.482E+05 0.293E+05 0.186E+05 0.137E+05 0.881E+04 0.955E+04 0.982E+04
2007 0.436E+05 0.407E+05 0.415E+05 0.630E+05 0.379E+05 0.231E+05 0.152E+05 0.115E+05 0.758E+04 0.173E+05
2008 0.225E+06 0.267E+05 0.320E+05 0.326E+05 0.496E+05 0.298E+05 0.189E+05 0.128E+05 0.989E+04 0.223E+05
2009 0.247E+06 0.138E+06 0.210E+05 0.252E+05 0.257E+05 0.390E+05 0.244E+05 0.158E+05 0.110E+05 0.290E+05

2010	0.260E+06	0.152E+06	0.108E+06	0.165E+05	0.198E+05	0.202E+05	0.319E+05	0.205E+05	0.136E+05	0.359E+05
2011	0.256E+06	0.159E+06	0.119E+06	0.853E+05	0.130E+05	0.156E+05	0.165E+05	0.268E+05	0.176E+05	0.445E+05
2012	0.277E+06	0.157E+06	0.125E+06	0.938E+05	0.671E+05	0.102E+05	0.128E+05	0.139E+05	0.231E+05	0.558E+05
2013	0.291E+06	0.169E+06	0.123E+06	0.987E+05	0.738E+05	0.528E+05	0.837E+04	0.107E+05	0.119E+05	0.708E+05
2014	0.306E+06	0.178E+06	0.133E+06	0.971E+05	0.776E+05	0.580E+05	0.432E+05	0.703E+04	0.922E+04	0.744E+05
2015	0.305E+06	0.187E+06	0.140E+06	0.105E+06	0.764E+05	0.611E+05	0.475E+05	0.363E+05	0.605E+04	0.754E+05
2016	0.333E+07	0.187E+06	0.147E+06	0.110E+06	0.825E+05	0.601E+05	0.500E+05	0.399E+05	0.312E+05	0.736E+05
2017	0.459E+07	0.204E+07	0.147E+06	0.116E+06	0.868E+05	0.649E+05	0.492E+05	0.420E+05	0.343E+05	0.942E+05
2018	0.302E+07	0.281E+07	0.160E+07	0.116E+06	0.912E+05	0.683E+05	0.531E+05	0.413E+05	0.361E+05	0.115E+06
2019	0.577E+08	0.185E+07	0.221E+07	0.126E+07	0.910E+05	0.717E+05	0.559E+05	0.446E+05	0.355E+05	0.136E+06
2020	0.168E+09	0.353E+08	0.145E+07	0.174E+07	0.992E+06	0.716E+05	0.587E+05	0.469E+05	0.384E+05	0.155E+06
2021	0.673E+09	0.103E+09	0.278E+08	0.114E+07	0.137E+07	0.780E+06	0.586E+05	0.493E+05	0.404E+05	0.174E+06
2022	0.254E+06	0.412E+09	0.809E+08	0.219E+08	0.899E+06	0.108E+07	0.639E+06	0.492E+05	0.424E+05	0.193E+06
2023	0.255E+06	0.156E+06	0.324E+09	0.636E+08	0.172E+08	0.707E+06	0.882E+06	0.536E+06	0.424E+05	0.211E+06
2024		0.156E+06	0.122E+06	0.255E+09	0.501E+08	0.135E+08	0.579E+06	0.740E+06	0.462E+06	0.228E+06

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TABLE 1E. PARAMETER ESTIMATES FOR East of 45

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TERMINAL AGE STRUCTURE OF POPULATION ABUNDANCE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
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2	0.170E+07	0.162E+07	0.475E+06	0.156E+06	9.6
3	0.129E+07	0.124E+07	0.375E+06	0.122E+06	9.9
4	0.142E+08	0.500E+08	0.472E+08	0.255E+09	510.0
5	0.156E+08	0.345E+08	0.273E+08	0.501E+08	144.9
6	0.325E+07	0.561E+07	0.244E+07	0.135E+08	241.1
7	0.132E+05	0.107E+06	0.952E+05	0.579E+06	542.5
8	0.140E+06	0.483E+06	0.189E+06	0.740E+06	153.2
9	0.703E+05	0.224E+06	0.164E+06	0.462E+06	206.4
10	0.426E+07	0.522E+07	0.107E+07	0.228E+06	4.4

TERMINAL AGE STRUCTURE OF FISHING MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
---	----------	----------	----------	----------	-----
1	0.800E-03	0.843E-03	-0.337E-03	0.808E-04	9.6
2	0.285E-01	0.300E-01	-0.123E-01	0.290E-02	9.7

3	0.120E-02	0.135E-02	-0.470E-02	0.102E-02	75.9
4	0.116E-02	0.317E+00	0.315E+00	0.964E+00	303.9
5	0.232E-02	0.111E+01	0.111E+01	0.201E+01	180.5
6	0.321E+00	0.615E+00	0.256E+00	0.579E+00	94.2
7	0.385E-01	0.219E+00	0.200E+00	0.480E+00	219.3
8	0.615E-01	0.563E+00	0.491E+00	0.130E+01	231.1
9	0.751E-02	0.614E-02	-0.157E-02	0.272E-03	4.4
10	0.901E-02	0.737E-02	-0.188E-02	0.326E-03	4.4

RATIO OF FISHING MORTALITY RATE ON LAST TWO AGES (F-RATIO)

Year	MLE	Average of bootstraps	Bias	Std. Error	% CV
----	----------	----------	----------	----------	-----
1975	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1976	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1977	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1978	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1979	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1980	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1981	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1982	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1983	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1984	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1985	0.600E+00	0.600E+00	0.000E+00	0.243E-07	0.0
1986	0.600E+00	0.600E+00	0.000E+00	0.258E-07	0.0
1987	0.600E+00	0.600E+00	0.000E+00	0.256E-07	0.0
1988	0.600E+00	0.600E+00	0.000E+00	0.160E-07	0.0
1989	0.600E+00	0.600E+00	0.000E+00	0.226E-07	0.0
1990	0.600E+00	0.600E+00	0.000E+00	0.182E-07	0.0
1991	0.600E+00	0.600E+00	0.000E+00	0.247E-07	0.0
1992	0.600E+00	0.600E+00	0.000E+00	0.239E-07	0.0
1993	0.600E+00	0.600E+00	0.000E+00	0.216E-07	0.0
1994	0.600E+00	0.600E+00	0.000E+00	0.216E-07	0.0
1995	0.120E+01	0.120E+01	0.000E+00	0.352E-07	0.0
1996	0.120E+01	0.120E+01	0.000E+00	0.493E-07	0.0
1997	0.120E+01	0.120E+01	0.000E+00	0.441E-07	0.0
1998	0.120E+01	0.120E+01	0.000E+00	0.518E-07	0.0
1999	0.120E+01	0.120E+01	0.000E+00	0.450E-07	0.0
2000	0.120E+01	0.120E+01	0.000E+00	0.314E-07	0.0
2001	0.120E+01	0.120E+01	0.000E+00	0.514E-07	0.0
2002	0.120E+01	0.120E+01	0.000E+00	0.408E-07	0.0
2003	0.120E+01	0.120E+01	0.000E+00	0.481E-07	0.0
2004	0.120E+01	0.120E+01	0.000E+00	0.492E-07	0.0
2005	0.120E+01	0.120E+01	0.000E+00	0.393E-07	0.0
2006	0.120E+01	0.120E+01	0.000E+00	0.407E-07	0.0
2007	0.120E+01	0.120E+01	0.000E+00	0.425E-07	0.0
2008	0.120E+01	0.120E+01	0.000E+00	0.465E-07	0.0
2009	0.120E+01	0.120E+01	0.000E+00	0.447E-07	0.0
2010	0.120E+01	0.120E+01	0.000E+00	0.421E-07	0.0
2011	0.120E+01	0.120E+01	0.000E+00	0.516E-07	0.0
2012	0.120E+01	0.120E+01	0.000E+00	0.444E-07	0.0
2013	0.120E+01	0.120E+01	0.000E+00	0.450E-07	0.0
2014	0.120E+01	0.120E+01	0.000E+00	0.389E-07	0.0
2015	0.120E+01	0.120E+01	0.000E+00	0.352E-07	0.0
2016	0.120E+01	0.120E+01	0.000E+00	0.417E-07	0.0
2017	0.120E+01	0.120E+01	0.000E+00	0.482E-07	0.0
2018	0.120E+01	0.120E+01	0.000E+00	0.472E-07	0.0

2019	0.120E+01	0.120E+01	0.000E+00	0.479E-07	0.0
2020	0.120E+01	0.120E+01	0.000E+00	0.406E-07	0.0
2021	0.120E+01	0.120E+01	0.000E+00	0.469E-07	0.0
2022	0.120E+01	0.120E+01	0.000E+00	0.406E-07	0.0
2023	0.120E+01	0.120E+01	0.000E+00	0.338E-07	0.0

NATURAL MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.490E+00	0.490E+00	0.000E+00	0.000E+00	0.0
2	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
3	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
4	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
5	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
6	0.200E+00	0.200E+00	0.000E+00	0.000E+00	0.0
7	0.175E+00	0.175E+00	0.000E+00	0.000E+00	0.0
8	0.150E+00	0.150E+00	0.000E+00	0.000E+00	0.0
9	0.125E+00	0.125E+00	0.000E+00	0.000E+00	0.0
10	0.100E+00	0.100E+00	0.000E+00	0.000E+00	0.0

TRANSFER COEFFICIENTS

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

VARIANCE SCALING PARAMETERS

Index	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
2	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
3	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
4	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
5	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
6	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
7	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
8	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
9	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
10	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
11	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
12	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6

CATCHABILITY COEFFICIENTS

Index	Year	MLE	Average of bootstraps	Bias	Std. Error	% CV

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1	1975	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1976	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1977	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1978	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1979	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1980	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1981	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1982	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1983	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1984	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1985	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1986	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1987	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1988	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1989	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1990	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1991	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1992	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1993	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1994	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1995	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1996	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1997	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1998	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1999	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2000	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2001	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2002	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2003	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2004	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2005	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2006	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2007	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2008	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2009	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2010	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2011	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2012	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2013	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2014	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2015	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2016	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2017	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2018	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2019	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2020	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2021	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2022	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2023	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
2	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

2	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	1975	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1976	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1977	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1978	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1979	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1980	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1981	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1982	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1983	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1984	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1985	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1986	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1987	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1988	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1989	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0

3	1990	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1991	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1992	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1993	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1994	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1995	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1996	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1997	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1998	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1999	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2000	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2001	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2002	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2003	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2004	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2005	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2006	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2007	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2008	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2009	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2010	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2011	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2012	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2013	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2014	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2015	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2016	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2017	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2018	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2019	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2020	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2021	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2022	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2023	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
4	1975	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1976	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1977	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1978	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1979	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1980	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1981	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1982	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1983	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1984	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1985	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1986	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1987	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1988	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1989	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1990	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1991	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1992	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1993	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1994	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1995	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1996	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1997	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0

4	1998	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1999	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2000	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2001	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2002	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2003	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2004	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2005	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2006	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2007	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2008	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2009	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2010	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2011	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2012	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2013	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2014	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2015	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2016	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2017	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2018	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2019	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2020	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2021	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2022	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2023	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
5	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

5	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

6	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	1975	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1976	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1977	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1978	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1979	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1980	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1981	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1982	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1983	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1984	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1985	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1986	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1987	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1988	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1989	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1990	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1991	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1992	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1993	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1994	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1995	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1996	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1997	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1998	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1999	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2000	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2001	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2002	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2003	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2004	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2005	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2006	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2007	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2008	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2009	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2010	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2011	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2012	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2013	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2014	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2015	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2016	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2017	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2018	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2019	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2020	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2021	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1

7	2022	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2023	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
8	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

9	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

10	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
11	1975	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1976	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1977	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1978	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1979	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1980	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1981	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1982	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1983	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1984	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1985	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1986	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1987	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1988	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1989	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1990	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1991	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1992	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1993	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1994	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1995	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1996	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4

11	1997	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1998	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1999	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2000	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2001	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2002	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2003	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2004	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2005	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2006	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2007	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2008	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2009	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2010	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2011	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2012	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2013	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2014	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2015	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2016	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2017	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2018	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2019	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2020	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2021	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2022	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2023	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
12	1975	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1976	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1977	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1978	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1979	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1980	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1981	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1982	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1983	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1984	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1985	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1986	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1987	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1988	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1989	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1990	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1991	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1992	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1993	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1994	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1995	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1996	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1997	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1998	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1999	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2000	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2001	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2002	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2003	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2004	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5

12	2005	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2006	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2007	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2008	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2009	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2010	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2011	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2012	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2013	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2014	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2015	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2016	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2017	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2018	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2019	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2020	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2021	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2022	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2023	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5

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CORRELATION AND COVARIANCE MATRICES OF PARAMETERS

****

TABLE 2A. CORRELATION MATRIX

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 :	1.0																			
2 :	1.0	1.0																		
3 :	0.2	0.2	1.0																	
4 :	0.0	0.0	-0.2	1.0																
5 :	0.0	0.0	-0.1	0.3	1.0															
6 :	0.1	0.1	-0.1	-0.1	-0.2	1.0														
7 :	0.1	0.1	-0.1	-0.1	0.0	-0.2	1.0													
8 :	0.1	0.1	0.1	-0.1	-0.1	0.3	0.0	1.0												
9 :	-0.1	-0.1	0.1	-0.1	-0.1	-0.1	0.1	0.1	1.0											
10 :	-0.1	-0.1	-0.1	0.1	0.0	0.1	-0.1	-0.2	0.0	1.0										
11 :	-0.1	-0.1	0.1	-0.1	-0.1	-0.1	0.1	0.1	1.0	-0.1	1.0									
12 :	-0.1	-0.1	0.1	-0.1	-0.2	-0.1	0.1	0.1	1.0	-0.1	1.0	1.0								
13 :	-0.1	-0.1	0.1	-0.1	-0.2	-0.1	0.1	0.1	1.0	-0.1	1.0	1.0	1.0							
14 :	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	-0.1	-0.2	0.2	-0.2	-0.2	-0.2	1.0						
15 :	-0.1	-0.1	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.3	-0.2	0.3	0.3	0.3	-0.3	1.0					
16 :	0.0	0.0	0.1	-0.1	-0.2	0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	0.1	1.0				
17 :	0.1	0.1	0.0	0.0	0.1	0.0	-0.2	0.1	-0.1	0.2	-0.1	-0.1	-0.1	0.3	-0.3	-0.1	1.0			
18 :	0.0	0.0	-0.1	-0.2	0.0	0.0	0.1	-0.1	0.2	0.0	0.2	0.2	0.2	-0.2	0.3	0.1	-0.2	1.0		
19 :	0.1	0.1	-0.1	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.1	1.0	
20 :	0.0	0.0	0.1	0.1	0.2	-0.2	0.1	-0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	-0.1	1.0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35					
21 :	-0.1	-0.1	0.1	-0.1	0.1	0.1	-0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.3	-0.1	-0.1	0.0
22 :	0.2	0.2	-0.2	0.0	0.1	0.3	-0.1	0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.0	0.1	-0.2	0.1	0.2	-0.2

```
  23 :  0.1  0.1 -0.1  0.1  0.2  0.1 -0.1 -0.1 -1.0  0.0 -1.0 -1.0 -1.0  0.3 -0.4  0.1  0.1 -0.2  0.0 -0.1
  24 :  0.1  0.1 -0.1  0.1  0.2  0.1 -0.1 -0.1 -1.0  0.0 -1.0 -1.0 -1.0  0.2 -0.3  0.1  0.1 -0.2  0.0 -0.1
  25 :  0.1  0.1 -0.1  0.1  0.2  0.1 -0.1 -0.1 -1.0  0.1 -1.0 -1.0 -1.0  0.2 -0.3  0.1  0.1 -0.2  0.0 -0.1
  26 :  0.1  0.1 -0.1  0.1  0.1  0.1 -0.1 -0.1 -1.0  0.0 -1.0 -1.0 -1.0  0.2 -0.3  0.2  0.0 -0.2  0.0 -0.1
  27 :  0.1  0.1 -0.1  0.1  0.1  0.1 -0.1 -0.1 -1.0  0.1 -1.0 -1.0 -1.0  0.2 -0.4  0.1  0.1 -0.2  0.0 -0.1
  28 :  0.1  0.1 -0.1  0.1  0.1  0.1 -0.1 -0.1 -1.0  0.0 -1.0 -1.0 -1.0  0.2 -0.3  0.1  0.1 -0.2  0.0 -0.1
  29 :  0.1  0.1 -0.1  0.1  0.2  0.2 -0.1 -0.1 -0.9  0.0 -0.9 -0.9 -0.9  0.1 -0.2  0.1  0.0 -0.1  0.0 -0.1
  30 :  0.1  0.1 -0.1  0.0  0.0  0.2 -0.1  0.0 -0.8  0.0 -0.8 -0.8 -0.8  0.0 -0.1  0.2  0.0  0.0  0.2 -0.2
  31 :  0.0  0.0 -0.1  0.1  0.1  0.1 -0.1 -0.1 -0.8  0.0 -0.8 -0.8 -0.8  0.3 -0.3  0.0  0.1 -0.3 -0.1 -0.1
  32 :  0.1  0.1 -0.1  0.1  0.1  0.1 -0.1 -0.1 -0.7  0.2 -0.7 -0.7 -0.7  0.3 -0.3  0.0  0.1 -0.1 -0.1  0.0
  33 :  0.1  0.1 -0.1  0.2  0.0  0.0  0.0 -0.1 -0.7  0.1 -0.7 -0.7 -0.7  0.1 -0.1  0.1  0.0  0.0 -0.1 -0.1
  34 :  0.1  0.1  0.0  0.2  0.1  0.2 -0.1  0.0 -0.2  0.0 -0.3 -0.2 -0.2  0.0 -0.1  0.0 -0.1 -0.1 -0.1 -0.2
  35 :  0.0  0.0  0.1  0.0  0.0  0.1  0.0  0.2 -0.4 -0.1 -0.3 -0.3 -0.3  0.1 -0.3  0.0  0.1 -0.2 -0.1  0.2

      21   22   23   24   25   26   27   28   29   30   31   32   33   34   35
  21 :  1.0
  22 : -0.2  1.0
  23 : -0.1  0.2  1.0
  24 : -0.1  0.2  1.0  1.0
  25 : -0.1  0.2  1.0  1.0  1.0
  26 : -0.1  0.2  1.0  1.0  1.0  1.0
  27 : -0.1  0.2  1.0  1.0  1.0  1.0  1.0
  28 : -0.1  0.2  1.0  1.0  1.0  1.0  1.0  1.0
  29 : -0.2  0.3  0.9  0.9  0.9  0.9  0.9  0.9  1.0
  30 : -0.1  0.3  0.8  0.8  0.8  0.8  0.8  0.8  0.8  1.0
  31 : -0.1  0.1  0.8  0.8  0.8  0.8  0.8  0.8  0.7  0.6  1.0
  32 :  0.0  0.1  0.7  0.7  0.7  0.7  0.7  0.7  0.6  0.5  0.6  1.0
  33 : -0.2  0.2  0.7  0.7  0.7  0.7  0.7  0.7  0.7  0.6  0.4  0.6  1.0
  34 : -0.1  0.2  0.2  0.2  0.2  0.3  0.3  0.3  0.3  0.3  0.2  0.2  0.2  1.0
  35 :  0.0 -0.1  0.4  0.4  0.3  0.3  0.4  0.4  0.3  0.2  0.3  0.2  0.0 -0.2  1.0
```

TABLE 2B. COVARIANCE MATRIX

```
==============================================================================================
==============================================================================================
==============================================================================================
=============
         1          2          3          4          5          6          7          8          9         10         11         12
13         14         15         16         17         18         19         20
    1 :   0.6525D-08
    2 :   0.2346D-06   0.8438D-05
    3 :   0.1368D-07   0.4896D-06   0.1045D-05
    4 :   0.1830D-06   0.2782D-05  -0.1970D-03   0.9284D+00
    5 :   0.8884D-06   0.2029D-04  -0.1981D-03   0.6663D+00   0.4039D+01
    6 :   0.4541D-05   0.1688D-03  -0.7324D-04  -0.5043D-01  -0.1971D+00   0.3355D+00
    7 :   0.2084D-05   0.7300D-04  -0.5919D-04  -0.4486D-01  -0.3743D-01  -0.5593D-01   0.2305D+00
    8 :   0.1401D-04   0.5063D-03   0.1526D-03  -0.1421D+00  -0.2575D+00   0.2176D+00   0.1581D-01
0.1694D+01
    9 :  -0.2445D-08  -0.9150D-07   0.3274D-07  -0.2255D-04  -0.8144D-04  -0.1759D-04   0.1326D-04
0.4128D-04   0.7383D-07
   10 :  -0.4437D-06  -0.1587D-04  -0.1306D-04   0.1090D-01  -0.1717D-02   0.3286D-02  -0.4792D-02  -
0.1787D-01  -0.1078D-05   0.7310D-02
   11 :  -0.7269D-08  -0.2730D-06   0.8156D-07  -0.6508D-04  -0.2186D-03  -0.5002D-04   0.4570D-04
0.1456D-03   0.2282D-06  -0.4273D-05   0.7167D-06
   12 :  -0.8661D-08  -0.3244D-06   0.1096D-06  -0.6879D-04  -0.2893D-03  -0.5706D-04   0.4759D-04
0.1518D-03   0.2492D-06  -0.4624D-05   0.7728D-06   0.8495D-06
```

