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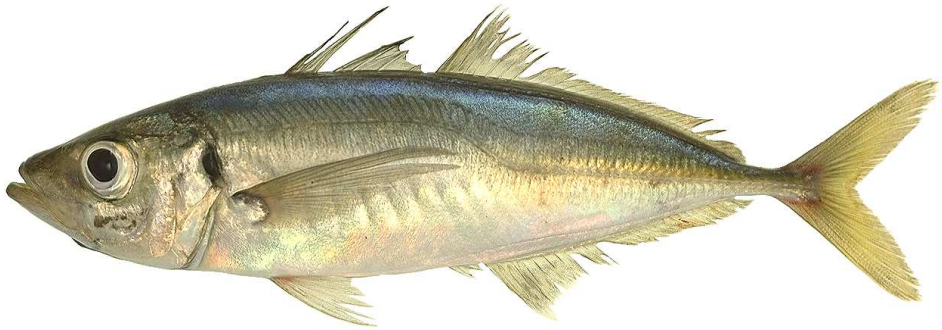
DELLE RISORSE DEL MARE

Report of the Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*Trachurus trachurus, T. mediterreaneus and T. picturatus*) Otolith Exchange 2015



Mahé K., Jurado A., Garcia Guerreiro A., Massaro A., Dueñas C., Lopez E., Mullins E., Lanteri L., Ferreira M.J., Elleboode R., Mannini A., Antolinez A., Delfs G., Casciaro L., O'Cuaig M., Torres P., Dijkman A., Bellamy E., Eriksen K., Carbonara P., 2015. Report of the Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*Trachurus trachurus, T. mediterreaneus and T. pictatus*) Otolith Exchange 2015. 30pp.

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1. Introduction

The Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS) meeting in February 2014 recommended a large exchange in 2014 and a workshop for 2015 (ICES, 2014). The planning group indicated that Kelig Mahe (IFREMER, France) and Pierluigi Carbonara (COISPA Tecnologia & Ricerca, Italy) will be responsible to organising a *Trachurus* species (*Trachurus trachurus*, *T. mediterreaneus* and *T. picturatus*) otolith exchange and workshop. There were 3 age reading workshops (1999, 2006 and 2012) which were preceded by one exchange.

2. Participants

19 readers from 8 countries participated at this exchange (Tab. 1).

Table 1: List of the readers.

Reader	Name	Country	Institution
1	Alba Jurado	Spain	Instituto Español de Oceanografia
2	Alexandra Garcia Guerreiro	Portugal	IMAR/University of Azores
3	Andrea Massaro	Italy	CIBM
4	Clara Dueñas	Spain	Instituto Español de Oceanografia
5	Eduardo Lopez	Spain	Instituto Español de Oceanografia
6	Eugene Mullins	Ireland	Marine Institute
7	Luca Lanteri	Italy	University of Genoa
8	Maria João Ferreira	Portugal	IPMA
9	Romain Elleboode	France	Institut Français de Recherche pour l'Exploitation de la Mer
10	Alessandro Mannini	Italy	Italian Society for Marine Biology
11	Ana Antolinez	Spain	Instituto Español de Oceanografia
12	Gertrud Delfs	Germany	Thünen Institute of Sea Fisheries
13	Loredana Casciaro	Italy	COISPA
14	Macdara O'Cuaig	Ireland	Marine Institute
15	Pedro Torres	Spain	Instituto Español de Oceanografia
16	Andre Dijkman	Netherlands	Wageningen IMARES
17	Elise Bellamy	France	Institut Français de Recherche pour l'Exploitation de la Mer
18	Pierluigi Carbonara	Italy	COISPA
19	Kirsti Eriksen	Norway	Institute of Marine Research

Appendix 1 presents the complete listing of the participants in the *Trachurus* species otolith exchange.

3. Sampling collection

A total of 550 fish was sampled from 2003 to 2014 (2003, 2004, 2005, 2006, 2007, 2009, 2011 and 2014) from both Atlantic and Mediterranean area (Tab. 2):

- 95 *Trachurus mediterraneus* sampled in the three geographical areas by COISPA (Italy) and IEO (Spain)
- 134 *Trachurus picturatus* sampled in the three geographical areas by IEO (Spain), COISPA (Italy) and DOP (Portugal)
- 321 *Trachurus trachurus* sampled in the three geographical areas by IFREMER (France), DISTAV (Italy), TI-SF (Germany) and IEO (Spain)

Table 2: Samples distribution by *Trachurus* species (number corresponding to map).

Species	Atlantic Ocean						Mediterranean Sea			Total
	Eastern Channel VIId (1)	Celtic Sea VIIh (2)	Bay of Biscay VIIIc (3)	Azores XII (4)	Portuguese waters IXa (5)	Tenerife (6)	Alboran Sea (7)	South Adriatic Sea (8)	Ligurian Sea (9)	
T. mediterraneus			35		10			50		95
T. picturatus				71		50		13		134
T. trachurus	50	154					20		97	321

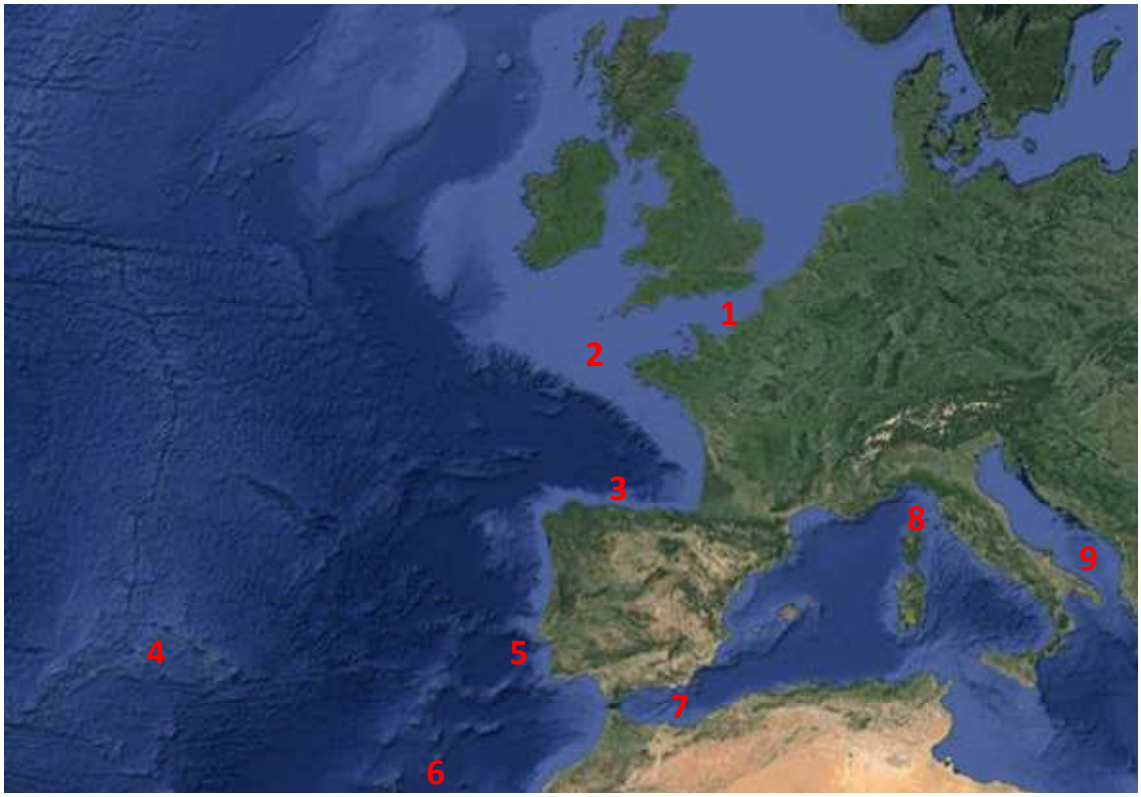

Figure 1: Map of *Trachurus* species sampling areas (*Source*: Google Map 2015).

The samplings came from both the harbor and the survey. The otolith sections and whole otoliths were used during the 2014/2015 exchange but only *Trachurus trachurus* was sampled with both techniques (Table 3).

Table 3: Samples distribution by *Trachurus* species and by preparation method of otolith.

Species	**Otolith section**	**Whole otolith**
Trachurus mediterraneus		95
Trachurus picturatus		134
Trachurus trachurus	201	120
Total	**154**	**349**

4. Reading procedure

One image of each otolith was uploaded to WebGR (http://webgr.azti.es/ce/search/myce). All participants received all informations to participate to this exercise in the WebGR tool. The WebGR tool was used to this exchange. The use of WebGR tool for the exchange has somes advantages: (i) it can facilitate and accelerate the whole exchange process, (ii) annotated images are obtained for every otolith which enables to compare age readings directly and to identify possible sources of bias (iii) it is very easy for the chairman to compile the results. However, the use of WebGR tool for the exchange present some limits: (i) the WebGR tool is not very intuitive tool (ii) the WebGR could be jammed (iii) it is not always possible to upload a large batch of images (problem with the format of the csv file with Windows 7).
The age was assigned taking into account the number of the transparent rings. Moreover the date of capture, the sex and total length were visible by the readers.
All data were extracted of the WebGR and after agreements between age-readers were calculated using the Guus Eltink spreadsheet (Eltink, 2000).

5. Results

The spreadsheet (Eltink, 2000) was completed according to the instructions contained in Guidelines and Tools for Age Reading Comparisons by Eltink *et al.* (2000). Modal ages were calculated for each otolith red, with percentage agreement, mean age and precision coefficient of variation as a definition (for each otolith):

- percentage agreement = 100x(no. of readers agreeing with modal age/total no. of readers).
- precision c. v. = 100x(standard deviation of age readings/mean of age readings).

5.1. Precision

The precision[1] analyse with Coefficient of Variation (CV) and percent of agreement to modal age for otoliths sets according to the *Trachurus* species was presented in the Table 4. Among three *Trachurus* species, all data showed the very low precision with the percent agreement between 47 and 56% and the CV from 29 to 69.

Table 4: Reading's precision by *Trachurus* species.

Trachurus species	Otoliths number	Readers number	Age range	Percentage of Agreement	CV
T. mediterraneus	95	15	0/12	47.1%	43.8%
T. picturatus	133	13	0/15	48.9%	69.0%
T. trachurus	309	17	0/15	55.8%	28.7%

5.1.1. Trachurus mediterraneus

The results of otoliths readings of *Trachurus mediterraneus* showed a better precision in the Mediterranean area than those obtained in the sampling areas from the Atlantic Ocean (Tab. 5).

Table 5: Reading's precision of *Trachurus mediterraneus* by sampling areas.

