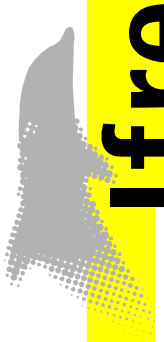

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Report of the Saithe (*Polliachius virens*, L.) Otolith Exchange 2013

Mahé K., Sevin K., Pétursdóttir G., Finnbogadottir G., Wilhelms I., Beußel F., Bland B., Solbakken B. L., Seim S. E., Holm E., Mjanger H., Senneset H., Ottesen M.V. , Skadal J., 2014. Report of the Saithe (*Polliachius virens,* L.) Otolith Exchange 2013. 20pp.

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1. Introduction

The Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS) meeting in March 2012 recommended a large exchange (ICES, 2012).

The planning group indicated that the IFREMER, France should be responsible to organising a saithe otolith exchange (ICES, 2012).

There was the first exchange in 2005-2006 and so the exchange in 2013 is the second exchange for saithe.

There was not workshop after the first exchange because the agreement among readers during the first exchange was very high.

2. Participants

13 readers from 5 institutes participated at this exchange (Tab. 1).

Table 1 : List of the readers.

Reader	Firstname	Lastname	Institution	Country
1	karine	Sevin	Institut français de recherche pour l'exploitation de la mer	France
2	Gróa	Pétursdóttir	Marine Research Institute MRI	Iceland
3	Gudrun	Finnbogadottir	Marine Research Institute MRI	Iceland
4	Ines	Wilhelms	Johann Heinrich von Thünen Institute (Germany)	Germany
5	Friederike	Beußel	Johann Heinrich von Thünen Institute (Germany)	Germany
6	Barbara	Bland	Swedish Board of Fisheries (Sweden)	Sweden
7	Lisbet	Solbakken	Institute of Marine Research (Norway)	Norway
8	Silje Elisabeth	Seim	Marine Institute	Norway
9	Else	Holm	Institute of Marine Research (Norway)	Norway
10	Hildegunn	Mjanger	Institute of Marine Research (Norway)	Norway
11	Harald	Senneset	Institute of Marine Research (Norway)	Norway
12	Merete Vik	Ottesen	Institute of Marine Research (Norway)	Norway
13	janicke	Skadal	Institute of Marine Research (Norway)	Norway

Appendix 1 presents the complete listing of the participants in the Saithe otolith exchange.

3. Sampling collection

A total of 295 fish was sampled (Fig. 1 & 2) :

- 24 fish from the Barent sea (ICES area : IIa) by Institute of Marine Research (Norway)
- 34 fish from the North Sea (ICES area : IV) by IFREMER institute (France)
- 237 fish from the Western Scotland (ICES area : VIa) by IFREMER institute (France)

The length range of the fish was between 37 and 96 cm, with mean 60 cm (Fig. 1).

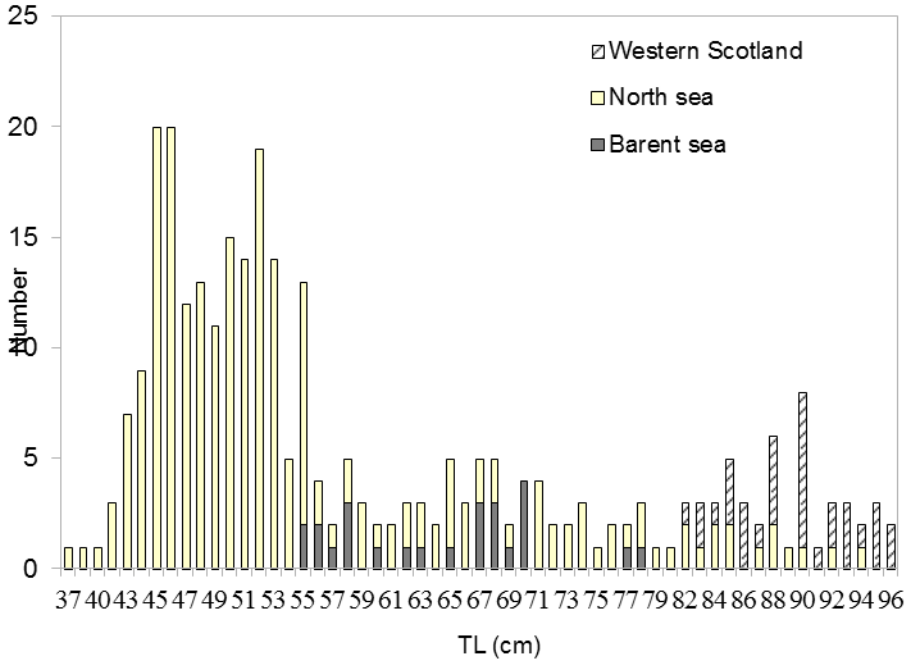

Figure 1 : Histograms of the samples.

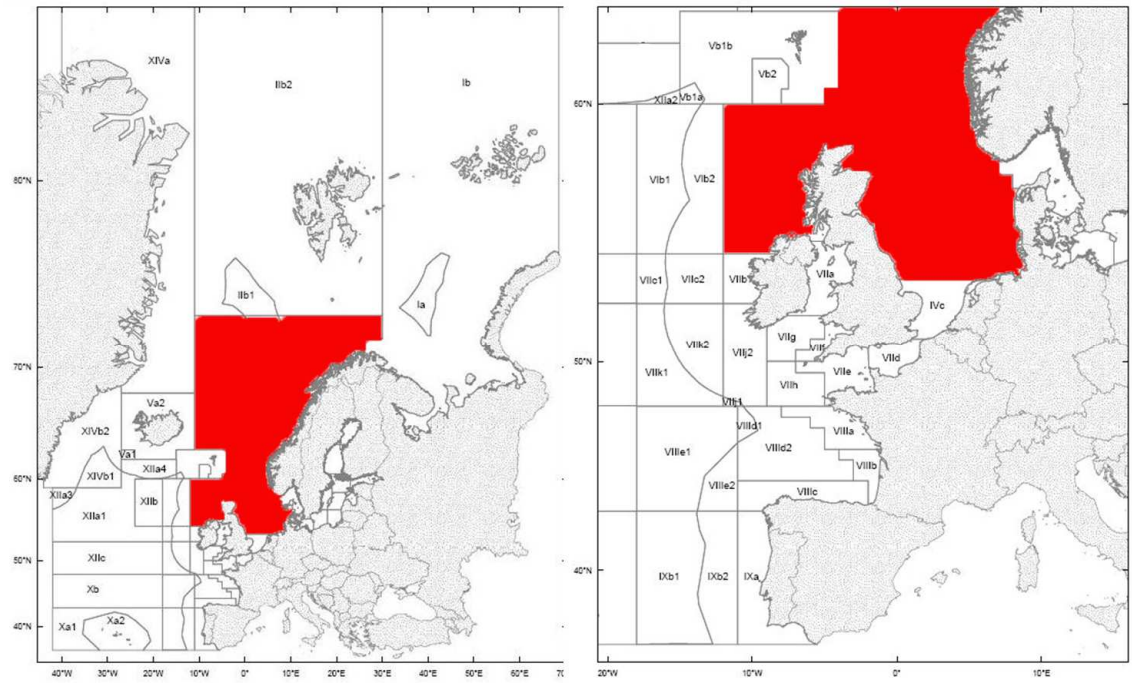

Figure 2 : ICES Areas of sampling 5 (red areas).

