



33rd Conference of the
European Cetacean Society

Marine mammal research and conservation effort - Are we on the right path?

33

5th to 7th April 2022
Ashdod, Israel



Acknowledgements

Hosted By

The 33rd ECS Conference, Ashdod, Israel is hosted by the **University of Haifa**, the largest research university in northern Israel, and the most pluralistic institution of higher education in the country. Founded in 1963, the University of Haifa has gained an international reputation in a variety of fields, where marine science is one of the most prominent.

The **Leon H. Charney School of Marine Sciences (CSMS)** is a unique initiative on a global scale, applying an interdisciplinary approach with highly professional standards. The largest academic center of marine sciences in Israel, CSMS (Uni of Haifa) was the only Israeli program included by the 2020 Shanghai Academic Ranking of World Universities for Oceanography in the top 200 universities worldwide. The Charney School of Marine Sciences was chosen by the State of Israel to lead the **Mediterranean Sea Research Center of Israel (MERC)**, a consortium of seven universities, two colleges and two governmental research institutes, working together under the leadership of the University of Haifa. MERC addresses the array of scientific, technological, economic, security and environmental challenges and opportunities we are facing within the Mediterranean and along Israel's coastline.

The **Morris Kahn Marine Research Station** at Sdot-Yam and Ashdod are CSMS facilities, conducting long-term marine ecological research that focus on coastal water research and long-term monitoring of the ecology and species of the coastal Mediterranean, as well as examining the anthropogenic impacts on the marine environment and on apex predator distribution (including dolphins, sharks, rays, and tunas).

The station is working in collaboration with **Delphis**, a non-profit organization, established by researchers, environmental activists and volunteers, who are at the forefront of activities for marine mammals' conservation in Israel. Delphis' flagship facility is the unique educational '**Dolphin & Sea Center**', established in 2016 at ORT Ashdod Naval Officers School complex. Delphis aims to pave the way for the next generation of marine mammal researchers, conservationists and policymakers, and to emphasize the importance of advancing legislation for marine mammals - both nationally and internationally.

The dolphin & Sea center was established in Ashdod for a reason: The city of Ashdod advocates achievements, values, equality and excellence in its educational system and encourage curricula that deal with the marine environment.

Acknowledgements

Collaborators and Sponsors



Table of Contents

005	Acknowledgments
006	Keynote Speakers
009	Conference Programme
009	Workshops
010	Tuesday 5/4/22
014	Wednesday 6/4/22
019	Thursday 7/4/22
021	Keynote Speaker Abstracts
025	Oral Abstracts
026	Tuesday 5/4/22
042	Wednesday 6/4/22
059	Thursday 7/4/22
068	Short Talks
069	Tuesday 5/4/22
084	Wednesday 6/4/22
108	Thursday 7/4/22
113	Poster Session Abstracts
114	Tuesday 5/4/22 (001-027)
140	Wednesday 6/4/22 (028-054)
167	Thursday 7/4/22 (055-082)



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Conference Theme

The development of marine mammal research goes a long way back, but... are we headed in the right direction? Have we succeeded in our efforts to protect endangered species, biodiversity, and marine mammal habitats while maintaining the ethical treatment of animals?

In the upcoming ECS conference, we propose to challenge the conventional approach to marine mammal science and raise critical questions on the past, present, and future to ensure that the shared goal - marine mammal conservation - is, indeed, being aptly pursued.



Keynote Speakers



Dr. Mia Roditi-Elasar has been studying the resident marine mammals along the Israeli coasts for the past 30 years, focusing on their ecology and ecotoxicology. She is a research fellow at the Leon Recanati Institute for Maritime Studies, the Leon Charney School for Marine sciences of the University of Haifa and a co-founder of 'Delphis' association. Currently coordinating mortality and pollutants data collection from stranded & by-caught cetaceans and conducting photo-ID surveys on the northern dolphin populations off the Israeli Mediterranean coast. Lately, leading the IUCN's 'Monk seal protection in the Eastern Mediterranean' project in Israel. Her keynote speech will summarize the information collected from the southeastern Mediterranean coast and will address its contribution, or lack thereof, to regional marine mammals' conservation.



Keynote Speakers



Peter T. Madsen is the director of the marine bioacoustics lab at Aarhus University where he leads a group of about 20 students and post docs. He is a sensory physiologist with a research focus on how marine mammals use sound to communicate, navigate and forage under natural and disturbed conditions. In particular, he is very interested in understanding how echolocating toothed whales use their active sensory system to find and capture prey, and how that process is affected by anthropogenic noise. He is also using biologging technology to understand how marine mammals spend and acquire energy in the wild, and how this energy balance may be offset in the Anthropocene oceans with implications for their fitness. He strives to do hypothesis-driven research in a biophysical framework to allow for quantification of marine mammal performance and ecophysiology to inform future management and enable mitigation of human encroachment in the marine environment.

www.marinebioacoustics.com

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Keynote Speakers



Prof. Ursula Siebert studied veterinary medicine at the Justus-Liebig-University Giessen (JLU) (Germany) and the Ecole National Vétérinaire de Nantes (France). She conducted her PhD in Ecotoxicology at the Free University of Brussels (Belgium) and the JLU and specializes in pathology and aquaculture. She was leader for the research group for marine mammals and sea birds at the Research and Technology Center Westcoast, Christian-Albrechts-University (CAU) of Kiel (Germany) and worked for many years as a consultant veterinarian, responsible for harbour porpoises and seals at the Fjord&Bælt (Denmark). She habilitated in the field of zoology on anthropogenic effects on marine mammals at the CAU. Since 2011 she is the director and professor of the newly founded Institute for Terrestrial and Aquatic Wildlife Research (ITAW) at the University of Veterinary Medicine which has reached 60-80 team members today. The work of the ITAW is characterized by interdisciplinary and international research. Third party funded projects with a volume of 35 million Euros have been raised over the last years. She is Diplomate of the European College of Zoological Medicine - Wildlife Population Health and Diplomate of the European College of Aquatic Animal Health and is an honorary professor at the Aarhus University Denmark since 2014. She has published more than 325 peer-reviewed scientific papers. Teaching at the university and training of the next generation scientists and wildlife specialists is very important to her and she supervised more than 65 national and international PhDs/dissertations. Dissemination and outreach of the research results to the public and especially schools have become a matter of the heart to her.



Conference Programme

Monday, April 4th / Central European Summer Time

Workshops

- | | |
|--------------------|--|
| 14:00-17:00 | Communicate your findings to the general public for early-career scientists |
| 09:00-13:00 | Long Term Ecological data series in cetaceans: essential but challenging! |
| 13:00-20:00 | Arts as a tool for communicating marine mammal science to the general public 8.2 |

Conference Programme

Tuesday, April 5th / Central European Summer Time

09:00-09:30

Opening Ceremony

Chairperson: ECS Chair, Joan Gonzalvo

Opening keynote lectures

Chairperson: Aviad Scheinin

09:30-10:15

Keynote lecture:

Marine mammals' conservation in the Eastern Mediterranean - Are we on the right path?

Dr. Mia Roditi-Elasar

10:15-10:30

Are we on the right path? A plea for mindful conservation

Fabian Ritter

Conservation status of single species' populations

Chairperson: Aviad Scheinin

10:30-10:45

Forty years of killer whale research in Iceland: the importance of long-term studies

Filipa Samarra

10:45-11:00

Challenges and perspectives in the conservation of the Indo-Pacific humpback dolphin (*Sousa chinensis*) in the northern South China Sea

Agathe Serres

11:00-11:30

Coffee break

Threats I - contamination & climate change

Chairperson: Frank Zanderink

11:30-11:45

Xenobiotic exposure and environmental stress associated cellular and molecular alterations in the skin of the Mediterranean fin whale (*Balaenoptera physalus*)

Anna Laura Mancía

11:45-12:00

First ecotoxicological insights from the critically endangered population of Mediterranean monk seals, *Monachus monachus*, from Madeira Archipelago (NE Atlantic)

Ashlie McIvor

12:00-12:15

You are what you eat: contaminant variability in New Zealand killer whales (*Orcinus orca*)

Karen Stockin



Conference Programme

Tuesday, April 5th / Central European Summer Time

(Continued)

Threats I - contamination & climate change (Continued)

Chairperson: Frank Zanderink

12:15-12:30

The Plastic Busters MPAs project: new methodology to detect the impact of microplastics and related plastic additives in cetaceans of the SPAMI Pelagos Sanctuary

Maria Cristina Fossi

12:30-12:45

On the rise: climate change will cause New Zealand indicator species to seek higher latitudes

Katharina J Peters

12:45-13:00

Clash on the high-seas: the rise and fall of deep-diving cetaceans in an oceanic environment

Marc Fernandez

13:00-14:00

Lunch break

14:00-14:30

Poster session: 001-027

14:30-15:25

Short talks - Threats II

Chairperson: Danny Morick

- **Stay behind, not high above - underwater noise levels of three drones measured at various horizontal and verticals distances**
Amelie Laute
- **Toxicological assessment of persistent organic pollutants (POPs) in Risso's dolphin (*Grampus griseus*)**
Lorenzo Minoia
- **Estimating the population size of *Tursiops truncatus* using signature whistles in a hotspot of summer tourism**
Margalida Cerdà
- **Assessment of bycatch level for the Black Sea harbour porpoise in the light of new data on population abundance**
Dimitar Popov
- **SARS-CoV-2 in marine mammals: survey results on the potential viral susceptibility in cetaceans stranded along the Italian coastline**
Tania Audino



Conference Programme

Tuesday, April 5th / Central European Summer Time

14:30-15:25
(Continued)

Short talks - Threats II (Continued)

Chairperson: Danny Morick

- **The application of area/time thresholds to manage noise impacts in UK harbour porpoise SACs**
Ophélie Humphrey
- **Is haul-out behaviour of harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) influenced by tourist activities?**
Emilie Stepien
- **The inner Ionian Sea archipelago: a stronghold for the Mediterranean monk seal in urgent need of conservation action**
Joan Gonzalvo
- **Determining which regions of European waters exhibit the highest risk for harbour porpoise from marine pollutants**
Matthew Saunders
- **Heavy metal concentrations in Grey Seals from the Southern Baltic Sea during population recovery**
Léon Rostock
- **Combining onsite conservation efforts and research: a team dedicated to promoting best dolphin-watching practices while studying its impacts on spinner dolphins (*Stenella longirostris*) in Reunion Island, Western Indian Ocean**
Anne Emmanuelle Landes

15:25-15:40

Short talks - Miscellaneous

Chairperson: Danny Morick

- **Is the Red Sea northern Gulf of Eilat a hotspot for solitary-social dolphins? Case studies of 5 individuals over the last three decades**
Oz Goffman
- **Legislative feasibility of unoccupied aerial vehicle usage for environmental surveys in the ACCOBAMS region**
Ori Galili
- **First documented alive stranding of a *Steno bredanensis* in Salamina Island, Aegean Sea, Greece**
Anastasia Komnenou



Conference Programme

Tuesday, April 5th / Central European Summer Time

Threats III - Bycatch

Chairperson: Daphna Feingold

- | | |
|-------------|---|
| 15:40-15:55 | <p>Mapping risk of bycatch for cetacean species regularly occurring in North-west Europe
Peter Evans</p> |
| 15:55-16:10 | <p>Testing deterrent devices to reduce depredation and bycatch of cetaceans in Southern Portuguese coastal fisheries
Ana Marçalo</p> |
| 16:10-16:25 | <p>Multi-tiers diagnostic framework for cetacean-fishery interaction assessment on stranded cetaceans
Guido Pietroluongo</p> |
| 16:25-16:55 | Coffee break |

Threats IV - Miscellaneous

Chairperson: Daphna Feingold

- | | |
|-------------|--|
| 16:55-17:10 | <p>The anthropause in Sarasota Bay, Florida: comparing the marine soundscape before and during the COVID-19 lockdown
Emma Longden</p> |
| 17:10-17:25 | <p>Ship strikes of fin whales in the north-east Atlantic: identifying hotspots and simulating mitigation measures
James Robbins</p> |
| 17:25-17:40 | <p>A real-time forecasting system to mitigate the risk of collision between whales and commercial vessels
Marine Randon</p> |
| 17:40-17:55 | <p>Cultural tipping points in whaling and fishing nations amid social and environmental change
Russell Fielding</p> |



Conference Programme

Wednesday, April 6th / Central European Summer Time

09:00-09:45	<p>Chairperson: Mia Roditi-Elasar</p> <p>Keynote lecture</p> <p>The need to use research knowledge of marine mammals on international level to achieve protection Professor Ursula Siebert</p>
09:45-10:00	<p>Distribution & habitat modelling I Chairperson: Mia Roditi-Elasar</p> <p>Beluga whales and narwhals in the Franz Josef Land archipelago waters (Russia) Olga V. Shpak</p>
10:00-10:15	<p>The importance of long-term monitoring of cetaceans in the data deficient regions of the Mediterranean Sea Aylin Akkaya</p>
10:15-10:30	<p>Fin whale (<i>Balaenoptera physalus</i>) in the Ligurian sea: preliminary study on acoustics demonstrates their regular occurrence in Autumn Laura Pintore</p>
10:30-10:45	<p>Spring summer southwards migration of fin whales in the Mediterranean Blanca Feliu</p>
10:45-11:15	<p>Coffee break</p>
11:15-12:10	<p>Short talks - Distribution & habitat modelling II Chairperson: Mario Acquarone</p> <ul style="list-style-type: none"> • Ecology and ranging movements of Risso's dolphins in coastal waters of western British Isles Diksha Mandlik • Fantastic sperm whales and where to find them: habitat preference of sperm whales in the Azores Inês Coelho • Endangered common dolphins of the Istanbul Strait: fine scale distributions and encounter rates Tim Awbery • Distribution of cetaceans based on a citizen science approach in the Cyclades region, Greece Kimon Koemtzopoulos



Conference Programme

Wednesday, April 6th / Central European Summer Time

11:15-12:10
(Continued)

Short talks - Distribution & habitat modelling II (Continued)

Chairperson: Mario Acquarone

- **Occurrence of long-finned pilot whales and killer whales in Icelandic coastal waters and their interspecific interactions**
Anna Selbmann
- **Environmental drivers of harbour porpoise (*Phocoena phocoena*) Distribution in the Irish Sea**
Leonie Lepple
- **Temporal patterns of Risso's dolphins (*Grampus griseus*) groups off Pico Island**
Arianna Fornaroli
- **Azorean waters as a migratory corridor for baleen whales**
Rui Peres dos Santos
- **Sperm whales in Macaronesia: Unveiling site fidelity and residency patterns in an insular oceanic system**
Rita Ferreira
- **Spatiotemporal distribution and habitat requirements of teutophagous cetacean species around S o Miguel (Azores): Can opportunistic data be used to study the overlap of ecological niches?**
Marc Ruiz-i-Sagal s
- **Geographical movements, site fidelity and connectivity of killer whales (*Orcinus orca*) within and outside herring (*Clupea harengus*) grounds in Icelandic coastal waters**
Tatiana Marchon

Distribution & habitat modelling III

Chairperson: Mario Acquarone

12:10-12:25

Distribution and association of the Antillean manatee (*Trichechus manatus*) with habitat characteristics in Brazil

Emma Deeks

12:25-12:40

Connectivity patterns of cetaceans in the oceanic islands system of Macaronesia inferred from photo-ID and biotelemetry: how much do we know?

Filipe Alves



Conference Programme

Wednesday, April 6th / Central European Summer Time

(Continued)

Distribution & habitat modelling III (Continued)

12:40-12:55

Spatio-temporal patterns in acoustic biodiversity and distribution of marine mammals in Fram Strait, based on passive acoustic monitoring

Linnea Pankoke

12:55-14:00

Lunch break

14:00-14:30

Poster session: 028-054

14:30-15:30

Short Talks - Biology I

(feeding, genetics, abundance, social, anatomy, physiology)

Chairperson: Jonas Teilmann

- **Mediterranean monk seal, a sign of hope: increased birth numbers and enlarged terrestrial habitat**
Aliko Panou
- **Fatty acids composition in blubber tissue of two odontocete species (*Tursiops truncatus* and *Globicephala macrorhynchus*) in NE Atlantic**
Annalisa Sambolino
- **Each patch tells a story: population estimates, distribution, and fisheries dependence from the Mediterranean bottlenose dolphin population in the northwestern Catalan waters**
Carla A. Chicote
- **Histomorphological stratification of blubber of three dolphin species from the KwaZulu-Natal coast, South Africa**
Stephanie Plön
- **AnimalAudiograms.org a new public tool for hearing physiology data**
Michael Dähne
- **Abundance of Cuvier's beaked whales in the Hellenic Trench and Ionian Basin: results from aerial surveys in spring 2021**
Simone Panigada
- **Investigation of fine-scale population structure and genetic diversity of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) across the eastern North Atlantic**
Marc-Alexander Gose



Conference Programme

Wednesday, April 6th / Central European Summer Time

14:30-15:30
(Continued)

Short Talks - Biology I (feeding, genetics, abundance, social, anatomy, physiology) (Continued)

Chairperson: Jonas Teilmann

- **Multi-species feeding association dynamics driven by a large generalist predator**
Julia Gostischa
- **Insights into the respiratory and gastrointestinal microbiome of odontocetes stranded along the Tyrrhenian coastline**
Caterina Raso
- **First observations of a mouth-breathing bottlenose dolphin (*Tursiops truncatus*)**
Jeroen Hofs
- **Improvement of knowledge on the Mediterranean monk seal sub-population in the central Ionian Sea, Greece, using photo-identification**
Luigi Bundone

Biology II

Chairperson: Jonas Teilmann

15:30-15:45

Abundance and trends of cetaceans across the Italian seas between 2009 and 2021: a contribution towards MSFD criteria

Giancarlo Lauriano

15:45-16:00

Cracking code: using metabarcoding to analyse the diet of seals (*Phoca vitulina*; *Halichoerus grypus*) from the southern North Sea

Eileen Heße

16:00-16:15

Seasonal variation and temporal stability in the social network of Icelandic herring-eating killer whales

Eilidh O'Brien

16:15-16:30

First evidence of grey seal (*Halichoerus grypus*) predation on a harbour seal (*Phoca vitulina*) in the German Baltic Sea

Linda Westphal

16:30-17:00

Coffee break



Conference Programme

Wednesday, April 6th / Central European Summer Time

Biology III

Chairperson: Dan Kerem

17:00-17:15

On the verge of extinction: what can be done to save the common dolphin (*Delphinus delphis*) in Israel?

Yaly Mevorach

17:15-17:30

First comprehensive density and abundance estimates of cetaceans in the Black Sea through aerial surveys

Romulus Marian Paiu

17:30-17:45

No local cuisines for humpback whales: a population comparison in the Southern Hemisphere

Jasmin Groß

17:45-18:00

The Pitcairn Islands in the southern Pacific Ocean established as a breeding and calving grounds for the humpback whales (*Megaptera novaeangliae*)

Terence Dawson

18:00-18:15

Validation of quantitative fatty acid signature analysis for estimating the diet composition of free-ranging killer whales

Anaïs Remili



Conference Programme

Thursday, April 7th / Central European Summer Time

- Chairperson: Joan Gonzalvo
- 09:00-09:45** **Keynote lecture**
Marine mammal conservation physiology: do we model the right things at the desk and measure the right things at sea?
 Professor Peter T. Madsen
- New Techniques I**
 Chairperson: Joan Gonzalvo
- 09:45-10:00** **A tool to improve management under climate change scenarios: using expert knowledge to estimate cetaceans thermal suitability in the future**
 Andreia Sousa
- 10:00-10:15** **Assessing the integration potential of unoccupied aerial vehicles (UAVs) with conventional cetacean surveys**
 Eyal Bigal
- 10:15-10:30** **Simultaneous drone and tag data suggest that bubble-nets are tools used by solitary foraging humpback whales to improve foraging efficiency**
 Andy Szabo
- 10:30-10:45** **Is the 'Dinner Bell' causing erroneous data in seal-fish predation studies? A harbour seal/brown trout case**
 Jonas Teilmann
- 10:45-11:00** **Development of a mass spectrometry method capable of detecting and quantifying a panel of steroid hormones in right whale blow**
 Andrew John Wright

11:00-11:30 Coffee break

- 11:30-12:00** **Short Talks - New Techniques II**
 Chairperson: Eyal Bigal
- **Sperm whale habitat use in Irish offshore waters using an innovative Bayesian modelling framework**
 Cynthia Barile
 - **Anatomical network as a tool for studies of evolution of marine mammal skeleton**
 Pavel Gol'din



Conference Programme

Thursday, April 7th / Central European Summer Time

11:30-12:00
(Continued)

Short Talks - New Techniques II (Continued)

Chairperson: Eyal Bigal

- **Assessing the feasibility and suitability of using a commercially available autonomous acoustic recorder, the SoundTrap 300HF, to conduct passive acoustic monitoring for cetaceans and noise from an underwater glider**
Morgane Pommier
- **Characterization of extracellular vesicle from two cetaceans cell lines**
Cinzia Centelleghé
- **Scar diminishment on dolphins vary with natural salinities: Implications for reliability of photo-identification**
Dara Orbach

New Techniques III

Chairperson: Eyal Bigal

12:00-12:15

Drivers of change in social networks of bottlenose dolphins (*Tursiops truncatus*) in Cardigan Bay, Wales

Sophie Thomson

12:15-12:30

Using expert opinion to highlight how we can achieve effective and ethical management at cetacean stranding events

Rebecca M. Boys

12:30-12:45

Sei whale acoustic occurrence in the Gulf of Corcovado (Chile) detected through convolutional neural networks

Florence Erbs

12:45-13:00

Short-term versus long-term strategies for studying rare cetaceans: lessons from a long-term study of Hawaiian odontocetes

Robin Baird

13:00-14:00

Lunch break

14:00-14:30

poster session: 055-082

14:30-18:00

ECS Annual General Meeting



Key Note Speakers Abstracts
ECS 2022/ Ashdod, Israel



Tuesday, April 5th / Central European Summer Time

Marine mammals' conservation in the Eastern Mediterranean - Are we on the right path?

Dr. Mia Roditi-Elasar

The Leon Recanati Institute for Maritime Studies, Haifa University, Israel; Delphis NGO

Although a significant amount of data has been collected, we are still far from true and meaningful science-based conservation, much dependent on the Israeli coastline being only 200 km long, while cetaceans' home range is known to be much wider. Individuals of species sighted in Israel are prominent in their tendency to ignore political borders and to demonstrate cross-border home ranges (e.g., the *Monachus monachus* in the north and D. Delphis in the south borders of Israel). The *T. truncatus* population is stable in size yet 'open' in composition. Activities like fishing, marine pollution, shipping, and seismic surveys, all posing a significant threat to marine mammals in the Basin, also have a cross-border impact. Collaboration between neighboring countries is therefore essential for efficient marine mammal conservation, yet for Israel and its neighbors such collaboration is politically challenging. Some creative solutions involving international go-betweens are urgently called for to ensure effective conservation of marine mammal populations in the Levant.



The need to use research knowledge of marine mammals on international level to achieve protection

Professor Ursula Siebert

Institute for Terrestrial and Aquatic Wildlife Research (ITAW) of the University of Veterinary Medicine Hannover, Foundation, Germany

Research on marine mammals in European waters has made impressive progress over the last years. National and international programs have been started and international guidelines agreed on. This is for example the case for abundance estimates, acoustic investigations, stranding networks, life history and health investigations. While in some countries data have been collected over three and more decades, in other areas infrastructure and know-how has been established over the last years only because of funding restrictions.

At the same time, the pressure by anthropogenic activities is increasing and their effects are becoming more complex. The increase of offshore windfarms driven by the wish to increase renewable energies have the potential to cause behavioural changes, habitat loss and health impacts. Large amounts of ammunition from the Second World War impact the hearing ability of marine mammals in case of explosions but are also have the potential to increase chemical pollution through corrosion of the material after 70 years in the sea. Activities such as fisheries, shipping and chemical pollution need to be assessed on international level.

Agreements such as ASCOBANS, ACCOBAMS, OSPAR, HELCOM, Natura 2000 and MSFD oblige the member states, resulting in national and international obligations for the protection and preservation of marine mammals. But in order to approach the concept of load/burden limits of those very mobile marine species we need interdisciplinary and international approaches. Funding should be secured on international level and permitted according to the speed of increasing anthropogenic activities. Thus, decisions on the protection, habitat and health preservation of marine mammals in European waters, but also elsewhere, need to be achieved with the best international data and knowledge.



Thursday, April 7th / Central European Summer Time

Marine mammal conservation physiology: do we model the right things at the desk and measure the right things at sea?

Professor Peter T. Madsen

Zoophysiology, Department of Biology Aarhus University, Denmark

While some marine mammal populations give us hope by their surprisingly speedy recoveries from past human exploitations, others are sadly going extinct in plain sight. In a few cases, we absolutely know what the problem is, but we may or may not be able to fix it for political reasons. In most cases, however, dwindling population numbers are due to a complex multifactorial mixture of habitat destruction, fishing, by-catch, toxic loads and disturbance that is a much harder problem to understand and quantify in order to enable informed political action to mitigate it. The scientific disentanglement of this problem is often further compounded by the interplay with a mixture of natural stressors such as climate change, parasites, predators and shifting prey availability that may be equally hard to measure at sea. The classic approaches to assess marine mammal population dynamics are visual or acoustic surveys and mark-recapture studies, but these methods do not allow us to say why population declines are happening. In the last decade, the rapid development of new biologging and drone technology has increasingly allowed us to gather detailed information about the behavior, ecology and physiology of wild marine mammals in the face of human encroachment. But such field studies are inherently limited by the fact that only a small fraction of a population can be studied this way with a potential bias towards the slow, the old and the naive individuals. To potentially alleviate that problem, advanced modelling is increasingly used to get at population consequences of human encroachment by propagating a suite of input parameters to translate the fitness of individuals into the fitness of populations in a changing world. The efficacy of that approach, in turn, is critically dependent on knowing what indeed those relevant parameters are for wild animals, to avoid those broad-scale inferences, and hence the critical use of finite conservation resources is essentially based on best guesses at the modellers' desk. In this talk, I will discuss examples of things we can measure at sea as opposed to things that we really ought to measure at sea to understand the drivers of marine mammal fitness in the Anthropocene. I will use that discussion to call for a much closer collaborative relationship between field biologists and modelers to ensure that we both measure and model the right parameters to turn correlation into causality to ensure the long-term survival of healthy marine mammal populations.



Oral Abstracts
ECS 2022/ Ashdod, Israel



Are we on the right path? A plea for mindful conservation

Fabian Ritter

MEER e.V. Berlin , Germany

Marine mammals enjoy a high esteem in the general public, and are recognized as flagship species for conservation, while at the same time they suffer from anthropogenic impacts on a global scale, and often in extreme ways. It seems there is a huge discrepancy between how we humans think about our fellow creatures in the sea, and how we behave to impact and/or conserve them. In this talk, I am going to argue that the purely scientific and thus intellectual approach to marine mammal conservation has largely failed over the past decades. The situation today is, for many species and populations, more dire than it has ever been. The idea of “we need to know more” – a credo of the scientific community – often is even being (mis)used to postpone necessary conservation decisions. To adapt our path towards more profound and, importantly, more effective marine conservation, we need to go deeper and change the narrative of “separation”, i.e. the concept of humans being set apart from the rest of nature. Instead, we need to create a narrative of connectedness, i.e. the consciousness of humans being an integral part of the planetary system. Rather than telling horror stories about their plight, we need to trigger positive emotions about them in us humans. More holistic aspects of conservation need to be incorporated in our future efforts, including the integration of traditional and indigenous knowledge, recognizing ecosystem functions of marine life and protecting the processes they sustain, respecting “holiness” of nature while focusing on the animals’ individuality, person-hood and the cultural identity of distinct communities. Fruitful marine mammal conservation will be possible only on the basis of a profound change of our own values and a fundamental change of the societal system we are living in.



Forty years of killer whale research in Iceland: the importance of long-term studies

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Killer whale occurrence in Iceland has been known for decades or possibly even centuries, regularly being sighted in fishing grounds by fishermen, while feeding on herring. During the 20th century, takes included whaling, conflicts with fisheries and live-captures, however the impacts of these are unknown due to lack of monitoring or consistent reporting. Research started in the early 1980s to evaluate the sustainability of live-captures. Research focus initially was on population estimates based on photo-identification and census and also included acoustics. However, long-term dedicated research (i.e., studies lasting 10 years) did not begin until the late 2000s. Here, we review the research that has been conducted over the past forty years in Iceland, including information on distribution and abundance, movements, feeding ecology, genetic structure, acoustic communication and social behaviour, as well as threats to this population, to identify the areas in need of most research and what future directions should be. We show that research points to potential structure within the population, including diversity in feeding preferences and in movement patterns. However, killer whales with divergent diets and movement patterns are not socially or genetically isolated. Pollutant levels vary dramatically within the population, and reflect divergent feeding and movement behaviours, suggesting threats vary within subsets of the population, complicating overall conservation status assessments. Killer whales are observed both in coastal waters and offshore, and some are known to travel seasonally between Iceland and Scotland yet connectivity patterns across the North Atlantic remain largely unknown. These results highlight the vital importance of continued long-term monitoring, as well as collating of data collected in different locations (coastal, both inside and outside herring grounds, and offshore), to fully understand how the population is coping with ongoing and potential future changes to the marine ecosystem.



Challenges and perspectives in the conservation of the Indo-Pacific humpback dolphin (*Sousa chinensis*) in the northern South China Sea

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Several populations of Indo-Pacific humpback dolphins (*Sousa chinensis*) inhabit coastal areas in the northern South China Sea. With the recent but fast development of China, the human activities and their impact on the marine environment increased, resulting in a deterioration of the humpback dolphins' habitat. Human activities on the coast of the northern South China Sea involve pollution (including much plastic waste), constructions, intense boat traffic (including both shipping cargo and fishing boats) and intense fishing activity (including trawling, seining, dredging and gill-netting). Humpback dolphins are directly impacted by the increase of such activities, including plastic ingestion, noise disturbance, boat-inflicted injuries, entanglements and other injuries and lack of prey. The populations found in the northern South China Sea have small home ranges and therefore have to adapt to the presence of such human disturbances. Recent research reported a decrease in some populations' size, indicating the need for urgent conservation measures to be taken. However, potentially because of the high number of people depending on these human activities (i.e., shipping, fishing), concrete measures have not been well implemented yet. In addition, each population does not experience the same kind and level of human activities, measures should therefore be adapted to each population. Through multiple research projects, including work about humpback dolphins' genetics, ecology, habitat use, social structure, acoustic behavior, and recently, welfare, scientists are trying to better understand these animals and to find suitable and applicable measures to participate to the conservation effort. New techniques are now implemented to better monitor dolphins at a population level, but also at an individual level to collect new kinds of data that can inform on the animals' health, physiology and behavior. Such data may contribute to the protection of this emblematic animal.



Xenobiotic exposure- and environmental stress- associated cellular and molecular alterations in the skin of the Mediterranean fin whale (*Balaenoptera physalus*)

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The Mediterranean fin whale is increasingly exposed to a plethora of anthropogenic impacts, including chemical pollutants. Among the different effects epigenetic modifications, such as DNA methylation (DNAm), can occur and subsequently affect and regulate gene expression. A panel of hyper- and hypo-methylated genes have been identified after the analysis of DNAm profiling on fin whale skin biopsies with different contaminant loads. Data about reduced representation bisulfite sequencing (RRBS) were correlated with real-time PCR data. The specimens were sampled in the Specially Protected Area of Mediterranean Interest Pelagos Sanctuary (NW Mediterranean Sea), heavily affected by pollution. To detect possible correlations to contaminant exposure, biopsy samples were analyzed for contaminant load (blubber) and structural effects (skin, by histology and immunohistochemistry). Variations in the expression of the selected genes (quantified by droplet digital PCR; ddPCR) and the differential occurrence of dystrophic signs allowed individual's blubber contaminant load (plastic additives such as phthalates) and cutaneous anomalies to be positively correlated. These findings suggest the potential role of environmental stressors on DNAm and, in turn, on silencing/activation of transcription of genes regulating skin health. A first insight on the potential use of a panel of biomarker genes related to epigenetic modifications is therefore provided. These genes could be used as prognostic markers for genetic adaptation to a changing and highly polluted environment, in a vulnerable marine species.



First ecotoxicological insights from the Critically Endangered population of Mediterranean monk seals, *Monachus monachus*, from Madeira Archipelago (NE Atlantic)

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The Mediterranean monk seal, *Monachus monachus*, is considered one of the most endangered species of marine mammal globally. The Madeiran archipelago currently represents the last refuge of *M. monachus* in the European Atlantic, with only ~20 individuals thought to remain. Here we present the first assessment of environmental pollutants, namely microplastic and trace element concentrations, that this isolated population may be exposed to. We collected 18 faecal (scat) samples between 2014-2021 and extracted microplastics using a 10% KOH solution followed by density separation with NaCl. Microplastic particles were recovered from all 18 samples ranging between 0.2 - 8.9 particles g⁻¹ dry weight (mean 1.88 ± 2.20 particles g⁻¹) consisting mainly of fragments (69%) of various sizes and polymer composition (e.g., PE, PET, PS). Microplastic prevalence (100% of samples analysed) was higher than what has been previously recorded using scat-based analysis in other pinniped species. Trace element levels were derived from various tissue types of two adult females found dead in 2021. There were differences in trace element concentrations among tissue types and were generally lower than those described in *M. monachus* from the Eastern Mediterranean, except for lead (Pb) from liver samples, which were higher (0.57 ± 0.14 c.f. 0.35 ± 0.28 mg/kg w.w.). Overall, trace element concentrations were low and within a normal range compared with other adult pinniped species, in line with similar research from the Mediterranean. This work not only represents the first ecotoxicological assessment of *M. monachus* in Madeira, but also represents the first microplastic investigation for this critically endangered population. Here we provide a preliminary understanding of the potential risks to *M. monachus* in the region that may contribute to future management decisions for the species and their long-term survival.