Sampling areas	Otoliths number	Readers number	Age range	Percentage of Agreement	CV
VIIIc	35	15	0/10	39.3%	40.2%
IXa	10	15	0/6	41.2%	41.7%
South Adriatic Sea	50	15	0/12	53.6%	46.7%

5.1.2. Trachurus picturatus

The results of otoliths readings of *Trachurus picturatus* showed a lower precision in the Azores area than those obtained in the other sampling areas due to especially the old specimen in this area (Tab. 6).

Table 6: Reading's precision by *Trachurus picturatus* by sampling areas.

Sampling areas	Otoliths number	Readers number	Age range	Percentage of Agreement	CV
Azores	70	13	0/15	35.3%	36.0%
Tenerife	50	12	0/5	60.1%	89.3%
South Adriatic Sea	13	12	0/1	79.3%	168.8%

[1] Precision is defined as the variability in the age readings. The precision's errors in age readings are better described by the coefficient of variation (CV) by age group. This measure of precision is independent of the closeness to the true age (ICES, 2007).

5.1.3. Trachurus trachurus

The results of otoliths readings of *Trachurus trachurus* showed a better precision in the Atlantic Ocean (VIId and VIIh) than those obtained in the sampling areas from the Mediterranean Sea (Alboran and Ligurian sea) (Tab. 7). Moreover, in the Ligurian Sea, the analysis between otoliths section and whole otoliths showed the same level of precision (Tab. 7).

Table 7: Reading's precision by *Trachurus trachurus* by sampling areas.

Sampling areas	Otoliths number	Otolith preparation	Readers number	Age range	Percentage of Agreement	CV
VIId	50	Section	16	2/15	55.7%	16.8%
VIIh	154	Section	16	1/14	63.8%	25.9%
Alboran Sea	20	Whole	17	1/3	50.1%	69.7%
Ligurian Sea	45	Section	13	1/14	44.6%	32.6%
Ligurian Sea	50	Whole	14	1/10	44.0%	28.9%

5.2. Relative bias (Accuracy)[2]

The minimal requirement for age reading's consistency is the absence of bias among readers and through time. The hypothesis of an absence of bias between two readers or between a reader and the modal age estimated can be tested non-parametrically with a one-sample Wilcoxon signed rank test.

5.2.1. Trachurus mediterraneus

It should be noted that there are certainly of bias between some readers and modal age for *Trachurus mediterraneus* otoliths. There were no observed bias between five readers (5/15 readers, 33%) and the modal age (Tab. 8).

[2] In absence of calcified structures of known age, the age readings can be compared to modal age, which is defined as the age determined for an individual structure whose most of the readers have a preference. Relative bias can be defined as a systematic over- or underestimation of age compared to the modal age. The age reading comparisons to modal age provide a low estimate of relative bias compared to absolute bias, when most readers have a similar serious bias in age reading (ICES, 2007).

Table 8: Inter-reader bias test and reader against modal age bias test of *Trachurus mediterraneus* otoliths (-: no sign of bias (p>0.05); *: possibility of bias (0.01<p<0.05); **: certainty of bias (p<0.01)).

Inter-reader bias test and reader against MODAL age bias test

	Spain Reader 15	Spain Reader 1	Ireland Reader 14	Italy Reader 3	France Reader 9	Italy Reader 10	Germany Reader 12	Ireland Reader 6	Portugal Reader 2	Portugal Reader 8	Spain Reader 4	Spain Reader 5	Italy Reader 7	Spain Reader 11	Italy Reader 13
Reader 15															
Reader 1	**														
Reader 14	**	**													
Reader 3	*	–	**												
Reader 9	**	*	**	**											
Reader 10	**	**	**	**	–										
Reader 12	*	**	**	**	**	**									
Reader 6	–	**	**	**	**	**	–								
Reader 2	**	**	**	**	–	–	**	**							
Reader 8	–	**	**	*	**	**	**	**	**						
Reader 4	*	**	**	**	**	**	–	–	**	**					
Reader 5	–	**	**	*	**	**	–	**	**	–	*				
Reader 7	**	–	**	*	–	**	**	**	–	**	**	**			
Reader 11	–	**	**	**	**	**	**	*	**	*	*	*	**		
Reader 13	–	**	**	–	**	**	**	**	**	–	**	*	**	**	
MODAL age	–	**	**	–	**	**	**	**	**	–	**	–	**	**	–

5.2.2. Trachurus picturatus

It should be noted that there are certainly of bias between some readers and modal age for *Trachurus picturatus* otoliths. There were no observed bias between two readers (2/13 readers, 15%) and the modal age (Tab. 9).

Table 9: Inter-reader bias test and reader against modal age bias test of *Trachurus mediterraneus* otoliths (-: no sign of bias (p>0.05); *: possibility of bias (0.01<p<0.05); **: certainty of bias (p<0.01)).

Inter-reader bias test and reader against MODAL age bias test

	Germany Reader 12	Spain Reader 4	France Reader 9	Portugal Reader 8	Portugal Reader 2	Italy Reader 10	Italy Reader 3	Ireland Reader 6	Ireland Reader 14	Spain Reader 1	Spain Reader 5	Italy Reader 7	Spain Reader 11
Reader 12													
Reader 4	**												
Reader 9	–	**											
Reader 8	**	**	**										
Reader 2	**	**	**	**									
Reader 10	**	**	**	**	*								
Reader 3	*	**	–	**	**	**							
Reader 6	**	–	**	**	–	**	**						
Reader 14	**	**	**	**		**	**	*					
Reader 1	–	**	–	**	**	**	–	**	**				
Reader 5	**	**	**	**	**	**	**	**	**	**			
Reader 7	**	**	**	**	**	–	**	**	**	**	**		
Reader 11	**	**	**	**	**	**	**	*	**	**	**	**	
MODAL age	*	**	**	**	**	**	–	**	**	**	–	**	**

5.2.3. Trachurus trachurus

It should be noted that there are certainly of bias between some readers and modal age for *Trachurus mediterraneus* otoliths. There were no observed bias between five readers (5/17 readers, 29%) and the modal age (Tab. 10).

Table 10: Inter-reader bias test and reader against modal age bias test of *Trachurus trachurus* otoliths (-: no sign of bias (p>0.05); *: possibility of bias (0.01<p<0.05); **: certainty of bias (p<0.01)).

Inter-reader bias test and reader against MODAL age bias test

	France Reader 9	France Reader 17	Spain Reader 15	Spain Reader 1	Ireland Reader 14	Italy Reader 3	Germany Reader 12	Ireland Reader 6	Netherland Reader 16	Spain Reader 11	Spain Reader 4	Portugal Reader 2	Portugal Reader 8	Spain Reader 5	Italy Reader 7	Norway Reader 19	Italy Reader 13
Reader 9																	
Reader 17	**																
Reader 15	**	**															
Reader 1	**	**	**														
Reader 14	**	**	**	**													
Reader 3	**	*	**	_	**												
Reader 12	**	**	_	**	**	**											
Reader 6	**	**	**	_	**	_	**										
Reader 16	**	**	**	_	**	_	**	_									
Reader 11	**	**	**	**	**	**	**	**	**								
Reader 4	**	**	**	**	**	**	**	**	**	*							
Reader 2	_	*	**	_	**	_	**	**	**	**	**						
Reader 8	**	**	_	**	**	**	_	**	**	*	**	**					
Reader 5	**	*	**	_	**	_	**	**	*	**	**	_	**				
Reader 7	**	_	**	**	**	**	**	**	**	**	**	**	**	**			
Reader 19	**	**	**	**	**	**	**	**	**	**	**	_	**	**	**		
Reader 13	**	**	_	**	**	**	_	_	**	_	_	**	_	_	**	**	
MODAL age	**	**	**	_	**	_	**	_	_	**	**	**	**	_	**	**	**

6. Images of reference

Seven otoliths (7/550, 1.3%) presented 100% agreement.

6.1. *Trachurus trachurus*

Among all otoliths of *Trachurus trachurus* (n=309), there were only five otoliths presented 100% agreement between readers. These five otoliths came from VIIh area (Celtic Sea) and the observed age was 1 year old.

Figure 2 : *Trachurus trachurus* otolith image (EB_14_B6_C4_Or_0004.jpg) from the Celtic Sea (VIIh) with 100% of agreement, 1 year old (from 16 readers). Total length was 10 cm. This specimen caught April 2014.

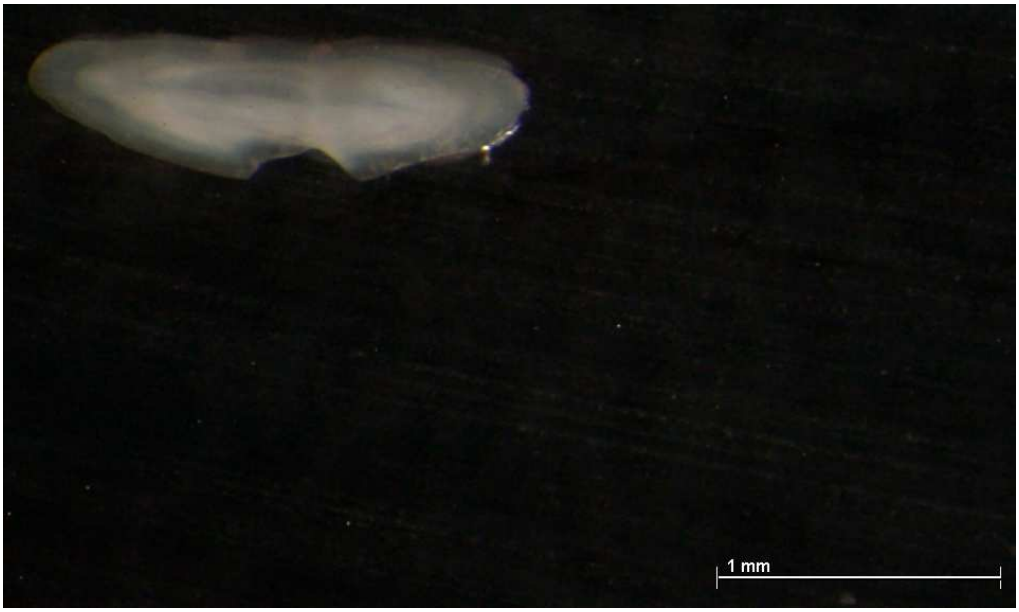

Figure 3 : *Trachurus trachurus* otolith image (EB_14_B6_C5_OCr_0001.jpg) from the Celtic Sea (VIIh) with 100% of agreement, 1 year old (from 16 readers). Total length was 10 cm. This specimen caught April 2014.