4. Reading procedure

Date of birth is set to the 1st of January as convention. One *annulus* consists of one opaque and one translucent zone. For the age estimation, we count the translucent zones.
All otoliths and scales were digitalised by TNPC software. 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 jam (as during the half of the 2013 year) (iii) it is not possible to upload always a large batch of images (problem with the format of the csv file with Windows 7).

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[1]

The analyse presented the results with 13 readers. Mean precision of age estimate for individual fish were Coefficient of Variation (CV) of 6.2% and percent agreement to modal age of 85.9 (Tab. 2). Among 298 fish, 54 were read with 100% agreement (18%) and thus a CV of 0%. There were variations in precision of age estimate between individual fish, with CV ranging from 0 to 27% and percent agreement range from 40 to 100% (Tab. 2). Appendix 1 examined the readings of individuals at each modal age and summarised the number of otoliths, the precision CV, percentage agreement.

Table 2 : Precision of readings from otoliths, from scales and from both calcified pieces.

ICES area	Number	Age range	Percentage of Agreement (range)	CV (range)
All samplings	298	2/14	85.9% 40/100	6.2% 0/27
IIa	24	4/12	83% 55/100	5.6% 0/17
IV	34	9/14	74.2% 42/100	4.2% 0/8
VIa	237	2/13	87.9% 40/100	6.5% 0/27

Precision of Age estimation from the North Sea was not as good as than those of the others areas. However, the size and age of fish from the North Sea were bigger than those of the others areas (Tab. 2)

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 (Tab. 3).

[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).

[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 3 : Inter-reader bias test and reader against modal age bias test (-: 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 1	Iceland Reader 2	Iceland Reader 3	Germany Reader 4	Germany Reader 5	Sweden Reader 6	Norway Reader 7	Norway Reader 8	Norway Reader 9	Norway Reader 10	Norway Reader 11	Norway Reader 12	Norway Reader 13
Reader 1													
Reader 2	–												
Reader 3	–	–											
Reader 4	*	–	–										
Reader 5	*	**	**	**									
Reader 6	–	–	–	–	**								
Reader 7	**	**	**	**	**	**							
Reader 8	**	**	**	**	**	**	**						
Reader 9	–		**	**	–	*	**	**					
Reader 10	**	**	*	*	**	*	**	**	**				
Reader 11	**	–	*	*	**	–	**	**	**	–			
Reader 12	**	**	**	**	**	**	**	**	**	**	**		
Reader 13	–	–	–	–	**	–	**	**	**	*	–	**	
MODAL age	–	–	–	*	**	–	**	**	*	**	**	**	–

It should be noted that there are certainly of bias between some readers and modal age.

The differences are primarily explained by the position and the number of rings after the eighth and closed the edge. The following annotated images for one otolith with agreement percentage of 42% and CV of 8% presents the estimated age from 9 to 12 years old, is a good example (Fig. 3).

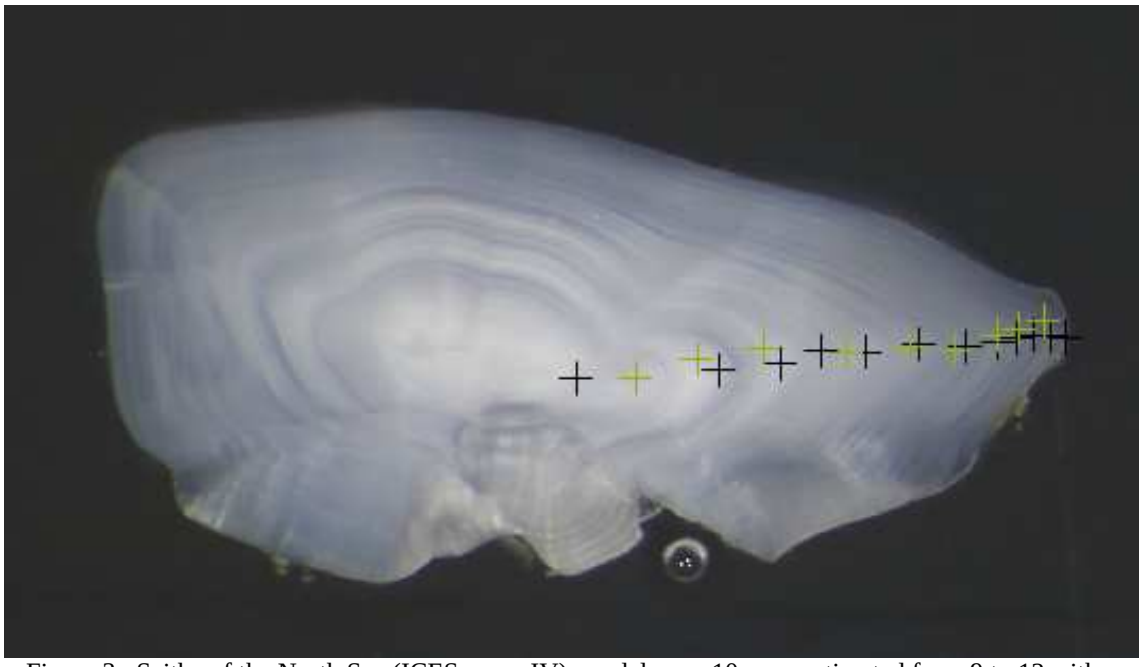

Figure 3 : Saithe of the North Sea (ICES area : IV), modal age : 10 ; age estimated from 9 to 12 with a majority at 10 years old, agreement percentage of 42% and CV of 8% with 13 readers. Difference in annotation on the same image: disagreement on the position and the number of rings after the eighth ring (exception of the first ring).

