Ifremer

Report of the pollack
(*Pollachius pollachius*)
Exchange 2016

Mahé K., Dufour, J.L., McCausland, I., Sainza, M., Leal, A., Gonzalez, C., Elleboode, R., 2016. Report of the the pollack (*Pollachius pollachius*) Exchange 2016. 17pp.

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1. Introduction

In September 2015, the Working Group on Biological Parameters (WGBIOP) recommended an otolith exchange for *Pollachius pollachius* in 2016 (Otolith Exchanges proposals for 2016/2017; ICES, 2015). Kélig Mahe (IFREMER, France) was decided to be the responsible to organise this otolith exchange. This is a first exchange. No workshop was organised before.

2. Participants

A total of 6 readers from 3 countries (France, Spain and UK England) have participated at this exchange but the reader from the UK England had some technical problems concerning the WebGR (Tab. 1). Consequently, only 5 readers from 2 countries have participated to this exchange.

Table 1: List of the readers.

Reader	Name	Country	Institution
1	Jean Louis Dufour	France	Ifremer
2	Romain Elleboode	France	Ifremer
3	Maria Sainza	Spain	Instituto Español de Oceanografia
4	Ian McCausland	UK England	Agri-Food and Biosciences Institute
5	Ana Leal	Spain	Instituto Español de Oceanografia
6	Cristina González	Spain	Instituto Español de Oceanografia

3. Sample collection

A total of 314 otoliths from the North-Eastern Atlantic ocean, collected from 2011 to 2015, were provided by 3 Institutes (IEO, AFBI and IFREMER) (Tab. 2).

Table 2: Samples examined by stocks and ICES area for pollack.

Stock	ICES areas	Total
Northern	IVc	2
	VIId	16
	VIIe	122
	VIIjh	75
Southern	IXa	99
Total		**314**

Samples came from commercial fisheries. The length distribution from the Northern Stock ranged from 30 to 84 cm TL, whereas that from the Southern Stock is more larger (29-92 cm TL) (Fig. 1). The individuals from the Southern Stock (51.1±14.8 cm) are smaller than those from the Northern Stock (60.7±12.2 cm; Fig. 1).
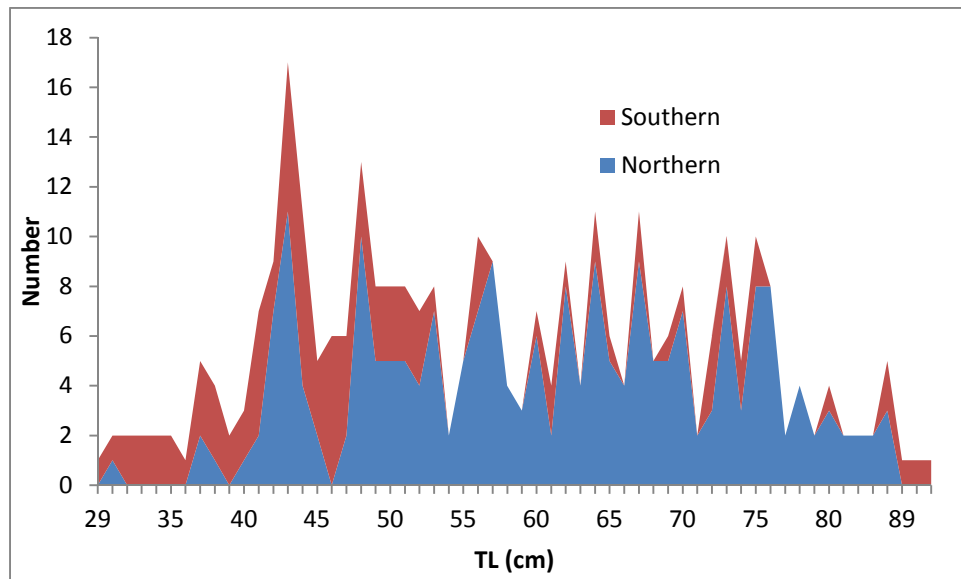
Figure 1: Length distribution of pollack by stocks.

4. Reading procedure

The WebGR tool was used for this exchange. The image of each otolith and the related necessary information (e.g. TL, sex, capture date) were uploaded to WebGR (http://webgr.azti.es/ce/search/myce). The use of WebGR tool has some advantages: (i) it can facilitate and accelerate the whole exchange process, (ii) it provides annotated images for every otolith, which enables to compare age readings directly and identify possible sources of bias and (iii) it facilitates the chairman to compile the results. However, the use of WebGR has also some limits: (i) It is not a very intuitive tool, (ii) it can be jammed and (iii) it is not always possible to upload a large batch of images (compatibility problems of the csv files with Windows 7).