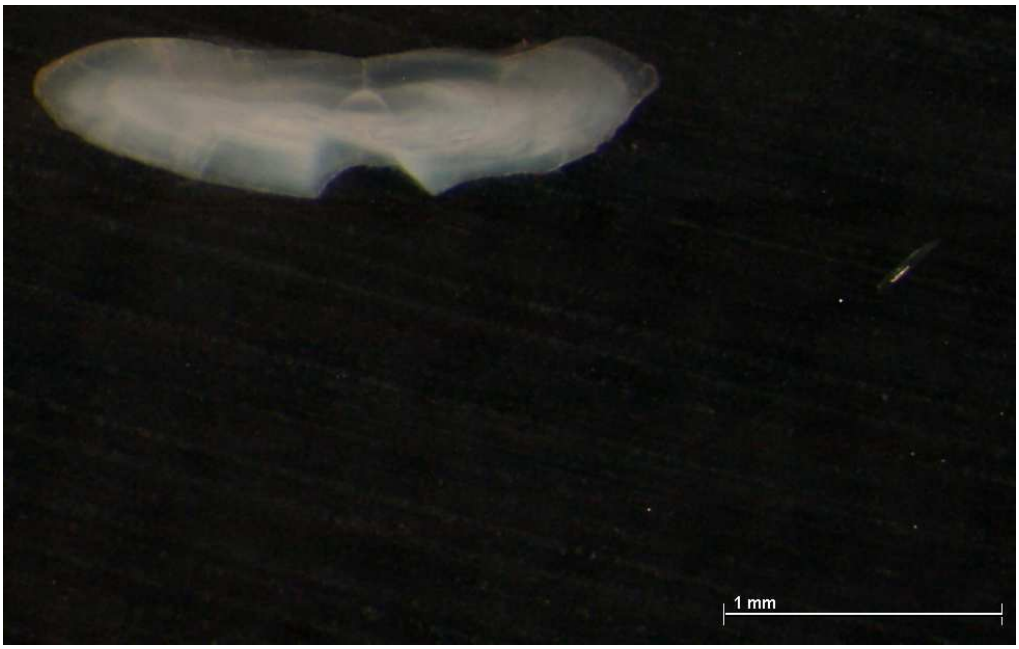

Figure 4 : *Trachurus trachurus* otolith image (EB_14_B6_C5_OCr_0002.jpg) from the Celtic Sea (VIIh) with 100% of agreement, 1 year old (from 16 readers). Total length was 11 cm. This specimen caught April 2014.

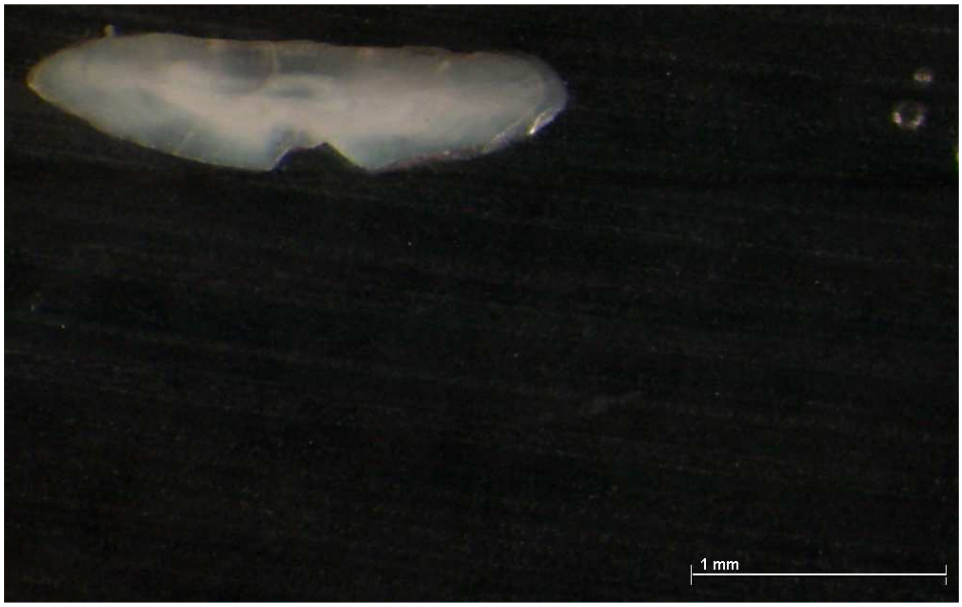

Figure 5 : *Trachurus trachurus* otolith image (EB_14_B6_C5_OCr_0003.jpg) from the Celtic Sea (VIIh) with 100% of agreement, 1 year old (from 16 readers). Total length was 11 cm. This specimen caught April 2014.

Figure 6 : *Trachurus trachurus* otolith image (EB_14_B6_C5_Or_0001.jpg) from the Celtic Sea (VIIh) with 100% of agreement, 1 year old (from 16 readers). Total length was 10 cm. This specimen caught April 2014.

6.2. *Trachurus picturatus*

Among all otoliths of *Trachurus picturatus* (n=132), there were only two otoliths presented 100% agreement between readers. These two otoliths came from South Adriatic Sea and the observed age was 0 year old.

Figure 7 : *Trachurus picturatus* otolith image (COISPA – 4967.jpg) from South Adriatic sea with 100% of agreement, 1 year old (from 13 readers). Total length was 10 cm. This specimen caught July 2013.

Figure 8 : *Trachurus picturatus* otolith image (COISPA – 4973.jpg) from South Adriatic sea with 100% of agreement, 0 year old (from 13 readers). Total length was 11 cm. This specimen caught July 2013.

6.3. *Trachurus mediterraneus*

Among all otoliths of *Trachurus mediterraneus* (n=95), there were no otoliths presented 100% agreement between readers.

7. Abstract

The ICES Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS) identified the need of the Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*Trachurus trachurus, T. mediterreaneus and T. picturatus*) otolith exchange to take place in 2015. It was the forth exchange. The IFREMER institute and the COISPA Tecnologia & Ricerca, Italy, coordinated this exchange. A total of 550 fish was sampled from the Atlantic Ocean (Eastern Channel, Celtic Sea, Bay of Biscay, Azores, Portuguese waters and Tenerife) and the Mediterranean Sea (Alboran Sea, South Adriatic Sea and Ligurian Sea). 19 readers from 8 countries (France, Germany, Spain, Ireland, Italy, Portugal, Netherlands and Norway) participated to this exchange. Among three *Trachurus* species, all data showed the very low precision with the percent agreement between 47 and 56% and the CV from 29 to 69%. The precision analysis showed the same level of precision between otolith sections and whole otoliths from the Ligurian Sea.

8. References

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Appendix 1 : List of participants

Country	Participants in exchange	Email	expertise level T. mediterraneus	expertise level T. pitcuratus	expertise level T. trachurus
Italy	Loredana Casciaro	casciaro@coispa.it	L	none	none
	Pierluigi Carbonara	carbonara@coispa.it	H	none	H
	Luca Lanteri	luca.lanteri@libero.it	M	none	M
	Alessandro Mannini	A.Mannini@unige.it	M	none	M
	Fulvio Garibaldi	garibaldi.f@libero.it	M	none	M
	Andrea Massaro	andreamassaro@live.it	M	L	M
France	Kélig Mahé	kelig.mahe@ifremer.fr	none	none	none
	Elise Bellamy	Elise.Bellamy@ifremer.fr	H	H	H
	Romain Elleboode	romain.elleboode@ifremer.fr	H	H	H
Germany	Gertrud Delfs	gertrud.delfs@ti.bund.de	none	none	medium
	Christoph Stransky	christoph.stransky@ti.bund.de	none	none	none
	Jens Ulleweit	jens.ulleweit@ti.bund.de	none	none	none
Ireland	Eugene Mullins	eugene.mullins@marine.ie	none	none	H
	Macdara O'Cuaig	macdara.ocuaig@marine.ie	none	none	Medium-still in training
Netherlands	André Dijkman	andre.dijkman@wur.nl	none	none	M
	Bolle, Loes	loes.bolle@wur.nl	none	none	none
Norway	Kirsti Børve Eriksen	kirstibe@imr.no	none	none	
	Jane Godiksen	jane.godiksen@imr.no	none	none	L
Spain	Begoña Villamor	begona.villamor@st.ieo.es	none	none	none
	Clara Dueñas	clara.duenas@st.ieo.es	L (1 year-200 otoliths)	none	H (10 years-25000 otoliths)
	Ana Antolinez	ana.antolinez@st.ieo.es	L (1 year-100 otoliths)	none	L (1 year-500 otoliths)
	Eduardo Lopez	eduardo.lopez@vi.ieo.es	M (2 years-1000 otoliths)	none	M (2 years-800 otoliths)
	Mª Teresa García Santamaría	teresa.garcia@ca.ieo.es	L	M	L
	Alba Jurado Ruzafa	alba.jurado@ca.ieo.es	L	M	L
	Pedro Torres	pedro.torres@ma.ieo.es	none	none	none
	Jesus costa	jesus.acosta@ma.ieo.es	L	none	H
Portugal	Alexandra	agarcia@uac.pt	none	M	none

	Garcia				
Poland	Tomasz Nermer	tnermer@mir.gdynia.pl	none	none	H
Denmark	Aage Thaarup	att@aqua.dtu.dk	none	none	H
Portugal	Maria João Ferreira	mjferreira@ipma.pt	L (1 year-200 otoliths)	L (1 year-200 otoliths)	H (13 years-26000 otoliths)

Appendix 2: Details results of *Trachurus trachurus*

The number of age readings, the coefficient of variation (CV), the percentage of agreement and the RELATIVE bias are presented by MODAL age for each age reader and for all readers combined. A weighted mean CV and a weighted mean percent agreement are given by reader and all readers combined. The CV's by MODAL age for each individual age reader and all readers combined indicate the precision in age reading by MODAL age. The weighted mean CV's over all MODAL age groups combined indicate the precision in age reading by reader and for all age readers combined.