6. Images of reference

There were some images with 100% agreement in all sampling areas. 3 images were selected (Fig. 4, 5 & 6).

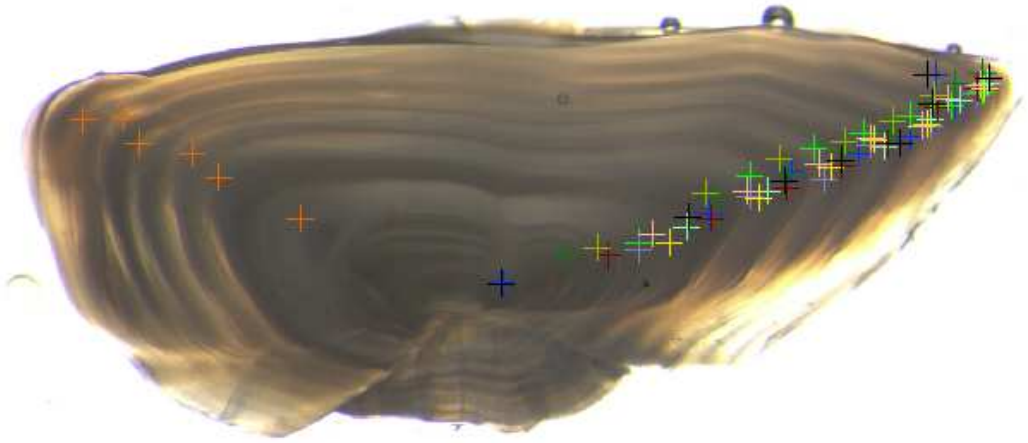

Figure 4 : Saithe otolith image from the Barent Sea with 100% of agreement, 6 years old (from 13 readers). Total length was 70 cm.

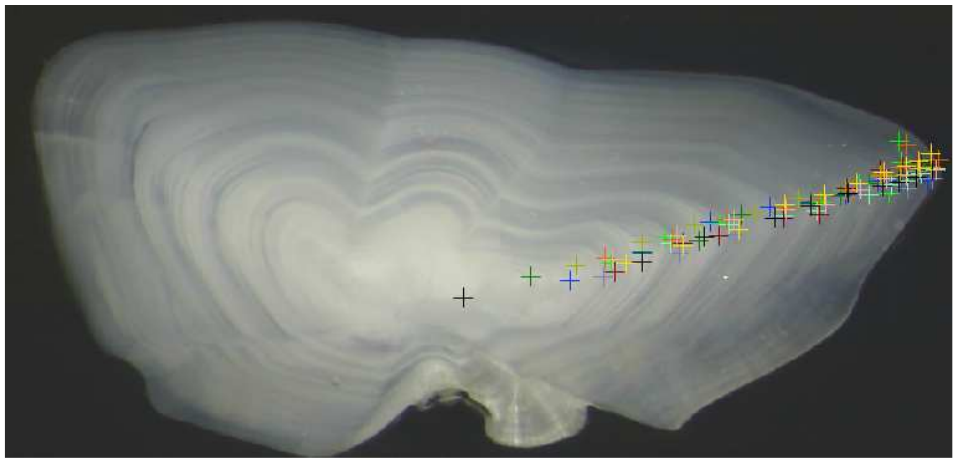

Figure 5 : Saithe otolith image from the North Sea with 100% of agreement, 10 years old (from 13 readers). Total length was 90 cm.

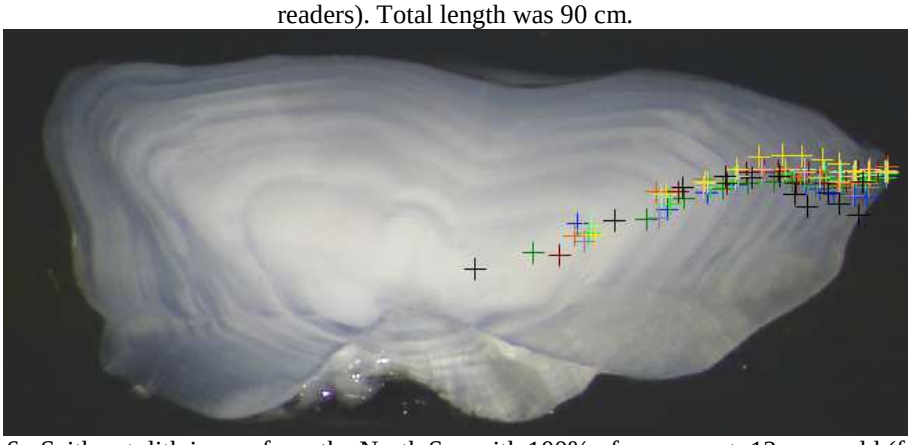

Figure 6 : Saithe otolith image from the North Sea with 100% of agreement, 12 years old (from 13 readers). Total length was 90 cm.

7. Abstract

The ICES Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS) identified the need of a Saithe (*Polliachius virens*) otolith exchange to take place in 2013. It was the second exchange after that's of 2008.

The IFREMER institute coordinated this exchange. A total of 295 fish was sampled from the Barent sea (ICES area : IIa, N=24), from the North Sea (ICES area : IV, N=34) and from the Western Scotland (ICES area : VIa, N=237). The length range of the fish was between 37 and 96 cm, with mean 60 cm

13 readers from 5 countries (France, Germany, Iceland, Sweden & Norway) were participated. Mean precision of age estimate for individual fish were Coefficient of Variation (CV) of 6.2% and percent agreement to modal age of 85.9. Among 298 fish, 54 were read with 100% agreement (18%) and thus a CV of 0%. There were variations in precision of age estimate between individual fish, with CV ranging from 0 to 27% and percent agreement range from 40 to 100% (Tab. 2).

Precision of Age estimation from the North Sea was not as good as than those of the others areas. However, the size and age of fish from the North Sea were bigger than those of the others areas. The differences are primarily explained by the position and the number of rings after the eighth and closed the edge.

8. References

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

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

ICES. 2005. Report of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS), 1-4 March 2005, Oostende, Belgium. ICES CM 2005/ACFM:15. 149 pp.

ICES. 2006. Report of the Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS), 28 February–3 March 2006, Rostock, Germany. ICES CM 2006/ACFM:18. 62 pp.

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. 2012. Report of the Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS 2012), 30 January–3 February 2012, Rome, Italy. ICES CM 2012/ACOM:50. 163 pp.