You are what you eat: Contaminant variability in New Zealand killer whales (*Orcinus orca*)

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Environmental contaminants of toxicological concern biomagnify within food webs. Consequently, feeding ecology can be an important predictor of contaminant burden. Despite a nationally critical threat status (<200 animals), the toxicology of New Zealand killer whales is poorly understood. While opportunistic field observations document Chondrichthyes and marine mammals within their diet, no systematic assessment of foraging ecology or contaminant burden has yet been completed for killer whales in New Zealand or even wider Australasian populations. We examined polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (BDEs) and multiresidue pesticides (including dichlorodiphenyltrichloroethane (DDT), dieldrin, Hexachlorobenzene (HCB), mirex, and oxychlorodane) in 18 killer whales (1:1 sex ratio), sampled from single and mass strandings from 2010 to 2021. Additionally, we analysed per- and polyfluoroalkyl substances (PFAS) and trace elements and measured carbon and nitrogen stable isotope ratios from skin as proxies for habitat and trophic position, respectively. Sum DDT and PCBs ranged from 476 to 60,969 and 444 to 11,990 ng/kg lw, respectively, aligning with various northern hemisphere populations. Sum DDT predominantly comprised p'p'-DDE, reflecting New Zealand's prolonged legacy of DDT use. Other multiresidue pesticides were considerably lower, the highest reported for mirex at 120 to 3900 ng/kg lw. Sum PBDE ranged from 28.3 to 556.4 ng/kg lw, with BDE47, BDE100 and BDE154 the most predominant congeners. Mercury and selenium levels ranged from 2.8 to 2,242 and 26 to 987 mg/kg lw, respectively. Total PFOS and PFOSA levels ranged from 5.9 to 31 and 3.9 to 21 ng/kg w wt, respectively. Differences were detected between sex and maturity with adult males exhibiting highest levels in several contaminants, while maternal offloading was evident in select females and calves. Generally, contaminant burdens elevated with increasing nitrogen (i.e. higher trophic position), indicating foraging plasticity within the New Zealand population has at least some influence on reported contaminant burdens.



The Plastic Busters MPAs project: new methodology to detect the impact of microplastics and related plastic additives in cetaceans of the SPAMI Pelagos Sanctuary

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In the last decades, there has been growing concern about hazards to cetaceans occasioned by multiple stressors in the Mediterranean Sea, due to bioaccumulation and effects of anthropogenic contaminants combined with the impact of infectious diseases, marine litter including microplastics, climate change, food depletion and noise. The simultaneous combination of these factors may produce dramatic effects on population stability, for different cetacean species. Plastic Busters MPAs (PBMPAs) is a 4-year-long Interreg EU Med-project aiming to contribute to maintaining biodiversity, and preserving natural ecosystems, against marine litter, in Mediterranean marine protected areas (MPAs). The overarching aim of this presentation is to describe the implementation of the PBMPAs monitoring approach to detect the impact of microplastics (MPs) on Mediterranean biodiversity, focusing mainly on cetacean species inhabiting the SPAMI Pelagos Sanctuary, and the Tuscan Archipelago National Park-PNAT. In 2019, researchers of 8 European institutions, monitored 2230 nautical miles, collecting 140 samples of superficial MPs in both study areas and carrying out a simultaneous monitoring of surface macrolitter and biota survey. High MPs concentrations were detected, with higher values in PNAT (0.36 ± 0.61 items/m²) compared to Pelagos (0.18 ± 0.58 items/m²). During the sampling campaign, in order to assess the multiple-ecotoxicological impact on cetaceans, 17 skin biopsies samples of fin whale (*Balaenoptera physalus*) and 24 samples of striped dolphin (*Stenella coeruleoalba*) were collected and further analyzed for plastic additives (phthalates). In parallel, we carried out 1H-NMR and MS metabolomics studies on extracts of skin biopsies. This is the first time metabolomics are used in cetaceans to attempt discriminate between different groups. Successful results open the road for further toxicological interpretation of the pathways modulated by xenobiotic exposure. Metabolomics could be an extremely relevant tool for discriminating the potential impact of microplastics and related chemicals on cetaceans inhabiting this fragile and highly anthropized ecosystem.



On the rise: climate change will cause New Zealand indicator species to seek higher latitudes

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Cetaceans are ideal indicator species of ecosystem change and ocean health given their high trophic level and cosmopolitan distribution. However, range shifts in response to future climate changes are unclear, which (i) limits our ability to predict future marine ecosystem dynamics, and (ii) hinders meaningful conservation actions, especially when species are classified as vulnerable or endangered. Here, we evaluate the potential human-driven climate change (i.e., changes in sea surface temperature, and chlorophyll) imminent impact on sperm (vulnerable) and blue (endangered) whale distributions around New Zealand shores. We use an ensemble of nine algorithms to investigate changes in suitable habitat for sperm and blue whales between the present day and the future (i.e., 2100) under three International Panel on Climate Change's Representative Concentration Pathways (RCP) of low (RCP 2.6), medium (RCP 4.5), and high (RCP 8.5) severity. Our results show a general southward shift in suitable habitat for both sperm and blue whales, increasing in magnitude with increasing severity of climate change. The RCP 8.5 scenario showed the strongest changes with loss or decrease of most currently suitable habitat in New Zealand's northern waters. Based on present day distribution, overall loss and decrease of suitable habitat for both species in New Zealand outweighed gain and increase only in RCP 8.5. However, on a smaller scale, even in RCPs 2.6 and 4.5, local distribution of both species is predicted to change considerably. Given the important role of large whales as ecosystem engineers, these predicted changes could potentially influence ecosystem functioning in New Zealand's northern waters. Sperm whales are the target of an economically importance tourism industry in Kaikōura, which would likely be negatively affected by a decrease in local sperm whale distribution and abundance due to fewer, less reliable sightings.



Clash on the high-seas: the rise and fall of deep-diving cetaceans in an oceanic environment

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Climate change is impacting the ecology of marine species all around the world, with already noticeable effects on cetaceans. Nevertheless, to the date, no studies focused on the effects of ocean warming perturbations on deep-diving cetaceans. These variations might reflect a more significant alteration on the ecosystem, including changes in mesopelagic and bathypelagic habitats. We used 17 years of land-based dedicated sighting data gathered in a critical habitat for Risso's dolphins to document the fluctuations in its relative abundance in comparison with two other deep-diving mammals, the short-finned pilot whale and the sperm whale. Data were standardized to correct effort heterogeneity, using a two-step delta-lognormal Generalized Linear Model approach, resulting in the sighting probability and the standardized sightings per unit of effort (SPUE). The year, month, Sea Surface Temperature (SST) mean values and SST anomaly for each month were introduced as explanatory variables. The probability of observing Risso's dolphins and sperm whales remained relatively constant. However, the probability of observing pilot whales increased steadily from 0.38 in 2005 to a maximum of 0.79 in 2020, reflecting the species' expansion. The SPUE confirmed the rise of pilot whales sightings, and revealed that even if Risso's dolphins are still present in the area regularly, the number of observations decreased gradually from 2.23 to 1.76 sightings per hour during the study period. We show that ocean warming, combined with potential pilot whales' known mobbing behaviour, can disrupt natural fluctuations of resident Risso's dolphins. The displacement of this species from one of the few documented critical habitats in the Atlantic might severely affect its conservation status. Moreover, the rise and fall of pilot whales and Risso's could reflect changes in the ecosystem, which might have profound impacts on the deep-sea ecology due to the differentiated prey preference and energetic needs.



Tuesday, April 5th / Central European Summer Time

Mapping risk of bycatch for cetacean species regularly occurring in North-west Europe

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For most cetacean species, entanglement in fishing gear is considered the main anthropogenic source of mortality. This has been the case for several decades and despite various attempts in Europe to reduce its impact through legislative instruments, the problem remains. One reason is the significant financial and human resources required to monitor bycatch rates, identify areas, times and precise gear presenting greatest risk, before applying appropriate mitigation measures. In order to go some way to addressing this, the European Commission funded a study to analyse spatial and temporal overlap of fishing effort by gear type and density distributions of cetacean species demonstrated from the literature to be vulnerable to bycatch. Using AIS data and machine-learning algorithms developed by Global Fishing Watch to better measure actual fishing effort, maps were prepared for ten gear type groupings (pelagic trawls, pelagic seines, demersal trawls, demersal seines, driftnets, static gillnets, trammel nets, set longlines, drifting longlines, pots & traps) for the Atlantic area from southern Norway to Portugal covering the years 2015 to 2018, and by nation. Maps of density distributions of 12 cetacean species were prepared by season using a modelling approach that incorporated environmental variables applied to two oceanographic domains: southern Scandinavia to NW France (northern) and NW France to southern Portugal (southern). These were based upon 1.25 million kilometres of dedicated survey effort for the northern domain, and 0.82 million kilometres for the southern domain, provided by 47 research groups, with surveys undertaken across the period 2005 to 2020. Standardised AIS effort rasters and animal density rasters were multiplied to create new rasters of relative bycatch risk for all twelve species. Overlap for every species-gear type combination was mapped for northern and southern domains on a seasonal basis, and with overlays of protected areas, identifying areas and times of greatest risk.



Testing deterrent devices to reduce depredation and bycatch of cetaceans in Southern Portuguese coastal fisheries

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Limited mitigation trials have been carried out in Portuguese fisheries where both cetacean bycatch and depredation are known to occur. Here, we present the results of mitigation trials from June 2019 to March 2021 in the Portuguese Southern coast, using DDD's and DiD's (two models of acoustic Dolphin Deterrent Devices manufactured by STM Industrial Electronics, Italy), in bottom set-net (gillnet and trammel net) and purse seine fisheries. Catch per Unit Effort (CPUE), bycatch and depredation rates in fishing operations (hauls) with no deterrents (control) were compared against operations with deterrents (test), to assess the possible effects of the use of deterrents on the three variables. Data collection was carried out by direct onboard observations and via logbook registrations submitted by skippers. In set-nets, data from 77 hauls (25 control and 52 test) for DiD testing and 482 hauls (228 control and 254 test) for DDD testing were analyzed for vessels larger ($n=2$) or smaller ($n=3$) than 12 m. One common dolphin, *Delphinus delphis*, was bycaught in test nets, although a deterrent malfunction was detected during the set. No bycatch was observed in controls. Depredation by bottlenose dolphins was significantly reduced in test nets targeting European hake, *Merluccius merluccius* ($P < 0.001$; DiD) and red mullet, *Mullus surmuletus* ($P=0.036$; DDD). In purse seines, 204 hauls (5 vessels; 127 control and 77 test) for DDD testing were analyzed. 22 common dolphins (80% released live) were recorded as bycaught in control nets and none were recorded in test nets. CPUE was not significantly different between controls and tests for all gears. Further trials, to help build on these initially promising results, are now being continued under the framework of the CetAMBICion project, which aims to provide relevant information for a coordinated management strategy to mitigate cetacean bycatch and other fisheries interactions in European Waters.



Multi-tiers diagnostic framework for cetacean-fishery interaction assessment on stranded cetaceans

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Marine mammal stranding events can provide insights for monitoring the health and conservation status of free-ranging animals, assessing the ecological role of these species in the marine ecosystem. Among the difficulties related to data collection and post-mortem examination of stranded cetaceans, standardised criteria and diagnostic approaches represent essential support for forensic investigation. Reviewing the main literature about fishery-interaction cases, a framework for the evaluation of the main post-mortem findings has been developed. The structure of the framework is organized in multiple tiers to allow different examiners to collect data and to assess post-mortem evidence based on their expertise and skills.

The principal findings are organized into 5 main categories (direct evidence of fishing interaction; other fishery interaction-associated lesions; nutritional findings; aspecific findings; other pathologies) and associated with the specific fishing gear and the decomposition code of the carcass. In order to define the correlation and the role of the fishery interaction with the cause of death, a scoring system was developed based on the different evidence and categories. To validate the framework, stranded animals' cases from the past were used, showing effective results and vantages.

The application of this diagnostic tool could help to increase the estimation of the anthropogenic mortalities, identify seasonal index, and support conservation policy in order to invest efficiently time and resources.



The anthropause in Sarasota Bay, Florida: comparing the marine soundscape before and during the COVID-19 lockdown

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During the COVID-19 pandemic, decreases in vessel activity and low-frequency noise have been reported across the globe. Changes in underwater noise levels in shallow, coastal areas have received less attention, yet sound from small, recreational vessels is a major source of mid-frequency noise in coastal waters. Sarasota Bay is home to a large and increasing number of recreational vessels, as well as a resident population of common bottlenose dolphins, *Tursiops truncatus*. A network of hydrophones was deployed in 2017 to better understand the biology of Sarasota Bay's marine life (Rycyk et al. 2020). Here, we analysed a subset of data from two of these hydrophones during (March-May 2020) and before the pandemic (March-May 2018/2019). Hourly 95th percentile noise levels were calculated in Third Octave Bands (TOBs) centred at 100, 2,000 and 16,000 Hz to capture the noisiest periods of each hour. Acoustic data were also used to quantify dolphin whistle presence and vessel passes at the hydrophones to understand changes in vessel activity and the effect on wildlife. Compared to pre-pandemic levels, vessel activity increased at one site and decreased at the other, although much less than seen for other vessel traffic situations globally. 95th percentile noise levels in TOBs mostly showed no relationship with vessel activity, suggesting they may not reflect small recreational vessel activity in shallow habitats where noise from vessel passes is short and attenuates quickly. Dolphin whistle presence largely remained the same across study years but did show an overall increase with vessel activity which likely reflects the response found by Buckstaff (2004) that dolphins whistle more at the onset of vessel approaches, which may initiate a group response to vessels. Results here highlight the need for local studies on the effects of the pandemic on wildlife as findings are unlikely to be homogenous globally.



Ship strikes of fin whales in the north-east Atlantic: identifying hotspots and simulating mitigation measures

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Large whales are likely the marine megafauna most at risk from vessel collisions; however, studies often identify areas of greatest risk by calculating two-dimensional overlap metrics, ignoring vertical overlap in the water column. Dive profiles of 21 fin whales instrumented with time-depth recorders in the Azores were used to estimate the proportion of time spent within reach of vessel draughts across the north-east Atlantic. Fin whales were at greater vertical risk at night, with a median dive depth of 5m compared to 12m during daylight hours. When vertical risk was integrated into temporal-spatial variation of vessel characteristics and animal distribution, 972 collisions were estimated to occur annually, of which 641 were likely to be fatal. This is well above the estimated sustainable potential biological removal level of 131 individuals a year in this region. Simulation of potential mitigation measures indicated that re-routing shipping lanes may be largely infeasible whereas vessel slowdowns may be more practical and effective. However, how such measures would be accepted by the shipping industry remains to be seen. These findings provide a quantitative assessment of ship strike risk and inform mitigation methods for a vulnerable cetacean species, providing an invaluable basis for discussions with environmental managers and maritime authorities.



A real-time forecasting system to mitigate the risk of collision between whales and commercial vessels

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The Southern Resident Killer Whales (SRKW) living year-round in the Salish Sea off southern British Columbia, Canada, and northern Washington State, USA, is an endangered population that suffers due to increasing marine traffic in the region which is associated with acoustic disturbance and a high risk of collision with commercial vessels. With only 73 individuals remaining as of December 2021, the loss of one single individual would be catastrophic for the population and the marine ecosystem through cascading effects. Motivated by these concerns, we develop a real-time forecasting system for the endangered SRKW that aims at predicting pod locations with probabilistic predictions of whale directional movement. The statistical framework is based on a state space model and sequential data assimilation, a method for model-data fusion initially developed for numerical weather predictions. Real-time SRKW location information relies on visual sightings from citizen scientists and passive acoustic monitoring from a network of underwater hydrophones. This real-time location information is combined with stochastic movement model predictions to provide forecasts of future animal locations and trajectories, as well as estimation of key behavioural parameters. Implementation uses ensemble-based sequential Monte Carlo methods. The movement model is a Continuous Time Correlated Random Walk that integrates historical SRKW distribution through a drift term using a potential function. Depending on the abundance and accuracy of location information, our forecasting system can predict the pods' locations up to 2.5 hours in advance with a moderate prediction error (< 5 km), providing reasonable lead-in time allowing commercial vessels to adjust their speed or pathway to minimize whale-vessel interactions. We argue that that this forecasting framework can be used to improve the conservation of at-risk populations, synthesize diverse data types, improve animal movement models and behavioural understanding, and has the potential to become an important new direction for movement ecology.

Cultural Tipping Points in Whaling and Fishing Nations amid Social and Environmental Change

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Anthropogenic environmental pollutants cause direct harm to important fish and cetacean species—cultural keystone species in the contexts of certain maritime societies—which can disrupt and decouple the socio-environmental system represented by small-scale fishing and whaling communities, with implications for food security, public health, ecological health, and cultural heritage. Unchecked, this decoupling can lead to cultural tipping points: inflections in a people’s history characterized by disconnection from the marine environment and loss of continuity with cultural heritage. The overarching hypothesis of this study is that internationally agreed-upon acceptable levels of pollutant releases, specifically those that disproportionately affect cetaceans and high trophic-level fishes through bioaccumulation and biomagnification, may have been overestimated due to a failure to account for their ultimate impacts on human cultures. Here, using the Faroe Islands in the North Atlantic, a traditional fishing and whaling society, as a case study, we critically examine present priorities of research into environmental pollutants and cetacean conservation efforts. We recommend stricter guidelines for acceptable levels of pollution emission and a broadened conceptualization of cetacean conservation efforts to consider the socio-environmental systems in which cetacean species are both cultural and ecological keystones.



Beluga whales and narwhals in the Franz Josef Land archipelago waters (Russia)

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Franz Josef Land (FJL) archipelago is located in the Arctic Ocean north of the Barents Sea. Arctic cetacean species are sporadically observed in FJL waters during opportunistic observations. We conducted two combined (vessel and helicopter) reconnaissance surveys of the narwhal and beluga in early summers 2019 and 2021. The routes depended on ice state and visibility conditions. Over 98% of whales in FJL were detected from a helicopter. Majority of sightings was recorded along the shore ice edge; however, some whales were detected in dense broken ice. In 2019, most narwhals and belugas were encountered near Jackson Island. In 13 flights, we counted 283 narwhals and 125 belugas. In 2021, most whales were found south off George Land and in Nightingale Sound. In 6 flights, we recorded 198 narwhals and 338 belugas. These numbers likely include re-sightings of same individuals in different days, which was proved with PhotoID of narwhals. Minimum abundance estimates for both species were taken as a “maximum number of individuals recorded during one flight”. In 2019, these were 35 narwhals and 37 belugas; in 2021, 93 narwhals and 110 belugas. Both species were represented by groups of different age classes. On several occasions in both years, we encountered mixed beluga-narwhal groups. Thus, the contacts between these species are not rare or sporadic. These photo-documented observations, along with recently confirmed “narluga” hybrid, are important for understanding cetacean hybridization. We showed that: (a) in FJL waters in early summer, narwhals and belugas form relatively large multi-age and multi-species aggregations; (b) both species are not traversing visitors, but rather seasonal residents; (c) vessel-based surveys are ineffective, and aerial techniques should be used whenever possible; (d) variable ice-cover in early summer makes advance survey planning impractical, and acoustic studies should be considered as an alternative or supplement to visual surveys.



The importance of long-term monitoring of cetaceans in the data deficient regions of the Mediterranean Sea

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The Eastern Mediterranean Sea is known as one of the least studied regions of the Mediterranean, thus the cetacean abundance is underestimated. The current study has been running the first and only seasonal research efforts within the Eastern Mediterranean Sea of Turkey since 2018. Visual and acoustic survey techniques have been employed on predetermined transects, covering both coastal and deep-sea habitats. Overall, 114 days were spent at sea across 11 seasons, resulting in 377 cetacean detections, of which 82% of the detections were acoustically recorded, highlighting the importance of acoustic effort. Delphinids were the highest detected species with 87% while deep-sea cetaceans comprised the rest of detections. While, bottlenose dolphins (*Tursiops truncatus*) were the most regularly sighted delphinids with coastal and offshore distributions, common dolphins (*Delphinus delphis*) and striped dolphins (*Stenella coeruleoalba*) were recorded rarely in the area. Sperm whales (*Physeter macrocephalus*) were detected on 43 occasions, with a preference for the warmer seasons on the eastern extension of the Rhodes Basin and the Finike Canyon, as solitary males, juvenile groups and social units. Cuvier's beaked whales (*Ziphius cavirostris*) were recorded on three occasions with a distribution nearer the western boundaries of the study area. Post-acoustic analysis is likely to reveal further presence of the beaked whales and assist us in identifying delphinids at a species level. Therefore, the current results may be underestimating species presence. The spatial-temporal distribution map of cetaceans and human pressures revealed a high overlap. While coastal waters were under the pressure of marine traffic and pollution, loud and impulsive noise continued throughout the surveys. Dedicated long-term seasonal survey efforts on cetaceans form the main tool not just to collect accurate baseline data but also to assess the impact level of human activities. This provides the necessary information for decisionmakers to take the right step towards protecting threatened species.



Fin whale (*Balaenoptera physalus*) in the Ligurian sea: preliminary study on acoustics demonstrates their regular occurrence in Autumn

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Although fin whale (*Balaenoptera physalus* (Linnaeus, 1758)) feeding aggregations are well known during summer in the Corso-Liguro-Provençal Basin, little information is present about the species occurrence in the area for the autumn and winter seasons. Fin whale acoustic presence was investigated in the Ligurian Sea from July to December 2011 through five autonomous recorders deployed between 700 and 900 m depths. The results showed that vocalizations were detected during all the monitored periods with a higher rate in October, November, and December. Furthermore, their occurrence peaked during light hours, and closer to the coast. Even if some individuals may migrate in the south of the Mediterranean Sea during the autumn, this study evidences that at least part of the fin whale population stays in the Corso-Liguro-Provençal Basin. Indeed, also during autumn, the zooplankton diel vertical migration in the area, and the development of an upwelling system due to the morphology of the seabed near the coast, might provide a feeding ground for the species. Further studies of a larger spatial and temporal PAM effort are needed to promote a long-term monitoring of fin whale, crucial for its conservation.



Spring summer southwards migration of fin whales in the Mediterranean

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The identification of critical areas for fin whales (*Balaenoptera physalus*) in the Mediterranean Sea is crucial for their conservation. Nonetheless, their habits, feeding and migration routes are not well understood. Two distinct sub-populations are reported in the western Mediterranean, the Mediterranean sub-population and the northeast North Atlantic Ocean group (NENA). Several studies suggest seasonal movements of Mediterranean fin whales between waters of the Strait of Sicily (winter feeding grounds) and the Ligurian Sea (summer feeding grounds). In this work, we describe a coastal southward migration observed at eastern Spain in late spring and summer. Observations were recorded from a land-based platform at Denia (Alicante, Spain) from mid-May to the end of July. Simultaneously, a passive acoustic monitoring device, named SAMARUC, was deployed near the coast. Overall, between 74 to 85 fin whales were observed from early June to the end of the observation period with a peak of sightings during first week of July. Most of them within 3 miles from the coast. Most of the fin whale sounds recorded were: down-sweep sounds with a centre frequency from 60-70 Hz and a duration of 0.6-0.7 s.; 60 Hz sounds with a duration of 0.5 s. and 75-85 Hz sounds with 0.7 s. duration. Most of these sounds were detected from the 2nd to 6th of July 2021. The observed migration behaviour described in this study overlapped in time with the migration of fin whales through the Strait of Gibraltar. This suggest that NENA fin whales undertake a coastal southward migration from spring feeding grounds in the Balearic Sea, towards the Atlantic in late spring and summer. This coastal migration is a behaviour not previously reported. Furthermore, the migration was observed outside the limits of the SPAMI “Mediterranean cetacean corridor”, but within an important maritime traffic area towards the Balearic Islands.



Distribution and association of the Antillean manatee (*Trichechus manatus*) with habitat characteristics in Brazil

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Coral, mangrove and seagrass ecosystems in North East Brazil support a biodiverse range of species, with the latter two acting as carbon sinks through sequestration. Due to climate change and degradation from anthropogenic activities, these habitats are in decline both regionally and globally. The Antillean manatee (*Trichechus manatus*), which is listed on the International Union for Conservation Nation (IUCN) Red List as 'Vulnerable', and on the Brazil IUCN Red list as 'Critically Endangered', use these ecosystems as pathways for feeding, mating and nursing their young. The disconnect between manatees and their food sources such as seagrass have led to a record number of manatee deaths in strongholds such as Florida (>1100) in 2021. This calls into question how populations are interacting with their environment and food sources. Currently, very little is known about Antillean manatee habitat use and the quality of resources along the Brazilian coast, especially seagrass habitats. Our aim is to address the lack of fine scale regional information on the spatial extent of coastal habitats along the coast of north Brazil, across 5 states from Alagoas state to Ceara state, through the use of remote sensing techniques. We classified regional coastal maps along the coast of Brazil for years 2015 to 2020 using high resolution Sentinel-2 satellite images and the random forest machine learning algorithm in the Google Earth engine environment. From these maps we report how key food sources have changed over this 5-year period and found evidence for seagrass and mangrove declines in multiple states. We overlaid telemetry data of manatee movements collected by the Chico Mendes Institute for Biodiversity over a 10-year period to understand how these food groups influence manatee movements and how they have responded to changes in their environment.



Connectivity patterns of cetaceans in the oceanic islands system of Macaronesia inferred from photo-ID and biotelemetry: how much do we know?

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Understanding animals' movement ecology paves the way to achieving key conservation goals. This is especially relevant when dealing with flagship species that may be vulnerable to anthropogenic threats, such as cetaceans, from poorly understood oceanic remote habitats. The biogeographic region of Macaronesia comprises an insular system of archipelagos (i.e., Azores, Madeira, and Canaries) that hosts a high cetacean diversity of >30 species. This offers an excellent in-situ offshore laboratory to study the biological connectivity patterns of these highly mobile animals. Here, an overview of inter-archipelago cetacean movements is presented based on long-term photographic-identifications throughout Macaronesia (>9000 individual identifications) and satellite telemetry tagging in Madeira, a key-central island of Macaronesia (with 20 deployments). Individual movements from at least four toothed whales' species (*Globicephala macrorhynchus*, *Tursiops truncatus*, *Steno bredanensis*, and *Physeter macrocephalus*) and one baleen whale species (*Balaenoptera edeni*) were documented among the three archipelagos. Fine-scale movements of *G. macrorhynchus* showed that some individuals present high-fidelity to a core coastal area in Madeira and that they can also undertake wide movements to offshore areas, suggesting the existence of a potential biological corridor. Other species, like the *Pseudorca crassidens* or *S. bredanensis*, were found to associate only briefly around islands, and in the latter, to also explore the coastal waters of northwest Africa. Moreover, several large whales' species were documented to use the Macaronesian waters temporarily and/or as a passage to west and north Atlantic regions. Here, we show a broad picture of the connectivity network of cetaceans over large latitudinal and longitudinal gradients, rethinking our view on their biogeographical ecology in the wider Atlantic; and how little do we know. We are currently expanding the aforementioned methodologies to other cetacean species, which will help increase our knowledge about these animals' lives and the paths to follow to proper management/conservation measures throughout the region.

Spatio-temporal patterns in acoustic biodiversity and distribution of marine mammals in Fram Strait based on passive acoustic monitoring

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The Arctic Ocean is currently undergoing enormous habitat modifications due to climate change which will also entail changes in marine mammal community compositions and hence, local marine soundscapes. Although Fram Strait is an important habitat for both Arctic endemic and seasonally migrating marine mammal species, long-term data on marine mammal distribution patterns are lacking, yet essential to assess the impact of future environmental changes associated with climate change. In this study, passive acoustic monitoring data collected at different locations in eastern and central Fram Strait (78-79°N, 0-7°E) between 2012 and 2019 as part of the Ocean Observing System FRAM (Frontiers in Arctic Marine Monitoring) were analysed to identify the main contributors to the marine soundscape and to explore spatio-temporal patterns in their acoustic presence and distribution. Both seasonal and spatial differences were evident in the acoustic occurrence patterns of marine mammals and of selected abiotic and anthropogenic noise sources. In eastern Fram Strait, the local marine soundscape was characterised by a year-round presence of fin whales, sperm whales and ship traffic and seasonal patterns in the acoustic presence of bowhead whales, blue whales, breaking sea ice and airguns. In central Fram Strait, fewer species were identified and the seasonal patterns were inconclusive. In line with previous studies, our results imply that Fram Strait may not only serve as a feeding area in summer for blue and sperm whales but also as a wintering or potential mating area for fin and bowhead whales. This study provides a valuable foundation for assessing future climate change-related modifications in the distribution and habitat use of Fram Strait by marine mammals. In this context, further long-term monitoring of anthropogenic noise sources, which were persistently present in Fram Strait, will considerably benefit our ability to assess possible effects of anthropogenic noise in such sensitive high-latitude ecosystems.



Abundance and trends of cetaceans across the Italian seas between 2009 and 2021: a contribution towards MSFD criteria

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Marine Strategy Framework Directive (MSFD) criteria D1C1 and D1C2 relate to the abundance of species, a population parameter essential in any management program. However, robust assessments of species' abundance and trends are often challenging; changes in food availability across home ranges and in seasonal distribution as well as immigration/emigration can potentially lead to abundance fluctuations between years. Systematic dedicated long-term monitoring programs are therefore necessary to obtain sound information on biological parameters, in particular for far-ranging species. In this context, the Italian Ministry of Ecological Transition funded, between 2009 and 2016, a series of systematic line transect distance sampling aerial surveys in the seas around Italy to gather baseline information on cetaceans' occurrence and abundance. These surveys were carried out under the framework of the Pelagos and ACCOBAMS Agreements. In relation to the implementation of monitoring activities related to the second cycle of the MSFD, further surveys took place in the Tyrrhenian Sea (October 2020), including the Pelagos Sanctuary, and the Strait of Sicily and the Ionian Sea (July 2021). These surveys accounted for 40% and 19% of the Western Mediterranean and the Ionian Sea and the Central Mediterranean Sea MSFD subregions, respectively. Uncorrected design-based abundance estimates for the whole Tyrrhenian Sea and Pelagos Sanctuary, were 139,540 striped dolphins (%CV= 10.65), 11,694 bottlenose dolphins (%CV= 31.9) and 895 fin whales (%CV= 33.8). For the Strait of Sicily and Ionian Sea striped and bottlenose dolphins were estimated at 52,707 (%CV= 29.9) and 5,127 (%CV= 29.9), respectively. Inter-annual and seasonal fluctuations in abundance emerged for these species across the monitored areas and time. The abundance estimates and the trends provide crucial information which are considered in light of the MSFD requirements and more specifically to set reference values for the D1C1 and D1C2 criteria.



Cracking code: using metabarcoding to analyze the diet of seals (*Phoca vitulina*; *Halichoerus grypus*) from the southern North Sea

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Long-lived top predators shape biodiversity structure in their ecosystems. Understanding predator-prey interactions in food webs is essential to support ecosystem productivity and stability and to improve conservation actions. Studies on the foraging ecology of seals in the southern North Sea are either scarce or outdated and most studies solely performed traditional hard part analyses. Molecular metabarcoding can be used as a non-invasive diet analysis tool, which in recent years has been proven efficient and complementary to conventional hard part analysis; however, its application is lacking in the wider North Sea area. In this study, DNA from scat samples, collected between 2014–2021, were used to identify fish prey species in the diet of harbour seals (*Phoca vitulina*) (n = 104) and grey seals (*Halichoerus grypus*) (n = 71) by applying a novel, next-generation metabarcoding approach. A new 16S rRNA primer providing the best coverage of > 130 local marine and freshwater fish species was designed to amplify fish prey. Additionally, the primer can target Lusitanian fish species which can help to reveal changes in prey composition of top predators due to climate change. Results showed previously unrecorded species in the diet of grey seals in our study area, namely hooknose and common roach. Pleuronectidae had the highest %FO (54.9%) in harbour seal diets, followed by sand gobies (45.1%). Bipartite network analysis showed a strong overlap of harbour and grey seal diet. An outlook on how to apply this metabarcoding approach to study the diet of other marine top predators (e.g., harbour porpoises) will be showcased. This study provides new knowledge about dietary composition and community assemblage of fish prey taxa in seals in the southern North Sea. Metabarcoding can help to elucidate predator-prey interactions as well as interspecies competition in a complex and changing ecosystem.



Seasonal variation and temporal stability in the social network of Icelandic herring-eating killer whales

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Understanding the social structure of long-lived, social animals requires long time-series. Certain populations of killer whales have been studied for decades, so their social ecology is relatively well understood. For many killer whale populations around the world, these long datasets are not available. A recent study of Icelandic killer whales found that their society is divided into clusters rather than a hierarchical structure, as in the more well-studied populations. However, that study was based on a relatively short dataset (2008-2015) which included data from both summer and winter. As part of ongoing research into social structure over a longer timescale, we used photographs taken in summer between 2008-2018 and analysed associations between individual killer whales using the half-weight index (HWI). The results supported previous findings that this population's social structure separates into many interconnected clusters rather than hierarchical tiers. However, the social network of these killer whales was more strongly interconnected than previously reported: although the majority of associations between individuals remained weak (35.33% of all associations $\text{HWI} \leq 0.1$; 3.56% $\text{HWI} \geq 0.5$), mean association strength within the population was greater (mean $\text{HWI} \pm \text{SD} = 0.18 \pm 0.06$; previous mean $\text{HWI} \pm \text{SD} = 0.02 \pm 0.01$). This suggests that there may be seasonal variation within social associations. Analysis of association patterns throughout time reinforced previous findings that Icelandic killer whales form a mixture of permanent and temporary associations. These results indicate that killer whale social structure in Iceland is to some extent flexible, and that social groups are liable to change over time. Further additions of photographic data will provide more information on the seasonal variation within this population's social structure, and its stability over time.



First Evidence of Grey Seal Predation (*Halichoerus grypus*) on a Harbour Seal (*Phoca vitulina*) in the German Baltic Sea

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Grey seal predation on other marine mammals is known in almost the entire distribution area except for the Baltic Sea. The Baltic grey seal (*Halichoerus grypus grypus*) was on the brink of extinction in the early 1990s. During the past three decades the counts increased from a few thousands to more than 40.000 in 2020. Nowadays, the grey seal inhabits the entire former Baltic distribution range including the Northern, but also more recently the Southern and Western Baltic Sea. However, less than 10 % of the Baltic grey seals are counted in the Southern Baltic Sea in the annual censuses. Since the 1970s, the German Oceanographic Museum conducts a stranding monitoring investigating all carcasses of marine mammals in Mecklenburg-Western Pomerania, a major part of the German Baltic coastline. In August 2021 for the first time, a harbour seal carcass was found showing 8 of 10 parameters indicating grey seal predation according to van Neer et al. 2021 (Sci Rep). Among other, the juvenile harbour seal showed the typical “cork-screw”, helical and cut-like lesions with a smooth wound margin. Earlier suspicious cases in harbour porpoise suggest that the presented case may not be an isolated one. It is rather a so far rare observation of a behaviour which may occur more frequently with increasing numbers of grey seals in the Southern Baltic Sea. A region where at the same time harbour seals and harbour porpoise are numerous and more frequent than in the Northern Baltic Sea.



On the verge of extinction: what can be done to save the common dolphin (*Delphinus delphis*) in Israel?

