Results of the First Exchange on Pouting Otoliths 2015

by

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Introduction

In order to identify the current and usual problems on ageing (identifying first ring, edge type, etc) between readers of pouting *(Trisopterus luscus)* in ICES Div VIIIc+IXa , a first otolith exchange between the Instituto Português do Mar e da Atmosfera (IPMA) and the Instituto Español de Oceanografía (IEO) was carried out during the second half of 2015. This document presents the results obtained in this otoliths Exchange.

Objectives:

- To compare the different criteria applying in both laboratories: IPMA and IEO.
- Checking of precision and relative bias in age reading using the reading methods applied by both Institutes.
- To try to establish a common ageing criteria.
- Create a reference collection of otoliths.

Material and Methods

List of participants:

Reader	Firstname	Lastname	Institution	Country	Expertise level	Role
7(AL)	Ana	Leal	IEO	Spain	Trainee	Reader
8(IB)	Isabel	Bruno	IEO	Spain	Trainee	Reader
9(CG)	Cristina	González	IEO	Spain	Trainee	Reader
10(MS)	Maria	Sainza	IEO	Spain	Expert	Coordinator
3(SD)	Sandra	Dores	IPMA	Portugal	Expert	Coordinator
4(DS)	Dina	Silva	IPMA	Portugal	Trainee	Reader
5(MG)	Marta	Gonçalves	IPMA	Portugal	Trainee	Reader

A set of 168 calibrated images of the pouting otolith sections (20X magnification) was used.
Only information on catch date and sex was available to the readers.

Institute	ICES Division	Set of otolith images	Number of otolith images by set and month					
			1st Semester			2nd Semester		
			Nº images	Months	Length range (cm)	Nº images	Months	Length range (cm)
IPMA Portugal	IXa Portuguese coast	IPMA otoliths	53	1-6	6 - 33	55	7,9-12	5 - 32
IEO (Vigo) Spain	VIIIc-IXa Galician coast	IEO otoliths	30	2-4	12 - 40	30	11	25- 35

Two separate calibration exercises ran using different criteria: IEO and IPMA criteria.

A.-IPMA **criteria**.

- The readers will interpret all the otoliths from both sets following the Portuguese age reading criteria.
- The first annual ring is the first one strongly marked, that we can observe without taking into account any distance measures from the core to that ring.
- The distance between annual rings is bigger near the core becoming smaller towards the edge (thinner in older fish otoliths).
- The annual rings should be continuous around the whole otolith.

The readers have to take note of their age readings and mark growth rings based on the translucent bands considered in each digitized image. Application: WebGR (http://webgr.azti.es/)

B.-IEO **criteria**.

- The readers will interpret all the otoliths from both sets following the Spanish age reading criteria.
- The first annual ring is considered within a distance between 1.0-1.6 mm from the core.
- The distance between annual rings is bigger near the core, becoming smaller towards the edge (thinner in older fish otoliths).
- The annual rings should be continuous around the whole otolith.

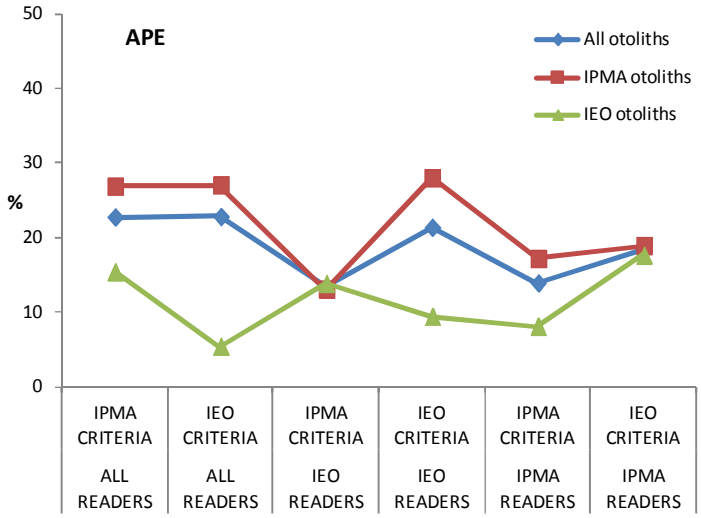
The readers have to take note of their age readings and mark growth rings based on the translucent bands considered in each digitized image. Application: ImageJ. The spreadsheet of Eltnik (2000) was completed according to the instructions contained in “Guidelines and Tools for Age Reading Comparisons” by Eltnik *et al*. (2000).

In order to know whether the readers count the same rings, total otolith radius (RT) and the radius of the first three rings considered by each reader for age estimation were measured.

Results:

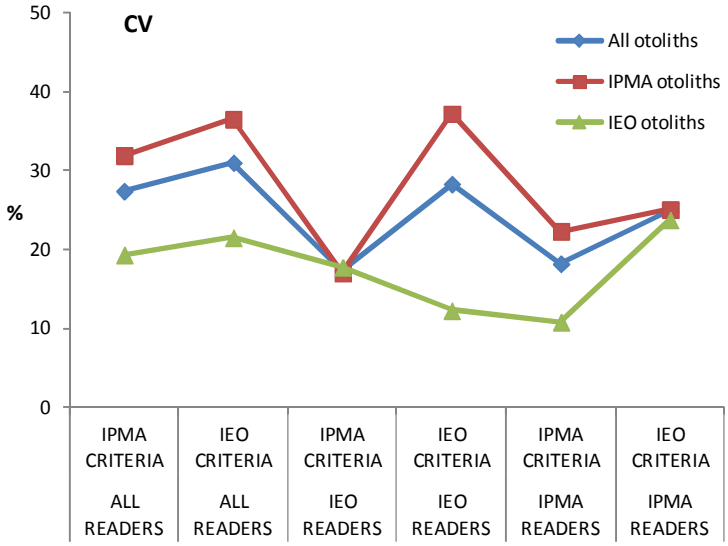
1. To access PRECISION: <u>APE, CV, D and Agreement</u>

Figures 1 below show the values obtained (%) for Average Percent Error (APE), Coefficient of Variation (CV) and Chang Index (D). The results of different sets of otoliths (all of them, otoliths from IPMA and otoliths from IEO) were compared from both calibration exercises (following IEO criteria or IPMA criteria) and different sets of readers (All readers, IPMA readers or IEO readers).



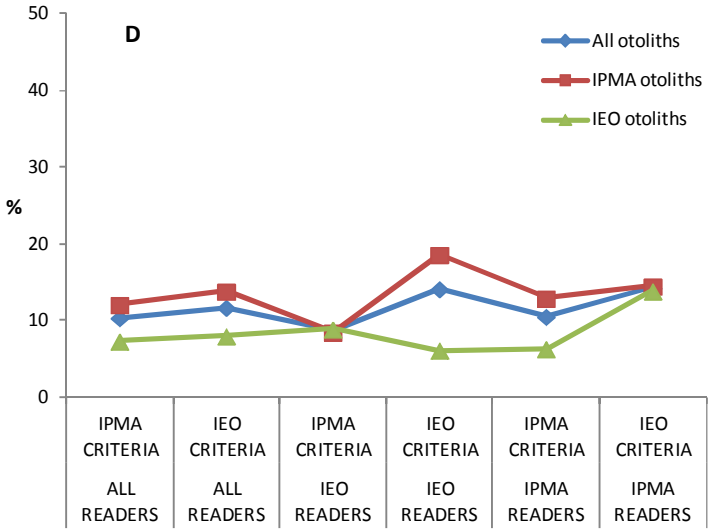
APE

The set of otoliths from the IEO presented the lower estimation of APE; IEO readers using IEO criteria had the least error (5.4%), following b the IPMA readers using IPMA criteria (8.1%). On the contrary, the set of otoliths from IPMA presented higher APE values, being the IEO readers using IEO criteria who obtained the worst results for APE (27.9%). A different calibration for both otoliths image sets could explain these differences on the APE values.



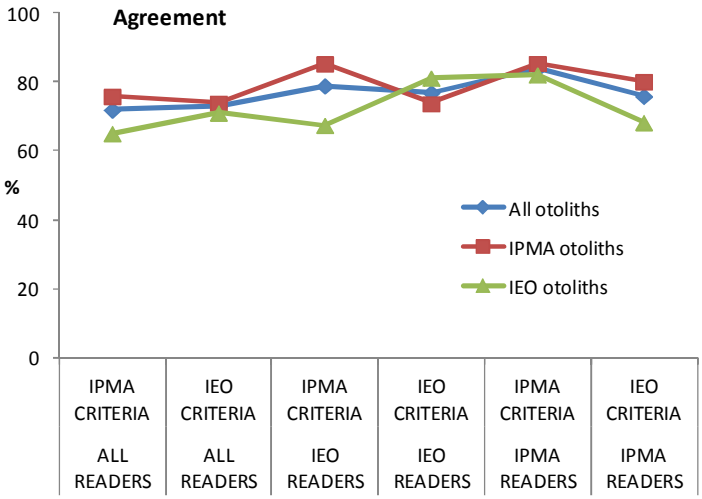
CV

The IEO otoliths sets presented the lower estimation of CV. The CV value for IPMA readers using IPMA criteria was 10.8%. The result obtained by IEO readers applying IEO criteria (12.3%) was very close to the CV value presented before. Readers from the same laboratory presented similar precision levels, as they apply the same age reading criteria. By contrast with the previous case, the IEO readers when applying IEO criteria obtained the highest CV value (37.3%) for the set of IPMA otoliths. This agrees with the mismatch between calibrations of both otolith images sets.



D

The interpretation of the Chang Index (1982) is similar to the above mentioned CV.



Agreement

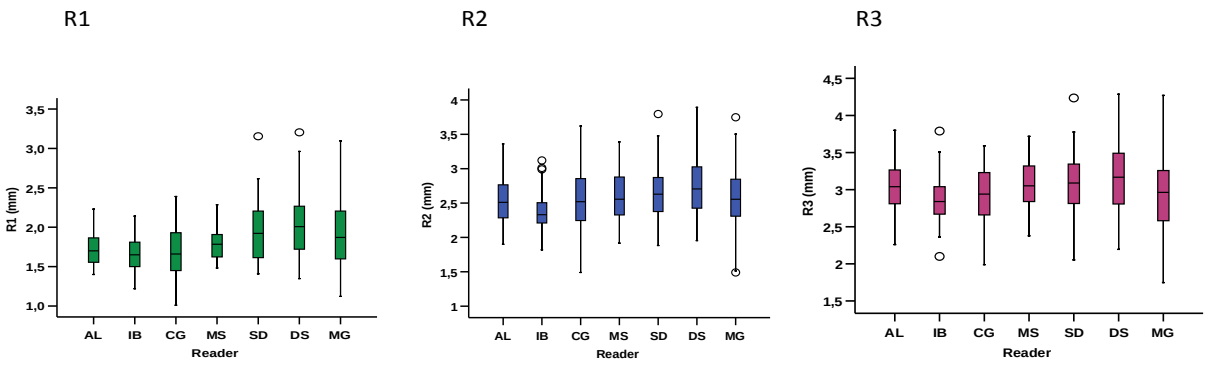
The agreement level reached between the two sets of otoliths was between 68% and 86%. The IPMA otoliths using the IPMA reading criteria have obtained the best result of age reading agreement for both IPMA and IEO readers, respectively 86% and 85%.

Anyway, the APE, CV and Chang index are considered more appropriate than the agreement level, because they incorporate the average of the fish yearly class.

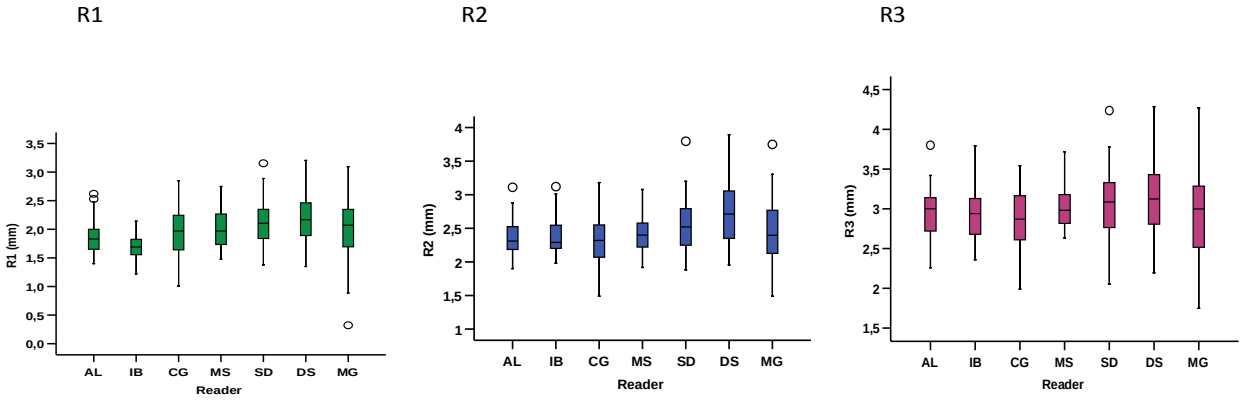
2. - To access bias: ABP (Age-bias plot) and TS (Tests of symmetry)

ABP

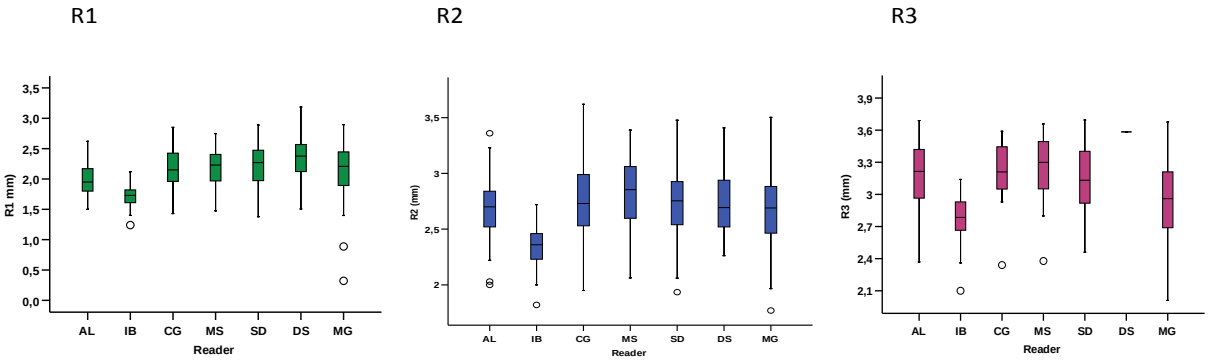
All otoliths



IEO otoliths



IPMA otoliths



Figures above show the Box-whisker plots comparison of the distances measured by reader, by applying IEO criteria.

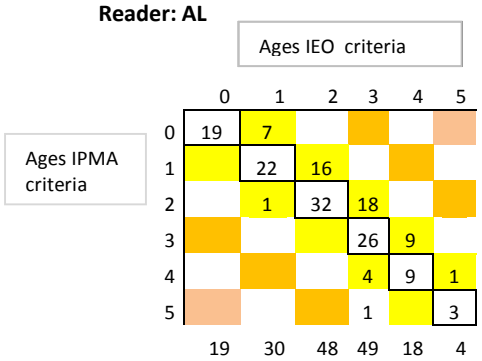
IB (IEO reader) and MG (IPMA reader) presented more differences between measures than the rest of readers for the distances of three rings. The inexperience could be the reason of this disagreement.

These results should be considered with caution, because the images of both sets of otoliths were obtained with different calibrations and the measures were a problem for the readers.