13 : -0.8091D-08 -0.3027D-06 0.1001D-06 -0.8354D-04 -0.2605D-03 -0.4670D-04 0.4206D-04 0.1132D-03 0.2304D-06 -0.3768D-05 0.7117D-06 0.7777D-06 0.7307D-06
14 : 0.1348D-09 0.7337D-08 -0.6601D-09 0.1177D-04 -0.1974D-05 0.3218D-05 -0.5564D-05 -0.1479D-04 -0.9858D-08 0.2571D-05 -0.3176D-07 -0.3425D-07 -0.2481D-07 0.2520D-07
15 : -0.9356D-09 -0.3510D-07 0.1261D-07 -0.1089D-04 -0.1579D-04 -0.6267D-05 -0.3748D-05 -0.1976D-04 0.1083D-07 -0.1899D-05 0.3419D-07 0.3735D-07 0.3085D-07 -0.6339D-08 0.1445D-07
16 : -0.1214D-09 -0.5830D-08 0.7132D-08 -0.1098D-04 -0.4995D-04 0.6682D-05 -0.8517D-06 -0.5299D-05 -0.4490D-08 -0.1118D-05 -0.1082D-07 -0.1312D-07 -0.1539D-07 -0.1932D-08 0.1211D-08 0.1240D-07
17 : 0.6447D-09 0.2310D-07 -0.4075D-08 0.6068D-05 0.2383D-04 0.2065D-05 -0.1194D-04 0.9703D-05 -0.2727D-08 0.1747D-05 -0.9880D-08 -0.1241D-07 -0.6279D-08 0.6211D-08 -0.4186D-08 -0.1464D-08 0.1694D-07
18 : 0.1261D-10 -0.6875D-09 -0.1962D-07 -0.2017D-04 0.9830D-05 0.3231D-05 0.5192D-05 -0.1383D-04 0.6457D-08 -0.4696D-06 0.2297D-07 0.2181D-07 0.2006D-07 -0.4517D-08 0.4447D-08 0.1831D-08 -0.4245D-08 0.1786D-07
19 : 0.1246D-08 0.4422D-07 -0.7851D-08 -0.5471D-05 0.5386D-04 -0.1247D-05 -0.1317D-05 0.1053D-04 0.8947D-09 -0.4852D-06 0.1522D-08 0.1210D-08 0.8492D-10 -0.3855D-08 -0.3757D-09 -0.1204D-08 0.8314D-09 0.1254D-08 0.1704D-07
20 : 0.6917D-10 0.2043D-08 0.1847D-07 0.1648D-04 0.4903D-04 -0.1577D-04 0.4037D-05 -0.1011D-04 0.3675D-08 0.2737D-06 0.1302D-07 0.1158D-07 0.1231D-07 0.8012D-09 -0.4992D-09 0.3591D-09 -0.2734D-09 0.9173D-09 -0.1565D-08 0.1457D-07

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
21 : -0.2797D-06 -0.9694D-05 0.5306D-05 -0.3132D-02 0.1339D-01 0.2403D-02 -0.4583D-02 0.2722D-02 0.1797D-05 0.5844D-03 0.5524D-05 0.4609D-05 0.5274D-05 0.7141D-07 0.1153D-06 -0.1504D-07 0.2021D-05 -0.9309D-06 -0.4997D-06 0.1576D-06
22 : 0.1881D-05 0.6862D-04 -0.2647D-04 -0.5901D-02 0.1522D-01 0.2270D-01 -0.3097D-02 0.1218D-01 -0.6842D-05 -0.2001D-02 -0.2070D-04 -0.2128D-04 -0.2036D-04 -0.2590D-05 -0.2723D-06 0.1417D-05 -0.3171D-05 0.1137D-05 0.3662D-05 -0.2519D-05
23 : 0.5703D-08 0.2140D-06 -0.8005D-07 0.6427D-04 0.2181D-03 0.4632D-04 -0.3546D-04 -0.9389D-04 -0.1749D-06 0.2380D-05 -0.5413D-06 -0.5902D-06 -0.5441D-06 0.2712D-07 -0.2768D-07 0.9643D-08 0.7908D-08 -0.1575D-07 -0.8826D-09 -0.8148D-08
24 : 0.9959D-08 0.3721D-06 -0.1238D-06 0.8278D-04 0.3166D-03 0.7378D-04 -0.4842D-04 -0.1458D-03 -0.2788D-06 0.3769D-05 -0.8630D-06 -0.9434D-06 -0.8719D-06 0.3521D-07 -0.4153D-07 0.1664D-07 0.1044D-07 -0.2199D-07 -0.1125D-08 -0.1296D-07
25 : 0.1219D-07 0.4557D-06 -0.1520D-06 0.1052D-03 0.3869D-03 0.8666D-04 -0.6652D-04 -0.1832D-03 -0.3470D-06 0.5748D-05 -0.1074D-05 -0.1173D-05 -0.1086D-05 0.4579D-07 -0.5077D-07 0.2062D-07 0.1320D-07 -0.2943D-07 -0.1141D-08 -0.1706D-07
26 : 0.1012D-07 0.3781D-06 -0.1131D-06 0.7827D-04 0.2867D-03 0.6879D-04 -0.5231D-04 -0.1460D-03 -0.2704D-06 0.4133D-05 -0.8372D-06 -0.9147D-06 -0.8492D-06 0.2909D-07 -0.3633D-07 0.1808D-07 0.5820D-08 -0.2023D-07 0.7078D-09 -0.1608D-07
27 : 0.6724D-08 0.2508D-06 -0.8579D-07 0.5454D-04 0.1856D-03 0.4232D-04 -0.2448D-04 -0.9238D-04 -0.1741D-06 0.3120D-05 -0.5395D-06 -0.5880D-06 -0.5412D-06 0.2487D-07 -0.2760D-07 0.1016D-07 0.7521D-08 -0.1513D-07 -0.1626D-08 -0.9020D-08
28 : 0.1620D-07 0.6029D-06 -0.1855D-06 0.1186D-03 0.4299D-03 0.1007D-03 -0.5864D-04 -0.2170D-03 -0.4013D-06 0.4931D-05 -0.1245D-05 -0.1357D-05 -0.1255D-05 0.4757D-07 -0.5775D-07 0.2310D-07 0.1290D-07 -0.3337D-07 -0.1225D-08 -0.2277D-07
29 : 0.1839D-08 0.6889D-07 -0.1658D-07 0.1329D-04 0.7293D-04 0.2079D-04 -0.8850D-05 -0.2871D-04 -0.5177D-07 0.5196D-06 -0.1604D-06 -0.1747D-06 -0.1627D-06 0.4190D-08 -0.4957D-08 0.2885D-08 0.8112D-09 -0.1678D-08 0.1029D-08 -0.2577D-08

30 : 0.1466D-08 0.5446D-07 -0.1174D-07 -0.3134D-06 0.8165D-05 0.2452D-04 -0.1077D-04 -
0.7850D-05 -0.3763D-07 0.1439D-06 -0.1171D-06 -0.1273D-06 -0.1203D-06 -0.2035D-09 -0.1918D-
08 0.3659D-08 0.2742D-09 -0.4773D-09 0.4391D-08 -0.5337D-08
31 : -0.2638D-09 -0.7412D-08 -0.1327D-07 0.9333D-05 0.4667D-04 0.1082D-04 -0.7150D-05 -
0.3153D-04 -0.3546D-07 0.6664D-06 -0.1096D-06 -0.1187D-06 -0.1086D-06 0.7774D-08 -0.5857D-
08 0.6973D-09 0.2148D-08 -0.5676D-08 -0.1114D-08 -0.1624D-08
32 : 0.1028D-08 0.3916D-07 -0.1747D-07 0.1550D-04 0.3121D-04 0.8752D-05 -0.6277D-05 -
0.1506D-04 -0.2750D-07 0.2860D-05 -0.8665D-07 -0.9331D-07 -0.8471D-07 0.7168D-08 -0.5599D-
08 -0.7365D-09 0.1082D-08 -0.1544D-08 -0.2609D-08 0.7328D-09
33 : 0.1113D-08 0.4125D-07 -0.1984D-07 0.1976D-04 0.1336D-04 -0.7999D-06 -0.1216D-05 -
0.2495D-04 -0.2503D-07 0.8271D-06 -0.7830D-07 -0.8431D-07 -0.7885D-07 0.2906D-08 -0.1868D-
08 0.1080D-08 -0.9466D-10 0.9946D-10 -0.1804D-08 -0.1760D-08
34 : 0.6433D-09 0.2349D-07 -0.1671D-08 0.2102D-04 0.2238D-04 0.1112D-04 -0.5088D-05 -
0.5602D-05 -0.7727D-08 0.2171D-06 -0.2564D-07 -0.2515D-07 -0.2464D-07 0.2288D-09 -0.8165D-
09 -0.3996D-09 -0.8712D-09 -0.1839D-08 -0.1655D-08 -0.2913D-08
35 : 0.3704D-09 0.1404D-07 0.5987D-08 0.2983D-06 -0.8250D-05 0.7664D-05 -0.1890D-06
0.3168D-04 -0.1140D-07 -0.8341D-06 -0.3318D-07 -0.3617D-07 -0.3405D-07 0.1030D-08 -0.4799D-
08 0.2999D-09 0.1124D-08 -0.2564D-08 -0.1792D-08 0.2233D-08

21 22 23 24 25 26 27 28 29 30 31 32
33 34 35
21 : 0.3233D-02
22 : -0.1181D-02 0.1596D-01
23 : -0.4107D-05 0.1707D-04 0.4204D-06
24 : -0.6938D-05 0.2660D-04 0.6613D-06 0.1060D-05
25 : -0.8639D-05 0.3088D-04 0.8223D-06 0.1313D-05 0.1638D-05
26 : -0.7467D-05 0.2784D-04 0.6399D-06 0.1025D-05 0.1276D-05 0.1004D-05
27 : -0.4770D-05 0.1716D-04 0.4125D-06 0.6577D-06 0.8180D-06 0.6386D-06 0.4162D-06
28 : -0.1048D-04 0.4258D-04 0.9526D-06 0.1521D-05 0.1888D-05 0.1476D-05 0.9504D-06
0.2215D-05
29 : -0.2075D-05 0.6732D-05 0.1232D-06 0.1979D-06 0.2448D-06 0.1939D-06 0.1223D-06
0.2831D-06 0.4373D-07
30 : -0.1285D-05 0.7264D-05 0.8955D-07 0.1457D-06 0.1802D-06 0.1440D-06 0.8816D-07
0.2089D-06 0.2944D-07 0.3188D-07
31 : -0.9789D-06 0.1945D-05 0.8492D-07 0.1344D-06 0.1652D-06 0.1280D-06 0.8365D-07
0.1897D-06 0.2463D-07 0.1783D-07 0.2748D-07
32 : -0.1961D-06 0.2098D-05 0.6525D-07 0.1029D-06 0.1304D-06 0.9915D-07 0.6528D-07
0.1493D-06 0.1827D-07 0.1264D-07 0.1386D-07 0.2049D-07
33 : -0.1319D-05 0.3340D-05 0.5798D-07 0.9540D-07 0.1188D-06 0.9421D-07 0.5903D-07
0.1391D-06 0.1969D-07 0.1347D-07 0.9740D-08 0.1144D-07 0.1815D-07
34 : -0.6949D-06 0.2511D-05 0.1834D-07 0.2945D-07 0.3613D-07 0.3088D-07 0.1891D-07
0.4312D-07 0.6632D-08 0.6216D-08 0.4459D-08 0.2586D-08 0.3156D-08 0.1330D-07
35 : 0.1185D-07 -0.1479D-05 0.2795D-07 0.4208D-07 0.5176D-07 0.3765D-07 0.2711D-07
0.6279D-07 0.6406D-08 0.3653D-08 0.6327D-08 0.3257D-08 0.6118D-09 -0.2706D-08 0.1336D-
07

APPENDIX V

VPA results for the strategy 3.. VPA analysis for ABFT for the period 1975 – 2023. Data for 2011 – 2023 was simulated using projected Fs and Ns from the 2010 stock assessment

```
 ***************************************
                    VPA-2BOX
          SUMMARY STATISTICS AND DIAGNOSTIC OUTPUT
          ***************************************

Model for strategy 2
14:40, 17  February 2011

======================================================================
Total objective function =       982.47
    (with constants)   =    -19846.30
Number of parameters (P) =          42
Number of data points (D)=         261
AIC : 2*objective+2P    =    -39608.60
AICc: 2*objective+2P(...)=    -39592.03
BIC : 2*objective+Plog(D)=    -39458.89
Chi-square discrepancy   =       112.79

Loglikelihoods (deviance)=      -989.71 (      758.44)
  effort data          =      -36.17 (      170.01)
  tagging data         =     -953.53 (      588.43)

Log-posteriors          =        6.54
  catchability         =        0.00
  f-ratio              =        0.00
  natural mortality    =        0.00
  mixing coeff.        =        0.00
  initial tag survival  =        0.00
  tag shedding rate    =       17.18
  tag reporting rate   =      -10.64
  tag nomixing factor   =        0.00

Constraints             =        0.69
  terminal F           =        0.00
  stock-rec./sex ratio  =        0.69

Out of bounds penalty   =        0.00
======================================================================
```

TABLE 1. FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.067	0.358	0.144	0.092	0.043	0.103	0.053	0.046	0.060	0.060
1976	0.009	0.267	0.466	0.121	0.097	0.030	0.067	0.031	0.047	0.047
1977	0.071	0.235	0.175	0.154	0.023	0.034	0.025	0.062	0.046	0.046
1978	0.135	0.353	0.177	0.084	0.041	0.011	0.024	0.013	0.036	0.036
1979	0.017	0.105	0.281	0.092	0.037	0.023	0.017	0.051	0.033	0.033
1980	0.111	0.241	0.408	0.188	0.030	0.035	0.030	0.016	0.035	0.035
1981	0.075	0.440	0.333	0.102	0.088	0.021	0.031	0.046	0.027	0.027
1982	0.242	0.392	0.481	0.172	0.067	0.041	0.022	0.076	0.055	0.055
1983	0.244	0.199	0.323	0.134	0.080	0.060	0.118	0.034	0.057	0.057

1984	0.109	0.452	0.122	0.131	0.130	0.095	0.086	0.117	0.063	0.063
1985	0.093	0.407	0.400	0.115	0.071	0.069	0.037	0.054	0.075	0.045
1986	0.277	0.319	0.244	0.149	0.032	0.046	0.042	0.032	0.072	0.043
1987	0.142	0.395	0.293	0.119	0.047	0.030	0.083	0.062	0.065	0.039
1988	0.339	0.211	0.387	0.163	0.058	0.041	0.049	0.075	0.099	0.060
1989	0.185	0.366	0.168	0.151	0.139	0.033	0.052	0.037	0.078	0.047
1990	0.172	0.239	0.313	0.129	0.163	0.055	0.054	0.074	0.092	0.055
1991	0.074	0.288	0.216	0.134	0.136	0.046	0.048	0.059	0.135	0.081
1992	0.076	0.278	0.350	0.087	0.069	0.061	0.103	0.128	0.157	0.094
1993	0.087	0.467	0.327	0.131	0.059	0.065	0.072	0.095	0.147	0.088
1994	0.114	0.268	0.192	0.081	0.118	0.090	0.181	0.202	0.343	0.206
1995	0.149	0.206	0.262	0.108	0.106	0.165	0.093	0.163	0.193	0.232
1996	0.168	0.433	0.329	0.248	0.119	0.060	0.105	0.082	0.222	0.266
1997	0.162	0.333	0.217	0.188	0.150	0.141	0.089	0.217	0.223	0.268
1998	0.100	0.502	0.359	0.256	0.118	0.266	0.042	0.048	0.145	0.174
1999	0.104	0.129	0.276	0.196	0.105	0.048	0.051	0.066	0.155	0.185
2000	0.269	0.241	0.134	0.165	0.183	0.140	0.055	0.087	0.101	0.121
2001	0.006	0.272	0.128	0.088	0.117	0.099	0.175	0.121	0.141	0.170
2002	0.021	0.292	0.193	0.088	0.042	0.105	0.067	0.114	0.127	0.153
2003	0.009	0.107	0.064	0.046	0.080	0.040	0.155	0.117	0.155	0.186
2004	0.033	0.103	0.117	0.040	0.023	0.055	0.060	0.093	0.157	0.189
2005	0.136	0.137	0.077	0.063	0.040	0.042	0.055	0.038	0.195	0.234
2006	0.136	0.116	0.121	0.037	0.017	0.057	0.030	0.044	0.127	0.153
2007	0.002	0.095	0.041	0.094	0.070	0.046	0.055	0.047	0.129	0.155
2008	0.000	0.096	0.056	0.089	0.047	0.040	0.045	0.057	0.069	0.082
2009	0.000	0.008	0.043	0.097	0.044	0.037	0.061	0.055	0.042	0.051
2010	0.000	0.008	0.010	0.154	0.062	0.074	0.050	0.044	0.036	0.043
2011	0.001	0.034	0.017	0.028	0.013	0.011	0.016	0.016	0.022	0.026
2012	0.001	0.030	0.016	0.026	0.012	0.010	0.014	0.014	0.018	0.022
2013	0.001	0.028	0.014	0.023	0.011	0.009	0.013	0.013	0.017	0.020
2014	0.001	0.026	0.014	0.022	0.010	0.008	0.012	0.012	0.015	0.018
2015	0.001	0.024	0.013	0.021	0.010	0.008	0.011	0.011	0.014	0.017
2016	0.004	0.023	0.012	0.019	0.009	0.008	0.010	0.010	0.013	0.015
2017	0.003	0.148	0.010	0.017	0.008	0.007	0.009	0.009	0.011	0.014
2018	0.009	0.098	0.074	0.016	0.007	0.006	0.008	0.008	0.010	0.012
2019	0.000	0.347	0.049	0.119	0.007	0.006	0.008	0.008	0.010	0.012
2020	0.000	0.007	0.219	0.077	0.055	0.005	0.007	0.007	0.009	0.011
2021	0.000	0.002	0.003	0.456	0.035	0.045	0.007	0.007	0.008	0.010
2022	0.001	0.002	0.001	0.005	0.294	0.029	0.061	0.006	0.008	0.010
2023	0.001	0.029	0.001	0.001	0.002	0.321	0.039	0.062	0.008	0.009

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TABLE 2. ABUNDANCE AT THE BEGINNING OF THE YEAR [BY AREA] FOR East of 45

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	1	2	3	4	5	6	7	8	9	10
1975	1640896.	1306625.	689303.	307117.	318292.	89086.	98166.	82543.	82260.	996794.
1976	2431348.	940503.	718572.	469456.	220342.	239889.	65785.	78141.	67858.	918149.
1977	1237566.	1475945.	566546.	354855.	327355.	157267.	190543.	51662.	65230.	849472.

1978	979553.	706073.	917541.	374188.	239380.	251600.	124483.	155962.	41777.	788727.
1979	1212444.	524135.	390092.	604852.	270718.	180754.	203673.	101986.	132524.	723745.
1980	1832896.	730410.	371372.	231644.	434129.	205171.	144556.	168085.	83427.	746842.
1981	1586091.	1004646.	451645.	194279.	151020.	331385.	162250.	117759.	142360.	723498.
1982	2538566.	901063.	509036.	254729.	138057.	108786.	265702.	132051.	96782.	759940.
1983	3853210.	1221265.	479163.	247429.	168638.	101529.	85465.	218202.	105289.	732026.
1984	1987913.	1849011.	787112.	272806.	170235.	122462.	78307.	63759.	181579.	713543.
1985	1799123.	1092233.	925828.	548081.	188232.	117565.	91218.	60346.	48820.	756749.
1986	3134562.	1004661.	572009.	488424.	384412.	137960.	89877.	73817.	49200.	694477.
1987	2221038.	1456251.	574643.	352670.	330858.	292806.	107863.	72379.	61522.	642368.
1988	3413817.	1180518.	771904.	337343.	246412.	248311.	232708.	83293.	58525.	609788.
1989	3400145.	1489552.	751701.	412381.	225501.	183003.	195071.	185962.	66495.	566657.
1990	3482179.	1731355.	812198.	499716.	278990.	154299.	145008.	155397.	154207.	543668.
1991	4281074.	1796986.	1072467.	467020.	345580.	186484.	119606.	115384.	124157.	589453.
1992	3938760.	2434779.	1059944.	679691.	321182.	237202.	145854.	95704.	93603.	587666.
1993	4256001.	2235809.	1450757.	587656.	490148.	235784.	182779.	110467.	72487.	554704.
1994	3556054.	2390714.	1102756.	822911.	405690.	363502.	180946.	142814.	86458.	514608.
1995	4029891.	1943384.	1438533.	715904.	597227.	283702.	272131.	126723.	100452.	433290.
1996	3615378.	2127524.	1244282.	870545.	505276.	422408.	196847.	208244.	92699.	383871.
1997	2569068.	1872830.	1085912.	704196.	534583.	352748.	325628.	148736.	165066.	331775.
1998	4561878.	1337838.	1056402.	687409.	459100.	361893.	250774.	250078.	103013.	346100.
1999	3687476.	2527943.	636712.	580088.	418680.	321094.	227171.	201854.	205253.	341844.
2000	4715563.	2034944.	1747900.	379959.	375247.	296489.	250642.	181276.	162627.	412147.
2001	3557474.	2206961.	1257328.	1202515.	253511.	245706.	211083.	199176.	143026.	460018.
2002	3651891.	2167014.	1322477.	870409.	866386.	177386.	182249.	148758.	151872.	460905.
2003	4408089.	2190931.	1272488.	858089.	626884.	653642.	130723.	143013.	114213.	476019.
2004	6178876.	2676477.	1548264.	938612.	644820.	455223.	513994.	93962.	109462.	443875.
2005	3119248.	3662526.	1898837.	1083007.	709079.	495810.	352680.	406170.	73693.	415118.