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Common dolphins (*Delphinus delphis*) in Israel are on the verge of extinction as their numbers are decreasing dramatically. This alarming trend is observed across several populations around the Mediterranean Sea, caused by the reduction of their prey due to overfishing in the basin. One of the few sub-populations left in the area, currently inhabits the southern waters of Israel, from south Tel Aviv to the southern Israeli border and is mainly observed in the coastal shallow waters off Ashdod and Ashkelon, between the 15-30 m isobaths. These common dolphins were observed and studied year-round between 2016-2021 using boat-based surveys and photo ID methods. Common dolphins were encountered and photographed 43 times during the study period, resulting in 2851 identifications of 25 distinctive mature individuals and 12 calves. Most individuals (62%) were sighted over multiple years with high yearly and monthly sighting rates, indicating long-term site fidelity and residency. Closed population mark recapture models estimated an abundance of 20 (95% CI 20 - 31) mature individuals in 2016 that declined to only 9 (95% CI 9 - 9) mature individuals in 2021. Social network analysis described these nine, along with five calves, as all part of one closed and well-associated social unit, thus, emphasizing their isolation from other common dolphins. Efforts are made to change their IUCN status from 'Endangered', as declared in the Mediterranean in 2003, to 'Critically Endangered' in order to raise awareness and enhance conservation measures. Yet, the overarching question remains the same, "can something to be done to save them?". A variety of efforts to save other mammalian species from extinction have been made worldwide, such as creating a reproductive nucleus in zoos, designated sanctuaries, refreshing the gene pool and more. Could one of these methods or others help save the common dolphins in Israel from extinction?



First comprehensive density and abundance estimates of cetaceans in the Black Sea through aerial surveys

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Three species of odontocetes, all represented by local subspecies, inhabit the Black and Azov Seas: the Black Sea bottlenose dolphin, the Black Sea common dolphin, and the Black Sea harbour porpoise. Seven different strata were defined, covering 62% of the entire Black Sea, including territorial waters and exclusive economic zones. Six of the strata were in the waters of Bulgaria, Georgia, Romania, Turkey and Ukraine and were surveyed in June-July (named CeNoBS study area), while the 7th stratum, covering the waters of Russia (named EMBLAS-Plus study area), in September. This was the first basin-wide survey, involving all the riparian countries. The line transect distance sampling method was used, following predefined transects within each stratum, achieving a 5% coverage of the surveyed area. A total of 9,354 kilometers were surveyed by three planes and a total of 1,984 cetacean sightings were recorded. Design-based abundance estimates were obtained for the three species with a Multiple Covariate Distance Sampling (MCDS) approach. A grid of 10x10 km was created and environmental covariates (e.g., bathymetric features, SST, CHL) were associated to each grid cell, to be used for the model-based abundance estimates, derived by Generalized Additive Models (GAMs). The uncorrected estimates obtained through the model-based analysis were 118,328 (CV=0.06) common dolphins, and 94,219 (CV=0.07) harbour porpoises, for both study areas together. For bottlenose dolphins, estimates were calculated separately for the two study areas, with 18,091 (CV=0.24) for CeNoBS and 24,078 (CV=0.18) for EMBLAS-Plus. These aerial surveys yielded the first insights on overall abundance, density and distribution, providing current regional baseline values and spatial modeling maps for all three cetacean species of the Black Sea during the summer months, to be used for the elaboration of effective conservation measures and to address national and international requirements.



No local cuisines for humpback whales: a population comparison in the Southern Hemisphere

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Climate change impacts across the Southern Ocean are not uniform. In areas with decreasing sea-ice extent and duration, Antarctic krill (*Euphausia superba*) biomass declines are hypothesised, potentially impacting krill-dependent predators like southern hemisphere humpback whales (SHHW). The seven philopatric SHHW breeding populations follow a high-fidelity Antarctic krill diet, utilising distinct sectors of the Southern Ocean for feeding. Their capital breeding life history requires predictable ecosystem productivity to fuel migration and migration-related behaviours. Hence, it is postulated that populations feeding in areas subject to the strongest climate change impacts are more likely to show the first signs of a departure from a high-fidelity krill diet. We explored this hypothesis by investigating blubber fatty acids and skin stable isotopes obtained from five SHHW populations in 2019. Fatty acid profiles and the $\delta^{13}\text{C}$ and ^{15}N values varied significantly among all five populations. However,



(Continued)

calculated trophic levels ranged from 2.7 to 3.1 and fatty acid ratios, 16:1 7c/16:0 and 20:5 3/22:6 3 were above 1, showing that whales from all five populations are secondary heterotrophs following an omnivorous diet with a diatom-origin. Thus, evidence for a potential departure from a high-fidelity Antarctic krill diet was not provided for any population, regardless of climatic conditions impacting their putative feeding grounds. Although significant variability in $\delta^{13}\text{C}$ values was quantified among populations, ^{13}C values of all populations aligned with ^{13}C values of *E. superba* sampled in productive upwelling areas or the marginal sea-ice zone. Consistency in trophic level and diet origin but significant fatty acid and stable isotope differences suggest that the observed variability arises at lower trophic levels. Our results indicate that climate change impacts are currently not reflected in SHHW diet.



The Pitcairn Islands in the southern Pacific Ocean established as a breeding and calving grounds for the humpback whales (*Megaptera novaeangliae*)

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From a scientific perspective, the provenance of the humpback whales (*Megaptera novaeangliae*), which have been observed in the Pitcairn Islands located in the central South Pacific, is unknown due to the current lack of migratory and connectivity studies. It may be that they are a distinct sub-species or possibly genetically connected to the endangered French Polynesian population (IWC 'breeding stock F') or those observed at Rapa Nui (Easter Islands), although the latter have not been scientifically studied. Whilst populations of humpback whales in the rest of the world have recovered well from commercial whaling, the Oceania sub-population, has not recovered so swiftly. It is likely to have declined by 70% since 1942 due to intense Soviet whaling in Antarctic feeding grounds and was listed as Endangered on the IUCN Red List in 2008. The Pitcairn Islands Marine Protected Area (MPA), established in 2016, covers almost 842,000 km² of ocean and provides a safe haven for the visiting whales, where several mother-calf pairs have been observed to frequent all four of the Pitcairn islands. We report on the initial biopsy sampling for DNA analysis recorded in the South Pacific Whale Research Consortium database and plans for further genetic sampling, deployment of hydrophones for whale song recording and establishment of a photo-ID database. This research supports the Government of Pitcairn Islands' commitments under the Convention on the Conservation of Migratory Species of Wild Animals and associated Memorandum of Understanding for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region, which aims to conserve all cetaceans and facilitate the exchange of scientific information necessary to coordinate conservation measures.



Validation of quantitative fatty acid signature analysis for estimating the diet composition of free-ranging killer whales

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Accurate diet estimates are necessary to assess trophic interactions and food web dynamics of ecosystems, particularly for apex predators like cetaceans, which top-down regulate entire food webs. Quantitative fatty acid analysis (QFASA) has been used to estimate the diets of marine predators in the last decade but has yet to be implemented on free-ranging cetaceans, from which typically only biopsy samples containing outer blubber are available due to a lack of empirically determined calibration coefficients (CCs), accounting for cetacean fatty acid (FA) metabolism. Here, we develop and validate QFASA for killer whales using full blubber from managed-care and free-ranging individuals. First, we compute full, inner, and outer blubber killer whale CCs from the FA signatures across the blubber layers of managed-care killer whales and their long-term diet items. We then run cross-validating simulations on the managed-care individuals to evaluate the accuracy of the estimates by comparing full-depth and depth-specific estimates to true diets. Finally, we apply these approaches to harvested killer whales from Greenland to test the utility of the method for free-ranging killer whales, particularly for the outer blubber. Accurate diet estimates for the managed-care killer whales are only achieved using killer whale-specific and blubber-layer-specific CCs. Modeled diets for the Greenlandic killer whales largely consisted of seals ($75.9 \pm 4.7\%$) and/or fish ($20.4 \pm 2.4\%$), mainly mackerel, which was in accordance with stomach content data and limited literature on this population. Given the remote habitats and below surface feeding of most cetacean species, this newly developed cetacean-specific QFASA method, which can be applied to biopsies, offers promise to provide a significant new understanding of diet dynamics of free-ranging cetacean species throughout the world's oceans.



A tool to improve management under climate change scenarios: using expert knowledge to estimate cetaceans' thermal suitability in the future

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Over the last decades, global warming has contributed to changes in marine species composition, abundance and distribution, in response to changes in oceanographic conditions such as temperature, acidification, and deoxygenation. Different methodologies have been used to assess changes in species distribution patterns, namely experimentally derived thermal limits, which are known to be related to observed latitudinal ranges in marine species. However, such experiments cannot be undertaken with marine megafauna like cetaceans. An alternative approach is to use expert elicitation to derive species' thermal suitability and assess their thermal responses. Here, we developed and applied a methodology based on expert derived thermal habitat suitability curves and projected future changes under different climate scenarios. We tested this approach on ten cetacean species currently present in the biogeographic area of Macaronesia (North Atlantic) under Representative Concentration Pathways (RCPs) 2.6, 4.5 and 8.5 until 2050. Species thermal responses relate to their suitability curves, where cooler water species show lower suitability to warmer temperatures and vice-versa. Overall, increases in annual thermal suitability were found for *Balaenoptera edeni*, *Globicephala macrorhynchus*, *Mesoplodon densirostris*, *Physeter macrocephalus*, *Stenella frontalis*, *Tursiops truncatus* and *Ziphius cavirostris*. Conversely, our results indicated a decline in thermal suitability for *B. physalus*, *Delphinus delphis* and *Grampus griseus*. Our study indicates potential responses in species thermal suitability and contributes to test this method's applicability as a cost-efficient tool to support conservation managers and practitioners.



Assessing the integration potential of unoccupied aerial vehicles (UAVs) with conventional cetacean surveys

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Unoccupied aerial vehicles (UAVs; or drones) are recognized as revolutionary tools for various ecological purposes. However, their suitability for estimating animal abundance has yet to be explored for multi-species surveys across large areas. In this study, we aimed to investigate the integration potential of those platforms with conventional cetacean surveys. First, we conducted a desktop study to examine the legislative capacity of states within the ACCOBAMS region to transition towards the new technology. In addition, we performed focal follows of common bottlenose dolphins (*Tursiops truncatus*), short-beaked common dolphins (*Delphinus delphis*) and striped dolphins (*Stenella coeruleoalba*) and used our imagery to train a state-of-the-art convolutional neural network (CNN) for the automated detection of marine mammals. We used various object sizes to test the performance of the CNN and determine the optimal ratio between coverage and resolution for UAV-based surveys. Finally, we distributed our data amongst trained aerial observers and investigated their capacity to correctly identify dolphin species as a function of reviewer-related variables and image attributes. Our study highlights significant limitations to UAV integration with the conventional approach and identifies potential measures to reduce the rate of errors when considered in the design phase of a survey.

Simultaneous drone and tag data suggest that bubble-nets are tools used by solitary foraging humpback whales to improve foraging efficiency

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Humpback whales (*Megaptera novaeangliae*; HBW) use bubble-nets while foraging on a variety of prey species. Previous studies have described aspects of the underwater behavior and group dynamics of bubble-netting HBWs inferred from animal-borne sensors and surface observations. Here, we incorporate unoccupied aerial systems (drones) equipped with laser altimeters and photogrammetry techniques together with CATSCam suction-cup tri-accelerometer video tags to describe the structure of bubble-nets and the behavior of HBWs in greater detail than previously available. Using drones, we observed 19 HBWs producing 83 bubble-nets while foraging individually on krill in Southeast Alaska. Nets consisted of 3 ± 1.3 internally tangent rings. UAS-derived measurements of the 2-dimensional area of these rings revealed the outermost ring to be 7.2 ± 4.8 times larger than the innermost ring. If krill are contained by the bubble rings, as has been demonstrated for other HBW prey species, this decrease in ring area - and by extension net volume - would lead to a proportional increase in prey density. CATSCam data from five HBWs indicated that they began expelling air at a depth of 22.0 ± 4.3 m, which was broadly correlated with the mid-depth of the uppermost scattering layer. Together, CATSCam and UAS data suggest that whales decrease the net 'mesh size' in the innermost ring - presumably to minimize prey escapement - by increasing the rate at which they produce bubbles while maintaining a constant swimming speed during net deployment. While ascending through the bubble-net, whales reached a maximum speed of 2.1 ± 0.2 ms⁻¹, which is substantially slower than speeds reported for HBWs lunge feeding on krill without nets. Given the high energetic costs associated with lunge feeding, these data suggest HBWs use bubble-nets as tools to increase their foraging efficiency by both concentrating their prey and reducing the energetic costs associated with lunge-feeding.



Is the Dinner Bell causing erroneous data in seal-fish predation studies? – harbour seal/brown trout case

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In the Danish inlet, “Limfjorden”, restoration of adjacent rivers has increased suitable spawning habitats for brown trout. From satellite tracking, we see that seals guard the narrow straits through the 120km long Limfjord. This coincides with migration of trout leaving for the open sea in spring or return to spawn in the fall. Based on 160 adult post-spawning trout equipped with 69kHz acoustic tags, we estimated that 66% of the fish that entered the fjord system disappeared in it. The mortality in the fjord system is record high and it is speculated to be due to seal predation. As 69kHz is within the harbour seal’s hearing range and controlled experiments show that grey seals, are attracted to tagged fish. As grey seals have similar hearing as harbor seals, this could explain the high trout mortality. We therefore made a follow-up study where 214 trout were tagged either with the standard 69kHz or a new 180kHz tag, which is outside the seal’s hearing range. To locate the fish and generate survival estimates we deployed 91 hydrophones at both frequencies covering the rivers and five narrow passages in the fjord. In addition, 12 seals were tagged with GPS position transmitters, acoustic fish tag recorders (VMT), depth/accelerometer/magnetometer dataloggers and 180kHz fish tags. This setup enabled us to track both the trout and the seals and estimate their interaction and predation rate for both audible and inaudible fish tags. Such studies are paramount when estimating the true predation rate from predators, and to provide relevant advice to managers.



Development of a mass spectrometry method capable of detecting and quantifying a panel of steroid hormones in right whale blow

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Over the last decades, global warming has contributed to changes in marine species composition, abundance and distribution, in response to changes in oceanographic conditions such as temperature, acidification, and deoxygenation. Different methodologies have been used to assess changes in species distribution patterns, namely experimentally derived thermal limits, which are known to be related to observed latitudinal ranges in marine species. However, such experiments cannot be undertaken with marine megafauna like cetaceans. An alternative approach is to use expert elicitation to derive species' thermal suitability and assess their thermal responses. Here, we developed and applied a methodology based on expert derived thermal habitat suitability curves and projected future changes under different climate scenarios. We tested this approach on ten cetacean species currently present in the biogeographic area of Macaronesia (North Atlantic) under Representative Concentration Pathways (RCPs) 2.6, 4.5 and 8.5 until 2050. Species thermal responses relate to their suitability curves, where cooler water species show lower suitability to warmer temperatures and vice-versa. Overall, increases in annual thermal suitability were found for *Balaenoptera edeni*, *Globicephala macrorhynchus*, *Mesoplodon densirostris*, *Physeter macrocephalus*, *Stenella frontalis*, *Tursiops truncatus* and *Ziphius cavirostris*. Conversely, our results indicated a decline in thermal suitability for *B. physalus*, *Delphinus delphis* and *Grampus griseus*. Our study indicates potential responses in species thermal suitability and contributes to test this method's applicability as a cost-efficient tool to support conservation managers and practitioners.



Drivers of change in social networks of bottlenose dolphins (*Tursiops truncatus*) in Cardigan Bay, Wales

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Development of social structure within animal societies is determined by a range of factors including population dispersion, individual fitness, and predation pressure. Consequently, societies may demonstrate diverse grouping, mating, and spacing patterns and show variation in the strength and quality of relationships between individuals. Although previous studies have established the nature of associations within delphinid social networks, few have analysed how association strength and patterns have changed over time and whether this correlates with fluctuations in population status, social group, sex, age, or changes in geographic location due to movement of individuals. This study describes the first long-term assessment, spanning two decades, of differences in association strength between individuals, determining whether preferential associations are maintained long-term, and examining the drivers of change within social networks of one of the UK's largest semi-resident bottlenose dolphin populations. Data were collected by extracting identification features from high-resolution images of groups of individuals, photo-identified on a regular basis, from the 1990s to the present in the waters around Wales, particularly Cardigan Bay. From 505 identified individuals, social analysis was undertaken on 305 individuals sampled ≥ 5 times, forming part of an open population. Social differentiation within the entire social network was high demonstrating the presence of diverse, non-random social bonds. Temporal associations best fitted the model of "preferred companions and casual acquaintances" against standardised lagged association rates. Most associations were between pairs of individuals that preferentially associate (constant over time), or associate for a period, dissociate, then re-associate (non-permanent associations). Long-term associations were favoured over short-term non-permanent companionships, correlating with a society governed by fission-fusion dynamics. Incorporation of techniques that evaluate environmental and physical factors may advance our knowledge of the ecological parameters determining cetacean population structure thus aiding area-based management and helping explain population fluctuations in response to human pressures and environmental change.



Using expert opinion to highlight how we can achieve effective and ethical management at cetacean stranding events

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Despite the often-compromised state of live stranded cetaceans, most human stranding response focuses on attempts to 'rescue' the animals. Yet, the current lack of empirical data informing response procedures, means that appropriate intervention may not be reliably undertaken. This has been identified as a major concern for cetacean welfare and requires further work to develop optimal response procedures. Firstly, an understanding of fundamental concepts, knowledge gaps and key concerns relating to the welfare and survival of stranded cetaceans is required. We solicited the opinions of global conservation and animal welfare science experts (n=63) using a two-stage Delphi method. High agreement among experts suggests that welfare should be characterised through the interrelated aspects of biological function, behaviour, and mental state. Survival was characterised by aspects of biological functioning, behaviour, and surviving for at least 6-months post-release. The way in which these concepts are conceived will influence how they are assessed, and which features are emphasised when evaluating outcomes. Post-release monitoring was the single major knowledge gap identified for survival, whilst nine gaps were ascertained for welfare. These related to diagnostics of internal injuries, interpretation of behavioural and physiological parameters, and when and how to make euthanasia decisions. Thirteen key concerns overlapped for both welfare and survival likelihood, including difficulty breathing, organ compression, skin damage, physical traumas, separation from conspecifics, and stress which animals may experience due to stranding and human intervention. Notably, our findings indicate inextricable links between the welfare state and survival likelihood of stranded cetaceans, providing evidence of the need to integrate animal welfare science alongside conservation biology. We therefore call for science-based decision-making at cetacean stranding events to achieve effective, ethical management.



Sei whale acoustic occurrence in the Gulf of Corcovado (Chile) detected through Convolutional Neural Networks

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Sei whale populations have been subject to intensive commercial whaling, especially in the Southern hemisphere. Due to a lack of data from this region, current IUCN status of protection and estimation of population recovery relies solely on models based on data from the Northern hemisphere. Here, we combined Passive Acoustic Monitoring (PAM) with advanced Deep Neural Networks (DNN) techniques to automatically detect sei whale acoustic presence in the Gulf of Corcovado (Chile). The first characterisation of sei whale vocalisations in the South Eastern Pacific Ocean was published by Español-Jiménez et al. in 2019. Based on this description of the sei whale downsweeps, sei whale calls were identified in recordings from an autonomous platform deployed in 2012-2013 at the entrance to the Gulf of Corcovado, Chile. Sei whale downsweep labels (N=978) were manually assigned and used to develop an automatic sei whale classifier using Convolutional Neural Networks (CNN). The sei whale classifier performance had a mean Average Precision of 0.96. This model was run over the full dataset (319 days). A threshold value of 0.82 was chosen for this model, which on the full dataset corresponded to a recall of 96%, i.e. the model was able to detect 96% of the calls present in the datasets, with a precision of 86%, i.e. 86% of the classified calls were correctly identified. Sei whale acoustic presence was mainly detected from ends of October 2012 to mid-April 2013, with a clear peak of detections during January 2013. These results corroborate previous publications based on visual sightings that identified this area as a feeding ground for sei whales during Austral summer.



Short-term versus long-term strategies for studying rare cetaceans: lessons from a long-term study of Hawaiian odontocetes

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Cetacean research efforts have traditionally focused in nearshore areas on species that are easy to study – those that are relatively common and/or are relatively approachable. Species that are difficult to find or approach are often ignored or left quickly even when they are encountered, and survey designs often constrain flexibility to venture offshore when conditions allow. While such short-term approaches may make sense for graduate students or meet the expectations of funding agencies, they are not effective for increasing knowledge and identifying conservation concerns of rare and/or difficult-to-study species. Since 1999, a study of odontocetes around the main Hawaiian Islands has taken a different approach. First, survey efforts have been undertaken as far offshore as possible when weather conditions are favorable. Second, regardless of the target of funding support, sampling priorities are in inverse proportion to encounter rates – rare species, when encountered, are always the priority. Given they are rare, there is little lost opportunity cost in terms of working with more common species that are often the focus of funding agencies. Combined with citizen science contributions and opportunistic photos taken by other researchers, in the long-term this approach has been extremely productive, leading, for example, to the identification of small resident populations of pygmy killer whales, dwarf sperm whales, and false killer whales. Hawaiian populations of Blainville's and Cuvier's beaked whales, rough-toothed dolphins, and melon-headed and short-finned pilot whales are now among the best-known populations of these species worldwide. Unfunded "pilot" studies of rare species have often led to funding, but such funding, or lack thereof, should not be a factor in species sampling priorities. Given the rarity of sightings of many of these species, and thus slow accumulation of information, collaboration with other researchers and citizen scientists is critical for the success of this approach.



Short Talks Abstracts
ECS 2022/ Ashdod, Israel



Stay behind, not high above - underwater noise levels of three drones measured at various horizontal and verticals distances

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Unmanned aerial vehicles (UAVs), or 'drones', serve as a powerful and cost-effective tool for cetacean research. Despite the increasing use of drones in ecological research, the impacts of drone noise on the marine environment remain largely unknown. In this study, we recorded underwater sound levels of three different UAV models (DJI Mavic Pro Platinum, DJI Phantom 4 Pro v2.0, DJI Inspire 1 Pro) commonly used in cetacean research. For each model, three replicate flights were conducted over 36 positions at standardized horizontal (0 - 30 m) and vertical (2 - 40 m) distances from the hydrophone (1 m depth). Broadband received levels of the Inspire were highest with 91 dB(RMS 250-17000 Hz) re 1 μ Pa when flown at 0 m distance and 2 m altitude. Noise levels of the Phantom were lower (87.1 dB(RMS 250-17000 Hz) re 1 μ Pa) and the Mavic was quietest (80.7 dB(RMS 250-17000 Hz) re 1 μ Pa). Median ambient noise levels in the absence of a drone were 80.0 dB(RMS 250-17000 Hz) re μ Pa. Standardizing horizontal distance at 0 m, altitude was significantly associated with received levels up to 40 m for both the Inspire and Phantom; the Mavic stopped significantly contributing to ambient sound after an altitude of 5 m. In contrast, standardizing altitude at 2 m, the Phantom and the Mavic significantly contributed to received levels to a horizontal distance of only 2 m; the Inspire contributed to received levels up to 5 m. In summary, drones contribute to ambient sound levels at higher altitude ranges than previously reported. Additionally, their contribution decreases more quickly with horizontal distance than with altitude. Despite the low broadband levels, the unnatural sound might cause disturbance to marine mammals. We recommend increasing horizontal distance rather than altitude to the animal to minimize noise impacts.



Toxicological assessment of persistent organic pollutants (POPs) in Risso's dolphin (*Grampus griseus*) specimens stranded along the Italian coasts

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Both globally and in the Mediterranean Sea, there are few studies on the toxicological status of Risso's dolphin (*Grampus griseus*, Cuvier 1812). In general, we can say that there is still little knowledge about this species and, in fact, in the Mediterranean Sea, this cetacean has been classified within the International Union for Conservation of Nature (IUCN) as "Data Deficient". To fill these gaps at least in a small part, in 20 specimens of *Grampus griseus* stranded along the Italian coasts between 1998 to 2021, hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane and its metabolites (DDTs) were analyzed. In fact, through the biomagnification process, these contaminants can be found in much high levels at the top of the food chain and therefore, in the Risso's dolphin which is a top predators of marine food chain. The presence of these Persistent Organic Pollutants (POPs) in the different biological materials (blubber, liver, muscle and brain) was evaluated, both quantitatively and qualitatively. The blubber is the biological material with the higher levels, followed from liver, muscle and brain, confirmed the results found in this species and in other cetaceans in the world. The results were discussed according to sex, age and stranding areas. No statistically significant differences were found between genders, age and stranding areas. The levels of POPs found in these specimens were the highest recorded among this species, except for two specimens stranded in 1995 in Ligurian and Tyrrhenian Sea.

Estimating the population size of *Tursiops truncatus* using signature whistles in a hotspot of summer tourism

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Pitiusas Islands (Ibiza and Formentera) in Spain constitute a prime tourism destination in the western Mediterranean. Nautical tourism increases boat presence and underwater noise pollution substantially, especially during summer months. *Tursiops truncatus* is the only marine mammal species that commonly inhabits this coastal area. Genetic and stable isotope studies revealed a small differentiation among the dolphins inhabiting the waters around Pitiusas and the ones that range around Mallorca-Menorca or along the eastern Iberian Peninsula. In this study, we aimed to determine the presence of bottlenose dolphins in the coastal areas around Pitiusas across the year and explore underwater noise pollution caused by coastal navigation. Between May 2020 and May 2021, seven hydrophones were deployed at a depth of around 30 m. Recording with a duty cycle of 3 minutes every 15, more than 200,000 sound files were generated. Following the signature identification method, bottlenose dolphins were individually identified by their signature whistle, which were then used to generate a capture-recapture matrix and estimate the population size. Results show the effectiveness of passive acoustics and the sonoidentification method for monitoring bottlenose dolphin populations in coastal marine areas while assessing the impact of one of their main threats, underwater noise pollution.

Assessment of bycatch level for the Black Sea harbour porpoise in the light of new data on population abundance

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Incidental catch (bycatch) in fishing gears (mainly bottom gillnets targeting turbot) is a major mortality factor for the Black Sea harbour porpoise (*Phocoena phocoena relicta*), an endemic subspecies listed as Endangered in the IUCN Red List. In 2019-2021, a study was conducted in Bulgaria, Romania, Turkey and Ukraine, aiming to assess the bycatch level. Data were collected by independent observers onboard turbot fishing boats (Bulgaria and Romania), complemented by questionnaire surveys and examination of stranded carcasses (in all countries). Forty-eight missions (days) that included 59 hauls were covered by onboard observations. In total, 189 cetaceans were recorded in 55% of all missions: 182 harbour porpoises, 4 bottlenose dolphins and 3 common dolphins. The median number of porpoises bycaught per trip was 1, the maximum number was 41. Besides, illegal, unreported and unregulated (IUU) fishing operations were identified as a source of bycatch as proven by observed stranded cetaceans with bycatch marks during the period of turbot fishing ban. Estimated total bycatch level for Black Sea harbour porpoise was between 11,826 (based on onboard observers' data) and 16,200 (based on questionnaire survey data) individuals. In the summer of 2019, the most comprehensive aerial survey of abundance and density of cetaceans in the Black Sea (covering 62% of its area) was conducted. Estimated uncorrected abundance of Black Sea harbour porpoise in the surveyed area was 94,219 (CV=0.07) with the highest density in the south-western part of the Black Sea. Corrected abundance for g(0) (using correction factor from SCANS-III aerial survey of European Atlantic) was estimated as 258,843 porpoises. Bycatch of the harbour porpoise in the Black Sea takes at least 4.6% and as much as 17.2% of the total population. Even the most conservative estimate, thus, far exceeds the sustainable level of 1-1.7% adopted by international agreements and organizations.



SARS-CoV-2 in marine mammals: survey results on the potential viral susceptibility in cetaceans stranded along the Italian coastline

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Due to marine mammal's demonstrated susceptibility to SARS CoV-2, based on homology level of the angiotensin-converting enzyme 2 (ACE2) receptor with the human one, along with the global spread of infection and the aquatic contamination, potential SARS CoV-2 transmission to marine mammals can be expected. Moreover, based on immune system and inflammatory responses to SARS-CoV-2 infection in humans, macrophages could also play an important role in antiviral defense mechanisms. In order to provide a more in-depth insight into SARS-CoV-2 susceptibility in marine mammals, we evaluated the presence of SARS CoV-2 and the expression of ACE2 and CD68, as a pan-macrophage marker. A large number of lung tissue samples, belonging to cetaceans stranded along the Italian coastline during 2020-2021, was collected for SARS CoV-2 analysis by real-time PCR and Immunohistochemistry (IHC), along with ACE2 expression by IHC. In addition, ACE2 and CD68 were also investigated by Double-Labeling Immunofluorescence (IF) Confocal Microscopy. From samples analysed for the survey, no SARS CoV-2 positivity was found while ACE2 protein was detected in the lower respiratory tract but heterogeneous for age, sex, and specie, suggesting that ACE2 expression can vary between different lung regions and among individuals. Finally, IF analysis showed elevated colocalization of



(Continued)

ACE2 and CD68 in macrophages only when an evident inflammatory condition is present, such as in human SARS CoV-2 infection. In conclusion, although no SARS CoV-2 spillover already occurred on cetaceans stranded along the Italian coastline and examined by our network within the investigated period, results on the expression of ACE2 allow us to hypothesize a possible susceptibility to SARS-CoV- 2 in marine mammals. From a One Health perspective, it is therefore important performing a constant and systematic surveillance of SARS-CoV-2 infection on marine mammals by monitoring stranded specimens, in order to help and protect both human health and endangered marine mammal species.



The application of area/time thresholds to manage noise impacts in UK harbour porpoise SACs

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In 2017, UK Statutory Nature Conservation Bodies presented a workshop at the ECS conference on proposed noise impact thresholds for the then candidate Special Areas of Conservation (SACs) for harbour porpoise. Following designation of the SACs in 2019, JNCC, Natural England and DAERA published their Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (JNCC et al., 2020). This details daily and seasonal area-based thresholds for exclusion of harbour porpoise, above which there is potential for Adverse Effect on site Integrity. Also detailed are evidence-based Effective Deterrent Ranges to calculate the contribution of ensonifying activities (piling, UXO clearance, geophysical surveys) to the thresholds. Natural England has used the guidance to advise developers and here summarise the outcomes. A key risk to the SACs, particularly the Southern North Sea SAC, is development of offshore wind. As identified in BEIS' Review of Consents (2020), there is potential for threshold exceedance, but Site Integrity Plans (SIPs) can be used to mitigate impacts. SIPs act as an updated in-combination assessment, undertaken post-consent when impacts from the project itself and projects that may act in-combination are better understood, which is needed in part due to uncertainty in project envelope and timings of noisy activities at the time of consent. Whilst Natural England are supportive of SIPs in principle, we have concerns over the management of multiple SIPs from multiple projects. SIPs require the Regulator, and ideally the developer, to have knowledge of all plans or projects that could act in-combination. Greater cross-industry and Regulator/adviser collaboration is needed to ensure all necessary activities are captured and assessed appropriately. To our knowledge, the thresholds have not yet been exceeded (JNCC, 2021); however, it is unlikely this will remain the case over the predicted offshore wind development in the next 5-10 years.



Is haul-out behaviour of harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) influenced by tourist activities?

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During the last decade, there has been an increasing interest to include seals in commercial wildlife tourism. One important seal tourist site is the Wadden Sea, shared between Denmark, Germany and the Netherlands. This unique intertidal area in the southern North Sea was included on UNESCO's World Heritage List in 2014 and has since experienced an annual 2% increase of tourist visits. Here, we use aerial counts of harbour (*Phoca vitulina*) – and grey seals (*Halichoerus grypus*) from 1998-2021 during harbour seals' pupping and moulting to investigate how numbers of seals at the various haul-out sites vary depending on tourist operations. Haul-out sites where wildlife tourism takes place vary between years from 25-50% of the harbour seals hauled-out in the entire Danish Wadden Sea. The number of harbour seals and number of pups born during the breeding season in June, as well as the number of seals counted during the moult in August have decreased since 2012 at the haul-out sites both with and without tourist activities. The distribution of seals in areas with tourist activities is significantly affected by the number of tour operators in both June and August. This is particularly true for the grey seals, that has decreased their use of areas with tourism activities since 2012-2013 correlating with an increasing number of tour operators. These results highlight a potential problem and may prompt the first step to develop code-of-conduct to ensure sustainable management of seal tourism in the Wadden Sea, where limited regulation of wildlife tourism is currently in place.



The Inner Ionian Sea Archipelago: a stronghold for the Mediterranean monk seal in urgent need of conservation action

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The Mediterranean monk seal *Monachus monachus* is one of the world's most threatened marine mammals, listed as Endangered in IUCN's Red List, and only a few hundred of them survive in the whole of the Mediterranean Sea. The main causes of such status are direct killing by fishermen, bycatch in fishing gear and human encroachment and disturbance in their critical habitat. A small islet, Formicula (less than 700 m wide), part of a Special Area of Conservation (SAC) and included in IUCN's global list of Important Marine Mammal Areas (IMMAs), contains key breeding, resting and feeding habitat for Mediterranean monk seals. During the past decade 30+ monk seals with various degrees of site fidelity have been photo-identified in Formicula, and in Autumn 2021 at least three different newborn pups were observed. However, the continued presence of monk seals in Formicula is at risk due to disturbance caused by uncontrolled human presence, including boat-based tourism and fishing. In particular, the highest concern derives from the observed increase of private boat tourism, which has become extremely intense in recent years, with visitors seeking close encounters with the seals, both from their boats and in the water, and even entering breeding caves without any form of control. While a procedure for the implementation of appropriate management and conservation measures is ongoing as part of the lengthy process for the adoption of the SAC management plan, urgent intervention is needed before the start of the 2022 summer tourist season. Measures proposed include the prohibition of access to Formicula through the establishment of a sufficiently wide area-time closure around the islet.

Determining which regions of European waters exhibit the highest risk for harbour porpoise from marine pollutants

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In European shelf seas, harbour porpoises are considered particularly vulnerable from coastal pressures. Higher trophic level species, such as porpoises, are particularly at risk due to bioaccumulation of pollutants originating from terrestrial ecosystems. Negative effects on reproduction and impaired resistance to disease have been demonstrated for porpoises in the region. Identifying locations where high densities of porpoise and concentrations of pollutants co-occur should help to identify where mitigation is most needed. This study sets out to identify where in European waters harbour porpoises are at higher risk from Cadmium, Lead, Mercury, PAH and PCB – by producing maps of pollutant concentrations and porpoise abundance, so that areas where overlap is greatest can be determined. Relationships between recorded concentrations of pollutants and relevant environmental variables were established and then modelling approaches were used to predict spatial variations in concentrations of pollutants across European waters. Those predictions were then overlaid with existing predictions of spatial variations in densities of porpoise in the same area. The results showed that porpoises in the German Bight were at the highest risk of any area in European waters. This is attributed to estuarine input from the River Elbe due to chemical industries upstream. Porpoise numbers in the Southern Bight, Irish Sea, and over the Dogger Bank are also at potential risk. Overall, estuarine areas in the southern North Sea are exposed to the highest risk. The return of porpoises into these regions has placed them at increased risk from contaminants, suggesting that these areas require urgent conservation effort if this range shift persists.



