SmartDots Report for the 2026 North Sea Sprat WKARSPRAT2 age reading exercise (ID 5015)

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1 Summary

This calibration exercise was run during the WKARSPRAT2 2026. 35 samples were selected to represent the samples which are routinely read for the spr.27.3a4 stock. 2 images of each otolith were provided, 1 with transmitted light and 1 with reflected light. Readers were asked to only read the images of the method which they routinely read.

During the workshop much time was spent discussing samples from SmartDots ID 1910 and ID 4004, both the annotated images and the corresponding physical samples, when available. The 2016 WKARSPRAT age reading protocol was updated in plenary to reflect the discussions.

The purpose of this event was to test for an improvement in agreement between readers following the WKARSPRAT2 discussions and updating of the agreed age reading protocol.

Based on all age readers, the overall percentage agreement (PA) was 84%, with a coefficient of variation (CV) of 29% and an average percentage error (APE) of 18% (modal age range of 0-4 years). When only advanced readers were included, the results improved, the overall PA was 91% with a CV of 23% and an APE 13%.

Not all advanced readers attended the workshop, so age readings from the advanced readers for Denmark and the Netherlands were not included in the analyses.

The results show an improvement on the 2025 age reading exercise, where based on the advanced readers only, the PA was 77 % with a CV of 28 % and an APE of 18 % https://smartdots.ices.dk/ViewEvent?key=1910 .

2 Methods

The results section includes the tables and plots from the Guus Eltink Excel sheet 'Age Reading Comparisons (Eltink, A.T.G.W. 2000). The order and numbering of tables and plots are the same as in the excel sheet. Tables 6.1 - 6.4 from the 'Age Reading Comparisons' sheet are not outputted since these are merely used to do calculations for the other tables.

Percentage Agreement (PA)

The percentage agreement per reader per modal age tells how large is the part of readings that are equal to the modal age. The percentage agreement is estimated by modal age and reader as the proportion (as percentage) of times that the lectures of that reader agreed with the resulting modal age. This percentage is estimated as the number of times that a reader agreed with the modal age divided by the total number of otoliths read by a reader for each modal age.

$$PA = \frac{number\ of\ readings\ that\ agree\ with\ modal\ age}{total\ number\ of\ readings\ by\ modal\ age} \cdot 100\%$$

Coefficient of Variation (CV)

The table presents the Coefficient of Variation (CV) per modal age and reader. The CV's are calculated as the ratio between the standard deviation (σ) and mean value (μ) per reader and modal age:

$$CV = \frac{\sigma}{\mu} \cdot 100\%$$

To the table is also added the CV of all readers combined per modal age and a weighted mean of the CV per reader.

Relative bias

The relative bias is calculated as the difference between the mean and the modal age. This statistic is presented in first place by modal age and reader, but it is also calculated as an average value by modal age for all readers together (or only advanced readers).

Average Percentage Error (APE)

The Average Percentage Error (APE) was calculated based on the method outlined by Beamish & Fournier (1981). This method is dependent of fish age and thus provides a better estimate of precision than percentage agreement. As the calculations of both CV and APE pose problems if the mean age is close to 0, all observations for which modal age was 0 were omitted from the CV and APE calculations.

The average percentage error is calculated per image as:

$$APE = \frac{100\%}{n} \sum_{i=1}^{n} \left| \frac{a_i - \bar{a}}{\bar{a}} \right|$$

where a_i is the age reading of reader i and $\bar{a}$ is the mean of all readings from 1 to n.

Age error matrix (AEM)

Age error matrices (AEM) were produced following procedures outlined by WKSABCAL (2014) where the matrix shows the proportion of each modal age mis-aged as other ages. The sum of each row is 1, which equals 100%. The age data was analysed twice, the first time all readers were included and the second time only the “advanced” readers were included. If a reader is “advanced” then they are considered well trained and they provide ages for stock assessment or similar purposes. When the AEM is compiled for assessment purposes it uses only those readers who provide age data for the stock assessment in that specific area.

Otolith Growth Analysis

SmartDots provides a measure of distance between the annotations made by the readers and thus provides a measure of growth increment width. This data is used to establish growth curves for each otolith (fish) and for each reader.

2.1 Overview of samples and readers

Table 1: Overview of samples used for the exchange event number 5015

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2023	27.3.a.21	Strata_RLX	4	5	0-3	95-135 mm
2024	27.3.a.20	Strata_RLX	2	4	1-2	85-130 mm
2025	27.3.a.20	Strata_RLX	3	4	1-2	115-125 mm
2025	27.4.b	Strata_RLX	2	4	1	110-130 mm
2025	27.4.b	Strata_RLX	3	5	0-1	90-135 mm
2025	27.4.b	Strata_RLX	4	5	0-3	95-135 mm
2026	27.3.a.20	Strata_RLX	1	4	1-3	90-120 mm
2026	27.4.b	Strata_RLX	1	4	1-4	100-150 mm

Table 2: Reader overview.

Reader code	Expertise	Expertise_rank	strata
R03 NO	Advanced	3	Strata_RLX
R04 SE	Advanced	4	Strata_RLX
R05 GB-SCT	Advanced	5	Strata_RLX
R06 DE	Advanced	6	Strata_RLX
R07 GB	Advanced	7	Strata_RLX
R08 FR	Advanced	8	Strata_RLX
R09 NO	Advanced	9	Strata_RLX
R10 SE	Basic	10	Strata_RLX
R11 NO	Basic	11	Strata_RLX
R12 DK	Basic	12	Strata_RLX
R13 SE	Basic	13	Strata_RLX
R14 SE	Basic	14	Strata_RLX
R15 DE	Basic	15	Strata_RLX
R16 GB-NIR	Basic	16	Strata_RLX

3 Results

3.1.1 All readers

Table 3: Summary of statistics; Total number of samples (NSample), coefficient of variance (CV), percentage of agreement (PA) and average percentage error (APE) for all ages and readers

NSample	CV	PA	APE
35	29 %	84 %	18 %

Coefficient of Variation (CV)

Table 4: Coefficient of Variation (CV) table presents the CV per modal age and reader, the CV of all readers combined per modal age and a weighted mean of the CV per reader

Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE
0	-	-	-	-	-	-	-	**-**
1	29 %	22 %	29 %	0 %	30 %	29 %	0 %	**40 %**
2	0 %	39 %	19 %	26 %	0 %	31 %	27 %	**39 %**
3	0 %	0 %	0 %	0 %	0 %	18 %	18 %	**0 %**
4	-	-	-	-	-	-	-	**-**
Weighted Mean	**17 %**	**24 %**	**22 %**	**7 %**	**19 %**	**28 %**	**10 %**	**35 %**

Modal age	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GB-NIR	all
0	-	-	-	-	-	-	**-**
1	0 %	35 %	39 %	36 %	29 %	54 %	**33 %**
2	31 %	34 %	26 %	0 %	27 %	29 %	**28 %**
3	0 %	40 %	23 %	18 %	0 %	23 %	**15 %**
4	-	-	-	-	-	-	**40 %**
Weighted Mean	**8 %**	**35 %**	**34 %**	**24 %**	**25 %**	**43 %**	**29 %**

Percentage of Agreement (PA)

Table 5: Percentage agreement (PA) table represents the PA per modal age and reader, the PA of all readers combined per modal age and a weighted mean of the PA per reader.

Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE
0	100 %	100 %	75 %	100 %	100 %	100 %	100 %	**100 %**
1	89 %	94 %	89 %	100 %	88 %	89 %	100 %	**82 %**
2	100 %	75 %	88 %	75 %	100 %	88 %	75 %	**62 %**
3	100 %	100 %	100 %	100 %	100 %	75 %	75 %	**100 %**
4	100 %	100 %	0 %	100 %	-	-	100 %	**0 %**
Weighted Mean	**94 %**	**91 %**	**86 %**	**94 %**	**93 %**	**88 %**	**91 %**	**79 %**

Modal age	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GB-NIR	total
0	100 %	100 %	100 %	100 %	75 %	100 %	**96 %**
1	100 %	78 %	83 %	61 %	89 %	44 %	**85 %**
2	88 %	62 %	75 %	100 %	75 %	71 %	**81 %**
3	100 %	0 %	50 %	75 %	100 %	50 %	**80 %**
4	100 %	0 %	100 %	0 %	0 %	0 %	**50 %**
Weighted Mean	**97 %**	**66 %**	**80 %**	**74 %**	**83 %**	**55 %**	**84 %**

Average Percentage Error (APE)

Table 6: Average Percentage Error (APE) table represents the APE per modal age and reader, the APE of all advanced readers combined per modal age and a weighted mean of the APE per reader.

Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE
0	-	-	-	-	-	-	-	**-**
1	18 %	10 %	18 %	0 %	19 %	18 %	0 %	**21 %**
2	0 %	22 %	12 %	21 %	0 %	19 %	12 %	**28 %**
3	0 %	0 %	0 %	0 %	0 %	14 %	14 %	**0 %**
4	0 %	0 %	0 %	0 %	-	-	0 %	**0 %**
Weighted Mean	**10 %**	**11 %**	**13 %**	**6 %**	**12 %**	**18 %**	**5 %**	**19 %**

Modal age	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GB-NIR	all
0	-	-	-	-	-	-	**-**
1	0 %	28 %	20 %	34 %	18 %	46 %	**21 %**
2	19 %	23 %	21 %	0 %	12 %	14 %	**12 %**
3	0 %	30 %	20 %	14 %	0 %	20 %	**11 %**
4	0 %	0 %	0 %	0 %	0 %	0 %	**33 %**
Weighted Mean	**5 %**	**26 %**	**20 %**	**22 %**	**14 %**	**33 %**	**18 %**

Relative bias

Table 7: The relative bias (as the difference between the mean and modal age) per modal age and reader is presented, as well as the weighted mean relative bias per reader and the relative bias per modal age for all readers combined.

Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE
0	0.00	0.00	0.25	0.00	0.00	0.00	0.00	**0.00**
1	0.11	0.06	0.11	0.00	0.12	0.11	0.00	**0.06**
2	0.00	0.12	-0.12	-0.25	0.00	0.25	0.00	**0.25**
3	0.00	0.00	0.00	0.00	0.00	-0.25	-0.25	**0.00**
4	0.00	0.00	-1.00	0.00	-	-	0.00	**-3.00**
Weighted Mean	**0.06**	**0.06**	**0.03**	**-0.06**	**0.07**	**0.09**	**-0.03**	**0.00**

Modal age	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GB-NIR	all
0	0.00	0.00	0.00	0.00	0.25	0.00	**0.04**
1	0.00	0.22	0.06	0.39	0.11	0.31	**0.12**
2	0.25	-0.12	-0.25	0.00	0.00	0.00	**0.01**
3	0.00	-0.50	-0.50	-0.25	0.00	-0.50	**-0.16**
4	0.00	-2.00	0.00	-1.00	-3.00	-2.00	**-**
Weighted Mean	**0.06**	**-0.03**	**-0.09**	**0.14**	**0.00**	**0.03**	**0.05**