9. Appendix 1 : List of participants

Institute & postal address	Participants in exchange	Email
IFREMER Centre Manche-mer du Nord, Laboratoire Ressources Halieutiques, 150 quai Gambetta, BP 699, 62 321 Boulogne sur mer, France	kélig mahé	kelig.mahe@ifremer.fr
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	Eva Ilic	eva.ilic@slu.se

10. Appendix 2 : Details results of Saithe from ICES IV

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 1	Iceland Reader 2	Iceland Reader 3	Germany Reader 4	Germany Reader 5	Sweden Reader 6	Norway Reader 7	Norway Reader 8	Norway Reader 9	Norway Reader 10	Norway Reader 11	Norway Reader 12	Norway Reader 13	TOTAL
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	2	2	2	2	2	2	2	1	2	2	2	2	2	25
	3	16	16	16	16	16	16	16	12	16	16	16	9	16	197
	4	137	135	137	137	137	137	137	123	136	136	136	56	136	1680
	5	49	49	49	49	49	49	49	42	49	49	49	10	49	591
	6	25	25	24	25	25	25	25	19	25	25	24	7	25	299
	7	10	10	10	10	10	10	10	7	10	10	10	3	10	120
	8	7	7	7	7	7	7	7	7	7	7	7	-	7	84
	9	12	12	12	12	12	12	12	1	12	12	12	8	12	141
	10	5	5	5	5	5	5	5	2	5	5	5	3	5	60
	11	12	13	13	13	13	13	13	3	13	13	13	9	13	154
	12	12	13	12	13	13	13	12	2	13	13	13	11	13	153
	13	7	7	7	7	7	7	7	2	7	7	7	5	7	84
	14	2	2	2	2	2	2	2	-	2	2	2	2	2	24
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0-15	296	296	296	298	298	298	297	221	297	297	296	125	297	3612

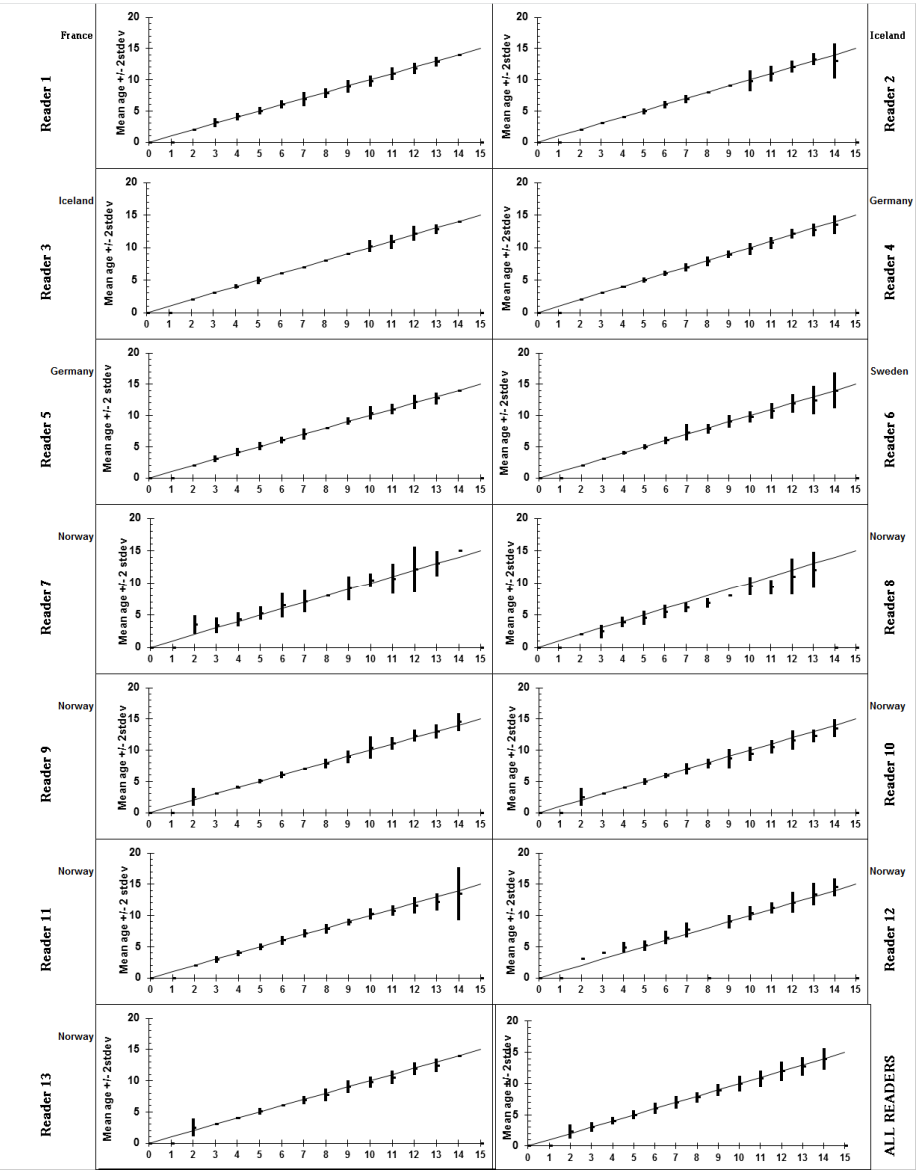
COEFFICIENT OF VARIATION (CV)