2006	2257945.	1667606.	2511315.	1382712.	799525.	535880.	389146.	280230.	336532.	350697.
2007	1263945.	1206871.	1168351.	1749892.	1047927.	618350.	414348.	317109.	230886.	533917.
2008	4986327.	773153.	863698.	881886.	1253298.	768922.	483382.	329363.	260502.	592577.
2009	5410170.	3054172.	552442.	642505.	634498.	940274.	605008.	388043.	267819.	708544.
2010	5737488.	3313379.	2382496.	416452.	458725.	477398.	742023.	477613.	316191.	835974.
2011	5539148.	3513901.	2586391.	1856007.	280958.	339137.	363066.	592626.	393283.	994140.
2012	5854092.	3390225.	2671188.	1999421.	1419129.	218069.	274557.	299943.	501784.	1216154.
2013	6057035.	3583303.	2587149.	2068793.	1533008.	1103472.	176755.	227288.	254479.	1511806.
2014	6259842.	3707815.	2740869.	2006307.	1589735.	1192930.	895339.	146511.	193122.	1561974.
2015	6177954.	3832195.	2841621.	2126921.	1544231.	1238079.	968475.	742839.	124605.	1555525.
2016	893583.	3782183.	2942977.	2207301.	1638396.	1203230.	1005633.	804149.	632468.	1492449.
2017	1208957.	545040.	2907372.	2288504.	1703301.	1277218.	977702.	835767.	685234.	1881875.
2018	355722.	738483.	369623.	2263196.	1769963.	1329394.	1038664.	813182.	712897.	2277578.
2019	14126115.	215943.	526564.	269976.	1752905.	1382342.	1081863.	864607.	694076.	2657929.
2020	52617549.	8652167.	120068.	394528.	188543.	1369697.	1125454.	901194.	738455.	2983467.
2021	37698713.	32233260.	6758170.	75908.	287209.	140419.	1115625.	938001.	770188.	3316284.
2022	2764770.	23093411.	25315748.	5298183.	37837.	218182.	109921.	930300.	801877.	3643567.
2023	2769575.	1692338.	18120668.	19899229.	4146060.	22176.	173599.	86830.	795704.	3968247.
2024		1695357.	1293795.	14237157.	15635156.	3253848.	13177.	140220.	70275.	4255376.

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TABLE 3. CATCH OF East of 45

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	1	2	3	4	5	6	7	8	9	10
1975	83784.	352022.	82482.	24055.	11863.	7932.	4665.	3441.	4480.	54950.
1976	17501.	196886.	239994.	47505.	18187.	6492.	3896.	2187.	2948.	40376.
1977	67420.	276479.	81061.	45074.	6677.	4738.	4363.	2903.	2778.	36620.
1978	98571.	188169.	132603.	26750.	8539.	2569.	2746.	1850.	1398.	26717.

1979	15968.	46352.	85484.	47174.	8803.	3802.	3158.	4700.	4051.	22395.
1980	153268.	139588.	111494.	35392.	11439.	6346.	3925.	2495.	2715.	24603.
1981	91413.	320656.	114393.	16726.	11334.	6214.	4537.	4938.	3506.	18037.
1982	435146.	261565.	174574.	35996.	8002.	3990.	5295.	9037.	4835.	38429.
1983	666700.	196954.	118435.	27650.	11539.	5339.	8741.	6724.	5468.	38481.
1984	162819.	602874.	80533.	29876.	18523.	10029.	5897.	6546.	10420.	41447.
1985	126331.	327195.	273250.	52930.	11441.	7067.	3014.	2958.	3329.	31801.
1986	605591.	245280.	110492.	60475.	10838.	5638.	3356.	2173.	3201.	27826.
1987	233815.	425594.	130379.	35130.	13521.	7777.	7936.	4073.	3661.	23513.
1988	787367.	200806.	221887.	45198.	12256.	9116.	10264.	5612.	5200.	33542.
1989	457214.	409308.	103865.	51467.	26166.	5342.	9140.	6317.	4674.	24558.
1990	436998.	328718.	195472.	53837.	37392.	7450.	6938.	10362.	12813.	27930.
1991	243244.	401949.	186084.	52344.	39257.	7563.	5140.	6163.	14736.	43603.
1992	229346.	527897.	280116.	50401.	19089.	12662.	13102.	10683.	12770.	50171.
1993	280527.	748303.	362086.	64110.	24965.	13406.	11620.	9313.	9358.	44738.
1994	304847.	502294.	171942.	56713.	40131.	28248.	27583.	24303.	23658.	91143.
1995	443084.	322790.	296579.	65551.	53670.	39327.	22103.	17701.	16646.	85605.
1996	444406.	669904.	312384.	170612.	50658.	22396.	18070.	15305.	17362.	85496.
1997	306609.	474221.	189334.	107589.	66458.	42200.	25467.	27051.	31144.	74425.
1998	345669.	474502.	285613.	138652.	45367.	76858.	9470.	10785.	13079.	52631.
1999	290410.	272684.	137390.	91981.	37213.	13567.	10306.	11996.	27670.	55145.
2000	889625.	389997.	195408.	51453.	56121.	35131.	12280.	14041.	14718.	44863.
2001	15982.	469971.	134430.	90060.	24959.	20977.	31157.	21135.	17744.	68378.
2002	59817.	491266.	206724.	65445.	31542.	16089.	10914.	14936.	17076.	62174.
2003	31034.	198423.	70574.	34139.	42902.	23442.	17278.	14727.	15451.	77055.
2004	158681.	233924.	152822.	33095.	12919.	22189.	27680.	7756.	14995.	72743.
2005	315743.	419028.	125613.	59295.	24776.	18596.	17314.	14100.	12307.	82641.
2006	228908.	162488.	255561.	44959.	11960.	27029.	10456.	11129.	37839.	47308.

2007	1510.	96996.	42050.	139516.	62706.	25349.	20195.	13425.	26398.	73222.
2008	755.	63119.	41758.	67048.	51597.	27174.	19392.	16913.	16230.	44546.
2009	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2010	1350.	22619.	20491.	52868.	24566.	30804.	33104.	19219.	10408.	33310.
2011	4138.	105125.	39701.	46206.	3325.	3438.	5285.	8951.	7954.	24372.
2012	3954.	90136.	36666.	44991.	14528.	1976.	3487.	3976.	8529.	25066.
2013	3706.	88052.	32583.	42548.	14664.	8980.	2041.	2705.	3922.	28258.
2014	3572.	84855.	32934.	38430.	14078.	9098.	9572.	1616.	2753.	27008.
2015	3367.	80876.	31654.	39230.	13011.	8875.	9671.	7446.	1625.	24609.
2016	3087.	76677.	29974.	37334.	13095.	8212.	9202.	7449.	7445.	21315.
2017	2785.	67016.	26931.	34188.	11842.	7790.	8258.	6966.	7282.	24267.
2018	2557.	61544.	23521.	30957.	11261.	7252.	7989.	6298.	6867.	26624.
2019	2416.	56673.	22267.	26995.	10388.	6986.	7633.	6170.	6276.	29168.
2020	1970.	54101.	21047.	26191.	8932.	6407.	7399.	5907.	6183.	30319.
2021	2261.	44913.	20328.	24947.	8758.	5588.	6798.	5902.	6089.	31823.
2022	1846.	51129.	16883.	24464.	8626.	5574.	5955.	5410.	6038.	33302.
2023	1752.	42345.	19288.	20493.	8543.	5541.	6024.	4816.	5594.	33865.

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TABLE 4. SPAWNING STOCK FECUNDITY AND RECRUITMENT OF East of 45

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year	spawning biomass	recruits from VPA
1975	297497.	1640896.
1976	295256.	2431348.
1977	285396.	1237566.
1978	273375.	979553.
1979	261857.	1212444.
1980	257736.	1832896.
1981	239955.	1586091.
1982	237753.	2538566.
1983	214174.	3853210.
1984	206813.	1987913.
1985	216987.	1799123.
1986	213552.	3134562.
1987	207085.	2221038.
1988	205171.	3413817.

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 1989    206246.   3400145.
 1990    191453.   3482179.
 1991    188531.   4281074.
 1992    192900.   3938760.
 1993    203235.   4256001.
 1994    194197.   3556054.
 1995    192552.   4029891.
 1996    187505.   3615378.
 1997    178075.   2569068.
 1998    178534.   4561878.
 1999    182883.   3687476.
 2000    184689.   4715563.
 2001    180949.   3557474.
 2002    205112.   3651891.
 2003    216752.   4408089.
 2004    224933.   6178876.

# terminal age structure of population
  0.0000D+00  0.8005D-03  0.5000D+01   1.0  0.4000D+01   1
  0.0000D+00  0.2853D-01  0.5000D+01   1.0  0.4000D+01   2
  0.0000D+00  0.1198D-02  0.5000D+01   1.0  0.4000D+01   3
  0.0000D+00  0.1159D-02  0.5000D+01   1.0  0.3000D+01   4
  0.0000D+00  0.2320D-02  0.5000D+01   1.0  0.3000D+01   5
  0.0000D+00  0.3205D+00  0.5000D+01   1.0  0.1000D+00   6
  0.0000D+00  0.3854D-01  0.3000D+01   1.0  0.6000D+01   7
  0.0000D+00  0.6154D-01  0.5000D+01   1.0  0.1000D+00   8
  0.0000D+00  0.7506D-02  0.3000D+01   1.0  0.8000D+01   9
# terminal-age f-ratios
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  10
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  11
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  12
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  13
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  14
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  15
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  16
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  17
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  18
  0.1000D+00  0.1000D+01  0.5000D+01   0.0  0.2000D+00  19
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  20
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  21
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  22
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  23
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  24
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  25
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  26
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  27
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  28
  0.1000D+00  0.6000D+00  0.5000D+01   0.0  0.2000D+00  29
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  30
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  31
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  32
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  33
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  34
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  35
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  36
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  37
  0.1000D+00  0.1200D+01  0.5000D+01   0.0  0.2000D+00  38
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```
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   39
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   40
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   41
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   42
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   43
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   44
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   45
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   46
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   47
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   48
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   49
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   50
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   51
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   52
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   53
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   54
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   55
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   56
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   57
 0.1000D+00  0.1200D+01  0.5000D+01    0.0  0.2000D+00   58
# natural mortality
 0.0000D+00  0.4900D+00  0.1000D+01    0.0  0.1000D+00   59
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   60
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   61
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   62
 0.0000D+00  0.2400D+00  0.1000D+01    0.0  0.1000D+00   63
 0.0000D+00  0.2000D+00  0.1000D+01    0.0  0.1000D+00   64
 0.0000D+00  0.1750D+00  0.1000D+01    0.0  0.1000D+00   65
 0.0000D+00  0.1500D+00  0.1000D+01    0.0  0.1000D+00   66
 0.0000D+00  0.1250D+00  0.1000D+01    0.0  0.1000D+00   67
 0.0000D+00  0.1000D+00  0.1000D+01    0.0  0.1000D+00   68
# transfer coefficients
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   69
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   70
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   71
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   72
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   73
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   74
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   75
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   76
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   77
 0.0000D+00  0.0000D+00  0.1000D+01    0.0  0.1000D+00   78
# Stock recruitment relationship
 0.0000D+00  0.2507D+06  0.1000D+21    0.0  0.4000D+00   79
 0.0000D+00  0.1660D+05  0.1000D+21    0.0  0.0000D+00   80
 0.0000D+00  0.1580D+00  0.9000D+00    0.0  0.0000D+00   81
 0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   82
 0.0000D+00  0.1000D+01  0.2000D+01    0.0  0.0000D+00   83
# Variance scaling parameters
 0.0000D+00  0.9012D+00  0.1000D+21    1.0  0.4000D+00   84
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   85
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   86
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   87
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   88
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   89
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   90
 0.0000D+00  0.9012D+00  0.1000D+21   -0.1  0.4000D+00   91
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0.0000D+00	0.9012D+00	0.1000D+21	-0.1	0.4000D+00	92		
0.0000D+00	0.9012D+00	0.1000D+21	-0.1	0.4000D+00	93		
0.0000D+00	0.9012D+00	0.1000D+21	-0.1	0.4000D+00	94		
0.0000D+00	0.9012D+00	0.1000D+21	-0.1	0.4000D+00	95		
# fraction surviving the intial tagging process							
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	96		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	97		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	98		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	99		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	100		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	101		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	102		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	103		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	104		
0.0000D+00	0.8000D+00	0.1000D+01	0.0	0.1000D+00	105		
# tag shedding rate							
0.0000D+00	0.2335D+00	0.1000D+01	2.0	0.1000D+00	106		
0.0000D+00	0.1918D+00	0.1000D+01	2.0	0.1000D+00	107		
0.0000D+00	0.2322D+00	0.1000D+01	2.0	0.1000D+00	108		
0.0000D+00	0.2601D+00	0.1000D+01	2.0	0.1000D+00	109		
0.0000D+00	0.2599D+00	0.1000D+01	2.0	0.1000D+00	110		
0.0000D+00	0.2603D+00	0.1000D+01	2.0	0.1000D+00	111		
0.0000D+00	0.2600D+00	0.1000D+01	2.0	0.1000D+00	112		
0.0000D+00	0.2599D+00	0.1000D+01	2.0	0.1000D+00	113		
0.0000D+00	0.2599D+00	0.1000D+01	2.0	0.1000D+00	114		
0.0000D+00	0.2599D+00	0.1000D+01	2.0	0.1000D+00	115		
# tag reporting rate							
0.0000D+00	0.8905D-01	0.1000D+01	1.0	0.1000D+00	116		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	117		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	118		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	119		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	120		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	121		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	122		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	123		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	124		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	125		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	126		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	127		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	128		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	129		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	130		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	131		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	132		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	133		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	134		
0.0000D+00	0.8905D-01	0.1000D+01	-0.1	0.1000D+00	135		
0.0000D+00	0.1802D+00	0.1000D+01	1.0	0.1000D+00	136	22	*****
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	137		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	138		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	139		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	140		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	141		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	142		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	143		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	144		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	145		

0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	146		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	147		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	148		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	149		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	150		
0.0000D+00	0.1802D+00	0.1000D+01	-0.1	0.1000D+00	151		
0.0000D+00	0.1775D+00	0.1000D+01	2.0	0.1000D+00	152		
0.0000D+00	0.1594D+00	0.1000D+01	2.0	0.1000D+00	153		
0.0000D+00	0.1458D+00	0.1000D+01	2.0	0.1000D+00	154		
0.0000D+00	0.1606D+00	0.1000D+01	2.0	0.1000D+00	155		
0.0000D+00	0.1767D+00	0.1000D+01	2.0	0.1000D+00	156		
0.0000D+00	0.4223D+00	0.1000D+01	2.0	0.1000D+00	157		
0.0000D+00	0.1930D+00	0.1000D+01	2.0	0.1000D+00	158		
0.0000D+00	0.1949D+00	0.1000D+01	2.0	0.1000D+00	159		
0.0000D+00	0.1962D+00	0.1000D+01	2.0	0.1000D+00	160		
0.0000D+00	0.1971D+00	0.1000D+01	2.0	0.1000D+00	161		
0.0000D+00	0.1980D+00	0.1000D+01	2.0	0.1000D+00	162		
0.0000D+00	0.1985D+00	0.1000D+01	2.0	0.1000D+00	163		
0.0000D+00	0.2309D+00	0.1000D+01	2.0	0.1000D+00	164		
# tag nonmixing factor for first year							
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	165	1975	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	166	1975	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	167	1975	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	168	1975	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	169	1975	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	170	1975	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	171	1975	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	172	1975	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	173	1975	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	174	1975	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	175	1976	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	176	1976	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	177	1976	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	178	1976	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	179	1976	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	180	1976	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	181	1976	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	182	1976	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	183	1976	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	184	1976	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	185	1977	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	186	1977	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	187	1977	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	188	1977	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	189	1977	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	190	1977	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	191	1977	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	192	1977	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	193	1977	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	194	1977	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	195	1978	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	196	1978	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	197	1978	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	198	1978	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	199	1978	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	200	1978	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	201	1978	7

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	202	1978	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	203	1978	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	204	1978	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	205	1979	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	206	1979	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	207	1979	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	208	1979	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	209	1979	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	210	1979	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	211	1979	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	212	1979	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	213	1979	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	214	1979	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	215	1980	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	216	1980	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	217	1980	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	218	1980	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	219	1980	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	220	1980	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	221	1980	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	222	1980	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	223	1980	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	224	1980	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	225	1981	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	226	1981	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	227	1981	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	228	1981	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	229	1981	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	230	1981	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	231	1981	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	232	1981	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	233	1981	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	234	1981	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	235	1982	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	236	1982	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	237	1982	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	238	1982	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	239	1982	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	240	1982	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	241	1982	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	242	1982	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	243	1982	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	244	1982	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	245	1983	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	246	1983	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	247	1983	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	248	1983	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	249	1983	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	250	1983	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	251	1983	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	252	1983	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	253	1983	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	254	1983	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	255	1984	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	256	1984	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	257	1984	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	258	1984	4

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	259	1984	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	260	1984	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	261	1984	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	262	1984	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	263	1984	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	264	1984	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	265	1985	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	266	1985	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	267	1985	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	268	1985	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	269	1985	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	270	1985	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	271	1985	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	272	1985	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	273	1985	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	274	1985	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	275	1986	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	276	1986	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	277	1986	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	278	1986	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	279	1986	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	280	1986	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	281	1986	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	282	1986	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	283	1986	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	284	1986	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	285	1987	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	286	1987	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	287	1987	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	288	1987	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	289	1987	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	290	1987	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	291	1987	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	292	1987	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	293	1987	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	294	1987	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	295	1988	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	296	1988	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	297	1988	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	298	1988	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	299	1988	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	300	1988	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	301	1988	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	302	1988	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	303	1988	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	304	1988	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	305	1989	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	306	1989	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	307	1989	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	308	1989	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	309	1989	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	310	1989	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	311	1989	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	312	1989	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	313	1989	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	314	1989	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	315	1990	1

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	316	1990	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	317	1990	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	318	1990	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	319	1990	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	320	1990	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	321	1990	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	322	1990	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	323	1990	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	324	1990	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	325	1991	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	326	1991	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	327	1991	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	328	1991	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	329	1991	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	330	1991	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	331	1991	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	332	1991	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	333	1991	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	334	1991	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	335	1992	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	336	1992	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	337	1992	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	338	1992	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	339	1992	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	340	1992	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	341	1992	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	342	1992	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	343	1992	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	344	1992	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	345	1993	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	346	1993	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	347	1993	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	348	1993	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	349	1993	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	350	1993	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	351	1993	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	352	1993	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	353	1993	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	354	1993	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	355	1994	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	356	1994	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	357	1994	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	358	1994	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	359	1994	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	360	1994	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	361	1994	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	362	1994	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	363	1994	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	364	1994	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	365	1995	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	366	1995	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	367	1995	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	368	1995	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	369	1995	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	370	1995	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	371	1995	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	372	1995	8

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	373	1995	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	374	1995	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	375	1996	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	376	1996	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	377	1996	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	378	1996	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	379	1996	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	380	1996	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	381	1996	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	382	1996	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	383	1996	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	384	1996	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	385	1997	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	386	1997	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	387	1997	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	388	1997	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	389	1997	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	390	1997	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	391	1997	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	392	1997	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	393	1997	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	394	1997	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	395	1998	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	396	1998	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	397	1998	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	398	1998	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	399	1998	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	400	1998	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	401	1998	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	402	1998	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	403	1998	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	404	1998	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	405	1999	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	406	1999	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	407	1999	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	408	1999	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	409	1999	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	410	1999	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	411	1999	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	412	1999	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	413	1999	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	414	1999	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	415	2000	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	416	2000	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	417	2000	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	418	2000	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	419	2000	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	420	2000	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	421	2000	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	422	2000	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	423	2000	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	424	2000	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	425	2001	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	426	2001	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	427	2001	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	428	2001	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	429	2001	5