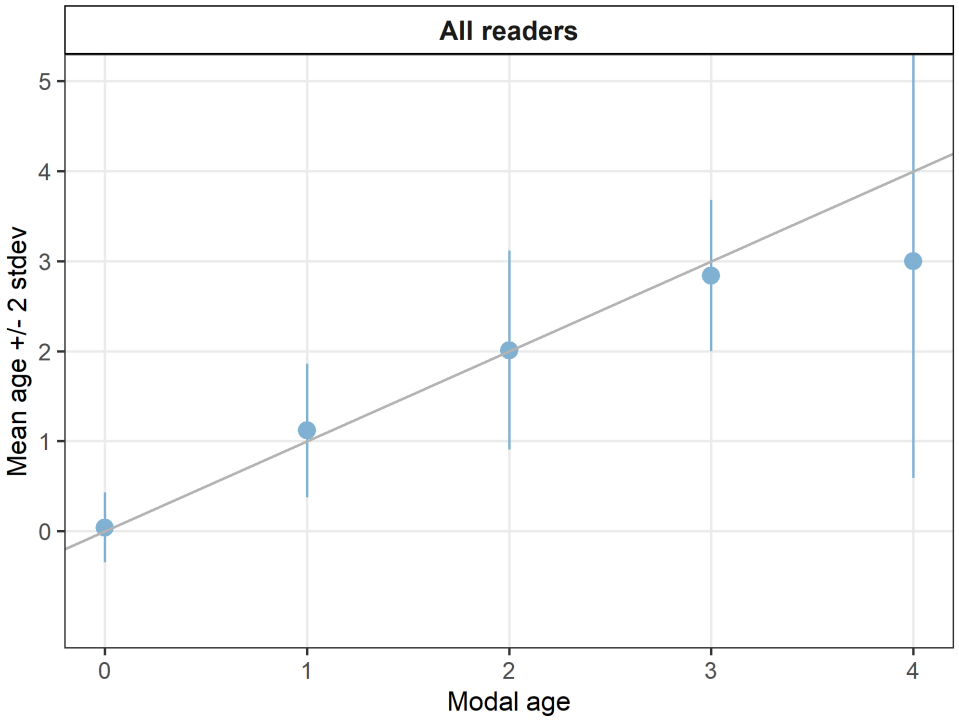

Figure 1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Growth analysis

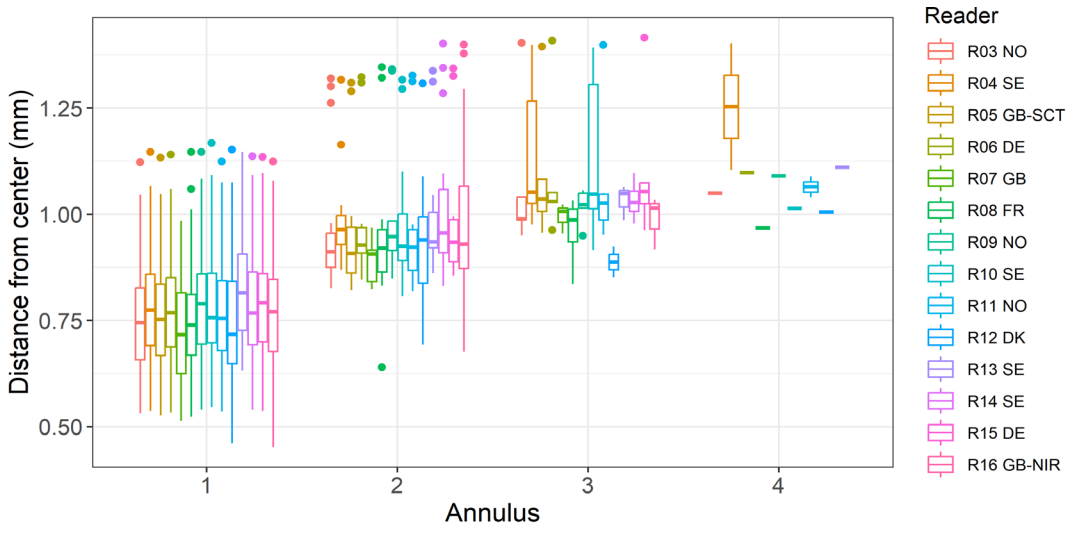

Figure 2: Plot of average distance from the centre to the winter rings for all readers. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

3.1.2 Advanced readers

Summary statistics

Table 8: Summary of statistics; Total number of samples (NSample), coefficient of variance (CV), percentage of agreement (PA) and average percentage error (APE) for all ages and readers

NSample	CV	PA	APE
35	23 %	91 %	13 %

Coefficient of Variation (CV)

Table 9: 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	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	all
0	-	-	-	-	-	-	-	**-**
1	32 %	22 %	29 %	0 %	33 %	32 %	0 %	**27 %**
2	0 %	33 %	0 %	20 %	0 %	33 %	18 %	**22 %**
3	0 %	0 %	0 %	0 %	0 %	18 %	18 %	**9 %**
4	-	-	-	-	-	-	-	**12 %**
Weighted Mean	**20 %**	**22 %**	**18 %**	**5 %**	**23 %**	**31 %**	**7 %**	**23 %**

Percentage of Agreement (PA)

Table 10: 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	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	total
0	100 %	100 %	75 %	100 %	100 %	100 %	100 %	**96 %**
1	84 %	95 %	89 %	100 %	82 %	84 %	100 %	**91 %**
2	100 %	86 %	100 %	86 %	100 %	86 %	86 %	**91 %**
3	100 %	100 %	100 %	100 %	100 %	75 %	75 %	**93 %**
4	100 %	100 %	0 %	100 %	-	-	100 %	**80 %**
Weighted Mean	**91 %**	**94 %**	**89 %**	**97 %**	**89 %**	**85 %**	**94 %**	**91 %**

Average Percentage Error (APE)

Table 11: Average Percentage Error (APE) table represents the APE per modal age and reader, the APE of all advanced readers combined per modal age and a weighted mean of the APE per reader.

Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	all
0	-	-	-	-	-	-	-	**-**
1	23 %	9 %	17 %	0 %	25 %	23 %	0 %	**15 %**
2	0 %	21 %	0 %	13 %	0 %	21 %	11 %	**10 %**
3	0 %	0 %	0 %	0 %	0 %	14 %	14 %	**5 %**
4	0 %	0 %	0 %	0 %	-	-	0 %	**8 %**
Weighted Mean	**14 %**	**11 %**	**10 %**	**3 %**	**17 %**	**21 %**	**4 %**	**13 %**

Relative Bias

Table 12: The relative bias (as the difference between the mean and modal age) per modal age and advanced reader is presented, as well as the weighted mean relative bias per reader and the relative bias per modal age for all advanced readers combined.

Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	all
0	0.00	0.00	0.25	0.00	0.00	0.00	0.00	**0.04**
1	0.16	0.05	0.11	0.00	0.18	0.16	0.00	**0.09**
2	0.00	0.29	0.00	-0.14	0.00	0.29	0.14	**0.08**
3	0.00	0.00	0.00	0.00	0.00	-0.25	-0.25	**-0.07**
4	0.00	0.00	-1.00	0.00	-	-	0.00	-
Weighted Mean	**0.09**	**0.09**	**0.06**	**-0.03**	**0.11**	**0.12**	**0.00**	**0.06**