Heavy metal concentrations in Grey Seals from the Southern Baltic Sea during population recovery

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Grey Seals inhabited the German Baltic Sea until 1920, when the last grey seal was shot. Afterwards, until 2005, only few individuals were recorded incidentally. The nowadays the protected species has been gradually returning to its historical habitats in recent years due to a hunting ban and reduced exposure to environmental toxins. Grey seals are apex predators of the Baltic Sea and they accumulate various environmental toxins, including heavy metals during their life span. The aim of this work was to obtain an estimation of the heavy metal load of grey seal tissues obtained from the current population to compare it to published data to detect a potential development over time. For this purpose, tissues of 35 dead-found animals from the Mecklenburg-Western Pommerian coast were analysed using atomic absorption spectrometry (AAS). Lead, cadmium, copper and selenium was measured in muscles, liver and kidney, as well as mercury contamination in the liver. Earlier studies from Finland (1986, 2002) and Sweden (1992) found elevated concentrations compared to our study. These results indicate that the heavy metal load in grey seals has decreased over the last decades. Returning grey seals were mostly subadult males leading to a potentially confounding factor. Therefore, further investigations are needed to confirm this and for an improved assessment of the influence of multiple factors.



Tuesday, April 5th / Central European Summer Time

Combining onsite conservation efforts and research: a team dedicated to promoting best dolphin-watching practices while studying its impacts on spinner dolphins (*Stenella longirostris*) in Reunion Island, Western Indian Ocean

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Marine wildlife tourism has expanded worldwide, with its impacts on cetaceans over the short and long terms widely reported. Likewise, whale- and dolphin-watching have rapidly developed in Reunion Island, due to a large demand for interactions with cetaceans. Monitoring the activity and the animals' behavioural responses allows to implement a well-informed and adapted management of the activity. Besides, awareness-raising and education are key to inform tourists and tour operators about the best practices, the impacts of the activity and the local regulations, strengthening the conservation efforts on cetaceans.

Since 2017 the team 'Quiétude' is dedicated to monitor and educate whale- and dolphin- watchers at sea to ensure compliance with the code of conduct. The daily presence of the team in the dolphin-watching zones firstly allows to guarantee the respect of the targeted animals, and secondly, to collect data on the activity and on the dolphins' reactions to the presence of vessels. As such, using scan sampling, we evaluated the short-term effects of dolphin-watching on spinner dolphins' behaviour. In presence of vessels, while travelling, dolphins were more likely to remain travelling or beginning to mill and less likely to begin socialising or diving. Besides, activity budgets for resting and socialising decreased simultaneous to increased travelling and milling. Dolphins showed greater avoidance responses when vessels were non-compliant with the regulations and when vessels were too numerous. Such alterations in the behavioural activity could at long term entail detrimental consequences at the population level.

Understanding the short-term effects of dolphin-watching on the spinner dolphins will allow to adapt the management measures that guarantee their welfare. This study demonstrates that research and direct field conservation efforts such as education are compatible, complementary and fundamental to ensure the respect and preservation of wild cetaceans.

Is the Red Sea northern Gulf of Eilat a hotspot for solitary-social dolphins? Case studies of 5 individuals over the last three decades

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The northern Gulf of Eilat hosts relatively small resident populations of four dolphin species: Risso's dolphin (*Grampus griseus*), Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), pantropical spotted dolphin (*Stenella attenuata*) and spinner dolphin (*Stenella longirostris*). We present here records of 4 bottlenose dolphins and one vagrant Indian Ocean humpback dolphin (*Sousa plumbea*) solitary-social individuals, reported there during 1992-2021. The documentation is based on personal encounters and citizen-science reports, including videos, of above and under water behavior.

1. In 1992, a young male bottlenose dolphin named "Crispy" was recorded in good condition while interacting for several months with workers on a marine fish farm in Eilat.
2. In 1994, an eight-year-old female bottlenose dolphin named "Holly" arrived in poor condition to the beaches of Nuweiba, Egypt. Her interactions with humans from the nearby Bedouin village and tourists were documented over a period of seven years on a daily basis.
3. In 2007, a young bottlenose dolphin male named "Marco" arrived in poor health to the beaches of Eilat. After a few months, he gradually grew stronger and initiated physical contact with swimmers.
4. In 2019, an adult female bottlenose dolphin named "Tomer" arrived to the north beach of Eilat. She was mostly interacted with SUP surfers and SCUBA divers and seldom allowed body contact. She was last observed in September 2021 in poor condition (very slim).
5. In January 2021, a vagrant adult female humpback dolphin named "Ella" arrived in good health accompanied by her still nursing calf, into Eilat's Marina. In February 2021 she lost her calf and is since seen on a daily basis. From May 2021, she began interacting with SUP surfers.

These observations may suggest that environmental conditions and human in-water activity of this region make it a favorable territory for social-solitary dolphins.

Legislative feasibility of unoccupied aerial vehicle usage for environmental surveys in the ACCOBAMS region

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The use of unoccupied aerial vehicles (UAVs; or drones) has become widespread in the field of ecology for surveying wildlife distribution and abundance. However, large-scale monitoring programs still refrain from adoption due to bureaucratic and legislative difficulties, as well as some technical limitations.

In recent years, the Agreement for the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Ocean (ACCOBAMS) initiated a regional-wide survey effort. As part of the ACCOBAMS Survey Initiative (ASI) the application of UAVs was assessed both in terms of regional legislation, technical capabilities, and operational recommendations.

During 2020, a desktop study was conducted to evaluate the legislative framework in each of the ACCOBAMS party countries regarding drone flying. Legislation differed in regard to drone registration, pilot licensing and registration, maximum flight altitude, pre-approval of flight plan, permission for flight beyond visual-line-of-sight and more.

To conclude the findings, each country was given an overall score to reflect feasibility of UAV usage. Seven countries did not permit any drone usage, while others varied in ease of permit obtainment. All countries that completely forbid drone usage were north-African countries, bordering the southern part of the Mediterranean Sea, an area known for its knowledge gaps in cetacean research. All other countries bordering the Mediterranean, Atlantic and Black Sea allowed for drone usage with 0-5 additional permits or requirements. Lastly, a map was created to visually display the overall score of ease and difficulty in obtaining flying permission across all waters of the ACCOBAMS region.



First documented alive stranding of a *Steno bredanensis* in Salamina Island, Aegean Sea, Greece

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The rough-toothed dolphin (*Steno bredanensis*) is found worldwide in deep temperate, subtropical and tropical waters. The distribution and its population structures are poorly understood. In the Mediterranean Sea, the species was once considered a visitor from the Eastern Atlantic, until more recent findings suggested that there may be a small resident population in the Mediterranean Sea. Hereby we document the presence of a rough-toothed adult male dolphin, that stranded alive in Salamina Island, Greece in July 2021. This is the first report of the species in the Saronic Gulf, Aegean Sea, Greece. The detailed clinical examination revealed that the dolphin suffered from severe dehydration, weakness, dyspnea, cachexia and had difficulties in swimming and diving. It had one deep infected wound on the right lateral abdomen, as well as several superficial ones elsewhere. Parasites of the genus *Penella* were present on the dolphin's skin. Hematological and biochemical examinations revealed severe anemia, elevated white blood cell count, hypoglycemia and malnutrition. Supportive treatment initiated with oral rehydration including electrolytes, with a homemade feeding formula and multi-vitamins. Long-acting antibiotics and corticosteroids were also administered. According to the morphological characteristics, teeth and body measurements, the species was identified as being a rough-toothed dolphin. For confirmation of this identification and phylogeography of the species, mitochondrial DNA sequences from the D-loop region and *Cox1* gene were amplified, and compared with sequences from Atlantic Ocean, Indian Ocean, Western Pacific and Central/Eastern Pacific Ocean (GenBank repository). Molecular analysis matched at >99% identity with *Steno bredanensis* as a species and showed close proximity with the Atlantic haplotypes. The presence of this specimen in the Aegean Sea and its connection to the Atlantic population remains a mystery; the possible isolation of a very small Mediterranean population still is to be confirmed and may be an important challenge for the survival of this species in the region.



Ecology and ranging movements of Risso's dolphins in coastal waters of western British Isles

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Despite Risso's dolphins being regular visitors to waters around the British Isles, their status, ecology, habitat preferences, and movements remain poorly known. They are uncommon with a patchy distribution along the western seaboard. A hotspot occurs in the northern Irish Sea around North Wales and the Isle of Man, where detailed observations have been undertaken in recent years with a particular focus on areas around Anglesey where Risso's dolphins overlap with marine renewable energy developments involving tidal turbines. For this study, sightings data collected by the Sea Watch Foundation during 2003-2021 were correlated with environmental parameters including bathymetry, slope gradient, sediment profile, underlying benthic habitats and energy profile of the region to understand ecological drivers influencing distribution of the species. Seasonal occurrence coincided with the spawning of the main cephalopod species in the region. The studied population favoured depths of 10-80 metres, 4.5° to 6.75° slopes, hard to coarse sediment, comparatively productive habitats such as reefs, and a high-energy environment. More detailed observations indicated recognisable individuals utilising the tidal cycle in their movements, whilst exhibiting day-time foraging behaviour. Using photo-identification, 105 individuals have been identified in Anglesey waters between 2014 and 2021, with a site fidelity rate of 16.2%. The re-sighting data suggest the presence of nursery groups in the area, and repeated sightings of females with young calves imply the offshore waters harbour breeding grounds for this population. Photo-ID matches revealed individual ranging movements not only within a potential core area from Bardsey Island, NW Anglesey and Manx waters to West Pembrokeshire, but also a much greater home range for the population with long-distance movements spanning from the Scottish Hebrides south to western Cornwall. These findings have implications when designing policies for effective conservation management, that require in-depth knowledge about the species' population distribution, ecology and habitat preferences.



Fantastic sperm whales and where to find them: habitat preference of sperm whales in the Azores

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The sperm whale (*Physeter macrocephalus*) has been a symbol of the Azores for decades, from the profitable whaling era in the last century to the popular whale watching nowadays. Sperm whales use this archipelago both as feeding and reproductive grounds throughout the year, but little is known about their habitat preferences in the region, an essential insight for the conservation of any species. This study investigates the relationship between different classes of sperm whales, solitary animals or groups in foraging or not, and remotely sensed environmental variables such as sea surface temperature, sea level anomaly, mixed layer thickness and depth. Generalized Additive Models were applied to a dataset of sperm whale occurrence collected between 2009 to 2019 during whale watching tours off the coast of São Miguel Island by Futurismo Azores Adventures. Differences in habitat preferences were found between family groups (79% of the observations), Mr. Liable (a possible resident male; 10%), and solitary animals (likely to be males; 11%). Foraging groups showed a preference for warmer and deeper waters, and thicker mixed layer than Mr. Liable. Models for this male suggested increased suitability with extreme (high and low) values of sea level anomaly. Foraging solitary animals (probable males) only highlighted the same depth preference than groups, but without any other variable showing significance. Such differences can be related with the exploitation of different prey types and sizes (different ecological requirements), but also might decrease the habitat overlap between family groups and Mr. Liable. Social structure, behaviour and individuality showed to be relevant in the habitat preference of sperm whales. Understanding the relationship between the environment and local populations of sperm whales is crucial for the management and conservation of this species, especially in such a vital area, and in an unpredictable changing ocean.



Endangered Common Dolphins of the Istanbul Strait: Fine Scale Distributions and Encounter Rates

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The sperm whale (*Physeter macrocephalus*) has been a symbol of the Azores for decades, from the profitable whaling era in the last century to the popular whale watching nowadays. Sperm whales use this archipelago both as feeding and reproductive grounds throughout the year, but little is known about their habitat preferences in the region, an essential insight for the conservation of any species. This study investigates the relationship between different classes of sperm whales, solitary animals or groups in foraging or not, and remotely sensed environmental variables such as sea surface temperature, sea level anomaly, mixed layer thickness and depth. Generalized Additive Models were applied to a dataset of sperm whale occurrence collected between 2009 to 2019 during whale watching tours off the coast of São Miguel Island by Futurismo Azores Adventures. Differences in habitat preferences were found between family groups (79% of the observations), Mr. Liable (a possible resident male; 10%), and solitary animals (likely to be males; 11%). Foraging groups showed a preference for warmer and deeper waters, and thicker mixed layer than Mr. Liable. Models for this male suggested increased suitability with extreme (high and low) values of sea level anomaly. Foraging solitary animals (probable males) only highlighted the same depth preference than groups, but without any other variable showing significance. Such differences can be related with the exploitation of different prey types and sizes (different ecological requirements), but also might decrease the habitat overlap between family groups and Mr. Liable. Social structure, behaviour and individuality showed to be relevant in the habitat preference of sperm whales. Understanding the relationship between the environment and local populations of sperm whales is crucial for the management and conservation of this species, especially in such a vital area, and in an unpredictable changing ocean.



Distribution of cetaceans based on a citizen science approach in the Cyclades region, Greece

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The Cyclades group of islands and their surrounding sea constitute a region of great cultural and biological importance in Greece. However, it has historically been ignored by marine researchers regarding the presence of cetaceans mostly because of the characteristically strong winds in the area, particularly during the summer season, which render boat-based surveys inefficient. This has resulted in a glaring gap in our knowledge of cetaceans in this large portion of the Aegean Sea, inhibiting our ability to formulate conservation and management plans for these species. In order to circumvent this limitation, a citizen science approach was used to collect information on the occurrence of cetaceans in the Cyclades. Both professional (sailing clubs, diving clubs, professional fishers) and amateur (amateur fishers, recreational boaters) users of the sea were approached directly and indirectly through social media platforms and were asked to provide spatial information and visual material (photographs and video) of their cetacean encounters. Additionally an extensive search was conducted on online video sharing platforms (Youtube) to collect information. This resulted in a total of 176 cetacean group observations where the species as well as their location on a pre-determined 10x10km grid were clearly identifiable in an area totaling 9200 km². These observations were of five species: Bottlenose Dolphin (*Tursiops truncatus*), Common Dolphin (*Delphinus delphis*), Striped Dolphin (*Stenella coeruleoalba*), Fin Whale (*Balaenoptera physalus*) and Sperm Whale (*Physeter macrocephalus*) with a relative group encounter rate of 46.6%, 34.1%, 18.2%, 0.7% and 0.7%, respectively. Even though the dataset is dependent on the concentration of observers, it constitutes the first systematic effort to record the distribution of cetaceans in the Cyclades and provides the largest baseline dataset to be used in conservation and management plans in the region to date.



Occurrence of long-finned pilot whales and killer whales in Icelandic coastal waters and their interspecific interactions

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Long-finned pilot whales are widely distributed across the North Atlantic, including in Icelandic offshore waters, but little is known about their occurrence in Icelandic coastal waters. Killer whales are commonly seen in the coastal waters to the south and west of Iceland, but their occurrence in other locations is less known. Here, we use sightings data from research platforms and whale watching tours in six areas around Iceland from 2007 to 2020 to show that the occurrence of pilot and killer whales varied with region and season. Killer whales were regularly encountered in the south of Iceland during summer and west of Iceland during winter/spring. Pilot whales were only seen during the summer and were most often encountered in the south, west and northwest of Iceland. Pilot whale occurrence in the south of Iceland appeared to increase during the study period but killer whale occurrence showed no noticeable changes. Pilot whales were sighted often in the areas that were also frequented by killer whales and when both species co-occurred, interspecific interactions were commonly observed. Interactions appeared to be antagonistic, with killer whales consistently avoiding pilot whales, similar to what has been described elsewhere in the North Atlantic where interactions between both species have also been observed. In the majority of interactions observed (~70%), killer whales avoided pilot whales by moving away but in ~30% a chase ensued with both species porpoising at high speed, indicating that these interactions may be more complex than previously described. As co-occurrence of both species leads to antagonistic interactions, this can have potentially negative consequences for killer whales that abandon feeding events or preferred areas to avoid pilot whales. Further research into the occurrence of both species and their interactions will be important to inform conservation management.

Environmental Drivers of Harbour Porpoise (*Phocoena phocoena*) Distribution in the Irish Sea

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Understanding spatiotemporal variation in cetacean distributions is critical for the establishment of marine protected areas and managing risk from human pressures. In the Irish Sea, hotspots in the distribution of a highly mobile and widely abundant species, the harbour porpoises (*Phocoena phocoena*), are relatively well known, but information on the underlying environmental determinants are not well understood. This study used a large sightings dataset collated by the Sea Watch Foundation from aerial and vessel-based surveys between April to September, 1990 to 2019, to perform habitat association models in four different study areas each with a different suite of environmental variables: the Celtic Deep, Cardigan Bay, coastal North Anglesey, and the Irish Sea Front. Generalised linear models were used to analyse porpoise presence in relation to a set of environmental and survey variables. The probability of a sighting increased with effort. Several relationships with specific environmental variables were significant although relatively weak; porpoises most often occurred when annual temperature variance was <9 °C and depth ranged between 20 - 90 m. Seabed roughness, average salinity, and thermal stratification also indicated preferences for particular areas, serving as proxies for localised habitat heterogeneity and subsequent prey availability. Environmental factors affecting porpoise distribution differ between sites with abundance best explained by a combination of environmental variables. These may be explained by the distributions of particular prey known to be important in porpoise diet.



Temporal patterns of Risso's dolphins (*Grampus griseus*) groups off Pico Island

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Monitoring trends in occurrence of different age-classes in wild populations is important for conservation and management decisions. The Azores archipelago hosts a resident population of Risso's dolphins (*Grampus griseus*). Off Pico Island, the social structure of Risso's dolphins is defined as a "stratified community". Within this population, three different group types, defined by age-class, have been identified: nurseries (adult females and offspring), sub-adults and adult males. This study aims to investigate the temporal patterns of occurrence and group size, by group type. Data were collected during dedicated surveys (2015/2020; study area: 512 km²) off Pico Island. Groups were first sighted during land-based surveys after which a research vessel was directed to group(s). At sea, standard Photo-ID and focal-group-follow methods were applied. Occurrence, expressed as groups per unit of effort (GPUE) -number of groups observed during 20 minutes of land-based surveys - and monthly and annual patterns were analysed using a Generalised Additive Models framework. A total of 1001 groups were included in the analysis, identified during 964 hours of land-based observations and 12,000 km of ocean-based effort. Groups of adult males were sighted most (51.65%), followed by sub-adults (34.47%) and nurseries (13.69%). All the three group types displayed a decrease in occurrence throughout the years, with the steepest trend observed for nurseries ($R^2=-1.57$), followed by adult males ($R^2=-1.35$) and sub-adults ($R^2=-1.18$), suggesting an overall decline in the study area. Although the cause of this decline was not investigated, we emphasise the influence of intense whale-watching activity in the area, the depletion of cephalopods stocks and the possible effects of climate change as potentially synergistic strong contributors. As precautionary measures, while further investigations will be conducted, local management actions should be taken to reduce anthropogenic pressure, such as adopting stricter codes of conduct for whale-watching operators and by establishing marine protected areas.

Azorean waters as a migratory corridor for baleen whales

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Migration is a fundamental part of the lifecycle of many species. Baleen whales are one of the most wide-ranging migratory marine species, and most populations use low latitude areas for breeding and high latitudes as feeding grounds. However, for temperate latitudes, it is not known how biological and non-biological variables influence migratory pathways and timing. Baleen whales are present in the Azores, an area that is strongly influenced by the spring bloom in the North Atlantic, therefore contributing directly to increase food availability for those species. The present study describes the Azorean populations of blue, fin, sei and humpback whales, based on the most comprehensive photo-identification catalogue to understand their distribution and habitat use. Our data reveal that the years with the highest and/or most extended levels of chlorophyll a are positively correlated to more sightings and particular individuals. This observation strongly indicates that the spring bloom's intensity, timing, and duration influences the arrival, abundance, and permanence in the study area. In addition, the present study shows that the blue and fin whales are more abundant and present in deeper and further away from the coast than sei and humpback whales. The behavioural data suggest that blue, fin and humpback whales use the Azores as a stop-over feeding area while sei whales use it mostly for travelling. With this study, we gathered evidence that baleen whales use the Azorean waters as a migratory route, possibly to restore their energetic reserves, being strongly affected by the timing and intensity of the North Atlantic spring bloom.



Sperm whales in Macaronesia: Unveiling site fidelity and residency patterns in an insular oceanic system

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Studying the distribution and occurrence of oceanic predators in pelagic environments faces countless challenges. However, information on these species is essential for establishing appropriate transborder conservation measures. The sperm whale (*Physeter macrocephalus*) is an iconic species with a worldwide distribution, heavily targeted during whaling and presently facing new threats. Known to occur and move between the oceanic islands of Macaronesia (Azores, Madeira, and the Canaries), basic information regarding site fidelity and residency in this area is scarce. Individual photographic data collected from 2014 to 2019 allowed to calculate site fidelity using an innovative index (Standardised Site Fidelity Index - SSFI), developed explicitly for populations that present difficulties in detection, such as the case of deep divers. Residency was assessed with lagged identification rates (LIRs). Photo-id catalogs comprised 1276 individuals for the Azores, 278 for Madeira, and 153 for the Canaries. The Azores and Madeira presented very similar tendencies, with discovery curves tending for stabilization and a similar proportion of individuals captured once (~75%) and recaptured (~25%), with most of the latter presenting a long-term (interannual) presence in these archipelagos. The Canaries discovery curve is still in linear growth, and most of the population (93%) was captured only once, invalidating further analysis. The SSFI indicated some degree of site fidelity in the Azores and Madeira archipelagos, and “Emigration + reimmigration + mortality” was selected as the best residency model. Although the Macaronesian archipelagos may share similar biological and oceanographic variables, the present finds suggest that sperm whales have different ecological uses in this biogeographic region of the central and eastern North Atlantic. Notwithstanding a more nomadic distribution in offshore waters, Macaronesian archipelagos constitute an important area for a small part of the population, requiring coordinated efforts with thorough planned research to establish effective conservation measures.



Spatiotemporal distribution and habitat requirements of teutophagous cetacean species around São Miguel (Azores): Can opportunistic data be used to study the overlap of ecological niches

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Large marine vertebrates, such as cetaceans, are increasingly exposed to impacts derived from anthropogenic activities, which often can cause alterations in their ecological niches.

This study aimed to determine (a) trends in spatiotemporal distribution, (b) habitat use and ecological requirements, (c) selection of diet components, and (d) overlap of the ecological niche of teutophagous cetaceans around the island of São Miguel (Azores), over a twelve-year period (2009-2020).

Opportunistic data from cetacean sightings was collected by whale-watching companies collaborating with the MONICET platform. At the beginning, up to 66,667 sightings were recorded in a total of 8,459 trips, of which were filtered in order to avoid data pseudo-replication, reducing them to 15,219. Specifically, a total of 4,053 sightings of sperm whale (*Physeter macrocephalus*) (26.6%), 823 of Risso's dolphin (*Grampus griseus*) (5.4%) and 436 of short-finned pilot whale (*Globicephala macrorhynchus*) (2.8%) were examined, as they were previously designated as study species due to their food habits and sighting occurrence. From these recorded sightings, the spatiotemporal distribution patterns of the target species were analyzed using kernel density estimation methods. Moreover, using EMODnet bathymetry data from environmental parameters, and selection of the prey size with current literature, we analyzed the overlap in the ecological niches of the three studied teutophagous cetaceans' by means of Schoener's index D (Rödder & Engler, 2011).

The results obtained showed differences among three ecological niches. Sperm whale and short-finned pilot whale showed a large ecological niche overlap, while the Risso's dolphin showed a different trend of ecological requirements. In addition, it is also claimed that during the summer months, when prey can be abundant, the three teutophagous species can coexist in large numbers. Therefore, this study demonstrates that opportunistic data sources can be a useful tool for studying cetacean's ecological niches and spatiotemporal patterns.



Geographical movements, site fidelity and connectivity of killer whales (*Orcinus orca*) within and outside herring (*Clupea harengus*) grounds in Icelandic coastal waters

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Icelandic killer whales regularly move between seasonal herring grounds. While they are present all-around Iceland, little is known about movements outside herring grounds due to low sampling effort. Data from these areas could shed light on the variability in movement patterns of this population. In this study, we used photo-identification to investigate the movements, site fidelity and connectivity of whales occurring within (South - S, and West - W, Iceland) and, for the first time, outside herring grounds (South West - SW, North West - NW, and North East - NE, Iceland). A total of 518 whales were identified, with 404 individuals identified more than once. As expected, a large proportion of these individuals (47%) were resighted between herring grounds (S-W). Nevertheless, some movements outside main herring grounds (1%), and between areas within and outside herring grounds (24%) were also observed. Movements between areas within and outside herring grounds were mostly between W-SW or S-SW (22%). 50% of the whales sighted in SW were only resighted in W. 8 of those individuals are known to feed on higher trophic level prey, other than herring, and have never been observed in S, thus suggesting they are not crossing SW to migrate between seasonal herring grounds. All areas had unique individuals, i.e., not identified elsewhere, but the region with the highest percentage of unique individuals was the NE (84%, $n = 49$). Individuals sighted in the NE are also not resighted often and, thus, may be part of a larger offshore population that occasionally visit this area. These results show that Icelandic killer whales have complex movement patterns, and that photographic data outside main herring grounds can help elucidate the structure of this population, which should aid future population assessments.



Mediterranean monk seal, a sign of hope: increased birth numbers and enlarged terrestrial habitat

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In our studies on the use of marine caves by the endangered Mediterranean monk seal for resting and reproduction in the Greek central Ionian Sea (1985-2002), between 1 and 4 monk seal births per annum were registered in 5 breeding caves out of the total of 38 caves used by seals at least once. The data were collected during regular habitat surveys, supported by verified reports of seal sightings through an observers' network. In 2018, a long-term monk seal photo-identification project was launched using infrared cameras installed in up to 16 caves throughout the central Ionian Sea. Data from own/ observer network sightings and/or camera material revealed possible signs of a population recovery. 6 births were registered in 2018 and 2 in 2019. In 2020, 11 births were registered and a cave hitherto unknown for breeding was identified. In 2021, 11 pups were born up to the middle of the main pupping season: an all-time record in the last 35 years of studies. Furthermore, two new caves were used for giving birth where reproduction was never registered before and the total known breeding caves increased to eight. It cannot be dismissed, however, that the use of modern infrared cameras may have contributed to these promising results through continuous coverage of the caves. Additionally, several caves which lied vacant in the past have been used for resting over the last 3-4 years, some on a regular basis. Long-term systematic monitoring is needed to confirm these data and help protect this important sub-population. Our long-term efforts appear to be paying off with more pups born annually and more caves used for reproduction, indicating a decrease of fear towards humans by the species that tolerates ever increasing human activity.



Fatty acids composition in blubber tissue of two odontocete species (*Tursiops truncatus* and *Globicephala macrorhynchus*) in NE Atlantic

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Fatty acids (FAs) are commonly used in marine ecology as indicators to assess the diet of marine predators, as certain FAs are transferred almost unmodified from prey. However, the composition of FAs in the adipose tissue may also give valuable information about individuals' nutritional status. Generally, polyunsaturated fatty acids (PUFAs) mainly derive from diet and are stored in the inner layer of blubber, while saturated (SFA) and monounsaturated fatty acids (MUFA) can derive both from dietary intake and endogenous de novo biosynthesis. In the present study, we analyzed and compared the FAs composition in blubber tissue collected by biopsy darts in free-ranging common bottlenose dolphins (BD) (*Tursiops truncatus*, n=29) and short-finned pilot whales (PW) (*Globicephala macrorhynchus*, n=30) around Madeira Island (NE Atlantic). Significantly different percentages of SFAs, MUFAs, and PUFAs were found between the two species, which may be related to their nutritional status or species-specific physiological differences in their blubber. MUFAs were the most represented FAs in both species (BD=48.5%; PW=67.2%). High percentages of PUFAs in BD (37.0%) suggest that the biopsies comprised the entire stratification of the blubber tissue (inner, middle, and outer layers). No significant difference was found in relation to sex, season (analyzed separately for the two species), or residency pattern (only available for pilot whales) (Wilcoxon rank-sum exact test or Kruskal-Wallis rank-sum test, $\alpha=0.05$). Principal Component Analysis (PCA) applied on ten dietary FAs revealed a clear separation between the two species, suggesting niche segregation. Analysis by



(Continued)

sex, season, and residency pattern revealed no separation, suggesting equivalent diets within these groups. The present results improve baseline information and fill a gap on marine mammals' FAs composition cohabiting remote NE Atlantic waters. Furthermore, they confirmed different foraging preferences between two delphinid species in an oceanic environment, representing key information from a conservation perspective.

Each patch tells a story: population estimates, distribution, and fisheries dependence from the Mediterranean bottlenose dolphin population in the northwestern Catalan water

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The northwestern Mediterranean coast of Catalonia includes two marine protected areas, Cap de Creus and Montgrí, Medes islands and Baix Ter Natural Parks. The presence of bottlenose dolphins is well known in these areas as well as the interaction with fishing activities. In 2017 a monitoring program was initiated to study the Common bottlenose dolphins (CBD) population.

The study area (158644,294 ha) was surveyed from 2017 to 2020 conducting visual transect and photo-identification surveys on a 6-meter-long RIB (115 HP). A total of 12445 nm of homogeneous effective effort was conducted in the study area. CBD were the most common cetacean detected, with a total of 77 sightings (ER=0.0242 sightings/nm). All CBD sightings occurred at depths shallower than 200 meters and group mean size was 9,31 individuals and a density of 0,00382 individuals/km². Presence of calf was reported in the 52,02% of the sightings. Most of the sightings (66%) were associated with trawl fishing activities indicating a strong association between CBDs and the trawling vessels presence and suggesting a potential CBD-fishing interaction in this MPA. Although, dolphins' presence was reported during summer and winter, the mean size of the groups did not present any significant differences between seasons (Mann-Whitney U test: $W = 709.5$; $n \text{ TTRU} = 77$; $p = 0.7417$).

Photo-identification sessions allowed to analyze 51920 photographs in which 682 individuals could be identified due to natural marks in the dorsal fins and 188 recaptures were made. A total of 494 different individuals identified from both, left and right sides of the dorsal fin, were incorporated to the photo-id catalog.

Abundance estimates were calculated using both side identifications. Only Good Quality Marks were used. We found the CAPTURE model M(0) for a closed population provided the best fit (lowest AIC value), obtaining an abundance of 822 (95% CI 670 to 1034) dolphins.

Histomorphological stratification of blubber of three dolphin species from the KwaZulu-Natal coast, South Africa

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Blubber is a highly specialised and dynamic tissue unique to marine mammals and reflects the nutritional status, environment, and life history traits of an individual. However, few data exist on the histomorphology of blubber from sub-tropical environments. We investigated adipocyte cell size, number, and density in the blubber of three different dolphin species off the sub-tropical KwaZulu-Natal coast, South Africa. Blubber tissue samples from 43 incidentally bycaught animals (4 *Sousa plumbea*, 36 *Tursiops aduncus* and 3 *Delphinus delphis*) were used to compare these parameters both between blubber layers and between species. Factors such as sex, age class and season, were also assessed for *T. aduncus*. Results showed that blubber stratification was absent in *S. plumbea*, which is presumably due to the species' warmer inshore environment, large body size and apparent lower mobility. *T. aduncus* and *D. delphis*, however, did exhibit blubber stratification, showing a gradual transition between layers rather than a marked difference between layers. Effects of sex and age class on blubber histomorphology of *T. aduncus* revealed significant differences in adipocyte cell number and density ($P < 0.05$). Females had significantly ($P < 0.05$) more cells (78 cells) than males (60 cells) in the deep layer. In comparison to adults, juveniles displayed significantly higher cell densities in the deep (70.10% vs 78.63%) and middle layer (72.37% vs 80.65%) and significantly more adipocyte cells in the middle (60 vs 78 cells) and superficial layer (58 vs 88 cells). However, season produced non-significant results, which was attributed to the small differences in water temperature between seasons. Future studies should focus on investigations of blubber lipid content in relation to reproductive status of the females and the temperature range of the study area.

AnimalAudiograms.org – a new public tool for hearing physiology data

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Audiograms of marine mammals are utilized for estimating impacts of sound on animal hearing, serve as a baseline data for impact assessments. They are in general useful as a representation of hearing abilities to compare sensitivities of different species and extrapolate to their sensitivity towards potential impacts of sounds, where actual observation data is not available. However, audiograms have certain properties, that may prevent a direct comparability of data using different methodologies (auditory evoked potentials vs. psychophysical hearing tests) and must undergo a detailed review process before the gathered data from hearing tests can be accepted as common scientific knowledge. Standardization in audiogram data collection is however tremendously difficult to achieve for different species and methods. Therefore, common standards are only established for human audiology. The animal audiogram database (www.animalaudiograms.org) targets audiology researchers and noise effects experts to serve as a standardized basis for using audiogram data, preventing errors by necessary unit conversions and providing detailed metadata for the experiments conducted, detailed information on the animal tested and bibliographic information. The whole system serves as a repository and shall in the future be used as a prime target for depositing new information on animal hearing physiology in general. Currently it holds 235 underwater audiograms and 71 in-air audiograms mostly of marine mammals. A wiki is incorporated to serve as accompanying information on how these data are acquired and a GIT repository is established where the code and current issues can be investigated and scrutinized. The database is hosted by the German Oceanographic Museum, Stralsund in collaboration with the Museum für Naturkunde, Berlin. We are inviting all researchers of the field to further develop the database together with us and submit their research to be easily accessible for the science community.

Abundance of Cuvier's beaked whales in the Hellenic Trench and Ionian Basin: results from aerial surveys in spring 2021

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The Hellenic Trench and the Ionian Basin provide sensitive habitats for the Endangered Cuvier's beaked whales (*Ziphius cavirostris*), where intense human activities have the potential to impact the persistence of this species of conservation concern. A visual line-transect distance sampling aerial survey was conducted between 24 May and 26 June 2021 to estimate the abundance of cetaceans in this large area. Overall, 115 parallel transects spaced 10 and 15 km were designed across 3 distinct strata, totalling 15,173 km of transects across an area of 180,400 km². Eleven sightings of Cuvier's beaked whales were recorded across relatively well-defined areas offshore Epirus and the Ionian Islands and, to a lesser extent, south-east of Crete. By pooling these data with Cuvier's beaked whales' sightings collected between 2009 and 2018 in the Mediterranean during the summer through similar aerial surveys, a total of 72 records were used to model the detection function. Uncorrected abundance was estimated at 274 animals (CV=31.5%). By applying a correction factor of 0.107 obtained for the NE Atlantic accounting for both availability and perception biases, the total abundance estimate increases to 2,561 animals. These results indicate how this area plays a strategic role for beaked whales in the Mediterranean Sea and stress the urgent need to implement the appropriate mitigation measures to reduce anthropogenic pressure and threats. Furthermore, the IUCN MMPA Task Force has recently identified an Important Marine Mammal Area in the Hellenic Trench for sperm (*Physeter macrocephalus*) and Cuvier's beaked whales, while ACCOBAMS has recognised the need to enhance place-based conservation efforts. The information we provide will be crucial to inform these and other regional processes such as the Marine Strategy Framework Directive and the Ecosystem Approach to contribute to maintain the favourable conservation status of this species in the Mediterranean Sea.