The age was assigned taking into account the number of the transparent rings in each otolith image. All data were extracted from the WebGR and afterwards, the level of agreement between the age-readers was estimated using the Guus Eltink spreadsheet (Eltink, 2000).

5. Analysis of readings

The spreadsheet (Eltink, 2000) was completed according to the Guidelines and Tools for Age Reading Comparisons (Eltink *et al.,* 2000). Modal age was calculated for each otolith, as well as the percentage of agreement (PA), the coefficient of variation (CV) and the average percent error (APE) according to the following formulas:

$$PA = \frac{\sum |n_{diff} \leq 1|}{n}$$

$$CVj(\%) = 100. \frac{\sqrt{\sum_{i=1}^{R} \frac{(X_{ij} - X_j)^2}{R-1}}}{x_j}$$

where R is the number of times each fish is aged, X_{ij} is the ith age determination of the jth fish, X_j is the mean age calculated for the jth fish, and n_{diff} is the difference in age determination between the two readers reading..

$$APE_j(\%) = 100.\frac{1}{R}\sum_{i=1}^{R}\frac{|X_{ij} + X_j|}{X_j}$$

where x_{ij} is the ith age determination of the jth fish, x_j is the average age calculated for the jth fish and R is the number of times each fish was aged.

Moreover, the average values of the above precision indices were calculated by stocks.

6. Results

6.1. Precision

The results of the precision[1] analysis (including the average CV, APE and PA) by stock are presented in Table 3. The results showed high precision with the PA to 86.2%, the CV to 7.3% and the APE to 1.13%. The reading precision for the Northern stock was higher than this for the Southern stock.

Table 3: Reading's precision by stocks.

Stock	Otoliths (number)	Length Range (cm)	Age range (year)	PA (%)	CV (%)	APE (%)
Northern stock	215	30 / 84	0/11	91.6	3.8	0.8
Southern stock	99	29 / 92	1/10	74.5	14.9	1.9

The coefficient of variation (CV), percent agreement (PA) and the standard deviation (STDEV) were plotted against the MODAL age (Fig. 3). The results by area and species showed the same trend with the first age groups presenting the higher CV values and in some cases lower PA values. These results could be explained by the position of the first growth increment and the two different approaches of reading interpretation used by the readers (ICES, 2012).

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[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).

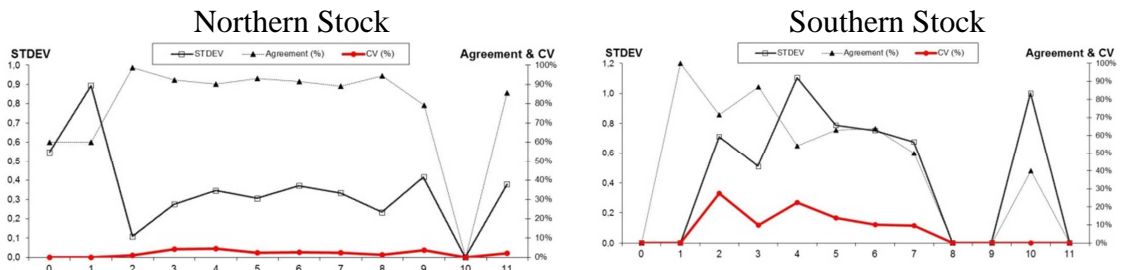Northern Stock   Southern Stock

Figure 2: The coefficient of variation (CV), percent agreement (PA) and the standard deviation (STDEV)
are plotted against MODAL age by Pollack stocks.

CV is much less age dependent than the standard deviation (STDEV) and the percent agreement (PA). CV is
therefore a better index for the precision in age reading. Problems in age reading are indicated by the
relatively high CV's at age.

For readers, the different of images magnification could be one reason of disagreements in
the interpretation of some otoliths.

6.2. 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.

6.2.1. Northern Stock

For Northern pollack otoliths, there was no bias between two French readers who are the
readers for Northern stock but there were bias between the French and Spanish readers
(Table 4).

Table 4: Inter-reader bias test and reader against modal age bias test of Northern pollack otoliths (-: no sign
of bias (p>0.05); *: possibility of bias (0.01<p<0.05); **: certainty of bias (p<0.01)).