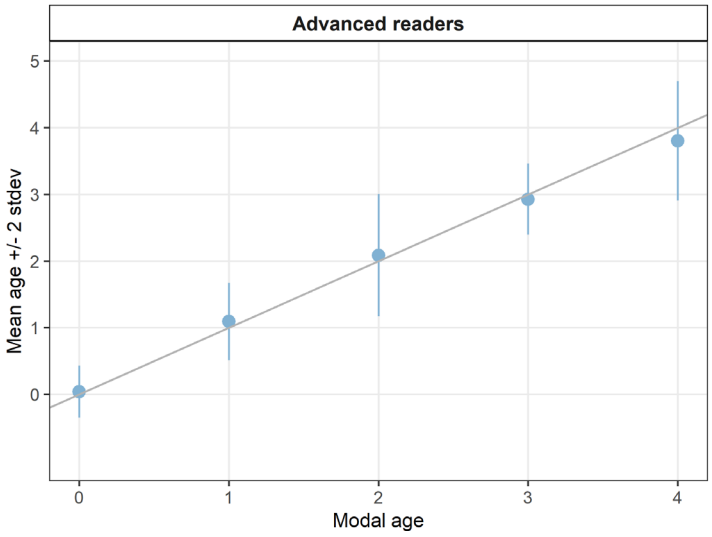

Figure 3: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Growth analysis

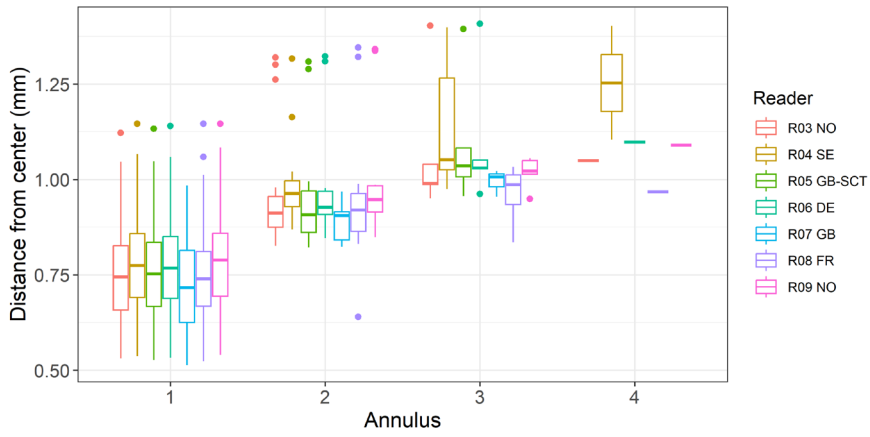

Figure 4: Plot of average distance from the centre to the winter rings for advanced readers. The boxes represent the mean, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

General Age Error Matrix (AEM)

Table 13: General Age error matrix (AEM). The modal age is in rows and the age classifications by the advanced readers in columns.

modal_age	0	1	2	3	4	Total
0	0.96	0.04	-	-	-	1.00
1	-	0.91	0.09	-	-	1.00
2	-	0.02	0.91	0.02	0.04	0.99
3	-	-	0.07	0.93	-	1.00
4	-	-	-	0.20	0.80	1.00

4 References

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

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5 Annex 3. Additional results

5.1 Results all readers

Table 14: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
35	29 %	84 %	18 %

Table 15: Data overview including modal age and statistics per sample.

Fish ID	length	Catch date	ICES area	R03 NO	R04 SE	R05 GBSCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GBNIR	Modal age	PA %	CV %	APE %
2548_1768_1_ALW_RLX	95	14-11-2023	27.3.a.21	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	100	-	-
2548_1768_2_ALW_RLX	135	14-11-2023	27.3.a.21	2	1	1	1	-	1	1	1	1	1	1	2	1	2	1	77	36	29
2548_1768_9_ALW_RLX	105	14-11-2023	27.3.a.21	1	2	1	1	-	1	1	1	1	1	1	2	1	2	1	77	36	29
2548_1769_5_ALW_RLX	130	15-11-2023	27.3.a.21	2	4	2	2	-	2	2	3	2	1	2	2	2	2	2	77	32	19
2548_1769_8_ALW_RLX	130	15-11-2023	27.3.a.21	3	3	3	3	-	2	2	3	3	2	2	2	3	2	3	54	20	20
8881499_ALW_RLX_XB	85	30-06-2024	27.3.a.20	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	93	29	14
8881564_ALW_RLX_CX	120	30-06-2024	27.3.a.20	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	93	14	7
8881565_ALW_RLX_XX	120	30-06-2024	27.3.a.20	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	93	25	12
8881566_ALW_RLX_XX	130	30-06-2024	27.3.a.20	2	2	2	2	-	4	3	4	4	2	1	2	3	-	2	50	39	33
9100524_ALW_RLX_XX	110	29-06-2025	27.4.b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	0	0
9100525_ALW_RLX_XB	110	29-06-2025	27.4.b	1	1	2	1	2	1	1	1	1	2	1	1	1	2	1	71	36	32
9100543_ALW_RLX_XX	125	29-06-2025	27.4.b	1	1	1	1	1	1	1	1	1	2	1	2	2	2	1	71	36	32
9100544_ALW_RLX_XX	130	29-06-2025	27.4.b	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	93	25	12

Fish ID	length	Catch date	ICES area	R03 NO	R04 SE	R05 GBSCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GBNIR	Modal age	PA%	CV%	APE%
9118173_ALW_RLX_XX	115	11-07-2025	27.3.a.20	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	93	25	12
9118174_ALW_RLX_OX	115	11-07-2025	27.3.a.20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	0	0
9118193_ALW_RLX_XO	125	11-07-2025	27.3.a.20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	0	0
9118194_ALW_RLX_XX	125	11-07-2025	27.3.a.20	2	1	1	1	2	2	1	2	2	2	2	2	1	2	2	64	30	28
9138460_ALW_RLX_OX	135	15-10-2025	27.4.b	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	86	13	9
9138461_ALW_RLX_XX	135	15-10-2025	27.4.b	2	2	2	2	2	2	2	2	2	3	2	2	2	3	2	86	17	11
9145971_ALW_RLX_XX	135	30-08-2025	27.4.b	1	1	1	1	1	1	1	-	1	2	1	2	1	-	1	83	33	24
9145972_ALW_RLX_XX	130	30-08-2025	27.4.b	2	1	2	1	2	1	1	1	1	1	2	2	2	2	1	50	35	33
9145973_ALW_RLX_BB	125	30-08-2025	27.4.b	1	1	1	1	1	2	1	2	1	1	1	2	1	2	1	71	36	32
9146016_ALW_RLX_XO	95	30-08-2025	27.4.b	0	0	1	0	-	0	0	0	0	0	0	0	1	-	0	83	-	-
9146017_ALW_RLX_XX	90	30-08-2025	27.4.b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	-	-
9147079_ALW_RLX_OX	105	18-10-2025	27.4.b	1	1	1	1	1	1	1	1	1	1	2	1	1	-	1	92	26	13
9147080_ALW_RLX_OX	100	18-10-2025	27.4.b	1	1	1	1	1	1	-	1	1	1	1	1	1	2	1	92	26	13
9147081_ALW_RLX_OX	95	18-10-2025	27.4.b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	-	-
9200702_ALW_RLX_XX	100	14-01-2026	27.4.b	1	1	1	1	1	2	1	0	1	1	1	1	1	0	1	79	51	29
9200703_ALW_RLX_XX	105	14-01-2026	27.4.b	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	93	14	7