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	430	2001	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	431	2001	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	432	2001	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	433	2001	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	434	2001	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	435	2002	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	436	2002	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	437	2002	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	438	2002	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	439	2002	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	440	2002	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	441	2002	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	442	2002	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	443	2002	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	444	2002	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	445	2003	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	446	2003	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	447	2003	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	448	2003	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	449	2003	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	450	2003	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	451	2003	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	452	2003	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	453	2003	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	454	2003	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	455	2004	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	456	2004	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	457	2004	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	458	2004	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	459	2004	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	460	2004	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	461	2004	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	462	2004	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	463	2004	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	464	2004	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	465	2005	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	466	2005	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	467	2005	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	468	2005	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	469	2005	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	470	2005	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	471	2005	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	472	2005	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	473	2005	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	474	2005	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	475	2006	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	476	2006	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	477	2006	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	478	2006	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	479	2006	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	480	2006	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	481	2006	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	482	2006	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	483	2006	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	484	2006	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	485	2007	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	486	2007	2

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	487	2007	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	488	2007	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	489	2007	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	490	2007	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	491	2007	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	492	2007	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	493	2007	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	494	2007	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	495	2008	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	496	2008	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	497	2008	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	498	2008	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	499	2008	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	500	2008	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	501	2008	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	502	2008	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	503	2008	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	504	2008	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	505	2009	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	506	2009	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	507	2009	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	508	2009	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	509	2009	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	510	2009	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	511	2009	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	512	2009	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	513	2009	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	514	2009	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	515	2010	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	516	2010	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	517	2010	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	518	2010	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	519	2010	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	520	2010	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	521	2010	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	522	2010	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	523	2010	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	524	2010	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	525	2011	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	526	2011	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	527	2011	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	528	2011	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	529	2011	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	530	2011	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	531	2011	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	532	2011	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	533	2011	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	534	2011	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	535	2012	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	536	2012	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	537	2012	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	538	2012	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	539	2012	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	540	2012	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	541	2012	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	542	2012	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	543	2012	9

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	544	2012	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	545	2013	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	546	2013	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	547	2013	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	548	2013	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	549	2013	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	550	2013	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	551	2013	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	552	2013	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	553	2013	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	554	2013	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	555	2014	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	556	2014	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	557	2014	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	558	2014	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	559	2014	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	560	2014	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	561	2014	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	562	2014	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	563	2014	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	564	2014	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	565	2015	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	566	2015	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	567	2015	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	568	2015	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	569	2015	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	570	2015	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	571	2015	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	572	2015	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	573	2015	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	574	2015	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	575	2016	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	576	2016	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	577	2016	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	578	2016	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	579	2016	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	580	2016	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	581	2016	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	582	2016	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	583	2016	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	584	2016	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	585	2017	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	586	2017	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	587	2017	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	588	2017	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	589	2017	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	590	2017	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	591	2017	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	592	2017	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	593	2017	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	594	2017	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	595	2018	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	596	2018	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	597	2018	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	598	2018	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	599	2018	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	600	2018	6

0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	601	2018	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	602	2018	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	603	2018	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	604	2018	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	605	2019	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	606	2019	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	607	2019	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	608	2019	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	609	2019	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	610	2019	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	611	2019	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	612	2019	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	613	2019	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	614	2019	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	615	2020	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	616	2020	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	617	2020	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	618	2020	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	619	2020	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	620	2020	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	621	2020	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	622	2020	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	623	2020	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	624	2020	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	625	2021	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	626	2021	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	627	2021	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	628	2021	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	629	2021	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	630	2021	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	631	2021	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	632	2021	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	633	2021	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	634	2021	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	635	2022	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	636	2022	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	637	2022	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	638	2022	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	639	2022	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	640	2022	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	641	2022	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	642	2022	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	643	2022	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	644	2022	10
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	645	2023	1
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	646	2023	2
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	647	2023	3
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	648	2023	4
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	649	2023	5
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	650	2023	6
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	651	2023	7
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	652	2023	8
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	653	2023	9
0.0000D+00	0.7863D+00	0.5000D+01	0.0	0.1000D+00	654	2023	10

tag nonmixing factor for second year

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	655	2024	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	656	2024	2

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	657	2024	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	658	2024	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	659	2024	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	660	2024	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	661	2024	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	662	2024	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	663	2024	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	664	2024	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	665	2025	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	666	2025	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	667	2025	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	668	2025	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	669	2025	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	670	2025	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	671	2025	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	672	2025	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	673	2025	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	674	2025	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	675	2026	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	676	2026	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	677	2026	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	678	2026	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	679	2026	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	680	2026	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	681	2026	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	682	2026	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	683	2026	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	684	2026	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	685	2027	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	686	2027	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	687	2027	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	688	2027	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	689	2027	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	690	2027	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	691	2027	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	692	2027	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	693	2027	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	694	2027	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	695	2028	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	696	2028	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	697	2028	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	698	2028	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	699	2028	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	700	2028	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	701	2028	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	702	2028	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	703	2028	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	704	2028	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	705	2029	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	706	2029	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	707	2029	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	708	2029	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	709	2029	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	710	2029	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	711	2029	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	712	2029	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	713	2029	9

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	714	2029	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	715	2030	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	716	2030	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	717	2030	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	718	2030	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	719	2030	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	720	2030	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	721	2030	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	722	2030	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	723	2030	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	724	2030	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	725	2031	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	726	2031	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	727	2031	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	728	2031	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	729	2031	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	730	2031	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	731	2031	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	732	2031	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	733	2031	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	734	2031	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	735	2032	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	736	2032	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	737	2032	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	738	2032	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	739	2032	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	740	2032	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	741	2032	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	742	2032	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	743	2032	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	744	2032	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	745	2033	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	746	2033	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	747	2033	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	748	2033	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	749	2033	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	750	2033	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	751	2033	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	752	2033	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	753	2033	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	754	2033	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	755	2034	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	756	2034	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	757	2034	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	758	2034	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	759	2034	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	760	2034	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	761	2034	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	762	2034	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	763	2034	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	764	2034	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	765	2035	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	766	2035	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	767	2035	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	768	2035	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	769	2035	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	770	2035	6

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	771	2035	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	772	2035	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	773	2035	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	774	2035	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	775	2036	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	776	2036	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	777	2036	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	778	2036	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	779	2036	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	780	2036	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	781	2036	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	782	2036	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	783	2036	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	784	2036	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	785	2037	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	786	2037	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	787	2037	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	788	2037	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	789	2037	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	790	2037	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	791	2037	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	792	2037	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	793	2037	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	794	2037	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	795	2038	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	796	2038	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	797	2038	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	798	2038	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	799	2038	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	800	2038	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	801	2038	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	802	2038	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	803	2038	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	804	2038	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	805	2039	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	806	2039	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	807	2039	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	808	2039	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	809	2039	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	810	2039	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	811	2039	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	812	2039	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	813	2039	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	814	2039	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	815	2040	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	816	2040	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	817	2040	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	818	2040	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	819	2040	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	820	2040	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	821	2040	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	822	2040	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	823	2040	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	824	2040	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	825	2041	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	826	2041	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	827	2041	3

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	828	2041	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	829	2041	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	830	2041	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	831	2041	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	832	2041	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	833	2041	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	834	2041	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	835	2042	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	836	2042	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	837	2042	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	838	2042	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	839	2042	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	840	2042	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	841	2042	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	842	2042	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	843	2042	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	844	2042	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	845	2043	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	846	2043	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	847	2043	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	848	2043	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	849	2043	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	850	2043	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	851	2043	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	852	2043	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	853	2043	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	854	2043	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	855	2044	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	856	2044	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	857	2044	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	858	2044	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	859	2044	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	860	2044	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	861	2044	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	862	2044	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	863	2044	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	864	2044	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	865	2045	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	866	2045	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	867	2045	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	868	2045	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	869	2045	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	870	2045	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	871	2045	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	872	2045	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	873	2045	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	874	2045	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	875	2046	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	876	2046	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	877	2046	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	878	2046	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	879	2046	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	880	2046	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	881	2046	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	882	2046	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	883	2046	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	884	2046	10

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	885	2047	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	886	2047	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	887	2047	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	888	2047	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	889	2047	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	890	2047	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	891	2047	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	892	2047	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	893	2047	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	894	2047	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	895	2048	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	896	2048	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	897	2048	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	898	2048	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	899	2048	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	900	2048	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	901	2048	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	902	2048	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	903	2048	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	904	2048	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	905	2049	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	906	2049	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	907	2049	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	908	2049	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	909	2049	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	910	2049	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	911	2049	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	912	2049	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	913	2049	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	914	2049	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	915	2050	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	916	2050	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	917	2050	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	918	2050	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	919	2050	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	920	2050	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	921	2050	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	922	2050	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	923	2050	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	924	2050	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	925	2051	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	926	2051	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	927	2051	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	928	2051	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	929	2051	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	930	2051	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	931	2051	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	932	2051	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	933	2051	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	934	2051	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	935	2052	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	936	2052	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	937	2052	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	938	2052	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	939	2052	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	940	2052	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	941	2052	7

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	942	2052	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	943	2052	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	944	2052	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	945	2053	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	946	2053	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	947	2053	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	948	2053	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	949	2053	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	950	2053	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	951	2053	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	952	2053	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	953	2053	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	954	2053	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	955	2054	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	956	2054	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	957	2054	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	958	2054	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	959	2054	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	960	2054	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	961	2054	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	962	2054	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	963	2054	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	964	2054	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	965	2055	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	966	2055	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	967	2055	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	968	2055	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	969	2055	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	970	2055	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	971	2055	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	972	2055	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	973	2055	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	974	2055	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	975	2056	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	976	2056	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	977	2056	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	978	2056	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	979	2056	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	980	2056	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	981	2056	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	982	2056	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	983	2056	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	984	2056	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	985	2057	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	986	2057	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	987	2057	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	988	2057	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	989	2057	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	990	2057	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	991	2057	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	992	2057	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	993	2057	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	994	2057	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	995	2058	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	996	2058	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	997	2058	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	998	2058	4

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	999	2058	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1000	2058	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1001	2058	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1002	2058	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1003	2058	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1004	2058	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1005	2059	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1006	2059	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1007	2059	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1008	2059	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1009	2059	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1010	2059	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1011	2059	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1012	2059	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1013	2059	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1014	2059	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1015	2060	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1016	2060	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1017	2060	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1018	2060	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1019	2060	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1020	2060	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1021	2060	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1022	2060	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1023	2060	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1024	2060	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1025	2061	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1026	2061	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1027	2061	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1028	2061	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1029	2061	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1030	2061	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1031	2061	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1032	2061	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1033	2061	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1034	2061	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1035	2062	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1036	2062	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1037	2062	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1038	2062	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1039	2062	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1040	2062	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1041	2062	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1042	2062	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1043	2062	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1044	2062	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1045	2063	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1046	2063	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1047	2063	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1048	2063	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1049	2063	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1050	2063	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1051	2063	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1052	2063	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1053	2063	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1054	2063	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1055	2064	1

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1056	2064	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1057	2064	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1058	2064	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1059	2064	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1060	2064	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1061	2064	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1062	2064	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1063	2064	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1064	2064	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1065	2065	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1066	2065	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1067	2065	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1068	2065	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1069	2065	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1070	2065	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1071	2065	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1072	2065	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1073	2065	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1074	2065	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1075	2066	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1076	2066	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1077	2066	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1078	2066	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1079	2066	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1080	2066	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1081	2066	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1082	2066	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1083	2066	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1084	2066	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1085	2067	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1086	2067	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1087	2067	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1088	2067	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1089	2067	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1090	2067	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1091	2067	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1092	2067	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1093	2067	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1094	2067	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1095	2068	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1096	2068	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1097	2068	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1098	2068	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1099	2068	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1100	2068	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1101	2068	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1102	2068	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1103	2068	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1104	2068	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1105	2069	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1106	2069	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1107	2069	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1108	2069	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1109	2069	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1110	2069	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1111	2069	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1112	2069	8

0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1113	2069	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1114	2069	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1115	2070	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1116	2070	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1117	2070	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1118	2070	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1119	2070	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1120	2070	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1121	2070	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1122	2070	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1123	2070	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1124	2070	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1125	2071	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1126	2071	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1127	2071	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1128	2071	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1129	2071	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1130	2071	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1131	2071	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1132	2071	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1133	2071	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1134	2071	10
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1135	2072	1
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1136	2072	2
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1137	2072	3
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1138	2072	4
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1139	2072	5
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1140	2072	6
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1141	2072	7
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1142	2072	8
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1143	2072	9
0.0000D+00	0.1000D+01	0.5000D+01	0.0	0.1000D+00	1144	2072	10

Number of parameters = 1144

VPA-2BOX
BOOTSTRAP ESTIMATES OF BIAS AND VARIANCE
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Strategy 2
14:40, 17 February 2011

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BIAS AND STANDARD ERROR ESTIMATES
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TABLE 1A. BIAS OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1976	0.000	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1977	0.000	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1978	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000

1980	0.000	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1981	0.000	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1982	-0.001	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
1983	-0.001	-0.001	-0.002	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000
1984	0.000	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000
1985	0.000	-0.002	-0.002	-0.001	0.000	0.000	0.000	0.000	-0.001	0.000
1986	-0.001	-0.001	-0.002	-0.001	0.000	0.000	0.000	0.000	-0.001	0.000
1987	-0.001	-0.001	-0.002	-0.001	0.000	0.000	-0.001	0.000	-0.001	0.000
1988	-0.002	-0.001	-0.002	-0.001	0.000	0.000	0.000	-0.001	-0.001	0.000
1989	-0.002	-0.002	-0.001	-0.001	-0.001	0.000	0.000	0.000	-0.001	0.000
1990	-0.001	-0.003	-0.003	-0.001	-0.001	0.000	0.000	-0.001	-0.001	-0.001
1991	-0.001	-0.003	-0.003	-0.002	-0.001	0.000	0.000	-0.001	-0.001	-0.001
1992	-0.001	-0.005	-0.005	-0.002	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001
1993	-0.001	-0.009	-0.007	-0.002	-0.001	-0.001	-0.001	-0.001	-0.002	-0.001
1994	-0.002	-0.004	-0.005	-0.002	-0.002	-0.002	-0.003	-0.003	-0.005	-0.003
1995	-0.002	-0.005	-0.005	-0.003	-0.003	-0.004	-0.002	-0.003	-0.003	-0.004
1996	-0.003	-0.009	-0.010	-0.006	-0.004	-0.002	-0.003	-0.002	-0.005	-0.006
1997	-0.004	-0.009	-0.006	-0.007	-0.005	-0.005	-0.003	-0.006	-0.006	-0.008
1998	-0.007	-0.016	-0.013	-0.009	-0.005	-0.010	-0.002	-0.002	-0.005	-0.006
1999	-0.007	-0.010	-0.013	-0.009	-0.005	-0.002	-0.002	-0.003	-0.006	-0.008
2000	-0.020	-0.019	-0.012	-0.009	-0.010	-0.007	-0.003	-0.004	-0.005	-0.006
2001	-0.001	-0.026	-0.012	-0.008	-0.008	-0.006	-0.010	-0.007	-0.008	-0.009
2002	-0.002	-0.032	-0.023	-0.009	-0.004	-0.008	-0.005	-0.007	-0.008	-0.010
2003	-0.001	-0.013	-0.008	-0.006	-0.009	-0.004	-0.013	-0.009	-0.011	-0.014
2004	-0.004	-0.013	-0.016	-0.005	-0.003	-0.007	-0.007	-0.009	-0.014	-0.016
2005	-0.017	-0.017	-0.011	-0.009	-0.006	-0.006	-0.007	-0.004	-0.021	-0.025
2006	-0.018	-0.016	-0.017	-0.005	-0.003	-0.008	-0.004	-0.006	-0.016	-0.019
2007	0.000	-0.014	-0.006	-0.014	-0.011	-0.007	-0.008	-0.007	-0.019	-0.022
2008	0.000	-0.014	-0.009	-0.014	-0.008	-0.006	-0.007	-0.009	-0.011	-0.013
2009	0.000	-0.002	-0.007	-0.016	-0.007	-0.006	-0.010	-0.009	-0.007	-0.008
2010	0.000	-0.001	-0.002	-0.026	-0.011	-0.013	-0.009	-0.008	-0.006	-0.007
2011	0.000	-0.006	-0.003	-0.005	-0.002	-0.002	-0.003	-0.003	-0.004	-0.005
2012	0.000	-0.006	-0.003	-0.005	-0.002	-0.002	-0.003	-0.003	-0.003	-0.004
2013	0.000	-0.005	-0.003	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.004
2014	0.000	-0.005	-0.003	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003
2015	0.000	-0.005	-0.002	-0.004	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003
2016	0.000	-0.005	-0.002	-0.004	-0.002	-0.001	-0.002	-0.002	-0.002	-0.003
2017	0.002	0.005	-0.002	-0.003	-0.002	-0.001	-0.002	-0.002	-0.002	-0.003
2018	-0.001	0.087	0.010	-0.003	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
2019	0.004	-0.020	0.054	0.034	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002
2020	0.002	0.162	-0.008	0.112	0.030	-0.001	-0.001	-0.001	-0.002	-0.002
2021	0.000	0.084	0.113	0.010	0.070	0.037	-0.001	-0.001	-0.002	-0.002
2022	0.000	-0.010	0.061	0.323	0.056	0.076	0.088	-0.001	-0.002	-0.002
2023	0.000	-0.012	-0.005	0.315	1.111	0.256	0.200	0.491	-0.002	-0.002

TABLE 1B. STANDARD ERROR OF FISHING MORTALITY RATE FOR East of 45

	1	2	3	4	5	6	7	8	9	10
1975	0.406E-04	0.178E-03	0.136E-03	0.857E-04	0.465E-04	0.948E-04	0.531E-04	0.459E-04	0.582E-04	0.582E-04
1976	0.789E-05	0.198E-03	0.347E-03	0.131E-03	0.987E-04	0.337E-04	0.665E-04	0.318E-04	0.489E-04	0.489E-04

1977 0.324E-04 0.201E-03 0.162E-03 0.155E-03 0.282E-04 0.372E-04 0.287E-04 0.653E-04 0.497E-04 0.497E-04
1978 0.813E-04 0.191E-03 0.185E-03 0.882E-04 0.455E-04 0.132E-04 0.273E-04 0.147E-04 0.404E-04 0.404E-04
1979 0.100E-04 0.714E-04 0.208E-03 0.110E-03 0.422E-04 0.269E-04 0.202E-04 0.599E-04 0.392E-04 0.392E-04
1980 0.471E-04 0.166E-03 0.358E-03 0.175E-03 0.350E-04 0.406E-04 0.356E-04 0.194E-04 0.428E-04 0.428E-04
1981 0.439E-04 0.241E-03 0.303E-03 0.115E-03 0.944E-04 0.277E-04 0.373E-04 0.566E-04 0.330E-04 0.330E-04
1982 0.225E-03 0.281E-03 0.415E-03 0.202E-03 0.833E-04 0.466E-04 0.291E-04 0.967E-04 0.703E-04 0.703E-04
1983 0.128E-03 0.231E-03 0.331E-03 0.156E-03 0.106E-03 0.775E-04 0.145E-03 0.451E-04 0.767E-04 0.767E-04
1984 0.842E-04 0.334E-03 0.165E-03 0.167E-03 0.173E-03 0.136E-03 0.120E-03 0.162E-03 0.903E-04 0.903E-04
1985 0.667E-04 0.403E-03 0.447E-03 0.175E-03 0.995E-04 0.997E-04 0.542E-04 0.809E-04 0.115E-03 0.688E-04
1986 0.158E-03 0.282E-03 0.334E-03 0.219E-03 0.533E-04 0.703E-04 0.650E-04 0.516E-04 0.115E-03 0.688E-04
1987 0.167E-03 0.314E-03 0.350E-03 0.194E-03 0.775E-04 0.477E-04 0.133E-03 0.101E-03 0.109E-03 0.655E-04
1988 0.332E-03 0.295E-03 0.452E-03 0.243E-03 0.102E-03 0.697E-04 0.852E-04 0.130E-03 0.175E-03 0.105E-03
1989 0.385E-03 0.511E-03 0.284E-03 0.230E-03 0.242E-03 0.604E-04 0.934E-04 0.680E-04 0.145E-03 0.868E-04
1990 0.280E-03 0.613E-03 0.610E-03 0.252E-03 0.289E-03 0.104E-03 0.104E-03 0.141E-03 0.181E-03 0.108E-03
1991 0.221E-03 0.592E-03 0.693E-03 0.326E-03 0.303E-03 0.919E-04 0.972E-04 0.122E-03 0.282E-03 0.169E-03
1992 0.231E-03 0.976E-03 0.980E-03 0.323E-03 0.185E-03 0.148E-03 0.219E-03 0.281E-03 0.358E-03 0.215E-03
1993 0.244E-03 0.185E-02 0.154E-02 0.461E-03 0.235E-03 0.185E-03 0.187E-03 0.223E-03 0.370E-03 0.222E-03
1994 0.482E-03 0.897E-03 0.104E-02 0.461E-03 0.468E-03 0.383E-03 0.584E-03 0.602E-03 0.994E-03 0.596E-03
1995 0.498E-03 0.101E-02 0.113E-02 0.677E-03 0.663E-03 0.756E-03 0.433E-03 0.619E-03 0.700E-03 0.840E-03
1996 0.721E-03 0.192E-02 0.209E-02 0.137E-02 0.829E-03 0.406E-03 0.548E-03 0.420E-03 0.102E-02 0.122E-02
1997 0.795E-03 0.182E-02 0.131E-02 0.152E-02 0.100E-02 0.111E-02 0.644E-03 0.132E-02 0.132E-02 0.158E-02
1998 0.140E-02 0.338E-02 0.272E-02 0.193E-02 0.109E-02 0.215E-02 0.360E-03 0.368E-03 0.104E-02 0.125E-02
1999 0.144E-02 0.199E-02 0.266E-02 0.191E-02 0.938E-03 0.480E-03 0.474E-03 0.595E-03 0.131E-02 0.157E-02
2000 0.404E-02 0.387E-02 0.231E-02 0.193E-02 0.213E-02 0.140E-02 0.578E-03 0.868E-03 0.983E-03 0.118E-02
2001 0.108E-03 0.516E-02 0.239E-02 0.167E-02 0.156E-02 0.130E-02 0.202E-02 0.138E-02 0.156E-02 0.188E-02
2002 0.462E-03 0.619E-02 0.441E-02 0.181E-02 0.837E-03 0.155E-02 0.958E-03 0.150E-02 0.162E-02 0.195E-02
2003 0.208E-03 0.249E-02 0.157E-02 0.115E-02 0.175E-02 0.837E-03 0.255E-02 0.180E-02 0.229E-02 0.275E-02
2004 0.732E-03 0.250E-02 0.297E-02 0.103E-02 0.590E-03 0.128E-02 0.130E-02 0.170E-02 0.272E-02 0.326E-02