Investigation of fine-scale population structure and genetic diversity of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) across the eastern North Atlantic

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Oceanic dolphins such as the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) are challenging species to monitor and there is therefore a relative paucity of data in terms of their ecology, life history, and population structure. This can hamper accurate assessment of their conservation status. Given the logistical and financial difficulties of obtaining data from free-ranging oceanic dolphins, investigations of stranded animals provide an important source of information regarding pathology (disease status through microbiological analyses), ecology (e.g., assessment of stomach contents) or life history parameters and an exceptional opportunity for obtaining tissue samples from individuals throughout large parts of their geographic range. Here, we investigated 92 tissue samples of Atlantic white-sided dolphins collected between 1992 and 2020 on coastlines of the eastern North Atlantic. We sequenced the mitochondrial control region and used a restriction-site associated DNA marker approach (DArTseq™) to generate a total of 41,000 nuclear markers, which were used to assess genome wide heterozygosity and perform multivariate and Bayesian analyses to estimate population structure. Results imply a widely connected population of Atlantic white-sided dolphins without any clear signs of reduced gene flow across the eastern North Atlantic. Adopting a multidisciplinary approach and combining more in-depth sequencing data with additional data on abundance and life history will provide valuable insights to assist in the conservation management of this data deficient species.



Multi-species feeding association dynamics driven by a large generalist predator

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Multi-species feeding associations (MSFAs) are temporary communities of animals exploiting the same or co-occurrent resources. Their dynamics are species dependent, often creating competitive interactions, but they can also increase foraging efficiency and ultimately individual fitness. The foraging behaviors of some species can enhance prey capture by others, with different roles depending on the species present. Here we use the Hauraki Gulf, New Zealand, as a model system to quantitatively characterize the principal types of MSFAs between 2011 and 2020. We determine the foraging associations of the large generalist predator, the Bryde's whale, and how their shift in prey preference changes the dynamics between seabird competitors. Hierarchical clustering from influential predator groups identified three types of MSFAs. Two of mainly fish-feeding predators, one including and one lacking Bryde's whales, and one involving (although not limited to) plankton-feeders associated with Bryde's whales. Cluster frequencies featured significant temporal trends, whereas MSFA diversity and whale association rate showed no significant changes. Bryde's whales' increasing reliance on zooplankton highlights their foraging plasticity, with changes in cluster frequencies and resource competition related to this shift from fish to zooplankton. The role of Bryde's whales varies from joiners and terminators in fish-feeding aggregations, to initiators with plankton-feeding seabird associations thereby changing the MSFA dynamics. MSFAs tend towards a diversity equilibrium, i.e. a maximum number of species involved before competitive effects exceed the benefits of interaction. Functional MSFAs where heterospecific interactions are important to foraging success can be affected by changing composition. Future work should focus on the behavioral interactions between key predators, prey availability and their effect on MSFAs.



Insights into the respiratory and gastrointestinal microbiome of odontocetes stranded along the Tyrrhenian coastline

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Marine environment is undergoing rapid changes due to anthropogenic pressure, climate change and pollution. Environmental changes are leading to habitat degradation and emerging of new pathogens, thus threatening the survival of several marine species. The microbiome of cetaceans, as marine sentinels, provides a non-invasive method for screening animal and environmental health, with implications for conservation purposes. Indeed, both the host and its surrounding environment influence the microbiome composition. Through the NGS analysis of the respiratory and intestinal microbiome, this study aimed to investigate the potential role of dead stranded odontocetes in monitoring the health of cetacean populations in the Tyrrhenian Sea. A protocol was developed for collecting relevant matrices from dead animals stranded along the Lazio and Tuscany coastline. Then, the respiratory and gastrointestinal microbiome composition was analysed using an amplicon sequencing approach. All the odontocetes underwent a complete necropsy in order to assess their health status. Data on microbiome were correlated to the anatomopathological findings and compared with the conventional microbiology and virology findings, focusing on the detection of potential pathogens. The resulting taxonomic composition of the odontocetes’ respiratory core-microbiome shared similarities with studied cetaceans from other geographical areas. Despite some differences, the intestinal microbiome composition generally overlapped with data in literature. Remarkably, several potential pathogenic and zoonotic microorganisms were identified in our samples, thus highlighting the importance of investigating the microbiome of sentinel species for monitoring animal and marine environmental health in a One Health perspective. The developed protocol, by means of NGS and bioinformatics on dead stranded animals’ samples, could be useful for the systematic monitoring of cetaceans in the future.



First observations of a mouth-breathing bottlenose dolphin (*Tursiops truncatus*)

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We report the first case of a common bottlenose dolphin (*Tursiops truncatus*) breathing through the mouth. A female dolphin was observed on 17 occasions, between 2009 and 2019, in the Central Adriatic Sea. During every observed surfacing, she would lift her head out of the water, open her mouth and inhale audibly. We discuss several possible explanations for the described breathing pattern. In delphinids, the respiratory tract leads from the trachea to the nares through the hollow larynx, which protrudes through the oral cavity. Breathing through the mouth is normally not possible. Injuries like perforation, dislocation or developmental incompleteness of the larynx allow air in the respiratory tract to escape into the oral cavity, which may enable a dolphin to breathe orally. However, these injuries expose the respiratory tract to ingested water and food, potentially risking asphyxiation due to choking. Alternatively, an occlusion of the nares could limit the airflow through the blowhole, forcing a dolphin to breathe orally. However, this would require the dolphin to voluntarily relocate its larynx to breathe. Whatever the underlying cause of this breathing pattern is, this dolphin always appeared to be in good physical condition. Besides breathing through her mouth, no other abnormal behaviour was observed. Furthermore, she was recorded mothering three calves, raising at least one to independence. This dolphin has demonstrated the remarkable ability of these animals to adapt to significant physical impairments, without negatively affecting their fitness.



Improvement of knowledge on the Mediterranean monk seal sub-population in the central Ionian Sea, Greece, using photo-identification

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Following a long period of studies in the Greek central Ionian Sea which begun in 1985, the first systematic monk seal photo-identification project was launched in 2018. Infrared cameras installed in up to 16 marine caves throughout the area were used as the primary tool for collecting seals' pictures. General and individual patterns of fur coloration and scars were used to identify the animals from the pictures collected. Altogether, 18 different seals of all age classes were included in a first catalogue.

In the ~3.5 years which followed, the methodology was reviewed and improved using strict criteria to avoid overestimating seal numbers.

The full identification of an individual requires a complete set of pictures (back, belly, left and right side). The new catalogue includes only fully identified subadult and adult seals; pictures of juveniles/pups, more difficult to evaluate, will be analysed separately. Subadults are defined as the animals with a morphological appearance of an adult seal but with no proof of sexual maturity so far. Adults are defined as the animals for which data for sexual maturity are available: fur coloration for males and evidence of giving birth or maternal care for females. These data along with pictures framing the genital area are used for reliably attributing gender.

For each camera session (installation to retrieval), sub-catalogues are developed which include the animals not completely identified yet, for further evaluation. The new catalogue includes 22 fully identified animals: 8 males, 10 females and 4 seals whose gender has not been identified yet. This represents the absolute minimum number of adult/subadult seals captured by our cameras.

The methodology used provides for an optimum combination of minimal disturbance to the seals, low impact on the environment and minimal expenses. It allows the coverage of a large area and is suitable for long-term monitoring.



Connectivity patterns of bottlenose dolphins (*Tursiops truncatus*) in the north-east Mediterranean: implications for local conservation

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Accurate description of population structure and genetic connectivity is essential for efficient conservation efforts. Along the Europe coast line, *Tursiops truncatus* shows high site fidelity to relatively small areas, often semi-enclosed waters, but patterns of genetic connectivity between such areas are often poorly understood. In this study we investigate the patterns of genetic structure and connectivity of *Tursiops truncatus* in the Adriatic Sea and contiguous Mediterranean, where photo-ID studies suggest the occurrence of several local 'resident communities' complex pattern of geographic structure has previously been suggested. Our results are consistent with the occurrence of communities with high site fidelity to the Gulf of Ambracia, Croatian island systems and the Gulf of Trieste. Dolphins in this region do not fit a model of complete panmixia, but neither exhibit multiple discrete population units. Even for the community in the Gulf of Ambracia, which is well separated by several population genetic estimates, we can unambiguously identify individual dispersal to relatively distant locations in the Adriatic Sea. We suggest that the patterns of population structure patterns in these animals might be best described as a stable metapopulation and discuss the implications of such model for local conservation efforts. The Ambracian sub-population is particularly well differentiated and is therefore at high risk of local extinction due to relatively small size, high degree of isolation and exposure to severe anthropogenic pressures. The exact geographic boundaries of individual sub-populations cannot always be determined due to lack of sampling and low resolution of the methods used. Nevertheless, our results have important implications for effective conservation of local communities showing strong site fidelity.



Sperm whale habitat use in Irish offshore waters using an innovative Bayesian modelling framework

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Species distribution models are increasingly used to understand species' environmental preferences and habitat use as a means to inform management decisions. To forecast changes in habitat suitability under future climate change scenarios, identify important areas and/or mitigate impacts of anthropogenic activities, an emphasis should be placed on computing accurate and representative models, from which reliable predictions can be derived. Most popular modelling techniques are limited by their capability to handle uncertainty, and conspicuously few studies in ecology exploited Bayesian frameworks. This study uses Bayesian Additive Regression Trees, an innovative alternative to traditional classification tree methods which inherently handles uncertainty by including a Bayesian component. This promising framework is applied to data collected over the course of six seasonal passive acoustic surveys (2015-2016) along the Irish continental shelf break to assess the habitat use of sperm whales (*Physeter macrocephalus*). Sperm whales are known to migrate through the area, to move between southern breeding grounds and more northern feeding areas. However, recent studies have confirmed that Irish Atlantic offshore waters, particularly along and beyond the shelf edge, do not act as a simple migration corridor but also provide important feeding habitats, which explains the year-round presence of the species in significant numbers. Hence, sperm whales' movements throughout the area result from interactions between migrations and access to patchy prey resources. The scale-dependent nature of those processes further complexifies the quantification of relationships between underlying environmental variables and the distribution of the species. For this reason, a multiscale framework is preferred here to investigate the influence of a set of topographic features and oceanographic processes acting as proxies of prey availability on sperm whale presence. This study will provide robust and reliable information to management and conservation, in an area subject to increasing noise levels considering its importance to oil and gas exploration.



Anatomical network as a tool for studies of evolution of marine mammal skeleton

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Anatomical networks (AnN) representing a complex structure as a network connecting its elements are increasingly used as a tool for studies of anatomy and evolution. For a skeleton, the simplest construction of the network is based on topography and representing the elements (bones) as nodes and connections (articulations) as edges of a graph, in which the basic characteristics can be assessed and further analyzed by statistic tools. In most previous studies, only isolated parts of animal skeleton (e.g., skull or limb) were quantified as AnN; however, a single recent attempt of analysis of the whole bird skeleton shows promises of such an approach. Here we provide a methodology for quantification an entire mammalian skeleton as an anatomical network, as well as a set of partial networks (skull, limb, axial skeleton), performed on extinct and extant cetaceans, including semi-aquatic and fully aquatic forms and describing transition to life in water and major steps of cetacean evolution as a set of graphs with their characteristics. Also, phylogenetic analysis of indicators derived from these AnN revealed a few statistically significant trends in cetacean evolution, such as increasing transitivity and heterogeneity, growing disparity in modularity of the entire skeleton. For the forelimb skeleton at least five indicators showing significant phylogenetic signal were found, including increasing modularity and decreasing measures of integration. They were interpreted as reflecting convergent changes in limb anatomy, in line with evolution of major lineages and more specific trends in ontogeny. Baleen whales (Mysticeti) were found to be the most derived group among extant lineages. Therefore, introducing a set of AnN analyses including but not limited to topographic networks for skeleton and its parts provide a flexible and powerful tool for investigating major trends in mammalian evolution, very relevant to studies of marine mammals.



Assessing the feasibility and suitability of using a commercially available autonomous acoustic recorder, the SoundTrap 300HF, to conduct passive acoustic monitoring for cetaceans and noise from an underwater glider

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Cetaceans are elusive species, ranging over wide territories and spending most of their time underwater. Scarcity of sightings and logistical constraints to access their habitat makes research challenging and often costly. Lately, rapid development and growing access to new technologies expanded possibilities in environmental research. Autonomous platforms, notably remotely operated underwater gliders, hold great potential to survey the marine environment and are praised for their cost-efficiency. Initially cut out for oceanographic surveys and monitoring of dynamic features such as currents, fronts and eddies, advantages and versatility of gliders have more recently spurred scientists to use them for broader ecosystem monitoring, from physical and chemical oceanography to characterisation of planktonic communities and detection of fish and marine mammals. Multidisciplinary missions are particularly promising to inform habitat modelling. Moving using variable buoyancy and foils, underwater gliders are very quiet platforms and therefore optimal tools to conduct ambient noise measurements, soundscape characterization and cetacean passive acoustic monitoring (PAM). Both surface and submarine gliders have been equipped with a range of acoustic sensors in order to detect marine mammals, including towed hydrophone arrays, custom-built instruments or stand-alone recorders typically used in static arrays, drifting systems or animal-borne telemetry studies. Completely autonomous and self-contained units are particularly interesting as they can be deployed opportunistically during non PAM-dedicated missions, without using power supply or memory space from the glider. Here, we present preliminary results from a short mission conducted over the Malin Shelf in October 2021. A SoundTrap 300HF was mounted onto a Slocum G3 underwater glider to assess feasibility and suitability of using this combination of devices to conduct PAM and ambient noise measurements following MSFD standards. Recordings gathered over a week enabled detection of dolphins and harbour porpoises, as well as investigation of ambient soundscape and characterisation of glider self-noise.



Characterization of extracellular vesicle from two cetaceans cell lines

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During the last two decades, extracellular vesicles (EVs) have been increasingly recognized as potent intercellular communicators transferring a wide variety of molecular cargoes in humans and animals. In the aquatic environment, despite the knowledge is still little, EVs modulate host-pathogen interaction and nutrient/toxins acclimation/scavenging. In terrestrial mammals, EVs can be isolated from most body fluids, cell culture media, and tissues and many studies are focusing on their possible role as biomarkers for the assessment of health status.

The aim of this preliminary study was to characterize EVs from cell culture media of immortalized fibroblasts cell lines isolated from skin of bottlenose dolphin (*Tursiops truncatus*) and Cuvier's beaked whale (*Ziphius cavirostris*).

EVs were isolated by ultracentrifugation and the obtained EV-enriched pellet was analyzed to characterize EV size using Nanoparticle Tracking Analysis (NTA) and EV morphology via Transmission Electron Microscopy (TEM), and to identify the presence of EV markers by Western Blot (WB) analysis.

NTA showed in each pellet a concentration of $4.02 \cdot 10^{10} \pm 2.07 \cdot 10^9$ particles/ml in bottlenose dolphin and $3.11 \cdot 10^{10} \pm 2.60 \cdot 10^9$ particles/ml in Cuvier's beaked whale. Particles had a mean diameter of $137,6 \pm 4,7$ nm for bottlenose dolphin and $144,9 \pm 5,7$ nm for Cuvier's beaked whale. TEM analysis revealed the presence of intact and rounded EVs. At WB analysis, EVs isolated from both species were CD9+ and Calnexin-, while only bottlenose dolphin EVs resulted also Alix+.

To the best of our knowledge, this is the first study that characterizes EVs in two cetaceans cell lines. Further investigations will be performed to differently isolate and better characterize EVs from these cell lines. Despite preliminary, this study offers a new prospective system to evaluate the host/pathogen-toxic compounds/aquatic environment relation in marine mammals and to possibly identify new biomarkers for assessing the impact of water pollution and pathogens on animals and human health.



Scar diminishment on dolphins vary with natural salinities: Implications for reliability of photo-identification

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Photo-identification of cetaceans is contingent upon the reliability of naturally-acquired markings. Few studies have explored how quickly wounds heal on cetaceans, although elevated salinities are known to accelerate healing in many organisms. The temporal stability of scars photographed on the dorsal fins of common bottlenose dolphins (*Tursiops truncatus*) inhabiting one of the only hypersaline lagoons in the world were compared to a genetically distinct population inhabiting an adjacent hyposaline bay. Two novel metrics were developed to quantify scar persistence (length and surface). The scars of all dolphins in the hypersaline bay disappeared between 3-6 years, whereas the scars on some of the dolphins in the hyposaline bay persisted over the same duration. Salinity appears to influence scar diminishment in dolphins, which has important applications for the reliability of photo-identification techniques of cetaceans as oceanic salinity levels decline with increasing climate change and natural disasters, and as urbanization drives the construction of desalination plants in many coastal regions.



Poster Abstracts
ECS 2022/ Ashdod, Israel



Tuesday, April 5th / Central European Summer Time

001

Assessing the interactions between dolphins and bottom trawlers and bycatch occurrence off the Catalan coast (Western Mediterranean)

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Interaction with fisheries has been described as the most frequent cause of death among striped (*Stenella coeruleoalba*) and common bottlenose dolphins (*Tursiops truncatus*) necropsied after having stranded along the Catalan coast (North-East Spain). The coastal waters of Catalonia are an important habitat for common bottlenose dolphins, as well as a remarkable fishing ground where interactions between dolphins and bottom trawlers have been observed regularly. However, the impact that these interactions have on both fishing operations and dolphin population in this area is still unknown. In order to gather information on dolphin and trawler interactions and bycatch occurrence in Catalan waters, interviews with crew members of fishing trawlers operating in this area were conducted between August and September 2021. Interviews covered 59% of the trawling fleet (125 trawlers) and all fishermen reported interactions with dolphins. Among the interviewed fishermen, 83% noted that bottlenose dolphins follow trawlers aiming to seize fish from the net. Despite this, interactions were considered to be non-negative by 93% of the respondents due to an increase in their catch when dolphins are present, their playful behaviour or not causing any damage to their fishing gear. Just 7% considered the interaction as negative because it results in catch loss. While 91% of the fishermen declared that they had caught occasionally dolphins in their nets, just 8% of them had ever caught an individual alive. Thus, fishermen have the perception that bycatch is not an important threat for dolphins. The results of this study show that dolphin bycatch occurs in this area as observed in necropsy studies; however it happens in relatively small numbers despite the high level of interaction. Collaboration between scientists and fishermen is essential to understand better the impact of the interactions as well as for finding mitigation measures to protect this threatened subpopulation.



Tuesday, April 5th / Central European Summer Time

002

Impacts of climate change on cetacean distribution, habitat and migration

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Climatic changes have had significant impacts on marine ecosystems, including apex predators such as cetaceans. A more complete understanding of the potential impacts of climate change on cetaceans is necessary to ensure their conservation. Here we present a review of the literature on the impacts of climate change on cetacean distribution, habitat and migrations and highlight research gaps. Our results indicate that due to rising migration sea surface temperatures (SSTs) and/or reducing sea ice extent, a variety of impacts on the distribution, habitat and migration of cetaceans have been observed to date and several more are predicted to occur over the next century. Many species have demonstrated a poleward shift, following their preferred SSTs to higher latitudes, and some have altered the timing of their migrations, while others appear not to be affected. These changes may benefit certain species, while others will be placed under extreme pressure and may face increased risk of extinction. Broader implications may include increased inter-specific competition, genetic alterations, ecosystem-level changes and conservation challenges. Existing research on the topic is both extremely limited and unevenly distributed (geographically and phylogenetically). Further research is necessary to determine which species and populations are most vulnerable and require the earliest conservation action.



Tuesday, April 5th / Central European Summer Time

003

Whale mortality events as a result of climate and environmental change? Identifying habitats and feeding behaviour of Patagonian sei whales using baleen isotopes

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Between February and April 2015, the largest ever recorded baleen whale mortality event occurred in Central Chilean Patagonia. Over 343 baleen whales, mainly sei whales (*Balaenoptera borealis*), died within a short period of time. In the following years, new whale carcasses were found repeatedly in the same limited area, around Golfo de Penas. We investigated the whales' migratory and feeding behaviour using sequential carbon and nitrogen stable isotope ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) analyses of their baleens. The isotope data are interpreted in terms of potential prey taxa and migratory behaviour based on latitudinal isotope gradients of particulate organic matter. Carbon and nitrogen isotope records of each baleen showed recurring oscillations. They slightly differed in periodicity indicating variable baleen growth rates between 10.0 and 16.5 cm/year. This cyclicity is best explained by regular migrations of the sei whales from subtropical calving areas to high latitude foraging grounds. $\delta^{15}\text{N}$ records of baleens differed between individuals eventually pointing to diverse feeding and migratory preferences among sei whale individuals. Little is known about the ecology of the sei whale populations off the coast of southern Chile or the southern hemisphere in general. Thus, spatial changes of the marine food web are of major interest. Our ongoing studies aim at a better understanding of the impact of various environmental factors on marine food webs in the South Pacific. Another objective is to evaluate the reasons for the ongoing mass mortalities of cetaceans in the context of global climate and environmental change and its impacts.



Tuesday, April 5th / Central European Summer Time

004

Detection of Nanoplastic Particles in the Brain of Indian Ocean Dolphins (*Tursiops aduncus* and *Sousa plumbea*)

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An estimated 4.8 to 12.7 million metric tons of plastic waste are entering the sea every year, and the trend is rising. A particular threat to aquatic animals is posed by nanoplastic (NP) particles, which are small enough to cross biological barriers and could thereby reach the brain and cause harm. NP either directly enter the sea or arise through decay of macroplastics by UV radiation, mechanical abrasion and other environmental factors. Studies on phytoplankton, crustaceans, gastropods and fishes showed effects on fitness, brain metabolism and tissue inflammation after plastic ingestion. Through the food chain, particularly high amounts of NP are expected to accumulate in predators like dolphins. The detection and localization of NP in biological tissue such as brain is methodologically challenging and has not previously been accomplished in dolphin tissue. Here we describe the establishment of a novel method to detect NP particles in the brain of dolphins. We used hyperspectral, confocal Raman imaging on sections of preserved brain tissue of *Tursiops aduncus* and *Sousa plumbea*, and compared the resulting spectra with reference spectra for plastic polymers. Our preliminary results suggest presence of polyethylene and polyamide NP in the sampled brain tissue. While the specificity of detection and signal-to-noise ratio will need to be optimized further by increasing the integration time of the Raman scanner, we conclude that this method holds immense potential for reliable detection of polymers in brain and other tissues. Further studies on the subcellular localization of NP and their potential effects in dolphin brains are required, however considering published pathophysiological effects of NP in other organisms, it appears reasonable to speculate that NP accumulation in the brain might cause physiological and/or behavioural abnormalities in marine mammals.



Tuesday, April 5th / Central European Summer Time

005

Collision risk for fin whales (*Balaenoptera physalus*) in the Catalan coast, northwest Mediterranean Sea

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Ship strikes are a widespread and concerning conservation issue for many marine mammal species globally, being the greatest threat for fin whales in the Mediterranean Sea. Population level impacts can occur depending on the occurrence and severity of collisions which may lead to life altering injuries or fatalities. Since 2014, a seasonal feeding aggregation of fin whales has been monitored annually from March to May off the Catalan coast, northeast Spain in the northwest Mediterranean Sea. Fin whale presence is driven by the presence of northern krill found around submarine canyons and the end of the continental shelf. A high abundance of fin whale sightings has been recorded. The study area covers a region between Tarragona and Palamós, with the collaboration of fisherman and sailors. The whole area is exposed to a high marine traffic density as it features Barcelona and Tarragona harbours that have major shipping lanes linking these ports to the Atlantic Ocean and the rest of the Mediterranean basin. Almost 3 million merchant vessels call to these important trading ports during the fin whale season. 9 individual live whales have been documented with injuries in the study area since 2018. At least 3 whales have been found dead in Barcelona Port since 1986 due to vessel collisions. Shipping lanes and fin whale presence were mapped for from March to May 2021. A high collision risk map has been evaluated by month indicating that April and May had the highest risk for collisions. An active management plan is required to slow vessel speeds and alter the route during critical feeding periods to further reduce the collision risk posed to fin whales off of the Catalan coast. This could be the basis for the designation of a Particularly Sensitive Sea Area under the framework of the International Maritime Organization.



Tuesday, April 5th / Central European Summer Time

007

Assessing human-wildlife interactions in the Anthropocene: a social media-based study on the Mediterranean monk seal, a flagship species for marine conservation

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Social media offer direct access to massive repositories of information that may act as non-traditional data sources in wildlife research. Particularly for threatened species, social media can be a valuable and cost-effective tool to inform conservation, as each photograph and video may provide information on individual identification, sex, behavior, and human-wildlife interactions. The Mediterranean monk seal, *Monachus monachus*, is one of the most endangered marine mammals worldwide. Historically, it used to haul out on open beaches, but more recently it has predominantly been using inaccessible remote marine



Tuesday, April 5th / Central European Summer Time

007

(Continued)

caves, thus rendering studies difficult. The present study aimed to assess all user-uploaded video content for geographical information, as well as to collect information on anthropogenic disturbance. We used a set of keywords and hashtags in five different social media platforms to retrieve videos featuring monk seals in the wild. In total, 20 researchers from eight countries analyzed nearly 10.5 video hours, originating from 475 posts shared during 2010-2020. Three independent researchers assigned a level of disturbance (“none”, “minor”, “major”) to each video, while the video was labelled as “null” when no agreement was reached. Major and minor disturbances were observed in 20.6% and 35.8% of the videos, respectively, 38.3% of the posts indicated no disturbance to the animals, while 5.3% of the posts were characterized as “null”. Out of the 14 geographic regions for which data were obtained, the highest percentage of major disturbance was documented in the Aegean Sea (25.2%), contrary to the Northern Levantine Sea, where nearly half of the videos (49.5%) showed no disturbance. Tourism related harassment constituted the most common form of disturbance. Our study demonstrates that an informal, yet freely and widely available source of data, can provide useful information on human-wildlife interactions, while it can be applied to a variety of taxa to assist conservation actions.



Tuesday, April 5th / Central European Summer Time

008

Assessing underwater noise levels in the Gulf of Trieste, northern Adriatic Sea

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With two large ports and several smaller marinas, the Gulf of Trieste represents both an important shipping and tourist destination. It is also one of the most human-impacted areas in the Mediterranean Sea. The increase in underwater noise due to human activities has the potential to negatively impact the local population of common bottlenose dolphins (*T. truncatus*), studied since 2002. During 2020–2021 we conducted continuous underwater sound recordings using four passive acoustic devices, to assess underwater noise levels and acoustic presence of dolphins at two ‘coastal’ and two ‘offshore’ locations. The devices recorded sound at a 144 kHz sample rate. Regular land-based surveys were carried out concurrently, to determine the presence and numbers of various types of vessels within the 2 km radius from the sampling locations. The devices logged more than 3000 hours of recordings. Coastal areas showed a clear diurnal pattern of noise in summer time with peak frequencies between 100 Hz and 5 kHz, consistent with heavy daily recreational traffic during this time. The two offshore locations do not show a distinct diurnal pattern in the same frequencies as the coastal locations, but show an increase in low-frequency noise, consistent with a higher number of large ships and lower presence of small leisure vessels, since these locations are near the main shipping lanes. Analysis of acoustic data showed dolphin detections at all four locations, but with apparent preference for the two coastal locations. This study provides a better understanding of underwater noise pollution in this area and its potential effects on the local dolphin population.



Tuesday, April 5th / Central European Summer Time

009

Rostrum abnormalities in the endangered Indian Ocean humpback dolphin (*Sousa plumbea*)

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Morphological abnormalities in wild animals can be indicators of the underlying health of a population and may be determined through routine photographic surveys. Here we assess unusual rostrum conditions in Indian Ocean humpback dolphins (*Sousa plumbea*) inhabiting South African coastal waters to understand the rate of prevalence of abnormal rostrums and formulate hypotheses on its potential causes. Photographic data were collated from systematic boat surveys and opportunistic sightings, obtained between April 1998 and March 2021 in various regions along the South African coast. Overall, 32 unique individuals were found with abnormal rostrum conditions, varying from slight to severe wounds and/or aberrant morphologies. From the systematic survey data, 10.7% of the identified individuals had rostrum abnormalities. Most of the cases were characterized as injuries potentially caused by natural events during their life history, including interactions with sharks and/or wounds caused by reef-associated hunting strategies. However, one animal clearly showed an injury caused by anthropogenic impacts as a potential fishing line was still attached to the base of the melon. Available mark-recapture data of affected individuals indicated they had survived with these injuries for at least ten years. This study highlights the highest incidence of rostrum abnormalities identified for the species, but numbers presumably only reflect those that have survived their injuries and are therefore a minimum estimate for these animals. A better understanding of the cause(s) of these injuries is deemed important to be considered when revisiting the endangered status of this species.



Tuesday, April 5th / Central European Summer Time

010

Opportunistic microorganism as markers in determining the causes of cetacean death

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There are many mass strandings of dolphins in Krasnodar Region in the Russian Federation and as a result about 300-400 dead cetaceans can be found in Krasnodar Region. Some scientists report that the most common causes of strandings are fishing and different diseases. We selected 83 samples of the biomaterial from dead and alive cetaceans in 2021. The samples were taken from different parts of dead dolphins right after their death. The research was carried out by standard microbiological methods including cultural and biological ones. The microbiological research of selected samples showed the absence of particularly dangerous diseases in the samples of marine mammals: tuberculosis, brucellosis, listeriosis, erysipelothrix. However, in the selected material of dead cetaceans we revealed some opportunistic microorganisms with high titers and pathogenicity factors which could either cause infectious diseases or show the symptoms of a dysfunctional state of their health until the moment of death.



Tuesday, April 5th / Central European Summer Time

011

A Stranding of a Harbour Porpoise Calf (*Phocoena phocoena relicta*) in the North Aegean Sea

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The Harbour porpoise *Phocoena phocoena*, is an elusive cetacean distributed in cold temperate to sub-polar waters of the Northern Hemisphere. Despite its wide distribution, its presence in the Mediterranean Sea has been debated up until recently, when a dedicated survey confirmed the species regular presence in the Thracian Sea, North Aegean. Hereby we present the stranding of a dead *Phocoena phocoena relicta* calf found in Nea Chili, Thracian Sea, Greece. Full necropsy, morphometric measurements and tissue samples were obtained along with stomachs contents and other parts of the digestive system. No indication of infectious disease was noticed. Therefore, the main findings were a deep skin injury at the lateral canthus area of the right eye along with a severe lethal skull fracture, which were considered the cause of death. Notes on the individual morphometric measurements and diet are also presented. This is the first case of a calf harbour porpoise stranded in the Aegean Sea. The presence of calves may indicate breeding grounds for harbour porpoises in the north Aegean Sea. Given the threatened status of the species subpopulation in the area, any indication of breeding harbour porpoises is vital and warrants protective regulations for the species, while it is important to understand the human-harbour porpoise interactions in the area.



Tuesday, April 5th / Central European Summer Time

012

Presence of polychlorinated biphenyls (PCB) in tissue of *Stenella coeruleoalba* stranded from the Sicily Channel

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The concentration of 13 individual PCB congeners (PCBs) were determined in tissues and organs of *Stenella coeruleoalba* (n=9) from the Sicily Channel. Samples were collected during 2017-2020. The concentration of PCBs congeners (8, 20, 28, 35, 52, 60, 101, 126, 138, 153, 180, 209) were determined in blubber, liver, lung, and muscle. The determination was done with GC-ECD (Perkin-Elmer Clarus 500). The total concentration (ng/g) 16233.48±6734.90 in melon, 23803.84±13175.81 in blubber, 6037.23±2562.68 in liver, 868.98±475.66 in lung, and 558.99±301.50 in muscle. Hexa-CBs (138, 153) were the most abundant in all tissues with a cumulative percentage of 53.10% (blubber)- 61.90% (liver), followed by penta-CBs (101, 126) 14.07% (lung)-17.09% (blubber) and tetra CBs (52, 60) 5.52%(melon)-6.50%(muscle). The highest percentage of PCB 209 was found in blubber (8.87%). Tri-CBs (20, 28, 35) were the 2.20% (liver)-5.46% (muscle). PCBs concentrations were relatively high, especially in the bubber. Results indicates that they might be prone to adverse health effects especially if we considered that dioxin-like PCBs were not analysed and the concentrations of all PCBs can be even higher.



Tuesday, April 5th / Central European Summer Time

013

Anthropogenic injuries in the Western Ligurian Sea common bottlenose dolphin population - case study

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Delfini del Ponente APS

Common bottlenose dolphins (*Tursiops truncatus*) are typically found in fragile and highly threatened coastal habitats. The Mediterranean Sea population, listed as vulnerable by the IUCN, occurs regularly in coastal waters despite being threatened by numerous human activities like overfishing, bycatch, chemical and noise pollution, collisions with boats, and habitat degradation. Observations of dolphins with anthropogenic marks are a worrying, not rare issue. Presented data were collected between April 2018 and December 2021 in the Western Ligurian Sea (NW Mediterranean Sea). Although the study area is located inside the Pelagos Sanctuary – a marine mammal protected area – it is still characterized by high levels of human pressure. The analysis resulted in 166 photo-identified individuals and the presence of anthropogenic marks was detected in about 6% of the animals. In this study, we present the two most relevant cases of bottlenose dolphins, showing injuries caused by interaction with human activities. The first dolphin, named Hook, is an adult female dolphin with the dorsal fin completely collapsed due to a potential fishing line entanglement. The dolphin was observed 21 times from May 2018 to August 2021. The second case, a calf born in Winter 2019 named Propeller, shows a typical propeller scar on the dorsal portion of the body, caused by a boat collision that occurred in the early days of its life. The individual was spotted 26 times from June 2019 to December 2021. In both cases, despite the injuries being significant, frequent observation of both dolphins suggests their wellness has not been severely affected by these anthropogenic events. Nevertheless, the described cases may suggest that additional restrictions are needed in the Pelagos Sanctuary to prevent dolphins' anthropogenic injuries. Moreover, continuous monitoring of this population is essential to track the threats and to contribute to effective conservation measures.



