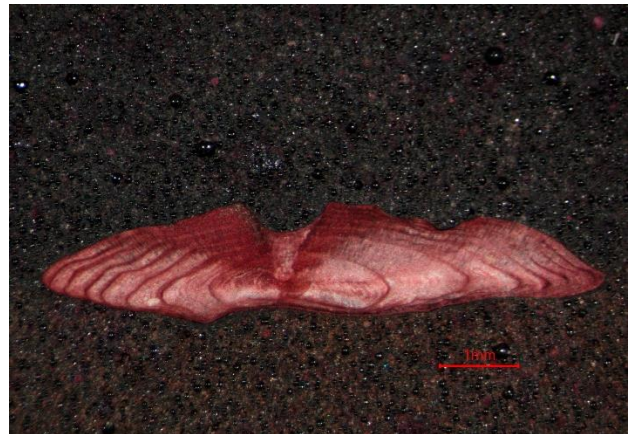


European Sea bass (*Dicentrarchus labrax*) scale and otolith exchange Summary Report – SmartDots event 271

Coordinated by Valerio Visconti and Mary Brown (Cefas)

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1 Executive summary

The goals of the 2020 European Sea bass (*Dicentrarchus labrax*) scale and otolith exchange were (1) to clarify the interpretation of annual growth rings using stained otolith sections and scales from the same fish and (2) to develop existing reference collections of calcified structures and improve the existing database of scales images. Both aims represent the base and key points to be discussed during the Workshop on Age reading of Sea bass (*Dicentrarchus labrax*) (WKARDL2) in June 2021 at Cefas (UK). Eight readers in total, 3 advanced and 5 basic, from three national laboratories (Cefas UK, Infremer FR, ILVO BE) were involved in this exchange, and read both otoliths and scales regardless of their expertise. The samples (n=100) used for this exchange were sourced from Cefas UK 2018 and 2019 collections and were representative of quarters 1 and 3 for the ICES area 27.7.

The scale calibration exercise showed an overall agreement of 68% (ranging between 35% and 78%) with a precision of 11% CV (ranging from 5% to 21%), and these results are generally better than the previous exchange. On the other hand, the otolith calibration exercise showed an overall agreement of 80% (ranging between 31% and 92%) with a precision of 9% CV (ranging from 3% to 9%). However, advanced readers scored 71% and 73% agreement for otoliths and scales, respectively. Interestingly, 100% agreement was only achieved for 5 scale and 24 otolith samples, highlighting the presence of marked bias. In particular, specific biases were found in modal ages 2, 3, and over 12 years and, more in general, the lack of general agreement for both calcified structures can be due to the difficulty identifying the position of the first annulus.

The 2021 bass workshop will provide an opportunity to analyse and discuss these results with the readers.

2 Overview of samples and advanced readers

Table 1: Overview of samples used for the SmartDots exchange n.271.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2018	27.7.a	Otolith	3	3	4-5	35-40 mm
2018	27.7.f	Otolith	3	32	2-11	25-55 mm
2019	27.7.d	Otolith	3	8	3-5	30-45 mm
2019	27.7.e	Otolith	1	48	4-17	35-70 mm
2019	27.7.f	Otolith	1	1	6	40 mm
2019	27.7.f	Otolith	3	7	4-16	35-70 mm
2019	27.7.g	Otolith	1	1	12	55 mm

Table 2: Overview of advanced readers.

Reader code	Expertise
R02 GB	Advanced
R04 FR	Advanced
R06 GB	Advanced

3 Results overview

3.1 Age readings

Table 3: Age reading table presents the number of readings made per expert reader for each modal age on **scales**.

Modal age	R02 GB	R04 FR	R06 GB	total
2	1	1	1	3
3	4	4	4	12
4	29	27	29	85
5	23	23	23	69
6	13	13	13	39
7	5	5	5	15
8	11	11	11	33
9	4	4	4	12
10	2	2	2	6
11	1	1	1	3
12	5	5	5	15
13	0	0	0	0
14	1	1	1	3
15	0	0	0	0
16	1	1	1	3
Total	100	98	100	298

Table 4: Age reading table presents the number of readings made per expert reader for each modal age on **otoliths**.