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 2005 0.320E-02 0.325E-02 0.201E-02 0.172E-02 0.105E-02 0.112E-02 0.133E-02 0.855E-03 0.402E-
02 0.482E-02
 2006 0.337E-02 0.301E-02 0.318E-02 0.101E-02 0.474E-03 0.156E-02 0.811E-03 0.110E-02 0.305E-
02 0.366E-02
 2007 0.392E-04 0.256E-02 0.114E-02 0.266E-02 0.197E-02 0.133E-02 0.155E-02 0.131E-02 0.348E-
02 0.418E-02
 2008 0.603E-05 0.265E-02 0.160E-02 0.258E-02 0.142E-02 0.117E-02 0.132E-02 0.168E-02 0.201E-
02 0.241E-02
 2009 0.100E-04 0.271E-03 0.124E-02 0.293E-02 0.135E-02 0.114E-02 0.188E-02 0.168E-02 0.130E-
02 0.155E-02
 2010 0.940E-05 0.252E-03 0.316E-03 0.478E-02 0.199E-02 0.234E-02 0.159E-02 0.140E-02 0.113E-
02 0.136E-02
 2011 0.305E-04 0.112E-02 0.574E-03 0.940E-03 0.443E-03 0.370E-03 0.523E-03 0.535E-03 0.706E-
03 0.847E-03
 2012 0.315E-04 0.101E-02 0.520E-03 0.858E-03 0.388E-03 0.335E-03 0.461E-03 0.475E-03 0.602E-
03 0.722E-03
 2013 0.261E-04 0.946E-03 0.482E-03 0.792E-03 0.367E-03 0.303E-03 0.425E-03 0.432E-03 0.553E-
03 0.663E-03
 2014 0.240E-04 0.887E-03 0.465E-03 0.743E-03 0.343E-03 0.288E-03 0.398E-03 0.404E-03 0.516E-
03 0.619E-03
 2015 0.231E-04 0.826E-03 0.435E-03 0.725E-03 0.328E-03 0.274E-03 0.376E-03 0.372E-03 0.477E-
03 0.573E-03
 2016 0.313E-02 0.798E-03 0.401E-03 0.670E-03 0.315E-03 0.263E-03 0.348E-03 0.347E-03 0.435E-
03 0.522E-03
 2017 0.331E-02 0.120E+00 0.366E-03 0.595E-03 0.276E-03 0.237E-03 0.323E-03 0.315E-03 0.397E-
03 0.476E-03
 2018 0.280E-02 0.127E+00 0.744E-01 0.547E-03 0.255E-03 0.214E-03 0.298E-03 0.294E-03 0.362E-
03 0.434E-03
 2019 0.484E-02 0.115E+00 0.797E-01 0.155E+00 0.238E-03 0.199E-03 0.275E-03 0.274E-03
0.341E-03 0.410E-03
 2020 0.412E-02 0.200E+00 0.839E-01 0.171E+00 0.990E-01 0.184E-03 0.258E-03 0.253E-03
0.319E-03 0.383E-03
 2021 0.628E-04 0.175E+00 0.152E+00 0.221E+00 0.114E+00 0.107E+00 0.239E-03 0.244E-03
0.303E-03 0.364E-03
 2022 0.832E-04 0.211E-02 0.139E+00 0.484E+00 0.211E+00 0.136E+00 0.227E+00 0.226E-03
0.290E-03 0.348E-03
 2023 0.808E-04 0.290E-02 0.102E-02 0.964E+00 0.201E+01 0.579E+00 0.480E+00 0.130E+01
0.272E-03 0.326E-03
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TABLE 1C. BIAS OF ABUNDANCE (BY AREA) OF East of 45
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      1      2      3      4      5      6      7      8      9      10
---------------------------------------------------------------------------------------------------------------
 1975 0.467E+04 0.252E+04 0.283E+04 0.126E+04 0.154E+04 0.377E+03 0.467E+03 0.396E+03
0.389E+03 0.471E+04
 1976 0.848E+04 0.286E+04 0.197E+04 0.223E+04 0.994E+03 0.122E+04 0.309E+03 0.392E+03
0.341E+03 0.462E+04
 1977 0.241E+04 0.520E+04 0.225E+04 0.155E+04 0.175E+04 0.781E+03 0.996E+03 0.259E+03
0.338E+03 0.440E+04
 1978 0.256E+04 0.147E+04 0.408E+04 0.177E+04 0.122E+04 0.138E+04 0.639E+03 0.836E+03
0.223E+03 0.421E+04
 1979 0.338E+04 0.156E+04 0.116E+04 0.321E+04 0.139E+04 0.958E+03 0.113E+04 0.536E+03
0.719E+03 0.393E+04
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1980 0.335E+04 0.207E+04 0.123E+04 0.910E+03 0.252E+04 0.110E+04 0.785E+03 0.947E+03
0.462E+03 0.413E+04
1981 0.407E+04 0.205E+04 0.163E+04 0.966E+03 0.715E+03 0.198E+04 0.898E+03 0.659E+03
0.815E+03 0.414E+04
1982 0.980E+04 0.249E+04 0.160E+04 0.128E+04 0.760E+03 0.562E+03 0.163E+04 0.754E+03
0.567E+03 0.445E+04
1983 0.838E+04 0.599E+04 0.195E+04 0.126E+04 0.100E+04 0.598E+03 0.460E+03 0.136E+04
0.649E+03 0.451E+04
1984 0.680E+04 0.511E+04 0.471E+04 0.153E+04 0.989E+03 0.788E+03 0.489E+03 0.386E+03
0.117E+04 0.462E+04
1985 0.579E+04 0.416E+04 0.400E+04 0.371E+04 0.121E+04 0.777E+03 0.645E+03 0.411E+03
0.332E+03 0.522E+04
1986 0.732E+04 0.355E+04 0.327E+04 0.314E+04 0.292E+04 0.948E+03 0.636E+03 0.542E+03
0.353E+03 0.506E+04
1987 0.114E+05 0.447E+04 0.279E+04 0.257E+04 0.247E+04 0.229E+04 0.776E+03 0.534E+03
0.466E+03 0.493E+04
1988 0.134E+05 0.699E+04 0.351E+04 0.219E+04 0.202E+04 0.194E+04 0.188E+04 0.652E+03
0.460E+03 0.489E+04
1989 0.307E+05 0.814E+04 0.549E+04 0.275E+04 0.172E+04 0.159E+04 0.159E+04 0.158E+04
0.561E+03 0.485E+04
1990 0.247E+05 0.188E+05 0.639E+04 0.432E+04 0.216E+04 0.135E+04 0.130E+04 0.133E+04
0.136E+04 0.487E+04
1991 0.583E+05 0.151E+05 0.148E+05 0.502E+04 0.339E+04 0.170E+04 0.111E+04 0.109E+04
0.115E+04 0.559E+04
1992 0.551E+05 0.357E+05 0.119E+05 0.116E+05 0.395E+04 0.267E+04 0.139E+04 0.930E+03
0.938E+03 0.608E+04
1993 0.547E+05 0.338E+05 0.281E+05 0.932E+04 0.912E+04 0.310E+04 0.219E+04 0.117E+04
0.801E+03 0.631E+04
1994 0.684E+05 0.335E+05 0.264E+05 0.220E+05 0.733E+04 0.717E+04 0.254E+04 0.183E+04
0.100E+04 0.640E+04
1995 0.601E+05 0.419E+05 0.263E+05 0.208E+05 0.173E+05 0.576E+04 0.587E+04 0.213E+04
0.158E+04 0.667E+04
1996 0.692E+05 0.368E+05 0.329E+05 0.207E+05 0.163E+05 0.136E+05 0.472E+04 0.493E+04
0.183E+04 0.743E+04
1997 0.563E+05 0.423E+05 0.288E+05 0.258E+05 0.163E+05 0.129E+05 0.112E+05 0.396E+04
0.424E+04 0.833E+04
1998 0.319E+06 0.345E+05 0.332E+05 0.227E+05 0.203E+05 0.128E+05 0.105E+05 0.936E+04
0.341E+04 0.113E+05
1999 0.254E+06 0.196E+06 0.270E+05 0.261E+05 0.178E+05 0.160E+05 0.105E+05 0.883E+04
0.806E+04 0.132E+05
2000 0.332E+06 0.156E+06 0.154E+06 0.212E+05 0.205E+05 0.140E+05 0.131E+05 0.878E+04
0.760E+04 0.191E+05
2001 0.368E+06 0.203E+06 0.122E+06 0.121E+06 0.167E+05 0.161E+05 0.115E+05 0.110E+05
0.755E+04 0.239E+05
2002 0.455E+06 0.225E+06 0.159E+06 0.961E+05 0.951E+05 0.131E+05 0.132E+05 0.962E+04
0.945E+04 0.283E+05
2003 0.589E+06 0.279E+06 0.177E+06 0.125E+06 0.756E+05 0.748E+05 0.107E+05 0.111E+05
0.828E+04 0.339E+05
2004 0.772E+06 0.361E+06 0.219E+06 0.139E+06 0.986E+05 0.594E+05 0.613E+05 0.900E+04
0.952E+04 0.380E+05
2005 0.400E+06 0.473E+06 0.284E+06 0.173E+06 0.110E+06 0.776E+05 0.487E+05 0.514E+05
0.775E+04 0.428E+05
2006 0.309E+06 0.245E+06 0.372E+06 0.223E+06 0.136E+06 0.861E+05 0.635E+05 0.409E+05
0.443E+05 0.455E+05
2007 0.203E+06 0.189E+06 0.193E+06 0.292E+06 0.176E+06 0.107E+06 0.705E+05 0.533E+05
0.352E+05 0.802E+05

2008 0.105E+07 0.124E+06 0.149E+06 0.151E+06 0.230E+06 0.138E+06 0.874E+05 0.592E+05
0.459E+05 0.104E+06
2009 0.115E+07 0.641E+06 0.978E+05 0.117E+06 0.119E+06 0.181E+06 0.113E+06 0.734E+05
0.510E+05 0.134E+06
2010 0.121E+07 0.705E+06 0.504E+06 0.769E+05 0.921E+05 0.937E+05 0.148E+06 0.950E+05
0.631E+05 0.166E+06
2011 0.120E+07 0.742E+06 0.555E+06 0.397E+06 0.605E+05 0.725E+05 0.767E+05 0.124E+06
0.817E+05 0.206E+06
2012 0.129E+07 0.733E+06 0.584E+06 0.436E+06 0.312E+06 0.476E+05 0.593E+05 0.644E+05
0.107E+06 0.259E+06
2013 0.136E+07 0.789E+06 0.576E+06 0.459E+06 0.343E+06 0.245E+06 0.389E+05 0.498E+05
0.554E+05 0.329E+06
2014 0.143E+07 0.833E+06 0.621E+06 0.453E+06 0.361E+06 0.270E+06 0.201E+06 0.327E+05
0.429E+05 0.346E+06
2015 0.143E+07 0.878E+06 0.655E+06 0.488E+06 0.357E+06 0.284E+06 0.221E+06 0.169E+06
0.281E+05 0.351E+06
2016 0.118E+07 0.878E+06 0.690E+06 0.515E+06 0.384E+06 0.281E+06 0.233E+06 0.186E+06
0.145E+06 0.342E+06
2017 0.117E+07 0.723E+06 0.690E+06 0.543E+06 0.405E+06 0.302E+06 0.230E+06 0.195E+06
0.160E+06 0.438E+06
2018 0.496E+06 0.716E+06 0.569E+06 0.543E+06 0.427E+06 0.319E+06 0.247E+06 0.193E+06
0.168E+06 0.536E+06
2019 0.104E+08 0.304E+06 0.563E+06 0.447E+06 0.427E+06 0.336E+06 0.261E+06 0.208E+06
0.166E+06 0.635E+06
2020 0.916E+08 0.637E+07 0.239E+06 0.443E+06 0.352E+06 0.336E+06 0.275E+06 0.219E+06
0.179E+06 0.722E+06
2021 0.125E+09 0.561E+08 0.501E+07 0.188E+06 0.349E+06 0.277E+06 0.275E+06 0.231E+06
0.189E+06 0.812E+06
2022 0.779E+06 0.763E+08 0.441E+08 0.394E+07 0.148E+06 0.274E+06 0.227E+06 0.231E+06
0.199E+06 0.902E+06
2023 0.776E+06 0.477E+06 0.600E+08 0.347E+08 0.310E+07 0.116E+06 0.225E+06 0.190E+06
0.199E+06 0.991E+06
2024 0.475E+06 0.375E+06 0.472E+08 0.273E+08 0.244E+07 0.952E+05 0.189E+06
0.164E+06 0.107E+07
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TABLE 1D. STANDARD ERROR OF ABUNDANCE (BY AREA) OF East of 45
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1 2 3 4 5 6 7 8 9 10

1975 0.101E+04 0.546E+03 0.612E+03 0.275E+03 0.335E+03 0.782E+02 0.955E+02 0.803E+02
0.786E+02 0.953E+03
1976 0.185E+04 0.618E+03 0.429E+03 0.481E+03 0.217E+03 0.264E+03 0.640E+02 0.802E+02
0.691E+02 0.935E+03
1977 0.525E+03 0.113E+04 0.485E+03 0.336E+03 0.379E+03 0.170E+03 0.216E+03 0.537E+02
0.690E+02 0.899E+03
1978 0.557E+03 0.323E+03 0.891E+03 0.382E+03 0.264E+03 0.298E+03 0.139E+03 0.181E+03
0.462E+02 0.872E+03
1979 0.731E+03 0.341E+03 0.253E+03 0.700E+03 0.300E+03 0.208E+03 0.244E+03 0.117E+03
0.156E+03 0.853E+03
1980 0.723E+03 0.447E+03 0.268E+03 0.199E+03 0.551E+03 0.236E+03 0.170E+03 0.205E+03
0.101E+03 0.902E+03
1981 0.876E+03 0.444E+03 0.352E+03 0.210E+03 0.156E+03 0.432E+03 0.193E+03 0.143E+03
0.176E+03 0.897E+03

1982 0.212E+04 0.537E+03 0.348E+03 0.276E+03 0.166E+03 0.123E+03 0.354E+03 0.162E+03 0.123E+03 0.964E+03
1983 0.179E+04 0.130E+04 0.421E+03 0.273E+03 0.217E+03 0.130E+03 0.101E+03 0.297E+03 0.140E+03 0.972E+03
1984 0.146E+04 0.110E+04 0.102E+04 0.331E+03 0.214E+03 0.171E+03 0.107E+03 0.843E+02 0.256E+03 0.100E+04
1985 0.125E+04 0.897E+03 0.861E+03 0.801E+03 0.260E+03 0.169E+03 0.140E+03 0.895E+02 0.726E+02 0.114E+04
1986 0.157E+04 0.765E+03 0.702E+03 0.674E+03 0.630E+03 0.204E+03 0.138E+03 0.117E+03 0.770E+02 0.110E+04
1987 0.246E+04 0.962E+03 0.601E+03 0.552E+03 0.530E+03 0.496E+03 0.168E+03 0.116E+03 0.101E+03 0.107E+04
1988 0.288E+04 0.151E+04 0.754E+03 0.472E+03 0.434E+03 0.417E+03 0.405E+03 0.141E+03 0.997E+02 0.106E+04
1989 0.661E+04 0.176E+04 0.118E+04 0.591E+03 0.371E+03 0.341E+03 0.342E+03 0.340E+03 0.121E+03 0.105E+04
1990 0.533E+04 0.405E+04 0.138E+04 0.931E+03 0.465E+03 0.292E+03 0.279E+03 0.287E+03 0.293E+03 0.105E+04
1991 0.126E+05 0.326E+04 0.318E+04 0.108E+04 0.732E+03 0.366E+03 0.239E+03 0.234E+03 0.247E+03 0.120E+04
1992 0.119E+05 0.769E+04 0.256E+04 0.250E+04 0.850E+03 0.576E+03 0.300E+03 0.200E+03 0.202E+03 0.131E+04
1993 0.118E+05 0.727E+04 0.604E+04 0.201E+04 0.197E+04 0.669E+03 0.471E+03 0.251E+03 0.173E+03 0.136E+04
1994 0.147E+05 0.723E+04 0.570E+04 0.474E+04 0.158E+04 0.155E+04 0.548E+03 0.395E+03 0.216E+03 0.138E+04
1995 0.130E+05 0.903E+04 0.567E+04 0.448E+04 0.373E+04 0.124E+04 0.127E+04 0.460E+03 0.340E+03 0.144E+04
1996 0.149E+05 0.793E+04 0.710E+04 0.446E+04 0.352E+04 0.293E+04 0.102E+04 0.106E+04 0.395E+03 0.160E+04
1997 0.121E+05 0.912E+04 0.622E+04 0.557E+04 0.350E+04 0.277E+04 0.240E+04 0.853E+03 0.914E+03 0.180E+04
1998 0.689E+05 0.743E+04 0.716E+04 0.489E+04 0.438E+04 0.275E+04 0.227E+04 0.202E+04 0.734E+03 0.243E+04
1999 0.548E+05 0.422E+05 0.582E+04 0.562E+04 0.384E+04 0.345E+04 0.225E+04 0.190E+04 0.174E+04 0.285E+04
2000 0.716E+05 0.335E+05 0.332E+05 0.457E+04 0.442E+04 0.302E+04 0.282E+04 0.189E+04 0.164E+04 0.411E+04
2001 0.793E+05 0.437E+05 0.264E+05 0.261E+05 0.359E+04 0.347E+04 0.247E+04 0.237E+04 0.163E+04 0.516E+04
2002 0.983E+05 0.486E+05 0.344E+05 0.207E+05 0.205E+05 0.283E+04 0.284E+04 0.207E+04 0.204E+04 0.610E+04
2003 0.127E+06 0.602E+05 0.382E+05 0.270E+05 0.163E+05 0.161E+05 0.231E+04 0.239E+04 0.178E+04 0.732E+04
2004 0.166E+06 0.780E+05 0.474E+05 0.300E+05 0.213E+05 0.128E+05 0.132E+05 0.194E+04 0.205E+04 0.820E+04
2005 0.861E+05 0.102E+06 0.613E+05 0.373E+05 0.236E+05 0.167E+05 0.105E+05 0.111E+05 0.167E+04 0.923E+04
2006 0.665E+05 0.527E+05 0.802E+05 0.482E+05 0.293E+05 0.186E+05 0.137E+05 0.881E+04 0.955E+04 0.982E+04
2007 0.436E+05 0.407E+05 0.415E+05 0.630E+05 0.379E+05 0.231E+05 0.152E+05 0.115E+05 0.758E+04 0.173E+05
2008 0.225E+06 0.267E+05 0.320E+05 0.326E+05 0.496E+05 0.298E+05 0.189E+05 0.128E+05 0.989E+04 0.223E+05
2009 0.247E+06 0.138E+06 0.210E+05 0.252E+05 0.257E+05 0.390E+05 0.244E+05 0.158E+05 0.110E+05 0.290E+05