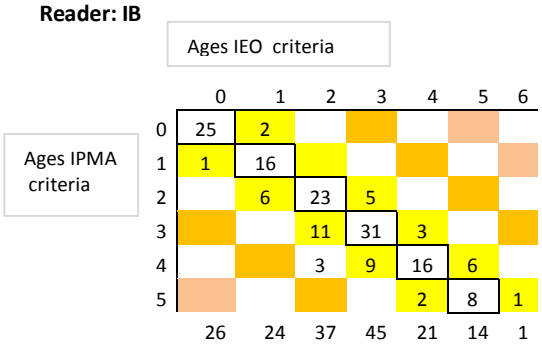
TS

Symmetry Test: The symmetry template calculates both Bowker's (unpooled) and Evans-Hoenig (diagonally-pooled, Evans & Hoenig 1998) tests of symmetry. (http://www.nefsc.noaa.gov/fbp/age-prec/). Both tests indicated certainty of bias for all readers except for MG.

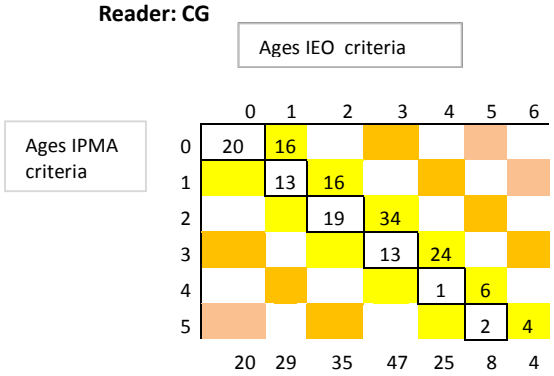
Reader: AL



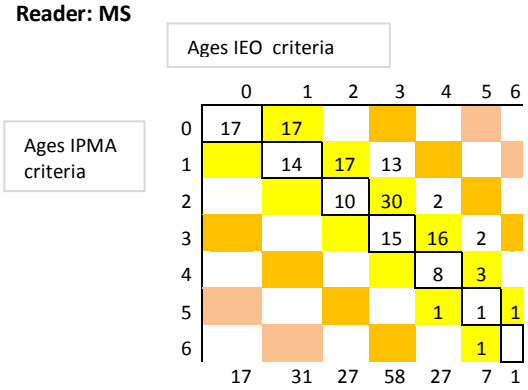
Reader: IB



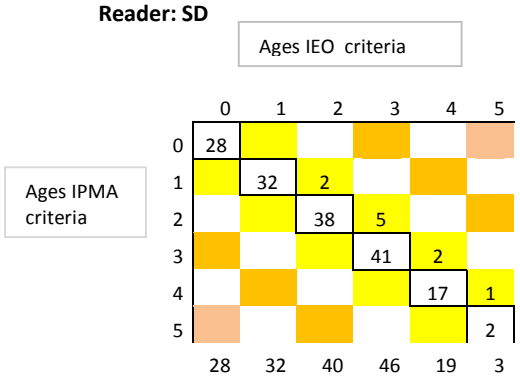
Reader: CG



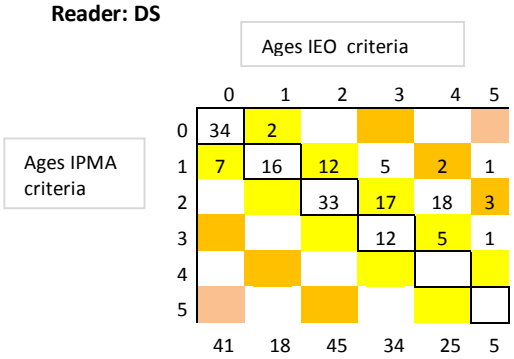
Reader: MS



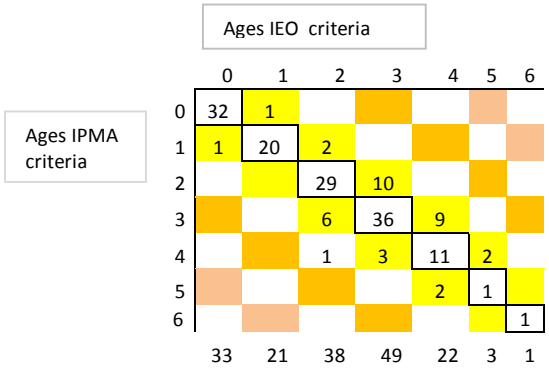
Reader: SD



Reader: DS



Reader: MG



The Kruskal-Wallis test was applied to try to determine ages with significant differences depending on the criteria used. For ages 1, 2 and 3 there were significant differences ($p<0.05$) if IEO and IPMA criteria were compared. The same test was used when the age readings of the expert readers (MS and SD) were compared and similar results were obtained.

Conclusions

Values of precision index have not concluded which of the two criteria is the most appropriated for reading pouting otoliths.

All analysis confirmed that there are differences on the ageing interpretation of the otoliths according to the applied criteria. If we compared both criteria, the main difference is the location of the first annual ring.

Studies about daily growth (validation of first annual ring) are recommended.

Problems in calibration of otoliths ageing could have affected the results of precision measures.

A new exchange must be proposed between IPMA and IEO readers to try to obtain the images with the same calibration.

References

Chang, N.Y. B. 1982. A statistical method for evaluating the reproducibility of age determination. Canadian Journal of fisheries and Aquatic Sciences, 39: 1208-1210.

Eltink, A.T.G.W., Newton, A. W., Morgado, C., Santamaria, M.T.G., and Modin, J. 2000. Guidelines and tools for age reading, European Fish Ageing Network (EFAN), EFAN Report 3 – 2000, www.efan.no/NewsAndReports/EFANReport32000.htm.

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

Evans, G. T., and Hoenig, J. M. (1998). Testing and viewing symmetry in contingency tables, with application to readers of fish ages. Biometrics 54: 620-629.

Hoenig, J. M., Morgan, M. J., and Brown, C. A. (1995). Analysing differences between two age determination methods by tests of symmetry. Can. J. Fish. Aquat. Sci. 52: 364-368.

ANNEX I: IPMA age reading criteria

IMAGE	R3 (SD)	R4 (DS)	R5 (MG)	R7(AL)	R8(IB)	R9(CG)	R10(MS)	APE	CV	STDDEV	VARIANCE
Expertise level	Expert	Trainee	Trainee	Trainee	Trainee	Trainee	Expert				
Stock assessment	no	no	no	no	no	no	no				
FAN 14_20x_0001.jpg		3	3	3	3	3	3	4 0,6494	11,1340	0,3499	0,1224
FAN 14_20x_0002.jpg		3	3	3	4	4	4	4 1,7143	13,8564	0,4949	0,2449
FAN 14_20x_0003.jpg		3	2	3	3	4	4	4 1,2422	21,2999	0,6999	0,4898
FAN 14_20x_0012.jpg		4	4	4	3	2	4	4 1,7143	20,3961	0,7284	0,5306
FAN 14_20x_0035.jpg		3	3	3	3	3	3	4 0,6494	11,1340	0,3499	0,1224
FAN 14_20x_0039.jpg		3	2	2	2	2	2	3 1,7857	19,7642	0,4518	0,2041
FAN 14_20x_0045.jpg		4	4	4	4	5	5	5 1,8433	11,1745	0,4949	0,2449
FAN 14_20x_0059.jpg		5	4	6	5	6	6	5 1,9305	13,2405	0,6999	0,4898
FAN 14_20x_0066.jpg		3	2	3	3	3	4	4 0,6494	20,3279	0,6389	0,4082
FAN 14_20x_0073.jpg		4	3	3	3	5	4	4 1,0989	18,8422	0,6999	0,4898
FAN 14_20x_0075.jpg		4	4	4	3	3	4	5 0,5291	16,5635	0,6389	0,4082
FAN 14_20x_0088.jpg		5	4	4	5	5	6	4 0,8658	14,8454	0,6999	0,4898
FAN 14_20x_O_0262.jpg		3	2	3	2	2	3	3 2,3810	19,2450	0,4949	0,2449
FAN 14_20x_O_0264.jpg		2	2	2	2	3	3	3 3,3613	20,3771	0,4949	0,2449
FAN 14_20x_O_0266.jpg		1	1	1	1	1	1	2 1,7857	30,6186	0,3499	0,1224
FAN 14_20x_O_0283.jpg		1	2	2	2	1	2	2 2,3810	26,3523	0,4518	0,2041
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FAN 14_20x_O_0290.jpg		2	1	1	1	1	2	2 4,2857	34,6410	0,4949	0,2449
FAN 14_20x_0140.jpg		2	2	2	2	2	2	2 0,0000	0,0000	0,0000	0,0000
FAN 14_20x_0141.jpg		1	2	2	1	1	2	2 3,8961	31,4918	0,4949	0,2449
FAN 14_20x_0146.jpg		2	2	2	2	3	4	3 2,3810	28,3279	0,7284	0,5306
FAN 14_20x_0160.jpg		2	2	2	2	3	3	3 2,5210	20,3771	0,4949	0,2449
FAN 14_20x_0179.jpg		3	3	3	2	3	3	3 0,7143	12,2474	0,3499	0,1224
FAN 14_20x_0186.jpg		2	2	3	2	2	3	3 2,5210	20,3771	0,4949	0,2449
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FAN 14_20x_0229.jpg		2	2	2	2	3	3	3 2,5210	20,3771	0,4949	0,2449
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FAN 14_20x_0242.jpg		2	2	2	2	2	2	3 0,9524	16,3299	0,3499	0,1224
FAN 14_20x_0247.jpg		3	3	3	3	3	4	3 3,8961	11,1340	0,3499	0,1224
FAN 14_20x_0296.jpg		3	5 -		3	3	4	4 3,0303	20,3279	0,7454	0,5556
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FAN 14_20x_0307.jpg		2	2	3	2	2	3	2 1,7857	19,7642	0,4518	0,2041
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FAN 14_20x_0309.jpg		2	2	2	3	3	3	3 2,3810	19,2450	0,4949	0,2449
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FAN 14_20x_0340.jpg		3	3	3	4	5	5	4 0,5291	21,5961	0,8330	0,6939
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FAN 14_20x_0344.jpg		2	2	2	2	2	3	2 5,7143	16,3299	0,3499	0,1224
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015_XCH_2015_20x.jpg		1	0	0	1	1	1	1 14,2857	63,2456	0,4518	0,2041
016_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
017_XCH_2015_20x.jpg		1	2	3	1	1	2	1 3,8961	46,3547	0,7284	0,5306
018_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
019_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
020_XCH_2015_20x.jpg		1	1	1	2	2	2	2 3,8961	31,4918	0,4949	0,2449
021_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
022_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
023_XCH_2015_20x.jpg		1	1	1	2	1	2	1 7,9365	35,1364	0,4518	0,2041
024_XCH_2015_20x.jpg		2	4	3	2	2	3	3 3,7594	25,7841	0,6999	0,4898
025_XCH_2015_20x.jpg		2	3	3	2	3	3	3 1,5038	16,6436	0,4518	0,2041
026_XCH_2015_20x.jpg		2	2	2	2	3	3	3 3,3613	20,3771	0,4949	0,2449
027_XCH_2015_20x.jpg		2	1	2	1	3	2	2 8,7912	34,4010	0,6389	0,4082
028_XCH_2015_20x.jpg		3	4	4	2	3	3	3 5,1948	20,3279	0,6389	0,4082

