Report of the 2025 age reading exchange for *Trachurus trachurus, T. mediterraneus* and *T. picturatus*) - SmartDots events 2926, 2927 and 2928-

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Index

1 Introduction 1

2 Methods 3

3 Results 5

3.1 Overview of samples and readers 6

3.2 *Trachurus trachurus* (Event-ID 2926) 9

3.2.1 Whole otoliths 9

3.2.1.1 All readers 9

3.2.1.2 Advanced readers 14

3.2.2 Sliced otoliths 19

3.2.2.1 All readers 19

3.2.2.2 Advanced readers 24

3.3 *Trachurus mediterraneus* (Event-ID 2927) 28

3.3.1 All readers 28

3.3.2 Advanced reader 32

3.4 *Trachurus picturatus* (Event-ID 2928) 33

3.4.1 All readers 33

3.5 Discussion 38

3.6 Conclusion 39

4 References 40

5 Annex 1. List of participants 41

6 Annex 2. Additional results 42

6.1 Results *T. trachurus* (Event-ID 2926) 43

6.1.1 All readers - whole otoliths 43

6.1.2 Advanced readers – whole otoliths 56

6.1.3 All readers - sliced otoliths 67

6.1.4 Advanced readers – sliced otoliths 78

6.1 Results *T. mediterraneus* (Event-ID 2927) 86

6.2 Results Advanced reader 97

6.3 Results *T. picturatus* (Event-ID 2928) 99

7 Annex 3. Recommendations 109

1 Introduction

Genus *Trachurus* belongs to the Family Carangidae and is composed by numerous medium-pelagic species with commercial interest, sustaining artisanal and industrial fisheries worldwide (Fischer et al., 1981). In the North-, Central-East Atlantic and the Mediterranean Sea, this group is mainly represented by *T. trachurus*, *T. mediterraneus* and *T. picturatus*, with different geographical distribution and abundance, though with some overlap among them depending on the area (Fig. 1.1).

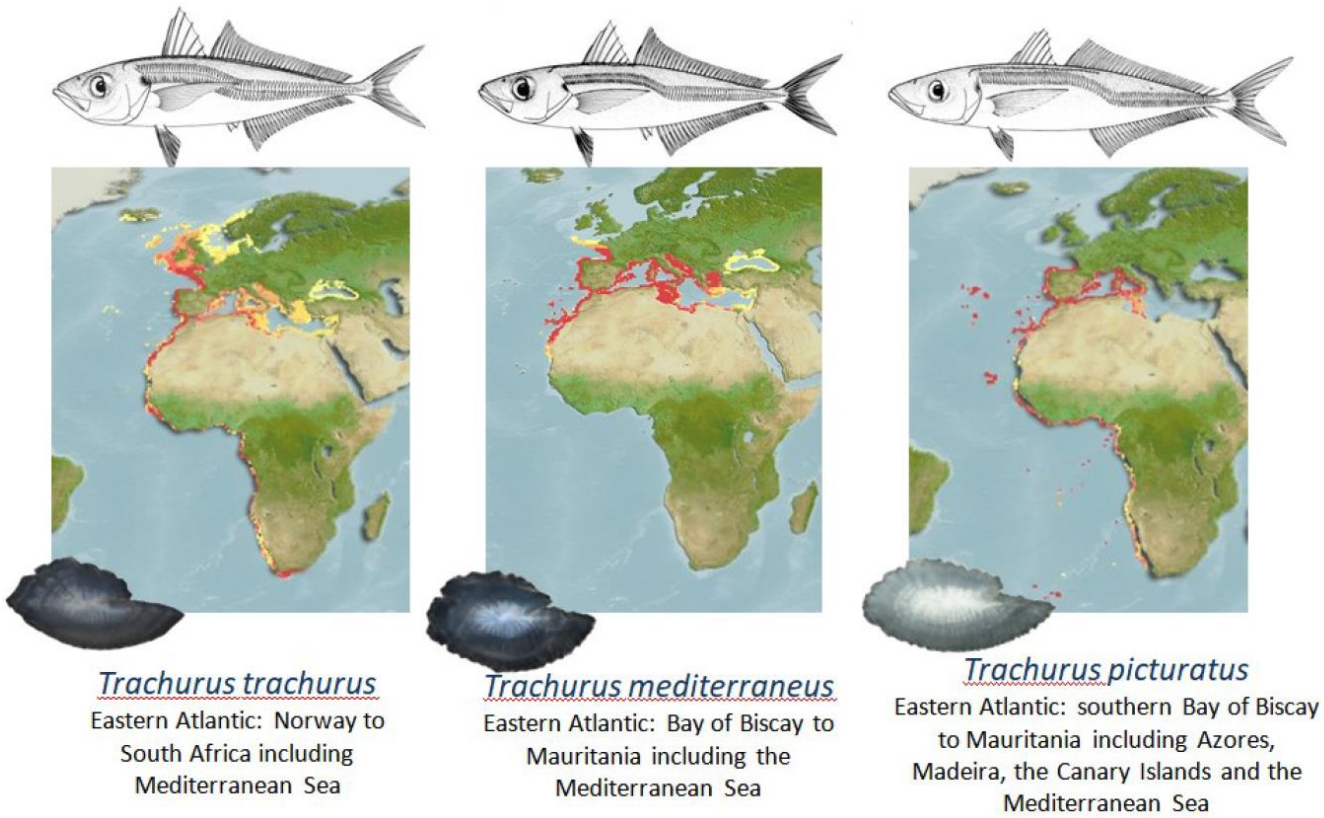

Figure 1.1. Geographical distribution of the *Trachurus* species addressed in the present otolith exchange (Froese and Pauly, 2022; Fischer et al., 1981)

The biological knowledge of these species is also variable and different among areas (ICES, 2018), but it is widely agreed that readability of the *Trachurus* otoliths is quite difficult and that there are regional differences, being the ageing interpretation more difficult in the southern areas of their distribution limits, where seasonal climate oscillations are lower. Due to age determination is essential in fish stock assessment to estimate the rates of moralities and growth, in order to provide appropriate management advice, ageing procedures must be reliable. However, otolith preparation and age reading methods might differ considerably between countries, and to organize otolith exchanges on a regular basis and age reading workshops is recommended if serious problems are found, to agree and to update the criteria used among countries. With this aim, an expert group met in 1996 to agree common criteria in the ageing process of horse mackerel. This was the actual origin of the activities which led to the creation of the ICES WKARHOM (Workshop on Age reading of Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*Trachurus trachurus*, *T. mediterraneus* and *T. picturatus*) in 2012 (Table 1.1). Based on the results of last otolith exchange and the workshop in 2022, the Working Group on Biological Parameters (WGBIOP) identified the need for another exchange and age reading workshop on *Trachurus* species (ICES, 2025).

Table 1.1 Summary of the otolith exchanges and workshops on *Trachurus* species in the ICES framework.

Year	Exchange/ Workshop	Species	References
1996 1999	Exchange Workshop	*T. trachurus*	-Report of the horse mackerel otolith workshop (ICES, 1999)
2006	Both	*T. trachurus*	-Report of the Horse Mackerel Exchange and Workshop 2006 (Bolle et al., 2011)
2012	Both	*T. trachurus* *T. mediterraneus* *T. picturatus*	-Report of the WKARHOM1 (ICES, 2016)
2015	Both	*T. trachurus* *T. mediterraneus* *T. picturatus*	-Report of the Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel Otolith Exchange 2015 (Mahé et al., 2015) -Report of the WKARHOM2 (ICES, 2015)
2018	Both	*T. trachurus* *T. mediterraneus* *T. picturatus*	-Report of the WKARHOM3 (ICES, 2018)
2022	Both	*T. trachurus* *T. mediterraneus* *T. picturatus*	-Report of the 2021-22 *Trachurus* species (*T. trachurus*, *T. mediterraneus* and *T. picturatus*) age reading exchange (Massaro and Jurado-Ruzafa, 2022) -Report of the WKARHOM4 (ICES, 2023)

WKARHOM 4's participants agreed to convene a new full otolith Exchange in 2025, for the three species. The overall otolith Exchange has been organized during 2025, and included 24 readers from 8 countries (Germany, Greece, Ireland, Italy, Netherlands, Norway, Spain and Portugal, including samples from the Atlantic Archipelago of Azores) interested on evaluating their ageing criteria and to inter-calibrate them with other laboratories/countries involved in ageing procedures along the geographical distribution of these species, both in the Atlantic Ocean and the Mediterranean Sea (Annex 1).

Readers were instructed to follow the WKARHOM4 schemes and protocols when completing the current otolith exchange annotations in SmartDots. Precision measures were analysed by species to evaluate the necessity of a 5th WKARHOM meeting.

2 Methods

All the laboratories participating in the Exchange contributed to the exchange with otolith pictures from their areas, following general instructions provided by the coordinators. Reading were carried out without information about individual length and readings were performed marking all the annual translucent rings and in addiction edge type (Opaque / Translucent) was annotated.

The statistical analysis was carried out follows traditional methods where the level of accuracy compared to modal age was indicated by percentage agreement (PA) and bias tests, plots and the level of precision (i.e. the reproducibility of age estimates) was indicated by the coefficient of variation (CV). The tables and plots presented are from the Guus Eltink Excel sheet 'Age Reading Comparisons' (Eltink, 2000; Eltink et al., 2000). Additional analyses as average percentage error (APE) and age error matrices (AEM's) were included; average percentage error (APE) and age error matrices (AEM's).

Modal age: a multistage approach to define the modal age by sampled fish

In this event, the multistage approach to calculate the modal age has been used. When summarizing the output and reporting the results of the exchange events developed within the SmarDots framework, the modal age (the most common age decided by the age readers for every fish sample) is the most relevant measurement. It is a key statistic by itself, but it is also fundamental for the estimation of some other relevant statistics to assess the performance of the techniques assessed in the exchange event, like the Percentage Agreement (PA), or input for stock assessments like the Age Error Matrix (AEM) (see below). However, the standard approach of calculating the mode (each reader has the same weight=1) the mode is taken as the lowest age of the multiple modal ages. This way renders multiple cases (fish samples) with multiple modal ages (i.e. different ages got the same highest number of readers). Accordingly, this imply a wrong perception of the age by fish individual and introduction of bias in the calculation of the PA and AEM. As a solution, in this report a multistage approach to select the modal age is used. This multistage approach is based in the different weight given to the age readers according to their experience. Two different weight scores scales were assigned, a weight score decreasing linearly with the experience and another decreasing with a negative exponential shape. The modal age by fish individual is decided following the next approach:

1. If there is a single mode estimated with the standard approach (equal weight for all readers) this value is used as the modal age, if not

2. Adding up, for each age category, the score assigned with the linear weighting for all the readers that decided that age for that fish. Next, the modal age is selected as the age category that obtains the highest score sum. If, despite this approach, there were still multiple ages with the same score (and hence multiple modes), the next step is applied:

3. Adding up, for each age category, the score assigned with the negative exponential weighting for all the readers that decided that age for that fish. Select as the modal age the age with the highest score sum.

During the WGBIOP 2019 (ICES, 2020) meeting it was found that the combination of the modes decided using these three methods (so called 'multistage approach'), allows assigning a single modal age to each fish individual.

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 PA 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 CVs (per modal age and reader) 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 tables, are 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 and 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 (ICES, 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.

3 Results

Results are presented separately for each species and otolith preparation. Table 3.1 summarizes the most general results by species.

Table 3.1: Overall summary of statistics for the total of the samples and species: Number of otoliths (N), Percentage of Agreement (PA, %), Coefficient of Variation (CV, %) and Average Percentage Error (APE, %).

		All readers			Advanced readers		
Species - preparation	**N**	**CV**	**PA**	**APE**	**CV**	**PA**	**APE**
Trachurus trachurus-whole	167	51	54	32	41	56	26
Trachurus trachurus-sliced	54	21	48	14	18	55	11
Trachurus mediterraneuss-whole	103	42	55	31	-	-	-
Trachurus picturatuss-whole	81	39	50	29	-	-	-

3.1 Overview of samples and readers

Table 3.2: Overview of samples used for the otolith exchange of *Trachurus* species.

Species	Event ID	Otolith preparation	Year	ICES/GSA area	Quarter	Number of samples	Modal age range (years)	Length range (mm)
Trachurus trachurus	2926	Whole	2005	8	4	26	3-5	215-225
			2016	11.1	1	1	1	140
			2016	11.1	3	2	1	105-115
			2020	11.1	1	8	1-3	135-220
			2020	11.1	3	1	4	270
			2021	11.1	4	1	2	140
			2021	27.8.c	3	1	3	255
			2021	27.8.c	4	5	2-5	195-260
			2022	27.8.c	1	12	1-5	145-260
			2022	27.8.c	2	2	3-4	225-255
			2022	27.8.c	3	1	3	210
			2022	27.8.c	4	3	0-3	125-205
			2023	11.1	4	2	2	155-170
			2023	27.4.a	1	5	5-9	335-380
			2024	20	2	15	0-7	65-330
			2024	20	3	12	0-5	65-245
			2024	20	4	3	6-7	275-305
			2024	27.4.a	1	8	3-8	300-375
			2024	27.4.a	3	6	5-8	325-360
			2024	27.6.a	1	5	3-9	250-325
			2024	27.8.c	2	1	4	255
			2024	27.8.c	3	5	2-3	210-265
			2024	27.9.a	1	2	4-6	255-260
			2024	27.9.a	2	13	1-4	145-245
			2024	27.9.a	3	15	0-4	110-275
			2025	11.1	1	2	1	170-180
			2025	11.1	2	10	1-3	165-260
		Sliced	2023	27.4.a	1	5	4-15	335-380
			2023	27.6.a	1	15	5-15	260-360
			2023	27.6.a	4	15	4-12	280-340
			2024	27.4.a	1	8	4-14	300-375
			2024	27.4.a	3	6	8-12	325-360
			2024	27.6.a	1	5	4-10	250-325
Trachurus mediterraneus	2927	Whole	2014	6.0	2	15	0-2	60-215
			2014	6.0	3	14	1-4	115-340
			2015	1.0	3	15	0-3	75-250
			2015	11.1	3	5	1-2	145-240
			2015	11.1	4	2	0-1	110-135
			2016	11.1	1	2	1-3	140-160
			2019	11.1	1	1	3	280
			2020	11.1	3	5	0-5	155-185
			2024	20.0	2	15	2-7	140-400
			2024	20.0	3	15	0-8	65-385
			2025	11.1	1	14	2-4	195-265
Trachurus picturatus	2928	Whole	2015	9	2	2	0	80-95
			2016	9	2	12	1-3	165-300
			2016	9	3	13	0-5	85-410
			2018	9	4	12	2-6	330-425
			2020	9	4	10	3-7	365-425
			2021	9	3	2	3	380-455
			2022	27.10.a.2	3	15	2-6	35-430
			2023	27.10.a.2	1	15	2-6	375-450

Table 3.2: Reader overview for the otolith exchange of *Trachurus* species.

Species	Event ID	Otolith preparation	Reader code	Expertise
Trachurus trachurus	2926	Whole	R04 NO	Advanced
			R06 ES	Advanced
			R08 PT	Advanced
			R10 DE	Advanced
			R12 NL	Advanced
			R14 ES	Advanced
			R16 IT	Advanced
			R18 NL	Advanced
			R20 NO	Advanced
			R22 IE	Advanced
			R24 ES	Advanced
			R28 ES	Basic
			R30 IT	Basic
			R32 IT	Basic
			R38 IT	Basic
			R40 GR	Basic
			R42 ES	Basic
			R44 ES	Basic
			R46 DE	Basic
			R48 GR	Basic
			R56 IT	Basic
			R58 ES	Basic
		Sliced	R04 NO	Advanced
			R06 ES	Advanced
			R08 PT	Advanced
			R10 DE	Advanced
			R12 NL	Advanced
			R14 ES	Advanced
			R16 IT	Advanced
			R18 NL	Advanced
			R20 NO	Advanced
			R22 IE	Advanced
			R24 ES	Advanced
			R28 ES	Basic
			R30 IT	Basic
			R32 IT	Basic
			R38 IT	Basic
			R40 GR	Basic
			R44 ES	Basic
			R46 DE	Basic
			R48 GR	Basic
			R50 IE	Basic
			R56 IT	Basic
Trachurus mediterraneus	2927	Whole	R04 IT	Advanced
			R08 IT	Basic
			R10 IT	Basic
			R16 NO	Basic
			R18 ES	Basic
			R20 PT	Basic
			R22 IT	Basic
			R26 NL	Basic
			R28 GR	Basic
			R30 ES	Basic
			R38 ES	Basic
			R42 GR	Basic
			R50 IT	Basic
			R54 ES	Basic
			R58 ES	Basic

Table 3.3 (Cont.): Reader overview for the otolith exchange of *Trachurus* species.

Species	Event ID	Otolith preparation	Reader code	Expertise
Trachurus picturatus	2928	Whole	R08 IT	Basic
			R10 IT	Basic
			R12 PT	Basic
			R16 NO	Basic
			R18 ES	Basic
			R20 PT	Basic
			R22 IT	Basic
			R26 NL	Basic
			R28 GR	Basic
			R30 ES	Basic
			R34 IT	Basic
			R38 NO	Basic
			R42 ES	Basic
			R46 GR	Basic
			R54 IT	Basic
			R58 ES	Basic

3.2 *Trachurus trachurus* (Event-ID 2926)

3.2.1 Whole otoliths

3.2.1.1 All readers

All samples included

A total of 167 whole otolith image samples were provided by participants of the exchange, from the north Atlantic (ICES areas: 27.4.a, 27.6.a, 27.8.c, 27.9.a) and Mediterranean Sea (GSAs: 8, 11.1, 20) (Table 3.2). The results of the readings showed low precision, with percent agreement (PA) of 54% for all readers, a coefficient variation (CV) of 51% (all readers), and an average percent error (APE) of 32%. An AQ3 score was assigned to 3.25% of the annotations (both whole and sliced otoliths, 221 total images).