2010 0.260E+06 0.152E+06 0.108E+06 0.165E+05 0.198E+05 0.202E+05 0.319E+05 0.205E+05
0.136E+05 0.359E+05
2011 0.256E+06 0.159E+06 0.119E+06 0.853E+05 0.130E+05 0.156E+05 0.165E+05 0.268E+05
0.176E+05 0.445E+05
2012 0.277E+06 0.157E+06 0.125E+06 0.938E+05 0.671E+05 0.102E+05 0.128E+05 0.139E+05
0.231E+05 0.558E+05
2013 0.291E+06 0.169E+06 0.123E+06 0.987E+05 0.738E+05 0.528E+05 0.837E+04 0.107E+05
0.119E+05 0.708E+05
2014 0.306E+06 0.178E+06 0.133E+06 0.971E+05 0.776E+05 0.580E+05 0.432E+05 0.703E+04
0.922E+04 0.744E+05
2015 0.305E+06 0.187E+06 0.140E+06 0.105E+06 0.764E+05 0.611E+05 0.475E+05 0.363E+05
0.605E+04 0.754E+05
2016 0.333E+07 0.187E+06 0.147E+06 0.110E+06 0.825E+05 0.601E+05 0.500E+05 0.399E+05
0.312E+05 0.736E+05
2017 0.459E+07 0.204E+07 0.147E+06 0.116E+06 0.868E+05 0.649E+05 0.492E+05 0.420E+05
0.343E+05 0.942E+05
2018 0.302E+07 0.281E+07 0.160E+07 0.116E+06 0.912E+05 0.683E+05 0.531E+05 0.413E+05
0.361E+05 0.115E+06
2019 0.577E+08 0.185E+07 0.221E+07 0.126E+07 0.910E+05 0.717E+05 0.559E+05 0.446E+05
0.355E+05 0.136E+06
2020 0.168E+09 0.353E+08 0.145E+07 0.174E+07 0.992E+06 0.716E+05 0.587E+05 0.469E+05
0.384E+05 0.155E+06
2021 0.673E+09 0.103E+09 0.278E+08 0.114E+07 0.137E+07 0.780E+06 0.586E+05 0.493E+05
0.404E+05 0.174E+06
2022 0.254E+06 0.412E+09 0.809E+08 0.219E+08 0.899E+06 0.108E+07 0.639E+06 0.492E+05
0.424E+05 0.193E+06
2023 0.255E+06 0.156E+06 0.324E+09 0.636E+08 0.172E+08 0.707E+06 0.882E+06 0.536E+06
0.424E+05 0.211E+06
2024 0.156E+06 0.122E+06 0.255E+09 0.501E+08 0.135E+08 0.579E+06 0.740E+06
0.462E+06 0.228E+06

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TABLE 1E. PARAMETER ESTIMATES FOR East of 45

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TERMINAL AGE STRUCTURE OF POPULATION ABUNDANCE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
2	0.170E+07	0.162E+07	0.475E+06	0.156E+06	9.6
3	0.129E+07	0.124E+07	0.375E+06	0.122E+06	9.9
4	0.142E+08	0.500E+08	0.472E+08	0.255E+09	510.0
5	0.156E+08	0.345E+08	0.273E+08	0.501E+08	144.9
6	0.325E+07	0.561E+07	0.244E+07	0.135E+08	241.1
7	0.132E+05	0.107E+06	0.952E+05	0.579E+06	542.5
8	0.140E+06	0.483E+06	0.189E+06	0.740E+06	153.2
9	0.703E+05	0.224E+06	0.164E+06	0.462E+06	206.4
10	0.426E+07	0.522E+07	0.107E+07	0.228E+06	4.4

TERMINAL AGE STRUCTURE OF FISHING MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.800E-03	0.843E-03	-0.337E-03	0.808E-04	9.6
2	0.285E-01	0.300E-01	-0.123E-01	0.290E-02	9.7

3	0.120E-02	0.135E-02	-0.470E-02	0.102E-02	75.9
4	0.116E-02	0.317E+00	0.315E+00	0.964E+00	303.9
5	0.232E-02	0.111E+01	0.111E+01	0.201E+01	180.5
6	0.321E+00	0.615E+00	0.256E+00	0.579E+00	94.2
7	0.385E-01	0.219E+00	0.200E+00	0.480E+00	219.3
8	0.615E-01	0.563E+00	0.491E+00	0.130E+01	231.1
9	0.751E-02	0.614E-02	-0.157E-02	0.272E-03	4.4
10	0.901E-02	0.737E-02	-0.188E-02	0.326E-03	4.4

RATIO OF FISHING MORTALITY RATE ON LAST TWO AGES (F-RATIO)

Year	MLE	Average of bootstraps	Bias	Std. Error	% CV
1975	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1976	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1977	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1978	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1979	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1980	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1981	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1982	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1983	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1984	0.100E+01	0.100E+01	0.000E+00	0.000E+00	0.0
1985	0.600E+00	0.600E+00	0.000E+00	0.243E-07	0.0
1986	0.600E+00	0.600E+00	0.000E+00	0.258E-07	0.0
1987	0.600E+00	0.600E+00	0.000E+00	0.256E-07	0.0
1988	0.600E+00	0.600E+00	0.000E+00	0.160E-07	0.0
1989	0.600E+00	0.600E+00	0.000E+00	0.226E-07	0.0
1990	0.600E+00	0.600E+00	0.000E+00	0.182E-07	0.0
1991	0.600E+00	0.600E+00	0.000E+00	0.247E-07	0.0
1992	0.600E+00	0.600E+00	0.000E+00	0.239E-07	0.0
1993	0.600E+00	0.600E+00	0.000E+00	0.216E-07	0.0
1994	0.600E+00	0.600E+00	0.000E+00	0.216E-07	0.0
1995	0.120E+01	0.120E+01	0.000E+00	0.352E-07	0.0
1996	0.120E+01	0.120E+01	0.000E+00	0.493E-07	0.0
1997	0.120E+01	0.120E+01	0.000E+00	0.441E-07	0.0
1998	0.120E+01	0.120E+01	0.000E+00	0.518E-07	0.0
1999	0.120E+01	0.120E+01	0.000E+00	0.450E-07	0.0
2000	0.120E+01	0.120E+01	0.000E+00	0.314E-07	0.0
2001	0.120E+01	0.120E+01	0.000E+00	0.514E-07	0.0
2002	0.120E+01	0.120E+01	0.000E+00	0.408E-07	0.0
2003	0.120E+01	0.120E+01	0.000E+00	0.481E-07	0.0
2004	0.120E+01	0.120E+01	0.000E+00	0.492E-07	0.0
2005	0.120E+01	0.120E+01	0.000E+00	0.393E-07	0.0
2006	0.120E+01	0.120E+01	0.000E+00	0.407E-07	0.0
2007	0.120E+01	0.120E+01	0.000E+00	0.425E-07	0.0
2008	0.120E+01	0.120E+01	0.000E+00	0.465E-07	0.0
2009	0.120E+01	0.120E+01	0.000E+00	0.447E-07	0.0
2010	0.120E+01	0.120E+01	0.000E+00	0.421E-07	0.0
2011	0.120E+01	0.120E+01	0.000E+00	0.516E-07	0.0
2012	0.120E+01	0.120E+01	0.000E+00	0.444E-07	0.0
2013	0.120E+01	0.120E+01	0.000E+00	0.450E-07	0.0
2014	0.120E+01	0.120E+01	0.000E+00	0.389E-07	0.0
2015	0.120E+01	0.120E+01	0.000E+00	0.352E-07	0.0
2016	0.120E+01	0.120E+01	0.000E+00	0.417E-07	0.0
2017	0.120E+01	0.120E+01	0.000E+00	0.482E-07	0.0
2018	0.120E+01	0.120E+01	0.000E+00	0.472E-07	0.0

2019	0.120E+01	0.120E+01	0.000E+00	0.479E-07	0.0
2020	0.120E+01	0.120E+01	0.000E+00	0.406E-07	0.0
2021	0.120E+01	0.120E+01	0.000E+00	0.469E-07	0.0
2022	0.120E+01	0.120E+01	0.000E+00	0.406E-07	0.0
2023	0.120E+01	0.120E+01	0.000E+00	0.338E-07	0.0

NATURAL MORTALITY RATE

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.490E+00	0.490E+00	0.000E+00	0.000E+00	0.0
2	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
3	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
4	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
5	0.240E+00	0.240E+00	0.000E+00	0.000E+00	0.0
6	0.200E+00	0.200E+00	0.000E+00	0.000E+00	0.0
7	0.175E+00	0.175E+00	0.000E+00	0.000E+00	0.0
8	0.150E+00	0.150E+00	0.000E+00	0.000E+00	0.0
9	0.125E+00	0.125E+00	0.000E+00	0.000E+00	0.0
10	0.100E+00	0.100E+00	0.000E+00	0.000E+00	0.0

TRANSFER COEFFICIENTS

Age	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
4	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

VARIANCE SCALING PARAMETERS

Index	MLE	Average of bootstraps	Bias	Std. Error	% CV
1	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
2	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
3	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
4	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
5	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
6	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
7	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
8	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
9	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
10	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
11	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6
12	0.901E+00	0.891E+00	-0.991E-02	0.855E-01	9.6

CATCHABILITY COEFFICIENTS

Index	Year	MLE	Average of bootstraps	Bias	Std. Error	% CV

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1	1975	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1976	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1977	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1978	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1979	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1980	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1981	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1982	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1983	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1984	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1985	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1986	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1987	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1988	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1989	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1990	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1991	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1992	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1993	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1994	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1995	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1996	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1997	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1998	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	1999	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2000	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2001	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2002	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2003	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2004	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2005	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2006	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2007	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2008	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2009	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2010	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2011	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2012	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2013	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2014	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2015	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2016	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2017	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2018	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2019	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2020	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2021	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2022	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
1	2023	0.131E-05	0.126E-05	-0.226E-06	0.103E-06	8.2
2	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

2	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
2	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
3	1975	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1976	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1977	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1978	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1979	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1980	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1981	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1982	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1983	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1984	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1985	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1986	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1987	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1988	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1989	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0

3	1990	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1991	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1992	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1993	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1994	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1995	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1996	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1997	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1998	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	1999	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2000	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2001	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2002	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2003	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2004	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2005	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2006	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2007	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2008	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2009	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2010	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2011	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2012	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2013	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2014	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2015	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2016	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2017	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2018	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2019	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2020	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2021	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2022	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
3	2023	0.838E-06	0.809E-06	-0.430E-06	0.145E-06	18.0
4	1975	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1976	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1977	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1978	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1979	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1980	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1981	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1982	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1983	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1984	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1985	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1986	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1987	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1988	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1989	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1990	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1991	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1992	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1993	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1994	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1995	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1996	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1997	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0

4	1998	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	1999	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2000	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2001	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2002	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2003	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2004	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2005	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2006	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2007	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2008	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2009	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2010	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2011	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2012	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2013	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2014	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2015	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2016	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2017	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2018	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2019	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2020	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2021	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2022	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
4	2023	0.140E-05	0.135E-05	-0.901E-06	0.230E-06	17.0
5	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

5	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
5	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

6	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
6	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
7	1975	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1976	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1977	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1978	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1979	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1980	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1981	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1982	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1983	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1984	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1985	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1986	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1987	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1988	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1989	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1990	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1991	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1992	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1993	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1994	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1995	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1996	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1997	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1998	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	1999	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2000	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2001	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2002	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2003	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2004	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2005	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2006	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2007	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2008	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2009	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2010	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2011	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2012	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2013	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2014	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2015	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2016	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2017	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2018	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2019	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2020	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2021	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1

7	2022	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
7	2023	0.119E-05	0.115E-05	-0.160E-06	0.814E-07	7.1
8	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
8	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

9	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
9	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1975	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1976	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1977	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1978	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1979	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1980	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1982	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1983	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1984	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1985	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1986	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1987	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1988	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0

10	1989	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1990	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1991	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1992	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1993	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1994	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1995	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1996	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1997	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1998	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	1999	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2005	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2006	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2008	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2009	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2010	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2012	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2015	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2016	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2017	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2018	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2020	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2021	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
10	2023	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0
11	1975	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1976	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1977	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1978	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1979	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1980	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1981	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1982	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1983	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1984	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1985	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1986	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1987	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1988	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1989	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1990	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1991	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1992	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1993	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1994	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1995	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1996	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4

11	1997	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1998	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	1999	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2000	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2001	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2002	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2003	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2004	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2005	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2006	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2007	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2008	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2009	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2010	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2011	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2012	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2013	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2014	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2015	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2016	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2017	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2018	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2019	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2020	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2021	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2022	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
11	2023	0.473E-08	0.527E-08	-0.104E-08	0.171E-08	32.4
12	1975	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1976	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1977	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1978	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1979	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1980	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1981	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1982	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1983	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1984	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1985	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1986	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1987	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1988	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1989	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1990	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1991	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1992	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1993	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1994	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1995	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1996	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1997	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1998	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	1999	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2000	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2001	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2002	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2003	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5
12	2004	0.668E-06	0.767E-06	0.152E-07	0.188E-06	24.5

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  12   2005   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2006   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2007   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2008   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2009   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2010   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2011   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2012   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2013   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2014   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2015   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2016   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2017   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2018   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2019   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2020   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2021   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2022   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5
  12   2023   0.668E-06  0.767E-06  0.152E-07  0.188E-06  24.5


************************************************
CORRELATION AND COVARIANCE MATRICES OF PARAMETERS
************************************************


TABLE 2A. CORRELATION MATRIX
========================================================================================
======================
      1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20
   1 :  1.0
   2 :  1.0  1.0
   3 :  0.2  0.2  1.0
   4 :  0.0  0.0 -0.2  1.0
   5 :  0.0  0.0 -0.1  0.3  1.0
   6 :  0.1  0.1 -0.1 -0.1 -0.2  1.0
   7 :  0.1  0.1 -0.1 -0.1  0.0 -0.2  1.0
   8 :  0.1  0.1  0.1 -0.1 -0.1  0.3  0.0  1.0
   9 : -0.1 -0.1  0.1 -0.1 -0.1 -0.1  0.1  0.1  1.0
  10 : -0.1 -0.1 -0.1  0.1  0.0  0.1 -0.1 -0.2  0.0  1.0
  11 : -0.1 -0.1  0.1 -0.1 -0.1 -0.1  0.1  0.1  1.0 -0.1  1.0
  12 : -0.1 -0.1  0.1 -0.1 -0.2 -0.1  0.1  0.1  1.0 -0.1  1.0  1.0
  13 : -0.1 -0.1  0.1 -0.1 -0.2 -0.1  0.1  0.1  1.0 -0.1  1.0  1.0  1.0
  14 :  0.0  0.0  0.0  0.1  0.0  0.0 -0.1 -0.1 -0.2  0.2 -0.2 -0.2 -0.2  1.0
  15 : -0.1 -0.1  0.1 -0.1 -0.1 -0.1 -0.1 -0.1  0.3 -0.2  0.3  0.3  0.3 -0.3  1.0
  16 :  0.0  0.0  0.1 -0.1 -0.2  0.1  0.0  0.0 -0.1 -0.1 -0.1 -0.1 -0.2 -0.1  0.1  1.0
  17 :  0.1  0.1  0.0  0.0  0.1  0.0 -0.2  0.1 -0.1  0.2 -0.1 -0.1 -0.1  0.3 -0.3 -0.1  1.0
  18 :  0.0  0.0 -0.1 -0.2  0.0  0.0  0.1 -0.1  0.2  0.0  0.2  0.2  0.2 -0.2  0.3  0.1 -0.2  1.0
  19 :  0.1  0.1 -0.1  0.0  0.2  0.0  0.0  0.1  0.0  0.0  0.0  0.0  0.0 -0.2  0.0 -0.1  0.0  0.1  1.0
  20 :  0.0  0.0  0.1  0.1  0.2 -0.2  0.1 -0.1  0.1  0.0  0.1  0.1  0.1  0.0  0.0  0.0  0.0  0.1 -0.1  1.0