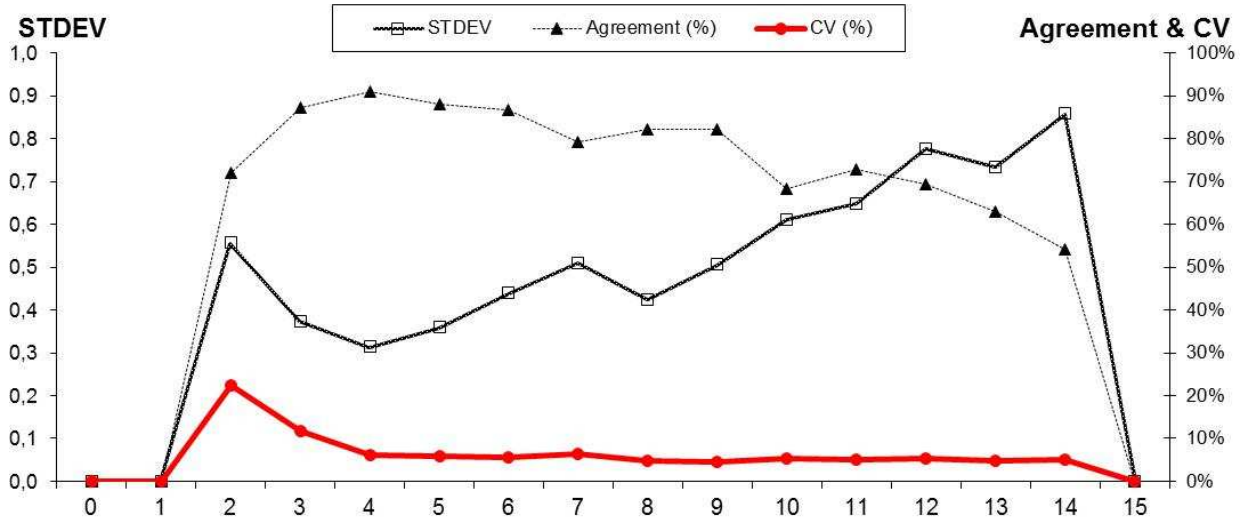
	MODAL age	France Reader 1	Iceland Reader 2	Iceland Reader 3	Germany Reader 4	Germany Reader 5	Sweden Reader 6	Norway Reader 7	Norway Reader 8	Norway Reader 9	Norway Reader 10	Norway Reader 11	Norway Reader 12	Norway Reader 13	ALL Readers
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	0%	0%	0%	0%	0%	0%	20%	-	28%	28%	0%	0%	28%	22,4%
	3	11%	0%	0%	0%	8%	0%	18%	21%	0%	0%	9%	0%	0%	11,8%
	4	7%	0%	4%	2%	8%	4%	12%	10%	3%	0%	6%	9%	2%	6,0%
	5	6%	5%	6%	4%	6%	4%	10%	12%	4%	5%	6%	8%	5%	5,8%
	6	6%	5%	0%	3%	5%	5%	15%	9%	5%	3%	6%	8%	0%	5,6%
	7	8%	5%	0%	5%	7%	9%	12%	6%	0%	7%	4%	8%	5%	6,4%
	8	5%	0%	0%	5%	0%	5%	0%	6%	5%	5%	5%	-	6%	4,8%
	9	6%	0%	0%	3%	3%	6%	10%	-	6%	9%	3%	6%	6%	4,6%
	10	5%	9%	4%	5%	5%	5%	5%	7%	9%	6%	4%	6%	5%	5,2%
	11	5%	6%	5%	4%	4%	6%	11%	6%	4%	5%	4%	4%	5%	5,1%
	12	4%	4%	5%	3%	5%	6%	15%	13%	4%	7%	6%	7%	4%	5,2%
	13	3%	4%	3%	4%	4%	9%	8%	12%	4%	4%	6%	7%	4%	4,8%
	14	0%	11%	0%	5%	0%	10%	0%	6%	5%	5%	16%	5%	0%	5,1%
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted mean	0-15	6,6%	2,1%	3,5%	2,9%	6,3%	4,6%	11,8%	10,6%	3,6%	2,7%	5,8%	7,0%	3,2%	6,2%
	RANKING	10	1	5	3	9	7	13	12	6	2	8	11	4	

PERCENTAGE AGREEMENT

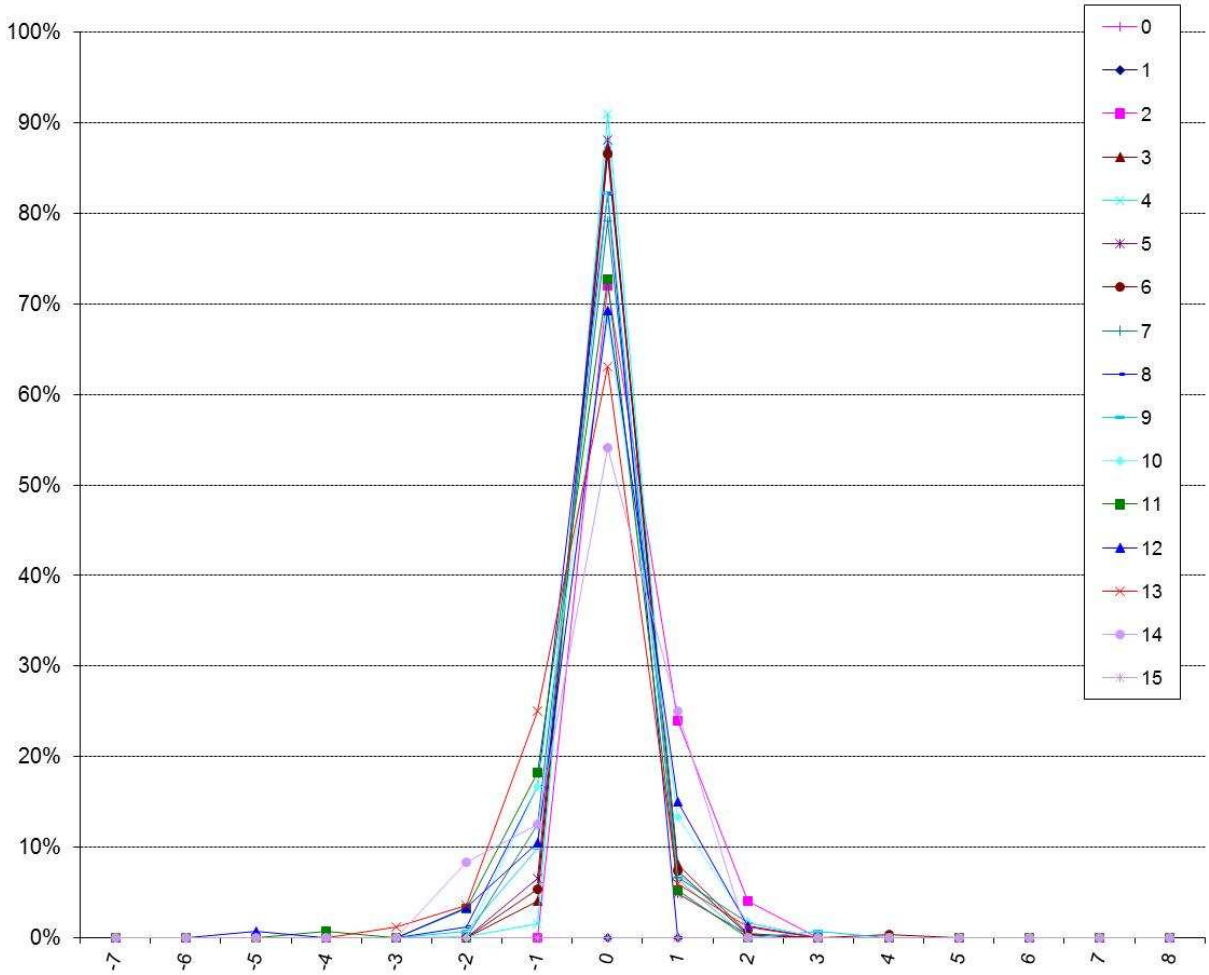
	MODAL age	France Reader 1	Iceland Reader 2	Iceland Reader 3	Germany Reader 4	Germany Reader 5	Sweden Reader 6	Norway Reader 7	Norway Reader 8	Norway Reader 9	Norway Reader 10	Norway Reader 11	Norway Reader 12	Norway Reader 13	ALL
	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	100%	100%	100%	100%	100%	100%	0%	100%	50%	50%	100%	0%	50%	72%
	3	88%	100%	100%	100%	94%	100%	69%	42%	100%	100%	94%	0%	100%	87%
	4	93%	100%	97%	99%	88%	97%	70%	84%	99%	100%	96%	16%	99%	91%
	5	90%	94%	92%	96%	90%	96%	76%	48%	96%	94%	92%	80%	92%	88%
	6	88%	92%	100%	96%	92%	92%	56%	47%	92%	96%	88%	57%	100%	87%
	7	70%	90%	100%	90%	80%	80%	60%	14%	100%	80%	90%	33%	90%	79%
	8	86%	100%	100%	86%	100%	86%	100%	0%	86%	86%	86%	-	71%	82%
	9	75%	100%	100%	92%	92%	75%	83%	0%	75%	58%	92%	75%	75%	82%
	10	80%	40%	80%	80%	60%	80%	60%	50%	80%	40%	80%	67%	80%	68%
	11	75%	85%	92%	69%	85%	77%	69%	0%	77%	54%	77%	78%	54%	73%
	12	75%	77%	67%	85%	69%	69%	33%	50%	69%	77%	69%	64%	77%	69%
	13	86%	71%	86%	71%	71%	71%	57%	50%	71%	29%	29%	80%	43%	63%
	14	100%	50%	100%	50%	100%	0%	0%	-	50%	50%	0%	50%	100%	54%
	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted mean	0-15	88,2%	94,3%	94,9%	94,3%	87,6%	91,3%	67,7%	64,3%	92,6%	89,6%	89,5%	39,2%	91,2%	85,9%
	RANKING	9	3	1	2	10	5	11	12	4	7	8	13	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.