Multimodal cases

Table 3.4: Total number of samples (NSample) and percentage of cases (fish samples) with multiple modes depending on the approach to weight the experience of the reader which will be considered when defining the fish age mode. PercMM_traditional shows the percentage of the total samples for which multiple modes are obtained when all the readers are equally weighted. PercMM_linear_weight shows the percentage of the total samples for which multiple modes are obtained when the weight assigned to the different readers decreases linearly with the experience, while in the PercMM_negexp the weight applied decreases with a negative exponential shape with the experience. The PercMM_multistage shows the percentage of multiple mode cases when a combination of the different methodologies is used, as explained in the material and methods section

NSample	PercMM_traditional	PercMM_linear_weight	PercMM_negexp_weight	PercMM_multistage
167	7 %	0 %	0 %	0 %

List of multimodal cases

Table 3.5: List of cases for which multiple modes here obtained when all readers are considered. The column NModes_trad shows the number of multiple modes for each SampleID when all readers are given the same expertise weight.

NModes_trad	SampleID
2	274A_2023_38309_007
3	274A_2024_38301_007
2	274A_2024_38301_014
2	274A_2024_38304_011
2	274A_2024_86650_007
2	GSA11TT06
2	GSA11TT12
2	GSA11TT21
2	GSA11TT22
2	HOM_9aN_20240523_N048
2	HOM_9aN_DEM24_L006_N031
2	HOM_9aN_DEM24_L006_N033
2	HOM_GSA20_10
3	HOM_GSA20_11
2	HOM_GSA20_24

Summary statistics

Table 3.6: 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
167	51 %	54 %	32 %

In this exchange event, 167 otolith fish individuals were aged. Of those, 7% when the traditional approach (all readers equally weighted) is used to define the mode. When all the otolith samples are considered (both single and multimodal cases) the weighted average percentage agreement based on modal ages for all readers is 54 %, with the weighted average CV of 51 % and APE of 32 %.

Coefficient of Variation (CV)

Table 3.7: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1	59	48	-	55	77	30	45	87	34	30	0	44	36	0	48	59	42	74	54	47	47	67	**95**
2	30	34	43	35	30	44	35	70	28	38	43	50	20	35	23	40	33	35	34	33	27	23	**62**
3	42	37	42	38	32	56	24	50	23	28	38	34	20	33	13	36	31	26	43	16	27	25	**50**
4	19	14	28	23	20	31	8	28	18	17	17	35	10	16	15	12	17	17	24	16	9	8	**36**
5	9	33	41	15	23	45	12	39	35	15	30	41	40	25	10	23	10	14	30	14	21	10	**37**
6	24	6	18	23	24	23	14	22	30	11	17	31	20	22	17	15	13	29	32	18	37	-	**36**
7	41	11	10	22	35	16	21	17	72	27	28	37	14	32	24	8	27	7	21	21	43	11	**35**
8	6	7	12	8	8	22	7	11	40	0	15	24	12	43	21	10	-	10	22	17	43	-	**32**
9	7	8	11	0	8	16	0	8	90	8	13	5	20	33	24	9	-	-	7	0	28	-	**30**
Weighted Mean	**31**	**27**	**33**	**31**	**31**	**40**	**22**	**47**	**28**	**25**	**30**	**39**	**20**	**25**	**21**	**29**	**29**	**31**	**34**	**23**	**26**	**23**	**51**

Percentage of Agreement (PA)

The percentage agreement per reader per modal age tells how large part of the readings that are equal to the modal age. The weighted mean including at the bottom of the table is weighted according to number of age readings.

Table 3.8: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	total
0	100	100	100	90	100	30	100	70	0	80	40	0	50	90	10	90	90	20	70	80	60	100	**67**
1	71	82	35	76	59	88	71	6	47	88	100	0	71	100	41	47	86	82	53	41	59	69	**62**
2	65	65	47	68	68	53	53	26	65	62	55	6	68	65	82	41	71	67	58	65	62	78	**58**
3	42	58	30	58	61	33	58	36	55	52	30	0	64	58	85	52	46	59	44	76	67	75	**51**
4	50	83	40	62	69	57	90	38	49	74	24	0	86	76	60	57	68	66	45	57	93	88	**60**
5	80	80	0	40	10	10	70	56	30	70	50	0	50	78	20	60	60	75	40	0	30	75	**44**
6	29	86	43	0	43	29	57	43	20	57	14	14	43	14	14	43	50	17	29	0	43	100	**33**
7	14	86	57	0	43	71	14	29	20	29	29	14	57	14	0	57	33	75	29	0	14	50	**32**
8	0	60	40	20	20	40	0	20	60	100	0	0	60	0	0	40	-	50	40	0	20	-	**28**
9	50	50	0	100	50	0	0	50	50	50	0	0	0	0	0	0	-	100	50	0	0	-	**26**
Weighted Mean	**54**	**74**	**41**	**58**	**60**	**49**	**65**	**34**	**48**	**66**	**40**	**2**	**67**	**65**	**55**	**52**	**67**	**62**	**48**	**52**	**63**	**80**	**54**

Average Percentage Error (APE)

Table 3.9: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1	35	35	-	35	59	19	33	67	33	19	0	30	32	0	37	47	29	43	44	36	41	50	**58**
2	18	20	35	24	22	29	27	50	20	24	32	44	19	24	14	31	24	25	24	25	22	12	**37**
3	28	28	31	27	18	45	20	41	18	19	31	28	15	22	9	31	25	21	31	9	17	17	**34**
4	15	9	20	15	14	19	3	20	14	8	14	27	4	9	13	11	14	13	18	15	4	5	**21**
5	4	22	33	13	18	32	7	30	30	12	22	28	25	19	8	18	9	10	23	12	16	8	**23**
6	21	4	13	16	17	17	12	18	23	8	13	23	14	18	14	12	9	22	23	13	30	0	**25**
7	30	7	7	17	31	8	17	13	63	19	19	28	8	27	19	7	20	5	16	17	34	8	**24**
8	5	6	9	4	4	15	5	9	28	0	10	16	10	34	16	8	-	6	15	13	30	-	**22**
9	5	6	8	0	6	11	0	6	64	6	9	4	14	23	17	7	-	0	5	0	20	-	**22**
Weighted Mean	**21**	**19**	**26**	**21**	**22**	**29**	**17**	**36**	**22**	**15**	**24**	**31**	**15**	**17**	**16**	**24**	**22**	**22**	**25**	**18**	**19**	**15**	**32**

Relative bias

The relative bias is the difference between the mean age (per modal age per reader) and modal age. As for the previous tables, a combined bias for all readers and weighted means are calculated.

Table 3.10: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	all
0	0.00	0.00	0.00	0.10	0.00	0.70	0.00	0.50	1.10	0.20	0.60	2.10	0.50	0.10	0.90	0.10	0.10	0.80	0.30	0.20	0.40	0.00	**0.40**
1	-0.06	-0.18	-0.29	-0.12	-0.18	0.12	0.18	2.59	0.53	0.12	0.00	4.06	0.29	0.00	0.82	0.59	-0.14	0.35	0.24	0.76	0.53	-0.19	**0.46**
2	0.00	-0.03	-0.21	0.18	-0.15	-0.03	0.24	1.74	0.12	0.09	0.48	4.50	0.32	-0.15	0.15	0.79	0.32	0.30	-0.10	0.32	0.29	0.03	**0.42**
3	0.64	0.85	0.03	0.36	-0.03	0.48	0.45	1.58	-0.15	-0.06	1.76	5.88	0.21	0.18	-0.15	0.94	1.08	0.45	0.59	0.06	0.24	0.39	**0.72**
4	0.43	0.19	-0.31	0.19	-0.26	0.07	0.05	1.21	-0.07	0.00	1.19	5.40	0.00	-0.10	-0.36	0.38	0.47	0.27	0.14	-0.40	0.10	0.12	**0.40**
5	0.00	0.80	-0.50	-0.40	-0.40	0.20	-0.10	1.67	-1.40	-0.40	1.30	4.30	-0.40	-0.56	-0.80	0.90	0.40	0.38	0.30	-1.33	0.00	-0.25	**0.17**
6	2.00	-0.14	-0.14	1.00	0.43	-0.14	-0.57	1.43	-0.40	0.14	1.86	6.57	0.29	-1.57	-1.43	0.43	-0.50	0.67	0.86	-2.14	-1.57	0.00	**0.32**
7	0.14	-0.29	-0.14	0.14	-1.29	0.00	-1.71	1.43	-2.80	-0.57	0.71	4.43	0.00	-2.14	-1.86	-0.43	-1.33	0.25	0.29	-2.43	-2.00	-0.50	**-0.46**
8	1.40	0.40	-0.80	1.00	1.00	0.40	-1.20	0.40	-1.40	0.00	2.40	5.80	-0.60	-3.80	-2.60	0.20	-	0.00	1.40	-3.20	-3.20	-	**-**
9	0.50	-0.50	-2.50	0.00	-0.50	0.00	-3.00	-0.50	-3.50	-0.50	2.00	4.50	-2.00	-2.50	-3.00	-1.50	-	0.00	0.50	-4.00	-4.00	-	**-**
Weighted Mean	**0.37**	**0.23**	**-0.24**	**0.20**	**-0.16**	**0.18**	**-0.01**	**1.49**	**-0.17**	**-0.02**	**1.07**	**4.92**	**0.11**	**-0.35**	**-0.25**	0.55	**0.38**	**0.37**	**0.29**	**-0.34**	**-0.08**	**0.08**	**0.42**

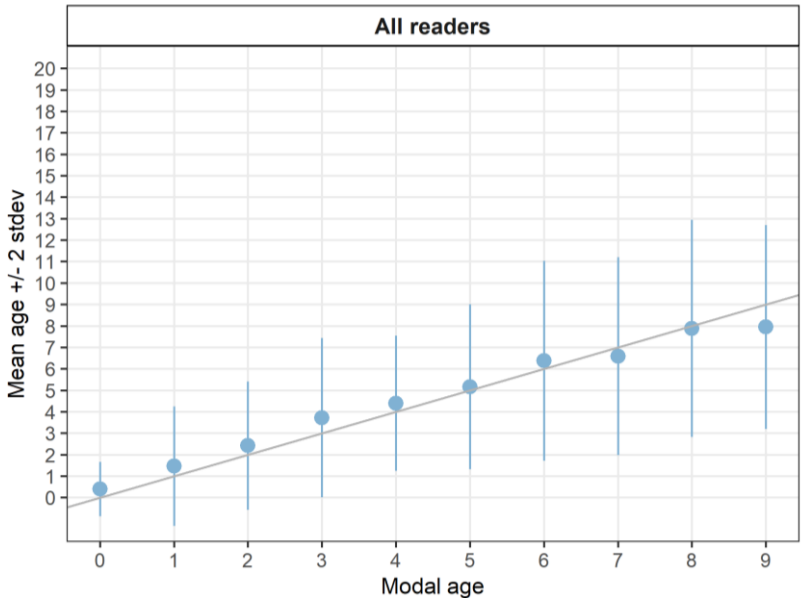

Figure 3.1: Age bias plot for all readers. Mean age recorded ± 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Inter-reader bias test

Table 3.11: Inter reader bias test. The Inter-reader bias test gives probability of bias between readers and with modal age. - = no sign of bias (p>0.05), * = possibility of bias (0.01<p<0.05), * * = certainty of bias (p<0.01), / = diagonal of the table (no bias)

Comparison	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES
R04 NO	/	**	*	*	**	**	**	**	**	*	**	*	**	-	*	**	-	**	**	-	**	**
R06 ES	**	/	-	**	-	**	**	**	**	**	**	*	**	**	*	**	-	*	**	-	**	**
R08 PT	*	-	/	-	**	-	**	**	-	**	**	*	-	**	**	**	*	*	-	**	-	-
R10 DE	*	**	-	/	-	**	**	**	*	**	**	*	**	-	*	*	*	-	**	**	**	**
R12 NL	**	-	**	-	/	**	-	**	**	**	**	*	-	**	**	**	**	**	**	**	-	-
R14 ES	**	**	-	**	**	/	**	**	**	**	**	*	**	**	**	*	**	-	**	**	**	**
R16 IT	**	**	**	**	-	**	/	**	*	**	**	*	**	-	**	**	-	-	**	**	**	**
R18 NL	**	**	**	**	**	**	**	/	**	**	**	**	**	**	**	**	**	**	**	**	**	**
R20 NO	**	**	-	*	**	**	*	**	/	**	**	*	*	**	**	-	**	**	**	**	**	**
R22 IE	*	**	**	**	**	**	**	**	**	/	**	*	**	**	**	-	-	-	**	**	**	**
R24 ES	**	**	**	**	**	**	**	**	**	**	/	*	**	**	**	-	-	-	**	**	**	**
R28 ES	*	*	*	*	*	*	*	**	*	*	*	/	*	*	*	*	**	*	*	*	*	*
R30 IT	**	**	-	**	-	**	**	**	*	**	**	*	/	-	-	*	**	**	**	-	**	**
R32 IT	-	**	**	-	**	**	-	**	**	**	**	*	-	/	**	**	-	*	-	*	-	**
R38 IT	*	*	**	*	**	**	**	**	**	**	**	*	-	**	/	**	-	-	*	**	**	**
R40 GR	**	**	**	*	**	*	**	**	-	-	-	*	*	**	**	/	**	**	**	**	-	-
R42 ES	-	-	*	*	**	**	-	**	**	-	-	**	**	-	-	**	/	**	**	-	**	-
R44 ES	**	*	*	-	**	-	-	**	**	-	-	*	**	*	-	**	**	/	**	-	**	-
R46 DE	**	**	-	**	**	**	**	**	**	**	**	*	**	-	*	**	**	**	/	-	**	**
R48 GR	-	-	**	**	**	**	**	**	**	**	**	*	-	*	**	**	-	-	-	/	*	**
R56 IT	**	**	-	**	-	**	**	**	**	**	**	*	**	-	**	-	**	**	**	*	/	-
R58 ES	**	**	-	**	-	**	**	**	**	**	**	*	**	**	**	-	-	-	**	**	-	/
Modal age	-	-	-	**	**	**	**	**	*	**	**	*	-	-	**	**	*	*	**	**	**	**

Growth analysis

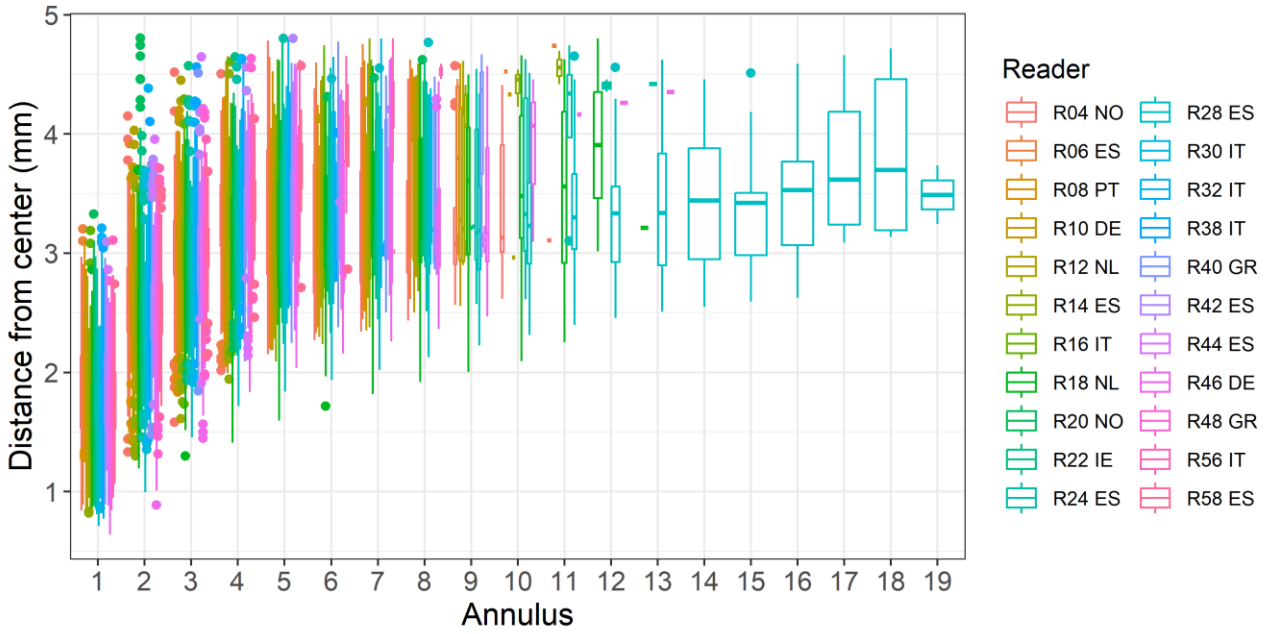

Figure 3.2: Plot of average distance from the centre to the winter rings for all readers. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

3.2.1.2 Advanced readers

Multimodal cases

Table 3.12: Summary of statistics; Total number of samples (NSample), a percentage of cases (fish samples) with multiple modes depending on the approach to weight the experience of the reader which will be considered when defining the fish age mode. PercMM_traditional shows the percentage of the total samples for which multiple modes are obtained when all the readers are equally weighted. PercMM_linear_weight shows the percentage of the total samples for which multiple modes are obtained when the weight assigned to the different readers decreases linearly with the experience, while in the PercMM_negexp the weight applied decreases with a negative exponential shape with the experience. The PercMM_multistage shows the percentage of multiple mode cases when a combination of the different methodologies is used, as explained in the material and methods section

NSample	PercMM_traditional	PercMM_linear_weight	PercMM_negexp_weight	PercMM_multistage
167	9 %	1 %	0 %	0 %

Summary statistics

Table 3.13: 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
167	41 %	56 %	26 %

In this exchange event, 167 otolith fish individuals were aged. Of those, 9 %when the traditional approach (all readers equally weighted) is used to define the modeWhen all the otolith samples are considered (both single and multimodal cases) the weighted average percentage agreement based on modal ages for all readers is 56 %, with the weighted average CV of 41 % and APE of 26 %.