ANNEX I: IPMA age reading criteria

IMAGE	R3 (SD)	R4 (DS)	R5 (MG)	R7(AL)	R8(IB)	R9(CG)	R10(MS)	APE	CV	STDDEV	VARIANCE
Expertise level	Expert	Trainee	Trainee	Trainee	Trainee	Trainee	Expert				
Stock assessment	no	no	no	no	no	no	no				
029_XCH_2015_20x.jpg		3	1	3	2	3	3	3 2,3810	28,3279	0,7284	0,5306
030_XCH_2015_20x.jpg		2	2	2	2	3	3	3 3,3613	20,3771	0,4949	0,2449
031_XCH_2015_20x.jpg		2	2	2	2	2	2	2 0,0000	0,0000	0,0000	0,0000
032_XCH_2015_20x.jpg		2	3	3	2	3	2	3 3,1746	19,2450	0,4949	0,2449
033_XCH_2015_20x.jpg		3	2	2	3	3	3	3 1,5038	16,6436	0,4518	0,2041
034_XCH_2015_20x.jpg		2	2	3	3	3	3	3 3,7594	16,6436	0,4518	0,2041
035_XCH_2015_20x.jpg		3	3	3	3	3	3	3 0,0000	0,0000	0,0000	0,0000
036_XCH_2015_20x.jpg		2	2	2	3	3	3	3 2,3810	19,2450	0,4949	0,2449
037_XCH_2015_20x.jpg		3	2	2	2	3	3	2 2,5210	20,3771	0,4949	0,2449
038_XCH_2015_20x.jpg		4	4	4	3	3	3	3 1,7857	14,4338	0,4949	0,2449
039_XCH_2015_20x.jpg		3	3	3	3	3	3	3 0,0000	0,0000	0,0000	0,0000
040_XCH_2015_20x.jpg		3	3	2	3	3	3	3 0,7143	12,2474	0,3499	0,1224
041_XCH_2015_20x.jpg		4	4	3	3	4	3	3 2,3810	14,4338	0,4949	0,2449
042_XCH_2015_20x.jpg		4	5	4	2	3	2	3 3,1056	31,3526	1,0302	1,0612
043_XCH_2015_20x.jpg		4	4	4	4	4	4	4 0,0000	0,0000	0,0000	0,0000
044_XCH_2015_20x.jpg		3	4	3	3	4	3	3 1,2422	13,7490	0,4518	0,2041
045_XCH_2015_20x.jpg		3	5	3	3	3	3	3 7,4534	21,2999	0,6999	0,4898
046_XCH_2015_20x.jpg		3	2	2	2	4	2	3 2,3810	28,3279	0,7284	0,5306
047_XCH_2015_20x.jpg		3	4	3	4	4	4	5 0,5291	16,5635	0,6389	0,4082
048_XCH_2015_20x.jpg		4	4	4	3	3	4	3 1,7143	13,8564	0,4949	0,2449
049_XCH_2015_20x.jpg		3	3	3	3	4	4	4 1,7857	14,4338	0,4949	0,2449
050_XCH_2015_20x.jpg		3	3	3	3	4	4	3 1,2422	13,7490	0,4518	0,2041
051_XCH_2015_20x.jpg		4	3	4	3	4	4	4 1,0989	12,1626	0,4518	0,2041
052_XCH_2015_20x.jpg		3	3	3	3	5	3	3 1,2422	21,2999	0,6999	0,4898
053_XCH_2015_20x.jpg		4	4	5	4	5	3	4 0,4926	15,4212	0,6389	0,4082
054_XCH_2015_20x.jpg		3	3	3	3	5	3	3 1,2422	21,2999	0,6999	0,4898
055_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
056_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
057_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
058_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
059_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
060_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
061_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
062_XCH_2015_20x.jpg		0	0	0	1	0	0	1 14,2857	158,1139	0,4518	0,2041
063_XCH_2015_20x.jpg		0	0	0	0	0	0	0 0,0000	0,0000	0,0000	0,0000
064_XCH_2015_20x.jpg		0	0	0	1	0	1	1 14,2857	115,4701	0,4949	0,2449
065_XCH_2015_20x.jpg		0	0	0	1	0	1	1 14,2857	115,4701	0,4949	0,2449
066_XCH_2015_20x.jpg		0	0	0	1	0	1	1 14,2857	115,4701	0,4949	0,2449
067_XCH_2015_20x.jpg		0	0	0	1	0	1	1 14,2857	115,4701	0,4949	0,2449
068_XCH_2015_20x.jpg		0	0	0	1	0	1	1 19,0476	115,4701	0,4949	0,2449
069_XCH_2015_20x.jpg		0	0	0	1	0	1	1 14,2857	115,4701	0,4949	0,2449
070_XCH_2015_20x.jpg		0	0	0	1	1	1	1 10,7143	86,6025	0,4949	0,2449
071_XCH_2015_20x.jpg		0	0	0	1	1	1	1 10,7143	86,6025	0,4949	0,2449
072_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
073_XCH_2015_20x.jpg		1	1	1	1	1	1	1 0,0000	0,0000	0,0000	0,0000
074_XCH_2015_20x.jpg		1	0	1	1	1	1	1 2,3810	40,8248	0,3499	0,1224
075_XCH_2015_20x.jpg		1	0	0	1	2	1	1 14,2857	74,5356	0,6389	0,4082
076_XCH_2015_20x.jpg		0	0	0	1	1	1	1 10,7143	86,6025	0,4949	0,2449
077_XCH_2015_20x.jpg		1	0	1	2	2	1	1 10,7143	55,9017	0,6389	0,4082
078_XCH_2015_20x.jpg		0	0	0	1	1	1	1 14,2857	86,6025	0,4949	0,2449
079_XCH_2015_20x.jpg		1	1	3	1	1	1	1 3,1746	54,4331	0,6999	0,4898
080_XCH_2015_20x.jpg		1	0	1	2	2	2	1 7,9365	54,4331	0,6999	0,4898
081_XCH_2015_20x.jpg		1	1	1	1	1	2	2 7,9365	35,1364	0,4518	0,2041
082_XCH_2015_20x.jpg		1	1	1	2	2	2	1 5,7143	34,6410	0,4949	0,2449
083_XCH_2015_20x.jpg		1	0	1	2	2	2	2 4,2857	50,9902	0,7284	0,5306
084_XCH_2015_20x.jpg		1	0	1	2	2	2	2 5,7143	50,9902	0,7284	0,5306
085_XCH_2015_20x.jpg		1	2	2	2	2	1	2 2,3810	26,3523	0,4518	0,2041
086_XCH_2015_20x.jpg		1	2	2	2	2	1	2 2,3810	26,3523	0,4518	0,2041
087_XCH_2015_20x.jpg		1	0	1	2	2	2	2 4,2857	50,9902	0,7284	0,5306
088_XCH_2015_20x.jpg		1	0	1	2	2	2	2 5,7143	50,9902	0,7284	0,5306
089_XCH_2015_20x.jpg		2	3	3	2	3	2	2 3,3613	20,3771	0,4949	0,2449
090_XCH_2015_20x.jpg		1	2	2	1	2	1	2 3,8961	31,4918	0,4949	0,2449
091_XCH_2015_20x.jpg		2	3	3	2	3	2	3 3,1746	19,2450	0,4949	0,2449
092_XCH_2015_20x.jpg		2	2	2	2	3	2	3 1,7857	19,7642	0,4518	0,2041
093_XCH_2015_20x.jpg		2	2	2	2	2	2	2 0,0000	0,0000	0,0000	0,0000
094_XCH_2015_20x.jpg		2	2	2	2	2	2	2 0,0000	0,0000	0,0000	0,0000
095_XCH_2015_20x.jpg		2	2	2	2	2	2	3 0,9524	16,3299	0,3499	0,1224
096_XCH_2015_20x.jpg		2	2	2	2	2	2	2 0,0000	0,0000	0,0000	0,0000
097_XCH_2015_20x.jpg		3	2	3	3	3	3	3 4,2857	12,2474	0,3499	0,1224
098_XCH_2015_20x.jpg		2	2	2	2	2	2	2 0,0000	0,0000	0,0000	0,0000
099_XCH_2015_20x.jpg		3	4	3	2	3	2	4 4,7619	25,1976	0,7559	0,5714
100_XCH_2015_20x.jpg		4	3	3	3	3	3	4 3,1056	13,7490	0,4518	0,2041
101_XCH_2015_20x.jpg		4	4	4	3	4	3	4 1,0989	12,1626	0,4518	0,2041
102_XCH_2015_20x.jpg		3	1	3	2	2	1	3 7,6190	38,8730	0,8330	0,6939
103_XCH_2015_20x.jpg		2	1	2	2	2	2	2 1,0989	18,8422	0,3499	0,1224
104_XCH_2015_20x.jpg		3	3	3	3	3	3	3 0,0000	0,0000	0,0000	0,0000
105_XCH_2015_20x.jpg		2	2	2	3	3	3	3 3,1746	19,2450	0,4949	0,2449
106_XCH_2015_20x.jpg		3	4	4	4	4	4	4 0,5291	9,0722	0,3499	0,1224
107_XCH_2015_20x.jpg		3	3	3	3	5	3	3 1,2422	21,2999	0,6999	0,4898
108_XCH_2015_20x_timol.jpg		3	3	3	3	3	3	3 0,0000	0,0000	0,0000	0,0000
109_XCH_2015_20x.jpg		4	5	5	3	5	2	3 3,1746	29,1630	1,1249	1,2653

ANNEX II IEO age reading criteria

Stratum	Sample year	Fish no	Fish length	Sex	Landing month	SD R3	DS R4	MG R5	AL R7	IB R8	CG R9	MS 10	MODAL age	Percent agreement	Precision CV
VIIIc-IXa	28/02/2014	FAN 14_20x_0001.jpg	26.5	female	2	3	2	3	4	3	3	3	3	71%	19%
VIIIc-IXa	28/02/2014	FAN 14_20x_0002.jpg	24	male	2	3	3	3	3	3	3	3	3	100%	0%
VIIIc-IXa	28/02/2014	FAN 14_20x_0003.jpg	23	male	2	3	2	3	4	3	3	3	3	71%	19%
VIIIc-IXa	28/02/2014	FAN 14_20x_0012.jpg	22.5	female	2	4	2	4	3	2	3	2	2	43%	31%
VIIIc-IXa	28/02/2014	FAN 14_20x_0035.jpg	27	male	2	3	3	3	3	3	3	3	3	100%	0%
VIIIc-IXa	28/02/2014	FAN 14_20x_0039.jpg	20.5	male	2	3	1	2	2	2	2	2	2	71%	29%
VIIIc-IXa	28/02/2014	FAN 14_20x_0045.jpg	31.5	female	2	4	1	4	4	4	4	5	4	71%	34%
VIIIc-IXa	28/02/2014	FAN 14_20x_0059.jpg	40	female	2	5	2	6	5	5	5	6	5	57%	28%
VIIIc-IXa	28/02/2014	FAN 14_20x_0066.jpg	28.5	female	2	3	2	3	3	3	3	3	3	86%	13%
VIIIc-IXa	28/02/2014	FAN 14_20x_0073.jpg	34	female	2	4	2	3	3	4	3	4	4	43%	23%
VIIIc-IXa	28/02/2014	FAN 14_20x_0075.jpg	30	male	2	4	2	4	3	3	3	4	4	43%	23%
VIIIc-IXa	28/02/2014	FAN 14_20x_0088.jpg	35.5	female	2	4	3	4	5	5	5	5	5	57%	18%
VIIIc-IXa	15/03/2014	FAN 14_20x_O_0262.jpg	19	male	3	3	2	3	2	2	2	2	2	71%	21%
VIIIc-IXa	15/03/2014	FAN 14_20x_O_0264.jpg	25.5	female	3	2	2	2	2	3	2	2	2	86%	18%
VIIIc-IXa	15/03/2014	FAN 14_20x_O_0266.jpg	16	female	3	1	1	1	1	1	1	1	1	100%	0%
VIIIc-IXa	15/03/2014	FAN 14_20x_O_0283.jpg	14.5	male	3	1	1	2	1	1	2	1	1	71%	38%
VIIIc-IXa	15/03/2014	FAN 14_20x_O_0286.jpg	12.5	undefined	3	1	1	3	1	1	2	1	1	71%	55%
VIIIc-IXa	15/03/2014	FAN 14_20x_O_0290.jpg	15	male	3	2	1	1	1	1	1	1	1	86%	33%
VIIIc-IXa	10/04/2014	FAN 14_20x_0140.jpg	20	male	4	1	1	2	2	2	2	1	2	57%	34%
VIIIc-IXa	10/04/2014	FAN 14_20x_0141.jpg	19.5	male	4	1	1	2	1	1	1	1	1	86%	33%
VIIIc-IXa	10/04/2014	FAN 14_20x_0146.jpg	23.5	female	4	2	2	2	2	3	3	1	2	57%	32%
VIIIc-IXa	10/04/2014	FAN 14_20x_0160.jpg	23	male	4	2	2	2	2	3	2	2	2	86%	18%
VIIIc-IXa	10/04/2014	FAN 14_20x_0179.jpg	20.5	female	4	3	3	3	2	3	3	1	3	71%	31%
VIIIc-IXa	10/04/2014	FAN 14_20x_0186.jpg	18.5	female	4	2	1	3	2	2	2	1	2	57%	37%
VIIIc-IXa	10/04/2014	FAN 14_20x_0228.jpg	22	male	4	3	2	4	2	2	2	1	2	57%	42%
VIIIc-IXa	10/04/2014	FAN 14_20x_0229.jpg	19.5	male	4	2	1	2	2	2	2	2	2	86%	20%
VIIIc-IXa	10/04/2014	FAN 14_20x_0234.jpg	22	male	4	2	2	2	2	2	2	2	2	100%	0%
VIIIc-IXa	10/04/2014	FAN 14_20x_0239.jpg	23.5	female	4	3	3	3	3	3	3	2	3	86%	13%
VIIIc-IXa	10/04/2014	FAN 14_20x_0242.jpg	22.5	male	4	2	2	2	2	2	2	2	2	100%	0%
VIIIc-IXa	10/04/2014	FAN 14_20x_0247.jpg	19.5	female	4	3	3	3	2	2	3	2	3	57%	21%
VIIIc-IXa	26/11/2014	FAN 14_20x_0296.jpg	30	female	11	3	1		3	3	3	3	3	83%	55%
VIIIc-IXa	26/11/2014	FAN 14_20x_0298.jpg	28	male	11	3	1	2	3	2	3	2	3	43%	33%
VIIIc-IXa	26/11/2014	FAN 14_20x_0303.jpg	28.5	female	11	2	2	3	2	3	3	2	2	57%	22%
VIIIc-IXa	26/11/2014	FAN 14_20x_0304.jpg	30.5	female	11	2	2	3	2	3	3	2	2	57%	22%
VIIIc-IXa	26/11/2014	FAN 14_20x_0306.jpg	28	male	11	3	2	3	3	3	3	2	3	71%	18%
VIIIc-IXa	26/11/2014	FAN 14_20x_0307.jpg	28.5	female	11	2	2	3	2	2	2	2	2	86%	18%
VIIIc-IXa	26/11/2014	FAN 14_20x_0308.jpg	30	female	11	2	2	3	2	3	2	2	2	71%	21%
VIIIc-IXa	26/11/2014	FAN 14_20x_0309.jpg	26	male	11	2	2	2	2	2	3	2	2	86%	18%
VIIIc-IXa	26/11/2014	FAN 14_20x_0322.jpg	32	female	11	3	2	4	3	3	3	4	3	57%	22%
VIIIc-IXa	26/11/2014	FAN 14_20x_0323.jpg	30	female	11	4	2	4	4	4	4	4	4	86%	20%
VIIIc-IXa	26/11/2014	FAN 14_20x_0325.jpg	29.5	male	11	4	3	4	4	4	4	4	4	86%	10%
VIIIc-IXa	26/11/2014	FAN 14_20x_0327.jpg	31.5	female	11	3	3	4	3	3	3	3	3	86%	12%
VIIIc-IXa	26/11/2014	FAN 14_20x_0328.jpg	31.5	female	11	4	2	5	4	4	5	4	4	57%	25%
VIIIc-IXa	26/11/2014	FAN 14_20x_0329.jpg	34	female	11	3	3	4	4	5	5	4	4	43%	20%
VIIIc-IXa	26/11/2014	FAN 14_20x_0330.jpg	33	female	11	5	3	5	5	4	5	5	5	71%	17%
VIIIc-IXa	26/11/2014	FAN 14_20x_0331.jpg	25.5	male	11	2	1	4	2	2	2	2	2	71%	42%
VIIIc-IXa	26/11/2014	FAN 14_20x_0332.jpg	26.5	male	11	2	2	2	2	2	2	2	2	100%	0%
VIIIc-IXa	26/11/2014	FAN 14_20x_0340.jpg	31.5	undefined	11	3	3	3	4	4	4	4	4	57%	15%
VIIIc-IXa	26/11/2014	FAN 14_20x_0342.jpg	28	female	11	2	2	2	3	3	3	3	3	57%	21%
VIIIc-IXa	26/11/2014	FAN 14_20x_0344.jpg	29	female	11	2	2	2	2	2	2	2	2	100%	0%
VIIIc-IXa	26/11/2014	FAN 14_20x_0345.jpg	33	female	11	3	2	4	3	3	3	3	3	71%	19%
VIIIc-IXa	26/11/2014	FAN 14_20x_0346.jpg	28.5	female	11	2	2	3	2	2	2	2	2	86%	18%
VIIIc-IXa	26/11/2014	FAN 14_20x_0347.jpg	32	female	11	3	2	3	4	4	4	3	3	43%	23%
VIIIc-IXa	26/11/2014	FAN 14_20x_0348.jpg	33.5	female	11	3	3	4	4	4	4	4	4	71%	13%
VIIIc-IXa	26/11/2014	FAN 14_20x_0349.jpg	35	female	11	4	2	3	4	4	5	3	4	43%	27%
VIIIc-IXa	26/11/2014	FAN 14_20x_0350.jpg	30	female	11	2	3	3	3	4	3	3	3	71%	19%
VIIIc-IXa	26/11/2014	FAN 14_20x_0354.jpg	32.5	female	11	3	2	3	3	4	3	3	3	71%	19%
VIIIc-IXa	26/11/2014	FAN 14_20x_0357.jpg	31	female	11	3	2	3	3	4	3	3	3	71%	19%
VIIIc-IXa	26/11/2014	FAN 14_20x_0358.jpg	33	female	11	3	3	3	5	4	3	4	3	57%	22%
VIIIc-IXa	26/11/2014	FAN 14_20x_0359.jpg	34	female	11	4	3	3	4	5	4	4	4	57%	18%
Ixa	01/04/2009	001_XCH_2015_20x.jpg	6.5	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	002_XCH_2015_20x.jpg	7.4	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	003_XCH_2015_20x.jpg	7.4	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	004_XCH_2015_20x.jpg	8.6	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	005_XCH_2015_20x.jpg	8.4	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	006_XCH_2015_20x.jpg	9.3	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	007_XCH_2015_20x.jpg	9.7	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	009_XCH_2015_20x.jpg	10.6	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	010_XCH_2015_20x.jpg	11.9	undefined	4	0	0	0	0	0	0	0	0	100%	0%
Ixa	02/04/2009	011_XCH_2015_20x.jpg	11.4	undefined	4	1	0	0	0	0	0	1	0	71%	171%
Ixa	02/04/2009	012_XCH_2015_20x.jpg	12.2	undefined	4	1	0	0	0	1	0	1	0	57%	125%
Ixa	02/04/2009	013_XCH_2015_20x.jpg	12.9	male	4	1	1	0	1	1	1	1	1	86%	44%
Ixa	19/02/2008	014_XCH_2015_20x.jpg	13.2	male	2	1	1	0	1	1	0	1	1	71%	68%
Ixa	02/04/2009	015_XCH_2015_20x.jpg	13.4	female	4	1	1	0	1	1	0	1	1	71%	68%
Ixa	11/02/2009	016_XCH_2015_20x.jpg	14.5	male	2	1	1	1	2	1	1	1	1	86%	33%
Ixa	14/04/2009	017_XCH_2015_20x.jpg	14.7	male	4	1	1	3	1	1	1	1	1	86%	59%
Ixa	11/02/2009	018_XCH_2015_20x.jpg	15.8	female	2	1	1	1	1	1	1	1	1	100%	0%
Ixa	11/02/2009	019_XCH_2015_20x.jpg	15.5	female	2	1	1	1	1	1	1	1	1	100%	0%
Ixa	11/02/2009	020_XCH_2015_20x.jpg	16.8	male	2	1	1	1	1	2	1	1	1	86%	33%
Ixa	11/02/2009	021_XCH_2015_20x.jpg	16.9	male	2	1	1	1	1	2	1	1	1	86%	33%
Ixa	29/01/2009	022_XCH_2015_20x.jpg	17.7	female	1	1	1	1	1	2	1	1	1	86%	33%
Ixa	11/02/2009	023_XCH_2015_20x.jpg	17.2	male	2	1	1	1	1	2	1	1	1	86%	33%
Ixa	11/02/2009	024_XCH_2015_20x.jpg	18.7	male	2	2	2	2	2	3	2	1	2	71%	29%
Ixa	11/02/2009	025_XCH_2015_20x.jpg	18.8	male	2	2	1	2	2	2	2	1	2	71%	28%
Ixa	29/01/2009	026_XCH_2015_20x.jpg	19.5	male	1	2	2	2	1	3	2	1	2	57%	37%
Ixa	11/02/2009	027_XCH_2015_20x.jpg	19.2	male	2	2	1	2	1	3	1	1	1	57%	50%
Ixa	29/01/2009	028_XCH_2015_20x.jpg	20.9	male	1	3	2	3	2	3	2	2	2	57%	22%
Ixa	29/01/2009	029_XCH_2015_20x.jpg	20.9	female	1	3	1	2	2	3	2	1	2	43%	41%
Ixa	29/01/2009	030_XCH_2015_20x.jpg	21.8	male	1	2	1	2	2	3	2	1	2	57%	37%