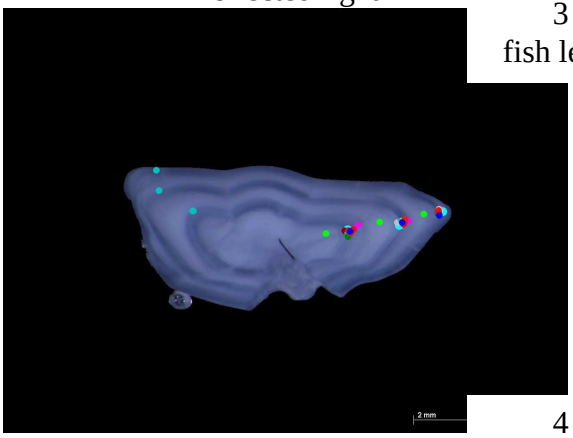
The distribution of the age reading errors in percentage by MODAL age as observed from the whole group of age readers in an age reading comparison to MODAL age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. It appears to be no RELATIVE bias,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

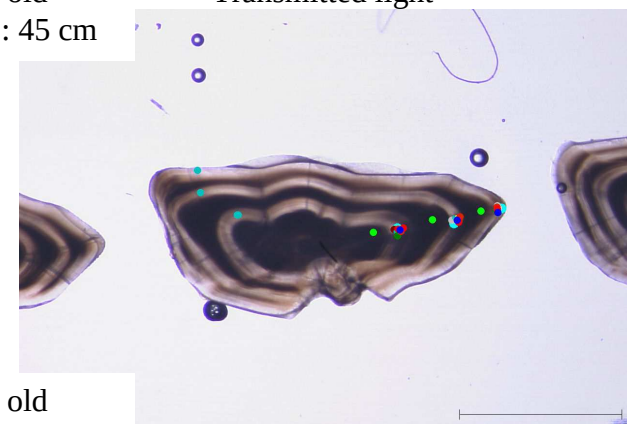
11. Appendix 3 : Reference images of the Saithe from the ICES IV (100% agreement)