Table 3.14: Number of age readings per modal age for all advanced readers combined.

Modal age	total
0	**143**
1	**198**
2	**352**
3	**318**
4	**429**
5	**99**
6	**117**
7	**76**
8	**44**
9	**54**
Total	**1830**

Coefficient of Variation (CV)

Table 3.15: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	**-**
1	33	22	85	36	52	29	36	70	33	29	35	**90**
2	23	31	38	36	28	39	35	65	23	24	43	**50**
3	28	34	39	34	20	55	24	52	24	24	33	**41**
4	11	12	20	14	16	25	9	34	18	15	17	**23**
5	10	35	40	12	24	48	10	28	33	16	31	**31**
6	21	14	15	22	23	20	18	26	38	19	19	**25**
7	46	12	8	28	34	15	24	19	63	27	32	**33**
8	9	10	13	11	12	27	15	10	69	0	22	**24**
9	6	10	8	5	10	10	9	11	48	9	11	**19**
Weighted Mean	**21**	**23**	**35**	**26**	**25**	**36**	**22**	**45**	**28**	**21**	**32**	**41**

Percentage of Agreement (PA)

Table 3.16: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	total
0	100	100	100	92	100	23	85	69	0	62	31	**69**
1	83	94	50	72	67	89	61	6	44	89	78	**67**
2	78	62	53	62	72	62	47	22	66	72	47	**59**
3	62	48	34	69	66	34	59	38	52	62	32	**51**
4	62	85	38	72	72	62	87	44	51	79	23	**61**
5	78	89	0	56	11	11	78	56	44	67	44	**48**
6	36	64	55	18	55	36	27	30	12	36	27	**37**
7	14	71	71	14	43	71	14	14	33	14	29	**36**
8	25	50	50	50	25	25	0	50	50	100	25	**41**
9	60	40	0	80	40	40	0	60	25	20	20	**35**
Weighted Mean	**66**	**72**	**46**	**64**	**65**	**51**	**59**	**36**	**46**	**67**	**37**	**56**

Average Percentage Error (APE)

Table 3.17: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	**-**
1	24	10	67	31	36	18	34	54	32	18	28	**51**
2	12	22	25	26	18	25	29	46	20	17	33	**32**
3	20	26	29	18	16	41	20	40	20	17	28	**29**
4	11	5	17	9	13	15	4	24	13	6	13	**15**
5	4	21	22	11	19	31	4	19	27	13	21	**18**
6	17	8	9	16	15	16	15	21	29	15	15	**19**
7	36	9	4	23	31	13	20	15	57	18	24	**25**
8	6	6	10	9	9	19	12	6	60	0	15	**15**
9	5	8	7	4	7	7	8	9	35	5	7	**14**
Weighted Mean	**15**	**15**	**25**	**18**	**18**	**25**	**18**	**33**	**22**	**13**	**26**	**26**

Relative Bias

Table 3.18: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	all
0	0.00	0.00	0.00	0.08	0.00	0.77	0.15	0.54	1.08	0.38	0.69	**0.34**
1	0.17	0.06	-0.17	0.28	0.11	0.11	0.39	3.22	0.56	0.11	0.22	**0.46**
2	0.03	0.16	0.00	0.22	-0.09	0.09	0.38	1.97	0.28	0.16	0.59	**0.34**
3	0.38	0.76	0.03	0.07	-0.21	0.31	0.41	1.38	-0.21	-0.14	1.64	**0.40**
4	0.38	0.03	-0.64	0.15	-0.33	-0.13	0.03	1.05	-0.03	0.00	1.15	**0.15**
5	0.00	0.67	-1.00	-0.44	-0.33	0.00	0.00	1.00	-1.11	-0.44	1.33	**-0.03**
6	1.36	-0.09	0.00	0.73	-0.09	0.45	-1.18	0.70	-1.88	-0.45	1.45	**0.09**
7	-0.14	-0.43	0.00	-0.57	-1.86	-0.57	-1.86	2.14	-2.33	-1.14	0.29	**-0.59**
8	1.00	0.00	-0.75	0.75	0.25	0.00	-1.75	0.00	-3.00	0.00	2.00	**-0.14**
9	0.40	-0.80	-2.40	-0.20	-0.20	-0.20	-2.60	-0.60	-2.50	-1.00	1.20	**-0.81**
Weighted Mean	**0.30**	**0.16**	**-0.31**	**0.14**	**-0.22**	**0.11**	**-0.07**	**1.43**	**-0.22**	**-0.08**	**1.01**	**0.20**

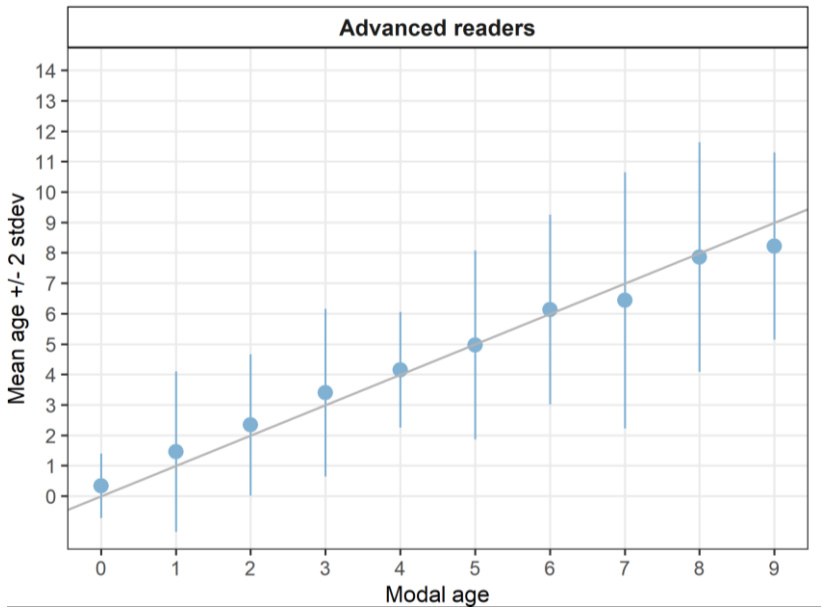

Figure 3.3: Age bias plot for advanced readers. Mean age recorded ± 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Growth analysis

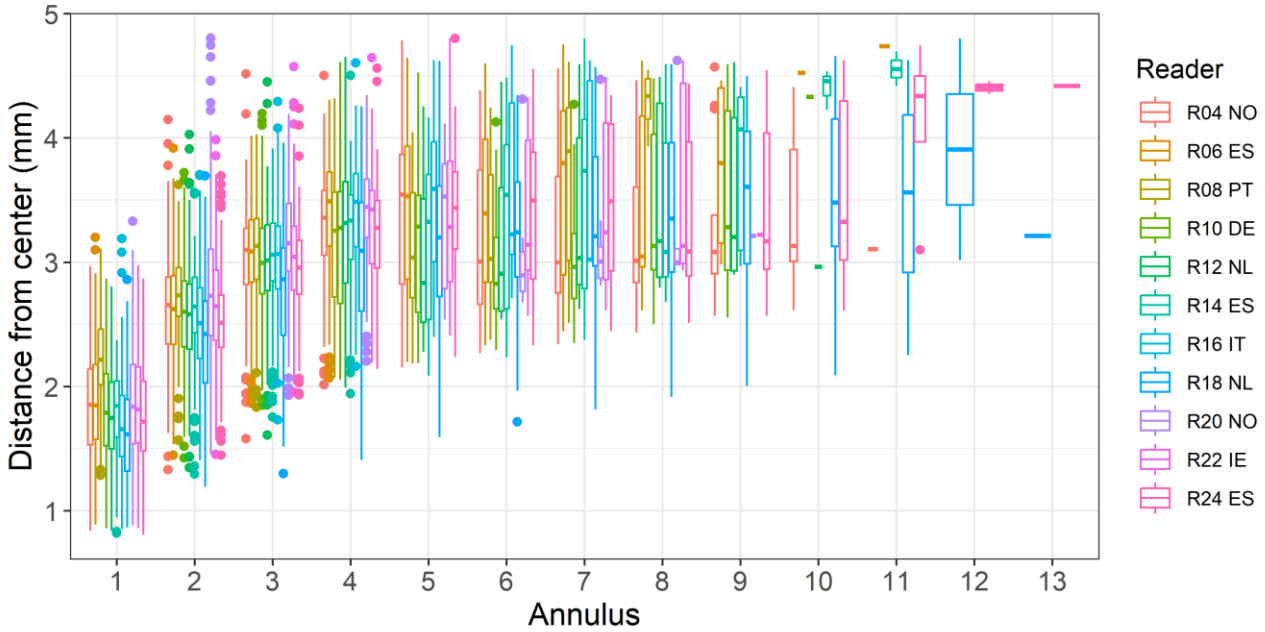

Figure 3.4: Plot of average distance from the centre to the winter rings for advanced readers. The boxes represent the mean, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

General Age Error Matrix (AEM)

Table 3.19: 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	5	6	7	8	9	10	11	12	13	Total
0	0.69	0.28	0.03	-	-	-	-	-	-	-	-	-	-	-	1.00
1	0.05	0.67	0.23	0.01	0.02	0.02	-	0.01	0.01	0.01	-	0.01	-	-	1.04
2	0.01	0.12	0.59	0.20	0.05	0.01	0.01	0.00	0.01	-	-	-	-	0.00	1.00
3	0.01	0.01	0.19	0.51	0.13	0.08	0.03	0.03	0.01	0.01	-	-	-	-	1.01
4	0.00	-	0.02	0.14	0.61	0.16	0.04	0.02	0.00	-	-	0.00	-	-	0.99
5	-	-	0.02	0.07	0.25	0.48	0.08	0.04	0.01	-	0.01	0.03	-	-	0.99
6	-	-	-	0.03	0.12	0.14	0.37	0.20	0.06	0.04	0.04	-	-	-	1.00
7	-	-	0.05	0.03	0.12	0.11	0.11	0.36	0.13	0.04	0.01	0.04	0.01	-	1.01
8	-	-	0.05	-	-	0.02	0.07	0.16	0.41	0.18	0.07	0.02	-	0.02	1.00
9	-	-	0.02	-	-	-	0.09	0.17	0.22	0.35	0.13	-	0.02	-	1.00

AEM by ICES area

Table 3.20: Age error matrix (AEM) by ICES/GSA area.

ICES/GSA area	modal_age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
11.1	0	0.55	0.45	-	-	-	-	-	-	-	-	-	-	-	-	1.00
11.1	1	0.06	0.61	0.28	-	-	0.01	-	0.01	0.01	0.01	-	-	-	-	0.99
11.1	2	-	0.17	0.54	0.21	0.07	0.01	-	-	-	-	-	-	-	-	1.00
11.1	3	0.04	0.04	0.26	0.52	0.06	0.07	-	0.02	-	-	-	-	-	-	1.01
11.1	4	0.05	-	-	0.23	0.59	0.14	-	-	-	-	-	-	-	-	1.01
20	0	0.74	0.25	0.01	-	-	-	-	-	-	-	-	-	-	-	1.00
20	1	0.09	0.77	0.09	-	-	-	-	-	-	-	-	0.05	-	-	1.00
20	2	0.04	0.20	0.62	0.09	0.04	-	-	-	-	-	-	-	-	0.02	1.01
20	3	-	-	0.07	0.39	0.11	0.14	0.11	0.11	0.05	0.02	-	-	-	-	1.00
20	4	-	-	0.06	0.12	0.48	0.12	0.12	0.09	-	-	-	-	-	-	0.99
20	5	-	-	0.09	-	0.36	0.45	0.09	-	-	-	-	-	-	-	0.99
20	6	-	-	-	-	0.20	0.20	0.35	0.20	-	0.05	-	-	-	-	1.00
20	7	-	-	0.09	0.05	0.21	0.14	0.05	0.33	0.07	0.02	-	0.02	0.02	-	1.00
27.4.a	3	-	-	0.09	0.27	0.18	0.18	0.09	0.18	-	-	-	-	-	-	0.99
27.4.a	5	-	-	0.09	-	-	0.27	0.09	0.09	0.09	-	0.09	0.27	-	-	0.99
27.4.a	6	-	-	-	0.04	0.11	0.12	0.36	0.19	0.07	0.05	0.07	-	-	-	1.01
27.4.a	7	-	-	-	-	-	0.06	0.18	0.39	0.21	0.06	0.03	0.06	-	-	0.99
27.4.a	8	-	-	0.05	-	-	0.02	0.07	0.16	0.41	0.18	0.07	0.02	-	0.02	1.00
27.4.a	9	-	-	0.03	-	-	-	0.03	0.18	0.21	0.33	0.18	-	0.03	-	0.99
27.6.a	3	-	-	0.09	0.55	0.09	0.18	-	-	0.09	-	-	-	-	-	1.00
27.6.a	6	-	-	-	0.05	0.09	0.14	0.41	0.23	0.09	-	-	-	-	-	1.01
27.6.a	9	-	-	-	-	-	-	0.19	0.14	0.24	0.38	0.05	-	-	-	1.00
27.8.c	0	0.64	0.18	0.18	-	-	-	-	-	-	-	-	-	-	-	1.00
27.8.c	1	0.09	0.64	0.27	-	-	-	-	-	-	-	-	-	-	-	1.00
27.8.c	2	-	0.08	0.69	0.19	0.01	0.02	0.01	-	-	-	-	-	-	-	1.00
27.8.c	3	-	-	0.17	0.61	0.14	0.05	0.02	0.02	0.02	-	-	-	-	-	1.03
27.8.c	4	-	-	0.03	0.22	0.62	0.08	0.04	0.02	-	-	-	-	-	-	1.01
27.8.c	5	-	-	-	0.12	0.27	0.58	-	0.03	-	-	-	-	-	-	1.00
27.9.a	0	0.64	0.27	0.09	-	-	-	-	-	-	-	-	-	-	-	1.00
27.9.a	1	0.01	0.70	0.21	0.01	0.04	0.03	-	-	-	-	-	-	-	-	1.00
27.9.a	2	-	0.03	0.51	0.28	0.09	0.01	0.03	0.01	0.02	-	-	-	-	-	0.98
27.9.a	3	-	-	0.19	0.52	0.19	0.06	0.02	0.01	-	0.01	-	-	-	-	1.00
27.9.a	4	-	-	0.06	0.21	0.61	0.12	-	-	-	-	-	-	-	-	1.00
27.9.a	5	-	-	-	-	0.18	0.45	0.36	-	-	-	-	-	-	-	0.99
8	3	-	-	0.36	0.45	0.05	0.09	0.05	-	-	-	-	-	-	-	1.00
8	4	-	-	0.00	0.08	0.63	0.21	0.05	0.02	0	-	-	0	-	-	0.99
8	5	-	-	-	0.09	0.30	0.48	0.06	0.06	-	-	-	-	-	-	0.99

3.2.2 Sliced otoliths

3.2.2.1 All readers

All samples included

A total of 54 sectioned otolith image samples were provided by participants of the exchange, from the north Atlantic ICES areas: 27.4.a and 27.6.a (Table 3.2). The results of the readings showed low precision, with percent agreement (PA) of 48% for all readers, a coefficient variation (CV) of 21% (all readers), and an average percent error (APE) of 14%.

Multimodal cases

Table 3.20: Total number of samples (NSample) and percentage of cases (fish samples) with multiple modes depending on the approach to weight the experience of the reader which will be considered when defining the fish age mode. PercMM_traditional shows the percentage of the total samples for which multiple modes are obtained when all the readers are equally weighted. PercMM_linear_weight shows the percentage of the total samples for which multiple modes are obtained when the weight assigned to the different readers decreases linearly with the experience, while in the PercMM_negexp the weight applied decreases with a negative exponential shape with the experience. The PercMM_multistage shows the percentage of multiple mode cases when a combination of the different methodologies is used, as explained in the material and methods section

NSample	PercMM_traditional	PercMM_linear_weight	PercMM_negexp_weight	PercMM_multistage
54	2 %	2 %	0 %	0 %

List of multimodal cases

Table 3.21: List of cases for which multiple modes where obtained when all readers are considered. The column NModes_trad shows the number of multiple modes for each SampleID when all readers are given the same expertise weight.

NModes_trad	SampleID
2	274A_38304_025slice
2	274A_38309_015slice
2	274A_86650_002slice
2	274A_86650_003slice

Summary statistics

Table 3.22: 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
54	21 %	48 %	14 %

In this exchange event, 54 otolith fish individuals were aged. Of those, 2 %when the traditional approach (all readers equally weighted) is used to define the mode. When all the otolith samples are considered (both single and multimodal cases) the weighted average percentage agreement based on modal ages for all readers is 48 %, with the weighted average CV of 21 % and APE of 14 %.