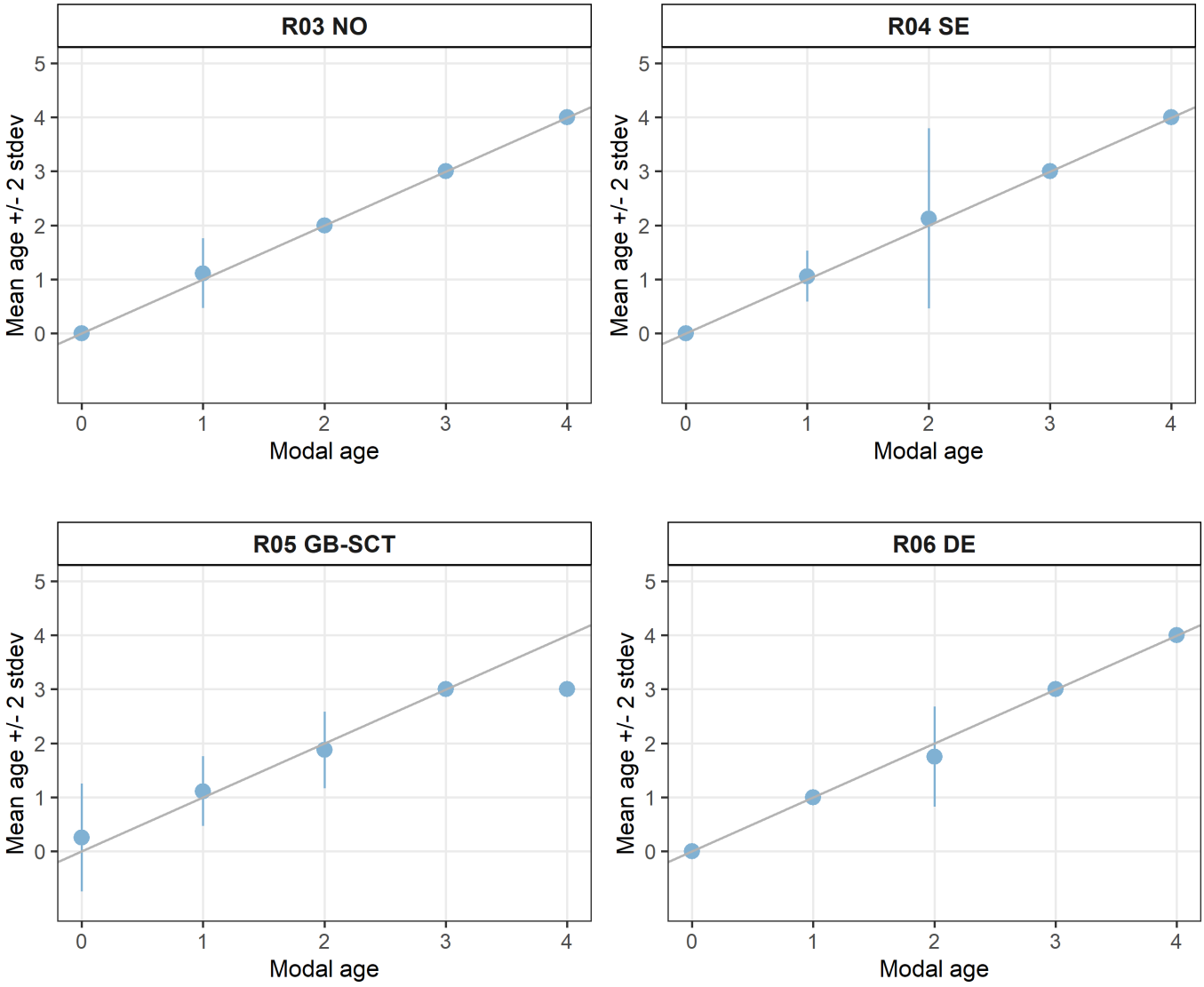
Fish ID	length	Catch date	ICES area	R03 NO	R04 SE	R05 GBSCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GBNIR	Modal age	PA %	CV %	APE %
9200707_ALW_RLX_XX	125	14-01-2026	27.4.b	2	2	2	1	2	2	2	2	2	1	2	2	2	2	2	86	20	13
9200708_ALW_RLX_XC	150	14-01-2026	27.4.b	4	4	3	4	-	-	4	1	4	2	4	3	1	2	4	50	40	33
9200711_ALW_RLX_XX	90	13-01-2026	27.3.a.20	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	93	29	14
9200712_ALW_RLX_XX	95	13-01-2026	27.3.a.20	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	93	14	7
9200716_ALW_RLX_XC	115	13-01-2026	27.3.a.20	3	3	3	3	3	3	3	3	3	2	3	3	3	2	3	86	13	9
9202685_ALW_RLX_XX	120	13-01-2026	27.3.a.20	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	93	9	4