Modal age	R02 GB	R04 FR	R06 GB	total
2	3	3	3	9
3	4	4	4	12
4	30	30	30	90
5	23	23	21	67
6	10	10	10	30
7	5	5	5	15
8	9	8	9	26
9	1	1	1	3
10	7	7	6	20
11	1	1	1	3
12	5	4	5	14
13	0	0	0	0
14	0	0	0	0
15	1	1	1	3
Total	99	97	96	292

3.2 CV table

Table 5: Scales - Coefficient of Variation (CV) table presents the CV per modal age and advanced reader, the CV of all advanced readers combined per modal age and a weighted mean of the CV per reader.

Modal age	R02 GB	R04 FR	R06 GB	all
2	-	-	-	25 %
3	0 %	0 %	0 %	15 %
4	6 %	10 %	8 %	13 %

5	4 %	4 %	11 %	9 %
6	8 %	9 %	6 %	8 %
7	0 %	0 %	7 %	4 %
8	11 %	8 %	19 %	13 %
9	8 %	0 %	5 %	7 %
10	0 %	0 %	0 %	0 %
11	-	-	-	5 %
12	14 %	12 %	19 %	16 %
13	-	-	-	-
14	-	-	-	7 %
15	-	-	-	-
16	-	-	-	8 %
Weighted Mean	6 %	7 %	9 %	10 %

Table 6: Otoliths - Coefficient of Variation (CV) table presents the CV per modal age and advanced reader, the CV of all advanced readers combined per modal age and a weighted mean of the CV per reader.

Modal age	R02 GB	R04 FR	R06 GB	all
2	22 %	0 %	16 %	30 %
3	16 %	0 %	13 %	21 %
4	7 %	0 %	8 %	13 %
5	4 %	6 %	11 %	9 %
6	5 %	17 %	10 %	12 %
7	0 %	14 %	7 %	9 %
8	0 %	6 %	0 %	6 %
9	-	-	-	0 %
10	7 %	8 %	8 %	9 %
11	-	-	-	11 %
12	16 %	9 %	17 %	16 %
13	-	-	-	-
14	-	-	-	-
15	-	-	-	6 %
Weighted Mean	7 %	6 %	9 %	12 %

3.3 PA table

Table 7: Scales - Percentage agreement (PA) table represents the PA per modal age and reader, advanced the PA of all advanced readers combined per modal age and a weighted mean of the PA per reader.

Modal age	R02 GB	R04 FR	R06 GB	all
2	100 %	100 %	0 %	67 %
3	100 %	100 %	0 %	67 %
4	93 %	93 %	7 %	64 %
5	96 %	96 %	39 %	77 %
6	77 %	92 %	85 %	85 %
7	100 %	100 %	80 %	93 %
8	91 %	64 %	82 %	79 %
9	25 %	100 %	75 %	67 %
10	100 %	100 %	100 %	100 %
11	100 %	0 %	100 %	67 %
12	80 %	40 %	60 %	60 %
13	-	-	-	-
14	0 %	100 %	0 %	33 %
15	-	-	-	-
16	100 %	0 %	100 %	67 %
Weighted Mean	88 %	87 %	45 %	73 %

Table 8: Otoliths - Percentage agreement (PA) table represents the PA per modal age and reader, advanced the PA of all advanced readers combined per modal age and a weighted mean of the PA per reader.

Modal age	R02 GB	R04 FR	R06 GB	all
2	33 %	100 %	0 %	44 %
3	50 %	100 %	0 %	50 %
4	90 %	100 %	7 %	66 %
5	96 %	91 %	48 %	79 %
6	90 %	80 %	90 %	87 %
7	100 %	60 %	80 %	80 %
8	100 %	25 %	100 %	77 %
9	100 %	100 %	100 %	100 %
10	57 %	57 %	67 %	60 %
11	100 %	0 %	100 %	67 %
12	60 %	75 %	60 %	64 %
13	-	-	-	-
14	-	-	-	-
15	0 %	100 %	0 %	33 %
Weighted Mean	85 %	82 %	45 %	71 %

3.4 Relative bias table

Table 9: Scales - Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader.

Modal age	R02 GB	R04 FR	R06 GB	all
2	0.00	0.00	1.00	0.33
3	0.00	0.00	1.00	0.33
4	0.07	0.11	1.00	0.39
5	-0.04	0.04	0.52	0.17
6	-0.08	0.15	0.15	0.08
7	0.00	0.00	-0.20	-0.07
8	0.27	0.00	0.36	0.21
9	1.00	0.00	0.25	0.42
10	0.00	0.00	0.00	0.00
11	0.00	-1.00	0.00	-0.33
12	0.80	-1.20	0.80	0.13
13	-	-	-	-
14	2.00	0.00	1.00	1.00
15	-	-	-	-
16	0.00	-2.00	0.00	-0.67
Weighted Mean	0.13	-0.03	0.57	0.22

Table 10: Otoliths - Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader.