Coefficient of Variation (CV)

Table 3.23: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	all
4	0	17	46	11	29	18	16	29	12	29	43	45	0	18	12	11	20	20	13	18	0	**35**
5	9	10	26	10	10	16	12	0	10	0	12	7	9	10	14	9	16	9	13	0	9	**17**
6	6	19	17	9	12	6	11	9	8	6	13	24	0	13	19	8	18	12	9	13	0	**19**
7	10	6	17	9	6	7	20	17	6	14	11	53	14	17	7	9	12	6	14	0	8	**22**
8	12	11	12	15	10	7	10	12	20	12	6	28	7	14	22	6	0	10	23	12	7	**22**
9	8	5	10	5	0	6	20	6	7	4	9	23	8	11	13	8	14	6	10	9	13	**18**
10	3	5	12	3	5	13	19	8	7	3	7	15	11	5	15	6	5	5	10	10	4	**18**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**24**
12	6	11	7	0	11	30	13	6	11	0	6	5	0	13	6	20	11	0	24	0	12	**20**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	10	9	12	5	0	5	20	10	9	5	9	11	5	11	10	11	14	10	11	5	5	**20**
15	0	0	5	4	4	11	14	11	0	4	4	6	4	11	31	14	-	4	11	20	31	**21**
Weighted Mean	**6**	**9**	**17**	**7**	**8**	**10**	**16**	**10**	**9**	**8**	**12**	**24**	**7**	**12**	**15**	**9**	**12**	**9**	**13**	**9**	**8**	**21**

Percentage of Agreement (PA)

The percentage agreement per reader per modal age tells how large part of the readings that are equal to the modal age. The weighted mean including at the bottom of the table is weighted according to number of age readings.

Table 3.24: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	total
4	100	40	40	80	80	60	40	80	40	80	40	20	100	60	60	80	0	80	75	60	100	**63**
5	80	60	20	60	60	40	0	100	60	100	20	0	80	60	60	80	60	80	33	100	80	**59**
6	88	38	38	75	75	88	0	75	50	88	25	25	100	75	62	75	25	38	25	50	100	**58**
7	60	80	40	40	80	80	0	40	80	20	40	20	20	40	80	40	33	80	0	100	60	**50**
8	80	40	60	20	60	40	0	60	0	20	40	20	60	40	40	80	0	40	0	40	60	**38**
9	80	80	60	80	100	60	0	70	30	90	20	20	20	30	20	10	33	70	0	40	25	**45**
10	88	62	25	88	75	25	0	38	25	88	12	12	62	25	25	50	38	75	0	50	88	**45**
11	100	0	0	0	0	0	0	0	0	100	0	0	100	0	100	0	100	0	0	0	0	**24**
12	50	50	0	100	50	0	0	50	50	100	50	0	0	50	50	50	50	100	0	0	0	**38**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	0	50	0	50	100	50	0	0	50	50	50	0	50	50	0	50	50	0	0	0	50	**31**
15	100	100	0	67	67	33	0	33	0	67	33	33	0	33	33	0	100	33	0	0	0	**33**
Weighted Mean	**80**	**59**	**35**	**67**	**76**	**52**	**4**	**59**	**37**	**74**	**28**	**17**	**56**	**44**	**44**	**50**	**33**	**61**	**12**	**50**	**63**	**48**

Average Percentage Error (APE)

Table 3.25: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	all
4	0	13	39	8	21	10	14	**21**	10	21	30	32	0	10	11	**8**	15	15	10	10	0	**23**
5	6	9	20	9	9	12	8	**0**	9	0	7	6	7	9	8	**6**	13	6	10	0	7	**13**
6	4	11	13	4	9	4	10	**4**	8	4	7	19	0	10	13	**7**	15	10	7	8	0	**12**
7	6	4	13	8	4	5	15	**13**	4	11	8	37	11	13	5	**8**	8	4	8	0	7	**13**
8	8	9	10	12	8	6	9	**10**	13	9	6	19	6	11	15	**4**	0	8	20	9	6	**14**
9	6	3	9	4	0	6	13	**5**	5	2	6	15	5	7	10	**6**	11	4	6	7	10	**12**
10	2	5	9	2	4	11	16	**7**	5	2	5	11	8	4	11	**5**	4	2	9	7	2	**12**
11	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	**18**
12	4	8	5	0	8	21	9	**4**	8	0	4	4	0	9	4	**14**	8	0	17	0	8	**14**
13	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
14	7	7	8	3	0	4	14	**7**	7	3	7	8	4	8	7	**8**	10	7	8	3	4	**13**
15	0	0	4	3	3	8	10	**8**	0	3	3	4	3	8	24	**10**	0	3	8	15	24	**17**
Weighted Mean	**4**	**7**	**13**	**5**	**6**	**8**	**12**	**7**	**7**	**5**	**8**	**17**	**5**	**8**	**11**	**7**	**9**	**6**	**9**	**6**	**6**	**14**

Relative bias

The relative bias is the difference between the mean age (per modal age per reader) and modal age. As for the previous tables, a combined bias for all readers and weighted means are calculated.

Table 3.26: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	all
4	0.00	0.80	1.40	0.20	0.60	0.00	-0.60	**0.60**	0.60	0.60	1.80	4.40	0.00	0.00	0.40	**0.20**	2.50	0.40	-0.25	0.00	0.00	**0.65**
5	0.20	0.40	1.00	0.40	0.40	0.20	-1.20	**0.00**	0.40	0.00	1.00	2.60	-0.20	0.40	0.00	**0.20**	0.60	0.20	-0.67	0.00	-0.20	**0.27**
6	0.12	1.00	0.25	0.00	0.38	-0.12	-1.38	**0.00**	0.50	0.12	1.00	2.88	0.00	-0.38	0.38	**-0.25**	1.62	0.38	-0.75	0.00	0.00	**0.27**
7	0.00	0.20	-0.40	-0.60	0.20	-0.20	-2.80	**-0.40**	0.20	-0.40	0.80	1.80	-0.40	-1.00	-0.20	**-0.60**	1.00	0.20	-2.00	0.00	-0.40	**-0.24**
8	-0.40	1.00	-0.60	-0.60	0.60	-0.60	-2.60	**-0.60**	0.80	-0.40	0.60	3.80	-0.40	-1.00	0.80	**-0.20**	1.00	0.20	-3.20	-0.80	-0.40	**-0.14**
9	-0.30	0.20	-0.60	-0.20	0.00	-0.40	-3.70	**-0.30**	0.90	-0.10	1.10	2.00	-1.00	-0.90	-0.60	**-1.20**	0.56	0.10	-3.10	-0.20	-1.25	**-0.43**
10	0.12	0.38	-1.25	0.12	0.25	-0.50	-4.50	**-0.12**	1.00	0.12	0.62	2.88	-0.62	-0.75	0.12	**-0.50**	0.62	0.00	-4.62	-0.38	-0.12	**-0.34**
11	0.00	2.00	-1.00	-1.00	3.00	6.00	-4.00	**-2.00**	1.00	0.00	4.00	4.00	0.00	-1.00	0.00	**2.00**	0.00	-2.00	-6.00	-1.00	2.00	**0.29**
12	0.50	1.00	-1.50	0.00	1.00	2.00	-6.50	**-0.50**	1.00	0.00	0.50	1.50	-1.00	-1.00	-0.50	**-1.50**	1.00	0.00	-6.00	1.00	0.00	**-0.43**
13	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	**-**	-	-	-	-	-	**-**
14	0.00	1.00	-2.00	0.50	0.00	-0.50	-7.00	**0.00**	1.00	0.50	1.00	4.50	-0.50	-1.00	0.00	**-1.00**	1.50	0.00	-7.50	1.50	-0.50	**-0.40**
15	0.00	0.00	-2.33	-0.33	0.33	-1.67	-8.00	**-1.33**	1.00	0.33	0.67	1.00	-1.67	-1.67	-4.00	**-4.33**	0.00	-0.67	-8.50	-2.00	-4.67	**-1.80**
Weighted Mean	**-0.02**	**0.57**	**-0.41**	**-0.09**	**0.37**	**-0.15**	**-3.24**	**-0.24**	**0.72**	**0.04**	**1.00**	**2.74**	**-0.52**	**-0.67**	**-0.19**	**-0.67**	**1.02**	**0.09**	**-3.06**	**-0.20**	**-0.56**	**-0.16**

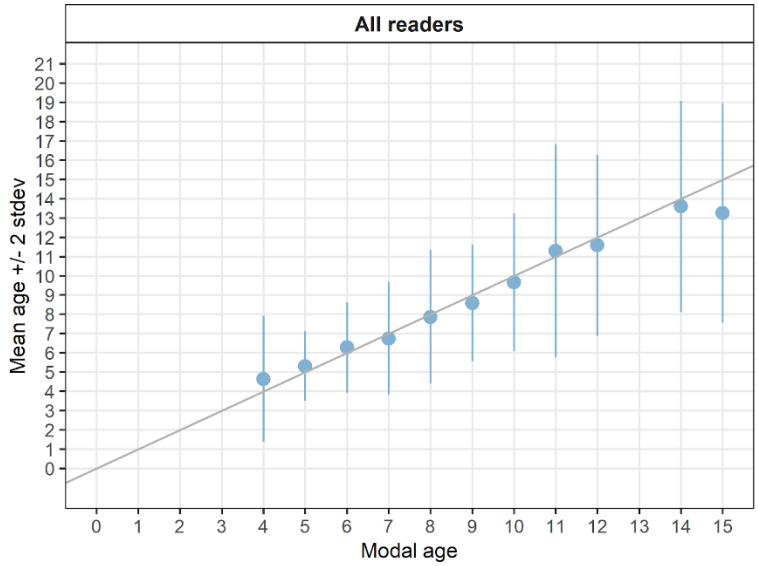

Figure 3.5: Age bias plot for all readers. Mean age recorded ± 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Growth analysis

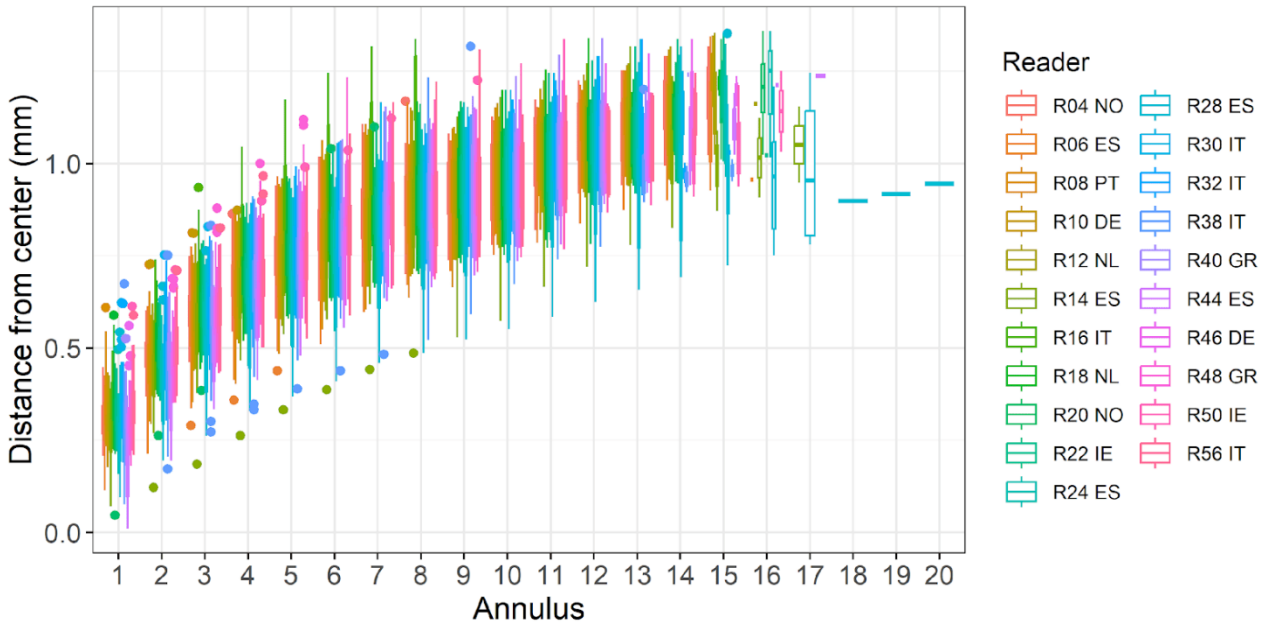

Figure 3.6: Plot of average distance from the centre to the winter rings for all readers. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

Inter-reader bias test

Table 3.27: Inter reader bias test. The Inter-reader bias test gives probability of bias between readers and with modal age. - = no sign of bias (p>0.05), * = possibility of bias (0.01<p<0.05), * * = certainty of bias (p<0.01), / = diagonal of the table (no bias)

Comparison	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT
R04 NO	/	**	-	**	-	-	**	-	**	**	**	**	*	-	**	*	**	**	**	**	*
R06 ES	**	/	**	*	*	**	**	**	-	-	-	**	**	**	*	**	-	-	**	**	**
R08 PT	-	**	/	**	**	**	**	**	**	-	**	**	**	*	*	**	**	-	**	*	**
R10 DE	**	*	**	/	-	*	**	-	**	-	**	**	-	-	**	-	**	**	**	**	-
R12 NL	-	*	**	-	/	**	**	*	-	-	-	**	**	**	-	**	-	**	**	-	**
R14 ES	-	**	**	*	**	/	**	**	**	**	**	**	*	*	*	-	**	-	**	**	-
R16 IT	**	**	**	**	**	**	/	**	**	**	**	**	**	**	**	**	**	**	-	**	**
R18 NL	-	**	**	-	*	**	**	/	**	-	**	**	-	-	*	-	**	-	**	**	*
R20 NO	**	-	**	**	-	**	**	**	/	**	**	**	**	**	**	**	**	-	**	**	**
R22 IE	**	-	-	-	-	**	**	-	**	/	**	**	**	*	**	-	**	**	**	**	-
R24 ES	**	-	**	**	-	**	**	**	**	**	/	**	**	**	**	**	**	**	**	**	**
R28 ES	**	**	**	**	**	**	**	**	**	**	**	/	**	**	**	**	**	**	**	**	**
R30 IT	*	**	**	-	**	*	**	-	**	**	**	**	/	**	-	**	**	**	**	-	*
R32 IT	-	**	*	-	**	*	**	-	**	*	**	**	**	/	-	**	**	-	**	-	**
R38 IT	**	*	*	**	-	*	**	*	**	**	**	**	-	-	/	-	**	-	**	*	-
R40 GR	*	**	**	-	**	-	**	-	**	-	**	**	**	**	-	/	**	**	**	-	**
R44 ES	**	-	**	**	-	**	**	**	**	**	**	**	**	**	**	**	/	**	**	**	**
R46 DE	**	-	-	**	**	-	**	-	-	**	**	**	**	-	-	**	**	/	**	-	-
R48 GR	**	**	**	**	**	**	-	**	**	**	**	**	**	**	**	**	**	**	/	**	**
R50 IE	**	**	*	**	-	**	**	**	**	**	**	**	-	-	*	-	**	-	**	/	-
R56 IT	*	**	**	-	**	-	**	*	**	-	**	**	*	**	-	**	**	-	**	-	/
Modal age	**	**	-	**	**	-	**	-	**	**	**	**	**	**	**	**	**	**	**	**	*

3.2.2.2 Advanced readers

All samples included

A total of 54 sectioned otolith image samples were provided by participants of the exchange, from the north Atlantic ICES areas: 27.4.a and 27.6.a (Table 3.2). The results of the readings showed low precision, with percent agreement (PA) of 55% for advanced, a coefficient variation (CV) of 18%, and an average percent error (APE) of 11%.

Multimodal cases

Table 3.28: Summary of statistics; Total number of samples (NSample), a percentage of cases (fish samples) with multiple modes depending on the approach to weight the experience of the reader which will be considered when defining the fish age mode. PercMM_traditional shows the percentage of the total samples for which multiple modes are obtained when all the readers are equally weighted. PercMM_linear_weight shows the percentage of the total samples for which multiple modes are obtained when the weight assigned to the different readers decreases linearly with the experience, while in the PercMM_negexp the weight applied decreases with a negative exponential shape with the experience. The PercMM_multistage shows the percentage of multiple mode cases when a combination of the different methodologies is used, as explained in the material and methods section

NSample	PercMM_traditional	PercMM_linear_weight	PercMM_negexp_weight	PercMM_multistage
54	7 %	0 %	0 %	0 %

Summary statistics

Table 3.29: 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
54	18 %	55 %	11 %

In this exchange event, 54 otolith fish individuals were aged. Of those, 7 %when the traditional approach (all readers equally weighted) is used to define the mode. When all the otolith samples are considered (both single and multimodal cases) the weighted average percentage agreement based on modal ages for all readers is 55 %, with the weighted average CV of 18 % and APE of 11 %.