      1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20
  21   22   23   24   25   26   27   28   29   30   31   32   33   34   35
  21 : -0.1 -0.1  0.1 -0.1  0.1  0.1 -0.2  0.0  0.1  0.1  0.1  0.1  0.1  0.0  0.0  0.0  0.3 -0.1 -0.1  0.0
  22 :  0.2  0.2 -0.2  0.0  0.1  0.3 -0.1  0.1 -0.2 -0.2 -0.2 -0.2 -0.2 -0.1  0.0  0.1 -0.2  0.1  0.2 -0.2
```

23 : 0.1 0.1 -0.1 0.1 0.2 0.1 -0.1 -0.1 -1.0 0.0 -1.0 -1.0 -1.0 0.3 -0.4 0.1 0.1 -0.2 0.0 -0.1
24 : 0.1 0.1 -0.1 0.1 0.2 0.1 -0.1 -0.1 -1.0 0.0 -1.0 -1.0 -1.0 0.2 -0.3 0.1 0.1 -0.2 0.0 -0.1
25 : 0.1 0.1 -0.1 0.1 0.2 0.1 -0.1 -0.1 -1.0 0.1 -1.0 -1.0 -1.0 0.2 -0.3 0.1 0.1 -0.2 0.0 -0.1
26 : 0.1 0.1 -0.1 0.1 0.1 0.1 -0.1 -0.1 -1.0 0.0 -1.0 -1.0 -1.0 0.2 -0.3 0.2 0.0 -0.2 0.0 -0.1
27 : 0.1 0.1 -0.1 0.1 0.1 0.1 -0.1 -0.1 -1.0 0.1 -1.0 -1.0 -1.0 0.2 -0.4 0.1 0.1 -0.2 0.0 -0.1
28 : 0.1 0.1 -0.1 0.1 0.1 0.1 -0.1 -0.1 -1.0 0.0 -1.0 -1.0 -1.0 0.2 -0.3 0.1 0.1 -0.2 0.0 -0.1
29 : 0.1 0.1 -0.1 0.1 0.2 0.2 -0.1 -0.1 -0.9 0.0 -0.9 -0.9 -0.9 0.1 -0.2 0.1 0.0 -0.1 0.0 -0.1
30 : 0.1 0.1 -0.1 0.0 0.0 0.2 -0.1 0.0 -0.8 0.0 -0.8 -0.8 -0.8 0.0 -0.1 0.2 0.0 0.0 0.2 -0.2
31 : 0.0 0.0 -0.1 0.1 0.1 0.1 -0.1 -0.1 -0.8 0.0 -0.8 -0.8 -0.8 0.3 -0.3 0.0 0.1 -0.3 -0.1 -0.1
32 : 0.1 0.1 -0.1 0.1 0.1 0.1 -0.1 -0.1 -0.7 0.2 -0.7 -0.7 -0.7 0.3 -0.3 0.0 0.1 -0.1 -0.1 0.0
33 : 0.1 0.1 -0.1 0.2 0.0 0.0 0.0 -0.1 -0.7 0.1 -0.7 -0.7 -0.7 0.1 -0.1 0.1 0.0 0.0 -0.1 -0.1
34 : 0.1 0.1 0.0 0.2 0.1 0.2 -0.1 0.0 -0.2 0.0 -0.3 -0.2 -0.2 0.0 -0.1 0.0 -0.1 -0.1 -0.1 -0.2
35 : 0.0 0.0 0.1 0.0 0.0 0.1 0.0 0.2 -0.4 -0.1 -0.3 -0.3 -0.3 0.1 -0.3 0.0 0.1 -0.2 -0.1 0.2

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
21 : 1.0
22 : -0.2 1.0
23 : -0.1 0.2 1.0
24 : -0.1 0.2 1.0 1.0
25 : -0.1 0.2 1.0 1.0 1.0
26 : -0.1 0.2 1.0 1.0 1.0 1.0
27 : -0.1 0.2 1.0 1.0 1.0 1.0 1.0
28 : -0.1 0.2 1.0 1.0 1.0 1.0 1.0 1.0
29 : -0.2 0.3 0.9 0.9 0.9 0.9 0.9 0.9 1.0
30 : -0.1 0.3 0.8 0.8 0.8 0.8 0.8 0.8 0.8 1.0
31 : -0.1 0.1 0.8 0.8 0.8 0.8 0.8 0.8 0.7 0.6 1.0
32 : 0.0 0.1 0.7 0.7 0.7 0.7 0.7 0.7 0.6 0.5 0.6 1.0
33 : -0.2 0.2 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.6 0.4 0.6 1.0
34 : -0.1 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.3 0.3 0.2 0.2 0.2 1.0
35 : 0.0 -0.1 0.4 0.4 0.3 0.3 0.4 0.4 0.3 0.2 0.3 0.2 0.0 -0.2 1.0

TABLE 2B. COVARIANCE MATRIX

==
==
==
============
1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 18 19 20
1 : 0.6525D-08
2 : 0.2346D-06 0.8438D-05
3 : 0.1368D-07 0.4896D-06 0.1045D-05
4 : 0.1830D-06 0.2782D-05 -0.1970D-03 0.9284D+00
5 : 0.8884D-06 0.2029D-04 -0.1981D-03 0.6663D+00 0.4039D+01
6 : 0.4541D-05 0.1688D-03 -0.7324D-04 -0.5043D-01 -0.1971D+00 0.3355D+00
7 : 0.2084D-05 0.7300D-04 -0.5919D-04 -0.4486D-01 -0.3743D-01 -0.5593D-01 0.2305D+00
8 : 0.1401D-04 0.5063D-03 0.1526D-03 -0.1421D+00 -0.2575D+00 0.2176D+00 0.1581D-01
0.1694D+01
9 : -0.2445D-08 -0.9150D-07 0.3274D-07 -0.2255D-04 -0.8144D-04 -0.1759D-04 0.1326D-04
0.4128D-04 0.7383D-07
10 : -0.4437D-06 -0.1587D-04 -0.1306D-04 0.1090D-01 -0.1717D-02 0.3286D-02 -0.4792D-02 -
0.1787D-01 -0.1078D-05 0.7310D-02
11 : -0.7269D-08 -0.2730D-06 0.8156D-07 -0.6508D-04 -0.2186D-03 -0.5002D-04 0.4570D-04
0.1456D-03 0.2282D-06 -0.4273D-05 0.7167D-06
12 : -0.8661D-08 -0.3244D-06 0.1096D-06 -0.6879D-04 -0.2893D-03 -0.5706D-04 0.4759D-04
0.1518D-03 0.2492D-06 -0.4624D-05 0.7728D-06 0.8495D-06

13 : -0.8091D-08 -0.3027D-06 0.1001D-06 -0.8354D-04 -0.2605D-03 -0.4670D-04 0.4206D-04 0.1132D-03 0.2304D-06 -0.3768D-05 0.7117D-06 0.7777D-06 0.7307D-06
14 : 0.1348D-09 0.7337D-08 -0.6601D-09 0.1177D-04 -0.1974D-05 0.3218D-05 -0.5564D-05 -0.1479D-04 -0.9858D-08 0.2571D-05 -0.3176D-07 -0.3425D-07 -0.2481D-07 0.2520D-07
15 : -0.9356D-09 -0.3510D-07 0.1261D-07 -0.1089D-04 -0.1579D-04 -0.6267D-05 -0.3748D-05 -0.1976D-04 0.1083D-07 -0.1899D-05 0.3419D-07 0.3735D-07 0.3085D-07 -0.6339D-08 0.1445D-07
16 : -0.1214D-09 -0.5830D-08 0.7132D-08 -0.1098D-04 -0.4995D-04 0.6682D-05 -0.8517D-06 -0.5299D-05 -0.4490D-08 -0.1118D-05 -0.1082D-07 -0.1312D-07 -0.1539D-07 -0.1932D-08 0.1211D-08 0.1240D-07
17 : 0.6447D-09 0.2310D-07 -0.4075D-08 0.6068D-05 0.2383D-04 0.2065D-05 -0.1194D-04 0.9703D-05 -0.2727D-08 0.1747D-05 -0.9880D-08 -0.1241D-07 -0.6279D-08 0.6211D-08 -0.4186D-08 -0.1464D-08 0.1694D-07
18 : 0.1261D-10 -0.6875D-09 -0.1962D-07 -0.2017D-04 0.9830D-05 0.3231D-05 0.5192D-05 -0.1383D-04 0.6457D-08 -0.4696D-06 0.2297D-07 0.2181D-07 0.2006D-07 -0.4517D-08 0.4447D-08 0.1831D-08 -0.4245D-08 0.1786D-07
19 : 0.1246D-08 0.4422D-07 -0.7851D-08 -0.5471D-05 0.5386D-04 -0.1247D-05 -0.1317D-05 0.1053D-04 0.8947D-09 -0.4852D-06 0.1522D-08 0.1210D-08 0.8492D-10 -0.3855D-08 -0.3757D-09 -0.1204D-08 0.8314D-09 0.1254D-08 0.1704D-07
20 : 0.6917D-10 0.2043D-08 0.1847D-07 0.1648D-04 0.4903D-04 -0.1577D-04 0.4037D-05 -0.1011D-04 0.3675D-08 0.2737D-06 0.1302D-07 0.1158D-07 0.1231D-07 0.8012D-09 -0.4992D-09 0.3591D-09 -0.2734D-09 0.9173D-09 -0.1565D-08 0.1457D-07

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
21 : -0.2797D-06 -0.9694D-05 0.5306D-05 -0.3132D-02 0.1339D-01 0.2403D-02 -0.4583D-02 0.2722D-02 0.1797D-05 0.5844D-03 0.5524D-05 0.4609D-05 0.5274D-05 0.7141D-07 0.1153D-06 -0.1504D-07 0.2021D-05 -0.9309D-06 -0.4997D-06 0.1576D-06
22 : 0.1881D-05 0.6862D-04 -0.2647D-04 -0.5901D-02 0.1522D-01 0.2270D-01 -0.3097D-02 0.1218D-01 -0.6842D-05 -0.2001D-02 -0.2070D-04 -0.2128D-04 -0.2036D-04 -0.2590D-05 -0.2723D-06 0.1417D-05 -0.3171D-05 0.1137D-05 0.3662D-05 -0.2519D-05
23 : 0.5703D-08 0.2140D-06 -0.8005D-07 0.6427D-04 0.2181D-03 0.4632D-04 -0.3546D-04 -0.9389D-04 -0.1749D-06 0.2380D-05 -0.5413D-06 -0.5902D-06 -0.5441D-06 0.2712D-07 -0.2768D-07 0.9643D-08 0.7908D-08 -0.1575D-07 -0.8826D-09 -0.8148D-08
24 : 0.9959D-08 0.3721D-06 -0.1238D-06 0.8278D-04 0.3166D-03 0.7378D-04 -0.4842D-04 -0.1458D-03 -0.2788D-06 0.3769D-05 -0.8630D-06 -0.9434D-06 -0.8719D-06 0.3521D-07 -0.4153D-07 0.1664D-07 0.1044D-07 -0.2199D-07 -0.1125D-08 -0.1296D-07
25 : 0.1219D-07 0.4557D-06 -0.1520D-06 0.1052D-03 0.3869D-03 0.8666D-04 -0.6652D-04 -0.1832D-03 -0.3470D-06 0.5748D-05 -0.1074D-05 -0.1173D-05 -0.1086D-05 0.4579D-07 -0.5077D-07 0.2062D-07 0.1320D-07 -0.2943D-07 -0.1141D-08 -0.1706D-07
26 : 0.1012D-07 0.3781D-06 -0.1131D-06 0.7827D-04 0.2867D-03 0.6879D-04 -0.5231D-04 -0.1460D-03 -0.2704D-06 0.4133D-05 -0.8372D-06 -0.9147D-06 -0.8492D-06 0.2909D-07 -0.3633D-07 0.1808D-07 0.5820D-08 -0.2023D-07 0.7078D-09 -0.1608D-07
27 : 0.6724D-08 0.2508D-06 -0.8579D-07 0.5454D-04 0.1856D-03 0.4232D-04 -0.2448D-04 -0.9238D-04 -0.1741D-06 0.3120D-05 -0.5395D-06 -0.5880D-06 -0.5412D-06 0.2487D-07 -0.2760D-07 0.1016D-07 0.7521D-08 -0.1513D-07 -0.1626D-08 -0.9020D-08
28 : 0.1620D-07 0.6029D-06 -0.1855D-06 0.1186D-03 0.4299D-03 0.1007D-03 -0.5864D-04 -0.2170D-03 -0.4013D-06 0.4931D-05 -0.1245D-05 -0.1357D-05 -0.1255D-05 0.4757D-07 -0.5775D-07 0.2310D-07 0.1290D-07 -0.3337D-07 -0.1225D-08 -0.2277D-07
29 : 0.1839D-08 0.6889D-07 -0.1658D-07 0.1329D-04 0.7293D-04 0.2079D-04 -0.8850D-05 -0.2871D-04 -0.5177D-07 0.5196D-06 -0.1604D-06 -0.1747D-06 -0.1627D-06 0.4190D-08 -0.4957D-08 0.2885D-08 0.8112D-09 -0.1678D-08 0.1029D-08 -0.2577D-08

30 : 0.1466D-08 0.5446D-07 -0.1174D-07 -0.3134D-06 0.8165D-05 0.2452D-04 -0.1077D-04 -
0.7850D-05 -0.3763D-07 0.1439D-06 -0.1171D-06 -0.1273D-06 -0.1203D-06 -0.2035D-09 -0.1918D-
08 0.3659D-08 0.2742D-09 -0.4773D-09 0.4391D-08 -0.5337D-08
31 : -0.2638D-09 -0.7412D-08 -0.1327D-07 0.9333D-05 0.4667D-04 0.1082D-04 -0.7150D-05 -
0.3153D-04 -0.3546D-07 0.6664D-06 -0.1096D-06 -0.1187D-06 -0.1086D-06 0.7774D-08 -0.5857D-
08 0.6973D-09 0.2148D-08 -0.5676D-08 -0.1114D-08 -0.1624D-08
32 : 0.1028D-08 0.3916D-07 -0.1747D-07 0.1550D-04 0.3121D-04 0.8752D-05 -0.6277D-05 -
0.1506D-04 -0.2750D-07 0.2860D-05 -0.8665D-07 -0.9331D-07 -0.8471D-07 0.7168D-08 -0.5599D-
08 -0.7365D-09 0.1082D-08 -0.1544D-08 -0.2609D-08 0.7328D-09
33 : 0.1113D-08 0.4125D-07 -0.1984D-07 0.1976D-04 0.1336D-04 -0.7999D-06 -0.1216D-05 -
0.2495D-04 -0.2503D-07 0.8271D-06 -0.7830D-07 -0.8431D-07 -0.7885D-07 0.2906D-08 -0.1868D-
08 0.1080D-08 -0.9466D-10 0.9946D-10 -0.1804D-08 -0.1760D-08
34 : 0.6433D-09 0.2349D-07 -0.1671D-08 0.2102D-04 0.2238D-04 0.1112D-04 -0.5088D-05 -
0.5602D-05 -0.7727D-08 0.2171D-06 -0.2564D-07 -0.2515D-07 -0.2464D-07 0.2288D-09 -0.8165D-
09 -0.3996D-09 -0.8712D-09 -0.1839D-08 -0.1655D-08 -0.2913D-08
35 : 0.3704D-09 0.1404D-07 0.5987D-08 0.2983D-06 -0.8250D-05 0.7664D-05 -0.1890D-06
0.3168D-04 -0.1140D-07 -0.8341D-06 -0.3318D-07 -0.3617D-07 -0.3405D-07 0.1030D-08 -0.4799D-
08 0.2999D-09 0.1124D-08 -0.2564D-08 -0.1792D-08 0.2233D-08

21 22 23 24 25 26 27 28 29 30 31 32
33 34 35
21 : 0.3233D-02
22 : -0.1181D-02 0.1596D-01
23 : -0.4107D-05 0.1707D-04 0.4204D-06
24 : -0.6938D-05 0.2660D-04 0.6613D-06 0.1060D-05
25 : -0.8639D-05 0.3088D-04 0.8223D-06 0.1313D-05 0.1638D-05
26 : -0.7467D-05 0.2784D-04 0.6399D-06 0.1025D-05 0.1276D-05 0.1004D-05
27 : -0.4770D-05 0.1716D-04 0.4125D-06 0.6577D-06 0.8180D-06 0.6386D-06 0.4162D-06
28 : -0.1048D-04 0.4258D-04 0.9526D-06 0.1521D-05 0.1888D-05 0.1476D-05 0.9504D-06
0.2215D-05
29 : -0.2075D-05 0.6732D-05 0.1232D-06 0.1979D-06 0.2448D-06 0.1939D-06 0.1223D-06
0.2831D-06 0.4373D-07
30 : -0.1285D-05 0.7264D-05 0.8955D-07 0.1457D-06 0.1802D-06 0.1440D-06 0.8816D-07
0.2089D-06 0.2944D-07 0.3188D-07
31 : -0.9789D-06 0.1945D-05 0.8492D-07 0.1344D-06 0.1652D-06 0.1280D-06 0.8365D-07
0.1897D-06 0.2463D-07 0.1783D-07 0.2748D-07
32 : -0.1961D-06 0.2098D-05 0.6525D-07 0.1029D-06 0.1304D-06 0.9915D-07 0.6528D-07
0.1493D-06 0.1827D-07 0.1264D-07 0.1386D-07 0.2049D-07
33 : -0.1319D-05 0.3340D-05 0.5798D-07 0.9540D-07 0.1188D-06 0.9421D-07 0.5903D-07
0.1391D-06 0.1969D-07 0.1347D-07 0.9740D-08 0.1144D-07 0.1815D-07
34 : -0.6949D-06 0.2511D-05 0.1834D-07 0.2945D-07 0.3613D-07 0.3088D-07 0.1891D-07
0.4312D-07 0.6632D-08 0.6216D-08 0.4459D-08 0.2586D-08 0.3156D-08 0.1330D-07
35 : 0.1185D-07 -0.1479D-05 0.2795D-07 0.4208D-07 0.5176D-07 0.3765D-07 0.2711D-07
0.6279D-07 0.6406D-08 0.3653D-08 0.6327D-08 0.3257D-08 0.6118D-09 -0.2706D-08 0.1336D-
07

APPENDIX VI

Catch at age data used for simulations and Catch parameters