Modal age	R02 GB	R04 FR	R06 GB	all
2	0.67	0.00	1.67	0.78
3	0.50	0.00	1.50	0.67
4	0.10	0.00	1.03	0.38
5	0.04	-0.09	0.57	0.18
6	0.10	-0.40	0.20	-0.03
7	0.00	-0.60	-0.20	-0.27
8	0.00	-0.75	0.00	-0.25
9	0.00	0.00	0.00	0.00
10	0.57	-0.57	0.50	0.17
11	0.00	-2.00	0.00	-0.67
12	1.60	-0.50	1.60	0.90
13	-	-	-	-
14	-	-	-	-
15	1.00	0.00	2.00	1.00
Weighted Mean	0.22	-0.24	0.71	0.23

3.5 Bias plot

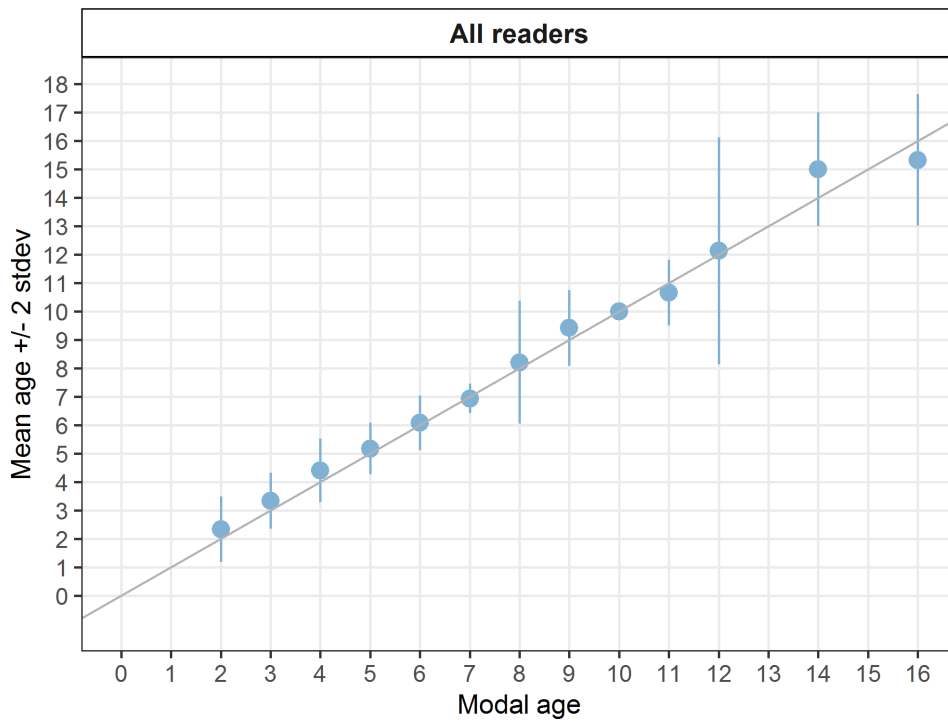


Figure 1: Age bias plot for advanced readers base on **scales**.