Coefficient of Variation (CV)

Table 3.30: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	all
4	0	13	54	12	0	20	16	**0**	13	0	20	**22**
5	0	0	37	11	0	12	16	**0**	11	0	10	**16**
6	8	22	12	7	11	12	12	**15**	10	10	13	**17**
7	20	17	16	17	15	18	22	**12**	25	8	14	**22**
8	0	0	8	8	0	0	11	**8**	7	8	7	**13**
9	8	4	10	5	0	6	19	**6**	8	3	9	**15**
10	3	10	12	0	13	28	17	**8**	8	3	16	**19**
11	-	-	-	-	-	-	-	**-**	-	-	-	**22**
12	-	-	-	-	-	-	-	**-**	-	-	-	**19**
13	-	-	-	-	-	-	-	**-**	-	-	-	**-**
14	0	9	0	11	0	19	0	**6**	0	11	5	**20**
15	0	3	4	3	5	10	13	**10**	0	3	3	**17**
Weighted Mean	**6**	**11**	**15**	**7**	**6**	**14**	**16**	**8**	**10**	**5**	**12**	**18**

Percentage of Agreement (PA)

Table 3.31: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	total
4	100	50	50	75	100	50	50	100	50	100	50	**70**
5	100	100	33	67	100	67	0	100	67	100	33	**70**
6	80	50	50	80	80	80	0	60	60	70	30	**58**
7	43	71	43	43	71	57	0	57	71	57	43	**51**
8	100	100	67	33	100	0	0	67	33	67	33	**55**
9	73	82	55	82	100	55	0	64	36	91	27	**60**
10	88	50	38	100	62	12	0	38	25	88	12	**47**
11	100	0	0	100	0	0	0	0	100	100	100	**45**
12	100	100	0	100	100	0	0	0	100	100	100	**64**
13	-	-	-	-	-	-	-	-	-	-	-	**-**
14	0	50	0	50	100	0	0	0	100	50	50	**36**
15	100	75	0	75	50	25	0	50	0	75	25	**43**
Weighted Mean	**78**	**67**	**41**	**74**	**81**	**44**	**4**	**57**	**48**	**80**	**33**	**55**

Average Percentage Error (APE)

Table 3.32: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	all
4	0	11	40	9	0	12	14	**0**	11	0	16	**13**
5	0	0	27	8	0	10	12	**0**	8	0	8	**8**
6	3	16	9	6	8	6	11	**9**	8	6	9	**10**
7	15	11	11	12	11	13	18	**10**	15	7	11	**15**
8	0	0	6	6	0	0	8	**6**	5	6	5	**10**
9	6	3	8	3	0	6	13	**5**	6	2	5	**10**
10	2	7	8	0	9	19	12	**7**	6	2	9	**11**
11	0	0	0	0	0	0	0	**0**	0	0	0	**15**
12	0	0	0	0	0	0	0	**0**	0	0	0	**12**
13	-	-	-	-	-	-	-	**-**	-	-	-	**-**
14	0	7	0	8	0	13	0	**4**	0	8	4	**14**
15	0	3	3	3	3	7	10	**7**	0	2	2	**12**
Weighted Mean	**4**	**7**	**11**	**5**	**4**	**9**	**12**	**6**	**7**	**4**	**8**	**11**

Relative Bias

Table 3.33: 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	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	all
4	0.00	0.50	1.00	0.25	0.00	0.00	-0.50	0.00	0.50	0.00	0.75	**0.23**
5	0.00	0.00	0.67	0.33	0.00	-0.33	-1.33	0.00	0.33	0.00	0.67	**0.03**
6	0.00	1.10	0.10	-0.20	0.30	0.10	-1.50	-0.10	0.20	-0.10	1.00	**0.08**
7	-0.57	0.29	-0.14	-0.86	0.57	-0.71	-2.86	-0.57	0.29	-0.43	1.00	**-0.36**
8	0.00	0.00	-0.33	-0.67	0.00	-1.00	-2.67	-0.33	0.67	-0.33	0.67	**-0.36**
9	-0.36	0.18	-0.64	-0.18	0.00	-0.45	-3.64	-0.36	0.82	-0.09	1.00	**-0.34**
10	0.12	0.75	-1.00	0.00	0.75	0.38	-4.12	-0.12	1.12	0.12	1.12	**-0.08**
11	0.00	-1.00	-3.00	0.00	-1.00	-1.00	-7.00	-2.00	0.00	0.00	0.00	**-1.36**
12	0.00	0.00	-2.00	0.00	0.00	-1.00	-7.00	-1.00	0.00	0.00	0.00	**-1.00**
13	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-1.00	1.00	-3.00	-1.00	0.00	1.00	-8.00	-1.50	0.00	-1.00	-0.50	**-1.27**
15	0.00	-0.25	-2.25	-0.25	0.00	-1.50	-7.75	-1.00	1.00	0.25	0.75	**-1.00**
Weighted Mean	**-0.17**	**0.43**	**-0.56**	**-0.24**	**0.22**	**-0.30**	**-3.39**	**-0.39**	**0.57**	**-0.11**	**0.85**	**-0.28**

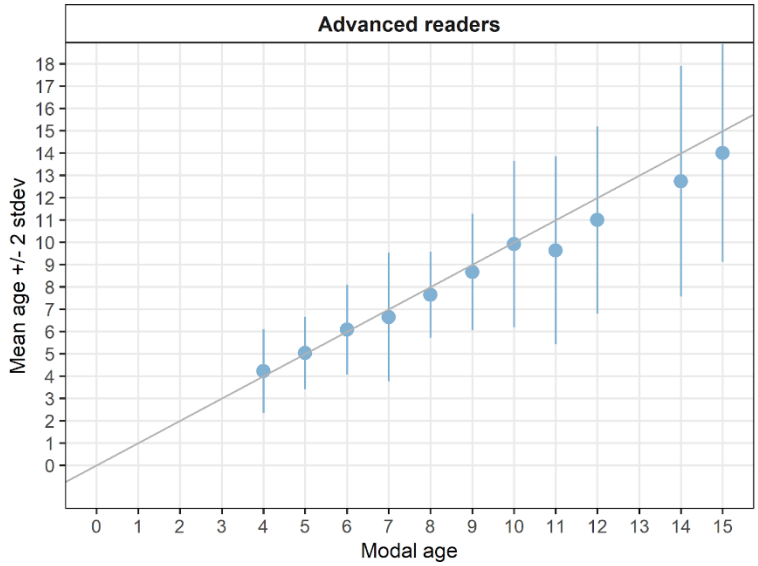

Figure 3.7: Age bias plot for advanced readers. Mean age recorded ± 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Growth analysis

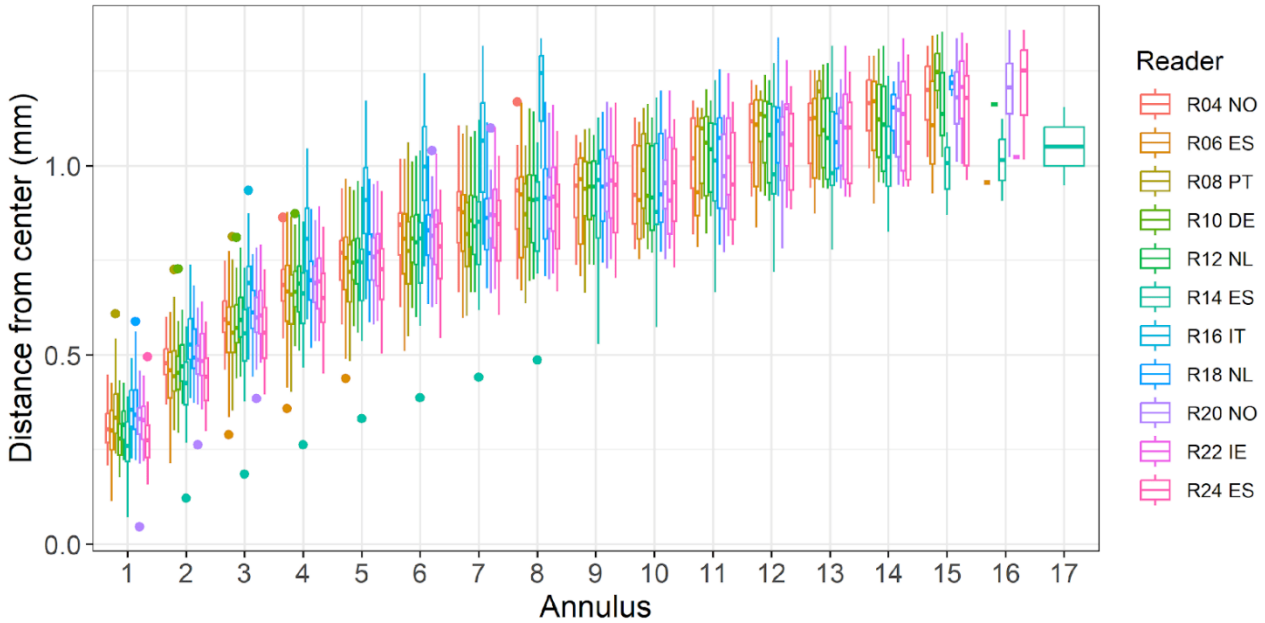

Figure 3.8: Plot of average distance from the centre to the winter rings for all readers. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

General Age Error Matrix (AEM)

Table 3.34: General Age error matrix (AEM). The modal age is in rows and the age classifications by the advanced readers in columns.

modal_age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
4	0.09	0.70	0.16	0.02	-	-	0.02	-	-	-	-	-	-	-	-	0.99
5	0.03	0.12	0.70	0.12	-	0.03	-	-	-	-	-	-	-	-	-	1.00
6	-	0.05	0.15	0.58	0.15	0.04	0.01	0.02	-	-	-	-	-	-	-	1.00
7	0.03	0.06	0.08	0.18	0.51	0.08	0.01	0.04	0.01	-	-	-	-	-	-	1.00
8	-	-	0.06	0.03	0.24	0.55	0.12	-	-	-	-	-	-	-	-	1.00
9	-	0.01	0.06	0.02	0.02	0.15	0.60	0.11	0.02	0.01	-	-	-	-	-	1.00
10	-	0.01	0.01	0.05	0.03	0.03	0.10	0.47	0.22	0.03	0.01	0.01	0.01	-	0.01	0.99
11	-	0.09	-	-	-	0.09	0.09	0.27	0.45	-	-	-	-	-	-	0.99
12	-	-	0.09	-	-	-	-	0.09	0.18	0.64	-	-	-	-	-	1.00
14	-	-	-	0.09	-	-	-	-	0.09	0.14	0.23	0.36	-	0.05	0.05	1.01
15	-	-	-	0.02	0.02	0.05	-	-	-	0.07	0.09	0.11	0.43	0.20	-	0.99

AEM by ICES area

Table 3.35: Age error matrix (AEM) for ICES/GSA area.

ICES/GSA area	modal_age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
27.4.a	4	0.05	0.68	0.18	0.05	-	-	0.05	-	-	-	-	-	-	-	-	1.01
27.4.a	5	0.09	-	0.55	0.27	-	0.09	-	-	-	-	-	-	-	-	-	1.00
27.4.a	6	-	0.09	0.36	0.36	0.18	-	-	-	-	-	-	-	-	-	-	0.99
27.4.a	7	0.03	0.09	0.09	0.12	0.39	0.12	0.03	0.09	0.03	-	-	-	-	-	-	0.99
27.4.a	8	-	-	0.09	-	0.27	0.55	0.09	-	-	-	-	-	-	-	-	1.00
27.4.a	10	-	0.02	0.02	0.05	0.02	0.02	0.12	0.48	0.20	0.03	0.02	0.02	0.02	-	0.02	1.04
27.4.a	11	-	0.09	-	-	-	0.09	0.09	0.27	0.45	-	-	-	-	-	-	0.99
27.4.a	14	-	-	-	0.09	-	-	-	-	0.09	0.14	0.23	0.36	-	0.05	0.05	1.01
27.4.a	15	-	-	-	0.09	-	-	-	-	-	-	0.09	0.18	0.36	0.27	-	0.99
27.6.a	4	0.14	0.73	0.14	-	-	-	-	-	-	-	-	-	-	-	-	1.01
27.6.a	5	-	0.18	0.77	0.05	-	-	-	-	-	-	-	-	-	-	-	1.00
27.6.a	6	-	0.04	0.13	0.61	0.15	0.04	0.01	0.02	-	-	-	-	-	-	-	1.00
27.6.a	7	0.02	0.05	0.07	0.23	0.59	0.05	-	-	-	-	-	-	-	-	-	1.01
27.6.a	8	-	-	-	0.09	0.18	0.55	0.18	-	-	-	-	-	-	-	-	1.00
27.6.a	9	-	0.01	0.06	0.02	0.02	0.15	0.60	0.11	0.02	0.01	-	-	-	-	-	1.00
27.6.a	10	-	-	-	0.05	0.09	0.09	0.05	0.41	0.27	0.05	-	-	-	-	-	1.01
27.6.a	12	-	-	0.09	-	-	-	-	0.09	0.18	0.64	-	-	-	-	-	1.00
27.6.a	15	-	-	-	-	0.03	0.06	-	-	-	0.09	0.09	0.09	0.45	0.18	-	0.99

3.3 *Trachurus mediterraneus* (Event-ID 2927)

3.3.1 All readers

A total of 103 otoliths' images were provided by participants from the Mediterranean Sea (GSAs: 1, 6, 11, 20), all of them corresponding to whole otoliths. The results of the readings showed limited precision, with percent agreement (PA) of 55.0% for all readers, a coefficient of variation (CV) of 42.0% (all readers), and an average percent error (APE) of 31.0%. An AQ3 score was assigned to 5.4% of the annotations.

Multimodal cases

Table 3.36: Total number of samples (NSample) and percentage of cases (fish samples) with multiple modes depending on the approach to weight the experience of the reader which will be considered when defining the fish age mode. PercMM_traditional shows the percentage of the total samples for which multiple modes are obtained when all the readers are equally weighted. PercMM_linear_weight shows the percentage of the total samples for which multiple modes are obtained when the weight assigned to the different readers decreases linearly with the experience, while in the PercMM_negexp the weight applied decreases with a negative exponential shape with the experience. The PercMM_multistage shows the percentage of multiple mode cases when a combination of the different methodologies is used, as explained in the material and methods section

NSample	PercMM_traditional	PercMM_linear_weight	PercMM_negexp_weight	PercMM_multistage
103	9 %	1 %	0 %	0 %

List of multimodal cases

Table 3.37: List of cases for which multiple modes were obtained when all readers are considered. The column NModes_trad shows the number of multiple modes for each FishID or SampleID when all readers are given the same expertise weight.

SampleID	NModes_trad
none	**zero**

Summary statistics

Table 3.38: 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
103	42 %	55 %	31 %

In this exchange event, 103 otolith fish individuals were aged. Of those, 9 %when the traditional approach (all readers equally weighted) is used to define the mode. The percentage of multiple mode cases is reduced to 0 %. When all the otolith samples are considered (both single and multimodal cases) the weighted average percentage agreement based on modal ages for all readers is 55 %, with the weighted average CV of 42 % and APE of 31 %.

Coefficient of Variation (CV)

Table 3.39: 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	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1	46	28	36	69	55	76	27	73	36	70	52	25	36	0	54	**59**
2	30	36	38	34	26	35	34	30	24	77	36	18	20	27	51	**44**
3	26	22	45	39	37	43	26	26	41	48	30	10	25	23	28	**37**
4	13	35	35	16	43	20	20	45	18	58	0	16	47	0	29	**32**
5	0	9	9	19	14	22	14	-	14	19	17	47	8	25	18	**22**
6	8	10	0	10	28	0	18	-	9	12	39	16	0	-	0	**21**
7	0	-	28	11	11	0	13	-	0	0	28	0	0	-	24	**24**
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**18**
Weighted Mean	**28**	**27**	**36**	**40**	**35**	**42**	**32**	**41**	**29**	**57**	**35**	**19**	**24**	**18**	**39**	**42**

Percentage of Agreement (PA)

The percentage agreement per reader per modal age tells how large part of the readings that are equal to the modal age. The weighted mean including at the bottom of the table is weighted according to number of age readings.

Table 3.40: 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	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	total
0	93	64	79	100	93	93	21	62	71	64	64	71	71	86	93	**75**
1	42	93	74	53	74	56	5	75	58	68	71	5	71	100	69	**60**
2	39	61	63	48	75	58	8	50	79	18	53	26	82	70	64	**53**
3	48	56	27	35	50	55	23	65	48	21	53	92	50	21	57	**47**
4	67	33	33	25	25	50	50	33	25	0	100	50	0	100	50	**40**
5	100	80	80	67	57	43	50	100	29	29	33	0	83	0	57	**51**
6	75	67	0	50	50	100	50	-	75	25	33	0	100	0	0	**48**
7	100	0	0	50	50	0	0	-	100	100	0	0	100	0	50	**42**
8	100	100	100	0	0	0	0	-	100	100	100	0	0	-	0	**46**
Weighted Mean	**57**	**66**	**57**	**54**	**66**	**60**	**18**	**62**	**62**	**37**	**57**	**41**	**68**	**65**	**63**	**55**

Average Percentage Error (APE)

Table 3.41: 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	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1	40	13	31	54	32	56	23	50	34	63	31	21	32	0	33	**46**
2	25	26	27	28	17	27	27	27	14	56	27	15	12	24	34	**31**
3	20	16	36	29	24	28	21	16	28	39	20	3	20	16	21	**25**
4	10	26	26	10	30	16	12	33	14	47	0	14	33	0	23	**25**
5	0	6	7	12	10	16	12	0	12	16	14	29	5	19	15	**15**
6	6	8	0	9	20	0	14	-	7	7	29	14	0	0	0	**16**
7	0	0	20	8	8	0	9	-	0	0	20	0	0	0	17	**17**
8	0	0	0	0	0	0	0	-	0	0	0	0	0	-	0	**13**
Weighted Mean	**23**	**18**	**28**	**30**	**22**	**30**	**26**	**29**	**21**	**45**	**23**	**13**	**18**	**14**	**26**	**31**

Relative bias

The relative bias is the difference between the mean age (per modal age per reader) and modal age. As for the previous tables, a combined bias for all readers and weighted means are calculated.