Tuesday, April 5th / Central European Summer Time

014

First voluntary use of ADDs in small scale fisheries as the foundation for effective mitigation of harbour porpoise *Phocoena phocoena* (L., 1758) bycatch in Polish Baltic waters

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Gillnet fishery significantly affects marine mammals in the Baltic Sea. Due to extremely low abundance of the Baltic population of harbour porpoises it was recognized by IUCN as critically endangered. Based on the occasional bycatch reporting by fishermen, as well as on the stranding data, it should be assumed that the anthropogenic mortality of these animals exceeds the ability of the natural population recovery. For this reason it is crucial to implement methods that will reduce bycatch and will be accepted by fishery sector. One of such measures is the use of Acoustic Deterrent Devices on gillnets. The obligation to use them in Polish waters results from Regulation of the European Parliament and of the European Council (EU) 2019/1241, but only applies to a small area of western waters – Pomeranian Bay and to fishery fleet above 12 meters. In this study additional measures have been taken, to fill those gaps both in the core Baltic harbour porpoise areas and in the small boat fishery responsible for the bycatch. 300 devices (Fishtek Banana Pinger) have been handed over to 24 volunteered shipowners, operating on gillnetters below 12 meters different areas within Polish territorial waters. Since 2018 fishermen have delivered nearly 150 reports from gillnets catches equipped with ADDs. They used them while fishing for herring, perch, garfish, cod, flounder, turbot, sea trout, and zander. They have not recorded porpoise bycatch in any of the catches. The fishermen are positive to the use of the devices which are continuously used by them. Their valuable comments on testing the devices, adapting the way of mounting them to various types of nets and even overcoming the difficulties in fishing operations caused by pingers installation will be important in convincing the other fishermen to use pingers to save the Baltic harbour porpoise.



015

Odontocete cetaceans foraging behind trawlers, worldwide

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Several populations of odontocete cetaceans, including at least 19 species, are known to forage and feed in association with trawlers. We reviewed information on odontocete interactions with different kinds of trawlers across 13 FAO fishing areas around the world. We also identified knowledge gaps, effects on odontocete ecology, distribution, behaviour and social organisation, the main mitigation options currently available or proposed, and some management avenues that could help reduce incidental mortality. Trawlers involved in the interactions varied greatly in terms of gear and target species, implying odontocetes have developed behavioural specialisations for foraging under a variety of conditions. Specialised behaviour included venturing deep into a moving trawl to feed on the organisms trapped in the net, feeding on fish stirred up by the net, extracting fish from the outer mesh, feeding on catch lost during hauling, and scavenging on discarded catch. Foraging behind trawlers facilitates access to prey, and in some instances may compensate for scarcity of preferred prey within areas exposed to intensive fishing or environmental degradation. This opportunistic foraging strategy, however, exposes the animals to the risk of harm and even mortality in trawl gear (bycatch). The combined effect of facilitated foraging and bycatch on the status and trends of odontocete populations is typically unknown. The economic consequences, e.g. in terms of loss of marketable catch and gear damage, remain largely conjectural. Attempts to reduce depredation and/or bycatch in trawl gear have included acoustic deterrents and exclusion devices installed in nets, although neither technique has proven to be consistently effective.



Tuesday, April 5th / Central European Summer Time

016

Microbiological analysis of Okhotsk Sea population bowhead whales (*Balaena mysticetus*) exhale samples

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Studying the health status of cetaceans allows us to assess the risks and identify the causes affecting the well-being of populations. The study of the microflora of the exhaled air of whales helps to identify not only pathogenic and opportunistic microorganisms circulating in the studied group of individuals, but also to assess the health of the population as a whole. In August 2020 in Wrangel bay (Sea of Okhotsk) we collected air samples exhaled by bowhead whales, utilizing non-invasive method, in compliance with the rules of asepsis. Water samples were taken simultaneously for control and sanitary-microbiological assessment of the environment. A total of 43 samples were collected from 20 individuals. Bacteriological and mycological surveys were carried out using standard techniques. The biological properties of the isolated cultures were studied in order to identify them and the species and quantitative ratio in the samples were assessed. Identifications of the isolats was done by MALDI-TOF Mass spectrometry. Particular attention was paid to the pathogenicity and resistance to antibacterial ugs. Microorganisms were found in 18 samples, including bacteria of the genera *Aeromonas*, *Corynebacterium*, *Bacillus* and fungi of the genera *Penicillium*, *Candida*, *Aspergillus*. An insignificant total microbial count in the studied samples and frequent detection of microorganisms in monocultures or no more than 2 species in one sample may indicate a low microbial contamination of the respiratory tracts of the surveyed whales. In one of the samples, hemolytic microorganisms were found in monoculture, which may be an indicator of health problems in this individual. Our results demonstrate differences in the composition of microbial associations of the respiratory tracts of bowhead whales of the Sea of Okhotsk from other species of large cetaceans, the absence of unconditional pathogens in the samples and the detection of bacteria with the presence of pathogenic factors in only one animal from the study group.



Tuesday, April 5th / Central European Summer Time

017

Neuropathological characterization of dolphin morbillivirus infection in cetaceans stranded in Italy

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Cetacean Morbillivirus (CeMV) is a pathogen of great concern for free ranging cetaceans, responsible of epidemic and endemic fatalities. Neuro-inflammation sustained by CeMV is regarded as one of the most common cause of death in stranded marine mammals. Despite the large literature describing demyelinating lesions related to Morbillivirus infection in dogs and pinnipeds, a few descriptions of myelin changes have been reported in cetaceans affected by CeMV infection so far. In the Italian waters a new dolphin morbillivirus (DMV) strain of Atlantic origin has circulated since the beginning of 2016 causing acute/subacute lesions in presence of positive In the present immunolabelling study we systematically described the histopathological changes observed in the central nervous system (CNS) of 31 cetaceans affected by DMV infection and stranded along the Italian coastlines in the period 2008-2020, unveiling differences in the virulence of the last two strains circulating in the Western Mediterranean Sea, along with the main cell changes occurring in areas of myelinopathy, through double indirect immunofluorescence analysis (IF). Astro-microgliosis, neuronal necrosis, spongiosis, malacia and non-suppurative meningoencephalitis were the most represented DMV-associated lesions. A specific myelin biomarker succeeded in demonstrating myelin reduction and areas of demyelination. Morbilliviral



Tuesday, April 5th / Central European Summer Time

017

(Continued)

antigen immunolabelling was proved in neurons and microglia cells associated to a marked activation of microglia and astrocytes. These results contribute to a better understanding of DMV-associated brain lesions, allowing to obtain valuable information on their pathogenesis. Furthermore, molecular and immunohistochemical data may suggest a higher neurotropic potential of the novel circulating strain. To the best of our knowledge this study represents the first neuropathological characterization by means of double IF staining in marine mammals affected by systemic CeMV infection, along with the first application of the confocal laser-scanning microscopy for the in-depth analysis of CeMV infections.



Tuesday, April 5th / Central European Summer Time

018

Documenting and processing behavioral patterns of groups from dolphin populations resident in Bazaruto, Mozambique, East Africa, in 2019-2020

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Uncontrolled dolphin-watching tourism joins a group of anthropogenic threats to their populations worldwide. This study examined undisturbed behavioral menus of dolphin groups from the following species: Indian Ocean bottlenose dolphin *Tursiops aduncus*, Indian Ocean humpback dolphin *Sousa plumbea*, and Spinner dolphin *Stenella longirostris*, occurring in the waters of the Bazaruto Archipelago, Mozambique, East Africa. The study of the daytime behaviors was carried out in an area yet devoid of dolphin watching tourism, but along routes likely to be taken by future ecotourists – focusing on the main attraction of breeding humpback whales (*Megaptera novaeangliae*). Documentation was by means of stills and video footage taken by an onboard waterproof camera and by a remotely operated drone. The behavioral menu was assessed from the photographic material through the cumulative amount of time spent in each of the following categories: Resting, Traveling, Foraging, Socializing, and Bow riding. We hypothesized that although the three species share the same space, their behavioral menus will be different enough to justify different future viewing instructions to ecotourist boats regarding each species. The results show that indeed there are differences in the predominant behavior presented by the three different species: spinner dolphins encounters include more bow riding, Indian Ocean humpback dolphins are most likely to be seen foraging, while Indian Ocean bottlenose dolphins are mostly observed traveling. We hope that this work and its extension will aid the formulation of species-specific whale-watching guidelines that will reduce the disruption caused to the animals to a minimum.



Tuesday, April 5th / Central European Summer Time

019

Distribution and accumulation of polycyclic aromatic hydrocarbons in blubber and liver of *Stenella coeruleoalba* stranded from the Sicily Channel

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Benzo(a)Anthracene (B[a]A), Chrysene (Chry), Benzo(b)Fluoranthene (B[b]F), and Benzo(a)Pyrene (B[a]P) concentrations in blubber and liver of *Stenella coeruleoalba* (n=9) from Sicily Channel (Southern Italy) have been investigated. Four males and five females were found stranded along Sicilian coasts during 2017-2019. Analyses were done with an accredited gas chromatography-mass spectrometry (GC-MS/MS) method. Chrysene was the most abundant PAH in blubber with a concentration of 242.0 ± 42.26 mg/kg, followed by benzo(a)anthracene 56.07 ± 39.19 , benzo(b)fluoranthene 3.627 ± 1.924 , and benzo(a)pyrene 2.007 ± 1.078 . A similar pattern of concentration was found in the liver. Chrysene was the most abundant PAH in liver (21.58 ± 6.440 mg/kg), followed by benzo(b)fluoranthene (1.285 ± 0.410), benzo(a)anthracene (1.260 ± 0.392), and benzo(a)pyrene (0.796 ± 0.182). Low molecular weight PAHs tend to be at higher concentrations in tissue, which are also the most water-soluble and largely bioavailable. These data confirm that the subcutaneous blubber of dolphins accumulates a high amount of PAH.



Tuesday, April 5th / Central European Summer Time

020

Assessment of bisphenols and phthalates concentrations in Mediterranean striped dolphins (*Stenella coeruleoalba*)

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Bisphenols (BP) and phthalates (PAE) have been called “everywhere chemicals” due to their ubiquity in several plastic products of daily use. Indeed, they are important chemical components for the plastics industry, where BP (especially BPA) are used to manufacture hard, transparent plastics such as water bottles, and PAE are used to manufacture soft, flexible plastics such as PVC products and food packaging. Both types of chemicals are also well-known environmental contaminants that pollute water and wildlife and cause damage to living organisms by acting as endocrine disruptors. Cetaceans are especially vulnerable to the potential effects of this type of contaminants, as they are long living mammals with a low reproduction rate and often occupy the top of the trophic web, being subject to both the bioaccumulation and biomagnification of pollutants. However, little is known about current BP and PAE concentrations in cetacean tissues, their potential relation with biological variables, or their trends over time. In this study, we assessed the concentration of 10 BPs and 13 PAEs in the muscle of 24 striped dolphins (*Stenella coeruleoalba*) stranded along the Spanish Catalan coast (NW Mediterranean) between 1990 and 2018. BP Z was the most abundant BP compound detected in the samples, followed by BP E and BP A. On the other hand, di-n-butylphthalate (DBP), bis(2-ethylhexyl) phthalate (DEHP), and diethylphthalate (DEP) were the most abundant PAE. No significant difference was found between sexes for individual BP or PAE; however, the overall concentration of PAE compounds was significantly higher in samples from males than in those from females. No correlation was found between year of sampling and the overall compounds concentration, with the exception of DEP, DMP and BP E, whose concentrations were lower, and of BPFL.



Tuesday, April 5th / Central European Summer Time

021

Organochlorine pollutants in the Black Sea harbour porpoises (*Phocoena phocoena relicta*)

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Residues of organochlorine pollutants were determined in the blubber of the 46 harbour porpoises (*Phocoena phocoena relicta*), incidentally bycatch in turbot nets in the North-Western Black Sea in May 2018. Concentrations of the dichlorodiphenyltrichloroethanes (DDTs) in males (n=15) were 6699,8 - 117977,7 (33841,7) ng/g lipid weight (l.w.), and in females (n=31) 867,6 - 30671,4 (8501,0) ng/g l.w. Juvenile females (n = 6) accumulated higher DDTs concentrations than mature females (n = 25): respectively, 8989,9 - 30671,4 (15933,7) ng/g l.w. versus 867,6 - 25277,0 (6717,1) ng/g l.w. This is due to the transmission of lipophilic pollutants by lactating females to suckers through milk. The concentrations of polychlorinated biphenyls (PCBs) in the blubber of the examined harbour porpoises were: in males (n = 15) 220,2-4430,5 (1455,1) ng/g l.w., females (n=31) 867,6 - 30671,4 (8501,0) ng/g l.w., including juvenile females (n=6) 8989,9 - 30671,4 (15933,7) ng/g l.w. and mature females (n=25) 106,0-1707,8 (590,3) ng/g l.w. The ratio of DDT metabolites to the main substance indicates the absence of fresh input of the insecticide into the environment. Dangerous dioxin-like congeners among PCBs were found in insignificant amounts.



Tuesday, April 5th / Central European Summer Time

022

Evidence of ingested plastics in stranded cetaceans along the Balearic islands, Western Mediterranean Sea

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The presence of plastic in oceans is extremely worrying because it poses potential threats for marine organisms, including plastic entanglement and ingestion. The consequences from plastic ingestion for cetaceans can be dramatic and include internal injuries and intestinal blockage, interference with swimming behaviour and buoyancy, or accumulation of plasticizers or heavy metals. In the present study, we examined the occurrence of marine debris in the gastrointestinal tract of 21 cetaceans: *Stenella coeruleoalba* (n=14), *Tursiops truncatus* (n=5), *Grampus griseus* (n=1), *Physeter microcephalus* (n=1) found stranded or incidentally captured dead by fisheries around the Balearic Sea. Three specimens (14.3 % of the sample) were found to have ingested marine debris composed exclusively of plastic items, including fishing nets, plastic bags and strapping lines. The affected species were two adult females of *Tursiops truncatus* (Total length = 314 cm and 320 cm) and one juvenile male of *Physeter microcephalus* (Total length = 540 cm). Average number of items was 3.3 ± 1.8 (mean \pm SE) per individual. Moreover, the highest number of plastic items (n = 6), composed by one plastic bag, two transparent threats and three strapping lines, were recorded in the stomach of the *Physeter microcephalus*, that most likely died due to stomach perforation. All plastic items were identified by μ -Fourier Transform Infrared Spectroscopy. Polypropylene plastics represented 78.1% of the total number of plastic and were found in 85.2 % of the cetaceans sampled with plastic ingestion. As a conclusion, the occurrence of marine debris observed in this work confirms the impact of plastic pollution of cetaceans in the Mediterranean Sea and highlights the importance of these species as good indicators for marine litter.



Tuesday, April 5th / Central European Summer Time

023

High levels of aluminum in the bone of marine mammals from three marine areas subject to a degree of metal contamination

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Aluminum is the most abundant metal in the earth's crust, but in seawater is scarce and its bioavailability is extremely low. The main sources of aluminum reach the oceans by the deposition of wind-blown dust from arid regions, anthropogenic activities (e.g., industry or coal combustion) and the dissolution from sediments. Here, the concentrations of aluminum in bone samples of marine mammal species (4 pinniped species and 6 cetacean species), collected from three marine areas (off Mauritania, Uruguay and Galápagos archipelago), were analysed to investigate variation in aluminum concentrations between and within areas. Results indicated remarkably high levels of aluminum in all species and areas as compared to terrestrial mammals. The species inhabiting Mauritanian waters showed the highest values (median = 571 mg/kg dw), likely a consequence of inputs from the Sahara desert. Those inhabiting waters off Uruguay had intermediate, though still high, aluminum concentrations (median = 125 mg/kg dw), likely due to aluminum inputs from local industry. In contrast, the species sampled in Galápagos waters were the least polluted due to the pristine nature of the habitat (median = 59 mg/kg dw). Interspecific differences in aluminum within each area were likely related to dissimilar use of habitat and diet preferences. Further research is needed to clarify if these overall exceptionally high levels of aluminum can cause adverse effects on these marine mammal populations. The study was funded by the Fundació Barcelona Zoo (Spain) through the Research and Conservation Programme - PRIC (309998).



Tuesday, April 5th / Central European Summer Time

024

Using harbour seal haulout data to better manage a cockle fishery

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Harbour seals (*Phoca vitulina*) are a designated feature of The Wash and North Norfolk Coast Special Area of Conservation (SAC). It is a known haul out and breeding site with pupping occurring annually between July and August. The population was been increasing year on year until 2019 and 2020 when a 20-30% decline in numbers was identified through annual aerial surveys by the Sea Mammal Research Unit (SMRU). The Wash itself is the largest embayment in the UK with extensive sand and mudflats. A successful hand-fished cockle fishery operates there each year. Natural England provide advice to the Eastern Inshore Fisheries and Conservation Authority (EIFCA) on their Habitat Regulations Assessments for the cockle fishery within the SAC. EIFCA currently mitigate against potential physical and visual disturbance to the seals by assessing the potential for seal haulouts and the cockle fishery to spatially overlap. To date, this has been done by applying a 600 m buffer around known haulout location points and spatially overlaying EIFCA annual cockle survey data, a strong indicator of where the fishing activity is likely to take place. Work is now underway to refine how this assessment and any resulting closure areas, implemented to protect seals from potential fisheries disturbance, are developed. SMRU will use historical survey data from multiple years to create a maximum seal haulout extent across the SAC. This will in turn inform the advice Natural England provide to EIFCA and ensure proportionate management measures are put in place to allow the cockle fishery to access viable cockle beds, whilst ensuring the seals and their pups are afforded the necessary level of protection from disturbance, particularly in the context of the identified population decline.



Tuesday, April 5th / Central European Summer Time

026

Distribution and accumulation of trace elements in tissues of *Stenella coeruleoalba* stranded from the Sicily Channel

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Cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), manganese (Mn), selenium (Se), zinc (Zn), iron (Fe), lead (Pb), tin (Sn), and arsenic (As) concentrations in muscle, kidney, and liver of *Stenella coeruleoalba* (n=9) from Sicily Channel (Southern Italy) have been investigated. Specimens were four males and five females collected during 2017-2019. Trace elements were determined by Quadrupole Inductively Coupled Plasma Mass Spectrometry (ICP-MS), and the Hg determination was carried out by a DMA-80 thermal direct mercury analysis. Hg showed the highest concentration in the liver (39.386 ± 26.05 mg kg⁻¹), followed by the kidney (4.170 ± 1.716 mg kg⁻¹), and muscle (2.986 ± 1.310 mg kg⁻¹). The kidney had the highest concentration of Cd (2.507 ± 0.829 mg kg⁻¹), followed by the liver (0.932 ± 0.153 mg kg⁻¹). Cd was not detected in muscle. Regarding As, it was present in a detectable amount in all matrices analyzed. The concentration in liver was 7.615 ± 3.400 mg kg⁻¹, 3.141 ± 1.535 mg kg⁻¹ in muscle, and 2.735 ± 1.265 mg kg⁻¹ in kidney. Fe was the most abundant trace element in all matrices, especially in the liver, with a concentration of 365.25 ± 9.415 mg kg⁻¹. These results could contribute to a better knowledge of *S. coeruleoalba* in the Sicily Channel.



Tuesday, April 5th / Central European Summer Time

027

Identification of anisakid nematodes isolated from cetaceans stranded along the coast of Sicily (south Mediterranean)

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The anisakid nematodes collected from 12 cetaceans (*T. truncatus*, *S. coeruleoalba*) stranded along the Sicilian coasts (South Mediterranean) were collected and analysed for genre and species determination. All the anisakid nematodes were found in the stomach of their hosts, showing a prevalence of infestation of 100%. The anisakid nematodes were morphologically identified as *Anisakis simplex* s.l.. A total of 30 anisakids (28 adults and 2 L3 larvae) were analysed for species identification by PCR-RFLP analysis and sequence analysis considering the entire ITS (ITS1, 5.8S rDNA gene and ITS2) and the mitochondrial DNA *cox2* region. The restrictions of the amplified ITS region with *HinfI* and *HhaI* verified a prevalence of *A. pegreffii* species. Only one sample showed *A. pegreffii*/*A. simplex* s.s. recombinant genotype. The ITS region sequence analysis not confirmed the presence of heterozygotes C/T at position 240 and 256 of the aligned sequence. The preliminary results on cetaceans stranded along the Sicilian coasts confirmed what was found in literature regarding the distribution of Anisakidae species in the Mediterranean Sea.



Wednesday, April 6th / Central European Summer Time

028

A potential inter-archipelago biological corridor for short-finned pilot whales in Macaronesia, using photo-identification and satellite-linked biologgers

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The analysis and description of space-use and movement patterns are important factors that contribute to the understanding of the ecology and conservation of cetacean populations. Previous photographic-identification studies have demonstrated that Macaronesian short-finned pilot whales (*Globicephala macrorhynchus*) are known to display inter-archipelago movements, however, no information is available on their fine-scale movements nor on the existence of preferred paths. To assess that and the potential existence of a biological corridor for pilot whales between archipelagos, we used photographic-identification and satellite-linked bilogger data. An unprecedented photographic-identification analysis identified a high percentage (20.86%) of matches from the catalogue of La Palma (Canary Islands, 2019-2021, n=302) when compared with the Madeira Island's catalogue (2003-2020, n=1222), in contrast with a relatively low percentage (5.63%) of matches between La Palma and other closer islands in the Canaries, suggesting the existence of a potential biological corridor between the western Canary Islands and Madeira. This finding is supported by satellite telemetry data obtained from three short-finned pilot whales tagged in Madeira (out of 12 animals) that moved to the Canaries and displayed a preference for the western islands (La Palma and El Hierro). Photographic-identification catalogues of other cetacean species and regions of the Canary Islands are being compared to obtain more robust results in order to inform conservation managers. Moreover, static and dynamic environmental variables will be linked with the obtained fine-scale location data to further infer on the drivers of these inter-archipelago movements.



Wednesday, April 6th / Central European Summer Time

029

Analysis of click trains detected from an AutoNaut USV PAM Fin system during a baseline survey on the continental shelf west of the UK

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Cetaceans were detected acoustically during an Innovate UK funded 'AutoNaut for Extreme Environments' (E-EE) long-duration baseline survey on the continental shelf west of the UK between August and November 2021 using the 5-m AutoNaut unmanned surface vessel (USV) Oban. The mission plan, which included ADCP, CTD and Wave sensors, was developed in partnership with the Scottish Association for Marine Science (SAMS) and other institutes. The AutoNaut is a zero-carbon, wave-propelled vessel and is operated remotely via a satellite link. Acoustic signals from a hydrophone mounted in a fin on the hull of Oban were recorded using a Seiche μ PAM unit. PAM operations focused on the Sea of the Hebrides and Stanton Banks sub-areas, west of Scotland from 4-18th Aug 21. Total survey effort in this area was 188 h, during which Oban covered 350 km. Acoustic data analysis had three phases: 1) offline processing of wave-format sound files using a click detector to identify click sounds; 2) classification of clicks by type (e.g., delphinid-type, porpoise-type); and 3) assignment of clusters of classified clicks to species encounters. There were 23 delphinid encounters, 21 harbour porpoise encounters and 1 candidate Kogia spp. event. Delphinid events tended to be longer in duration: there were 242 detection positive survey minutes (2.2% DPM) for delphinids, compared to 59 (0.5%) DPM for harbour porpoise and 7 (0.1%) DPM attributed to candidate Kogia spp. This study provides baseline information on the distribution of cetaceans during a long-duration, multi-disciplinary baseline study. The next stage of this project will be to compare AutoNaut PAM detections with data obtained from SAMS' long-term fixed seabed recorders.



Wednesday, April 6th / Central European Summer Time

030

Assessing habitat use and the effect of vessel density on the harbour porpoise (*Phocoena phocoena*) in the Rockabill to Dalkey Island SAC, Ireland

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The Rockabill to Dalkey Island Special Area of Conservation (SAC) is one of three designated sites in Ireland aimed to protect harbour porpoise. The aim of this research was to use historic data sets to investigate harbour porpoise habitat use and the effect of vessel densities on harbour porpoise presence within the SAC. Recent boat-based dedicated SAC monitoring surveys suggests harbour porpoise densities are declining in this marine protected area. An average density of 0.83 harbour porpoise per km² was estimated for the SAC in 2021 compared to 1.55 and 1.44 individuals per km² in 2016 and 2013 which represents a 44% decline. This trend was also reported from the other two harbour porpoise SACs in Ireland. What is driving these negative trends is not clear but changes in habitat use within these protected areas by harbour porpoise is very likely. Alternatively, it could represent a broader decline in species abundance. Since 2007, there have been five dedicated boat-based surveys of the Rockabill to Dalkey Island SAC. Four of these were NPWS (National Park and Wildlife Services) funded surveys and one was part of an environmental impact assessment, all carried out by the Irish Whale and Dolphin Group. This results in survey effort during six of the last 14 years and 29 days of data that can be used for this research. By modelling the data with static environmental variables, such as depth and seabed roughness, and temporal environmental variables, including sea temperature and hydrodynamic variables, we are aiming to improve both our fine and broad scale understanding of harbour porpoise distribution and use within this SAC. Additionally, the results of this research can inform future management plans, and hopefully contribute to elucidating what is driving the observed declines in densities in the Rockabill to Dalkey Island SAC.



Wednesday, April 6th / Central European Summer Time

031

Automatic detection of delphinid echolocation clicks based on audio source separation

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Passive acoustic monitoring has been increasingly used in the assessment of the cetacean distribution and habitat use. The interpretation of acoustic results depends on whether the applied signal processing techniques can effectively separate cetacean vocalizations and unwanted noise. Despite considerable research efforts, automatic detection and feature extraction of cetacean vocalizations in shallow-water coastal environments remain challenging due to the interference of various biotic and abiotic sounds. This study investigated the use of audio source separation in detecting delphinid echolocation clicks in an estuarine environment. On the basis of periodicity-coded non-negative matrix factorization, a machine learning algorithm for identifying independent sound sources according to their unique periodicity patterns, we developed a source separation model to decompose long-duration underwater recordings into echolocation clicks and other sound sources such as fish calls and shipping noise. The model can also distinguish echolocation clicks from the high-frequency sounds generated from echosounders, which are often difficult to remove by using high-frequency energy detectors. The separation significantly improved the measurement of spectral characteristics and inter-click intervals (ICIs), which are key to identifying the species and behavior of delphinids. By performing a clustering analysis on the ICIs, we further identified false alarms due to broadband pulses likely produced from snapping shrimps and the ambient environment. Based on a one-month underwater recording off western Taiwan, our results demonstrate that the application of audio source separation streamlines the automatic detection and feature extraction of cetacean vocalizations in noisy environments. The spectral and temporal characteristics of delphinid echolocation clicks can be preserved in detail, which opens new directions to acoustically investigate the species and behavioral diversity of cetaceans.



Wednesday, April 6th / Central European Summer Time

032

Avvistiamo: a new platform to monitor trends in coastal cetacean species along Sicily

Andrea Calascibetta, Lorenzo Gordigiani

Avvistiamo

Studying cetacean populations, especially in isolated areas, can be costly and logistically difficult. An important tool to study cetaceans is citizen science. “Avvistiamo” project aims to increase the knowledge on the distribution of cetaceans along the Sicilian coasts and the Tyrrhenian sub-basin, through the direct contribution of citizens, who are asked to fill in a detailed form on the project website. The database is built through the data collected from citizens, who followed a specific protocol for entering information: photo/video, sighting’s date and coordinates, species and group size. The investigated period goes from January 2020 to December 2021. The data were analyzed to understand the presence, relative abundance and distribution of cetaceans. 102 sightings were collected. *T. truncatus* (47), *S. coeruleoalba* (23) and *D. delphis* (10) account for the majority of sightings. *B. physalus* (8), *P. macrocephalus* (7), *G. griseus* (4), *G. melas* (1), *Z. cavirostris* (1) represent an important part of the sightings, although they are numerically lower than the three species mentioned above. For each species, mean group size was derived. Mean group size of *B. physalus* and *P. macrocephalus* is 1; mean group size of *D. delphis* and *G. melas* is 5, while for *G. griseus* is 6. Mean group size of *T. truncatus* is 4 and of *S. coeruleoalba* is 10. Mean group size of *Z. cavirostris* is 5. Therefore, sightings were divided by marine area of origin. The majority of notifications refer to the Sicilian coasts (74%), a good part to the central Tyrrhenian Sea (16%), and a small percentage refers to the western Mediterranean basin (4%) and to the Adriatic Sea (6%).



Wednesday, April 6th / Central European Summer Time

033

Blowing in the wind: testing a consumer drone for the collection of humpback whales' blows during the Arctic polar nights

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In recent years, Unmanned Aerial Systems (UAS), or drones, have revolutionized the field of marine mammal research. This includes their use for the collection of cetacean blow samples, that offers unique potential for non-invasive cetacean health. However, the high costs and expertise associated with purpose-built waterproof UASs, paired with the challenges of operating during difficult meteorological conditions, can be prohibitive for their standardized use worldwide. During November 2021, a pilot-study was conducted in a Northern Norwegian fjord, where humpback whales aggregated to feed on overwintering Norwegian spring-spawning herring. Our aim was to assess the feasibility of using a minimally modified and affordable consumer drone to collect blow samples from these individuals, even during the polar nights' challenging weather conditions. For each flight, petri dishes were attached to a DJI Mavic 2 Pro. The flights were conducted under temperatures ranging from -5 to -19 degrees Celsius, wind speeds ranging from 9 to 31 km/h and low light conditions (civil twilight) that lasted for 5 to 6 hours. During the 7 day-long boat survey, 16 blow samples were successfully collected from 11 distinct groups of humpback whales. The contributing factors that maximized the flight time and quick sampling success in such meteorological conditions were: having multiple spare charged batteries, kept warm at all times, and only changed in the moment of the flight; having a spotter assessing the whales' surfacing intervals and behaviour, to decide the best moment to launch; during the flight, positioning the drone laterally to the whale's blowhole, in the direction of the wind; the immediate recovery of the drone after successful collection, to avoid freezing of the sample. Thus, with this study, we further validate the use of a consumer drone as a practical, affordable and simplified tool for whale blow collection, functional even in harsh meteorological conditions.



Wednesday, April 6th / Central European Summer Time

034

Bottlenose dolphin occurrence near finfish aquaculture facilities in the Gulf of Corinth, Greece

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As finfish cage aquaculture expanded in the coastal waters of the Mediterranean Sea, several communities of common bottlenose dolphins *Tursiops truncatus* came into contact with this type of gear. Some animals or communities learned to take advantage of the new foraging opportunities provided by aquaculture facilities, where wild prey tends to be more concentrated and possibly easier to catch. While this opportunistic behaviour is relatively well known, little information exists about the frequency and timing of feeding forays around coastal fish farms (hereafter, “farms”), or the duration of such forays. As an attempt to bridge this gap, between September and November 2021 we sampled dolphin presence/absence from two land-based vantage points situated above three seabass and seabream farms in the Gulf of Corinth, Greece. Out of 37 days (157h) of survey effort, dolphins were observed in 16 days (43.2%), with up to 3 sightings per day. We recorded a total of 229 standardised dolphin observation samples (SDOS) of 5 min (total 19h 5min), between 9:00 AM and 6:30 PM. If dolphins were spotted, observation sessions continued until the animals moved away from the farm area and out of sight. Bottlenose dolphins occurred within 50, 200 and 500 m of a farm’s perimeter in 42.7%, 66.8%, and 97.8% of SDOS, respectively. In 17 “complete” sightings (i.e. when dolphins were observed both approaching a farm and leaving it), permanence within 50 m of a farm lasted between 10 and 92 min (mean 37.6, SD=22.62). Dolphin groups averaged 3.8 individuals (SD=1.07, range 1-5), based on 226 SDOS. This preliminary study highlights the potential of an inexpensive and non-invasive land-based research approach, which could be easily replicated across coastal areas and aquaculture facilities (possibly in conjunction with other approaches and taking advantage of e.g. digital photography, unoccupied aerial vehicles and underwater acoustic recordings).



Wednesday, April 6th / Central European Summer Time

035

Cetacean strandings on the Southwest coast of mainland Portugal (Alentejo) between 2010 and 2021

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Cetacean stranding data can provide valuable information on species occurrence, population dynamics, distribution and threats they face. Through the years, stranding data has been collected along the coast of mainland Portugal. Regardless, in the Alentejo coastal region, Southwest mainland Portugal, information on cetaceans' occurrence is scarce with few studies targeting these mammals specifically. The present study aims to analyse 215 cetacean strandings reported over a 12-year period (2010-2021) in this region. The Alentejo coastline is approximately 130 km long, ranging from Troia (38°29'26" N, 8°54'42" W) to Odeceixe (37°26'39" N, 8°48'0" W). The stranding data were collected by maritime authorities and the Portuguese Institute for Nature Conservation and Forests, from January 2010 to April 2021, and by a local stranding network, from May 2021 to December 2021. The coastline was divided into small sectors and a density analysis was performed using QGIS software. Spatial and temporal analyses were conducted including all species. Out of the 215 stranded individuals, nine cetacean species were identified (7 Odontoceti; 2 Mysticeti). Data were compared with those obtained in other regions. The identification of areas and periods with a higher occurrence of strandings can contribute to the development of future cetacean conservation efforts in this specific region. This study demonstrates the usefulness of stranding data for monitoring cetacean populations.



Wednesday, April 6th / Central European Summer Time

036

Cetaceans' occurrence off the Southern Portuguese coast

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Cetaceans are present in the adjacent waters of Portugal mainland, however most of the data available from these species, is a result from stranding's and their respective necropsies, or from very limited research: dedicated surveys and opportunistic data collection. Live sightings allow observers to log information regarding the animal's behaviour, boat reaction, population dynamics and other valuable data, therefore impossible or hard to obtain through strandings. From 2020 to 2021 a whale watching vessel was used as an opportunity platform, to gather data regarding cetacean sightings in Faro (Algarve, Portugal). A total of 10 species of cetaceans were recorded from 4 different families: 4 belonging to the Delphinidae family, 4 species of Balaenoptera, 1 species of Phocoenidae, and 1 Ziphiidae species. The most abundant species of Delphinidae in this study was the common dolphin whilst the most seen baleen whale was the fin whale. Feeding and travelling are the most frequently observed behaviours for most of the species logged. The study area - Faro, Cape Santa Maria - is a potential hotspot for cetaceans as it has the shortest distance from shore to the continental slope in Portugal mainland, within just 6nm.