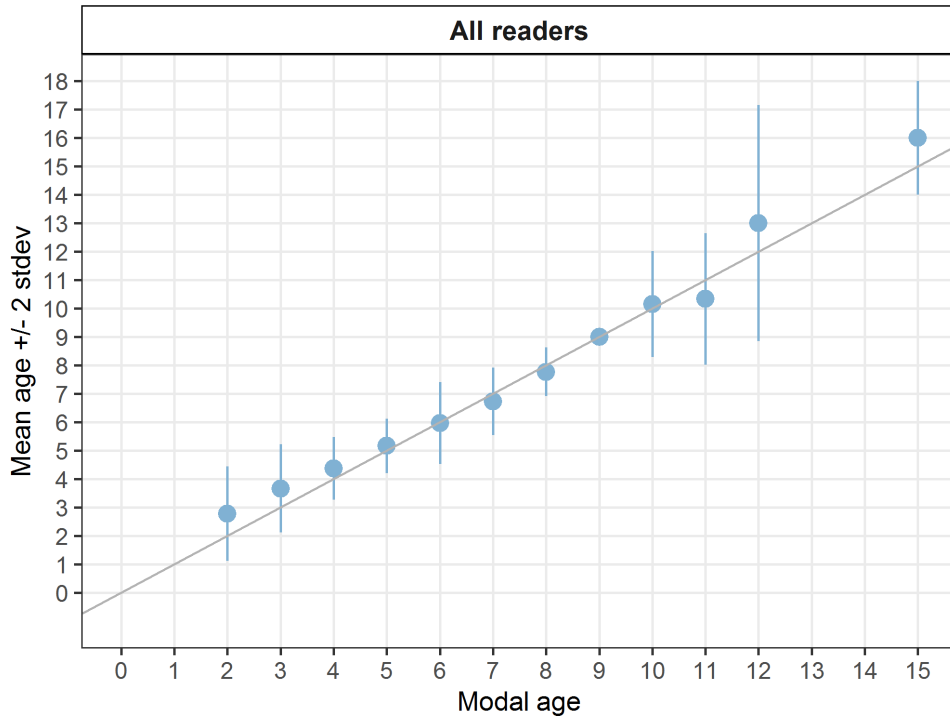


Figure 2: Age bias plot for advanced readers based on **otoliths**.