Table 3.42: 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	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	all
0	0.14	0.50	0.21	0.00	0.07	0.07	1.43	0.75	0.36	0.36	0.57	0.57	0.50	0.14	0.07	**0.38**
1	0.53	-0.07	0.26	0.26	-0.05	-0.11	1.58	0.50	0.42	-0.32	0.06	1.26	0.29	0.00	0.06	**0.31**
2	0.71	0.22	-0.19	0.26	-0.11	-0.19	1.81	0.72	-0.07	-0.68	0.21	0.78	0.09	-0.30	0.28	**0.24**
3	0.78	0.11	-0.32	0.75	0.04	-0.20	1.41	0.09	0.17	-1.12	0.05	0.00	-0.17	-0.84	0.22	**0.06**
4	0.33	0.33	0.33	1.00	1.00	0.75	0.00	0.67	1.25	0.75	0.00	-0.50	-1.00	0.00	-0.75	**0.28**
5	0.00	0.20	-0.20	0.17	-0.14	-0.14	0.67	0.00	0.43	0.71	-0.33	-2.14	0.17	-0.33	-0.57	**-0.10**
6	0.25	-0.33	-1.00	-0.50	-1.00	0.00	-0.75	-	-0.25	1.00	-0.67	-2.50	0.00	-2.00	-1.00	**-**
7	0.00	-1.00	-2.00	-0.50	-0.50	-1.00	-1.50	-	0.00	0.00	0.50	-4.00	0.00	-4.00	-1.00	**-**
8	0.00	0.00	0.00	-1.00	-1.00	-2.00	-1.00	-	0.00	0.00	0.00	-4.00	-1.00	-	-3.00	**-**
Weighted Mean	**0.53**	**0.16**	**-0.11**	**0.29**	**-0.05**	**-0.13**	**1.28**	**0.45**	**0.22**	**-0.34**	**0.13**	**0.14**	**0.08**	**-0.34**	**-0.01**	**0.21**

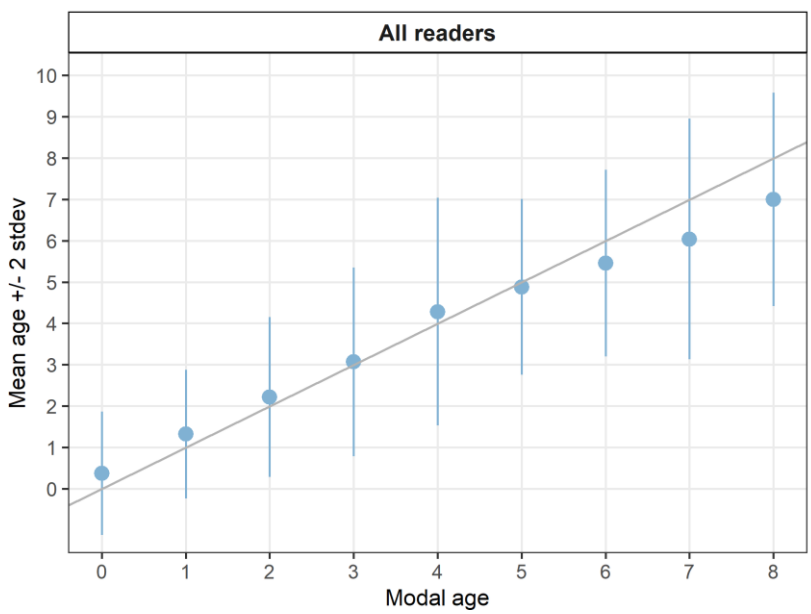

Figure 3.9: Age bias plot for all readers. Mean age recorded ± 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Inter-reader bias test

Table 3.43: Inter reader bias test. The Inter-reader bias test gives probability of bias between readers and with modal age. - = no sign of bias (p>0.05), * = possibility of bias (0.01<p<0.05), * * = certainty of bias (p<0.01) , / = diagonal of the table (no bias)

Comparison	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES
R04 IT	/	*	*	*	**	**	**	*	*	**	-	**	-	**	-
R08 IT	*	/	**	**	**	-	**	-	**	-	**	**	**	**	-
R10 IT	*	**	/	*	**	**	**	-	**	-	*	-	**	-	**
R16 NO	*	**	*	/	-	-	**	**	**	-	**	**	**	-	-
R18 ES	**	**	**	-	/	**	**	-	-	-	-	-	*	-	**
R20 PT	**	-	**	-	**	/	**	-	*	**	-	-	*	**	**
R22 IT	**	**	**	**	**	**	/	**	**	**	**	**	**	**	**
R26 NL	*	-	-	**	-	-	**	/	*	**	**	**	-	**	*
R28 GR	*	**	**	**	-	*	**	*	/	-	**	-	**	**	-
R30 ES	**	-	-	-	-	**	**	**	-	/	-	*	-	**	-
R38 ES	-	**	*	**	-	-	**	**	**	-	/	**	**	*	**
R42 GR	**	**	-	**	-	-	**	**	-	*	**	/	-	**	*
R50 IT	-	**	**	**	*	*	**	-	**	-	**	-	/	**	-
R54 ES	**	**	-	-	-	**	**	**	**	**	*	**	**	/	-
R58 ES	-	-	**	-	**	**	**	*	-	-	**	*	-	-	/
Modal age	**	**	**	-	**	**	**	-	**	-	**	-	**	*	**

Growth analysis

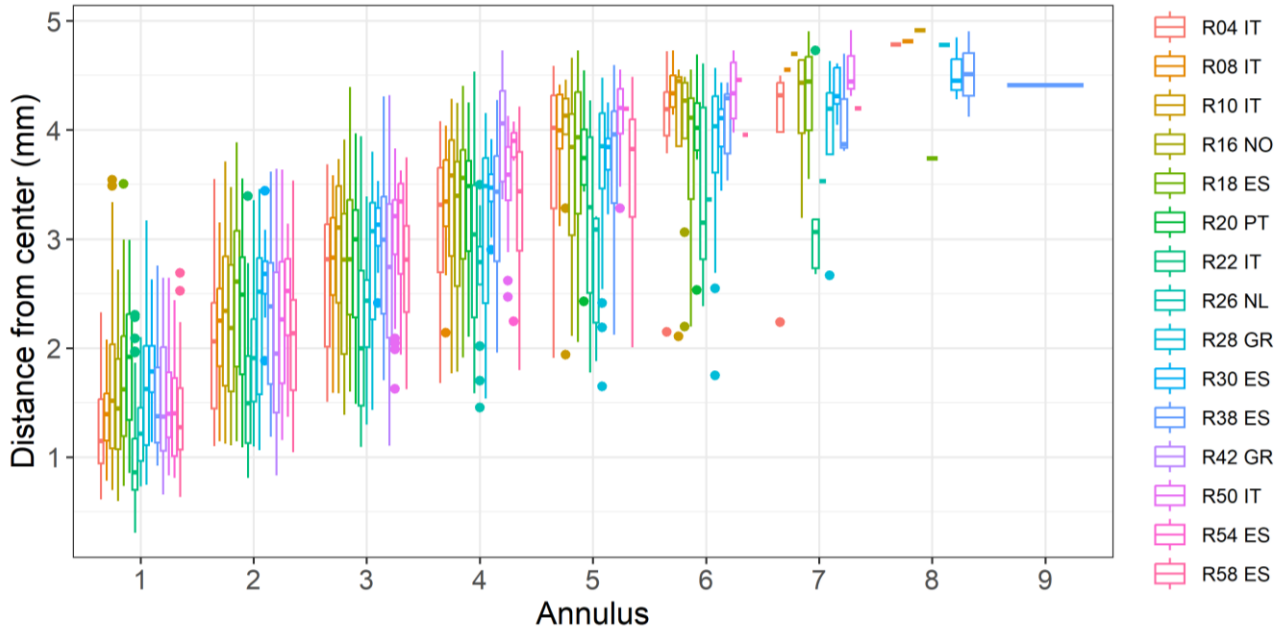

Figure 3.10: Plot of average distance from the centre to the winter rings for all readers. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

3.3.2 Advanced reader

Table 3.44: Number of age readings per modal age for the advanced reader.

Modal age	total
0	**14**
1	**9**
2	**21**
3	**23**
4	**15**
5	**9**
6	**3**
7	**4**
8	**1**
Total	**99**

Since only one advanced reader on *Trachurus mediterraneus* participated in the Exchange, we do not include the precision analysis but the Growth analysis results are shown in Figure 3.11.

Growth analysis

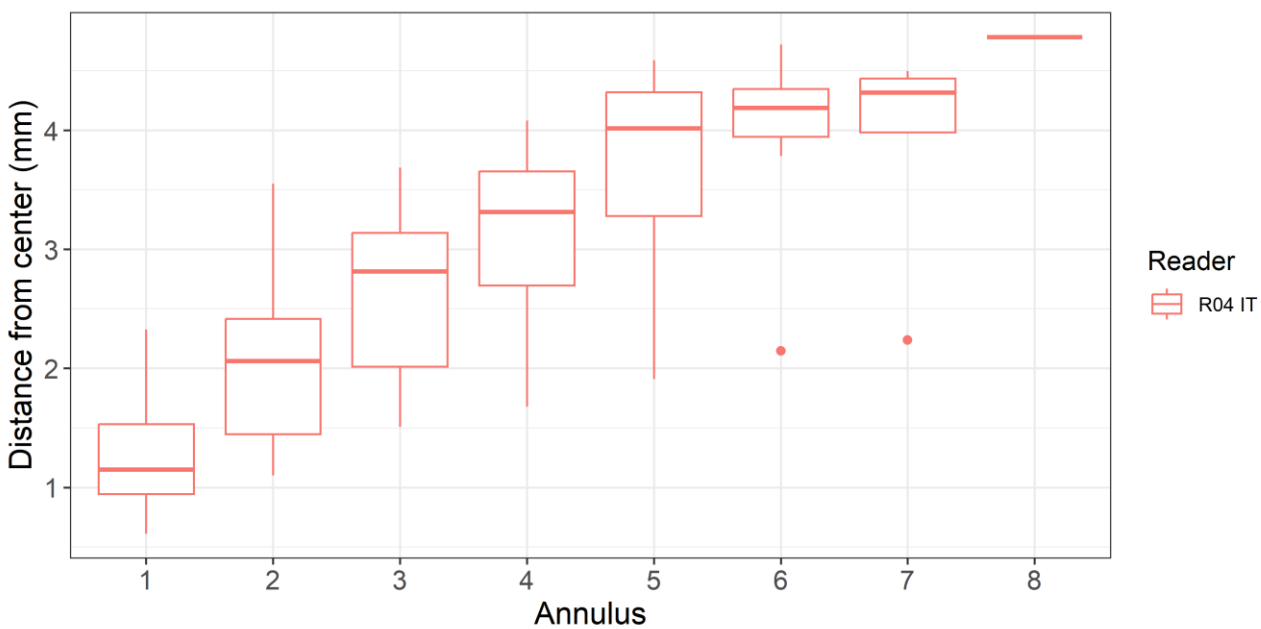

Figure 3.11: Plot of average distance from the centre to the winter rings for advanced readers. The boxes represent the mean, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

3.4 *Trachurus picturatus* (Event-ID 2928)

3.4.1 All readers

The results obtained for *T. picturatus* correspond to all readers (all with basic expertise for the species) and the interpretation of the age was made on whole otoliths. A total of 81 otoliths' images were provided by participants from the Ligurian and North Tyrrhenian Sea in the Mediterranean Sea (GSA 9) and from Azores grounds in the East Atlantic Ocean (ICES 27.10.a.2). The results of the readings showed limited precision, with percent agreement (PA) of 50.0% for all readers (all of them with basic expertise), a coefficient of variation (CV) of 39.0% (all readers), and an average percent error (APE) of 29.0%. A total of 14.4% of the annotations received an AQ3 score.

Multimodal cases

Table 3.45: Total number of samples (NSample) and percentage of cases (fish samples) with multiple modes depending on the approach to weight the experience of the reader which will be considered when defining the fish age mode. PercMM_traditional shows the percentage of the total samples for which multiple modes are obtained when all the readers are equally weighted. PercMM_linear_weight shows the percentage of the total samples for which multiple modes are obtained when the weight assigned to the different readers decreases linearly with the experience, while in the PercMM_negexp the weight applied decreases with a negative exponential shape with the experience. The PercMM_multistage shows the percentage of multiple mode cases when a combination of the different methodologies is used, as explained in the material and methods section

NSample	PercMM_traditional	PercMM_linear_weight	PercMM_negexp_weight	PercMM_multistage
81	14 %	1 %	0 %	0 %

List of multimodal cases

Table 3.46: List of cases for which multiple modes were obtained when all readers are considered. The column NModes_trad shows the number of multiple modes for each SampleID when all readers are given the same expertise weight.

NModes_trad	SampleID
2	GSA9_TP_WHOLE_07
2	GSA9_TP_WHOLE_08
2	GSA9_TP_WHOLE_20
2	GSA9_TP_WHOLE_28
2	GSA9_TP_WHOLE_29
2	TRAPIC_1S_01
2	TRAPIC_1S_06
3	TRAPIC_1S_08
2	TRAPIC_1S_14
3	TRAPIC_2S_01
3	**TRAPIC_2S_15**

Summary statistics

Table 3.47: 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
81	39 %	50 %	29 %

In this exchange event, 81 otolith fish individuals were aged. Of those, 14% when the traditional approach (all readers equally weighted) is used to define the mode. The percentage of multiple mode cases is reduced to 0 %. When all the otolith samples are considered (both single and multimodal cases), the weighted average percentage agreement based on modal ages for all readers is 50%, with the weighted average CV of 39% and APE of 29%.

Coefficient of Variation (CV)

Table 3.48: 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	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1	0	0	13	32	30	28	27	0	0	31	37	-	38	17	0	0	**65**
2	56	31	21	45	24	42	46	31	51	67	30	0	77	21	0	32	**50**
3	16	29	26	36	26	25	19	21	32	22	26	24	39	19	21	24	**38**
4	27	15	18	17	23	15	20	15	23	13	23	25	27	12	14	10	**29**
5	20	26	12	17	17	17	18	10	30	22	20	31	16	0	17	11	**30**
6	-	16	8	47	9	23	10	10	41	-	-	47	20	17	0	-	**30**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**30**
Weighted Mean	**21**	**21**	**18**	**29**	**23**	**23**	**22**	**16**	**28**	**27**	**26**	**25**	**36**	**14**	**13**	**16**	**39**

Percentage of Agreement (PA)

The percentage agreement per reader per modal age tells how large part of the readings that are equal to the modal age. The weighted mean including at the bottom of the table is weighted according to number of age readings.

Table 3.49: 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	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	total
0	100	100	0	100	100	100	89	100	100	100	100	-	100	78	100	100	**94**
1	100	100	0	0	12	29	12	100	100	88	75	-	62	0	100	100	**57**
2	50	67	0	33	29	40	29	43	57	75	33	100	60	71	100	67	**49**
3	77	71	5	44	33	23	21	62	50	9	36	67	20	62	56	53	**43**
4	64	53	6	46	18	77	41	76	65	0	50	29	9	6	25	77	**41**
5	17	25	0	33	64	33	60	73	27	14	44	43	17	0	0	67	**34**
6	0	0	75	50	75	25	67	50	25	0	0	0	50	0	0	0	**32**
7	-	-	0	100	0	0	0	100	0	100	100	-	0	0	-	-	**36**
Weighted Mean	**70**	**66**	**7**	**46**	**41**	**49**	**39**	**73**	**59**	**45**	**53**	**48**	**42**	**34**	**57**	**73**	**50**

Average Percentage Error (APE)

Table 3.50: 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	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	all
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
1	0	0	10	25	21	24	12	0	0	19	30	-	34	10	0	0	**47**
2	39	27	17	33	17	36	33	26	34	50	22	0	54	18	0	17	**38**
3	13	16	21	27	21	21	13	16	25	17	21	19	29	18	19	16	**29**
4	20	14	13	14	18	11	17	10	17	11	17	19	22	4	12	8	**23**
5	14	18	10	13	13	14	13	8	21	16	16	26	10	0	13	10	**23**
6	0	12	6	33	7	18	8	9	25	0	0	34	14	13	0	0	**25**
7	-	-	0	0	0	0	0	0	0	0	0	-	0	0	-	-	**22**

Relative bias

The relative bias is the difference between the mean age (per modal age per reader) and modal age. As for the previous tables, a combined bias for all readers and weighted means are calculated.