NUMBER OF AGE READINGS

	MODAL age	France Reader 9	France Reader 17	Spain Reader 15	Spain Reader 1	Ireland Reader 14	Italy Reader 3	Germany Reader 12	Ireland Reader 6	Netherland Reader 16	Spain Reader 11	Spain Reader 4	Portugal Reader 2	Portugal Reader 8	Spain Reader 5	Italy Reader 7	Norway Reader 19	Italy Reader 13	TOTAL
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	41	7	45	13	41	27	47	46	43	47	47	9	46	36	10	21	20	546
	2	62	6	64	60	46	63	68	68	68	68	68	7	67	67	67	67	26	942
	3	50	10	49	42	24	44	50	51	52	52	52	11	46	51	49	51	26	710
	4	27	-	27	24	11	24	25	27	27	27	26	-	26	26	27	26	13	363
	5	39	4	39	33	26	35	38	39	38	39	39	4	38	39	37	39	14	540
	6	20	4	21	20	11	20	21	21	21	21	21	4	21	21	20	21	8	296
	7	20	1	20	20	13	20	21	21	21	21	21	1	20	21	20	21	5	287
	8	7	-	8	8	4	6	8	8	8	8	8	-	8	8	7	8	1	105
	9	10	2	10	9	4	8	10	10	10	10	10	2	10	10	10	10	3	138
	10	9	1	9	9	4	9	9	9	9	9	9	1	9	9	8	9	2	124
	11	8	1	7	6	1	6	7	8	7	8	8	1	8	8	6	8	-	98
	12	3	1	3	3	2	3	3	3	3	3	3	1	3	3	3	3	-	43
	13	3	1	3	3	2	3	3	3	3	3	3	1	3	3	3	3	-	43
	14	2	1	2	2	1	1	2	2	2	2	2	1	2	2	2	2	-	28
	15	1	-	1	1	-	1	1	1	1	1	1	-	1	1	1	1	-	13
Total	0-15	303	39	309	254	191	271	314	318	314	320	319	43	309	306	271	291	118	4290

COEFFICIENT OF VARIATION (CV)

	MODAL age	France Reader 9	France Reader 17	Spain Reader 15	Spain Reader 1	Ireland Reader 14	Italy Reader 3	Germany Reader 12	Ireland Reader 6	Netherland Reader 16	Spain Reader 11	Spain Reader 4	Portugal Reader 2	Portugal Reader 8	Spain Reader 5	Italy Reader 7	Norway Reader 19	Italy Reader 13	ALL Readers
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	30%	33%	39%	0%	61%	32%	71%	106%	62%	31%	38%	30%	26%	26%	29%	27%	41%	39,1%
	2	24%	32%	33%	38%	42%	23%	51%	66%	31%	32%	32%	28%	31%	39%	38%	31%	23%	35,7%
	3	21%	34%	38%	30%	35%	28%	36%	65%	30%	46%	47%	15%	30%	53%	29%	36%	24%	34,0%
	4	19%	-	22%	15%	31%	12%	29%	33%	16%	32%	29%	-	35%	34%	23%	22%	23%	24,1%
	5	24%	12%	25%	21%	25%	13%	14%	13%	17%	27%	28%	11%	30%	22%	20%	19%	23%	21,2%
	6	24%	18%	16%	13%	32%	20%	21%	16%	26%	19%	20%	9%	22%	18%	15%	18%	11%	17,2%
	7	32%	-	15%	23%	32%	19%	22%	31%	24%	19%	20%	-	20%	21%	17%	22%	23%	21,8%
	8	29%	-	12%	14%	5%	5%	10%	9%	16%	20%	20%	-	11%	13%	19%	15%	-	17,6%
	9	33%	0%	19%	15%	14%	15%	12%	32%	29%	5%	5%	18%	9%	10%	22%	8%	14%	18,0%
	10	28%	-	31%	13%	38%	23%	23%	37%	27%	8%	8%	-	28%	12%	21%	25%	11%	19,0%
	11	38%	-	7%	6%	-	5%	22%	25%	35%	15%	9%	-	7%	5%	5%	11%	-	16,6%
	12	35%	-	5%	30%	9%	5%	5%	5%	5%	5%	5%	-	5%	10%	11%	5%	-	15,5%
	13	50%	-	8%	25%	11%	31%	5%	5%	0%	4%	4%	-	8%	16%	64%	5%	-	24,5%
	14	33%	-	5%	5%	-	-	10%	6%	6%	0%	0%	-	6%	5%	42%	0%	-	22,4%
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted mean	0-15	25,3%	22,6%	27,7%	23,0%	38,2%	20,5%	36,3%	50,4%	30,0%	28,6%	29,5%	17,3%	26,2%	30,3%	26,3%	24,8%	24,6%	28,7%
	RANKING	7	3	10	4	16	2	15	17	13	11	12	1	8	14	9	6	5	

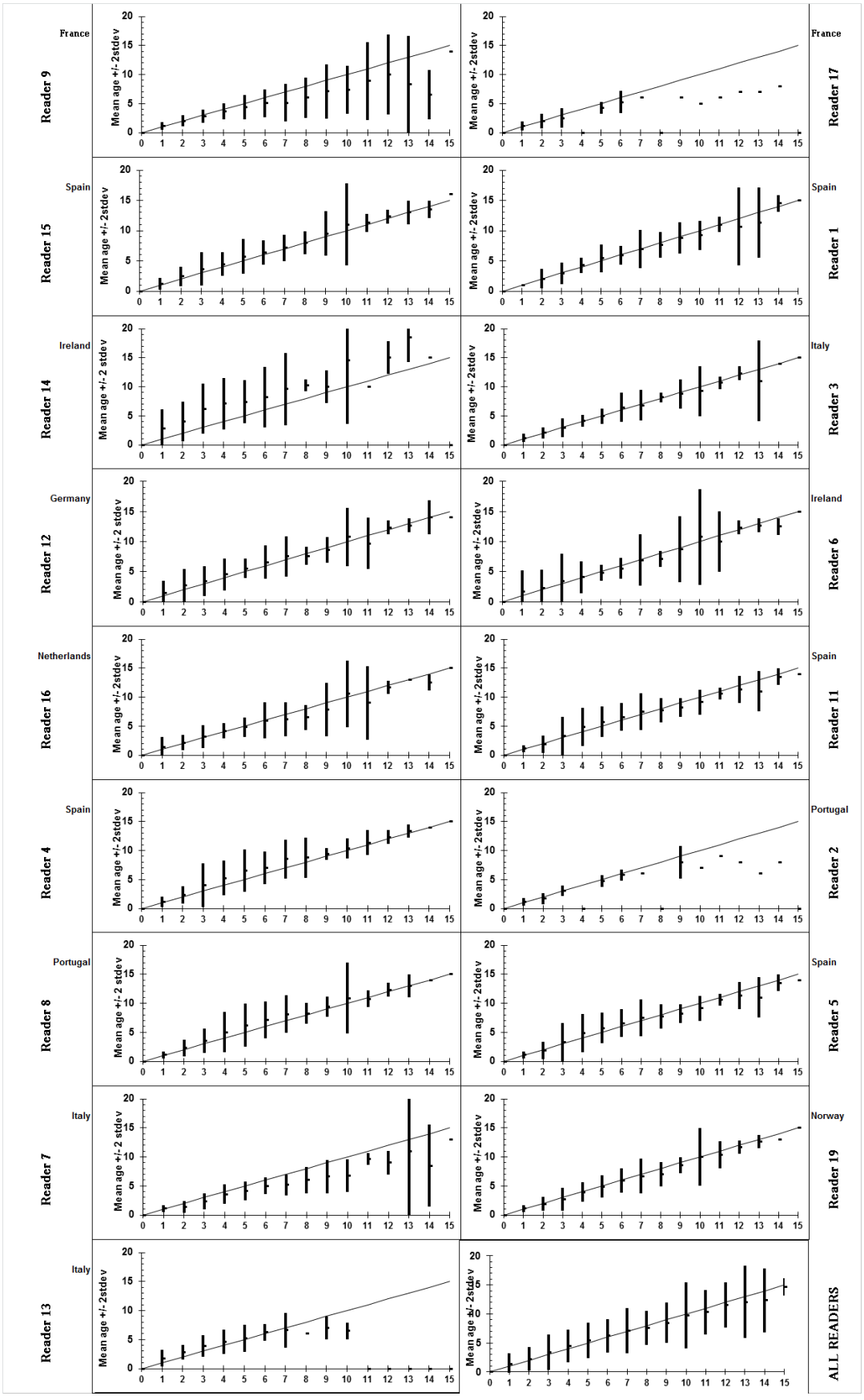
PERCENTAGE AGREEMENT

	MODAL age	France Reader 9	France Reader 17	Spain Reader 15	Spain Reader 1	Ireland Reader 14	Italy Reader 3	Germany Reader 12	Ireland Reader 6	Netherland Reader 16	Spain Reader 11	Spain Reader 4	Portugal Reader 2	Portugal Reader 8	Spain Reader 5	Italy Reader 7	Norway Reader 19	Italy Reader 13	ALL
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	88%	86%	80%	100%	12%	85%	74%	78%	77%	85%	83%	89%	91%	92%	90%	90%	40%	77%
	2	82%	67%	56%	60%	13%	78%	44%	85%	65%	79%	78%	71%	70%	69%	31%	64%	31%	63%
	3	74%	40%	63%	38%	17%	57%	50%	49%	60%	46%	48%	82%	59%	45%	37%	51%	23%	50%
	4	63%	-	67%	67%	9%	75%	28%	52%	67%	44%	42%	-	54%	46%	48%	62%	69%	54%
	5	54%	25%	51%	42%	15%	74%	37%	77%	66%	41%	41%	75%	45%	51%	24%	69%	43%	50%
	6	45%	50%	57%	70%	27%	60%	48%	57%	71%	43%	43%	75%	52%	52%	20%	52%	50%	51%
	7	35%	0%	55%	45%	23%	65%	67%	43%	14%	33%	29%	0%	55%	43%	5%	33%	60%	39%
	8	29%	-	63%	88%	0%	83%	38%	25%	13%	75%	75%	-	63%	38%	14%	38%	0%	47%
	9	40%	0%	30%	33%	50%	50%	40%	30%	40%	60%	60%	50%	50%	40%	10%	40%	0%	39%
	10	11%	0%	33%	67%	0%	44%	44%	44%	67%	56%	56%	0%	78%	44%	0%	56%	0%	44%
	11	50%	0%	43%	67%	0%	67%	43%	50%	29%	75%	88%	0%	50%	63%	0%	38%	-	50%
	12	67%	0%	67%	33%	0%	67%	67%	67%	67%	67%	67%	0%	67%	67%	0%	67%	-	53%
	13	33%	0%	33%	67%	0%	67%	67%	67%	100%	67%	67%	0%	33%	0%	0%	67%	-	47%
	14	0%	0%	50%	50%	0%	100%	0%	0%	0%	100%	100%	0%	100%	50%	0%	0%	-	36%
	15	0%	-	0%	100%	-	100%	0%	100%	100%	100%	100%	-	100%	0%	0%	100%	-	62%
Weighted mean	0-15	63,4%	43,6%	58,9%	56,3%	14,7%	69,7%	48,7%	63,5%	59,9%	60,0%	59,6%	67,4%	63,4%	56,5%	28,4%	58,1%	37,3%	55,1%
	RANKING	5	14	9	12	17	1	13	3	7	6	8	2	4	11	16	10	15	