ANNEX II IEO age reading criteria

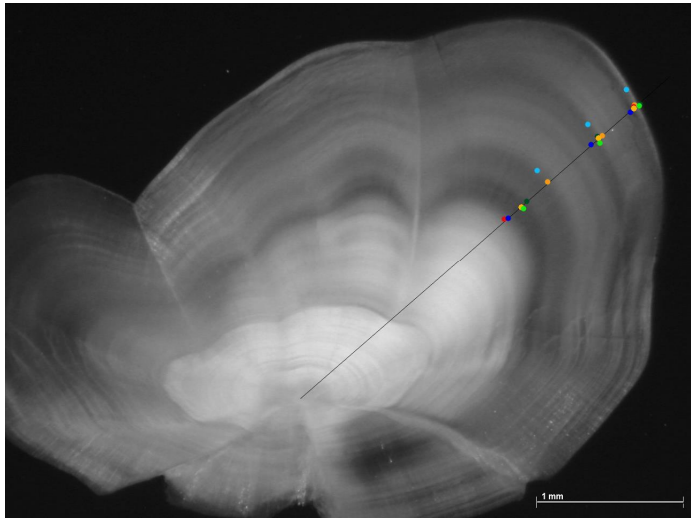
Stratum	Sample year	Fish no	Fish length	Sex	Landing month	SD R3	DS R4	MG R5	AL R7	IB R8	CG R9	MS 10	**MODAL age**	**Percent agreement**	**Precision CV**
Ixa	29/01/2009	031_XCH_2015_20x.jpg	21.6	female	1	2	2	2	1	3	1	1	2	43%	44%
Ixa	29/01/2009	032_XCH_2015_20x.jpg	22.2	male	1	2	2	2	2	2	1	1	2	71%	28%
Ixa	29/01/2009	033_XCH_2015_20x.jpg	22.5	male	1	2	2	2	2	3	2	1	2	71%	29%
Ixa	29/01/2009	034_XCH_2015_20x.jpg	23.6	female	1	2	2	2	2	3	2	1	2	71%	29%
Ixa	29/01/2009	035_XCH_2015_20x.jpg	23.2	male	1	3	2	3	2	3	2	1	3	43%	33%
Ixa	29/01/2009	036_XCH_2015_20x.jpg	24.2	female	1	2	2	2	2	3	2	2	2	86%	18%
Ixa	29/01/2009	037_XCH_2015_20x.jpg	24.3	female	1	2	2	2	2	3	2	2	2	86%	18%
Ixa	29/01/2009	038_XCH_2015_20x.jpg	25.1	female	1	3	2	3	2	4	2	2	2	57%	31%
Ixa	29/01/2009	039_XCH_2015_20x.jpg	25.4	female	1	3	2	2	2	3	2	2	2	71%	21%
Ixa	29/01/2009	040_XCH_2015_20x.jpg	26.7	female	1	3	2	2	2	4	2	2	2	71%	32%
Ixa	11/02/2009	041_XCH_2015_20x.jpg	26.6	female	2	4	2	3	2	4	2	3	2	43%	31%
Ixa	21/01/2004	042_XCH_2015_20x.jpg	27.8	female	1	4	2	3	2	3	2	2	2	57%	31%
Ixa	25/02/2009	043_XCH_2015_20x.jpg	27.2	female	2	4	2	3	3	4	3	2	3	43%	27%
Ixa	11/02/2009	044_XCH_2015_20x.jpg	28	female	2	3	2	3	3	5	3	3	3	71%	29%
Ixa	29/04/2009	045_XCH_2015_20x.jpg	28.1	female	4	3	2	2	2	3	2	2	2	71%	21%
Ixa	07/01/2004	046_XCH_2015_20x.jpg	29.3	female	1	3	2	2	3	4	2	3	3	43%	28%
Ixa	25/02/2009	047_XCH_2015_20x.jpg	29.4	female	2	3	2	3	3	4	3	3	3	71%	19%
Ixa	29/06/2005	048_XCH_2015_20x.jpg	30.3	female	6	4	2	3	3	4	3	3	3	57%	22%
Ixa	11/03/2008	049_XCH_2015_20x.jpg	30.6	female	3	3	2	3	3	4	3	3	3	71%	19%
Ixa	26/05/2004	050_XCH_2015_20x.jpg	31	female	5	3	3	3	3	4	3	3	3	86%	12%
Ixa	12/06/2012	051_XCH_2015_20x.jpg	31.7	female	6	4	3	3	3	4	3	3	3	71%	15%
Ixa	11/03/2008	052_XCH_2015_20x.jpg	32.5	female	3	3	2	3	4	5	3	3	3	57%	29%
Ixa	11/06/2007	053_XCH_2015_20x.jpg	33.3	female	6	4	2	4	3	5	2	3	4	29%	34%
Ixa	10/01/2012	054_XCH_2015_20x.jpg	33.1	female	1	3	2	2	4	5	2	3	2	43%	38%
Ixa	16/07/2009	055_XCH_2015_20x.jpg	5	male	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	056_XCH_2015_20x.jpg	5.4	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	057_XCH_2015_20x.jpg	6.6	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	058_XCH_2015_20x.jpg	6.7	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	059_XCH_2015_20x.jpg	7.4	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	060_XCH_2015_20x.jpg	7.7	male	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	061_XCH_2015_20x.jpg	8.9	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	062_XCH_2015_20x.jpg	8.8	female	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	063_XCH_2015_20x.jpg	9.4	female	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	064_XCH_2015_20x.jpg	9.6	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	065_XCH_2015_20x.jpg	10.3	female	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	066_XCH_2015_20x.jpg	10.3	female	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	067_XCH_2015_20x.jpg	11.3	male	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	068_XCH_2015_20x.jpg	11.2	undefined	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	069_XCH_2015_20x.jpg	12.8	male	7	0	0	0	0	0	0	0	0	100%	0%
Ixa	16/07/2009	070_XCH_2015_20x.jpg	12.6	female	7	0	0	0	1	0	0	0	0	86%	265%
Ixa	16/07/2009	071_XCH_2015_20x.jpg	13.7	female	7	0	1	1	1	0	0	0	0	57%	125%
Ixa	22/12/2005	072_XCH_2015_20x.jpg	13.5	male	12	1	1	1	1	1	0	0	1	71%	68%
Ixa	14/12/2011	073_XCH_2015_20x.jpg	14.4	male	12	1	1	1	1	1	0	0	1	71%	68%
Ixa	14/12/2011	074_XCH_2015_20x.jpg	14.9	male	12	1	1	1	1	1	0	0	1	71%	68%
Ixa	15/09/2004	075_XCH_2015_20x.jpg	15.8	male	9	1	0	0	1	2	1	1	1	57%	81%
Ixa	15/09/2004	076_XCH_2015_20x.jpg	15.5	female	9	0	0	0	1	1	0	0	0	71%	171%
Ixa	06/09/2008	077_XCH_2015_20x.jpg	16.9	female	9	1	0	1	1	2	0	0	1	43%	106%
Ixa	06/09/2008	078_XCH_2015_20x.jpg	16.5	female	9	0	0	0	1	2	0	0	0	71%	184%
Ixa	03/09/2008	079_XCH_2015_20x.jpg	17.9	male	9	1	1	3	1	2	1	0	1	57%	74%
Ixa	03/09/2008	080_XCH_2015_20x.jpg	17.8	male	9	1	0	1	1	2	1	0	1	57%	81%
Ixa	03/09/2008	081_XCH_2015_20x.jpg	18.2	male	9	1	0	1	1	2	1	1	1	71%	58%
Ixa	03/09/2008	082_XCH_2015_20x.jpg	18.5	male	9	1	0	1	1	2	1	1	1	71%	58%
Ixa	03/09/2008	083_XCH_2015_20x.jpg	19.4	female	9	1	0	1	1	2	1	1	1	71%	58%
Ixa	03/09/2008	084_XCH_2015_20x.jpg	19.5	male	9	1	0	1	1	2	1	1	1	71%	58%
Ixa	03/09/2008	085_XCH_2015_20x.jpg	20	male	9	1	1	1	1	2	1	1	1	86%	33%
Ixa	03/09/2008	086_XCH_2015_20x.jpg	20.1	female	9	1	1	1	1	3	1	1	1	86%	59%
Ixa	03/09/2008	087_XCH_2015_20x.jpg	21	male	9	1	1	1	1	2	1	1	1	86%	33%
Ixa	03/09/2008	088_XCH_2015_20x.jpg	21.1	female	9	1	1	1	2	3	1	1	1	71%	55%
Ixa	03/09/2008	089_XCH_2015_20x.jpg	22.8	male	9	2	1	3	2	3	2	2	2	57%	32%
Ixa	03/09/2008	090_XCH_2015_20x.jpg	22.9	male	9	1	1	2	1	3	1	1	1	71%	55%
Ixa	03/09/2008	091_XCH_2015_20x.jpg	23.8	male	9	2	2	3	2	3	2	2	2	71%	21%
Ixa	03/09/2008	092_XCH_2015_20x.jpg	23.9	male	9	2	2	3	2	4	2	2	2	71%	32%
Ixa	03/09/2008	093_XCH_2015_20x.jpg	24.2	male	9	2	2	3	2	3	2	2	2	71%	21%
Ixa	04/09/2008	094_XCH_2015_20x.jpg	24.7	male	9	2	2	2	2	3	2	2	2	86%	18%
Ixa	04/09/2008	095_XCH_2015_20x.jpg	25	female	9	2	2	2	2	4	2	2	2	86%	33%
Ixa	04/09/2008	096_XCH_2015_20x.jpg	25.4	female	9	2	2	3	2	3	2	2	2	71%	21%
Ixa	08/09/2008	097_XCH_2015_20x.jpg	26.7	female	9	2	2	3	2	3	2	2	2	71%	21%
Ixa	08/09/2008	098_XCH_2015_20x.jpg	26.5	female	9	2	2	2	2	4	2	2	2	86%	33%
Ixa	23/11/2004	099_XCH_2015_20x.jpg	27.2	male	11	3	2	4	3	4	2	3	3	43%	27%
Ixa	23/11/2004	100_XCH_2015_20x.jpg	27.8	female	11	4	2	4	3	4	3	3	4	43%	23%
Ixa	27/07/2004	101_XCH_2015_20x.jpg	28.5	female	7	3	2	5	3	4	2	3	3	43%	34%
Ixa	28/10/2004	102_XCH_2015_20x.jpg	28.8	female	10	2	1	2	2	4	1	2	2	57%	50%
Ixa	08/11/2010	103_XCH_2015_20x.jpg	29.6	female	11	2	1	3	1	3	1	2	1	43%	48%
Ixa	08/11/2010	104_XCH_2015_20x.jpg	29.2	female	11	2	1	3	3	4	2	2	2	43%	40%
Ixa	08/11/2010	105_XCH_2015_20x.jpg	30.4	female	11	2	2	2	3	4	2	3	2	57%	31%
Ixa	08/11/2010	106_XCH_2015_20x.jpg	30.4	female	11	3	3	3	3	5	3	3	3	86%	23%
Ixa	12/11/2012	107_XCH_2015_20x.jpg	31.8	female	11	3	1	2	3	5	2	3	3	43%	46%
Ixa	28/10/2004	108_XCH_2015_20x_timol.jpg	32.4	female	10	3	2	3	3	4	3	3	3	71%	19%
Ixa	25/10/2005	109_XCH_2015_20x.jpg	32.8	male	10	4	2	4	3	5	2	3	4	29%	34%

ANNEX III

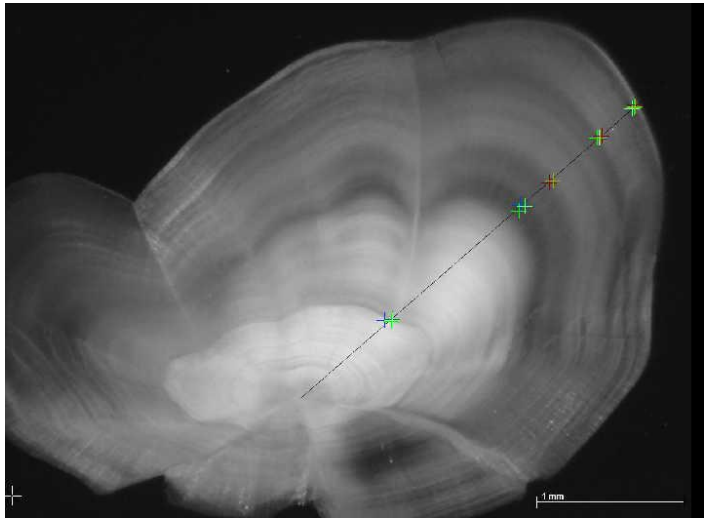
OTOLITHS IMAGES

IEO otoliths

IEO criteria
Age: 3 (all readers)

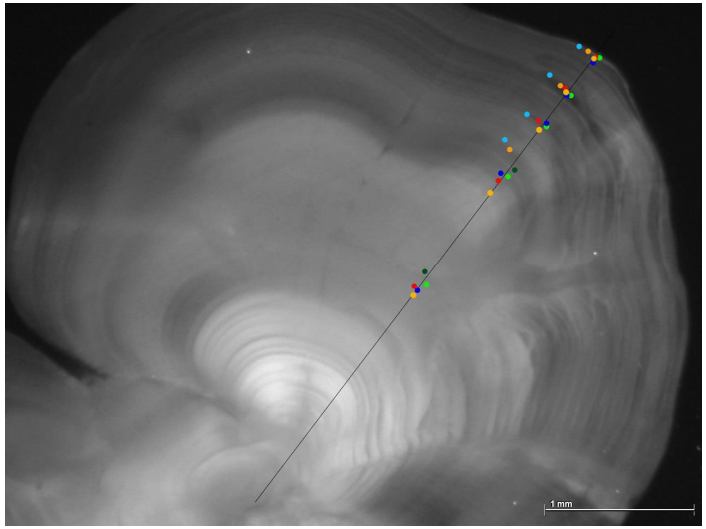


IPMA criteria
Age: 4 (IPMA readers); 3 (IEO readers)