		Reader1	Reader2	Reader3	Reader5	Reader6
		France	France	Spain	Spain	Spain
Reader1	France					
Reader2	France	—				
Reader3	Spain	**	**			
Reader5	Spain	**	**	*		
Reader6	Spain	*	—	**	**	
MODAL age		**	*	**	*	—

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[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).

6.2.2. Southern Stock

For Southern pollack otoliths, there was no bias between three Spanish readers who are the readers for Southern stock but there were bias between the French and Spanish readers (Table 5).

Table 5: Inter-reader bias test and reader against modal age bias test of Southern pollack otoliths (-: no sign of bias (p>0.05); *: possibility of bias (0.01<p<0.05); **: certainty of bias (p<0.01)).

		Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain
Reader1	France					
Reader2	France	**				
Reader3	Spain	*	**			
Reader5	Spain	—	**	—		
Reader6	Spain	—	**	—	—	
MODAL age		**	**	—	—	—

7. Images of reference

7.1. Northern stock

Among the otoliths of Northern stock Pollack (n=215), 162 otoliths (75%) presented 100% agreement between the readers (Fig. 3-7).
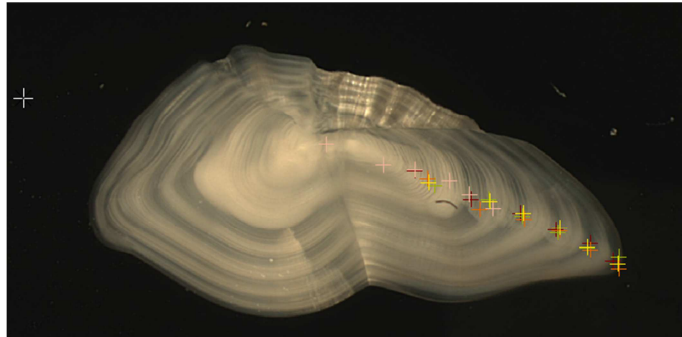

Figure 3: Pollack otolith image from the Northern stock (ICES areas: VIIj-k) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was female 6 years old (750 mm TL) caught in March 2015.
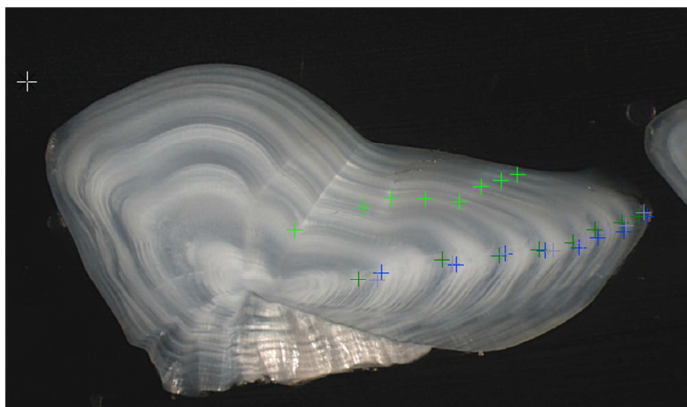
Figure 4: Pollack otolith image from the Northern stock (ICES areas: VIIj-k) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was male 8 years old (730 mm TL) caught in January 2015.

Figure 5: Pollack otolith image from the Northern stock (ICES area: VIId) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was male 5 years old (700 mm TL) caught in January 2015.

Figure 6: Pollack otolith image from the Northern stock (ICES area: VIIe) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was female 4 years old (600 mm TL) caught in March 2015.

Figure 7: Pollack otolith image from the Northern stock (ICES areas: VIIj-k) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was female 4 years old (491 mm TL) caught in May 2015.