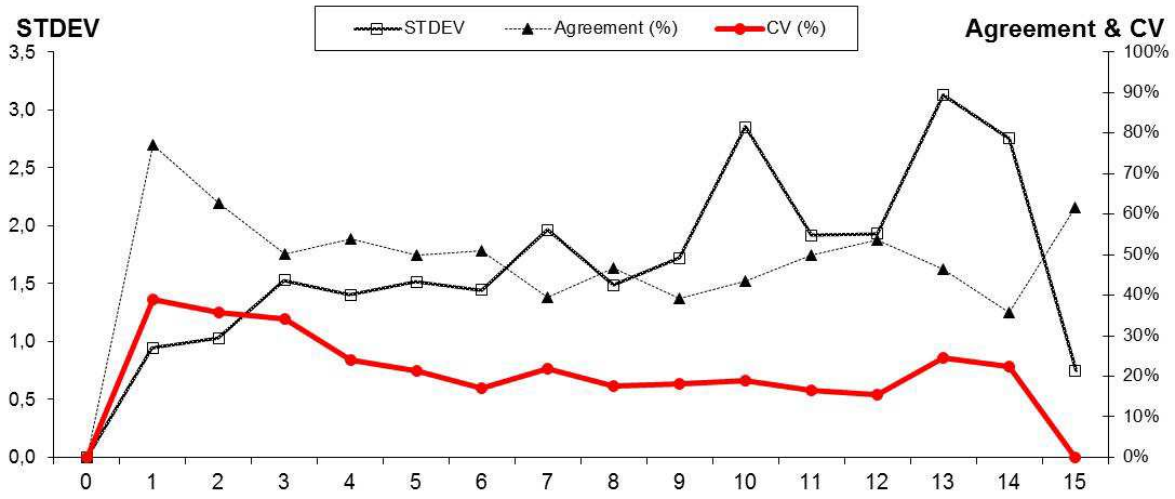
RELATIVE BIAS

	MODAL age	France Reader 9	France Reader 17	Spain Reader 15	Spain Reader 1	Ireland Reader 14	Italy Reader 3	Germany Reader 12	Ireland Reader 6	Netherland Reader 16	Spain Reader 11	Spain Reader 4	Portugal Reader 2	Portugal Reader 8	Spain Reader 5	Italy Reader 7	Norway Reader 19	Italy Reader 13	ALL
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	0,12	0,14	0,22	0,00	1,76	0,15	0,43	0,65	0,37	0,15	0,19	0,11	0,09	0,08	0,10	0,10	0,75	0,37
	2	0,03	0,00	0,42	0,07	2,02	0,06	0,71	0,31	0,12	0,29	0,35	-0,29	0,31	-0,13	-0,66	-0,12	0,81	0,24
	3	-0,18	-0,50	0,63	-0,05	3,21	-0,09	0,46	0,47	0,17	0,94	1,02	0,00	0,52	0,24	-0,63	-0,31	0,92	0,36
	4	-0,37	-	0,44	0,29	3,09	0,08	0,56	0,07	0,15	1,37	1,27	-	1,00	0,88	-0,41	-0,08	0,62	0,49
	5	-0,64	-0,75	0,74	0,45	2,42	-0,09	0,55	-0,18	-0,18	1,51	1,56	-0,25	1,21	0,74	-0,89	-0,10	0,21	0,45
	6	-0,95	-0,75	0,38	-0,10	2,18	0,45	0,57	-0,48	-0,05	0,86	1,00	-0,25	1,10	0,57	-1,00	-0,10	0,25	0,24
	7	-1,90	-1,00	0,15	-0,05	2,62	-0,20	0,52	-0,10	-0,86	1,29	1,52	-1,00	1,10	0,48	-1,85	-0,33	-0,40	0,10
	8	-2,00	-	0,00	-0,38	2,25	0,17	-0,38	-0,88	-1,50	0,75	0,75	-	0,25	-0,25	-2,00	-1,00	-2,00	-0,39
	9	-1,90	-3,00	0,50	-0,22	1,00	-0,25	-0,40	-0,30	-1,20	0,40	0,40	-1,00	0,40	-0,80	-2,40	-0,40	-2,00	-0,51
	10	-2,67	-5,00	1,00	-0,78	4,50	-0,78	0,78	0,78	0,56	0,33	0,33	-3,00	0,89	-0,89	-3,25	0,00	-3,50	-0,22
	11	-2,13	-5,00	0,29	0,00	-1,00	-0,33	-1,29	-1,00	-2,00	0,75	0,38	-2,00	-0,25	-0,38	-1,33	-0,63	-	-0,66
	12	-2,00	-5,00	0,33	-1,33	3,00	0,33	0,33	0,33	-0,33	0,33	0,33	-4,00	0,33	-0,67	-3,00	-0,33	-	-0,44
	13	-4,67	-6,00	0,00	-1,67	5,50	-2,00	-0,33	-0,33	0,00	0,33	0,33	-7,00	0,00	-2,00	-2,00	-0,33	-	-0,93
	14	-7,50	-6,00	-0,50	0,50	1,00	0,00	0,00	-1,50	-1,50	0,00	0,00	-6,00	0,00	-0,50	-5,50	-1,00	-	-1,64
	15	-1,00	-	1,00	0,00	-	0,00	-1,00	0,00	0,00	0,00	0,00	-	0,00	-1,00	-2,00	0,00	-	-0,31
Weighted mean	0-15	-0,67	-1,13	0,44	0,00	2,33	-0,03	0,44	0,14	-0,08	0,74	0,79	-0,65	0,58	0,16	-1,01	-0,20	0,47	0,21
	RANKING	12	16	8	1	17	2	7	4	3	13	14	11	10	5	15	6	9	

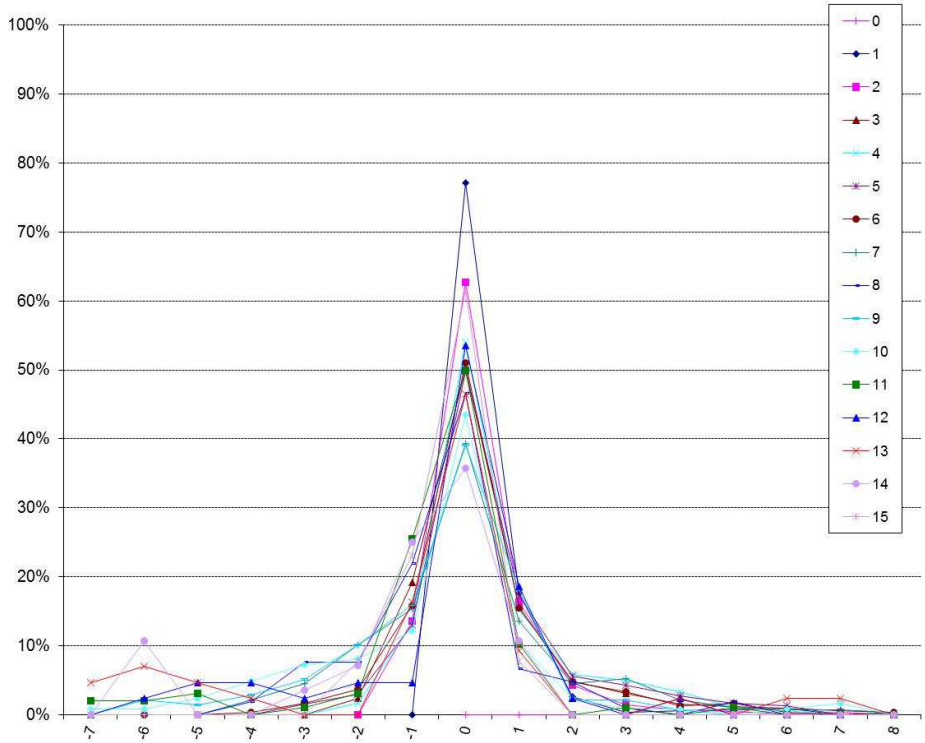
In the age bias plots below the mean age recorded +/- 2stdev of each age reader and all readers combined are plotted against the MODAL age. The estimated mean age corresponds to MODAL age, if the estimated mean age is on the 1:1 equilibrium line (solid line). RELATIVE bias is the age difference between estimated mean age and MODAL age.


Reader 9
France
Reader 17
France
Reader 15
Spain
Reader 1
Spain
Reader 14
Ireland
Reader 3
Italy
Reader 12
Germany
Reader 6
Ireland
Reader 16
Netherlands
Reader 11
Spain
Reader 4
Spain
Reader 2
Portugal
Reader 8
Portugal
Reader 5
Spain
Reader 7
Italy
Reader 19
Norway
Reader 13
Italy
ALL READERS
Mean age +/- 2stdev

The coefficient of variation (CV%), percentage of agreement and the standard deviation (STDEV) are plotted against MODAL age. CV is much less age dependent than the standard deviation (STDEV) and the percentage of agreement. CV is therefore a better index for the precision in age reading. Problems in age reading are indicated by relatively high CV's at age.



The distribution of the age reading errors in percentage by MODAL age as observed from the whole group of age readers in an age reading comparison to MODAL age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. It appears to be no RELATIVE bias, if the age reading errors are normally distributed. The distributions are skewed, if RELATIVE bias occurs.



Appendix 3: Details results of *Trachurus picturatus*

The number of age readings, the coefficient of variation (CV), the percentage of agreement and the RELATIVE bias are presented by MODAL age for each age reader and for all readers combined. A weighted mean CV and a weighted mean percent agreement are given by reader and all readers combined. The CV's by MODAL age for each individual age reader and all readers combined indicate the precision in age reading by MODAL age. The weighted mean CV's over all MODAL age groups combined indicate the precision in age reading by reader and for all age readers combined.