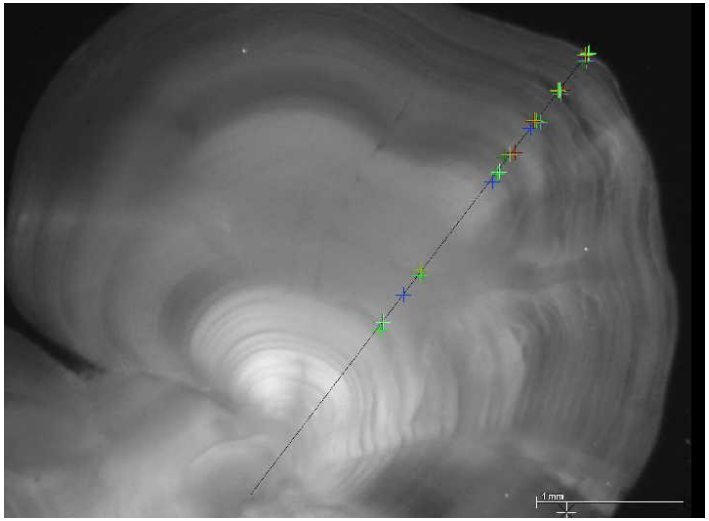


Cod: FAN14_20x_0002
TL: 24cm
Sex: male
Caught: Feb 2014

IEO criteria
Age: 3-4 (IPMA readers); 5 (IEO readers)



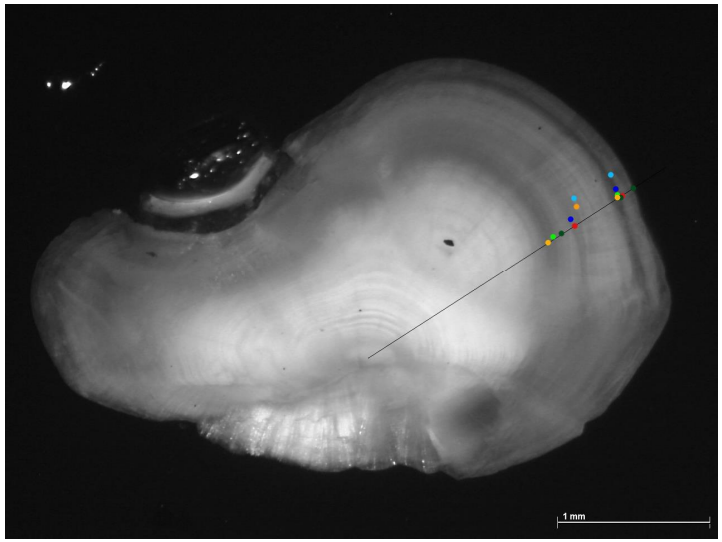
IPMA criteria
Age: 4-5 (IPMA readers); 4,5,6 (IEO readers)



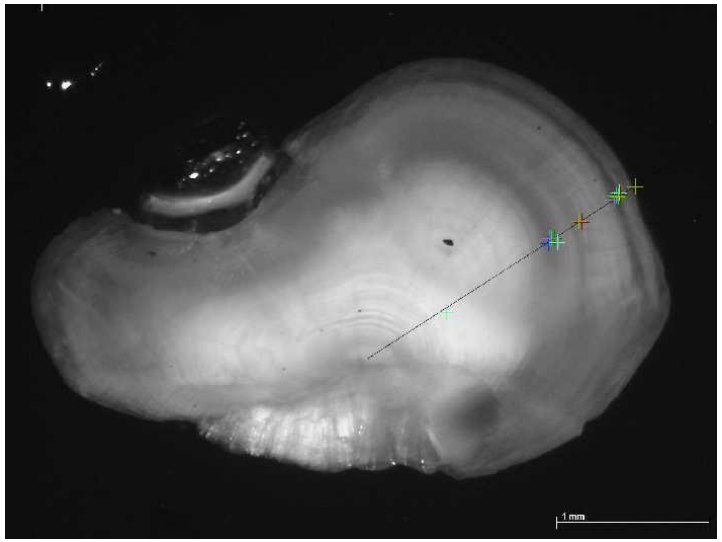
Cod: FAN14_20x_0088
TL: 35.5cm
Sex: female
Caught: Feb 2014

IEO otoliths

IEO criteria
Age: 1,2,3 (IPMA readers); 2 (IEO readers)

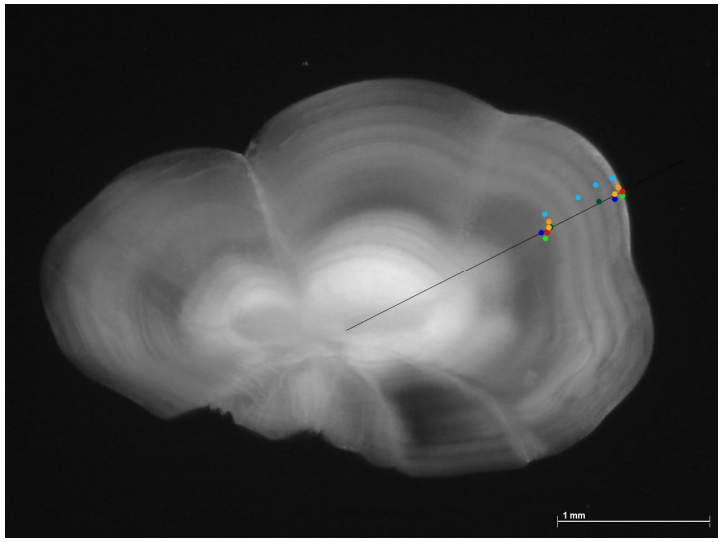


IPMA criteria
Age: 2-3 (all readers)

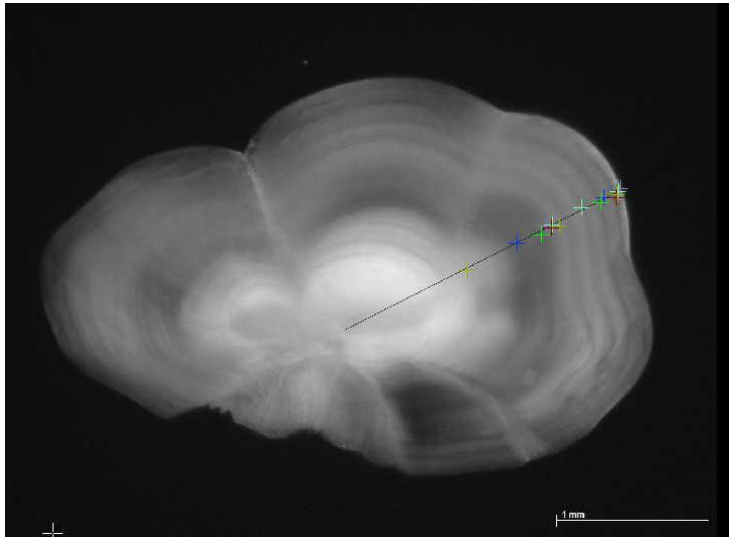


Cod: FAN14_20x_0039
TL: 20.5cm
Sex: male
Caught: Feb 2014

IEO criteria
Age: 2,3,4 (IPMA readers);1-2 (IEO readers)



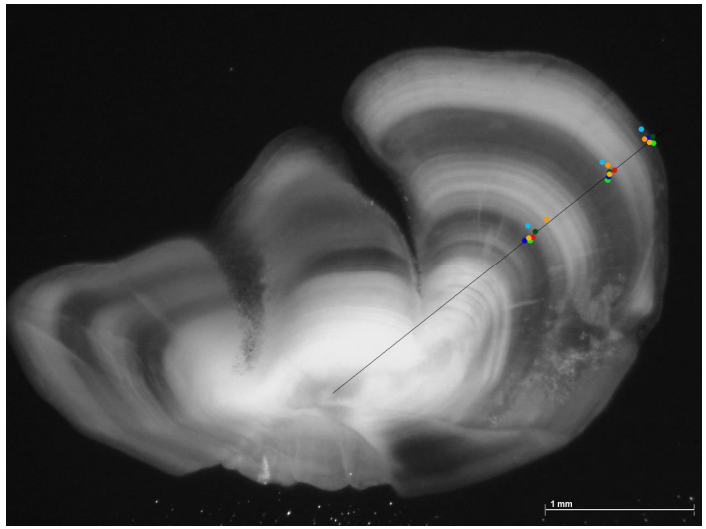
IPMA criteria
Age: 2-3 (all readers)



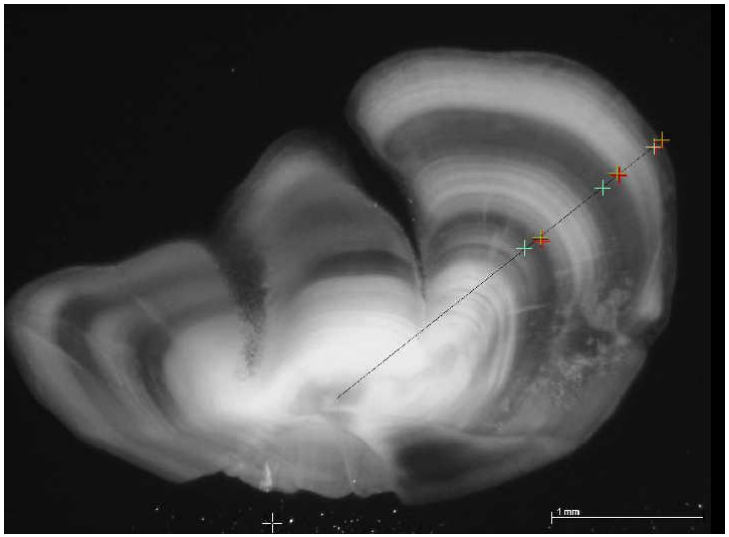
Cod: FAN14_20x_0228
TL: 22cm
Sex: male
Caught: Apr 2014

IEO otoliths

IEO criteria
Age: 3 (IPMA readers); 2-3 (IEO readers)

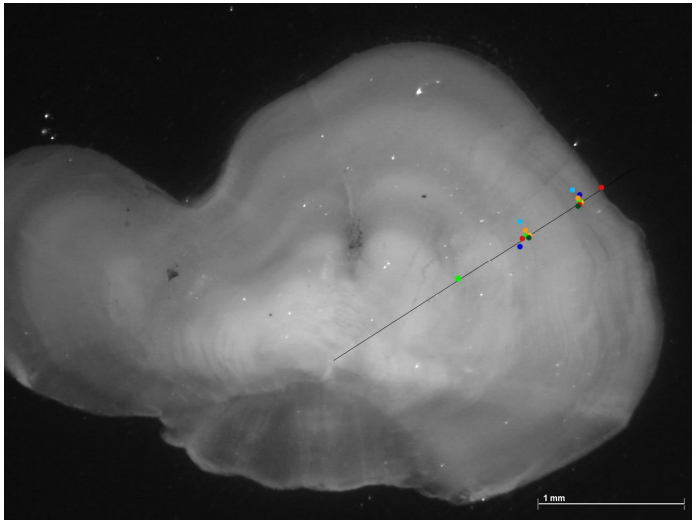


IPMA criteria
Age: 3 (IPMA readers); 3-4 (IEO readers)

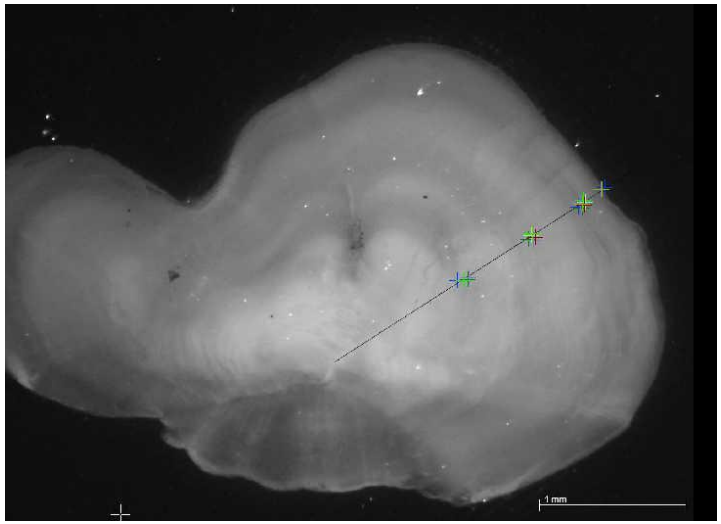


Cod: FAN14_20x_0239
TL: 23.5cm
Sex: female
Caught: Apr 2014

IEO criteria
Age: 2 (IPMA readers); 2-3 (IEO readers)



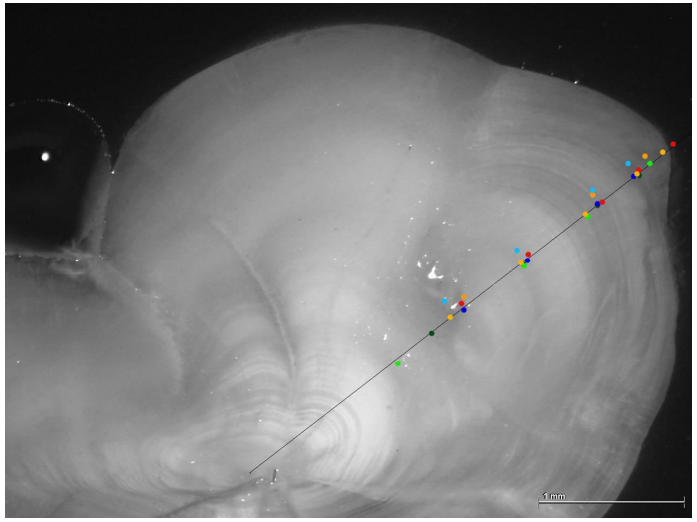
IPMA criteria
Age: 2 (IPMA readers); 3 (IEO readers)



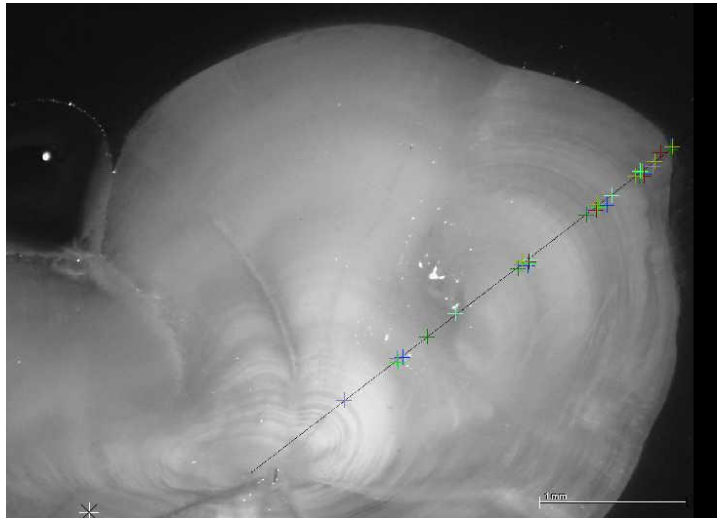
Cod: FAN14_20x_0309
TL: 26 cm
Sex: male
Caught: Nov 2014

IEO otoliths

IEO criteria
Age: 3-4 (IPMA readers); 4 (IEO readers)