Table 3.51: 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	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	all
0	0.00	0.00	4.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	-	0.00	0.22	0.00	0.00	-
1	0.00	0.00	4.14	1.43	1.12	0.71	1.00	0.00	0.00	0.12	0.25	-	0.38	1.12	0.00	0.00	-
2	0.25	-0.33	3.43	1.33	0.86	1.60	0.71	0.86	0.86	1.00	1.00	0.00	1.40	0.29	0.00	0.00	**0.83**
3	-0.23	-0.05	3.18	0.22	1.17	1.46	0.88	0.25	0.42	2.09	0.91	0.33	2.50	-0.38	-0.44	0.00	**0.77**
4	-0.55	-0.47	2.25	0.23	1.53	0.31	0.71	0.18	0.35	1.62	0.12	0.43	2.36	-1.00	-0.75	0.23	**0.47**
5	-1.17	-1.12	2.27	0.00	0.55	-0.22	-0.30	-0.27	-0.73	2.00	-0.22	-1.14	2.00	-2.00	-1.67	-0.33	**-0.15**
6	-2.00	-2.33	0.25	-1.50	-0.25	-0.50	-0.33	-0.50	-2.00	1.00	-1.00	-1.25	1.00	-2.67	-3.00	-1.00	**-1.01**
7	-	-	1.00	0.00	-1.00	-3.00	-2.00	0.00	-1.00	0.00	0.00	-	3.00	-4.00	-	-	**-**

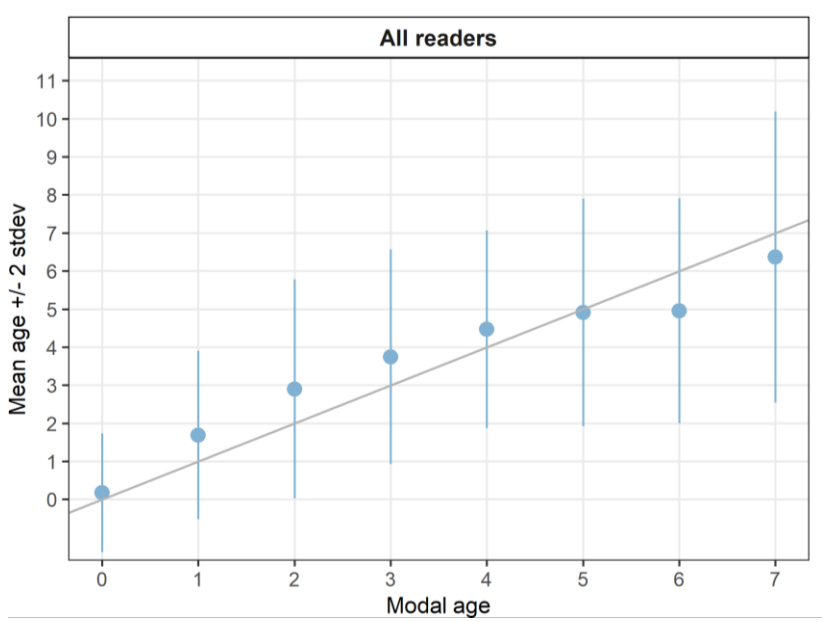

Figure 3.12: Age bias plot for all readers. Mean age recorded ± 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

Inter-reader bias test

Table 3.52: Inter reader bias test. The Inter-reader bias test gives probability of bias between readers and with modal age. - = no sign of bias (p>0.05), * = possibility of bias (0.01<p<0.05), * * = certainty of bias (p<0.01), / = diagonal of the table (no bias)

Comparison	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES
R08 IT	/	*	**	**	**	**	**	**	*	**	**	-	**	**	-	*
R10 IT	*	/	**	-	**	**	**	-	*	**	-	-	**	**	-	-
R12 PT	**	**	/	**	**	**	**	**	**	**	**	**	*	**	**	**
R16 NO	**	-	**	/	-	**	**	*	**	-	**	*	*	**	**	-
R18 ES	**	**	**	-	/	-	-	**	**	**	-	**	-	**	**	**
R20 PT	**	**	**	**	-	/	**	-	-	-	-	-	**	**	**	-
R22 IT	**	**	**	**	-	**	/	-	-	-	**	*	-	**	**	-
R26 NL	**	-	**	*	**	-	-	/	**	**	-	**	**	-	**	**
R28 GR	*	*	**	**	**	-	-	**	/	**	*	**	**	-	**	*
R30 ES	**	**	**	-	**	-	-	**	**	/	-	**	-	-	**	**
R34 IT	**	-	**	**	-	-	**	-	*	-	/	*	**	-	**	-
R38 NO	-	-	**	*	**	-	*	**	**	**	*	/	**	**	*	**
R42 ES	**	**	*	*	-	**	-	**	**	-	**	**	/	**	**	**
R46 GR	**	**	**	**	**	**	**	-	-	-	-	**	**	/	**	*
R54 IT	-	-	**	**	**	**	**	**	**	**	**	*	**	**	/	**
R58 ES	*	-	**	-	**	-	-	**	*	**	-	**	**	*	**	/
Modal age	**	*	**	*	**	-	-	**	-	**	-	*	**	-	**	**

Growth analysis

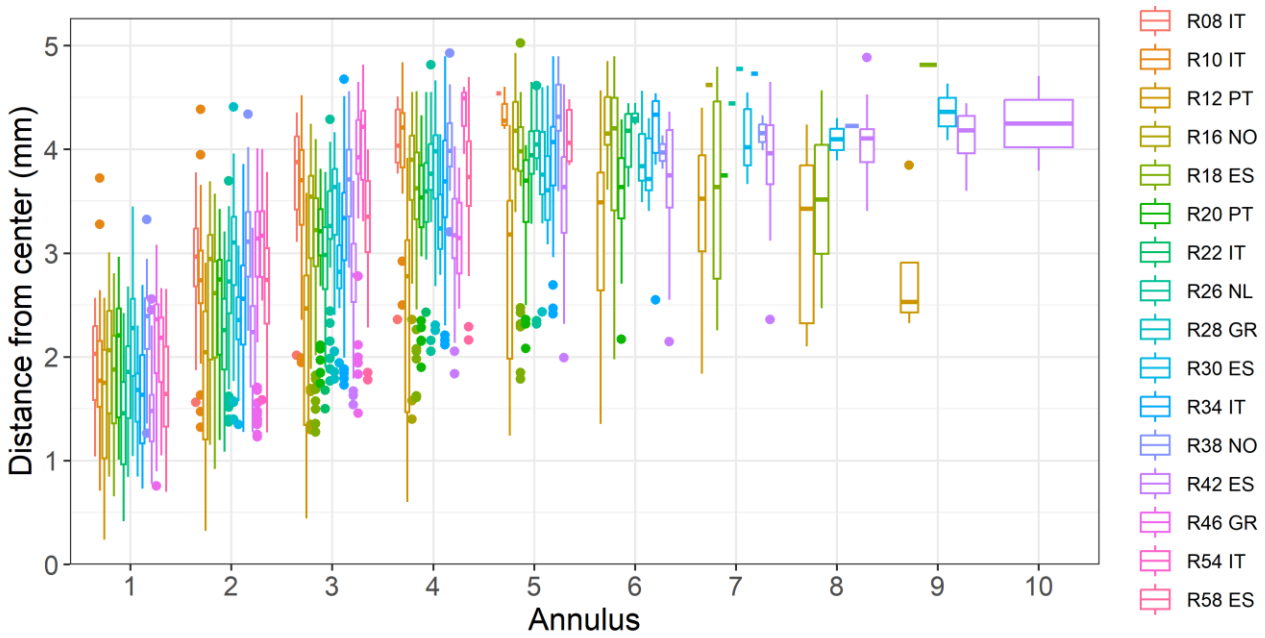

Figure 3.13: Plot of average distance from the centre to the winter rings for all readers. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values and the dots represent the outliers.

General Age Error Matrix (AEM)

Table 3.53: General Age error matrix (AEM). The modal age is in rows and the age classifications by all readers in columns.

modal_age	0	1	2	3	4	5	6	7	8	9	10	Total
0	0.94	0.02	-	-	0.04	-	-	-	-	-	-	1.00
1	-	0.57	0.31	0.05	0.02	0.04	0.02	-	-	-	-	1.01
2	-	0.06	0.49	0.21	0.11	0.04	0.07	0.01	0.01	-	-	1.00
3	-	0.01	0.11	0.43	0.20	0.13	0.07	0.02	0.01	0.01	-	0.99
4	-	0.00	0.01	0.19	0.41	0.19	0.13	0.04	0.01	0.01	0.00	0.99
5	-	-	0.02	0.15	0.22	0.34	0.11	0.08	0.04	0.02	-	0.98
6	-	-	0.02	0.18	0.20	0.16	0.32	0.07	0.05	-	-	1.00
7	-	-	-	0.09	0.09	0.09	0.18	0.36	0.09	-	0.09	0.99

AEM by area

Table 3.54: Age error matrix (AEM) for ICES area 27.10.a.2.

ICES area	modal_age	0	1	2	3	4	5	6	7	8	9	10	Total
27.10.a.2	2	-	-	0.58	0.18	0.18	0.06	-	-	-	-	-	1.00
27.10.a.2	3	-	0.03	0.15	0.47	0.22	0.11	0.03	-	-	-	-	1.01
27.10.a.2	4	-	-	0.02	0.21	0.39	0.21	0.12	0.04	-	0.01	-	1.00
27.10.a.2	5	-	-	-	0.20	0.25	0.34	0.12	0.08	-	-	-	0.99
27.10.a.2	6	-	-	0.04	0.21	0.25	0.11	0.36	0.04	-	-	-	1.01

Table 3.55: Age error matrix (AEM) for GSA area 9.

GSA area	modal_age	0	1	2	3	4	5	6	7	8	9	10	Total
9	0	0.94	0.02	-	-	0.04	-	-	-	-	-	-	1.00
9	1	-	0.57	0.31	0.05	0.02	0.04	0.02	-	-	-	-	1.01
9	2	-	0.09	0.44	0.23	0.07	0.04	0.11	0.02	0.02	-	-	1.02
9	3	-	-	0.09	0.41	0.19	0.15	0.10	0.03	0.02	0.02	-	1.01
9	4	-	0.01	-	0.16	0.44	0.17	0.14	0.05	0.02	0.01	0.01	1.01
9	5	-	-	0.04	0.11	0.20	0.35	0.11	0.08	0.08	0.04	-	1.01
9	6	-	-	-	0.12	0.12	0.25	0.25	0.12	0.12	-	-	0.98
9	7	-	-	-	0.09	0.09	0.09	0.18	0.36	0.09	-	0.09	0.99

3.5 Discussion

Based on the recommendations provided in the previous WKARHOM meetings, it was of great importance to use the same magnification when taking photos for the same "otolith set", to be able to compare size and partial *annuli* radii. It was a source of age determination error (even intra-reader) repeatedly reported. However, the use of different magnitudes for pictures taken for the some "otolith sets" was observed.

The axis selected by coordinators for annotating each annulus was not always the preferred one that readers had chosen to mark them. However, this is personal down to individual preferences and difficult to avoid, and it is useful to have a common reference axis to get annuli measurements.

The assignment of the edge type constituted a critical point highlighted by some readers, due to its not easy recognition.

Regarding the Otolith Growth Analysis, although clear instructions were provided, some readers did not mark annuli at the end of the translucent ring. Therefore, distance measures and the subsequent analyses obtained using these data were not reliable.

Another problem was the low quality of some images, with low illumination or blurry, what should be carefully considered and avoided when taking the photos.

Coordinators want to mention that some readers asked for the fish length data related to the otolith images, what has been pointed out to be avoided during the age interpretation.

Finally, some issues were encountered with SmartDots outputs:

- when we use one stratum for all samples to evaluate two preparation methods, program does not work.
- plot of average distance from the centre to the winter rings is not divided into the two preparation methods making it unreadable.
- "Figure X: The relative bias by modal age as estimated by all age readers combined" is incorrect.
- Inability to edit files (e.g. image name or completely delete a file without enter all or part of filename) directly in the "Edit Event" page.

3.6 Conclusion

The exchange results showed a low value of percentage of agreement (PA) between 46.0 % and 54.0 % for the three *Trachurus* species. For all readers, the CV for *T. trachurus* was 45.0% for whole otoliths and a much lower value of 26.0% for sliced otoliths; for *T. mediterraneus* CV was 42.0 % and for *T. picturatus* it was 54.0 %.

Recommendations produced in the last workshop do not seem to have been considered by the different laboratories, both the ones related to the species assessment and the ones recently interested on the beginner readers training.

Lower agreement among readers was related to interpretation and ageing difficulties for older species and for the presence of multiple rings, mostly in *T. trachurus*. For age group 0 and 1, disagreement was correlated to the recognition of the first winter ring. In addition, lower agreement was notice in sample with poor quality image.

A workshop to again revise and agree the ageing criteria by the readers in charge is necessary.

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5 Annex 1. List of participants

Table 5.1: Participants' list. Reader details: Expertise level is defined as *advanced* (Ad) if reader provides age data for assessment purposes, or *basic* (B) if not.

Participant (Surname, Name)	Country	Institution	Expertise		
			T. trachurus	***T. mediterraneus***	***T. picturatus***
Arévalo, Ainhoa	Spain	AZTI	B		
Bellodi, Andrea	Italy	UNICA	B	B	B
Casciaro, Loredana	Italy	COISPA	B	B	B
Charo Navarro-Rodríguez	Spain	IEO, CSIC-Santander	B	B	B
Clara, Nietz	Germany	Thünen Inst. SF	B		
Cruz, Renato	Portugal	SGMP, DRP-Açores			B
Diaz, Justine	Norway	IMR	Ad	B	B
Dueñas, Clara	Spain	IEO, CSIC-Santander	Ad	B	B
Elisa Fodde	Italy	UNICA	B	B	B
Ferreira, Maria João	Portugal	IPMA	Ad	B	B
Gloria Blaya	Spain	IEO, CSIC-Baleares		B	
Hemken, Gitta	Germany	Thünen Inst. SF	B		
José Carlos Rodríguez	Spain	IEO, CSIC-Baleares	B	B	B
Legaki, Aglaia	Greece	HCMR	B	B	B
López, Eduardo	Spain	IEO, CSIC-Vigo	Ad	B	B
Massaro, Andrea	Italy	APLYSIA	Ad	Ad	B
Meissner, Timo	Norway	IMR	Ad		B
Mullins, Eugene	Ireland	Marine Institute	Ad		
Nikiforidou, Vasiliki	Greece	HCMR	B	B	B
Norie Van Der Meeren	Netherlands	IMARES	Ad		
Pesci, Paola	Italy	UNICA	B	B	B
Rico, Iñaki	Spain	AZTI	Ad		
Tim Huijer	Netherlands	IMARES	Ad	B	B
Yago Lozano	Spain	IEO, CSIC-Málaga	B		

6 Annex 2. Additional results

6.1 Results *T. trachurus* (Event-ID 2926)

6.1.1 All readers - whole otoliths

Summary statistics

Table 6.1: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
167	51 %	54 %	32 %

Table 6.2: Data overview including modal age and statistics per sample.