NUMBER OF AGE READINGS

	MODAL age	Germany Reader 12	Spain Reader 4	France Reader 9	Portugal Reader 8	Portugal Reader 2	Italy Reader 10	Italy Reader 3	Ireland Reader 6	Ireland Reader 14	Spain Reader 1	Spain Reader 5	Italy Reader 7	Spain Reader 11	TOTAL
	0	25	25	25	25	24	25	25	25	-	24	25	25	25	298
	1	28	27	28	28	17	28	27	28	4	28	27	28	28	326
	2	16	16	16	16	14	15	15	16	-	16	16	15	16	187
	3	7	7	7	7	7	7	6	7	-	7	6	7	7	82
	4	1	1	1	1	-	1	1	1	-	1	1	1	1	11
	5	3	3	3	3	1	2	3	3	1	3	3	3	3	34
	6	2	3	3	2	-	3	2	3	-	3	3	3	3	30
	7	4	5	5	4	-	4	2	5	3	5	5	4	5	51
	8	10	12	12	12	-	6	5	12	4	12	12	11	12	120
	9	11	13	13	12	-	11	5	13	3	13	13	13	13	133
	10	4	6	6	6	-	5	3	6	2	6	6	6	6	62
	11	4	5	5	5	-	5	2	5	2	5	5	5	5	53
	12	2	2	2	2	-	2	2	2	1	2	2	2	2	23
	13	3	4	4	4	-	4	2	4	1	4	4	4	4	42
	14	1	2	2	2	-	2	1	2	-	2	2	2	2	20
	15	-	1	1	1	-	1	-	1	-	1	1	1	1	-
Total	0-15	121	132	133	130	63	121	101	133	21	132	131	130	133	1481

COEFFICIENT OF VARIATION (CV)

	MODAL age	Germany Reader 12	Spain Reader 4	France Reader 9	Portugal Reader 8	Portugal Reader 2	Italy Reader 10	Italy Reader 3	Ireland Reader 6	Ireland Reader 14	Spain Reader 1	Spain Reader 5	Italy Reader 7	Spain Reader 11	ALL Readers
	0	125%	276%	106%	234%	0%	0%	149%	115%	-	270%	115%	0%	346%	191,5%
	1	40%	51%	48%	46%	94%	118%	43%	51%	7%	57%	92%	69%	47%	64,9%
	2	38%	37%	68%	32%	30%	135%	19%	12%	-	51%	63%	56%	37%	46,2%
	3	28%	38%	41%	35%	28%	79%	21%	21%	-	19%	35%	44%	37%	36,8%
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	44%	36%	60%	29%	-	35%	27%	54%	-	20%	20%	43%	44%	32,6%
	6	20%	18%	0%	31%	-	22%	11%	16%	-	0%	22%	9%	11%	29,8%
	7	9%	34%	18%	22%	-	35%	0%	32%	25%	18%	27%	24%	30%	33,8%
	8	12%	22%	18%	19%	-	14%	20%	20%	11%	19%	19%	24%	28%	26,7%
	9	17%	21%	20%	20%	-	27%	6%	26%	8%	21%	34%	23%	20%	28,7%
	10	5%	13%	14%	16%	-	24%	33%	16%	9%	13%	5%	12%	15%	23,9%
	11	17%	8%	25%	5%	-	27%	8%	19%	18%	15%	9%	18%	8%	25,9%
	12	28%	0%	16%	5%	-	8%	9%	20%	-	8%	6%	0%	0%	25,3%
	13	10%	0%	11%	6%	-	12%	16%	13%	-	25%	8%	12%	0%	23,9%
	14	-	0%	14%	0%	-	9%	-	6%	-	8%	6%	8%	6%	-
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted mean	0-15	47,3%	76,8%	48,4%	67,2%	35,1%	56,8%	56,4%	44,3%	10,8%	75,6%	58,3%	31,7%	89,2%	69,0%
	RANKING	5	12	6	10	3	8	7	4	1	11	9	2	13	

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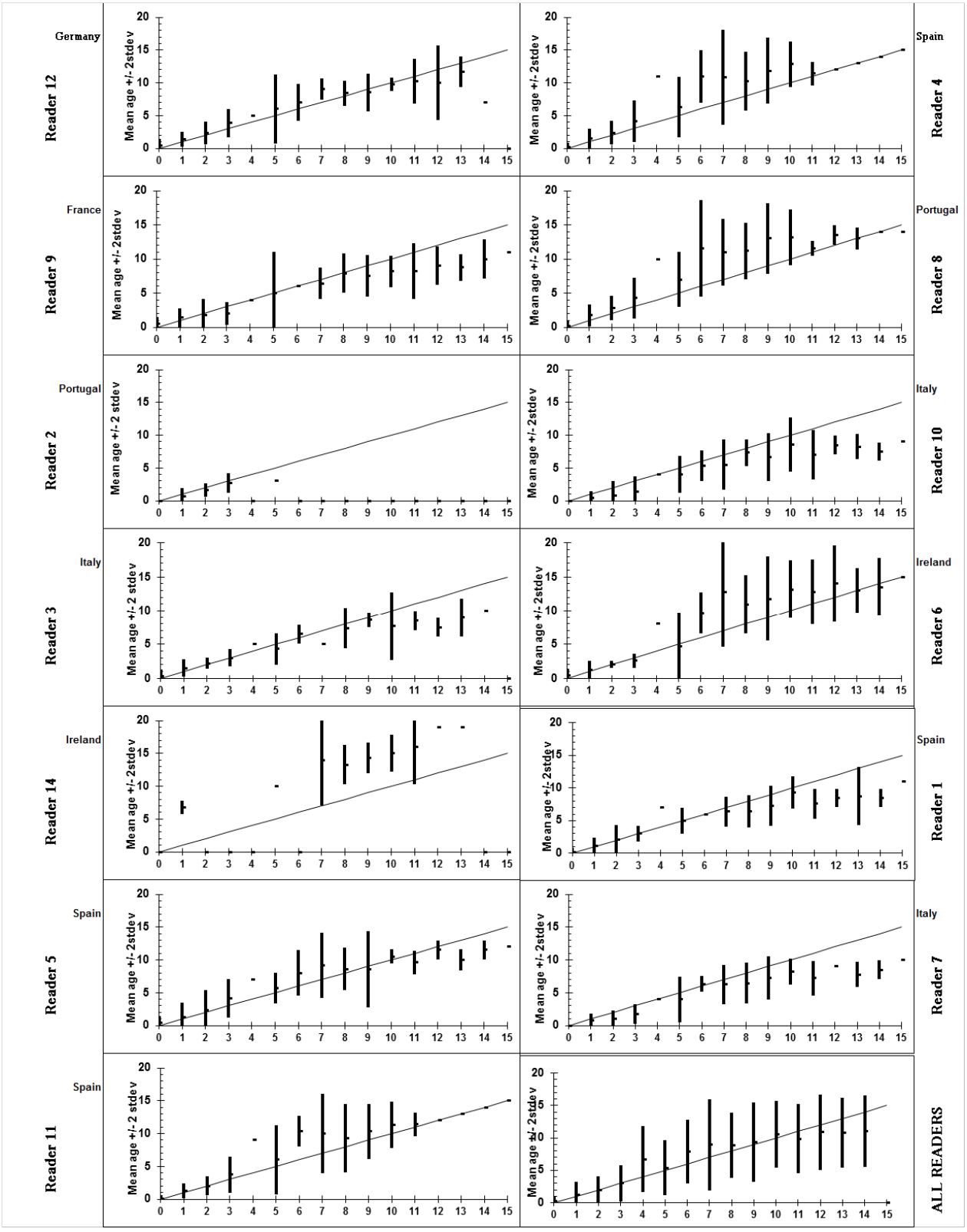
	MODAL age	Germany Reader 12	Spain Reader 4	France Reader 9	Portugal Reader 8	Portugal Reader 2	Italy Reader 10	Italy Reader 3	Ireland Reader 6	Ireland Reader 14	Spain Reader 1	Spain Reader 5	Italy Reader 7	Spain Reader 11	ALL
	0	60%	88%	52%	84%	100%	100%	68%	56%	-	88%	56%	100%	92%	79%
	1	61%	56%	57%	32%	53%	43%	37%	82%	0%	68%	56%	68%	71%	56%
	2	56%	81%	31%	44%	64%	7%	80%	94%	-	56%	38%	20%	69%	53%
	3	57%	57%	29%	43%	43%	29%	67%	57%	-	71%	50%	14%	43%	46%
	4	0%	0%	100%	0%	-	100%	0%	0%	-	0%	0%	100%	0%	27%
	5	33%	67%	33%	33%	0%	50%	67%	33%	0%	33%	67%	67%	33%	44%
	6	50%	0%	100%	0%	-	67%	50%	0%	-	100%	33%	67%	0%	43%
	7	0%	40%	20%	0%	-	50%	0%	0%	0%	20%	40%	75%	40%	25%
	8	80%	33%	50%	17%	-	17%	40%	25%	0%	33%	33%	36%	42%	36%
	9	45%	31%	23%	8%	-	0%	60%	38%	0%	15%	46%	31%	38%	29%
	10	75%	17%	17%	0%	-	20%	33%	0%	0%	67%	50%	0%	50%	27%
	11	25%	80%	0%	40%	-	0%	0%	20%	0%	0%	20%	0%	80%	25%
	12	50%	100%	0%	0%	-	0%	0%	50%	0%	0%	50%	0%	100%	30%
	13	33%	100%	0%	50%	-	0%	0%	50%	0%	0%	0%	0%	100%	31%
	14	0%	100%	0%	100%	-	0%	0%	0%	-	0%	0%	0%	100%	30%
	15	-	100%	0%	0%	-	0%	-	100%	-	0%	0%	0%	100%	-
Weighted mean	0-15	54,5%	60,6%	39,1%	38,5%	71,4%	39,7%	51,5%	52,6%	0,0%	52,3%	44,3%	49,2%	64,7%	50,0%
	RANKING	4	3	11	12	1	10	7	5	13	6	9	8	2	