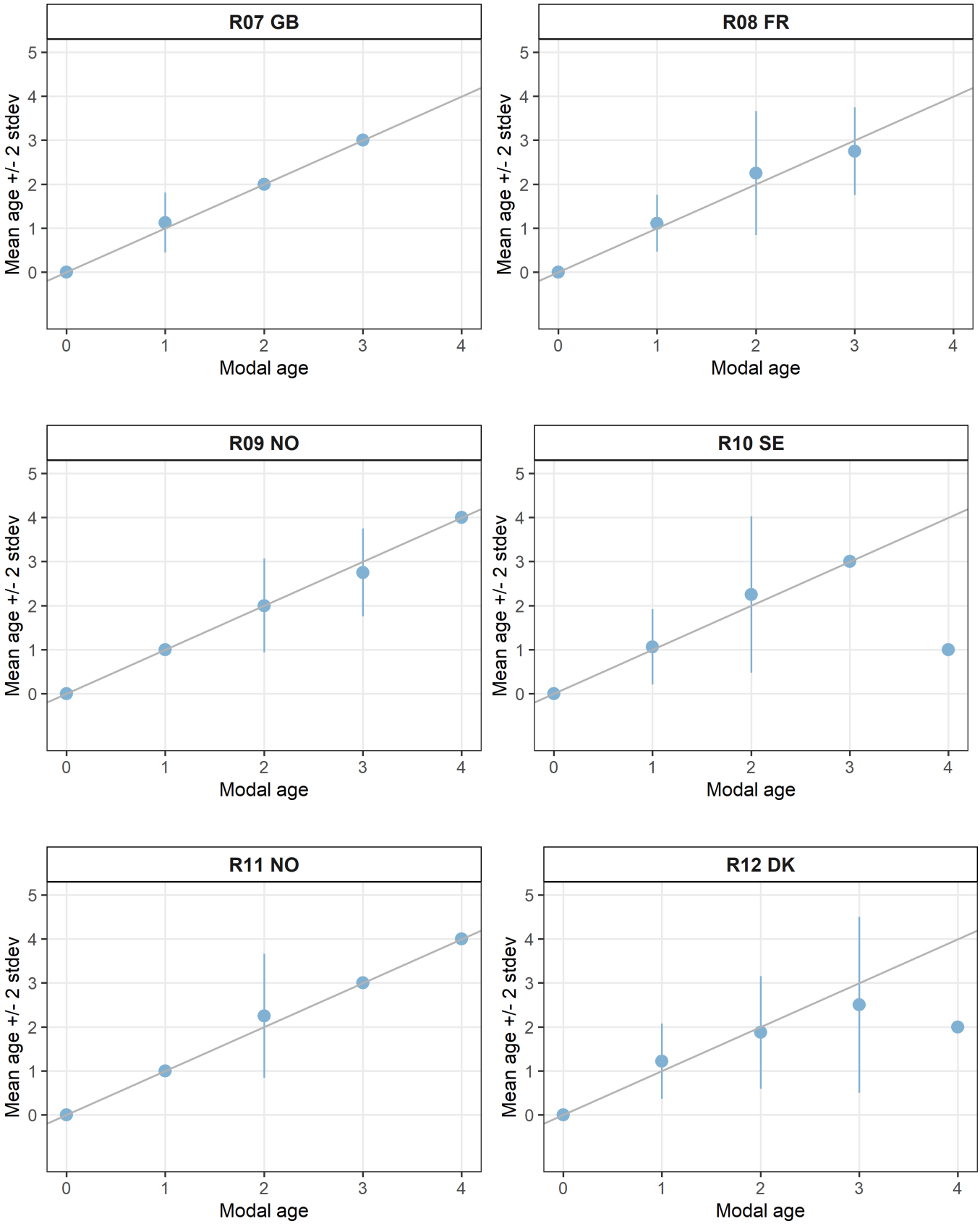
Number of age readings by modal age

Table 16: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings by modal age and by reader are also presented.

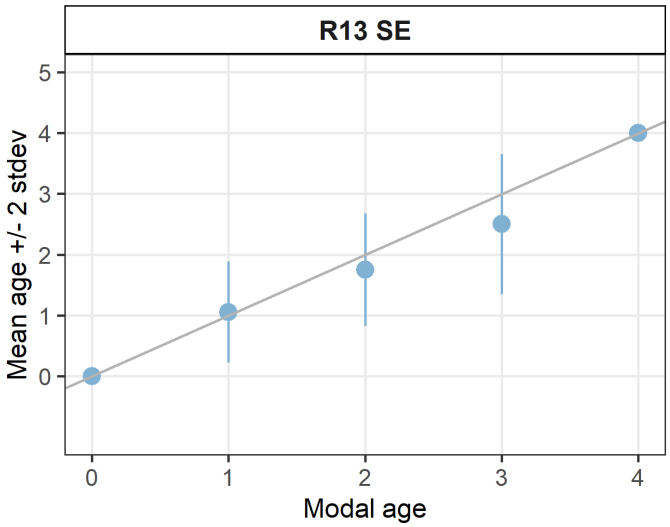
Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	R10 SE	R11 NO	R12 DK	R13 SE	R14 SE	R15 DE	R16 GB-NIR	total
0	4	4	4	4	2	4	4	3	4	4	4	4	4	3	52
1	18	18	18	18	16	18	17	17	18	18	18	18	18	16	246
2	8	8	8	8	6	8	8	8	8	8	8	8	8	7	109
3	4	4	4	4	3	4	4	4	4	4	4	4	4	4	55
4	1	1	1	1	0	0	1	1	1	1	1	1	1	1	12
Total	**35**	**35**	**35**	**35**	**27**	**34**	**34**	**33**	**35**	**35**	**35**	**35**	**35**	**31**	**474**

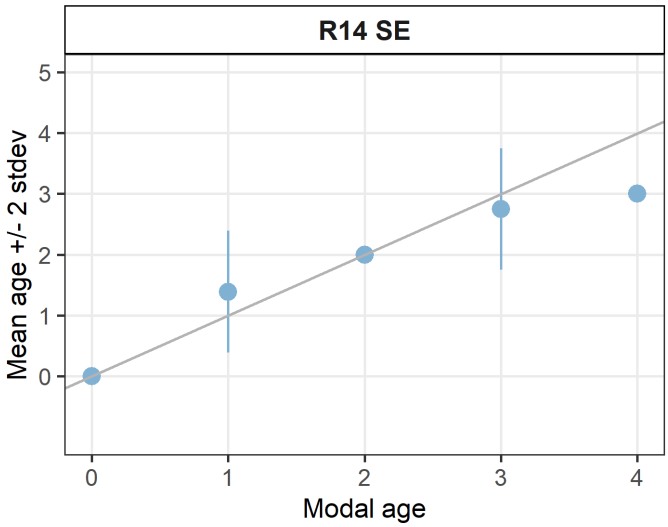
Separate age bias plots by reader

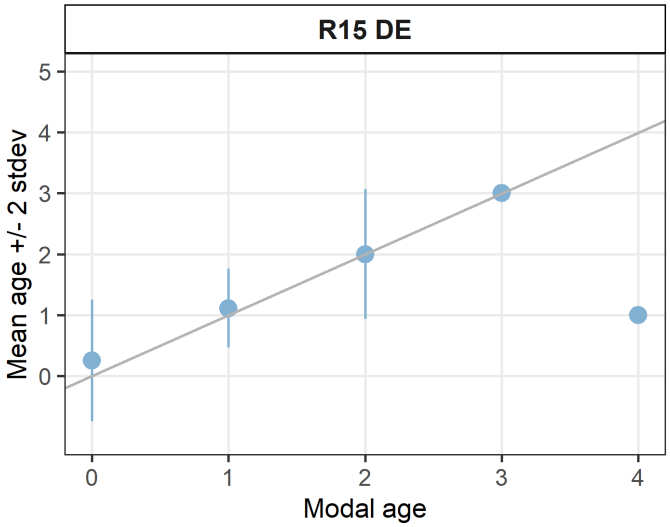


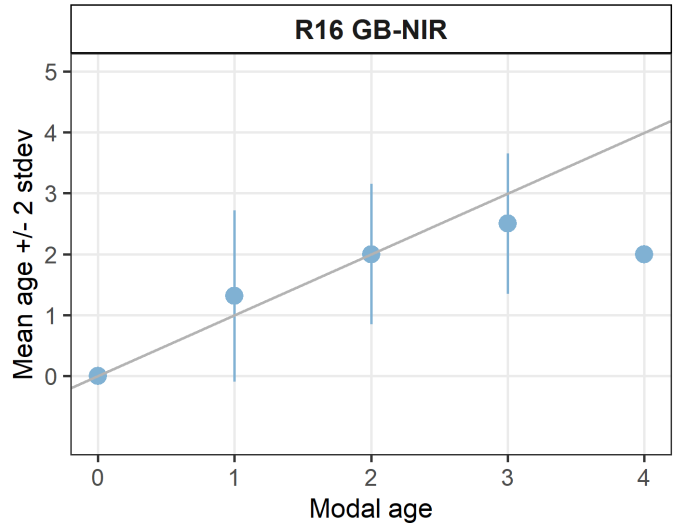

R07 GB
R08 FR
R09 NO
R10 SE
R11 NO
R12 DK
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5

[[


R13 SE
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5


R14 SE
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5


R15 DE
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5


R16 GB-NIR
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5

5.2 Results Advanced readers

Table 17: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
35	23 %	91 %	13 %

Table 18: Data overview including modal age and statistics per sample.