Wednesday, April 6th / Central European Summer Time

037

Community Science (Program): A door to Cetacean Research and Community Engagement

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On the pacific coast of Colombia, there are at least 23 cetaceans that are known to occur. The Gulf of Tribugá (GT) located in the Colombian pacific, holds a high diversity of marine species and is an important reproductive area for humpback whales' stock G (*Megaptera novaeangliae*). Even though there are numerous studies on humpback whales, there is still a vast gap on other marine mammals in the area. COVID-19 impacted cetacean research as well as the local community in 2020 due to the absence of scientists and lack of tourism. This study was an opportunity for both scientists, and local fishermen, to come together and monitor cetacean occurrence, frequencies, and distribution through education and participation. Local fishermen were trained on monitoring, data collection and species identification. A transect line was designed to cover the study area (GT) and was distributed in three consecutive days. The community science team carried out two monitoring surveys during the months of August and December. From 24 observations recorded, four species of cetaceans were sighted, and three species identified as humpback whale, pantropical spotted dolphin (*Stenella attenuata*) and common bottlenose dolphin (*Tursiops truncatus*). Even though this study is in its early stages, the opportunity for cetacean research and community engagement is of great value. The GT might also be as important an area for small cetaceans as it is for humpback whales, and thus the continuation of this program could provide more information, on their distribution, habitat use, potential threats, and conservation.



Wednesday, April 6th / Central European Summer Time

038

Drone estimates of sperm whale body mass

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Body mass is a fundamental component of animal physiology. Although the sperm whale (*Physeter macrocephalus*) is the largest toothed predator on earth, body mass is rarely incorporated as a variable in studies of ecophysiology and bioenergetics due to the inherent difficulties of obtaining direct measurements from live animals. We used unmanned aerial vehicle (UAV) photogrammetry to estimate the weight of free-ranging sperm whales. Aerial photographs of sperm whales (23 calves, 11 juveniles, 55 adults and 13 mothers) were collected in the Eastern Caribbean and Mediterranean Sea between 2017 and 2020. From dorsal and lateral photographs, the body length, widths (at 5% increments) and heights (dorso-ventral distance; at 5% increments) of the whales were measured. An elliptical body shape model was then used to calculate their body volume, thus capturing the true body shape of the whales. Body volume varied noticeably ($12.01 \pm 4.79 \text{ m}^3$) in larger animals ($> 8 \text{ m}$), indicating fluctuations in the body condition of adults and mothers. Volume was converted to mass using estimates of tissue-density derived from different published sources, including catch data, animal-borne tags and body tissue composition. The resulting weight predictions matched with existing mass measurements and weight-length relationships. Average tissue density ranged from 853 to $1,030 \text{ kg}\cdot\text{m}^{-3}$, depending on the approach used, and needs to be validated with methods combining UAV photogrammetry and tag-derived tissue-density estimates. The body mass model presented can be used to study sperm whale bioenergetics, including inter- and intra-seasonal variations in body condition, somatic growth, metabolic rates, and cost of reproduction.



Wednesday, April 6th / Central European Summer Time

039

Enhancing place-based conservation efforts for fin whales in the North-Western Mediterranean Sea using satellite transmitters to assess habitat use and movements

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Every spring, high numbers of fin whales visit the Balearic Sea, spending up to three months in the Catalan coastal waters. Fin whales in the Mediterranean Sea constitute a genetically isolated sub-population, whose IUCN conservation status was recently uplisted from Vulnerable to Endangered, following on an inferred trend of decline. Satellite telemetry data can support the assessment of habitat use and migration routes, and consequently inform conservation measures. In May 2021, three fin whales were equipped with Argos satellite transmitters off Villanova i la Geltrü, Catalunya, within the Edmaktub's Fin Whale Project, and each whale was also biopsied to allow sex determination and perform stable isotope and genetic analyses. A preliminary Bayesian hierarchical switching state-space model (hSSSM) was used to identify transit and area-restricted search (ARS) behaviours, which can be indicative of foraging activity. The three whales were tracked for multiple weeks ($n = 32, 25, 15$ days) and mostly engaged in ARS, as also witnessed by visual observations. No long-distance migrations were undertaken, as the three fin whales moved between the coasts of Garraf and the recently declared Specially Protected Area of Mediterranean Importance (SPAMI) 'Cetacean Migration Corridor' and adjacent waters. These preliminary results, together with existing long-term survey data, support the role of this area as a core feeding habitat for fin whales and urge the need to expand monitoring efforts and to deploy additional satellite transmitters. The designation of a Particularly Sensitive Sea Area under the framework of the International Maritime Organization - covering a wider area encompassing the Pelagos Sanctuary - would contribute to reduce ship strikes and traffic disturbance. Also, the declaration of an Important Marine Mammal Area by the IUCN Marine Mammal Protected Areas Task Force would provide the ideal framework for targeted management and conservation actions.



Wednesday, April 6th / Central European Summer Time

040

Estimation of the ringed seals abundance on the fast ice southeastern area of the Laptev Sea (Russia) based on the aerial surveys results in May-June 2021

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The extensive southeastern area of the Laptev Sea between the mainland and the Novosibirsk Islands archipelago is covered with fast ice. Studies of the marine mammals abundance and distribution in this area have not been conducted since the 80s of the last century. We conducted an aerial survey from May 21 to June 08, 2021. In total, 8 flight routes were completed over 8 flight days with a total length of more than 11,000 km. All routes took place over the area covered by fast ice or along the edge of polynya. During all aerial surveys carried out, the areas of fast ice over which flights were mainly carried out, were stable. Sightings of seals were recorded on the basis of photographs and infrared shooting. In total, 1141 ringed seals were recorded: the vast majority of single individuals, 127 encounters were 2 individuals each. It may indicate the mating period in seals. Most of the seals were recorded near the hole, a small part lay on the edge of cracks. 538 holes were found separately (without seals). Design-based abundance estimates were obtained with a Distance Sampling approach. In total, 6 accounting districts were allocated for which extrapolation was performed. The extrapolation results amounted to 27,972 individuals (95% confidence interval from 23,675 to 32,820 individuals) for a total area of 190,033 sq.km. We were unable to assess the ringed seals reaction to the plane. It is necessary to investigate this issue specifically. Other species were also recorded on the routes: polar bears, walruses, wild reindeers, musk oxen.



Wednesday, April 6th / Central European Summer Time

041

Fatty acid profiles of two populations of short-finned pilot whales in Macaronesia (NE Atlantic): implications for diet

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Five short-finned pilot whales' resident populations are described worldwide. Two of them are in the Macaronesia biogeographic region, i.e., in Madeira and in the Canary Islands. To date, little is known about the differences and connectivity between these two populations and what is the ecological role of these top-predators in the ecosystem. Fatty acids (FAs) are useful biochemical tracers for the study of trophic ecology of marine mammals, as the FAs composition of the blubber tissue is influenced by the diet. Sixteen FAs were used to examine the relative similarities among FAs profiles of 61 short-finned pilot whales' subcutaneous blubber samples collected by remote biopsies in the Madeira (n=30) and Canary Islands (n=31). The influence of factors as sex or sampling date were also checked. Non-parametric multidimensional scaling (nMDS) ordination, followed by analysis of similarity (ANOSIM; Euclidean distances calculated) were applied to detect similarities between groups. When a significant difference was detected, the contributions of individual FAs to dissimilarities between groups were assessed using similarity percentages analysis (SIMPER). Statistical analysis showed significant differences with partial overlap in FAs profiles between both archipelagos (ANOSIM, $R=0.58$, $p<0.005$). By contrast, no significant differences relative to sex (ANOSIM, $R=0.002$, $p>0.05$) or year of sampling (ANOSIM, $R=0.018$, $p>0.05$) were observed. SIMPER analysis showed that four FAs; C18:1n-9, C22:6n-3 (more abundant in Madeira samples) and C16:0, C16:1n-7 (more abundant in Canary samples) explained 92% of the dissimilarities between short-finned pilot whales from the two Islands. These differences could indicate that the two populations have different foraging preferences or they feed in different habitats. To demonstrate possible qualitative dietary differences, the FAs profiles of pilot whales and their potential preys collected in both Islands will be compared. Quantitative dietary analyses (QFASA) will be applied in the future when the prey libraries are completed.



Wednesday, April 6th / Central European Summer Time

042

Features of the occurrence of ambergris in sperm whales

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The frequency of occurrence of ambergris (*Ambra ambrosiaca grisea* L.) in sperm whales caught by the Odessa's whaling fleets "Slava" and "Soviet Ukraine" (1961-1979) was analyzed. When cutting the sperm whales (43,211 whales, of which 25893 males and 17318 females), ambergris was found 150 times, which is 0.35% of cases. In males, the occurrence of ambergris was 0.42%, in females it was almost twice as low - 0.24%. However, this fact disproves the claim that ambergris is found only in males! In both males and females, black ambergris was more often, less often gray. 3 cases of ambergris were recorded, covered on top with large transparent crystals of ammonium magnesium phosphate ($\text{NH}_4\text{MgPO}_4 \cdot 6\text{H}_2\text{O}$). Ambergris was more often represented as separate rounded pieces (nodules), weighing from several grams to more than 100 kilograms. The average weight of the discovered ambergris was 16.8 kg: in males it was 13.0 kg, in females - 17.4 kg. Perhaps due to the fact that the average age of the females caught was higher than that of the males, and, therefore, the formation (growth) time of ambergris was longer in them. Soft black ambergris due to its plasticity, in the process of excrement of sperm whales, can be freely evacuated from the intestines along with the rest of the fecal masses. Individuals with especially large nodules of solid ambergris are likely to die. The occurrence of sperm whales with the largest ambergris is strictly localized, so it possible to distinguish two populations of sperm whales in the Antarctic zone of the Indian Ocean - Madagascar and Australo-Tasmanian. The zone of the most frequent occurrence of ambergris was practically limited to the Indian Ocean, and, oddly enough, coincided with the range of the pygmy blue whale. It is not yet clear what environmental reasons are behind this coincidence.



Wednesday, April 6th / Central European Summer Time

043

Fin whale presence in the Adriatic Sea from acoustic recordings

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Fin whales (*Balaenoptera physalus*) are a common cetacean species in the Mediterranean. Two distinct populations use the Mediterranean region; “resident” Mediterranean fin whales are present year-round and eastern north Atlantic fin whales enter seasonally. Fin whales are predominantly observed in the western Mediterranean, but while their occurrence in the eastern Mediterranean is low in numbers, they are considered to be regular visitors in those regions. Historic records and recent research indicate that a small number of fin whales use the Adriatic Sea during spring and summer. We employed passive acoustic recorders throughout the Adriatic Sea to investigate the occurrence of fin whales in this area. In the southern Adriatic Sea, a recorder was deployed at 1,000 m depth between October 2018 and December 2020. Additional recorders were deployed more coastally in shallow waters of central and northern Adriatic during 2020 and 2021. Fin whale song was detected in the southern Adriatic in the fall (November) and at one location in the central Adriatic in the late summer of 2020 and again in the spring of 2021. In addition, fin whale 40 Hz calls were recorded during the summer at multiple locations in central Adriatic. Fin whale songs may be population-specific and the song type recorded in the Adriatic was not similar to fin whale songs recorded in the western Mediterranean or the Atlantic Ocean in the past. Consistent seasonal pattern in song occurrence in the Adriatic together with recent observation of individuals feeding in the central Adriatic may indicate that this area is more than an occasional destination for solitary animals. More recent recordings from the western Mediterranean, as well as passive acoustic recording effort in the eastern Mediterranean is needed to help us understand movement patterns and possible population structure for this endangered species across the Mediterranean basin.



Wednesday, April 6th / Central European Summer Time

044

Formic acid effect on stable carbon and nitrogen isotope ratios in sperm whale dentine

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Odontocete teeth can be used to investigate life-span changes in stable isotope values and thus provide an insight into migration and diet. Etching sperm whale teeth half-sections with formic acid is a standard technique to enhance surface relief of growth layers and facilitate age determination. Furthermore, it facilitates the identification and sampling of specific growth layer groups for stable isotope analysis (SIA). However, the non-etched half-section of the tooth is normally used in SIA to avoid potentially biased results caused by the etching process, although no research has been done to prove if formic acid treatment actually alters dentine stable isotope ratios. In the present study, stable carbon and nitrogen isotope ratios of selected growth layers were determined by mass spectrometry (Thermo Finnigan Flash 1112) and compared between etched and non-etched half-sections of 30 sperm whale teeth. A statistically significant difference was found in both $\delta^{13}\text{C}$ ($Z = -3.644$, $p < 0.001$) and $\delta^{15}\text{N}$ ($t = -3.959$, $df = 29$, $p < 0.001$) values, with $\delta^{13}\text{C}$ values on average 0.165 ‰ higher (SD = 0.194) and $\delta^{15}\text{N}$ values on average 0.206 ‰ higher (SD = 0.285) in samples from etched half-sections. Due to relatively consistent differences between etched and non-etched samples, we suggest applying such correction factors for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values and using the etched half-section for SIA of sperm whale dentine to improve growth layer group visibility and, therefore, to reduce sampling error. However, each study should develop a correction factor of its own due to potential differences that may have arisen during the etching process.



Wednesday, April 6th / Central European Summer Time

045

Habitat preference of common minke whale (*Balaenoptera acutorostrata*) in Skjálfandi Bay, Iceland

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Anthropogenic activity has contributed to increased extinction rates, creating a need to monitor and conserve vulnerable species. Understanding the distribution and habitat preference of threatened species can identify crucial habitats, for which protection can improve the population size numbers. Here, we investigate the habitat preference of the common minke whale, a rapidly declining yet understudied cetacean species. We analysed minke whale sightings over time and in relation to environmental factors (depth, sea surface temperature, sediment, chlorophyll), based on long-term monitoring data from Skjálfandi Bay in the northeast of Iceland. We found minke whales have a preference for water depth between 9-70m, and water temperature of either colder than 6°C or warmer than 9°C. Shallow depth was a strong predictor of minke whale presence, which matched sandeel distribution. Sandeels require shallow depths for spawning and overwinter burrowing, and the match between minke whale depth presence and sandeel habitat is in good agreement with sandeels being an important minke whale food source. Although the relationship between minke whale presence and sea surface temperature is weak, it also matched sandeel distribution. We also detected a decline in minke whale population size over the study period (2009-2018). The population decline observed here is consistent with the population trend estimated for the Icelandic population. We suggest that the habitat preferences identified here should be considered for conservation recommendations and minimising disturbance in the identified, crucial feeding areas.



Wednesday, April 6th / Central European Summer Time

046

In vitro digestion experiments in Odontocetes

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In vitro digestion experiments are utilized to understand the digestion process of consumed food items. Results can be applied to stomach content analyses to determine accurate food composition and biomass intake. This approach is typical for cryptic species, like most odontocetes. Due to missing data on the composition of gastric fluids previous in vitro digestion experiments were based on the stomach morphology and physiology of pinnipeds. However, the odontocete and pinniped stomachs show major differences. Odontocete stomachs have four compartments, like most cetartiodactyla species, while pinnipeds, like most mammalian carnivores, have only one stomach compartment. These morphological differences lead to different digestion processes concerning the composition of gastric fluids and motility. We adapted in vitro digestion experiments to the morphology and physiology of the first stomach compartment of an odontocete by changing the pH value from 2 to 4 (equivalent to hippotamidae, the sister taxon of cetaceans) and simulating motoric movement using a power stirrer. The force of the power stirrer (2N) was similar to the stomach muscle contraction force in pigs (1.14 N), being the only available literature value of the cetartiodactyla clade. We in vitro digested three common prey species of porpoises (whiting, black goby, sprat). Our results show, that digestion function and rates differ greatly between the digested fish species and therefore contrast previously published results of pinniped in vitro digestion showing a similar digestion function and rate in all considered fish species. The digestion rate was found to be much shorter in our adapted in vitro digestion experiments showing the high impact of motoric digestion on the digestion rate in odontocetes. We argue therefore that current approaches to estimate biomass consumption in odontocetes have to be adapted based on appropriate in vitro digestion experiments using a simulation of motoric digestion.



Wednesday, April 6th / Central European Summer Time

047

Indian Ocean humpback dolphins (*Sousa plumbea*) in the Bazaruto Archipelago, Mozambique population abundance and ecology. A preliminary assessment

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The Indian Ocean humpback dolphin (*Sousa plumbea*) was listed as “Endangered” by the International Union for the Conservation of Nature in 2015/2016 as well as put onto the Red List of Mammals of South Africa (IUCN; Plön et al., 2016). *Sousa plumbea* are an elusive species that occupy the coastal waters of the western Indian Ocean. This coastal distribution makes them vulnerable to recreational and commercial disturbances. Conservation of the species is hampered by the limited information on its population abundance and ecology. The Bazaruto Archipelago is a Mozambican protected National Marine Reserve that falls within this species’ habitat range. The last published marine mammal distribution survey of the Bazaruto Archipelago’s waters was in 1997. Here we present the first records of our four field seasons (2018-2021) of collected photos of humpback dolphins in the Bazaruto Archipelago by the University of Haifa’s IMMRAC - Israel Marine Mammal Research & Assistance Center research team. Over these field seasons a total of 62 days was spent in the field and over 800 photos were taken of humpback dolphins. Using photo identification methods, approximately 25 individuals have been identified, 10 with very distinct dorsal fins. One animal, a female, seen initially in 2019 was potentially re-sighted in 2021. This project provides a preliminary picture of a unique and under-documented region and species. It sets a baseline for future studies in this area, so as to gain insight into the ecology of the *S. plumbea* population around this archipelago. By expanding on this catalog, the population, habitat range, social patterns, and behavioral ecology can be established and studied. Marine mammal stocks with small population sizes are especially vulnerable. Further knowledge of this species is critical to its conservation.



Wednesday, April 6th / Central European Summer Time

048

Insight into the social organisation of striped dolphins in a semi-enclosed Mediterranean embayment

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Group membership is an important attribute of animal societies. Here, we investigated the social organisation of striped dolphin *Stenella coeruleoalba* through a relatively novel method based on time and space criteria associated with geo-referenced identification photographs. Instead of adopting traditional group definitions, we considered individuals associated if photographed within a specific time-space window (10 min and 1000 m of one another). Such approach, not relying on a definition of “group”, can be valuable under field situations where defining or delimiting a group might be challenging, as happens with striped dolphins—gregarious animals that tend to occur in relatively large groups of ever-changing sizes, dispersed over wide areas in offshore waters. We applied our time-space method to an isolated population in the Gulf of Corinth, Greece, based on 7 years (2011–2017) of intensive survey effort. Photo-identification was performed on 189 days, totaling 72606 digital photos of single dorsal fins taken across 2492 km (414h 27min) of dolphin tracking. We considered only high-quality photos of well-marked individuals and restricted our analyses to a subset of 179 adults encountered in 5 or more years. The mean half-weighted association index was 0.03 (SD=0.01). Permutation tests indicated the occurrence of non-random associations, preferred associations (observed SD=0.076, random SD=0.070, $p < 0.001$), and avoided-associations (proportion of non-zero association indices in real data 0.202, in random data 0.222, $p < 0.001$). Hierarchical cluster analysis indicated a division into 8 clusters composed of 4–45 individuals (CCC 0.81; modularity 0.48). The Gulf’s single Risso’s dolphin, *Grampus griseus*, that is known to occur exclusively in multi-species groups, was associated with the most numerous striped dolphin cluster. This study, facilitated by the long-term occurrence of roughly 1300 individuals within a semi-enclosed Mediterranean embayment of 2400 km², provides one of the first insights into the poorly-known social organisation of striped dolphins.



Wednesday, April 6th / Central European Summer Time

049

Long-term passive acoustic monitoring of coastal dolphins inhabiting the Israeli Mediterranean coast and the impact of marine fish far on their habitat utilization

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The easternmost Mediterranean is an ultra-oligotrophic sea with an ecosystem subjected to a host of environmental and anthropogenic stressors. Marine fish-far, being wild fish attractors, are recognized hotspots for top predators in such low productive regions. This study aimed to verify this trend for year-round resident coastal dolphins of the Israeli Mediterranean coast: common bottlenose dolphin (*Tursiops truncatus*; inhabiting the entire coastline) and common dolphin (*Delphinus delphis*; sighted only in its southern portion) – through year-long passive acoustic monitoring, using C-POD and F-POD recorders (<https://www.chelonia.co.uk>). Different sampling points were selected along the coastline, two of them near fish-far off the northern and the southern portions of the coast. Data were collected from December 2018 until October 2021, resulting in a cumulative monitoring time of 98,799h. Dolphins' presence (as expressed by the proportion of 'Dolphin Positive Minutes' out of the total recording time in minutes) in the vicinity of both fish-far was significantly higher ($p > 0.000001$) than at open water sites in the respective portions of the coast. This was particularly evident in the south, where presence near the fish-farm was 2 orders of magnitude higher. Open water sites in the south also demonstrated higher presence than in the north, partly reflecting the fact that two species occupy that region. For the first time, this research sheds light on the habitat use of resident coastal dolphins along the Israeli coast, stressing their reliance on and exploitation of marine fish far and the major influence they have on their distribution.



Wednesday, April 6th / Central European Summer Time

050

Marine megafauna feeding aggregations within productive oceanographical conditions off southwestern Ireland

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Irish inshore waters act as important foraging grounds for a suite of marine megafauna during summer months when primary production reaches its peak supporting nutritionally rich pelagic fish populations. High numbers of marine predators utilise this annual resource however the predator-prey relationships are poorly understood. Preliminary observations suggested the 100 m contour and Irish coastal current which overlaps with this bathymetric feature may act as an important feature in the distribution of large baleen whales and to explore this potential relationship we carried out, a multidisciplinary survey over the 100 m bathymetric contour line along the southern and western coasts of Ireland in August 2019, aboard R.V. Celtic Voyager. A total of 24 marine top predators were identified to species level included cetaceans (fin whales, minke whales, common dolphins and bottlenose dolphins) pinnipeds, seabirds, bluefin tuna, blue sharks and ocean sunfish in concentrated clusters. Two fishing tows took place in the presence of surface feeding fin whales and common dolphins which comprised of 12 fish and cephalopod species. Fish shoal density and their position in the water column was determined using the vessels EA400 echosounder. Active surface feeding was observed when fish were within 23 m of the surface. Six overnight conductivity, temperature and depth (CTD) transects took place across the 100 m contour line to examine this hydrologically and biologically dynamic region along the shelf. Strong frontal structures (up to 30 cm/s) were identified along the south coast with relatively stronger coastal jets where marine predator activity was highest. Weaker frontal systems were identified off the southwest and western coasts where marine predator presence was at its lowest. This study provides insights into the biological and oceanographical drivers of the presence of coastal marine predators off Ireland and in their complex prey and habitat relationships.



Wednesday, April 6th / Central European Summer Time

051

Mark-recapture abundance estimates of humpback whale (*Megaptera novaeangliae*) in Irish waters based on photo-ID data sourced by citizen science

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Through a long-term citizen science, the IWDG have built an extensive humpback whale photo-identification catalogue since 1999, confirming the identification of 116 individual humpback whales to date. This unique catalogue in Ireland provides the chance to derive the first robust abundance estimates for humpback whales in Irish waters using mark-recapture techniques. We created a series of sighting histories to estimate abundance through a number of mark-recapture approaches. Approach 1) used annual capture data to run open population models using the POPAN formulation, 2) created within-year sighting histories to derive closed-population estimates and 3) applied the robust design to estimate humpback whale abundance between 2015 and 2020 seasons, during which a large increase in the number of whales were identified. The best fitted open population model estimated a superpopulation size of 145 whales present in the study area between 1999 and 2020 (95% CI: 131-159). Closed population model outputs ranged from 12 in 2012 (95% CI: 11-18) to 54 in 2019 (95% CI: 43-87), whereas the robust design best fitted model yielded estimates ranging from 50 in 2018 (95% CI: 41-69) to 62 in 2017 (95% CI: 46-94). Minimum abundance ranged between 1 in 2010 to 46 in 2015. All the estimates derived from several mark-recapture approaches, while slightly different, tended to track the observed minimum annual abundance values in coastal waters. These estimates corresponded with a discovery curve, which has yet to reach a clear plateau. These results add value to the work that the IWDG have been carrying out for more than two decades in Ireland and demonstrate the important role that citizen science plays to inform the conservation of large cetaceans. They also highlight the increasing presence of humpback whales in the inshore waters of Ireland and the implications this may have in the future.



Wednesday, April 6th / Central European Summer Time

052

Perfect timing: Understanding Chlorophyll influence on fin whale occurrence in the Azores using a CCF

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The variations in habitat use of baleen whales in the Azores are thought to be closely related to oceanographic variables and their effects on prey density and distribution. Previous studies assessed the relation between variations of chlorophyll-a concentration (Chl-a) (primary production proxy) and baleen whale occurrences, acknowledging a time-lapse between the two events. However, these investigations weren't specific to fin whales (*Balaenoptera physalus*) and were mainly focused on their migratory season. Therefore, this study explored the relation between Chl-a and fin whale occurrences using 11 years of opportunistic whale-watching data (945 fin whale sightings). Seasonal and inter-annual differences in chlorophyll patterns were analyzed based on monthly Chl-a means between 2009 and 2020. A positive correlation between Chl-a values and the encounter rate (ER) was identified (Spearman correlation test; p -value= 0.00075). However, fin whales feed mostly on secondary production (krill), therefore it is necessary to consider the possible lag between the bloom and krill maturation time until it reaches the adequate size to be foraged by whales. Using a cross-correlation function (CCF) we compared the complete time-series of Chl-a concentration and the whales' ER indicating a 1 to 2 months lag between both series. The results also point to the increase in fin whale ER, after punctual enhancement of Chl-a concentration even outside of their known migratory season. In conclusion, oceanographic features and events (e.g., phytoplankton bloom) have a large influence on the timing of fin whale migration and occurrence in São Miguel. Therefore, understanding how shifts in bloom location and intensity might influence whales' occurrence can be used to successfully implement conservation measures, especially in the face of climate change. Nevertheless, further analyses considering long-term research of cetacean occurrence and monitorization of phytoplankton/zooplankton communities are still necessary to assess their relationship and possibly obtain predictions of whale presence.



Wednesday, April 6th / Central European Summer Time

053

Photo-identification of Danish harbour porpoises

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Following individual harbour porpoises over time is notoriously difficult due to limitations in available monitoring methods. With little knowledge about the behaviour of individual animals, we lack information about e.g., the residency of porpoises, their social and reproductive behaviour, as well as their population structure, all of which is important for conservation efforts. We advanced state-of-the-art monitoring by developing methods to identify single individuals in photographs through unique features from the body that we can recognize over time (such as pigmentation patterns, scars or dorsal fin shape). Through long-term field work around North-eastern Funen with high-resolution photographs taken from land and boat as well as from a one, we successfully followed several individual porpoises over several years. We were able to provide the first direct estimates on local numbers and level of site fidelity of Danish porpoises and to obtain detailed insights into the animals' foraging, social and reproductive behaviour, as well as their general whereabouts. We also detected injuries and other signs of sickness through photographs and one close-ups. This method allows for studying long-term trends in spatial occurrence of harbour porpoises and their movements throughout the year, and furthermore locating important habitats for porpoises (e.g. foraging and breeding grounds) that need special protection.



Wednesday, April 6th / Central European Summer Time

054

Photo-identification of resident Shannon Estuary bottlenose dolphins outside their known range

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The Shannon dolphins are Ireland's only resident population of Bottlenose Dolphins. They have been monitored using photo-identification since 1993, where ~ 145 animals were recorded to be present in 2012. The range of this genetically discrete population was believed to be limited to within the Shannon Estuary SAC. However, in recent years their regular presence was confirmed in the adjacent Tralee and Brandon Bays. These resident dolphins have since been recorded outside of their extended range. Several boat-based surveys and land watches have confirmed they are also regularly present northwest of the estuary. Through matches using images from the public, we have now confirmed several sightings of individuals in the population much further outside of their known range. Matches from 2016 onwards have confirmed Shannon dolphins ~ 50 km north and ~ 125 km south of the estuary, these animals have since been sighted back within it. In April 2021 an individual dolphin from this population was sighted in the river Boyne on the east coast. It was subsequently sighted in the Merseyside and the River Eden in England. This is the first confirmed match of a Shannon Dolphin outside of Irish waters. This adult male animal (008) was one of the first animals added to the photo-identification catalogue in 1993. Sightings of this individual have been mainly limited to the inner Shannon Estuary, with rare sightings in the outer estuary. It was never seen in either Tralee or Brandon Bays before appearing in the Irish sea, ~ 600 km from the estuary. These sightings reflect on the movements of other resident bottlenose dolphins outside of their normal ranges into other European countries in recent years and confirm this population is not fully limited to the Shannon Estuary, Brandon, and Tralee Bay.



Thursday, April 7th / Central European Summer Time

055

Preliminary results from vessel-based and aerial surveys on cetaceans for the establishment of a long-term monitoring strategy in Malta

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A study on marine mammals and reptiles in Maltese waters was commissioned by Malta's Environment and Resources Authority as part of EU funded project EMFF 8.3.1. The study was aimed at establishing a long-term monitoring strategy for marine mammals and reptiles in Maltese waters, satisfying the requirements of the EU Marine Strategy Framework Directive, the EU Habitats Directive, and the Barcelona Convention, to develop long-term processes enabling the continuous assessment for the determination of the conservation status of the species. Presence, distribution, and abundance were investigated on three target species. Data on common bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*) and striped dolphin (*Stenella coeruleoalba*) were systematically collected in two Natura 2000 sites (MPAs) within the Maltese Fisheries Management Zone (FMZ). The surveys were conducted by EcoMarine Malta on behalf of the Environment and Resources Authority between June and August 2021. Line-transect surveys were performed for 730 km in 14 days from a 45 feet sailing vessel, while 707 km were flown in 5 hours and 54 minutes during a line-transect aerial survey. In addition, further methodologies were used, including acoustic, photo-identification, behavioural observations, environmental DNA (eDNA), and one filming. All the target species were encountered during the study. Striped dolphins were the most common and abundant species encountered in both Natura 2000 sites. Bottlenose dolphins were sighted only in one site, with preliminary results from photo-identification suggesting the presence of an offshore population. Common dolphins showed a relatively high average group size, compared to the results of previous studies in the Mediterranean Sea. This pilot survey provides the first estimate of density and relative abundance for dolphins for the Maltese FMZ. The resultant estimates represent important baseline data for future assessments of trends and to inform policymakers and stakeholders on how to implement conservation actions and to evaluate the effects of management.



Thursday, April 7th / Central European Summer Time

056

Seeing the Science: Art and science languages connect to open access, enhance meaning and broaden communication

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How societies perceive and absorb topics related to the environment influences the efforts invested in nature conservation. It is crucial to communicate scientific data and make it accessible outside technicians' terminology. Expressing accurate scientific data through art might provide a clearer, more accessible message through which to comprehend the state of the environment. The process should be free of a partisan judgmental evaluation; allowing the audience to gain awareness of the issue detected by the data analysis. Overlapping long-term experiences using quilt and woodcuts addressing environmental themes was attempted by one of the authors (B.P.) of the present contribution to connect art expressions with science. As a step forward in this direction accurate scientific data was incorporated into the creative process. The Mediterranean monk seal's habitat was chosen as the primary source of data to be codified into artistic expression. The data utilized were retrieved from peer-review publications, focusing on the five main microplastic pollutants present on the surface of the Mediterranean Sea, and portrayed in a hand-dyed and quilted textile piece called "Presence". We hypothesize that layering the two disciplines, encouraging a more interdisciplinary form of research and expression, can broaden the means by which data is presented to the audience (general public, stakeholders, museum curators, decision-makers, and funders), providing a first perceptive access point through an experience with a work of art. Moving forward, a second collaborative piece is under development, using directly collected Mediterranean monk seal photo-identification studies as a primary data source. The creation of such a common language between the two fields, even in a nascent stage, already shows reciprocal advantages that can be used by both the artist and the scientist to great advantage in all phases of research and communication.



Thursday, April 7th / Central European Summer Time

057

Sightings of the Arnoux's beaked whales (*Berardius arnouxii*) in the Penola and Gerlache Straits, West Antarctic Peninsula

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Arnoux's beaked whales (ABWs; *Berardius arnouxii* Duvernoy, 1851) are found in the cold waters of the southern hemisphere (south of 34°S), including the Antarctic. The purpose of the present study was to reveal the presence of the ABWs in the waters of the West Antarctic Peninsula in different seasons. Shore-based and vessel surveys were conducted in 2019 - 2020 in waters of West Antarctic Peninsula, in frames of the 24th Ukrainian Antarctic Expedition, based at Akademik Vernadsky station (65°15 'S, 64°16 'W). Three sightings of ABWs occurred during our studies. On 5 November 2019, a group of 7 ABWs was sighted in the Penola Strait near Galindez Island. The whales appeared to be foraging, synchronous dive durations were up to 24 min and the whales remained active at the surface for up to 6 min between dives. Later, on 7 November 2019 in a similar location near Uruguay Island, another sighting was made of the probably same group of ABWs. The whales were socially active and performed different patterns of surface behavior. Another encounter of the ABWs happened on April 24, 2020, in the Gerlache Strait, near Brabant Island - 11 ABWs were sighted while swimming north. In all ABWs encounters, individuals of different age groups were sighted. High-quality images of dorsal fin profiles, body scars, and pigmentation patterns have been used for the photo-identification of three ABWs. Our sightings corroborate other rare opportunistic sightings of this species in the nearshore waters of the Antarctic Peninsula. Long-term year-round studies such as regular coast-based and boat-based surveys, photo-identification, and passive acoustic monitoring are essential for understanding the ecology and population dynamics of the ABWs in the rapidly changing marine environment of the Antarctic Peninsula.



Thursday, April 7th / Central European Summer Time

058

Sperm whale coda vocal repertoire in the Pelagos Sanctuary, north-western Mediterranean Sea

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Sperm whales produce 'codas', stereotyped social calls, made of sequences of broadband clicks classified into different types, according to the number and pattern of the clicks they contain. The most common pattern in the Mediterranean, where the species classifies as Endangered, is the 3+1. Here, we describe codas recorded in the Pelagos Sanctuary, north-western Mediterranean Sea. The coda structure and duration, based on measurements of inter-click-intervals and coda repetition rates, were used to characterise these signals. Overall, 356 codas collected between 2011-2019 were analysed: 262 (73.60%) were coda 3+1, 83 (23.32%) were coda 2+1, while the remaining 11 (3.08%) were coda of different types including 3, 1+2, 2+2, 3+1+1, 3+2+++1, 1++2+1++1 and 4. Coda duration ranged between 0.259 and 1.14 seconds, with the most common types, the 3+1 and 2+1, averaging 0.662 and 0.469 seconds, respectively. The duration of codas is not correlated to the number of clicks within each coda ($R^2 = 0,0907$). Sequences are composed by a variable number of codas ranging from 2 to 27. The number of codas in a sequence did not vary significantly with group-size ($R^2 = 0,0488$). This study confirms that the 3+1 is the most common type in the region. However, the presence of other coda types suggests that the coda repertoire of Mediterranean sperm whales is richer than previously thought. Moreover, this coda variability could reflect the presence of distinct cultural clans conforming to a common coda type, where differences might arise from an internal innovation process and/or external genetic and cultural contribution. Our results pose the basis for future studies investigating the role of cultural transmission and social learning in a species with a uniquely complex vocal ecology. These studies, extended to the entire basin, would be pivotal towards an in-depth assessment of the Mediterranean sperm whale population status and its conservation.