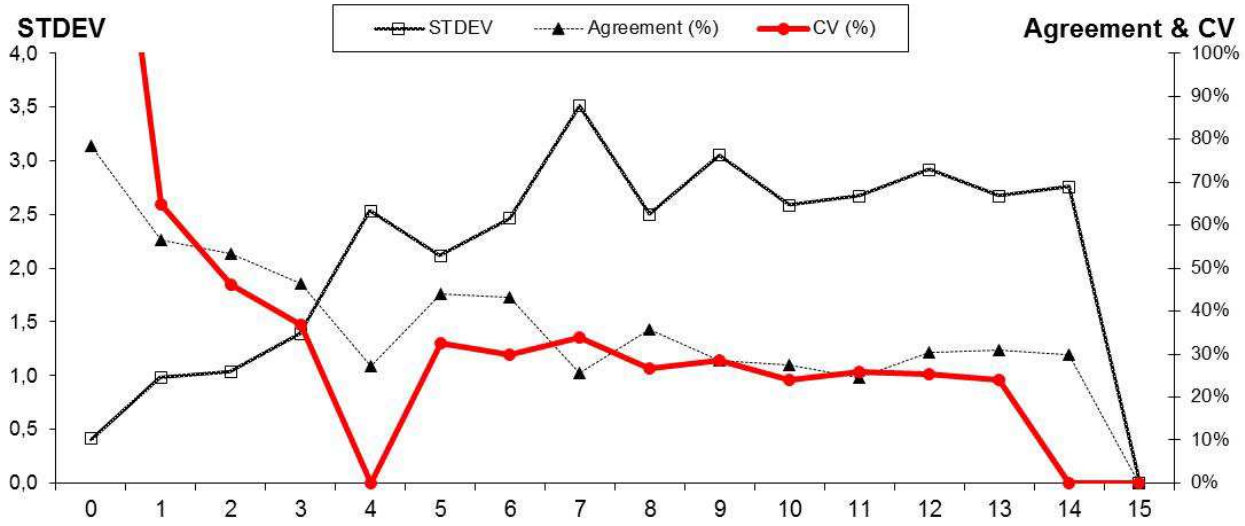
RELATIVE BIAS

	MODAL age	Germany Reader 12	Spain Reader 4	France Reader 9	Portugal Reader 8	Portugal Reader 2	Italy Reader 10	Italy Reader 3	Ireland Reader 6	Ireland Reader 14	Spain Reader 1	Spain Reader 5	Italy Reader 7	Spain Reader 11	ALL
	0	0,40	0,12	0,48	0,16	0,00	0,00	0,32	0,44	-	0,13	0,44	0,00	0,08	0,21
	1	0,43	0,48	0,43	0,75	-0,35	-0,57	0,48	0,29	5,75	0,14	0,22	-0,25	0,25	0,28
	2	0,31	0,38	-0,25	0,81	-0,36	-1,20	0,20	0,06	-	0,13	0,38	-0,93	0,00	-0,03
	3	0,86	1,14	-1,00	1,29	-0,29	-1,57	0,00	-0,43	-	0,00	1,17	-1,29	0,71	0,04
	4	1,00	7,00	0,00	6,00	-	0,00	1,00	4,00	-	3,00	3,00	0,00	5,00	2,73
	5	1,00	1,33	0,00	2,00	-2,00	-1,00	-0,67	-0,33	5,00	0,00	0,67	-1,00	1,00	0,38
	6	1,00	5,00	0,00	5,50	-	-0,67	0,50	3,67	-	0,00	2,00	0,33	4,33	1,93
	7	2,00	3,80	-0,60	4,00	-	-1,50	-2,00	5,80	7,00	-0,60	2,20	-0,75	3,00	1,96
	8	0,40	2,25	-0,08	3,17	-	-0,67	-0,60	2,92	5,25	-1,58	0,58	-1,55	1,33	0,87
	9	-0,45	2,85	-1,46	4,00	-	-2,36	-0,40	2,77	5,33	-1,77	-0,46	-1,77	1,31	0,38
	10	-0,25	2,83	-1,83	3,17	-	-1,40	-2,33	3,17	5,00	-0,67	0,50	-1,83	1,33	0,56
	11	-0,75	0,40	-2,80	0,60	-	-4,00	-2,50	1,80	5,00	-3,40	-1,40	-3,80	0,40	-1,11
	12	-2,00	0,00	-3,00	1,50	-	-3,50	-4,50	2,00	7,00	-3,50	-0,50	-3,00	0,00	-1,13
	13	-1,33	0,00	-4,25	0,00	-	-4,75	-4,00	0,00	6,00	-4,25	-3,00	-5,25	0,00	-2,19
	14	-7,00	0,00	-4,00	0,00	-	-6,50	-4,00	-0,50	-	-5,50	-2,50	-5,50	0,00	-3,00
	15	-	0,00	-4,00	-1,00	-	-6,00	-	0,00	-	-4,00	-3,00	-5,00	0,00	-
Weighted mean	0-15	0,22	1,20	-0,53	1,51	-0,24	-1,30	-0,18	1,22	5,67	-0,70	0,21	-1,14	0,70	0,21
	RANKING	3	9	5	12	4	11	1	10	13	7	2	8	6	

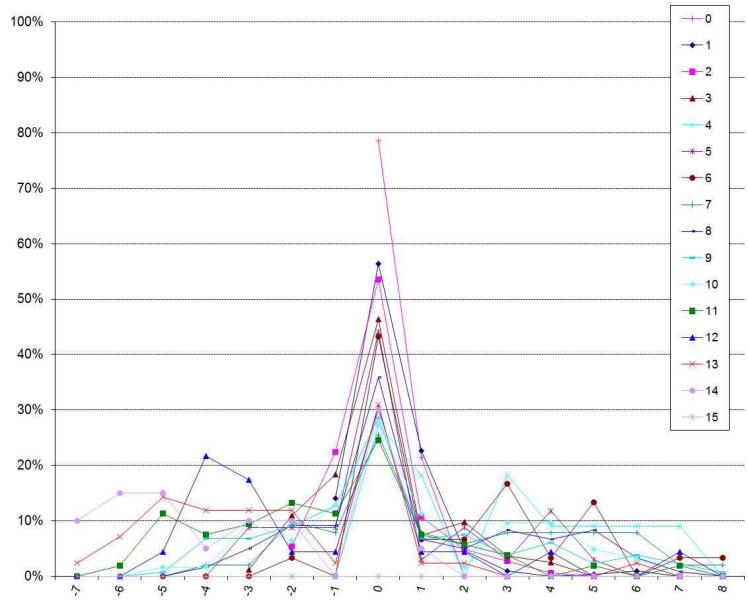
In the age bias plots below the mean age recorded +/- 2stdev of each age reader and all readers combined are plotted against the MODAL age. The estimated mean age corresponds to MODAL age, if the estimated mean age is on the 1:1 equilibrium line (solid line). RELATIVE bias is the age difference between estimated mean age and MODAL age.



The coefficient of variation (CV%), percentage of agreement and the standard deviation (STDEV) are plotted against MODAL age. CV is much less age dependent than the standard deviation (STDEV) and the percentage of agreement. CV is therefore a better index for the precision in age reading. Problems in age reading are indicated by relatively high CV's at age.



The distribution of the age reading errors in percentage by MODAL age as observed from the whole group of age readers in an age reading comparison to MODAL age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. It appears to be no RELATIVE bias, if the age reading errors are normally distributed. The distributions are skewed, if RELATIVE bias occurs.



Appendix 4: Details results of *Trachurus mediterraneus*

The number of age readings, the coefficient of variation (CV), the percentage of agreement and the RELATIVE bias are presented by MODAL age for each age reader and for all readers combined. A weighted mean CV and a weighted mean percent agreement are given by reader and all readers combined. The CV's by MODAL age for each individual age reader and all readers combined indicate the precision in age reading by MODAL age. The weighted mean CV's over all MODAL age groups combined indicate the precision in age reading by reader and for all age readers combined.

NUMBER OF AGE READINGS

	MODAL	Spain	Spain	Ireland	Italy	France	Italy	Germany	Ireland	Portugal	Portugal	Spain	Spain	Italy	Spain	Italy	
	age	Reader 15	Reader 1	Reader 14	Reader 3	Reader 9	Reader 10	Reader 12	Reader 6	Reader 2	Reader 8	Reader 4	Reader 5	Reader 7	Reader 11	Reader 13	TOTAL
	0	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	59
	1	10	10	10	7	10	8	10	10	10	10	10	10	10	10	9	144
	2	12	10	12	11	12	10	12	12	12	12	12	12	12	12	12	175
	3	19	17	20	18	19	19	19	20	20	20	20	20	20	20	20	291
	4	12	11	12	12	11	10	12	12	12	9	12	12	12	12	12	173
	5	13	11	13	11	12	9	13	13	13	12	13	13	13	13	13	185
	6	13	13	13	12	13	11	13	13	13	13	13	13	13	13	13	192
	7	6	6	6	4	6	6	5	6	5	6	6	6	6	6	6	86
	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	43
	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12	1	1	1	1	-	1	1	1	1	1	1	1	1	1	1	14
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0-15	94	87	95	83	89	82	93	95	94	91	95	95	95	95	94	1377

COEFFICIENT OF VARIATION (CV)

	MODAL	Spain	Spain	Ireland	Italy	France	Italy	Germany	Ireland	Portugal	Portugal	Spain	Spain	Italy	Spain	Italy	ALL
	age	Reader 15	Reader 1	Reader 14	Reader 3	Reader 9	Reader 10	Reader 12	Reader 6	Reader 2	Reader 8	Reader 4	Reader 5	Reader 7	Reader 11	Reader 13	Readers
	0	0%	0%	0%	0%	87%	0%	0%	115%	0%	0%	0%	0%	0%	0%	0%	215,3%
	1	50%	0%	35%	55%	72%	119%	92%	61%	66%	35%	29%	73%	82%	29%	34%	59,5%
	2	28%	37%	27%	33%	60%	72%	59%	35%	32%	35%	27%	14%	37%	27%	25%	43,9%
	3	33%	36%	48%	25%	26%	52%	33%	32%	22%	58%	50%	54%	31%	46%	49%	33,4%
	4	32%	31%	32%	29%	24%	35%	31%	18%	23%	33%	17%	37%	29%	17%	25%	31,8%
	5	13%	11%	31%	51%	26%	43%	36%	23%	58%	13%	10%	16%	42%	23%	26%	36,5%
	6	0%	19%	19%	37%	26%	32%	19%	24%	36%	11%	15%	15%	29%	10%	29%	23,6%
	7	6%	15%	17%	74%	35%	35%	7%	16%	31%	19%	11%	9%	36%	7%	24%	36,9%
	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10	10%	11%	17%	40%	90%	39%	18%	28%	48%	6%	0%	19%	108%	6%	43%	30,3%
	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14	-	-	-	-	-	-	-	6%	-	-	-	-	6%	-	-	-
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Veighted mea	0-15	22,1%	20,8%	29,7%	35,4%	39,2%	49,7%	36,8%	32,9%	34,8%	29,2%	23,2%	30,8%	38,8%	23,3%	30,5%	43,8%
	RANKING	2	1	6	11	14	15	12	9	10	5	3	8	13	4	7	