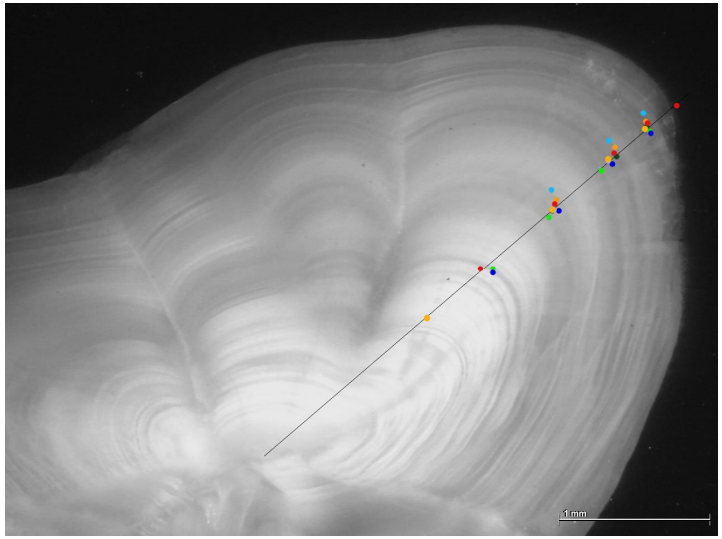


IPMA criteria
Age: 4 (IPMA readers); 4-5 (IEO readers)

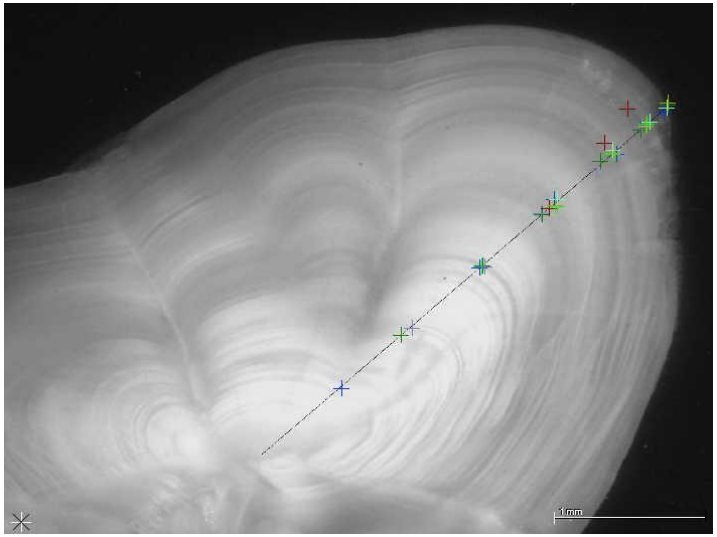


Cod: FAN14_20x_0325
TL: 29.5 cm
Sex: male
Caught: Nov 2014

IEO criteria
Age: 3-4 (IPMA readers); 4 (IEO readers)



IPMA criteria
Age: 3-4 (IPMA readers); 4-5 (IEO readers)

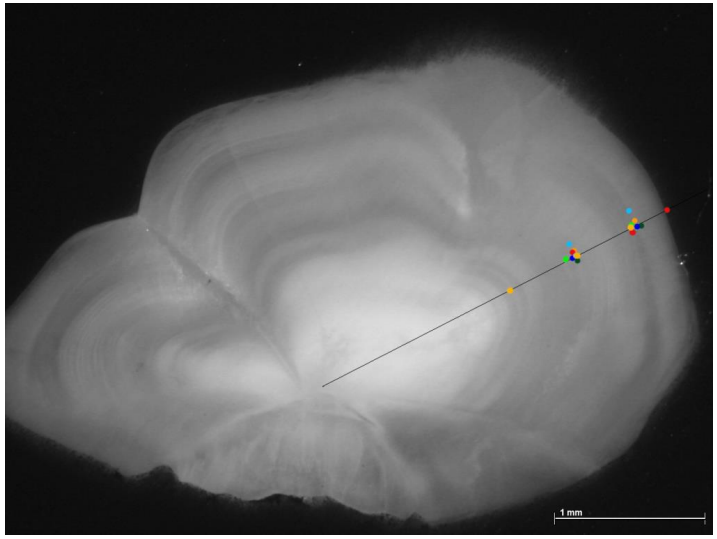


Cod: FAN14_20x_0340
TL: 31.5 cm
Sex: Und.
Caught: Nov 2014

IEO otoliths

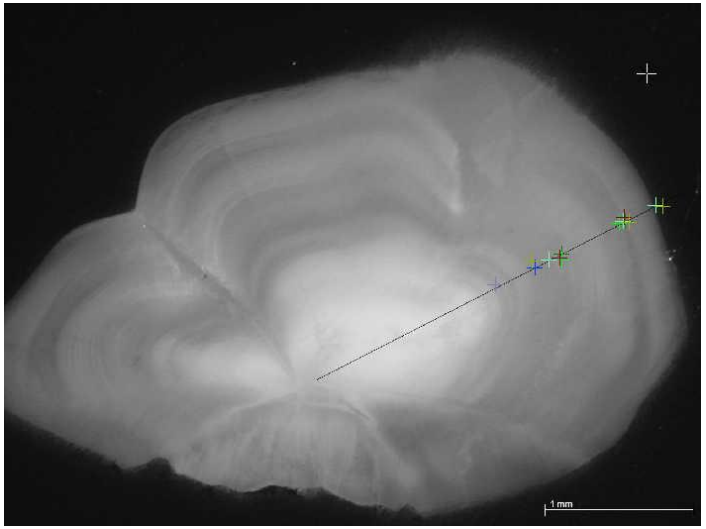
IEO criteria

Age: 2 (all readers)



IPMA criteria

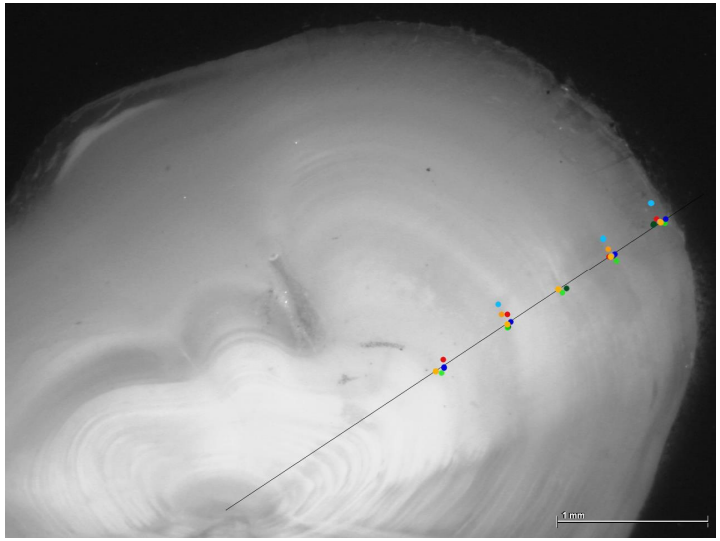
Age: 2 (IPMA readers); 2-3 (IEO readers)



Cod: FAN14_20x_0344
TL: 29 cm
Sex: female
Caught: Nov 2014

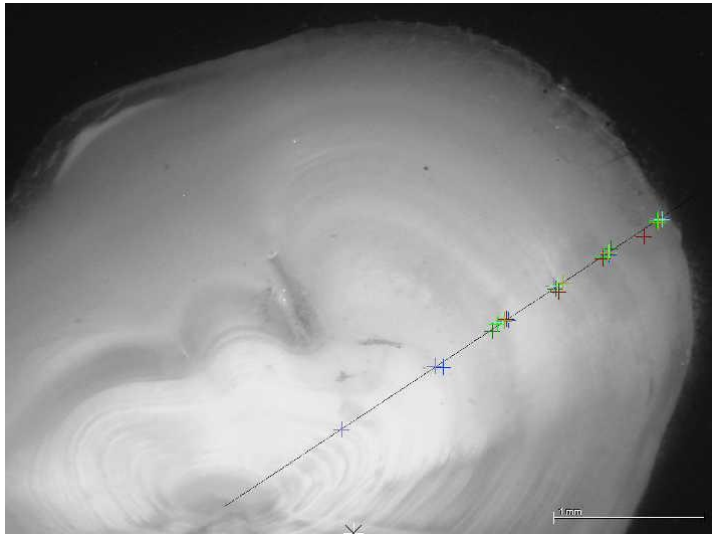
IEO criteria

Age: 2,3,4 (IPMA readers); 3,4,5 (IEO readers)



IPMA criteria

Age: 3-4 (IPMA readers); 3,4,6 (IEO readers)

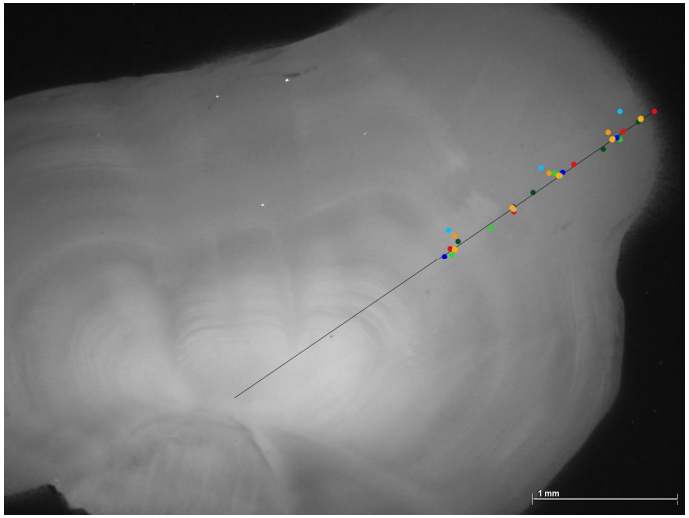


Cod: FAN14_20x_0349
TL: 35 cm
Sex: female
Caught: Nov 2014

IEO otoliths

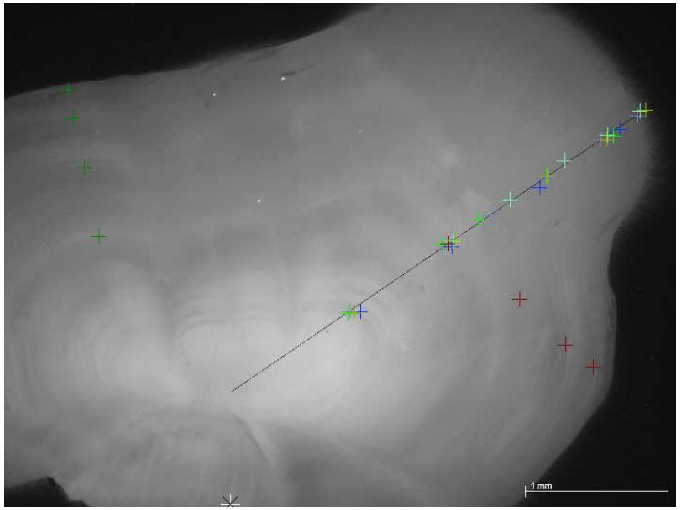
IEO criteria

Age: 3-4 (IPMA readers); 4-5 (IEO readers)



IPMA criteria

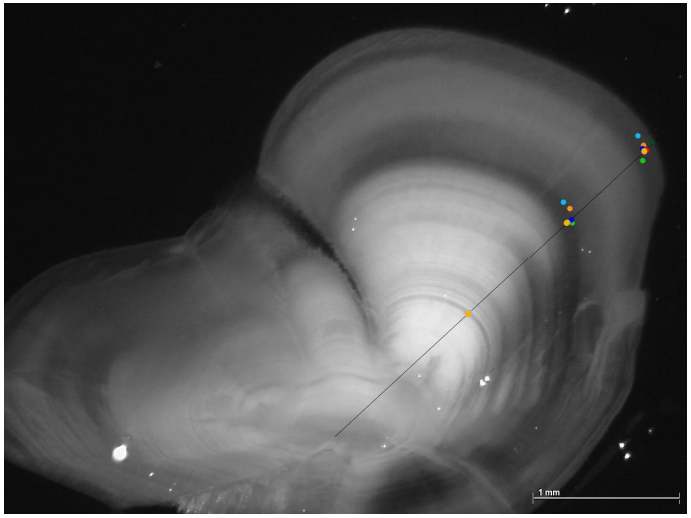
Age: 4 (IPMA readers); 4-5 (IEO readers)



Cod: FAN14_20x_0359
TL: 34 cm
Sex: female
Caught: Nov 2014

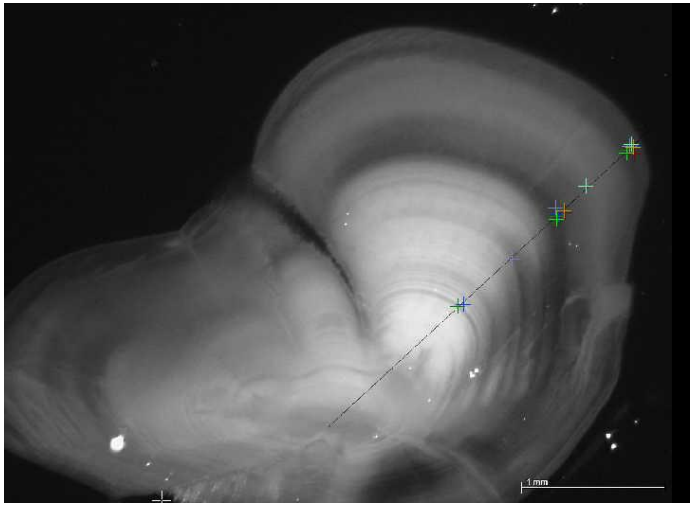
IEO criteria

Age: 2 (IPMA readers); 2-3 (IEO readers)



IPMA criteria

Age: 2 (IPMA readers); 2-3 (IEO readers)



Cod: FAN14_20x_0264
TL: 25.5 cm
Sex: female
Caught: March 2014

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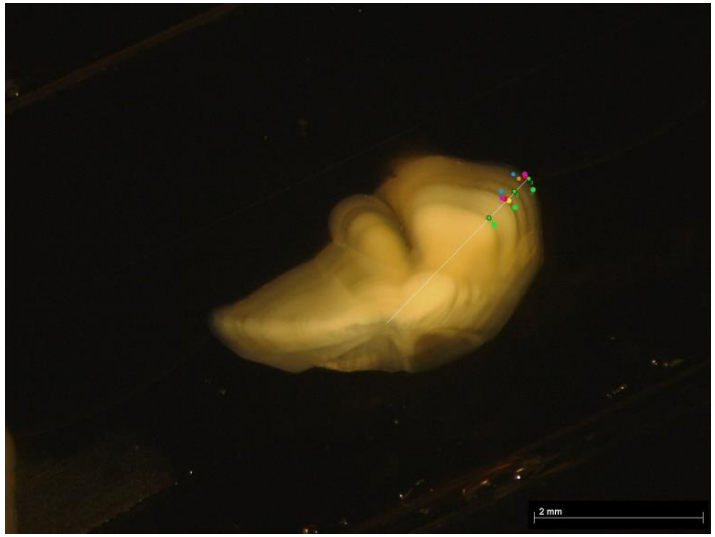
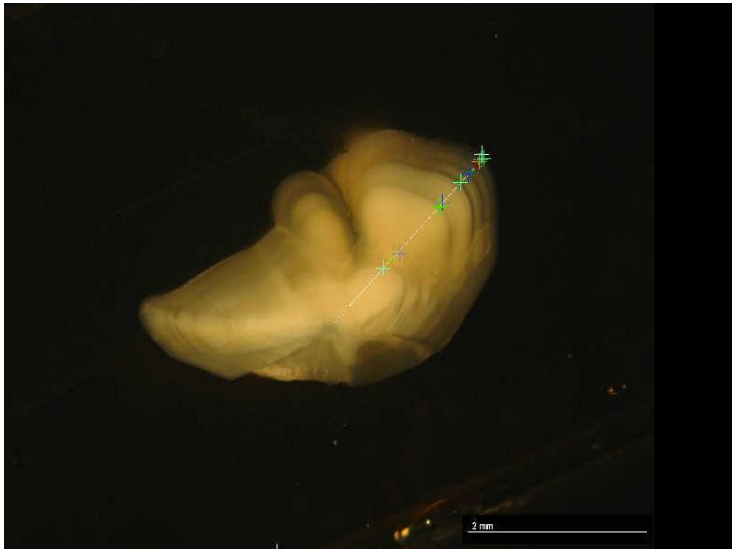
IEO criteria