7.2. Southern stock

Among the otoliths of Southern stock Pollack (n=99), 26 otoliths (26%) presented 100% agreement between the readers (Fig. 8-10).
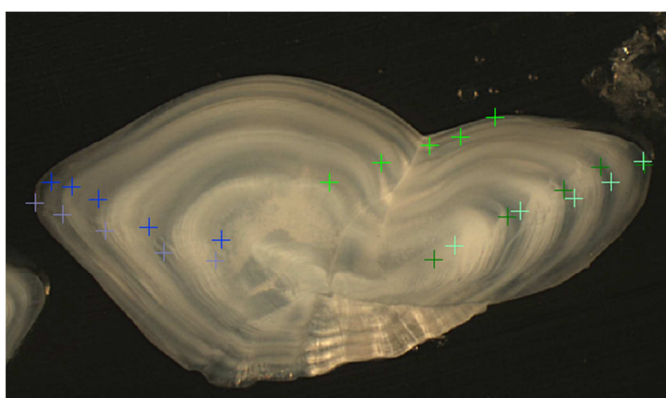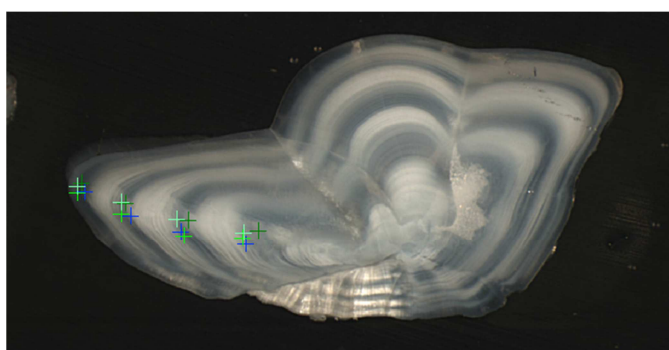

Figure 8: Pollack otolith image from the Southern   stock (ICES area: IXa) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was male 1 year old (330 mm TL) caught in September 2015.

Figure 9: Pollack otolith image from the Southern   stock (ICES area: IXa) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was female 2 years old (489 mm TL) caught in August 2015.
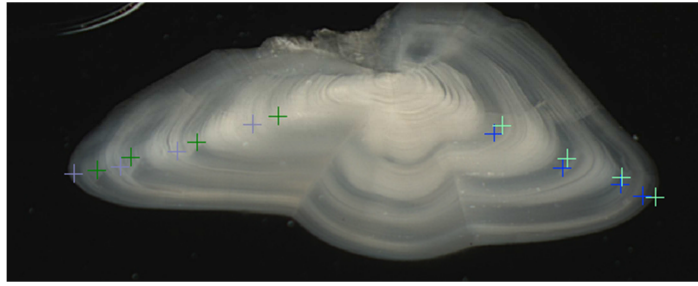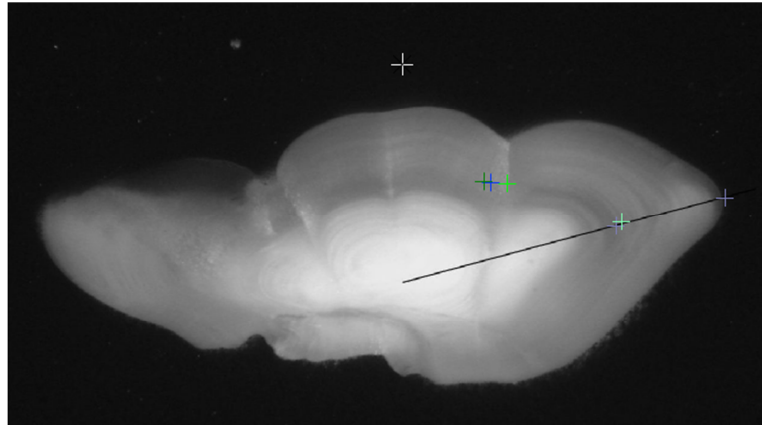
Figure 10: Pollack otolith image from the Southern   stock (ICES area: IXa) annotated by 5 readers on the WebGr tool with 100% of agreement. The specimen was female 3 years old (447 mm TL) caught in February 2015.

8. Abstract

In September 2015, the Working Group on Biological Parameters (WGBIOP) recommended the first otolith exchange for *Pollachius pollachius* in 2016 (Otolith Exchanges proposals for 2016/2017; ICES, 2015). Kélig Mahe (IFREMER, France) was decided to be the responsible to organise this otolith exchange. A total of 5 readers from 2 countries (France & Spain) participated at the exchange of 2016. The otoliths of 314 individuals sampled from 2011 to 2015 in Southern stock (ICES area: IXa; n=99) and in (ICES areas: IVc, VIId, VIIe, VIIj-h; n=215) were used for this exchange. For the Northern stock, the precision values for both stocks were very high but the value for Northern stock (PA=91.6%, CV=3.8%; APE= 0.8%) was higher than this for Southern stock (PA=74.5%, CV=14.9%; APE= 1.9%). There were some differences between readers but there were no difference between Northern stock readers and between Southern stock readers.