3.6 Growth analysis

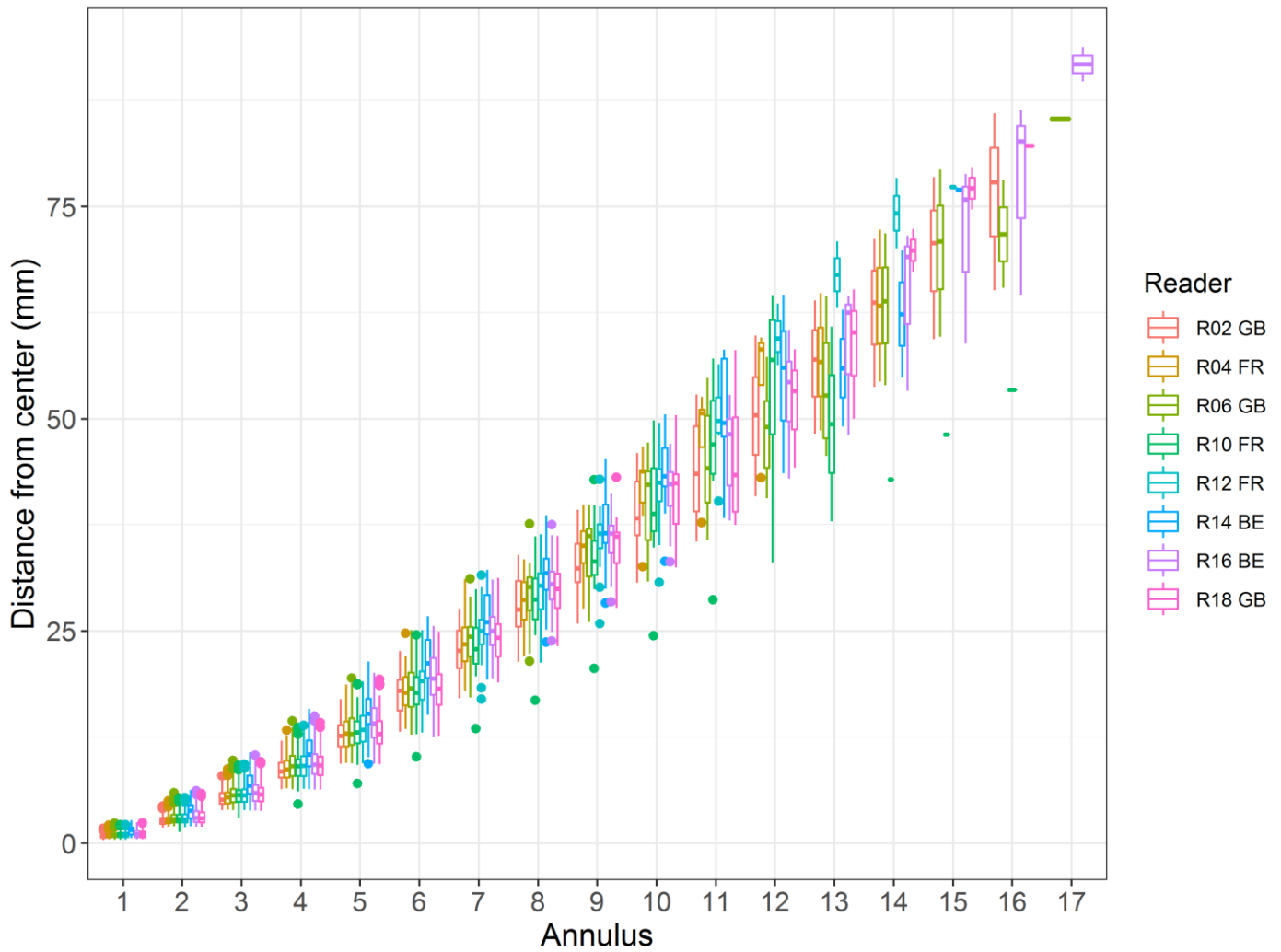


Figure 3: Scales - Plot of average distance from the centre to the winter rings for advanced readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers extend no further than $1.5 \cdot \text{IQR}$ (where IQR is the inter-quartile range) from the box boundary. Data beyond the end of the whiskers are represent outliers and are plotted individually.

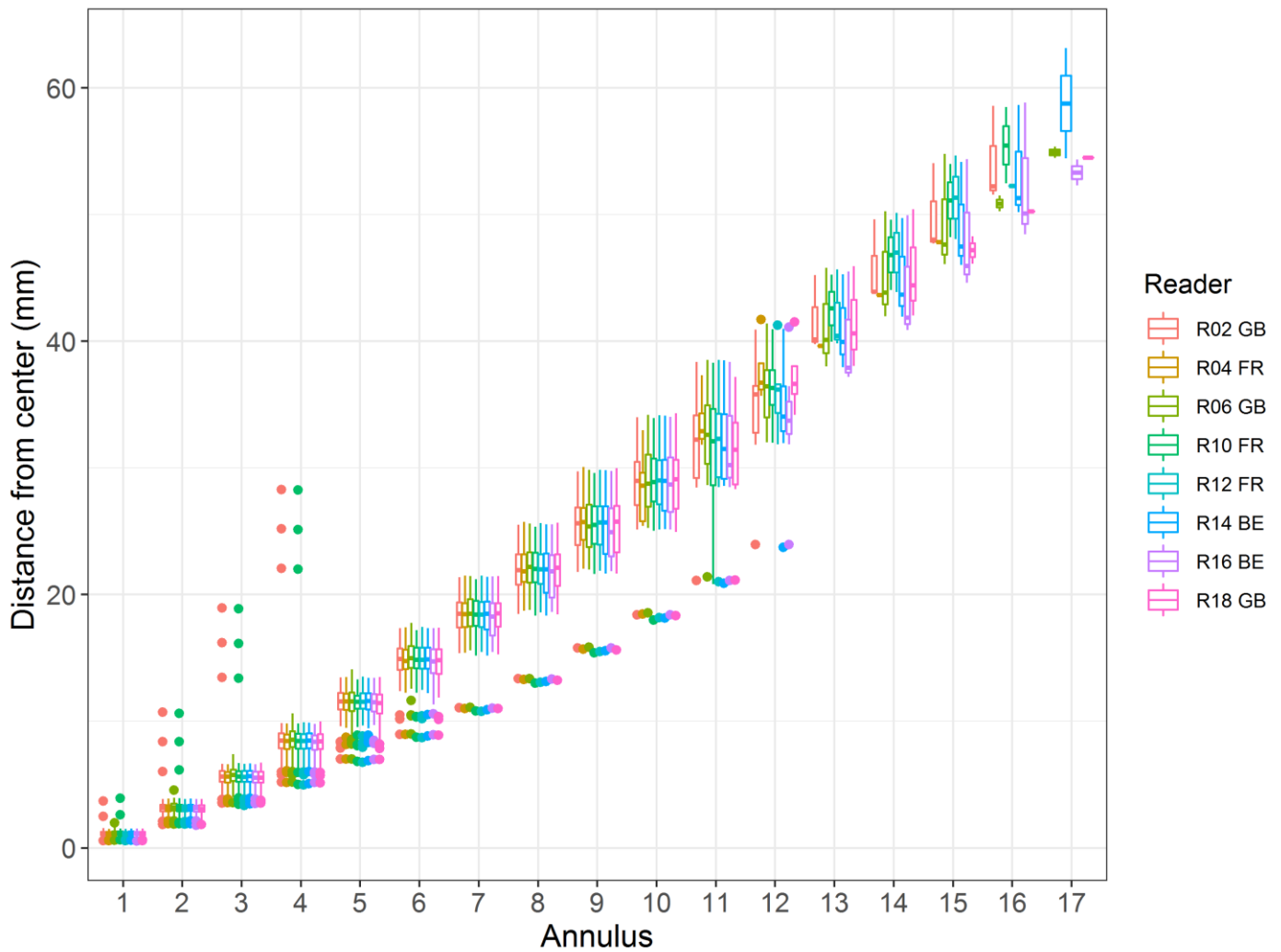


Figure 4: Otoliths - Plot of average distance from the centre to the winter rings for advanced readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers extend no further than $1.5 \times \text{IQR}$ (where IQR is the inter-quartile range) from the box boundary. Data beyond the end of the whiskers are represent outliers and are plotted individually.