Age:1,2,3 (IPMA readers); 1,2,3 (IEO readers)



IPMA criteria

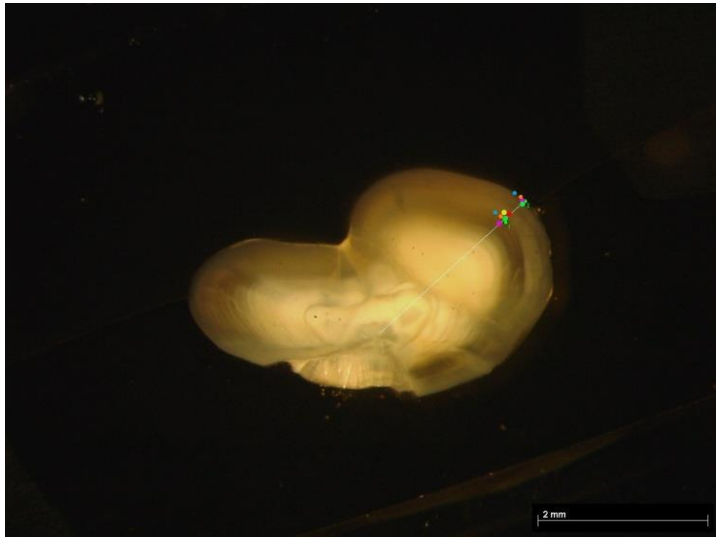
Age: 1,3 (IPMA readers); 3 (IEO readers)



Cod:
029_XCH_2015_20x
TL: 20.9 cm
Sex: female
Caught: Jan 2009

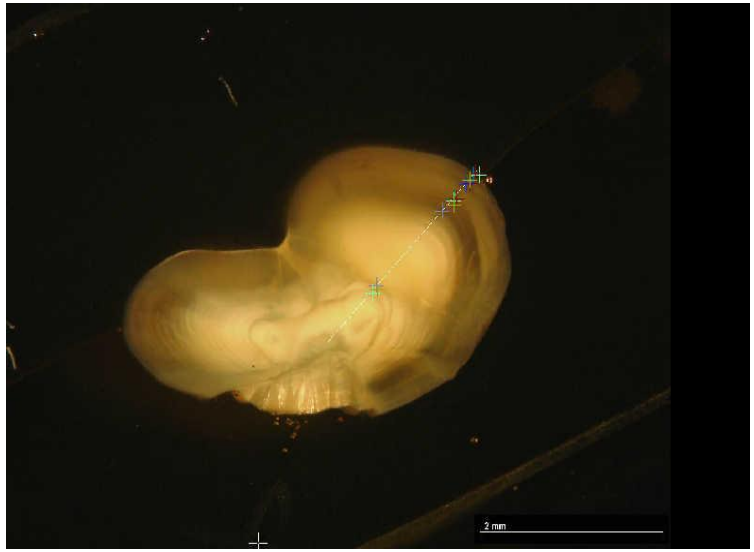
IEO criteria

Age:2 (IPMA readers); 1-2 (IEO readers)



IPMA criteria

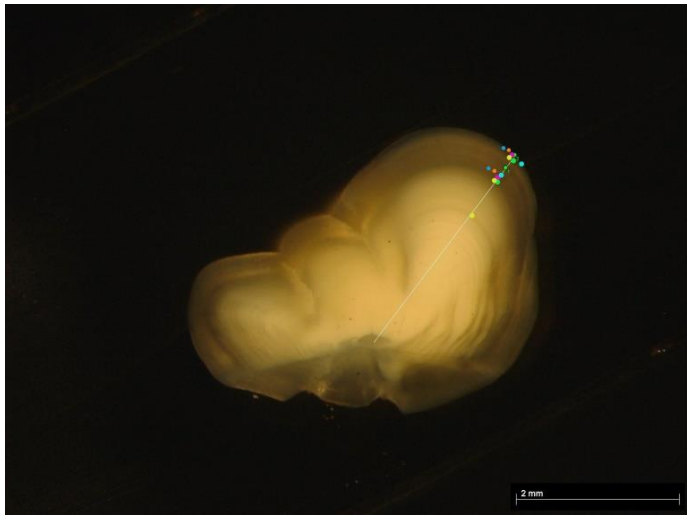
Age: 2-3 (IPMA readers); 2-3 (IEO readers)



Cod:
032_XCH_2015_20x
TL: 22.2 cm
Sex: male
Caught: Jan 2009

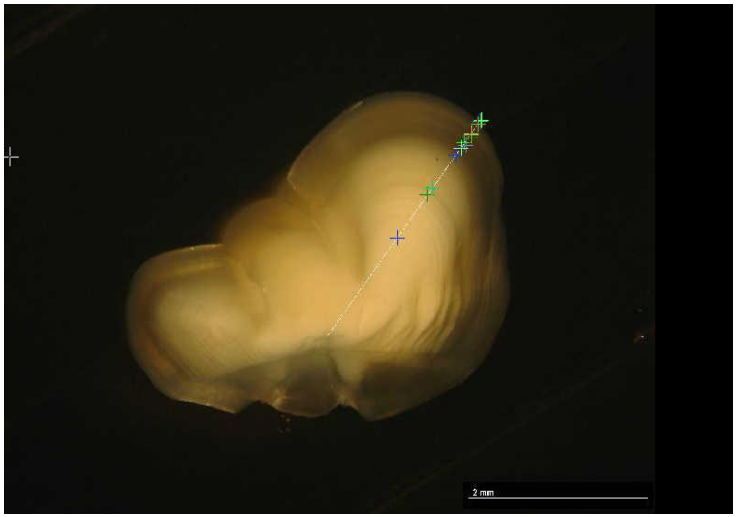
IEO criteria

Age:2 (IPMA readers); 2-3 (IEO readers)



IPMA criteria

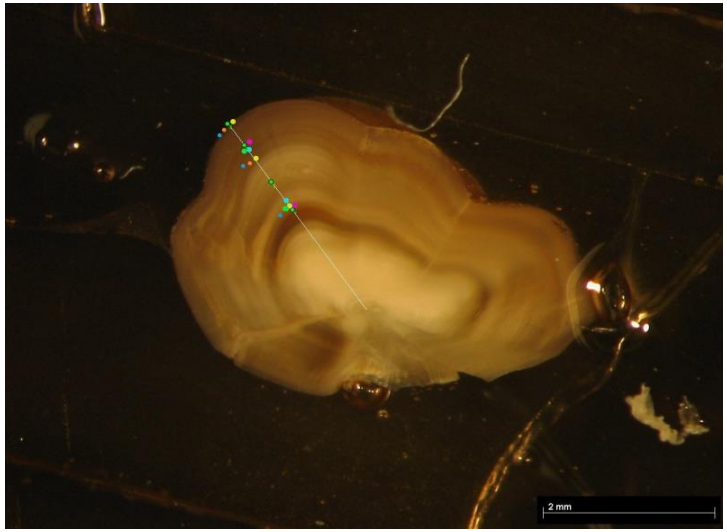
Age: 2-3 (IPMA readers); 2-3 (IEO readers)



Cod:
037_XCH_2015_20x
TL: 24.3cm
Sex: female
Caught: Jan 2009

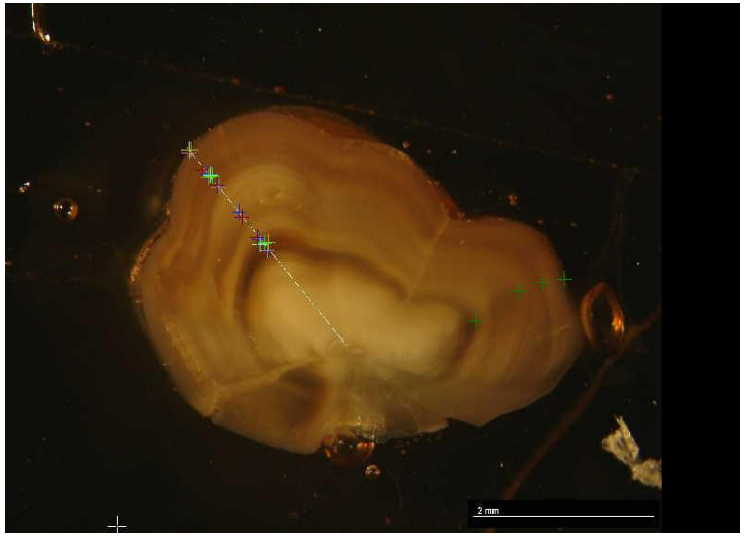
IEO criteria

Age:2,3,4 (IPMA readers);2-3 (IEO readers)



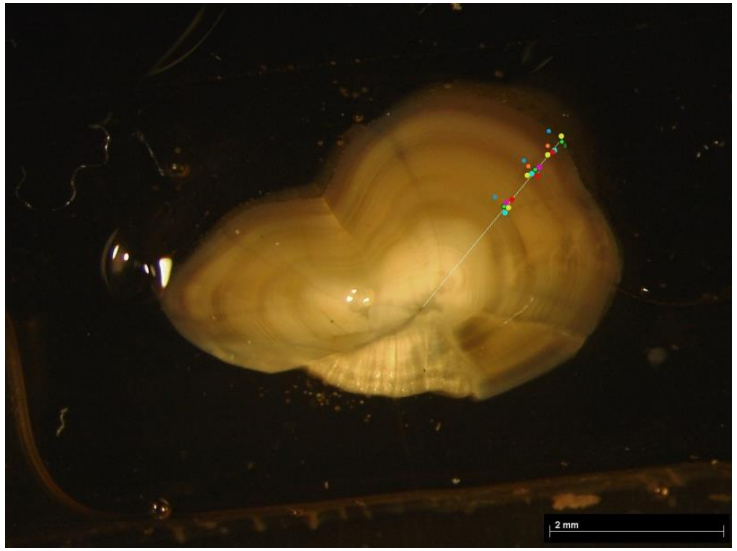
IPMA criteria

Age: 4-5 (IPMA readers); 2-3 (IEO readers)

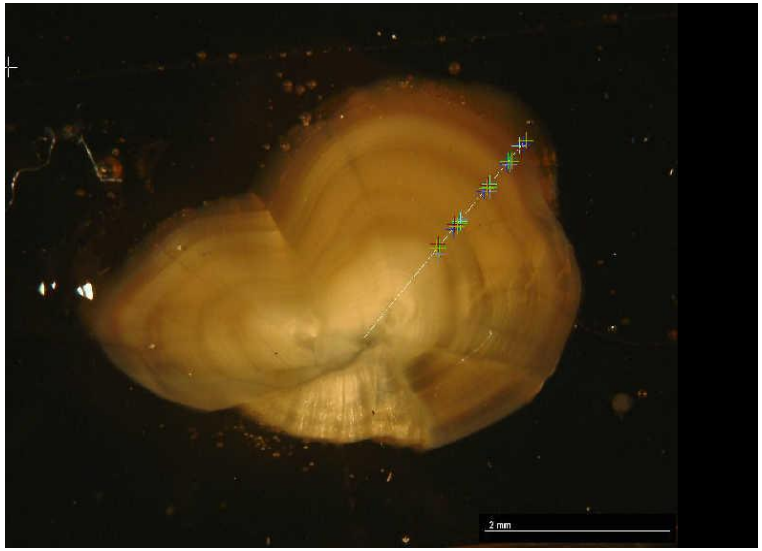


Cod:
042_XCH_2015_20x
TL: 27.8 cm
Sex: female
Caught: Jan 2004

IEO criteria
Age:2-3 (IPMA readers); 3-4 (IEO readers)

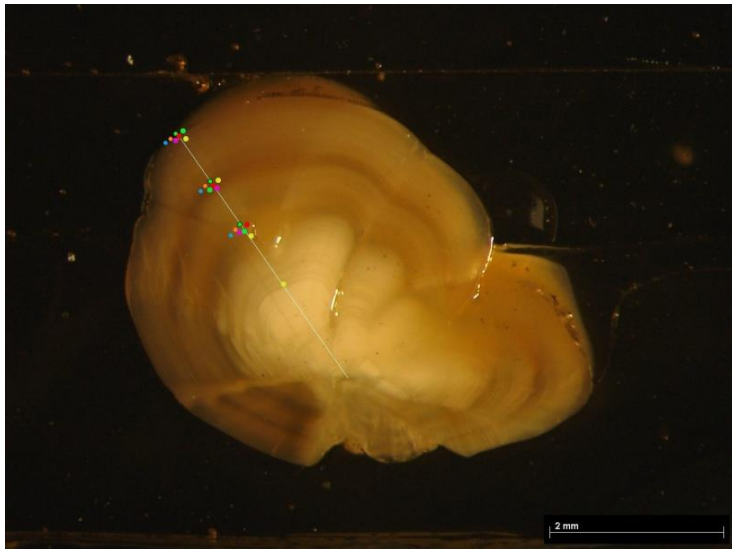


IPMA criteria
Age: 3-4 (IPMA readers); 4-5(IEO readers)

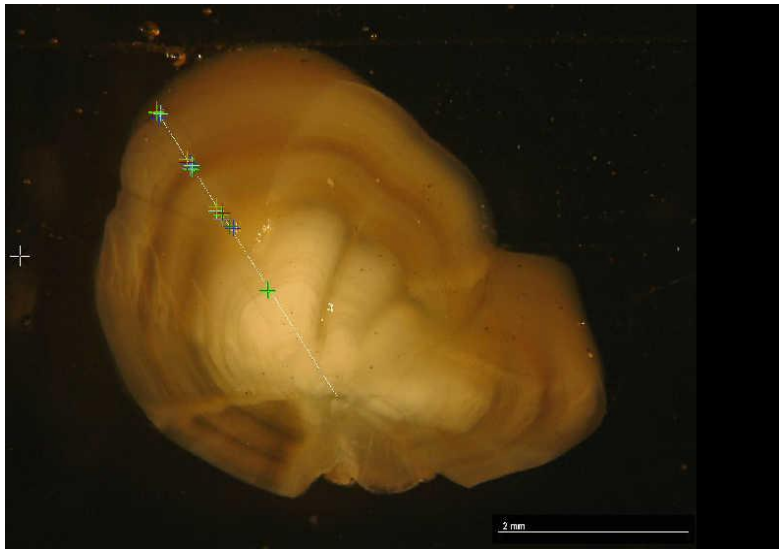


Cod:
047_XCH_2015_20x
TL: 29.4 cm
Sex: female
Caught: Feb 2009

IEO criteria
Age:3 (IPMA readers); 3-4 (IEO readers)



IPMA criteria
Age:3 (IPMA readers); 3-4 (IEO readers)