9. References

Eltink, A. T. G. W., 2000. Age reading comparisons. (MS Excel workbook version 1.0 October 2000) Internet : http://www.efan.no

Eltink, A. T. G. W., Newton, A. W., Morgado, C., Santamaria, M. T. G., Modin, J., 2000. Guidelines and Tools for Age Reading. (PDF document version 1.0 October 2000) Internet : http://www.efan.no

ICES. 2007. Report of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS), 5–9 March 2007, Valetta, Malta. ACFM:09. 115p.

ICES. 2015. First Interim Report of the Working Group on Working Group on Biological Parameters (WGBIOP), 7-11 September 2015, Malaga, Spain. ICES CM 2015/SSGIEOM:08. 67 pp.

Appendix 1 : List of participants

Reader	Name	Country	Institution	Email
1	Jean Louis Dufour	France	Ifremer	Jean.Louis.Dufour@ifremer.fr
2	Romain Elleboode	France	Ifremer	Romain.Elleboode@ifremer.fr
3	Maria Sainza	Spain	Instituto Español de Oceanografia	maria.sainza@vi.ieo.es
4	Ian McCausland	UK England	Agri-Food and Biosciences Institute	Ian.McCausland@afbini.gov.uk
5	Ana Leal	Spain	Instituto Español de Oceanografia	ana.leal@vi.ieo.es
6	Cristina González	Spain	Instituto Español de Oceanografia	cristina.gonzalez@vi.ieo.es

Appendix 2: Detailed results of Northern Stock

The number of age readings, the coefficient of variation (CV), the percentage of agreement (PA) 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 PA 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.
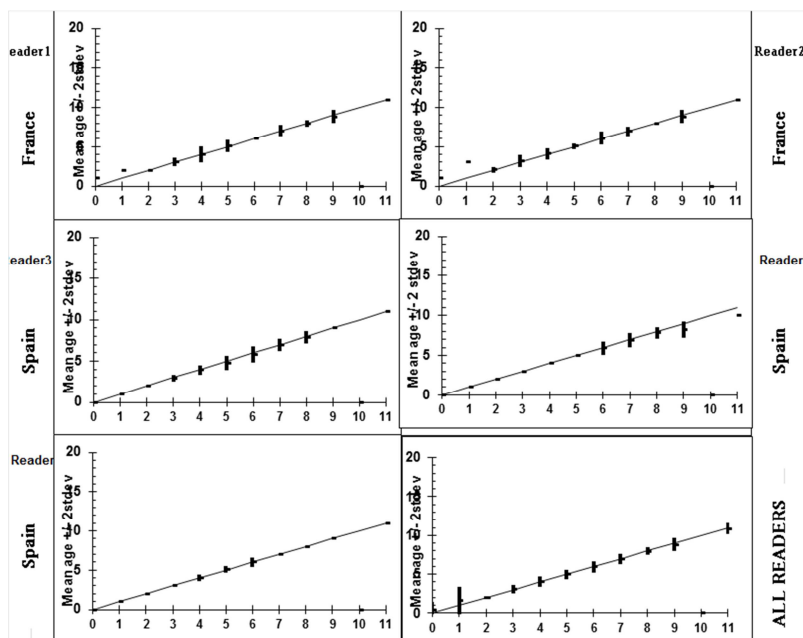
NUMBER OF AGE READINGS

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	TOTAL
0	1	1	1	1	1	5
1	1	1	1	1	1	5
2	24	24	13	13	13	87
3	45	45	26	26	26	168
4	37	37	23	23	23	143
5	29	29	24	24	24	130
6	24	24	23	23	23	117
7	23	23	15	15	15	91
8	23	23	14	14	14	88
9	6	6	4	4	4	24
10	-	-	-	-	-	-
11	2	2	1	1	1	7
0-11	215	215	145	145	145	865

COEFFICIENT OF VARIATION (CV)

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	ALL Readers
0	-	-	-	-	-	-
1	-	-	-	-	-	-
2	0%	10%	0%	0%	0%	1,2%
3	9%	13%	7%	0%	0%	4,1%
4	12%	9%	7%	0%	5%	4,6%
5	8%	4%	9%	0%	4%	2,4%
6	0%	7%	8%	7%	5%	2,8%
7	5%	4%	5%	7%	0%	2,3%
8	3%	0%	5%	5%	0%	1,2%
9	5%	5%	0%	6%	0%	3,6%
10	-	-	-	-	-	-
11	0%	0%	-	-	-	2,1%
0-11	6,0%	7,1%	6,1%	2,4%	2,3%	3,8%
RANKING	3	5	4	2	1	