```
#
# Catch Data File Generated by VPA-2BOX GUI - Version 3.02
#
#  1st Year - Last Year
1975  2023
# 1st Age - Last Age - Plus Group
1  10  10
#
#   *** Zone 1 ***
#
# Number of Indices
12
# Spawntime
-1
# Maturity
0  0  0  0.5  1  1  1  1  1  1
# Zone Name
'East of 45'    0  0
# Catch At Age
1975	83784	352022	82482	24055	11863	7932	4665	3441	4480
54950
1976	17501	196886	239994	47505	18187	6492	3896	2187
2948	40376
1977	67420	276479	81061	45074	6677	4738	4363	2903	2778
36620
1978	98571	188169	132603	26750	8539	2569	2746	1850	1398
26717
1979	15968	46352	85484	47174	8803	3802	3158	4700	4051
22395
1980	153268	139588	111494	35392	11439	6346	3925	2495
2715	24603
1981	91413	320656	114393	16726	11334	6214	4537	4938
3506	18037
1982	435146	261565	174574	35996	8002	3990	5295	9037
4835	38429
1983	666700	196954	118435	27650	11539	5339	8741	6724
5468	38481
1984	162819	602874	80533	29876	18523	10029	5897	6546
10420	41447
1985	126331	327195	273250	52930	11441	7067	3014	2958
3329	31801
1986	605591	245280	110492	60475	10838	5638	3356	2173
3201	27826
1987	233815	425594	130379	35130	13521	7777	7936	4073
3661	23513
1988	787367	200806	221887	45198	12256	9116	10264	5612
5200	33542
1989	457214	409308	103865	51467	26166	5342	9140	6317
4674	24558
1990	436998	328718	195472	53837	37392	7450	6938	10362
12813	27930
1991	243244	401949	186084	52344	39257	7563	5140	6163
14736	43603
1992	229346	527897	280116	50401	19089	12662	13102	10683
12770	50171
```

1993	280527	748303	362086	64110	24965	13406	11620	9313	9358	44738
1994	304847	502294	171942	56713	40131	28248	27583	24303	23658	91143
1995	443084	322790	296579	65551	53670	39327	22103	17701	16646	85605
1996	444406	669904	312384	170612	50658	22396	18070	15305	17362	85496
1997	306609	474221	189334	107589	66458	42200	25467	27051	31144	74425
1998	345669	474502	285613	138652	45367	76858	9470	10785	13079	52631
1999	290410	272684	137390	91981	37213	13567	10306	11996	27670	55145
2000	889625	389997	195408	51453	56121	35131	12280	14041	14718	44863
2001	15982	469971	134430	90060	24959	20977	31157	21135	17744	68378
2002	59817	491266	206724	65445	31542	16089	10914	14936	17076	62174
2003	31034	198423	70574	34139	42902	23442	17278	14727	15451	77055
2004	158681	233924	152822	33095	12919	22189	27680	7756	14995	72743
2005	315743	419028	125613	59295	24776	18596	17314	14100	12307	82641
2006	228908	162488	255561	44959	11960	27029	10456	11129	37839	47308
2007	1510	96996	42050	139516	62706	25349	20195	13425	26398	73222
2008	755	63119	41758	67048	51597	27174	19392	16913	16230	44546
2009	1350	22619	20491	52868	24566	30804	33104	19219	10408	33310
2010	1350	22619	20491	52868	24566	30804	33104	19219	10408	33310
2011	4138	105125	39701	46206	3325	3438	5285	8951	7954	24372
2012	3954	90136	36666	44991	14528	1976	3487	3976	8529	25066
2013	3706	88052	32583	42548	14664	8980	2041	2705	3922	28258
2014	3572	84855	32934	38430	14078	9098	9572	1616	2753	27008
2015	3367	80876	31654	39230	13011	8875	9671	7446	1625	24609
2016	3087	76677	29974	37334	13095	8212	9202	7449	7445	21315
2017	2785	67016	26931	34188	11842	7790	8258	6966	7282	24267
2018	2557	61544	23521	30957	11261	7252	7989	6298	6867	26624
2019	2416	56673	22267	26995	10388	6986	7633	6170	6276	29168
2020	1970	54101	21047	26191	8932	6407	7399	5907	6183	30319

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2021	2261	44913	20328	24947	8758	5588	6798	5902	6089
31823
2022	1846	51129	16883	24464	8626	5574	5955	5410	6038
33302
2023	1752	42345	19288	20493	8543	5541	6024	4816	5594
33865
-1
# Index Specification
   1    1    1    4   -1    6    10  'ESP'
   2    0    1    1   -1    1     1  'ESP1'
   3    1    1    1   -1    2     2  'ESP2'
   4    1    1    1   -1    3     3  'ESP3'
   5    0    1    1   -1    4     4  'ESP4'
   6    0    1    1   -1    5     5  'ESP5'
   7    1    1    4   -1    6    10  'JJL'
   8    0    1    4   -1    6    10  'MAR'
   9    0    1    4   -1    6    10  'ESPT'
  10    1    2    4   -1    2     3  'ESPH'
  11    1    2    1   -1   10    10  'NOR'
  12    1    1    4    1    4    10  'JAP'
-1
# Index Data
1	1981	3145.86	58.40
1	1982	4151.93	33.70
1	1983	4402.08	33.70
1	1984	4854.68	33.70
1	1985	3288.16	33.71
1	1986	1556.12	27.05
1	1987	1713.63	27.04
1	1988	4026.80	27.02
1	1989	2091.12	25.09
1	1990	2433.10	22.46
1	1991	2871.90	21.50
1	1992	1256.65	22.48
1	1993	1233.91	21.53
1	1994	1370.23	22.48
1	1995	 888.94	22.50
1	1996	1598.01	22.47
1	1997	3754.01	22.45
1	1998	3950.27	22.44
1	1999	4463.56	22.44
1	2000	3411.81	21.50
1	2001	5907.80	21.49
1	2002	4240.52	21.50
1	2003	2417.06	22.49
1	2004	1319.61	21.53
1	2005	2598.59	21.51
1	2006	2456.74	21.51
1	2007	3690.98	21.50
1	2008	2455.05	21.51
1	2009	3330.17	21.50
2	1975	19.5	0.301722594
2	1976	1.38	0.365184884
2	1977	1.5	0.344893461
2	1978	22.96	0.311574386
2	1979	0.04	1.25247235
2	1980	12.14	0.431465087
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2	1981	50.51	0.367385406
2	1982	11.28	0.34197267
2	1983	93.97	0.315407628
2	1984	2.8	0.349590467
2	1985	9.6	0.331331843
2	1986	30.97	0.326149248
2	1987	16.38	0.314638074
2	1988	387.81	0.343953968
2	1989	194.33	0.300103539
2	1990	53.08	0.334979388
2	1991	55.19	0.326764189
2	1992	15.88	0.36882219
2	1993	7.61	0.365288759
2	1994	3.21	0.364660456
2	1995	85.55	0.29448168
2	1996	268	0.317598225
2	1997	120.19	0.321147241
2	1998	69.96	0.505632812
2	1999	8.94	0.703002896
2	2000	56.98	0.371009945
2	2001	4.9	0.388045946
2	2002	0.76	0.348518084
2	2003	1.58	0.810532296
2	2004	73.11	0.477242551
2	2005	114.28	0.315662258
2	2006	7.94	0.406263903
3	1975	213.72	0.301546579
3	1976	146.32	0.360598645
3	1977	215.13	0.307760327
3	1978	75.11	0.310675409
3	1979	34.67	0.379178632
3	1980	69.41	0.418049219
3	1981	94.95	0.367013077
3	1982	128.09	0.338809229
3	1983	118.83	0.315281148
3	1984	485.62	0.348214302
3	1985	382.16	0.311419959
3	1986	87.36	0.323541413
3	1987	420.3	0.312510669
3	1988	51.8	0.322736952
3	1989	488.14	0.294750089
3	1990	108.78	0.317756717
3	1991	171.11	0.317696352
3	1992	254.59	0.329302453
3	1993	432.27	0.339253135
3	1994	34.84	0.296863934
3	1995	194.75	0.28862487
3	1996	167.51	0.310364124
3	1997	127.41	0.303781796
3	1998	63.56	0.31546185
3	1999	3.37	0.469828669
3	2000	44.4	0.332947754
3	2001	336.76	0.377874453
3	2002	359.87	0.334212009
3	2003	83.22	0.494185012
3	2004	87.65	0.332476785
3	2005	134.47	0.305683586

3	2006	104.88	0.382252328
3	2007	23.12	0.381109846
4	1975	48.74	0.304951812
4	1976	63.04	0.360037507
4	1977	100.63	0.307734828
4	1978	14.67	0.322941781
4	1979	71.91	0.380889422
4	1980	27.2	0.417884852
4	1981	5.47	0.367116689
4	1982	42.67	0.343923563
4	1983	14.6	0.34198715
4	1984	126.38	0.348054653
4	1985	110.43	0.309249876
4	1986	24.32	0.323267578
4	1987	10.8	0.367273094
4	1988	6.97	0.378027896
4	1989	8.26	0.317627669
4	1990	40.68	0.33167214
4	1991	23.88	0.324809227
4	1992	12.04	0.333637636
4	1993	185.98	0.338303902
4	1994	44.93	0.296386805
4	1995	63.03	0.291702924
4	1996	129.24	0.326458839
4	1997	196.79	0.297906942
4	1998	50.1	0.316448645
4	1999	13.21	0.38140172
4	2000	34.65	0.416074924
4	2001	64.42	0.404416745
4	2002	153.96	0.35254892
4	2003	12.73	0.535833658
4	2004	10.71	0.439504871
4	2005	64.34	0.347719067
4	2006	12.37	0.374943728
4	2007	36.62	0.366547024
5	1975	20.09	0.335741467
5	1976	10.69	0.368712439
5	1977	22.53	0.307766312
5	1978	23.86	0.370962315
5	1979	92.94	0.378494799
5	1980	16.92	0.433151742
5	1981	1.53	0.519057291
5	1982	11.82	0.353960747
5	1983	1.95	0.444482303
5	1984	20.2	0.348586817
5	1985	1.68	0.422643342
5	1986	9.77	0.35137688
5	1987	6.7	0.420922764
5	1988	1.54	0.4239247
5	1989	0.98	0.503858369
5	1990	6.79	0.351981141
5	1991	7.07	0.450864314
5	1992	3.2	0.613143493
5	1993	65.4	0.360758536
5	1994	11.84	0.298735289
5	1995	1.76	0.333464861
5	1996	62.5	0.372333207

5	1997	17.48	0.300583038
5	1998	63.89	0.338114789
5	1999	32.77	0.405526291
5	2000	23.05	0.414452339
5	2001	11.23	0.461746952
5	2002	3.88	0.460948587
5	2003	10.39	0.458766715
5	2004	4.66	0.396282583
5	2005	3.94	0.388732748
5	2006	2.78	0.415291665
5	2007	27.18	0.367502841
6	1975	0.53	0.384776339
6	1976	3.75	0.548137977
6	1977	1.57	0.432798359
6	1978	12.23	0.472536592
6	1979	26.14	0.378084175
6	1980	32.38	0.499242475
6	1981	0.76	0.760703277
6	1982	5.22	0.535238411
6	1983	0.25	1.024165614
6	1984	0.04	0.42347686
6	1985	0.44	0.708761378
6	1986	3.23	0.502939281
6	1987	4.62	0.491575833
6	1988	2.2	0.631778314
6	1989	0.58	0.63012023
6	1990	1.97	0.544944973
6	1991	0.84	0.49620187
6	1992	0.76	0.65554142
6	1993	6.91	0.454429916
6	1994	0.27	0.364135559
6	1995	0.25	0.686165342
6	1996	11.18	0.414936708
6	1997	4.32	0.388901329
6	1998	5.47	0.380051713
6	1999	78.48	0.418535061
6	2000	20.21	0.456536854
6	2001	4.02	0.574817634
6	2002	0.98	0.642494448
6	2003	7.07	0.598785363
6	2004	8.71	0.420866061
6	2005	5.12	0.475891393
6	2006	4.45	0.47311446
6	2007	12.72	0.39239124
7	1975	1.90	0.15
7	1976	2.15	0.12
7	1977	3.53	0.14
7	1978	1.50	0.15
7	1979	2.70	0.14
7	1980	1.69	0.16
7	1981	1.63	0.17
7	1982	3.32	0.13
7	1983	2.12	0.13
7	1984	1.62	0.12
7	1985	1.75	0.15
7	1986	1.32	0.14
7	1987	2.16	0.13

7	1988	1.35	0.14
7	1989	1.05	0.16
7	1990	1.41	0.14
7	1991	1.21	0.13
7	1992	1.03	0.14
7	1993	1.04	0.14
7	1994	1.12	0.16
7	1995	1.42	0.15
7	1996	0.50	0.22
7	1997	0.53	0.21
7	1998	0.71	0.17
7	1999	0.64	0.22
7	2000	0.74	0.20
7	2001	0.96	0.17
7	2002	2.05	0.15
7	2003	1.70	0.13
7	2004	0.82	0.18
7	2005	0.88	0.15
7	2006	1.91	0.15
7	2007	0.94	0.19
7	2008	1.22	0.17
7	2009	1.04	0.24
8	1986	680	0.667
8	1987	516	0.6673
8	1988	1291	0.6665
8	1989	423.1	0.4847
8	1990	143.23	0.3327
8	1991	720.66	0.3314
8	1992	116.96	0.3634
8	1993	149.15	0.3326
8	1994	197.16	0.3625
8	1995	109.19	0.3636
8	1996	243.21	0.362
8	1997	450.05	0.3615
8	1998	831.88	0.3612
8	1999	538.75	0.3614
8	2000	746.1	0.3314
8	2001	1799.85	0.3312
8	2002	1069.61	0.3313
8	2003	633.82	0.3314
8	2004	259.41	0.332
8	2005	726.22	0.3314
8	2006	524.38	0.3315
9	1981	3131.286	0.304313
9	1982	4136.253	0.175392
9	1983	4381.475	0.175374
9	1984	4829.583	0.175346
9	1985	3271.688	0.175478
9	1986	1160.605	0.155471
9	1987	1543.459	0.155237
9	1988	3533.468	0.154835
9	1989	1885.369	0.155108
9	1990	3891.184	0.154806
9	1991	2062.447	0.155057
9	1992	1879.304	0.155109
9	1993	1766.584	0.155147
9	1994	1676.375	0.15518

9	1995	1207.677	0.155435
9	1996	1853.754	0.155117
9	1997	4983.419	0.154744
9	1998	3406.71	0.154847
9	1999	6041.51	0.154705
9	2000	2723.359	0.154928
9	2001	2186.156	0.155027
9	2002	3092.75	0.15488
9	2003	1374.193	0.17604
9	2004	1364.778	0.15533
9	2005	1616.453	0.155205
9	2006	2167.122	0.155032
11	1975	38	1
11	1976	21.16	1
11	1977	42.44444444	1
11	1978	12.27777778	1
11	1979	3.75	1
11	1980	20.14285714	1
12	1990	0.35	0.32
12	1991	0.44	0.27
12	1992	0.77	0.16
12	1993	0.75	0.14
12	1994	0.90	0.16
12	1995	0.95	0.13
12	1996	2.53	0.13
12	1997	1.62	0.13
12	1998	0.85	0.16
12	1999	1.19	0.15
12	2000	1.22	0.12
12	2001	1.44	0.12
12	2002	1.11	0.13
12	2003	1.14	0.14
12	2004	1.03	0.12
12	2005	0.74	0.11
12	2006	0.87	0.11
12	2007	0.89	0.11
12	2008	1.06	0.12
12	2009	1.54	0.11
12	2010	1.6	0.11
12	2011	1.632	.11
12	2012	1.72992	.11
12	2013	1.8337152	.11
12	2014	1.943738112	.11
12	2015	2.060362399	.11
12	2016	2.183984143	.11
12	2017	2.315023191	.11
12	2018	2.453924583	.11
12	2019	2.601160058	.11
12	2020	2.757229661	.11
12	2021	2.75	.11
12	2022	2.76	.11
12	2023	2.76	.11

-1

Index Vulnerability

1	1975	15	37	0	0	8	0	0	15	55	1932
1	1976	0	0	0	0	0	0	0	15	17	2096
1	1977	8	19	0	0	4	0	64	117	152	2463

1	1978	0	0	0	0	0	10	34	167	195	1790
1	1979	0	0	0	0	81	176	226	343	556	2337
1	1980	232	0	0	0	39	126	483	270	254	2814
1	1981	0	0	0	0	174	831	1271	1713	570	2401
1	1982	0	0	0	3	162	565	2069	2044	2170	8323
1	1983	0	0	0	0	1	2	2	291	529	9209
1	1984	0	0	0	84	139	177	616	1231	3140	11774
1	1985	0	0	70	481	263	651	537	541	720	7958
1	1986	2476	12363	595	0	0	48	171	139	229	4871
1	1987	0	3	0	0	10	125	317	290	447	5586
1	1988	186	39	59	59	188	859	990	819	745	11631
1	1989	236	0	2	31	253	1062	1684	1912	1419	6159
1	1990	0	0	0	40	706	1527	3371	5075	6426	8741
1	1991	352	2259	4194	1641	1774	2361	1113	1446	2340	7068
1	1992	31	146	77	78	316	984	2022	1482	1434	5296
1	1993	8	27	21	9	25	99	164	420	894	7016
1	1994	3178	0	25	76	1740	2947	1606	795	802	7259
1	1995	0	0	2	7	98	42	89	279	1080	5179
1	1996	0	0	5	108	273	235	258	287	664	7287
1	1997	0	0	30	465	2092	2347	1491	2390	2607	15078
1	1998	0	0	2	42	298	1072	1490	1755	2953	12081
1	1999	0	0	9	30	104	496	659	1198	1310	12132
1	2000	0	0	0	72	602	649	1225	2382	2904	11961
1	2001	0	0	0	449	1180	1624	1987	3159	4414	14184
1	2002	0	0	0	6	77	201	599	1711	2364	13815
1	2003	0	0	0	5	255	564	654	1576	3363	7289
1	2004	0	0	0	0	62	164	182	451	1700	8912
1	2005	0	0	13	3	60	252	668	1340	1438	10953
1	2006	0	0	0	131	434	2054	2259	2779	1884	8298
1	2007	0	0	0	216	713	3336	3341	3616	2449	9845

1	2008	0	0	1	2	73	147	362	1046	2477	13275
1	2009	0	0	0	24	461	653	629	1520	2295	12506
7	1975	0	44.4	32.1	138.9	89.2	131.4	142	305.6	398	14833
7	1976	1.8	14.2	16.7	62.9	259.7	232.9	203.8	213.9	232.3	9119.8
7	1977	0	16.2	31.7	38.9	33	181.8	388.2	975	1536.4	6270.2
7	1978	0	0	12.4	62	142.6	155	65.2	49.6	21.4	1730.6
7	1979	0	0	29.2	57.3	70.7	876.8	855.6	2072.4	1282.1	339.3
7	1980	0	0.2	70.3	38.4	82.9	146.2	258.6	485.7	504	2294.3
7	1981	1	3	7	3.5	11.5	56	137	388	325	1674
7	1982	0	0	4.4	37	14	57.1	398.2	4257.7	37	10954.2
7	1983	0	29	161	284	886.5	1123.5	1717	2101	1664.5	9448.5
7	1984	0	0	20	134	284.5	494.5	784	1677.5	3055	5657.5
7	1985	8.5	48	101	116	290.5	313.5	485	437.5	406	5478.5
7	1986	0	9.2	27.2	83.1	231.4	233.9	232.8	320.2	397.4	3989
7	1987	0	0	15.6	22.8	67.8	200.4	529.4	466.4	562.9	4048.7
7	1988	0	7.2	19.2	80.4	76.7	245.3	574.8	861.4	771.9	3997.5
7	1989	0	0	20.8	63.6	73.9	115.7	184.4	294.7	475.9	2524.4
7	1990	0	4.6	4.1	24.4	111.3	344.8	495.8	827.4	952.6	3139.8
7	1991	8.6	0	8.6	0	8.6	21.1	360.1	971.7	1984.9	3726.4
7	1992	0	0	35.8	111.4	58.4	204.8	136.2	421.5	1113.6	8467.7
7	1993	0	23	11.5	0	0	30.1	32.3	100.4	524.4	7293.2
7	1994	0	0	66.6	310	81.5	116.3	546.6	553.8	539.5	5076.8
7	1995	0	0	0	293.6	255.5	306.4	515.7	606.4	824.4	10661.2
7	1996	0	0	30.8	61.8	205.3	209.7	138.1	254.3	260.9	5026.2
7	1997	0	0	0	0	32.18	0	96.44	368.97	803.84	2782.95
7	1998	0	0	7	22.2	29	78.7	14.4	14	206.9	5139.5
7	1999	0	0	0	0	0	0	0	532.7	927.6	2725.2
7	2000	0	0	16.2	341.2	171.4	104.7	0	33.9	162.5	1005.5
7	2001	0	0.56	1.82	98.25	107.37	1604.33	2383.91	4478.39	1796.86	1924.76

7	2002	0	0	23.7	0	23.7	63.1	564.3	223.3	165.6	1198
7	2003	0	0	46.8	158.3	4.8	74.2	168	72.9	236.6	2097.5
7	2004	0	0	35.3	14.9	96.5	97.6	219.7	119.8	267.9	2990.6
7	2005	0	0	0	0	0	0	34.94	134.36	321.26	5841.16
7	2006	0	0	26.88	4.64	0	31.52	346.64	441.22	557.97	1521.97
7	2007	0	69.63	505.69	366.44	75.73	6.11	233.43	760.4	664.63	2711.81
7	2008	0	0	0	21.72	55.55	22.96	66.4	119.5	203.81	2565.17
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1987 5.169671991 10.69691622 18.7842877 35.24457623 53.25654014 72.3255438
96.80229042 118.5800965 144.4794527 237.7962962
1988 4.879236947 10.93253837 20.34509406 35.94833832 53.44336485 75.05225905
97.48246509 119.7405856 145.9503118 240.0959242
1989 5.368883546 10.71486271 21.51416168 33.10146714 45.35298827 73.83069294
97.86710207 116.7034421 144.5465923 255.1091459
1990 4.548624972 10.06599814 18.12982545 32.93583972 52.22108001 72.00975096
95.42016396 117.7320878 145.0023617 226.2441345
1991 4.954666558 10.42707653 19.06780543 33.74107075 54.43349387 73.27369824
95.56298828 118.9988577 146.1548535 214.2932013
1992 4.775494781 11.09427118 19.47004992 32.53201428 57.96686987 78.63418923
102.4657501 122.7226926 146.2967385 216.7682154
1993 4.571158046 10.21923039 17.64503018 34.15121339 54.12603393 72.70167
93.15228851 116.4423212 143.2689179 239.8727074
1994 5.82181453 10.07023688 20.6501471 35.25400537 53.06823362 71.61649777
93.14720725 118.755683 148.4213229 230.8334329
1995 5.242707669 11.7655284 19.06778646 32.93392942 54.83896043 72.12844731
94.24246949 120.0547923 145.0614585 243.3887441
1996 4.918472241 9.396248024 18.88063411 32.38359366 50.58203882 72.54799737
95.75396956 121.4964346 147.5257377 240.5401598
1997 4.940700617 11.35392343 20.29426545 34.27897207 52.31030464 71.82051493
94.51473886 119.8458041 146.6218931 220.6145647
1998 4.668477895 10.12175481 18.22518761 33.79584746 50.4764863 69.60554671
93.52993563 120.5987555 146.2134953 224.936234
1999 5.673689093 11.04442874 22.44002012 34.47452794 52.4326685 72.5886693
96.92809251 120.2852089 155.2824576 222.6537184
2000 4.10148992 10.81089962 17.80813151 36.47432003 54.16630789 72.72439063
96.34723343 120.3894307 143.3268297 222.5262338
2001 6.376125086 9.443725233 20.14890658 30.59692952 51.87015895 74.76908554
95.53873424 119.3906448 142.3309094 204.868165
2002 5.786106324 11.04185911 19.18265485 32.85790141 54.11991936 74.01638439
98.22885205 120.9626448 144.9958538 219.9206051
2003 6.16321871 10.49259701 20.03512441 35.53107646 55.50633485 75.77367425
96.46465761 123.79166 144.8378101 214.9564757
2004 6.337506417 10.71888573 18.88894759 33.95756804 50.79347189 76.78983801
96.55691729 119.0495427 149.1392103 215.2929784
2005 6.416237612 11.47535127 17.09113749 30.65364574 54.17648338 77.79007011
98.7457164 118.286677 149.3882884 200.9193016
2006 6.942113004 10.28073154 18.03993859 31.92481626 50.95424881 71.85431926
94.23180577 117.2096875 145.7999131 213.6357546

2007 2.942670496 10.68324966 23.81974706 32.51360201 51.50071591 70.33791862
95.24807043 116.5792406 145.7955898 214.6264797
2008 6.68941587 10.8654977 20.31012986 34.595139 51.88870395 70.48552104
94.81452822 121.7847599 146.1491009 232.8143377
2009 5.025823036 12.38107107 21.78789033 37.1293659 51.28982671 78.11288673
93.88095453 124.8887365 145.5458535 214.2656634
2010 4.940700617 11.35392343 20.29426545 34.27897207 52.31030464 71.82051493
94.51473886 119.8458041 146.6218931 220.6145647
2011 4.940700617 11.35392343 20.29426545 34.27897207 52.31030464 71.82051493
94.51473886 119.8458041 146.6218931 220.6145647
2012 4.668477895 10.12175481 18.22518761 33.79584746 50.4764863 69.60554671
93.52993563 120.5987555 146.2134953 224.936234
2013 5.673689093 11.04442874 22.44002012 34.47452794 52.4326685 72.5886693
96.92809251 120.2852089 155.2824576 222.6537184
2014 4.10148992 10.81089962 17.80813151 36.47432003 54.16630789 72.72439063
96.34723343 120.3894307 143.3268297 222.5262338
2015 6.376125086 9.443725233 20.14890658 30.59692952 51.87015895 74.76908554
95.53873424 119.3906448 142.3309094 204.868165
2016 5.786106324 11.04185911 19.18265485 32.85790141 54.11991936 74.01638439
98.22885205 120.9626448 144.9958538 219.9206051
2017 6.16321871 10.49259701 20.03512441 35.53107646 55.50633485 75.77367425
96.46465761 123.79166 144.8378101 214.9564757
2018 6.337506417 10.71888573 18.88894759 33.95756804 50.79347189 76.78983801
96.55691729 119.0495427 149.1392103 215.2929784
2019 6.416237612 11.47535127 17.09113749 30.65364574 54.17648338 77.79007011
98.7457164 118.286677 149.3882884 200.9193016
2020 6.942113004 10.28073154 18.03993859 31.92481626 50.95424881 71.85431926
94.23180577 117.2096875 145.7999131 213.6357546
2021 2.942670496 10.68324966 23.81974706 32.51360201 51.50071591 70.33791862
95.24807043 116.5792406 145.7955898 214.6264797
2022 6.68941587 10.8654977 20.31012986 34.595139 51.88870395 70.48552104
94.81452822 121.7847599 146.1491009 232.8143377
2023 5.025823036 12.38107107 21.78789033 37.1293659 51.28982671 78.11288673
93.88095453 124.8887365 145.5458535 214.2656634
-1
@
#
Parameter Data File Generated by VPA-2BOX GUI - Version 3.02
#
#
*** Zone 1 ***
#
Terminal Year Parameters
0.0000D 0.000817422 .5000D+01 1 0.4000D+01
0.0000D 0.032660237 .5000D+01 1 0.4000D+01
0.0000D 0.017102507 .5000D+01 1 0.4000D+01
0.0000D 0.028365853 .5000D+01 1 0.3000D+01
0.0000D 0.013389163 .5000D+01 1 0.3000D+01
0.0000D 0.011824117 .5000D+01 1 0.1000D+00
0.0000D 0.01671592 .3000D+01 1 0.6000D+01
0.0000D 0.017104837 .5000D+01 1 0.1000D+00
0.0000D 0.021938556 .3000D+01 1 0.8000D+01
F-Ratio Parameters
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0.1000D+00 0.1000D+01 0.5000D+01 0 0.2000D+00
0.1000D+00 0.1000D+01 0.5000D+01 0 0.2000D+00
0.1000D+00 0.1000D+01 0.5000D+01 0 0.2000D+00

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 0.1000D+00   0.1000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00  0.06000D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
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 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
 0.1000D+00   0.1200D+01   0.5000D+01         0   0.2000D+00
# Natural Mortality Parameters
 0.0000D+00   0.4900D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.2400D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.2400D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.2400D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.2400D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.2000D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.1750D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.1500D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.1250D+00   0.1000D+01         0   0.1000D+00
 0.0000D+00   0.1000D+00   0.1000D+01         0   0.1000D+00
# Mixing Parameters
```

```
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
 0.0000D+00   0.0000D+00   0.1000D+01          0   0.1000D+00
# Stock Recruitment Parameters
 0.0000D+00   0.2507D+06   0.1000D+21          0   0.4000D+00
 0.0000D+00   0.1660D+05   0.1000D+21          0   0.0000D+00
 0.0000D+00   0.1580D+00   0.9000D+00          0   0.0000D+00
 0.0000D+00   0.1000D+01   0.2000D+01          0   0.0000D+00
 0.0000D+00   0.1000D+01   0.2000D+01          0   0.0000D+00
# Variance Scaling Parameters
 0.0000D+00   0.1000D+01   0.1000D+21          1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
 0.0000D+00   0.1000D+01   0.1000D+21       -0.1   0.4000D+00
# Tag Misapplication Parameters
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
      0     0.8     1     0     0.1
# Tag Shedding/Fouling Parameters
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
      0     0.26     1     2     0.1
# Tag Reporting Parameters
      0     0.2331     1     1       0.1
      0     0.2331     1     -0.1    0.1
      0     0.2331     1     -0.1    0.1
      0     0.2331     1     -0.1    0.1
      0     0.2331     1     -0.1    0.1
```

0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
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0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
0	0.2331	1	-0.1	0.1
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0	0.2331	1	-0.1	0.1
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0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1
0	0.2	1	2	0.1

Tag Pre-Mix Year 1 Parameters

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