Reflected light

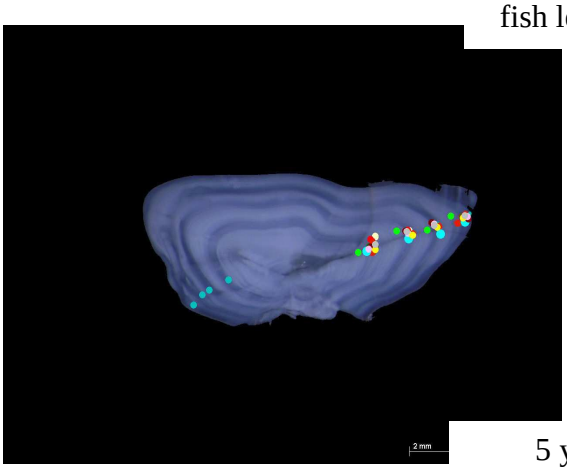
Transmitted light

3 years old
fish length : 45 cm

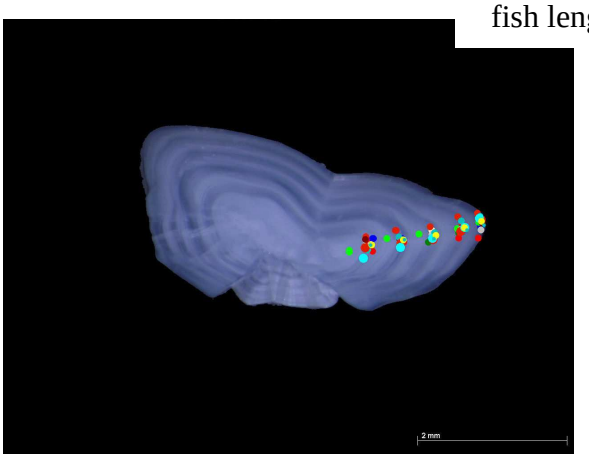


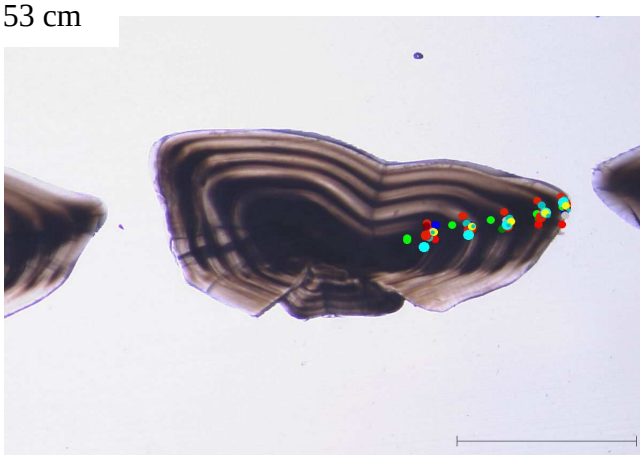


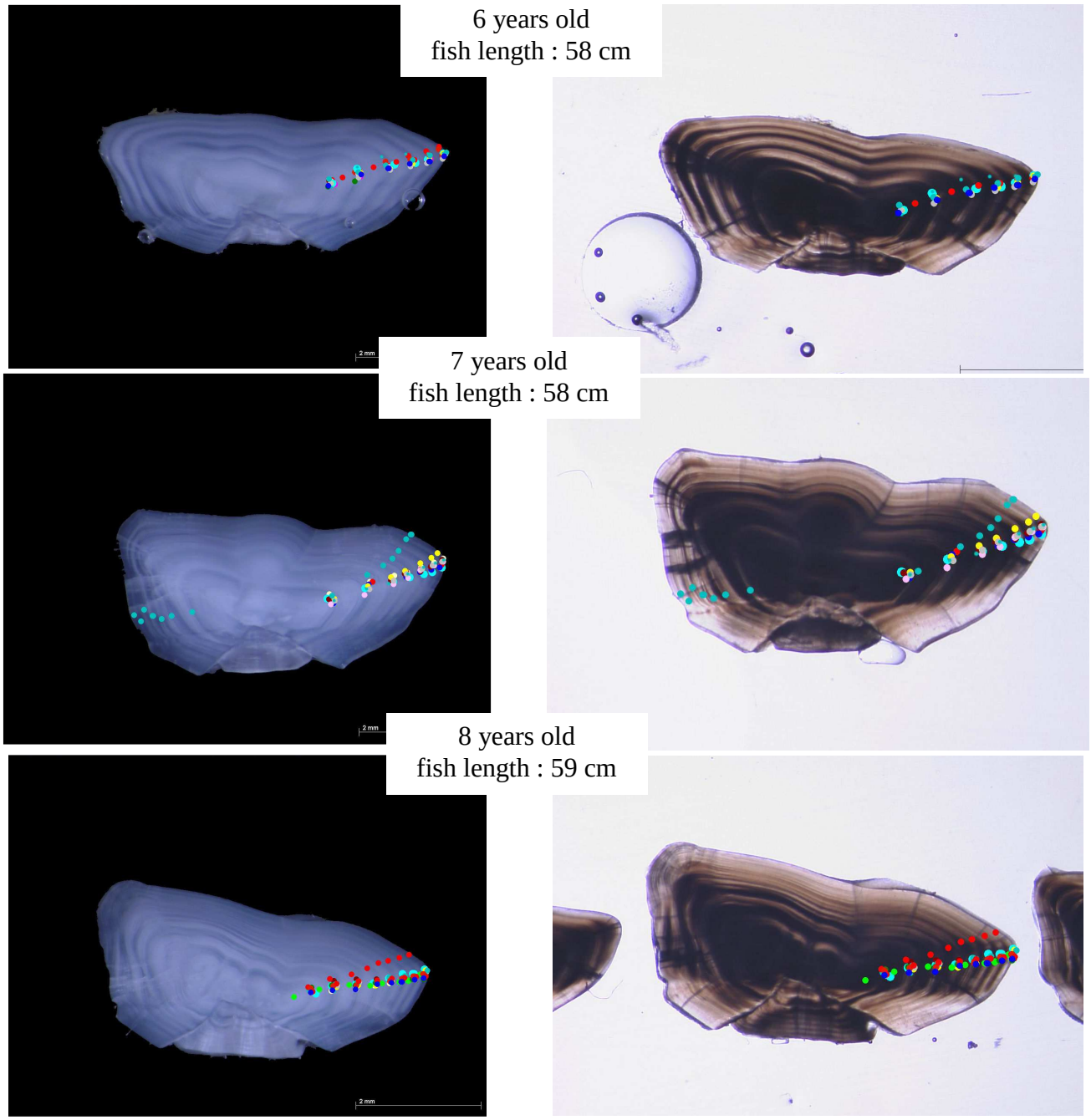
4 years old
fish length : 45 cm



5 years old
fish length : 53 cm