Fish ID	length	Catch date	ICES area	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	Modal age	PA %	CV %	APE %
2548_1768_1_ALW_RLX	95	14-11-2023 00:00:00	27.3.a.21	0	0	0	0	-	0	0	0	100	-	-
2548_1768_2_ALW_RLX	135	14-11-2023 00:00:00	27.3.a.21	2	1	1	1	-	1	1	1	83	35	24
2548_1768_9_ALW_RLX	105	14-11-2023 00:00:00	27.3.a.21	1	2	1	1	-	1	1	1	83	35	24
2548_1769_5_ALW_RLX	130	15-11-2023 00:00:00	27.3.a.21	2	4	2	2	-	2	2	2	83	35	24
2548_1769_8_ALW_RLX	130	15-11-2023 00:00:00	27.3.a.21	3	3	3	3	-	2	2	3	67	19	17
8881499_ALW_RLX_XB	85	30-06-2024 14:26:07	27.3.a.20	1	1	1	1	1	1	1	1	100	0	0
8881564_ALW_RLX_CX	120	30-06-2024 14:26:07	27.3.a.20	2	2	2	2	2	2	2	2	100	0	0
8881565_ALW_RLX_XX	120	30-06-2024 14:26:07	27.3.a.20	1	1	1	1	1	1	1	1	100	0	0
8881566_ALW_RLX_XX	130	30-06-2024 14:26:07	27.3.a.20	2	2	2	2	-	4	3	2	67	33	27
9100524_ALW_RLX_XX	110	29-06-2025 12:16:00	27.4.b	1	1	1	1	1	1	1	1	100	0	0
9100525_ALW_RLX_XB	110	29-06-2025 12:16:00	27.4.b	1	1	2	1	2	1	1	1	71	38	32
9100543_ALW_RLX_XX	125	29-06-2025 12:16:00	27.4.b	1	1	1	1	1	1	1	1	100	0	0
9100544_ALW_RLX_XX	130	29-06-2025 12:16:00	27.4.b	1	1	1	1	1	1	1	1	100	0	0
9118173_ALW_RLX_XX	115	11-07-2025 04:41:58	27.3.a.20	1	1	1	1	1	1	1	1	100	0	0
9118174_ALW_RLX_OX	115	11-07-2025 04:41:58	27.3.a.20	1	1	1	1	1	1	1	1	100	0	0
9118193_ALW_RLX_XO	125	11-07-2025 04:41:58	27.3.a.20	1	1	1	1	1	1	1	1	100	0	0
9118194_ALW_RLX_XX	125	11-07-2025 04:41:58	27.3.a.20	2	1	1	1	2	2	1	1	57	37	34
9138460_ALW_RLX_OX	135	15-10-2025 06:29:28	27.4.b	3	3	3	3	3	3	3	3	100	0	0
9138461_ALW_RLX_XX	135	15-10-2025 06:29:28	27.4.b	2	2	2	2	2	2	2	2	100	0	0
9145971_ALW_RLX_XX	135	30-08-2025 13:05:11	27.4.b	1	1	1	1	1	1	1	1	100	0	0
9145972_ALW_RLX_XX	130	30-08-2025 13:05:11	27.4.b	2	1	2	1	2	1	1	1	57	37	34
9145973_ALW_RLX_BB	125	30-08-2025 13:05:11	27.4.b	1	1	1	1	1	2	1	1	86	33	21

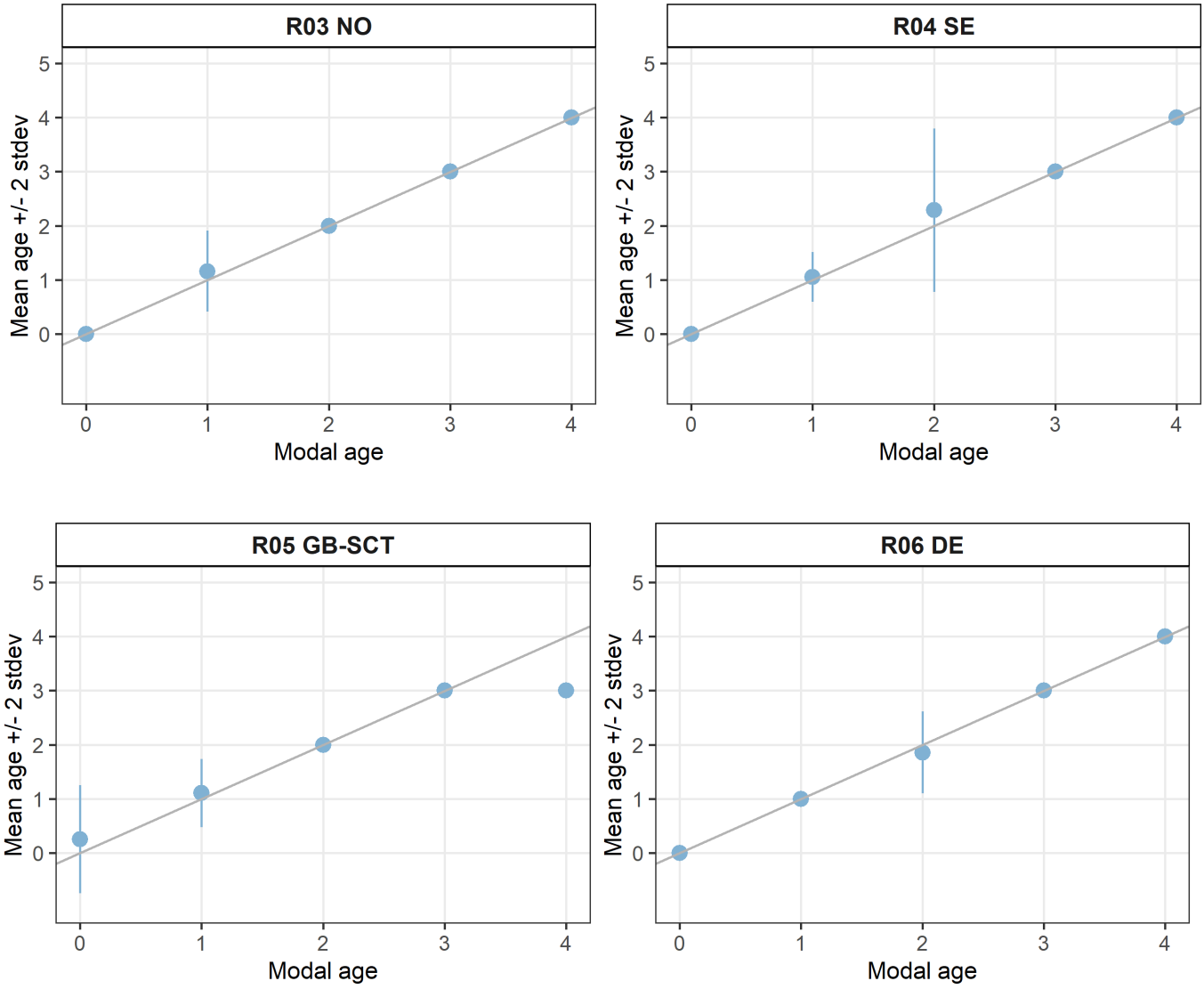
Fish ID	length	Catch date	ICES area	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	Modal age	PA %	CV %	APE %
9146016_ALW_RLX_XO	95	30-08-2025 13:05:11	27.4.b	0	0	1	0	-	0	0	0	83	-	-
9146017_ALW_RLX_XX	90	30-08-2025 13:05:11	27.4.b	0	0	0	0	0	0	0	0	100	-	-
9147079_ALW_RLX_OX	105	18-10-2025 16:00:13	27.4.b	1	1	1	1	1	1	1	1	100	0	0
9147080_ALW_RLX_OX	100	18-10-2025 16:00:13	27.4.b	1	1	1	1	1	1	-	1	100	0	0
9147081_ALW_RLX_OX	95	18-10-2025 16:00:13	27.4.b	0	0	0	0	0	0	0	0	100	-	-
9200702_ALW_RLX_XX	100	14-01-2026 12:27:30	27.4.b	1	1	1	1	1	2	1	1	86	33	21
9200703_ALW_RLX_XX	105	14-01-2026 12:27:30	27.4.b	2	2	2	2	2	2	2	2	100	0	0
9200707_ALW_RLX_XX	125	14-01-2026 12:27:30	27.4.b	2	2	2	1	2	2	2	2	86	20	13
9200708_ALW_RLX_XC	150	14-01-2026 12:27:30	27.4.b	4	4	3	4	-	-	4	4	80	12	8
9200711_ALW_RLX_XX	90	13-01-2026 10:31:51	27.3.a.20	1	1	1	1	1	1	1	1	100	0	0
9200712_ALW_RLX_XX	95	13-01-2026 10:31:51	27.3.a.20	2	2	2	2	2	2	2	2	100	0	0
9200716_ALW_RLX_XC	115	13-01-2026 10:31:51	27.3.a.20	3	3	3	3	3	3	3	3	100	0	0
9202685_ALW_RLX_XX	120	13-01-2026 14:57:48	27.3.a.20	3	3	3	3	3	3	3	3	100	0	0