Thursday, April 7th / Central European Summer Time

059

The acoustic world of Short-finned pilot whales, a resident species off the South-West coast of Tenerife

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While bioacoustics literature may be saturated with studies on “popular” cetaceans such as *Orcinus orca* (killer whales) and *Tursiops truncatus* (bottlenose dolphins), little is known about short-finned pilot whales (*Globicephala macrorhynchus*) - especially regarding dialect. Since pods of this species are matrilineally structured, it comes as no surprise that they are highly territorial animals - with typically only males moving between groups to mate. Consistent data collection (facilitated by The Atlantic Whale & Dolphin Foundation) has been conducted at two separate locations off the South-West coast of Tenerife since June. Recent spectrographic analyses of recorded calls and whistles (via SQ26-H1 hydrophones) has revealed that, despite such a short distance of just 30 kilometers between the two study sites, a clear difference in dialect can be observed in each respective population. The categorisation of pulsed calls specifically (Raven Pro, Version 1.6.1) enabled for the identification of repeated call types, as well as two component calls (otherwise known as biphonation). Interestingly, some recordings displayed an almost Marco Polo like conversation between two distinct individuals, each conspecific replying to the other with their own “signature call”. Further research on the acoustic behaviour of this species hopes to incorporate fin identification, in order to determine whether a dialect difference is also present between pods occupying the same study site. Ultimately, this could answer the hypothesis that dialect is not only location-specific, but also completely unique for each matrilineal group. Short-finned pilot whales are sentient beings, potentially with an even more sophisticated social structure than our own. However, up until just four years ago in 2018, this species was listed as “data-deficient” on the IUCN red list. While it is now widely known that their numbers are stable, not enough is being done conservation-wise (especially here in Tenerife) to protect them from ever increasing anthropogenic disturbance.



Thursday, April 7th / Central European Summer Time

060

The false killer whale (*Pseudorca crassidens* Owen, 1846) in German and Danish Baltic waters and the rediscovery of this species by Reinhardt 1862

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In the morning of November 24th, 1861 a herd of 150 black dolphins of an unknown species appeared in the Kiel bay. One of them was killed by fishermen and eventually sold to Georg Wilhelm Behn at the Zoological Museum of the Kiel University. Rumors about this dolphin reached Copenhagen where it roused Daniel Frederik Eschricht's and Johannes Theodor Reinhardt's interest very much. Three more strandings of these dolphins were recorded in the northern part of the Great Belt between May and August 1862. Comparing this specimens with Owens description of a subfossil skull and cervical vertebra found near Stamford (UK) Reinhardt became convinced: „we have only to do with one and the same species... I therefore, believe, that we must really acknowledge this *Phocaena crassidens* of Owen to be the dolphin stranded on our coasts, however strange it may seem". Reinhard finally renamed the species *Pseudorca crassidens*.



Thursday, April 7th / Central European Summer Time

061

The longest recorded movement of a common bottlenose dolphin (*Tursiops truncatus*) in the Mediterranean Sea: why paying attention at online meetings matters

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Information on movements and connectivity among populations of animals is important for the delineation of units to conserve, so that other types of information, such as abundance, fecundity and mortality, can be placed in an appropriate population and conservation context. Common bottlenose dolphins (*Tursiops truncatus*) in the Mediterranean Sea are often considered relatively 'resident' and demonstrating strong site fidelity to specific areas. However, this perception may partly be an artefact of the distribution and 'habitat use' of cetacean researchers, rather than animals themselves, and bottlenose dolphins have been shown to be capable of substantial movements, often in relatively short periods of time. Here, we report on a long-distance movement of a bottlenose dolphin, discovered by spotting a known fin in a presentation during an online scientific meeting. The matched dolphin moved across the Tyrrhenian, Ionian and Adriatic Seas, making this the longest recorded movement for this species in the Mediterranean Sea to date and one of the longest in the world. We also review published records of long-distance movements in this species worldwide. This study underscores the utility of photo-ID and the importance of regional data sharing. Photo-ID comparisons are always worth a shot, as we never know what interesting results we may find.



Thursday, April 7th / Central European Summer Time

062

The results of Baltic grey seal census versus continuous monitoring of a newly recolonized haul-out in Polish waters

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Grey seals in the Baltic Sea are counted annually in a coordinated way since 2000 by countries whose coasts are inhabited by the species. The only haul-out so far recolonized by grey seals on the Polish Baltic coast are the sandy unstable islets in the estuary of the Vistula River. With the return of grey seals, a year-round online video haul-out monitoring was established in 2010. In 2014, Poland joined the group of countries participating in the grey seals census based on the HELCOM guidelines. It recommends conducting 3 flights over the haul-out sites within two weeks of the grey seal moulting season at the turn of May and June and providing the highest obtained number of grey seals as a result. The data obtained from the continuous observation of the seals during the 2-week period show however, that the daily results differ significantly from each other. The number of seals is highly dependent on several factors such as e.g. size and number of surfaced sandbanks or the effect of scaring. Therefore, the number of seals during census period in randomly selected days of flight could be either several hundred or none individuals and the final result might be biased by such selection. Presented results of the everyday observations and their comparison with the results obtained from the census flights indicate the need to take into account the specificity of the haul-out use by seals and consider the modification of the census methodology especially in the light of the ongoing recolonization of the southern Baltic coast by grey seals.



Thursday, April 7th / Central European Summer Time

063

Unusual presence of Risso's dolphin (*Grampus griseus*) in a coastal area of the Northern Portugal

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Risso's dolphin (*Grampus griseus*) is a cetacean species present in areas spanning from coastal to oceanic habitats, although evidence suggests a stronger association with steep-sloped bottom near the outer edge of the continental shelf or upper slope. In mainland Portugal, the species is classified as "Data Deficient" under the IUCN Red List, with few sightings scientifically reported and mostly concentrated in southern Portuguese waters. Within CETUS Project, a dedicated cetacean monitoring program started in 2017 with standardized surveys from a fixed shore-based lookout in the mouth of Douro River (Porto, Portugal). The aim was to study cetacean diversity and occurrence in this poorly-studied area. So far, four species were recorded: *Phocoena phocoena*, *Delphinus delphis*, *Tursiops truncatus* and *Grampus griseus*. Risso's dolphin was first observed in the summer of 2019, with several records not only in this particular area but also in adjacent areas. In a total of 168 days and ~520 hours of observation, performed between 2017 and 2020, Risso's dolphins were observed on 10 occasions, plus several anecdotal records provided by fishermen and local citizens. In 2019, an individual was re-captured with 18 days' difference and may suggest that sightings in that year were from the same group of animals that selected the region to stay throughout that summer period. The presence of mother-calf pairs may explain why the species was found so close to the coast: possibly to avoid predators, shorten the time away from the calves and for energetic reasons. We hypothesize that this rare presence of Risso's dolphins in coastal waters might be for nursing and/or energetic purposes, although there is the possibility of a more frequent occurrence in the area. These rare sightings together with the lack of published data on the species distribution in Northern Portugal emphasize the need for further monitoring.



Thursday, April 7th / Central European Summer Time

064

Using citizen science and ecological niche modelling approach to identify bottlenose dolphin's habitat in the Normand Breton Gulf, France

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Modelling dolphin distribution is key to understanding their ecology and therefore their their conservation and management. Information on the distribution and preferred habitats of Normano-Breton Gulf's bottlenose dolphins (*Tursiops* sp.) is lacking, particularly in the Mont Saint Michel Bay, where the species could be threatened by several anthropogenic activities. In this study, a boat survey sampling dataset based on a citizen sciences sampling strategy is used and coupled with a modelling approach. This use of citizen sciences data ai to identify areas of high probability of bottlenose dolphin occurrence and the environmental variables influencing their distribution. Four modelling techniques are used in order to compare their predictive power and to determine which type of model is the most adapted to the data collected by the associative structure. The Ecological Niche Factor Analysis (ENFA) uses presence data only, while Generalized Linear Models (GLM) and Generalized Additive Models (GAM) use presence/absence data. A comparison between these models with an aggregate modelling approach will be conducted to determine whether this approach is more efficient than individual models. The data were collected over four years (March 2016 to November 2019), and represent 741 trips and 494 sightings of bottlenose dolphins. The ENFA modeling approach appears to be more appropriate to the dataset available in this study. Ensemble models don't always perform better than individuals GLM and GAM. Results show that bottom roughness, depth, and distance from the shore are the environmental variables influencing the distribution of the species. In addition, this study reveals that citizen sciences data could provide preliminary information for a more accurate and complete Understanding on the distribution of this specie in the area. This approach highlights the interest of combining a participatory sampling effort with specie's distribution models in the development of effective conservation strategies for this specie.



Thursday, April 7th / Central European Summer Time

065

Using PAM to study the presence of bottlenose dolphins (*T. truncatus*) in the Gulf of Trieste, northern Adriatic Sea

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The waters of the Gulf of Trieste in the northern Adriatic Sea are inhabited by common bottlenose dolphins (*T. truncatus*), the only regularly present species of marine mammals in this area. This population has been thoroughly studied since 2002 by Morigenos – Slovenian Marine Mammal Society through boat-based and land-based surveys, focal follows, photo-identification and biopsy sampling. During 2020–2021, we deployed passive acoustic devices (C-PODs) at three ‘coastal’ and two ‘offshore’ locations in the Gulf of Trieste, to improve existing monitoring of bottlenose dolphins and get a better understanding the seasonal and diel patterns of their habitat use. Dolphin classification was performed using the KERNO echolocation classifier in the CPOD program. For further analysis we used only high and medium quality echolocation click trains. To explain the potential relationship between the presence of dolphins and predictor variables (sample location, month, time of day, water temperature, angle of the hydrophone) we used a negative binomial generalized additive model (GAM) in program R. The highest number of recorded detections was at coastal location near the town of Piran, with 717 detection positive minutes (DPM) and the lowest at offshore location oceanographic buoy Zora with 41 DPM. The highest number of detections was in February (42 % of all DPM) and the lowest in October (0.45 % of all DPM). Almost half (44.4%) of DPM was during night time. The final GAM model included sample location, month of the year and water temperature. It explained 34.5% of deviance, with water temperature being the most important explanatory variable. Future long-term PAM at these locations will help us better understand the impacts of tourism, maritime traffic and other anthropogenic activities on the local marine biodiversity.



Thursday, April 7th / Central European Summer Time

066

White Sea killer whale (*Orcinus orca*) mtDNA control region analysis

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Apex predators are widely recognized as indicator species for ecosystem wellbeing. The distribution and population structure of killer whales is relatively well understood for the North-East Atlantic. However, for the adjacent waters of the Arctic Ocean, such information is scarce. It is known that in the summer-fall period, orca are regularly observed in the Barents Sea; their visits to the White Sea are rare, but, nevertheless, they have been known at least since the 1930s. It is not known at this time whether these killer whales belong to one of the North Atlantic populations or are poorly studied populations living in the Barents Sea. In 2021, a dead orca was found on the Bolshoy Solovetsky Island (White Sea). The mtDNA control region was processed from a sample of this whale. It was compared with other orca haplotypes presented in the NCBI GenBank. It has turned out to be unique and new to the GenBank. We have built a median network of orca haplotypes including ones from Atlantic, Pacific and White Sea. The network clusters the White Sea and Atlantic killer whales. The White Sea orca shown closest to the ENA13 haplotype, collected off Iceland. Global climate change has been recognized as a factor affecting marine ecosystems and is causing significant changes in the habitat and kinds of prey used by killer whales. Declining sea ice in the Arctic is resulting in the increase in the new habitats becoming available and those be increasingly more frequently and longer visited by orca. It is unknown to which population the orca found in the White Sea belongs, yet it warrants further studies of the genetic structure and/or potential changes in spatial distribution of the North Atlantic and the Arctic Ocean orca populations, and the effects these may have on corresponding ecosystems.



Thursday, April 7th / Central European Summer Time

068

Acoustic presence of baleen whales in the North Atlantic; a case study using the humpback whale (*Megaptera novaeangliae*)

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This PhD contains four hypotheses centered on the use of acoustics as a tool for baleen whale conservation and ecosystem management: (1) There is a distinct seasonal pattern in baleen whale presence in NI/Scottish waters which can be effectively monitored through passive acoustics; (2) Timings of detections across baleen whale breeding locations can be used to reveal/confirm potential migratory patterns; (3). The spectral characteristics of humpback whale song recorded in NI/Scottish waters are significantly different to those in other North Atlantic locations; (4) Through a spatial representation of data, it is possible to highlight regions of risk for baleen whales in local waters. The first chapter is focusing on the seasonal presence of baleen whales in Scottish and Northern Irish waters, building upon a preliminary assessment of humpback whale acoustic behaviour in the NE Atlantic. Chapter two is exploring the timings of humpback whale song across the North Atlantic to build an ocean basin scale understanding of humpback whale migrations by comparing the timing of acoustic detections. Chapter three aims to investigate differences in song structure of humpback whales from breeding grounds across the North Atlantic. Chapter four is intended to have an applied management and marine spatial planning focus in local Northern Irish waters with the aim to explore potential overlaps of baleen whale occurrence with specific human activities that are considered key threats.



Thursday, April 7th / Central European Summer Time

069

Bottlenose dolphin calving and nursery area in the waters of Rome

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This study presents data on a local population of bottlenose dolphins monitored in the coastal waters of Rome (central Tyrrhenian Sea, Italy) over a period of seven years (2015-2021). We studied dolphin presence and distribution and performed photo-identification analysis. According to our data, the waters of Rome represent a calving and an important nursery area for this local population. The study area measures 700km², extends from the coastline to the 200 m bathymetric, it is delimited north by the mouth of the river Tiber, south by a submarine mountain, the MPA "Secche di Tor Paterno" (managed by the regional authority RomaNatura). Data was collected throughout all seasons, 256 surveys covered a total of 11655 km. 94 bottlenose dolphin groups (mean 13.28, range 1-46) were encountered. Immature dolphins were present in 40% of the encountered groups, including 24 newborns with evident fetal folds. Photo-identification analysis was performed on 89 sightings and produced a catalog of 230 individuals. Among these, 50% were re-sighted through the years. Gender was assessed for 38 identified individuals (17%), 36 females and two males. In order to use the capture history to investigate site fidelity, we created two categories based on the time spans of recaptures. Results show that 76 dolphins (33%) were re-sighted over a period of 2-4 years, and 38 dolphins (17%, among them were 23 females) over a period of 5-7 years, showing a high degree of site fidelity. The stable presence of a nucleus of females frequently accompanied by immatures and newborns shows that the species uses the area for calving and nursing. The Tiber mouth and the submarine mountain of the MPA, geological features known for the concentration of food resources, may represent the main factor in making the area suitable for these critical activities.



Thursday, April 7th / Central European Summer Time

070

Bottlenose dolphin interactions with fishery in the Phlegraean Islands (Gulf of Naples, Italy)

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This study examines the interactions between the bottlenose dolphin (*Tursiops truncatus*) and the fishing activities in the waters of Ischia and Procida Islands (Gulf of Naples, Italy) over a period of fifteen years (2004-2018). The study area lies partially within the limits of the Marine Protected Area "Regno di Nettuno". Data were collected in the frame of the Ischia Dolphin Project, an ongoing long-term field research program on cetaceans, and through questionnaires to fishermen. A total of 1186 daily surveys were performed, covering 58332.47 km and resulting in 91 encounters with the species. Interactions with trawling were recorded, when bottlenose dolphins were seen following fishing vessels for feeding. Interactions with bottom gillnets were also recorded, when the animals were seen swimming in the proximity of fishing gears for more than 20 minutes and performing prolonged apneas (more than 4 minutes). Interactions were observed in 22 sightings (25.18%), 55% of which involved gillnets used by artisanal fisheries and 27% trawlers of the industrial fleet. On 4 occasions, interactions with both fishing gears have been recorded. The routes traveled by dolphins during the interactions were analyzed using QGIS Kernel Density Estimation and Hotspot analysis. Interactions with gillnets are concentrated NW of Ischia and in the channel between Ischia and Procida islands; instead, interactions with trawlers are located N of Procida. Interviews were carried out almost entirely (93%) with artisanal fishermen, who mostly used fixed gillnet (87%). All the interviewed fishermen denounced cases of depredation, 65% reported several interactions per week. Main damages to the fishermen include the stealing of fish from nets (41%) and the breaking of nets (44%). Solutions are proposed, such as the replacement of gillnets with traps, the use of pingers, the enlargement of the perimeter of the MPA, and the establishment of new no-take zones.



Thursday, April 7th / Central European Summer Time

071

Core habitats of bottlenose dolphins in the MPA Regno di Nettuno, Gulf of Naples, Italy

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Species conservation requires a clear understanding of habitat use. The bottlenose dolphin (*Tursiops truncatus*) is a coastal species subjected to various anthropogenic threats. In this research, we use a combination of behavioral observations and GIS analysis to identify core hotspots for bottlenose dolphins around the Islands of Ischia and Procida. The surveys took place mainly within the Marine Protected Area “Regno di Nettuno” which is organized in five zones with different levels of protection; one of these, the D-zone, is dedicated to marine mammals. Data were collected from 2004 to 2018 by the Ischia Dolphin Project, an ongoing long-term research program on cetaceans. In order to evaluate the use of habitat, GPS coordinates were taken every three minutes during the sightings and then analyzed using QGIS Kernel Density Estimation and Hotspot analysis. We conducted 1186 boat-based surveys (58332 km). During these, we encountered 91 bottlenose dolphin groups and spent 156 hours (877 km) in direct observations. The hotspot maps were created from the analysis of 71 behavioral sequences > 40 min, with a mean duration of 121 min (range 41-417). Feeding hotspots were identified N, NW of Ischia, and NW of Procida; socializing and mating hotspots partially intersected with the feeding ones, but the one NW of Procida was wider; a milling and resting hotspot was located NW of Procida. Core habitats of bottlenose dolphins are only in part protected by the zonation of the Marine Protected Area. More specifically, the hotspots NW of Procida, located on the main route to Naples, are particularly exposed to disturbance from commercial and recreational traffic. Cutting-edge conservation policies can take advantage of this spatial information to increase the safeguard of protected species. In particular, the MPA should use them to revise and enlarge the boundaries of the D-zone dedicated to marine mammals.



Thursday, April 7th / Central European Summer Time

072

Cranial shape differentiation between coastal and offshore bottlenose dolphins (*Tursiops truncatus*) based on 3D modelling: implications for Mediterranean conservation.

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The bottlenose dolphin (*Tursiops truncatus*) shows differentiation between offshore and coastal environments worldwide. Genetic studies suggest similar division within the Mediterranean, with several communities showing high site fidelity to coastal areas with varying degrees of social segregation from dolphins elsewhere. However, information about differentiation in other biological traits is lacking. In this study, we quantify bottlenose dolphin skull shape variation between Mediterranean and other offshore populations worldwide (North/South Atlantic and South Pacific), comparing it with a well differentiated coastal community from the Gulf of Guayaquil (Ecuador). We performed skull shape analyses on 3D models of 56 adult skull specimens. We manually digitized 71 single point landmarks in homologous skull features, and 1280 pseudo-landmarks based on 8 line and 3 patch guides. Additionally, we used an automatic landmarking method, which placed 798 single points without considering features' homology. Afterwards, we used manual and automatic landmark datasets to carry out geometric morphometrics analysis (Procrustes superimposition and Principal Component Analyses). Results from both manual and automatic 3D landmarking, showed clear skull shape differentiation between coastal specimens, both in the Mediterranean and Ecuador. Some specimens from the Ligurian coast were particularly well differentiated from offshore, as seen in the of Guayaquil, Ecuador. However, both populations skull shape changes occurred in opposite directions, evidence of their distinctiveness. Contrarily, offshore skulls showed considerable overlap between all areas sampled. Our results support local data on site-fidelity and social segregation, both in the Ligurian Sea and Guayaquil Gulf. It also agrees with previous suggestions of a coastal vs offshore differentiation within the Mediterranean, although levels of overlap in skull shape are consistent with a potential metapopulation dynamics. This study provides insight into Mediterranean bottlenose dolphin population dynamics, with important conservation implications. It also shows the potential of 3D modelling in identifying fine-scale morphological differentiation in cetacean species.



Thursday, April 7th / Central European Summer Time

073

Distribution of the Atlantic spotted dolphin (*Stenella frontalis*) in Azores

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Climate change has severe impacts on marine ecosystems, including fluctuations in ocean temperature, chemical composition and primary productivity. In response, many species are changing their distribution to maintain the same ecological niche. Species with tropical distribution, can act therefore, as an indicator of ocean changes, as they may expand their distribution northwards with raising sea surface temperature. Cetacean data are challenging to obtain due to the complex and expensive logistics involved, but opportunistic data are becoming increasingly important and available worldwide. In the Azores, long-term opportunistic data from whale watching are available since 2009, and include occurrences of the Atlantic spotted dolphin (*Stenella frontalis*), a tropical dolphin species sighted every year in the archipelago. The aim of this study is to understand how environmental variables influence the distribution of *Stenella frontalis* in the Azores. To do so, Generalized Additive Models are applied. We confirm the regular seasonality of *S. frontalis* in the archipelago, with 86.1% of the records between July and September. The final model obtained explains 17.8% of deviance, considering depth, distance to the coast and sea surface temperature (SST) as significant environmental variables. The SST is the most significant variable in the model, showing increased habitat suitability for *S. frontalis* in waters warmer than 21 °C. With these results in mind and taking into account the effects of climate change in the mid-Atlantic, we expect that habitat conditions for *Stenella frontalis* will be more suitable for longer periods in the archipelago in the future than now. Thus, changes in its distribution might be easily detectable, playing a key role as a sentinel species.



074

Occurrence of killer whales (*Orcinus orca*) along the Snæfellsnes Peninsula, West Iceland: A decade of photo-identification (2011–2021) reveals travel routes

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Killer whales (*Orcinus orca*) are known to occur seasonally in large aggregations in Icelandic coastal herring grounds and year-round in small aggregations along the Icelandic shoreline. In this study, findings obtained from the analysis of a photo-identification catalogue of killer whales in Iceland published in 2022 are presented. The catalogue comprises photo-identification images from February 2011 to December 2021. While the catalogue includes additional individuals from other areas around Iceland, the focus is on identification images taken along the Snæfellsnes Peninsula, West Iceland. Data on killer whales was collected both from land and onboard whale-watching vessels, and included photo-identification, geographical location, pod size, and behavioural observations. The sex of individuals was identified based on their dorsal fin size and shape, body size, and/or the exposure of genitals on the surface. Individuals were also determined to be female when close associations with the same calves were repeatedly observed.

From a total of 631 sightings and over 330,000 analysed images, 961 individual killer whales were identified in the waters around the Snæfellsnes Peninsula. Of these, 216 (22.5 %) were classified as females, 296 (30.8 %) as males, and 449 (46.7 %) as unknown sex.

Identification work has revealed both round-trip and one-way movements of killer whales to areas outside of Iceland. There are currently 23 individuals documented to travel between Scotland (including Shetland, Orkney, and the Outer Hebrides) and Snæfellsnes. In 2019 and 2020, four killer whales were found



186

074

(Continued)

to have travelled from Iceland via Spain to Italy, with one individual having swum farther to Lebanon and Israel, covering a total distance of over 8,000 km.

Further studies and analyses of current data are needed to better understand the travel routes, social structure, feeding behaviour, and reproductive rates of killer whales in West Iceland, to aid in their conservation.



Thursday, April 7th / Central European Summer Time

075

Exploring the spatio-temporal distribution of cetacean species off Pico Island (Azores, Portugal) using long term land- based surveys

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As apex marine predators, cetaceans have many important ecological roles in marine environments, and are often recognised as ecosystem sentinels. In many areas cetacean populations are vulnerable and being affected by several threats, including climate change, pollution, and human activities. With this study we aim to explore the spatio-temporal trends in cetacean sightings along the South-East coast of Pico Island (Azores, Portugal), where current observations have documented 24 species of cetaceans (66% of which are classified by IUCN as data deficient). Dedicated land-based surveys took place from 2005 to 2020 from two vantage points (at elevations of 31m and 85m) in Santa Cruz das Ribeiras. A scan sampling protocol was followed, with 20 minutes of survey conducted every 2 hours, recording: time, species, position, behaviour and group size for every sighting. Kernel density estimation (KDE), a grid pattern and linear regressions were employed to test the effect of year, depth and their interaction on species presence and group size. Within the considered study area (1176km²), we obtained 16000+ sightings, composed mostly by Risso's dolphins (35.5%) and small delphinids, such as common, striped and Atlantic spotted dolphins (34.5%). The spatial analysis showed strong correlation between cetacean presence and depth, to different degree depending on the species. The temporal analysis highlighted a general declining trend in cetacean presence (especially Northern bottlenose whales, Risso's dolphins and bottlenose dolphins). By contrast, presence of Mesoplodon beaked whales and false killer whales appears to be increasing. These findings appear to show significant changes in species presence in this area, and coupled with high species diversity, make the waters adjacent to Pico Island a potentially important area for future conservation efforts. Further investigation is required to understand the potential drivers of changing species distribution (e.g. climate change, anthropogenic impacts) and to formulate appropriate management and conservation recommendations.



Thursday, April 7th / Central European Summer Time

076

Identification and sex-age classification of northern bottlenose whales in the Northeast Atlantic based on photographic evidence

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Migration patterns, site fidelity, and life history of the northern bottlenose whale are poorly understood. The lack of long-term data and the difficulties associated with studying such an elusive and long-lived species make population monitoring and conservation extremely challenging. In this study, we present the first version of a northern bottlenose whale photo-ID catalog for the Northeast Atlantic, spanning the region Iceland-Faroe Islands-Norway. Photographs from 2008-2020 contributed by researchers, naturalists, and citizen scientists were analyzed. Photographs were first sorted in left and right side dorsal fins and melons, and quality rated following an established scale. Roundness of the melon (forehead) was used to determine the sex-age class of whales, whereas different individuals were identified based on their markings in the dorsal fin area. High distinctiveness was defined as whales with a minimum of one reliable marking (dorsal notch or back indentation) or at least three less reliable markings (e.g. scars). The catalog currently holds a total of 302 left sides (180 high distinctiveness; 122 low distinctiveness) and 334 right sides (152 high distinctiveness; 182 low distinctiveness). Only 24 individuals were resighted (>12 h between photographs) within the same area and year, with a maximum interval of 16 days. No photographic matches were made between years or areas. These findings may reflect poor distinctiveness of individuals, a large population size, or a lack of site fidelity. Twenty percent (n=30) of melons analyzed were classified as mature males and 80% (n=123) were classified as female-juvenile. A comparison with biopsy results from 15 individuals suggested that sex can be accurately determined through melon analysis. Increasing sample sizes for dorsal fin and melon photos, comparisons with photo-ID catalogs for other regions, and an in-depth analysis of markings are recommended to effectively inform future conservation measures.



Tuesday, April 5th / Central European Summer Time

077

In-field comparison of C-POD and F-POD performance in detecting echolocation clicks trains of harbour porpoise (*Phocoena phocoena*)

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Static acoustic monitoring (SAM) is one key method for observing cetacean populations difficult to assess with other traditional monitoring techniques such as aerial and ship-based surveys or photo-ID. The C-POD (Cetacean POrpoise Detector) has been a highly versatile tool for static acoustic monitoring programmes for more than a decade. F-PODs (Full waveform capture Pods) are the successor of the C-POD with advanced electronics enabled aiming to improve train detection, false positive rates, and sensitivity. Here we compare the performance of the C-POD with that of the F-POD deployed together in West Cork, Ireland, between April and November 2021, in a custom-built frame to optimise the simultaneous recording of echolocation clicks on both instruments. While similar trends in detection were found for both devices across the recording period, we found a positive but poor correlation in detection positive minutes (DPM) recorded on the different PODs, with the C-POD detecting 58% of DPM detected by the F-POD. Indicating that while C-PODs may be appropriately detecting cetacean presence, they may be underestimating the extent of echolocation activity. Higher click rates indicative of social click bursts rather than foraging were also identified by the F-POD, highlighting it's advantage over the C-POD for investigating differences in harbour porpoise echolocation behaviour. Results suggest that while both instruments performed well in detecting harbour porpoise clicks, it would not be possible to directly compare results obtained from the two PODs. We recommend that lessons learned from this in-field comparison can help develop best practice guidelines for switching from C-PODs to F-PODs. Additionally, undertaking similar in-field comparisons between the PODs, across variety of different monitoring sites, could allow for the formulation of a correction factor allowing greater longevity of data collected on C-PODs and strengthening monitoring programmes for the future.



Thursday, April 7th / Central European Summer Time

078

Mobilising data: The Joint Cetacean Data Programme as an example of maximising value of the growing data collection effort

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Cetacean abundance and distribution data are vital for drawing accurate conclusions on population trends and status. These data are collected by a growing range of organisations for a variety of purposes, but all with the same goal of a clearer understanding of cetacean ecology, abundance and distribution in their area of interest. Independently, these data are limited in capacity to perform analyses at relevant spatial and temporal scales, but together, have the potential to significantly increase our understanding of these cryptic species. Combining cetacean datasets from the existing evidence base has been proven to be highly effective in enabling the assessment of cetacean populations across wide areas and appropriate time periods, increasing the value of these data. The Joint Cetacean Data Programme (JCDP) aims to better facilitate this process of accessing and utilising cetacean survey data by collating the growing evidence-base across the northeast Atlantic into a single accessible resource. The JCDP is a collaboration with partners from across the region; from policy makers, academics, marine industry and NGOs to maximise the value of ongoing survey effort. The JCDP encourages data collectors to come together to make high quality data more readily available and enable development of open access data products to better inform research. The project has produced an agreed Data Standard and created a dedicated online portal to host cetacean survey data collected from vessel and aerial platforms, as well as a number of key data products that will be developed from the data. It is a growing resource that will enable best use of all available comparable data from which to carry out analyses to better inform cetacean policy and conservation.



Thursday, April 7th / Central European Summer Time

079

Photo identification and travelling direction of sei whales (*Balaenoptera borealis*): a migrant ocean traveler in São Miguel, Azores

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The sei whale (*Balaenoptera borealis*) is a migratory baleen whale that generally undertakes seasonal migrations between wintering breeding areas in the tropics and feeding areas in higher latitudes, in the sub poles, during summer. Along its migration path, it is observed passing through Azores. This study aims to create a photo identification catalogue of the individuals sighted off São Miguel between 2008 and 2020 and to assess their travelling direction and movements observed based on opportunistic data collected between 2008 and 2020 by Futurismo Azores Adventures, a whale watching company located in São Miguel Island. It was possible to identify 87 individuals with three re-sightings in São Miguel, with short times of permanence in the study area (max. registered of one month), agreeing with behavioural notes, which indicate a predominant travelling behaviour. These results support the hypothesis that they are mostly passing through the waters of São Miguel and may be using it as a navigational tip on their migration. Sei whales were registered every year, with most of the sightings (84.39%) between March and July. The dominant northwest travelling direction during this season agrees with the expected northward migration to the feeding grounds. 12.42% of the sightings occurred in August and September, however the direction of movement was not clear, and therefore not suggesting a clear southward migration. Along the study period, maximum sei whale occurrences seem to delay in the season, although further studies are needed to confirm any possible trend. With these results we provide a better understanding of sei whale occurrence in São Miguel, Azores, essential to support conservation and management plans for this endangered migrant species.



Thursday, April 7th / Central European Summer Time

080

Study of the distribution of *Stenella coeruleoalba* in the Azores archipelago

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The striped dolphin (*Stenella coeruleoalba*) has a worldwide distribution in tropical, subtropical and temperate waters in both hemispheres. It is the third most abundant cetacean species in European Atlantic waters, but despite its abundance, studies on this species are scarce. In the Azores archipelago, the striped dolphin is sighted every year. The main objective of this work is to study the distribution and seasonality of this species in the archipelago, comparing the distance from the coast of its sightings among other delphinid species (common, spotted and bottlenose dolphins). For this purpose, 12 years of opportunistic data provided by different whale-watching companies under the MONICET project are used. In this way, the long-term presence of this species in the Azores can be studied. In order to weight the number of sightings by the survey effort, an encounter ratio has been calculated to compare inter-annual variations. For each sighting of the species considered, the distance to the coast of the different species of Delphinidae was extracted. By applying Monte Carlo simulation, the distances to shore of these species were compared, with the striped dolphin's distance to shore being significantly greater. The absence of seasonality throughout the year in the archipelago has also been observed. This work provides important evidence on the ecology of striped dolphins in the Azores.



Thursday, April 7th / Central European Summer Time

081

Using genetic data to aid evidence-based management and conservation of grey seals (*Halichoerus grypus*) in European waters

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Effective conservation management relies on the delineation of discrete and measurable units, such as Management Units (MUs). Delineation of such units for grey seals (*Halichoerus grypus*) in the Northeast Atlantic has largely been based on movement patterns identified by telemetry data, as significant geographical sampling gaps have hindered the thorough assessment of population genetic structure. We addressed these sampling gaps by generating mitochondrial (up to 350bp of the control region) and nuclear data (11 microsatellites) from areas that had not been previously studied, including Ireland, Northern Ireland, southwest England and the German/Danish North Sea coasts. New mitochondrial data were merged with previously published data to generate an unprecedentedly large and exhaustive dataset of over 2000 individuals. Both mitochondrial and nuclear diversity were high across all sub-regions and genetic structuring results revealed that grey seals from Ireland and Northern Ireland are part of the same interbreeding population. Southwest England and the Southern North Sea (Germany, Denmark) were identified as source areas of migrants to Ireland/ Northern Ireland, though it may be possible that the Southern North Sea shares a common source of migrants not included within analysis, rather than representing a direct source for Ireland/ Northern Ireland. Based on genetic findings, two distinct MUs are proposed for the Northeast Atlantic: (i) Faroe Islands, Scotland and Greater North Sea; and (ii) Northern Ireland, Ireland, southwestern UK (Cornwall), and France. While further sampling will be required



Thursday, April 7th / Central European Summer Time

081

Using genetic data to aid evidence-based management and conservation of grey seals (*Halichoerus grypus*) in European waters

(Continued)

to accurately delimit the boundaries between these MUs, two transition zones are hereby proposed: (i) Northwest Scotland and (ii) the English Channel/southern (Dutch) North Sea. To account for potential ongoing admixture between the proposed MUs (and hence a shift or even eventually disappearing of the proposed boundaries), continued monitoring and assessment of regional population structure using a multidisciplinary framework is advised.





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thank you...