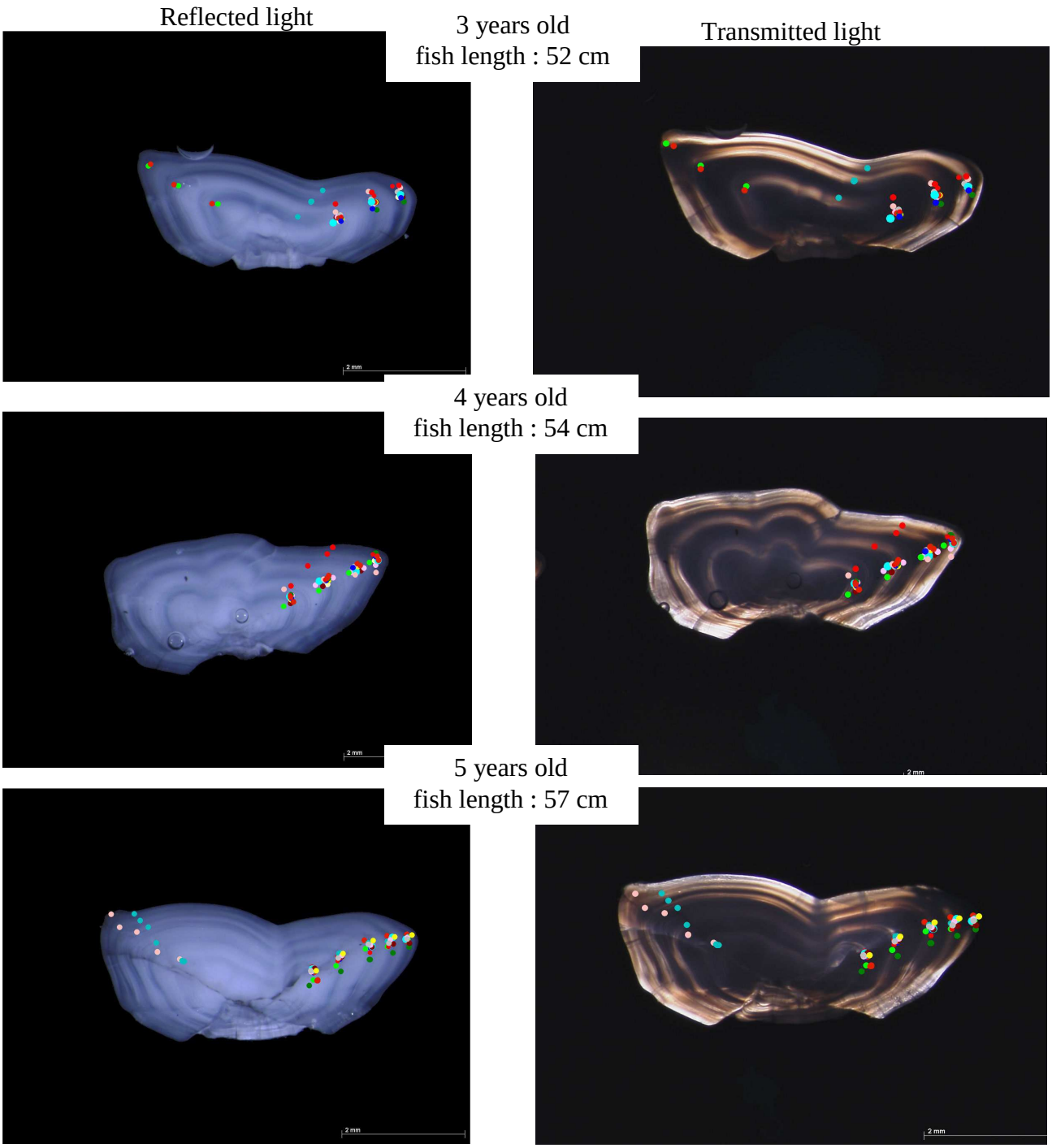


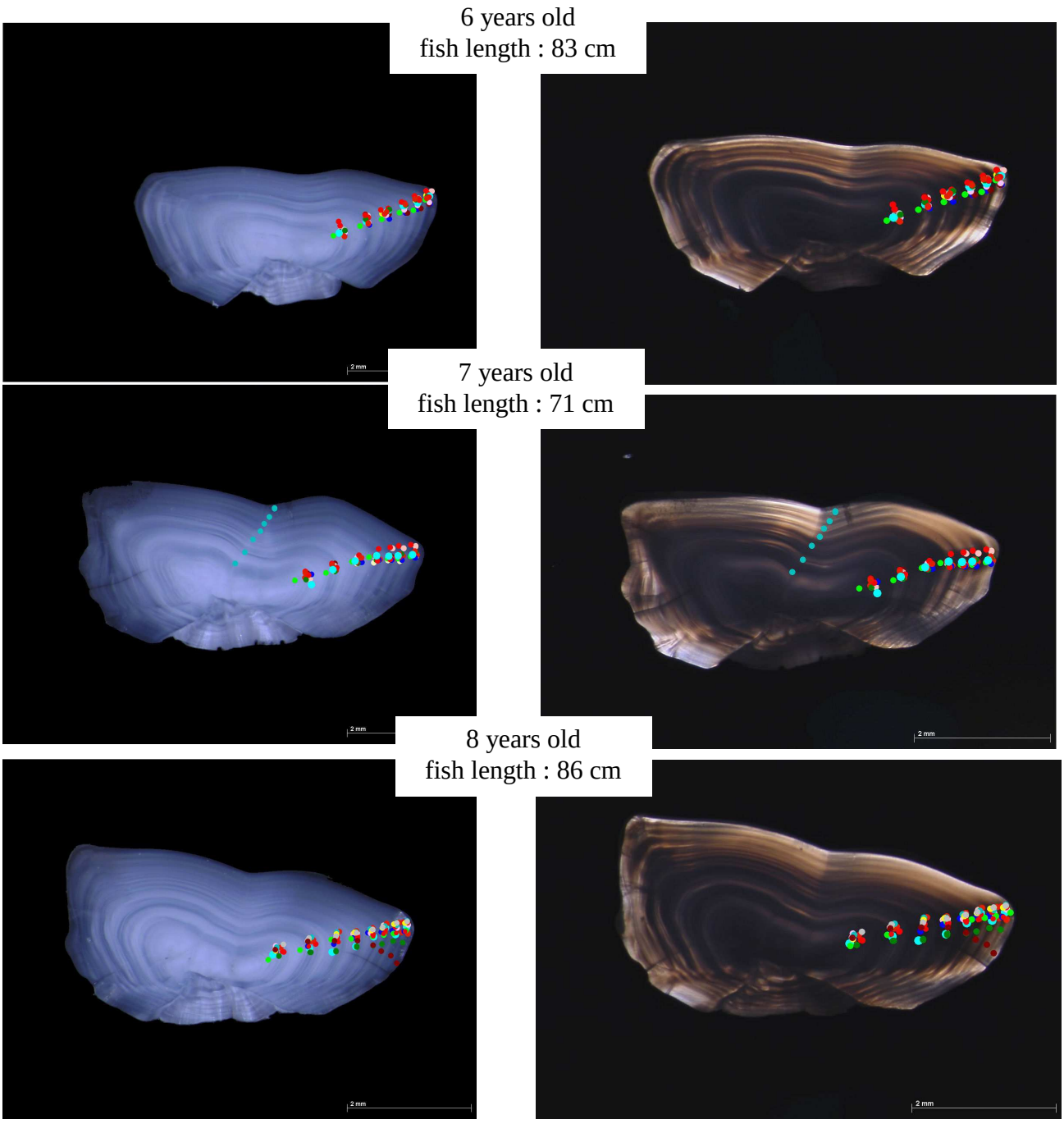




Saithe of IVa, agreement percentage of 100 % with 20 readers of 10 countries.

12. Appendix 4 : Reference images of the Saithe from the ICES VI (100% agreement)





Saithe of VI, agreement percentage of 100 % with 18 readers of 10 countries.