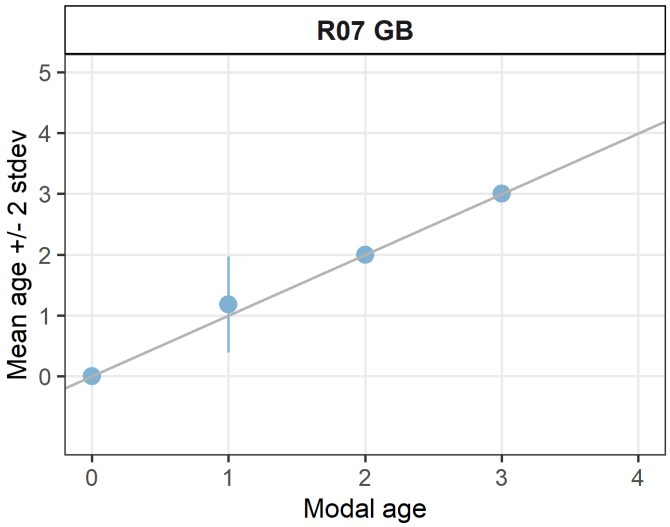
Number of age readings by modal age

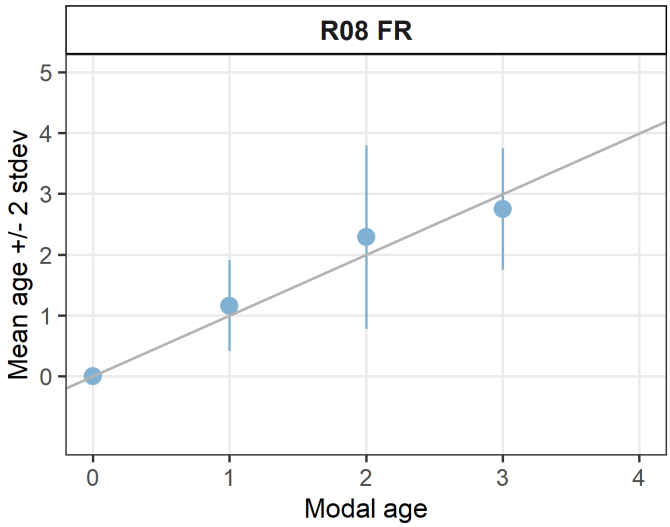
Table 19: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings by modal age and by reader are also presented.

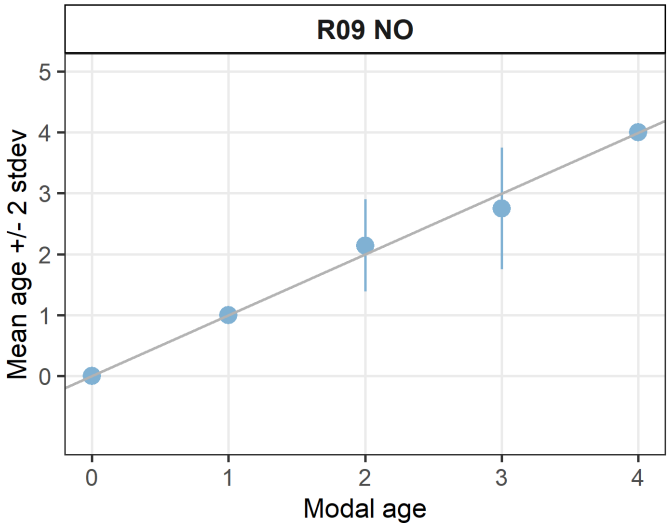
Modal age	R03 NO	R04 SE	R05 GB-SCT	R06 DE	R07 GB	R08 FR	R09 NO	total
0	4	4	4	4	2	4	4	26
1	19	19	19	19	17	19	18	130
2	7	7	7	7	5	7	7	47
3	4	4	4	4	3	4	4	27
4	1	1	1	1	0	0	1	5
Total	**35**	**35**	**35**	**35**	**27**	**34**	**34**	**235**

Separate age bias plots by reader




R07 GB
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5


R08 FR
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5


R09 NO
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5