3.7 Age error matrices

Table X: Age error matrix (AEM) for **scale**.

strata	Modal age	2	3	4	5	6	7	8	9	10	11	12	14	16
Scale	Age 2	0.6667	-	-	-	-	-	-	-	-	-	-	-	-
Scale	Age 3	0.3333	0.6667	-	-	-	-	-	-	-	-	-	-	-
Scale	Age 4	-	0.3333	0.63529	0.02899	-	-	-	-	-	-	-	-	-
Scale	Age 5	-	-	0.32941	0.76812	0.05128	-	-	-	-	-	-	-	-
Scale	Age 6	-	-	0.03529	0.20290	0.84615	0.06667	-	-	-	-	-	-	-
Scale	Age 7	-	-	-	-	0.07692	0.93333	0.09091	-	-	-	-	-	-
Scale	Age 8	-	-	-	-	0.02564	-	0.78788	-	-	-	-	-	-
Scale	Age 9	-	-	-	-	-	-	0.06061	0.66667	-	-	0.06667	-	-
Scale	Age 10	-	-	-	-	-	-	-	0.25000	1	0.3333	0.06667	-	-
Scale	Age 11	-	-	-	-	-	-	0.03030	0.08333	-	0.6667	0.13333	-	-
Scale	Age 12	-	-	-	-	-	-	-	-	-	-	0.60000	-	-
Scale	Age 13	-	-	-	-	-	-	0.03030	-	-	-	-	-	-
Scale	Age 14	-	-	-	-	-	-	-	-	-	-	-	0.3333	0.3333
Scale	Age 15	-	-	-	-	-	-	-	-	-	-	-	0.3333	-
Scale	Age 16	-	-	-	-	-	-	-	-	-	-	0.06667	0.3333	0.6667
Scale	Age 17	-	-	-	-	-	-	-	-	-	-	0.06667	-	-

Table 12: Age error matrix (AEM) for **otolith**.

strata	Modal age	2	3	4	5	6	7	8	9	10	11	12	15
Otolith	Age 2	0.4444	-	-	-	-	-	-	-	-	-	-	-
Otolith	Age 3	0.3333	0.5000	-	-	0.03333	-	-	-	-	-	-	-
Otolith	Age 4	0.2222	0.3333	0.65556	0.02985	-	-	-	-	-	-	-	-
Otolith	Age 5	-	0.1667	0.31111	0.79104	0.03333	0.06667	-	-	-	-	-	-
Otolith	Age 6	-	-	0.03333	0.16418	0.86667	0.13333	-	-	-	-	-	-
Otolith	Age 7	-	-	-	0.01493	0.03333	0.80000	0.2308	-	-	-	-	-
Otolith	Age 8	-	-	-	-	0.03333	-	0.7692	-	0.05	-	-	-
Otolith	Age 9	-	-	-	-	-	-	-	1	0.10	0.3333	-	-
Otolith	Age 10	-	-	-	-	-	-	-	-	0.60	-	0.07143	-
Otolith	Age 11	-	-	-	-	-	-	-	-	0.15	0.6667	-	-
Otolith	Age 12	-	-	-	-	-	-	-	-	0.10	-	0.64286	-
Otolith	Age 15	-	-	-	-	-	-	-	-	-	-	0.07143	0.3333
Otolith	Age 16	-	-	-	-	-	-	-	-	-	-	0.14286	0.3333
Otolith	Age 17	-	-	-	-	-	-	-	-	-	-	0.07143	0.3333

4 Conclusion and following Workshop

The 2021 Workshop on Age reading of Sea bass (*Dicentrarchus labrax*) 2 (WKARDL2) will provide an opportunity to analyse and discuss these results with all the readers (both advanced and basic). Particular attention will be given to those modal ages (2, 3 and over 10 years) for which agreement and precision were low. In addressing the bias that emerged in this exchange, we will further develop the existing reference collections of calcified structures and improve the existing database of both scales and otolith images. A report from the WKARDL2 will be submitted by 15 August 2021 for the attention of ACOM.