PERCENTAGE AGREEMENT

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	ALL
0	0%	0%	100%	100%	100%	60%
1	0%	0%	100%	100%	100%	60%
2	100%	96%	100%	100%	100%	99%
3	93%	80%	96%	100%	100%	92%
4	84%	86%	91%	100%	96%	90%
5	93%	97%	79%	100%	96%	93%
6	100%	83%	87%	96%	91%	91%
7	87%	91%	87%	80%	100%	89%
8	96%	100%	86%	86%	100%	94%
9	83%	83%	100%	25%	100%	79%
10	-	-	-	-	-	-
11	100%	100%	100%	0%	100%	86%
0-11	91,6%	88,4%	89,7%	93,1%	97,2%	91,7%
RANKING	3	5	4	2	1	

RELATIVE BIAS

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	ALL
0	1,00	1,00	0,00	0,00	0,00	0,40
1	1,00	2,00	0,00	0,00	0,00	0,60
2	0,00	0,04	0,00	0,00	0,00	0,01
3	0,02	0,20	-0,04	0,00	0,00	0,05
4	0,03	0,08	-0,09	0,00	0,04	0,02
5	0,10	0,03	-0,21	0,00	0,04	0,00
6	0,00	0,08	-0,17	-0,09	0,00	-0,03
7	0,04	0,00	0,00	-0,07	0,00	0,00
8	-0,04	0,00	-0,14	-0,14	0,00	-0,06
9	-0,17	-0,17	0,00	-0,75	0,00	-0,21
10	-	-	-	-	-	-
11	0,00	0,00	0,00	-1,00	0,00	-0,14
0-11	0,03	0,08	-0,10	-0,06	0,01	0,00
RANKING	2	4	5	3	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 the estimated mean age and MODAL age.

Appendix 3: Details results of Southern stock

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	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	TOTAL
0	-	-	-	-	-	-
1	1	1	1	1	1	5
2	21	21	21	21	21	105
3	43	43	43	43	43	215
4	7	7	7	7	7	35
5	13	13	13	13	13	65
6	11	11	11	11	11	55
7	2	2	2	2	2	10
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	1	1	1	1	1	5
11	-	-	-	-	-	-
0-11	99	99	99	99	99	495

COEFFICIENT OF VARIATION (CV)

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	ALL Readers
0	-	-	-	-	-	-
1	-	-	-	-	-	-
2	25%	24%	16%	0%	11%	27,4%
3	7%	24%	13%	7%	5%	9,8%
4	0%	28%	23%	20%	18%	22,3%
5	6%	14%	20%	8%	8%	13,9%
6	5%	13%	13%	9%	7%	10,2%
7	11%	0%	0%	0%	0%	9,5%
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
0-11	9,8%	20,9%	14,6%	6,6%	7,6%	14,9%
RANKING	3	5	4	1	2	

PERCENTAGE AGREEMENT

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	ALL
0	-	-	-	-	-	-
1	100%	100%	100%	100%	100%	100%
2	62%	10%	90%	100%	95%	71%
3	95%	60%	86%	95%	98%	87%
4	100%	29%	43%	43%	57%	54%
5	92%	23%	31%	85%	85%	63%
6	91%	27%	45%	73%	82%	64%
7	50%	100%	100%	0%	0%	50%
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	100%	0%	100%	0%	0%	40%
11	-	-	-	-	-	-
0-11	86,9%	39,4%	72,7%	85,9%	87,9%	74,5%
RANKING	2	5	4	3	1	

RELATIVE BIAS

MODAL age	Reader1 France	Reader2 France	Reader3 Spain	Reader5 Spain	Reader6 Spain	ALL
0	-	-	-	-	-	-
1	0,00	0,00	0,00	0,00	0,00	0,00
2	0,43	1,38	0,00	0,00	0,05	0,37
3	0,05	0,60	-0,05	0,00	0,02	0,13
4	0,00	1,43	-0,71	0,00	-0,14	0,11
5	-0,08	1,08	0,00	-0,15	-0,15	0,14
6	0,09	1,09	0,00	0,09	0,00	0,25
7	-0,50	0,00	0,00	1,00	1,00	0,30
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	0,00	-1,00	0,00	-2,00	-2,00	-1,00
11	-	-	-	-	-	-
0-11	0,10	0,91	-0,07	-0,01	-0,01	0,18
RANKING	4	5	3	1	2	

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.