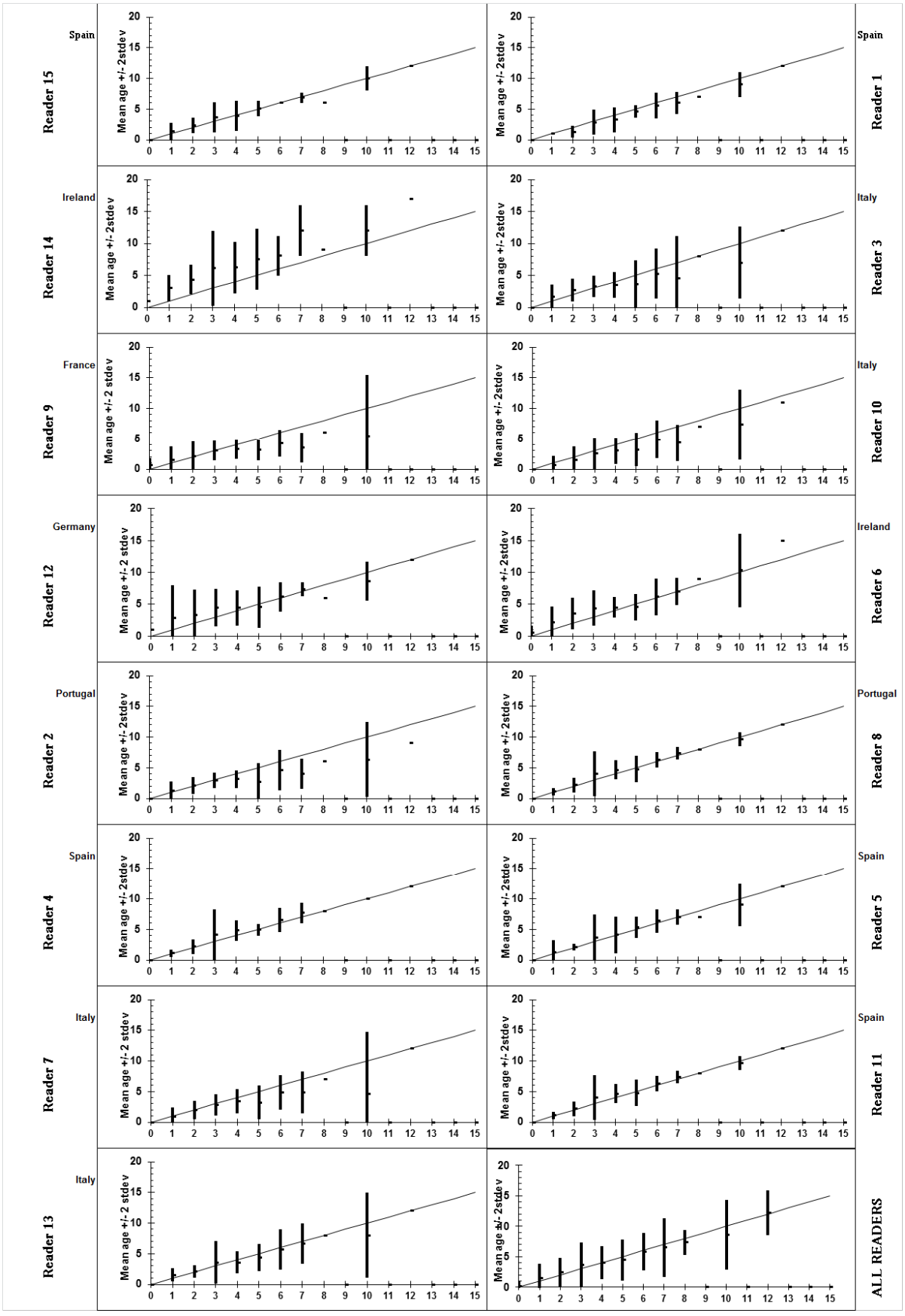
PERCENTAGE AGREEMENT

	MODAL	Spain	Spain	Ireland	Italy	France	Italy	Germany	Ireland	Portugal	Portugal	Spain	Spain	Italy	Spain	Italy	
	age	Reader 15	Reader 1	Reader 14	Reader 3	Reader 9	Reader 10	Reader 12	Reader 6	Reader 2	Reader 8	Reader 4	Reader 5	Reader 7	Reader 11	Reader 13	ALL
	0	100%	100%	0%	100%	33%	100%	0%	50%	100%	100%	100%	100%	100%	100%	100%	80%
	1	70%	100%	0%	57%	80%	38%	40%	30%	40%	80%	90%	90%	50%	90%	44%	60%
	2	75%	30%	0%	45%	33%	30%	50%	17%	58%	58%	67%	92%	50%	67%	75%	50%
	3	63%	53%	0%	72%	58%	21%	32%	20%	75%	40%	55%	35%	65%	60%	40%	46%
	4	58%	55%	17%	33%	45%	20%	58%	67%	33%	22%	42%	25%	25%	50%	33%	39%
	5	85%	64%	8%	9%	8%	33%	23%	62%	8%	58%	77%	46%	23%	69%	38%	41%
	6	100%	69%	23%	25%	15%	36%	38%	15%	38%	77%	54%	62%	38%	77%	15%	46%
	7	83%	33%	0%	0%	0%	17%	60%	50%	0%	67%	50%	67%	17%	67%	50%	38%
	8	0%	0%	0%	100%	0%	0%	0%	0%	0%	100%	100%	0%	0%	100%	100%	33%
	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10	33%	33%	33%	0%	0%	0%	33%	0%	0%	67%	100%	67%	33%	67%	67%	37%
	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12	100%	100%	0%	100%	-	0%	100%	0%	0%	0%	100%	100%	100%	100%	100%	64%
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Veighted mea	0-15	74,5%	59,8%	7,4%	43,4%	36,0%	29,3%	38,7%	33,7%	42,6%	58,2%	65,3%	57,9%	44,2%	69,5%	45,7%	47,2%
	RANKING	1	4	15	9	12	14	11	13	10	5	3	6	8	2	7	

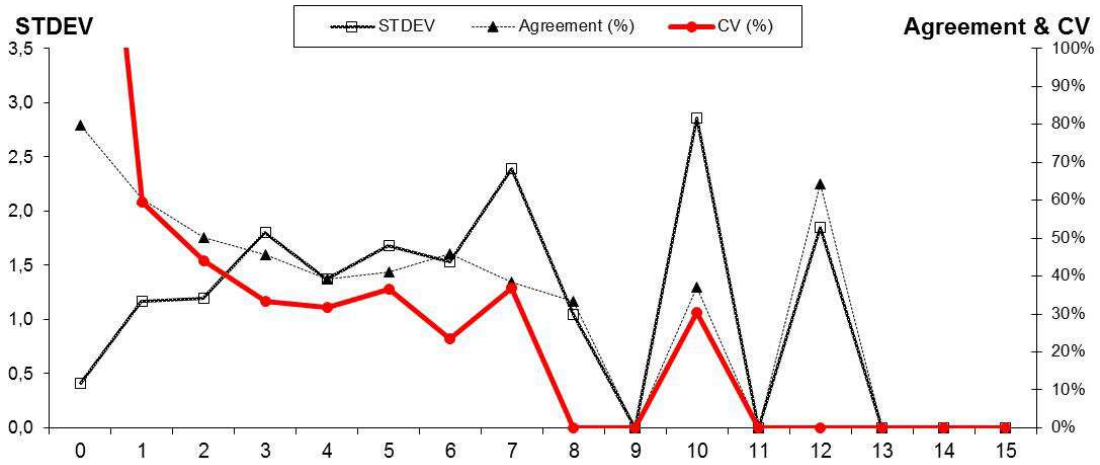
RELATIVE BIAS

	MODAL	Spain	Spain	Ireland	Italy	France	Italy	Germany	Ireland	Portugal	Portugal	Spain	Spain	Italy	Spain	Italy	
	age	Reader 15	Reader 1	Reader 14	Reader 3	Reader 9	Reader 10	Reader 12	Reader 6	Reader 2	Reader 8	Reader 4	Reader 5	Reader 7	Reader 11	Reader 13	ALL
	0	0,00	0,00	1,00	0,00	0,67	0,00	1,00	0,50	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,20
	1	0,40	0,00	2,00	0,71	0,50	-0,38	1,80	1,10	0,20	0,20	0,10	0,30	-0,10	0,10	0,56	0,51
	2	0,33	-0,70	2,33	0,73	0,08	-0,50	1,33	1,58	0,08	-0,08	0,17	0,08	0,00	0,17	0,08	0,40
	3	0,63	-0,18	3,10	0,28	0,05	-0,47	1,47	1,40	-0,10	0,70	1,15	0,60	-0,15	1,00	0,55	0,68
	4	-0,08	-0,73	2,25	-0,50	-0,73	-1,00	0,42	0,50	-0,83	-0,11	0,83	0,08	-0,58	0,67	-0,42	0,01
	5	0,08	-0,36	2,54	-1,36	-1,83	-1,78	-0,46	-0,46	-2,31	-0,25	-0,08	0,31	-1,77	-0,23	-0,62	-0,54
	6	0,00	-0,38	2,08	-0,75	-1,69	-1,09	0,15	0,15	-1,38	0,15	0,54	0,38	-1,15	0,31	-0,31	-0,19
	7	-0,17	-1,00	5,00	-2,50	-3,50	-2,67	0,40	0,00	-3,00	0,33	0,67	0,00	-2,17	0,33	-0,33	-0,51
	8	-2,00	-1,00	1,00	0,00	-2,00	-1,00	-2,00	1,00	-2,00	0,00	0,00	-1,00	-1,00	0,00	0,00	-0,67
	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10	0,00	-1,00	2,00	-3,00	-4,50	-2,67	-1,33	0,33	-3,67	0,33	0,00	-1,00	-5,33	-0,33	-2,00	-1,37
	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12	0,00	0,00	5,00	0,00	-	-1,00	0,00	3,00	-3,00	-1,00	0,00	0,00	0,00	0,00	0,00	0,21
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Veighted mea	0-15	0,18	-0,43	2,56	-0,34	-0,84	-0,99	0,68	0,71	-0,94	0,16	0,48	0,23	-0,83	0,35	-0,09	0,08
	RANKING	3	7	15	5	12	14	9	10	13	2	8	4	11	6	1	

In the age bias plots below the mean age recorded +/- 2stdev of each age reader and all readers combined are plotted against the MODAL age. The estimated mean age corresponds to MODAL age, if the estimated mean age is on the 1:1 equilibrium line (solid line). RELATIVE bias is the age difference between estimated mean age and MODAL age.


Reader 15
Spain
Reader 1
Spain
Reader 14
Ireland
Reader 3
Italy
Reader 9
France
Reader 10
Italy
Reader 12
Germany
Reader 6
Ireland
Reader 2
Portugal
Reader 8
Portugal
Reader 4
Spain
Reader 5
Spain
Reader 7
Italy
Reader 11
Spain
Reader 13
Italy
ALL READERS
Mean age +/- 2stdev
Mean age +/- 2 stdev

The coefficient of variation (CV%), percentage of agreement and the standard deviation (STDEV) are plotted against MODAL age. CV is much less age dependent than the standard deviation (STDEV) and the percentage of agreement. CV is therefore a better index for the precision in age reading. Problems in age reading are indicated by relatively high CV's at age.



The distribution of the age reading errors in percentage by MODAL age as observed from the whole group of age readers in an age reading comparison to MODAL age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. It appears to be no RELATIVE bias, if the age reading errors are normally distributed. The distributions are skewed, if RELATIVE bias occurs.