Cod:
050_XCH_2015_20x
TL: 31 cm
Sex: female
Caught: May 2004

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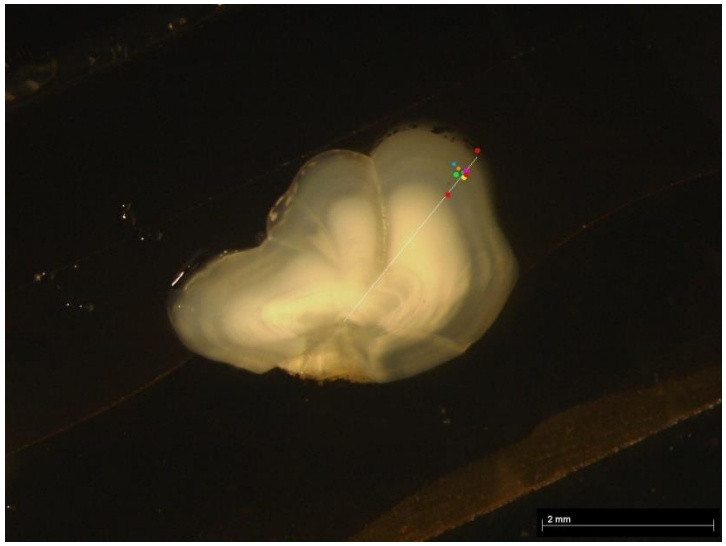
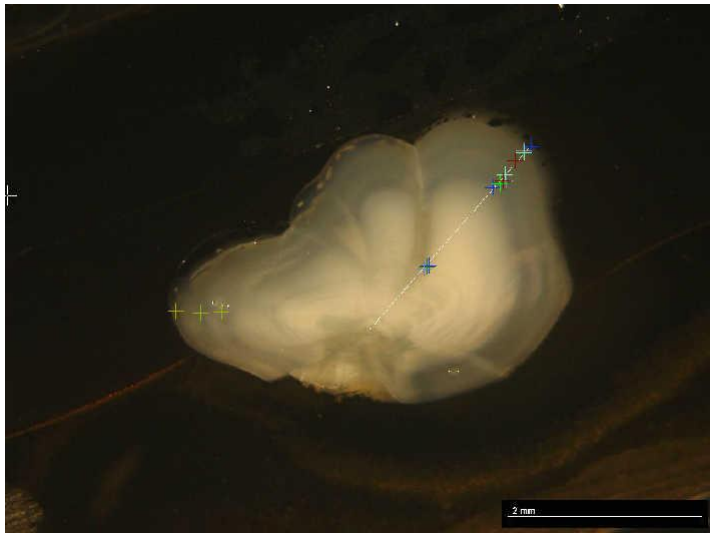
IEO criteria

Age:1 (IPMA readers); 1,3 (IEO readers)



IPMA criteria

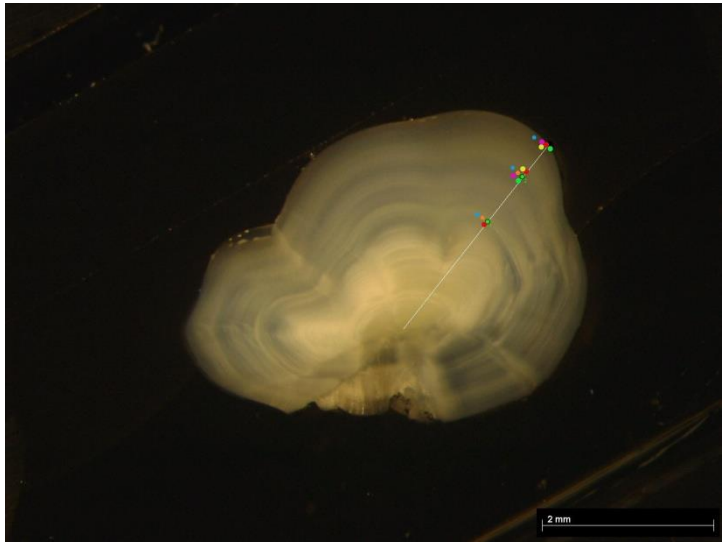
Age: 1-2 (IPMA readers); 1-2 (IEO readers)



Cod:
086_XCH_2015_20x
TL: 20.1 cm
Sex: female
Caught: Sep 2008

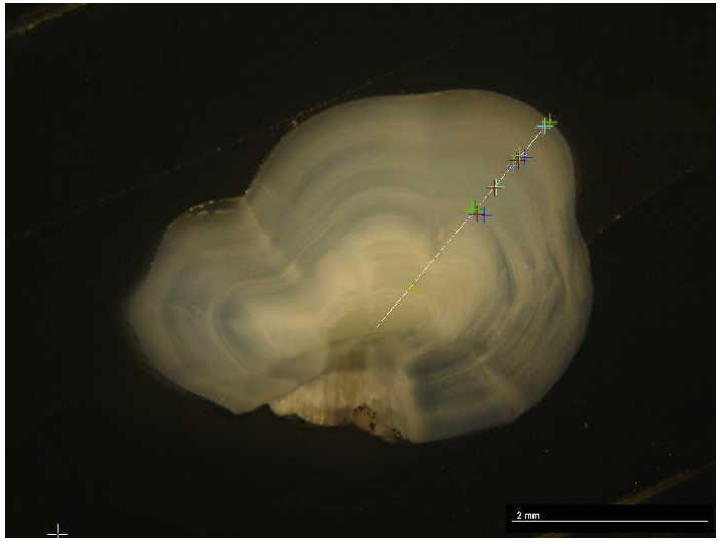
IEO criteria

Age:2-3 (IPMA readers); 2-3 (IEO readers)



IPMA criteria

Age: 2-3 (IPMA readers); 2-3 (IEO readers)



Cod:
091_XCH_2015_20x
TL: 23.8 cm
Sex: male
Caught: Sep 2008

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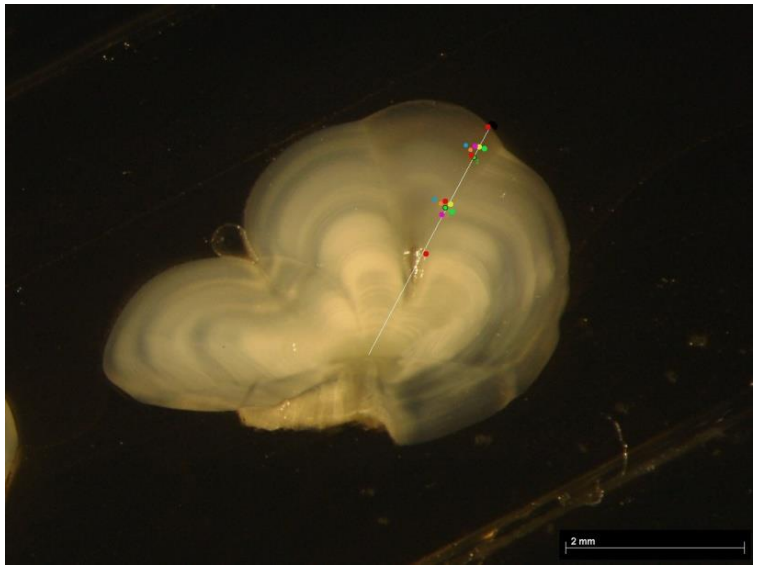
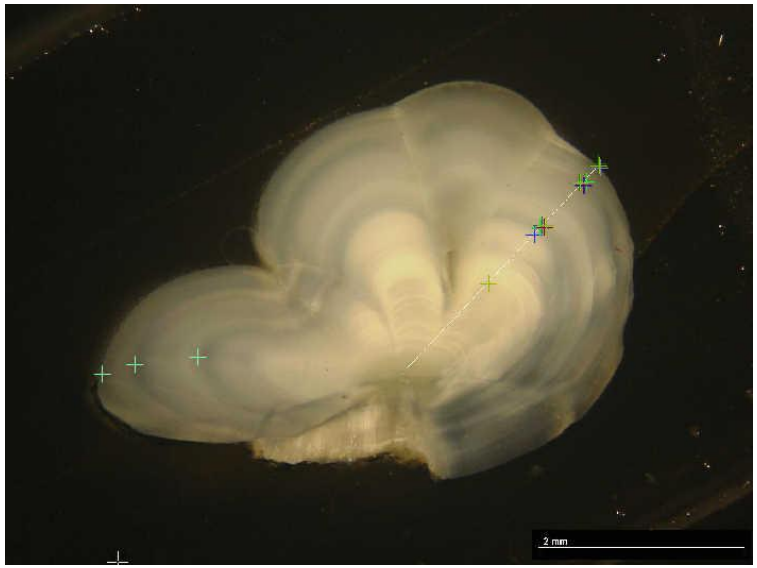
IEO criteria

Age:2 (IPMA readers); 2,4 (IEO readers)



IPMA criteria

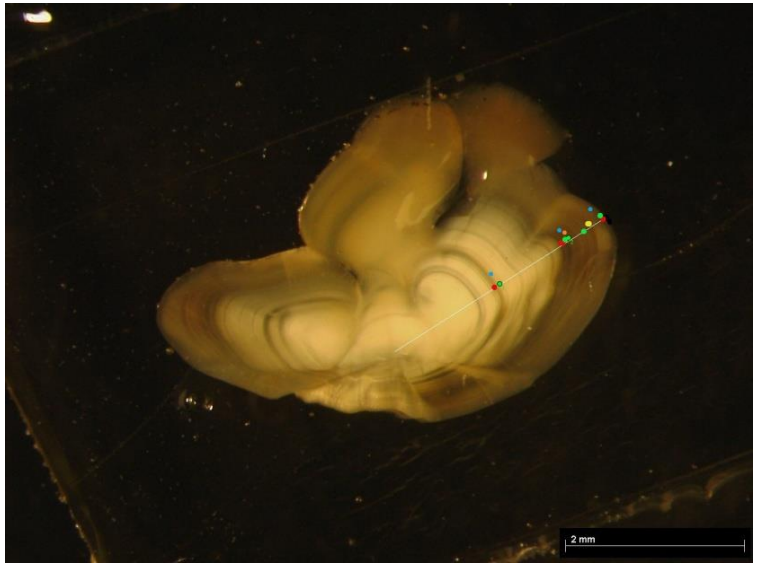
Age: 2 (IPMA readers); 2-3 (IEO readers)



Cod:
095_XCH_2015_20x
TL: 25 cm
Sex: female
Caught: Sep 2008

IEO criteria

Age:1,2,3 (IPMA readers); 1,2,3 (IEO readers)



IPMA criteria

Age: 1-2 (IPMA readers); 2 (IEO readers)

Cod:
103_XCH_2015_20x
TL: 29.6 cm
Sex: female
Caught: Nov 2010

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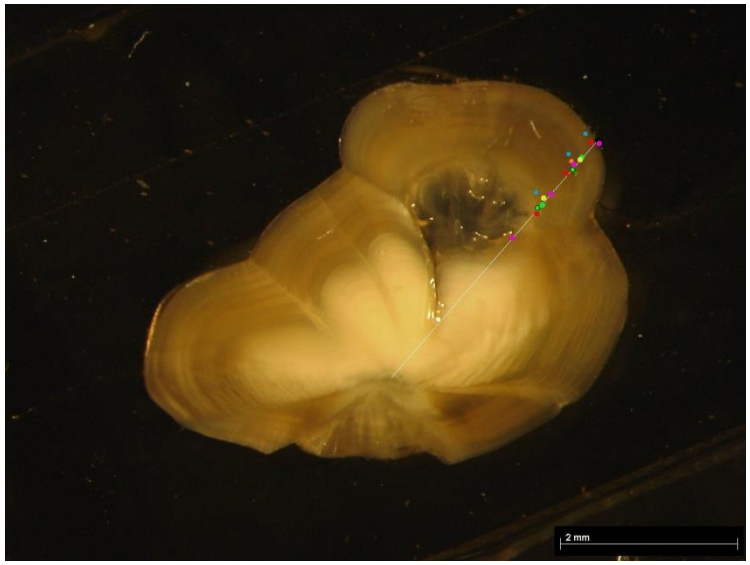
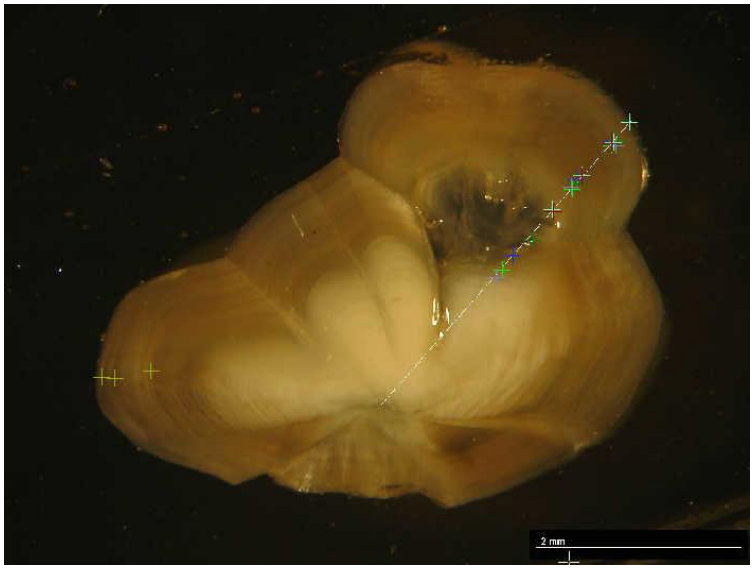
IEO criteria

Age:1,2,3 (IPMA readers); 2,3,4 (IEO readers)



IPMA criteria

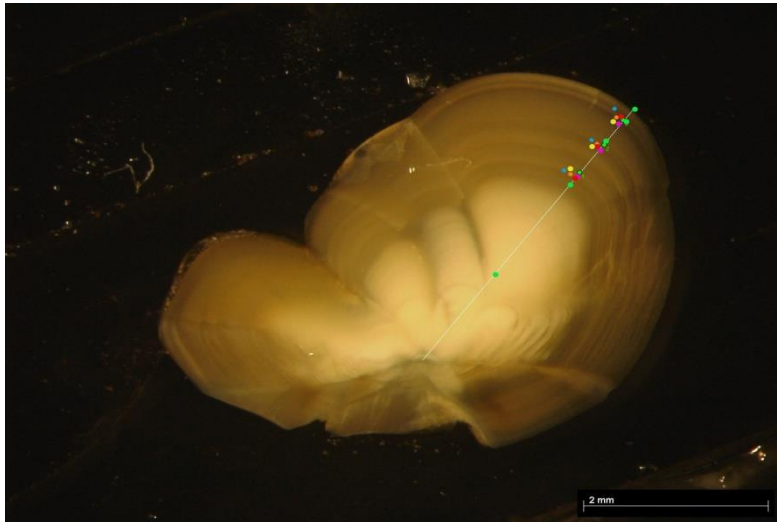
Age: 1,3 (IPMA readers); 3 (IEO readers)



Cod:
104_XCH_2015_20x
TL: 29.2cm
Sex: female
Caught: Nov 2010

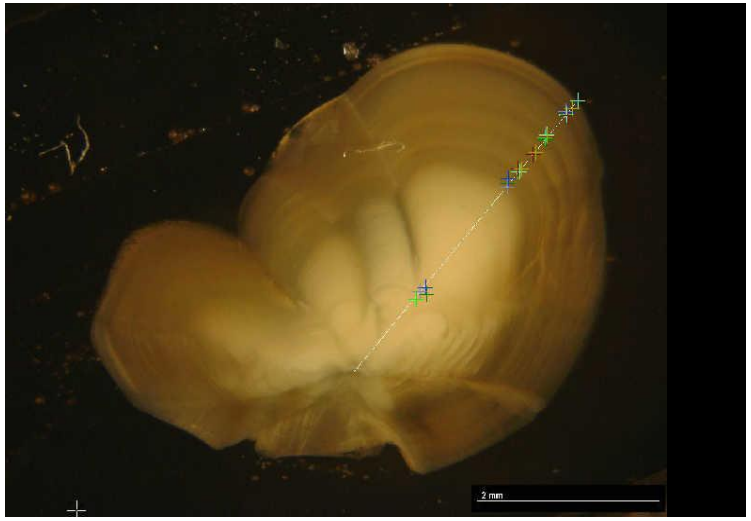
IEO criteria

Age:3 (IPMA readers); 3,5 (IEO readers)



IPMA criteria

Age: 3-4 (IPMA readers); 4 (IEO readers)



Cod:
106_XCH_2015_20x
TL: 30.4 cm
Sex: female
Caught: Nov 2010