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	Modal age	PA %	CV %	APE %
274A_2024_38301_003	350	F	31/01/2024	27.4.a	10	6	6	9	7	6	4	6	3	7	8	16	4	3	4	7	-	3	6	4	4	-	6	25	50	34
274A_2024_38301_004	300	M	31/01/2024	27.4.a	4	4	5	7	3	7	5	3	2	3	6	9	4	2	3	4	-	3	4	2	3	-	3	30	45	34
274A_2024_38301_007	340	M	31/01/2024	27.4.a	9	8	7	9	10	8	7	9	7	8	10	15	7	6	6	8	-	8	9	5	5	-	8	25	27	18
274A_2024_38301_009	340	M	31/01/2024	27.4.a	6	5	7	7	6	6	4	5	3	4	6	10	4	3	3	5	-	4	7	2	4	-	4	25	37	29
274A_2024_38301_013	355	F	31/01/2024	27.4.a	9	8	6	7	6	6	4	8	3	5	10	13	4	3	3	7	-	3	9	3	2	-	3	25	49	40
274A_2024_38301_014	350	F	31/01/2024	27.4.a	8	7	6	8	7	7	7	7	8	8	8	15	7	7	6	6	-	7	9	6	2	-	7	40	31	18
274A_2024_38301_015	375	M	31/01/2024	27.4.a	10	9	7	9	9	9	7	9	8	8	10	14	8	6	7	8	-	8	8	6	3	-	8	30	26	17
274A_2024_38301_023	325	M	31/01/2024	27.4.a	7	6	6	7	5	8	4	5	4	6	6	13	3	3	3	5	-	4	5	4	4	4	4	29	42	29
274A_2024_38304_009	250	F	12/02/2024	27.6.a	4	3	3	5	3	8	3	3	2	3	5	13	4	2	3	3	-	3	5	3	2	3	3	52	63	39
274A_2024_38304_011	320	M	12/02/2024	27.6.a	9	7	6	8	8	9	6	7	-	7	9	19	7	6	6	7	-	7	9	5	3	-	7	32	41	24
274A_2024_38304_021	325	M	12/02/2024	27.6.a	9	9	6	9	8	8	6	8	9	9	10	13	8	8	7	7	-	9	9	5	4	-	9	35	24	17
274A_2024_38304_023	320	M	12/02/2024	27.6.a	7	6	6	7	6	8	5	6	6	6	7	18	6	5	5	5	-	8	10	4	3	-	6	35	46	27
274A_2024_38304_025	290	M	12/02/2024	27.6.a	7	5	4	6	6	8	4	6	3	5	7	10	4	3	3	6	-	-	-	3	3	-	3	28	39	32
274A_2023_38309_007	335	M	20/01/2023	27.4.a	5	11	8	5	7	11	6	10	2	5	11	18	0	-	4	9	-	-	7	-	6	-	5	18	57	42
274A_2023_38309_011	360	M	20/01/2023	27.4.a	10	9	8	10	8	11	7	9	2	8	13	18	8	2	5	9	-	-	13	4	8	-	8	26	45	31
274A_2023_38309_013	375	M	20/01/2023	27.4.a	8	7	7	8	7	7	5	8	2	8	8	8	7	6	6	7	-	7	8	5	7	-	7	40	22	15
274A_2023_38309_015	370	M	20/01/2023	27.4.a	10	8	7	9	9	10	6	9	2	8	12	14	6	5	5	8	-	-	10	5	6	-	9	16	36	28
274A_2023_38309_016	380	M	20/01/2023	27.4.a	9	8	8	9	9	8	7	7	8	8	10	13	6	4	4	7	-	7	9	4	5	-	8	25	29	22
274A_2024_86650_002	360	F	19/09/2024	27.4.a	10	6	7	7	7	5	6	8	7	6	9	11	6	4	4	6	-	8	8	3	2	-	6	25	34	26
274A_2024_86650_003	325	F	19/09/2024	27.4.a	9	8	6	8	9	6	6	8	8	8	9	9	8	3	5	9	-	9	8	5	3	-	8	35	27	23
274A_2024_86650_007	345	F	19/09/2024	27.4.a	10	6	7	9	9	6	6	10	-	7	10	11	7	4	5	8	-	-	8	4	4	-	6	17	31	26
274A_2024_86650_010	345	F	19/09/2024	27.4.a	6	5	6	6	6	4	5	-	4	5	7	13	5	2	4	5	-	-	8	3	4	-	5	28	43	28
274A_2024_86650_019	335	F	19/09/2024	27.4.a	7	6	6	7	6	5	6	7	7	6	8	12	6	6	6	7	-	7	6	5	6	-	6	50	22	14
274A_2024_86650_029	345	F	19/09/2024	27.4.a	11	7	7	8	7	5	6	9	7	6	11	11	7	4	6	7	-	-	7	5	5	7	7	40	28	20
GSA11TT01	104	U	19/07/2016	11.1	0	0	0	0	0	1	1	0	1	1	1	2	1	1	2	1	0	1	0	1	1	0	1	50	95	82
GSA11TT02	115	U	19/07/2016	11.1	0	0	0	0	0	1	1	0	1	1	1	4	1	1	2	1	0	1	0	1	2	0	1	45	117	82
GSA11TT03	134	F	09/03/2020	11.1	1	1	0	1	0	1	1	2	1	1	1	3	1	1	1	1	1	1	1	1	1	0	1	77	62	27
GSA11TT04	175	F	09/03/2020	11.1	1	2	1	4	1	1	2	2	2	2	3	7	2	1	3	3	2	-	1	2	2	2	2	48	62	39
GSA11TT05	189	F	09/03/2020	11.1	2	3	1	3	2	1	3	4	3	3	3	4	3	3	3	3	3	3	3	2	3	3	3	68	27	19
GSA11TT06	182	F	09/03/2020	11.1	2	3	2	3	2	2	4	3	2	3	3	5	2	2	3	2	3	3	3	3	2	3	3	50	28	22
GSA11TT07	180	F	09/03/2020	11.1	2	1	1	4	2	1	3	4	2	3	2	4	2	1	3	4	2	3	3	2	3	2	2	36	41	35
GSA11TT08	216	F	09/03/2020	11.1	2	3	2	3	2	2	3	3	2	3	3	5	3	3	3	3	3	3	4	3	4	4	3	59	25	15
GSA11TT09	218	F	09/03/2020	11.1	2	2	2	3	2	1	3	4	2	3	3	5	2	2	2	4	3	2	2	2	2	2	2	59	37	29
GSA11TT10	136	M	09/03/2020	11.1	2	2	1	2	1	1	3	2	2	3	2	3	3	2	3	3	2	3	2	2	3	2	2	50	31	25
GSA11TT11	142	M	11/02/2016	11.1	1	1	0	1	0	1	2	9	1	1	1	6	1	1	2	1	1	1	1	1	1	-	1	71	127	74
GSA11TT12	140	M	14/12/2021	11.1	1	2	0	2	1	1	2	2	1	1	2	2	2	2	2	3	2	2	1	1	2	2	2	59	40	34
GSA11TT13	156	M	14/12/2023	11.1	1	1	1	2	2	1	2	5	1	1	2	2	2	2	2	2	2	2	1	1	1	2	2	55	51	34
GSA11TT14	168	M	14/12/2023	11.1	1	1	1	2	2	1	2	8	1	1	2	3	2	2	2	5	2	2	1	4	3	-	2	43	73	48
GSA11TT15	272	F	27/07/2020	11.1	4	4	4	4	3	4	4	4	4	4	5	5	4	-	3	5	5	6	3	5	4	4	4	57	18	13
GSA11TT16	172	F	28/03/2025	11.1	1	1	1	1	2	1	2	2	2	2	1	5	1	1	3	2	-	1	1	3	1	1	1	57	61	46
GSA11TT17	179	M	28/03/2025	11.1	1	1	1	1	2	2	2	7	2	1	1	5	2	1	4	1	-	5	1	4	1	2	1	48	77	59
GSA11TT21	260	M	02/04/2025	11.1	3	4	3	3	2	2	4	0	2	5	-	10	3	2	4	6	-	-	2	5	2	-	2	33	63	45
GSA11TT22	247	F	02/04/2025	11.1	4	4	3	4	3	3	5	0	3	4	5	7	3	3	3	5	-	5	2	4	4	4	3	33	37	27
GSA11TT23	207	F	02/04/2025	11.1	2	2	1	3	2	2	3	2	2	2	5	9	3	1	3	4	-	-	2	3	3	3	2	40	61	37
GSA11TT24	235	F	02/04/2025	11.1	3	3	2	3	3	2	3	3	3	2	7	9	3	3	3	5	-	-	2	4	3	3	3	60	50	32
GSA11TT25	214	F	02/04/2025	11.1	2	2	2	2	2	2	3	2	2	2	3	11	3	1	2	3	-	2	-	3	2	2	2	65	77	38
GSA11TT26	167	F	02/04/2025	11.1	1	1	1	1	1	1	2	1	1	1	1	9	2	1	3	4	-	1	1	2	1	1	1	71	105	62
GSA11TT27	188	F	02/04/2025	11.1	1	1	1	1	2	2	2	3	2	2	2	11	2	1	2	5	-	-	2	2	1	1	2	50	98	53
GSA11TT28	249	M	02/04/2025	11.1	3	3	3	5	3	3	5	0	2	3	5	13	3	2	3	6	-	-	3	3	3	3	3	60	69	42
GSA11TT29	182	M	02/04/2025	11.1	2	3	2	4	3	2	3	4	2	2	4	13	2	2	2	3	-	5	2	3	3	2	2	48	74	41
GSA11TT30	190	M	02/04/2025	11.1	2	1	1	2	1	2	2	2	2	2	3	10	2	1	2	3	-	2	-	2	2	2	2	65	82	40

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	Modal age	PA %	CV %	APE %
HOM_8c_20210901_N106	256	F	01/09/2021	27.8.c	3	4	2	3	4	2	3	4	4	3	3	9	4	3	3	3	3	3	4	3	3	3	3	59	40	23
HOM_8c_20211104_N005	195	M	04/11/2021	27.8.c	2	2	2	1	2	1	1	3	2	2	1	3	2	1	1	2	2	2	1	2	2	1	2	55	37	31
HOM_8c_20211104_N031	208	F	04/11/2021	27.8.c	3	3	2	2	3	2	3	3	3	2	3	7	3	3	3	3	3	3	2	3	3	3	3	73	34	15
HOM_8c_20221013_N021	207	F	13/10/2022	27.8.c	3	3	2	2	3	2	3	3	3	2	3	7	3	3	3	3	3	3	2	2	3	3	3	68	35	17
HOM_8c_20221013_N083	201	M	13/10/2022	27.8.c	2	2	2	1	2	2	2	3	2	1	2	3	2	2	2	2	2	2	1	2	2	1	2	73	28	17
HOM_8c_20240425_N008	256	F	25/04/2024	27.8.c	5	4	4	5	4	4	5	6	4	6	7	8	4	4	4	5	6	5	5	4	4	4	4	50	23	18
HOM_8c_20240731_N022	265	M	31/07/2024	27.8.c	3	5	4	3	3	4	3	5	2	3	6	6	3	4	3	3	5	3	3	4	3	-	3	52	30	25
HOM_8c_20240801_N042	219	M	01/08/2024	27.8.c	2	2	3	2	2	2	2	5	3	2	2	5	2	2	2	2	2	2	2	2	2	2	2	82	38	25
HOM_8c_20240801_N058	233	M	01/08/2024	27.8.c	2	2	2	2	2	2	2	5	3	2	2	4	2	2	2	2	2	2	2	2	2	2	2	86	34	21
HOM_8c_20240801_N071	210	F	01/08/2024	27.8.c	2	3	3	2	2	2	2	6	3	2	2	8	2	2	2	2	3	2	2	2	2	2	2	73	57	35
HOM_8c_20240801_N074	216	M	01/08/2024	27.8.c	3	4	3	3	3	3	3	8	3	3	7	8	3	3	3	3	5	3	3	3	4	3	3	73	43	31
HOM_8c_CAREVA0322_L001_N029	260	M	20/03/2022	27.8.c	4	4	3	4	4	4	4	4	5	4	4	5	4	4	4	4	4	4	4	3	4	4	4	82	11	5
HOM_8c_CAREVA0322_L001_N046	222	F	20/03/2022	27.8.c	4	3	2	4	3	3	3	4	4	4	4	4	3	3	3	3	4	4	3	3	3	3	3	55	17	15
HOM_8c_CAREVA0322_L001_N057	183	F	20/03/2022	27.8.c	2	2	1	2	2	2	2	4	3	3	2	4	2	2	2	2	2	2	3	2	2	2	2	73	31	23
HOM_8c_CAREVA0322_L001_N078	211	F	20/03/2022	27.8.c	4	3	2	4	3	3	3	7	4	4	4	6	3	3	3	3	3	4	4	3	3	3	3	55	31	22
HOM_8c_CAREVA0322_L004_N018	246	M	23/03/2022	27.8.c	4	4	2	4	3	3	4	6	4	4	4	6	4	4	3	4	4	4	4	4	4	4	4	73	21	11
HOM_8c_CAREVA0322_L004_N042	249	M	23/03/2022	27.8.c	5	5	3	5	4	4	5	5	4	5	7	9	5	5	5	5	6	6	5	4	5	5	5	59	23	14
HOM_8c_CAREVA0322_L004_N043	261	F	23/03/2022	27.8.c	5	5	3	5	4	4	5	5	5	5	5	7	5	5	4	5	6	5	5	4	5	5	5	68	16	10
HOM_8c_CAREVA0322_L004_N064	205	F	23/03/2022	27.8.c	3	2	2	3	2	2	2	3	2	3	2	5	3	2	2	3	2	2	3	3	2	2	2	59	30	24
HOM_8c_CAREVA0322_L004_N080	232	F	23/03/2022	27.8.c	5	4	3	4	3	3	4	4	4	4	5	8	4	4	4	4	4	4	4	3	4	4	4	68	25	13
HOM_8c_CAREVA0322_L004_N087	245	M	23/03/2022	27.8.c	5	4	3	5	3	3	4	4	4	5	6	8	4	4	4	4	5	4	5	3	4	4	4	50	26	18
HOM_8c_CAREVA0322_L006_N022	193	U	30/03/2022	27.8.c	2	2	1	2	2	2	2	2	2	2	2	4	2	2	2	1	2	2	2	2	2	2	2	86	27	9
HOM_8c_CAREVA0322_L006_N024	145	U	30/03/2022	27.8.c	1	1	0	1	1	1	1	2	2	2	1	4	1	1	1	1	1	1	1	1	1	1	1	77	61	38
HOM_8c_DEM21_L061_N003	260	F	04/10/2021	27.8.c	5	5	4	4	4	3	4	5	5	3	5	9	4	5	4	5	5	5	4	3	4	4	5	41	27	18
HOM_8c_DEM21_L092_N004	247	M	04/10/2021	27.8.c	4	4	3	4	4	3	4	4	4	3	4	5	4	4	4	4	4	4	3	3	4	4	4	73	13	10
HOM_8c_DEM21_L104_N005	252	M	07/11/2021	27.8.c	4	4	3	4	4	3	4	4	4	3	4	6	4	4	4	4	4	4	3	3	4	4	4	73	17	10
HOM_8c_DEM22_L023_N006	210	F	22/09/2022	27.8.c	2	3	2	2	3	2	3	3	3	2	2	7	2	2	3	3	3	2	2	3	3	3	3	50	39	24
HOM_8c_DEM22_L070_N009	125	U	05/10/2022	27.8.c	0	0	0	0	0	0	0	2	2	1	1	2	1	0	1	0	1	1	1	0	0	0	0	55	-	-
HOM_8c_PELACUS0422_L020_N033	254	M	27/04/2022	27.8.c	4	4	3	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	91	8	2
HOM_8c_PELACUS0422_L025_N032	224	M	29/04/2022	27.8.c	4	3	3	3	3	3	3	3	3	4	5	6	3	3	3	4	5	3	3	3	3	3	3	73	25	19
HOM_9aN_20240312_N041	255	F	12/03/2024	27.9.a	3	4	3	3	3	3	4	5	3	4	4	17	5	3	4	4	4	3	3	4	4	4	4	45	68	30
HOM_9aN_20240312_N091	260	F	12/03/2024	27.9.a	6	5	4	5	6	4	5	6	5	5	6	14	7	4	4	6	5	6	3	4	6	6	6	36	38	22
HOM_9aN_20240523_N006	228	F	23/05/2024	27.9.a	4	3	3	4	4	2	4	5	3	4	5	9	4	2	4	3	4	5	3	3	4	4	4	45	36	22
HOM_9aN_20240523_N008	219	F	23/05/2024	27.9.a	4	3	2	3	3	3	3	3	3	3	5	12	3	3	3	3	4	3	3	3	3	3	3	77	56	28
HOM_9aN_20240523_N010	226	F	23/05/2024	27.9.a	3	2	3	2	3	2	2	6	3	2	6	10	2	2	2	3	5	2	2	3	2	3	2	50	62	41
HOM_9aN_20240523_N020	217	M	23/05/2024	27.9.a	3	2	2	2	3	2	2	3	3	3	3	10	2	2	2	2	3	2	2	2	3	2	2	59	62	32
HOM_9aN_20240523_N024	235	M	23/05/2024	27.9.a	3	3	2	2	3	2	3	4	4	3	4	12	3	2	2	2	4	3	4	3	3	3	3	45	61	32
HOM_9aN_20240523_N029	246	M	23/05/2024	27.9.a	4	4	3	4	4	4	4	5	4	4	5	8	4	4	4	4	4	4	4	3	4	4	4	77	23	12
HOM_9aN_20240523_N035	243	F	23/05/2024	27.9.a	3	2	2	2	2	4	4	4	2	2	3	11	3	3	2	3	3	4	3	3	4	2	2	36	59	33
HOM_9aN_20240523_N048	234	M	23/05/2024	27.9.a	2	3	3	2	2	3	3	8	2	2	3	12	3	2	2	2	2	3	2	3	2	2	2	55	77	41
HOM_9aN_20240605_N013	156	F	05/06/2024	27.9.a	1	1	2	1	1	1	1	4	2	1	1	5	1	1	1	3	1	1	2	2	3	1	1	64	67	52
HOM_9aN_20240605_N014	157	F	05/06/2024	27.9.a	1	1	2	1	1	1	1	5	2	1	1	7	1	1	1	2	1	1	2	2	2	1	1	64	86	54
HOM_9aN_20240605_N020	149	F	05/06/2024	27.9.a	2	1	1	1	1	1	1	4	2	1	1	4	1	1	2	2	1	1	2	2	2	1	1	59	57	44
HOM_9aN_20240605_N023	147	U	05/06/2024	27.9.a	2	1	0	1	1	1	1	3	2	1	1	4	1	1	2	2	1	1	2	2	2	1	1	55	57	45
HOM_9aN_20240605_N028	163	U	05/06/2024	27.9.a	1	1	1	1	1	1	1	4	2	1	1	4	2	1	2	1	1	2	1	2	1	1	1	68	61	45
HOM_9aN_DEM24_L001_N007	110	U	20/09/2024	27.9.a	0	0	0	0	0	1	0	2	1	0	1	1	1	1	1	0	0	0	1	1	1	0	0	50	-	-
HOM_9aN_DEM24_L001_N019	184	F	20/09/2024	27.9.a	1	1	2	1	1	1	1	5	2	1	1	5	2	1	1	2	1	1	1	2	2	1	1	64	72	49
HOM_9aN_DEM24_L001_N027	182	F	20/09/2024	27.9.a	3	3	2	3	2	2	3	5	3	2	3	7	3	3	3	3	3	3	2	3	3	3	3	68	36	18
HOM_9aN_DEM24_L006_N030	191	M	21/09/2024	27.9.a	2	2	2	2	2	1	1	5	2	1	2	8	2	2	2	2	2	3	1	2	2	2	2	68	67	37
HOM_9aN_DEM24_L006_N031	225	F	21/09/2024	27.9.a	2	3	3	3	2	2	2	6	3	2	3	7	2	5	3	3	3	6	3	3	3	3	3	55	43	30
HOM_9aN_DEM24_L006_N033	258	F	21/09/2024	27.9.a	2	4	4	2	2	2	4	8	3	3	4	12	3	4	3	4	4	4	3	3	4	4	4	45	56	30
HOM_9aN_DEM24_L006_N035	246	M	21/09/2024	27.9.a	3	3	2	3	2	3	3	6	3	2	4	8	4	3	2	4	4	5	3	3	4	4	3	41	40	28
HOM_9aN_DEM24_L006_N036	265	M	21/09/2024	27.9.a	4	5	4	3	3	3	4	5	3	3	7	13	3	4	3	6	6	4	3	3	3	6	3	45	51	34
HOM_9aN_DEM24_L006_N037	268	F	21/09/2024	27.9.a	3	4	4	3	3	3	3	5	4	3	4	14	4	4	3	4	4	5	4	4	4	4	4	55	54	24
HOM_9aN_DEM24_L006_N040	275	M	21/09/2024	27.9.a	3	5	6	3	4	3	4	9	2	3	4	10	3	3	2	6	4	4	3	3	4	4	3	36	48	33
HOM_9aN_DEM24_L016_N013	185	F	23/09/2024	27.9.a	2	1	1	2	1	1	1	2	2	1	2	4	2	2	2	2	2	2	2	2	2	2	2	68	37	25
HOM_9aN_DEM24_L016_N019	205	F	23/09/2024	27.9.a	4	4	3	4	3	2	4	4	4	3	4	8	3	4	3	4	4	4	3	3	4	4	4	59	29	17

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	Modal age	PA %	CV %	APE %
HOM_9aN_DEM24_L016_N020	210	F	23/09/2024	27.9.a	4	3	3	2	2	2	3	4	3	2	3	11	3	4	3	3	3	3	3	3	3	3	3	64	55	27
HOM_9aN_DEM24_L016_N022	210	F	23/09/2024	27.9.a	2	2	3	2	2	2	2	7	3	2	4	8	2	4	2	4	4	3	3	3	3	3	2	41	50	34
HOM_9aN_DEM24_L017_N013	211	M	23/09/2024	27.9.a	2	3	2	2	2	2	3	3	3	2	3	6	2	3	2	3	3	3	2	2	3	2	2	50	34	24
HOM_GSA20_01	111	M	15/05/2024	20	0	0	0	0	0	1	0	1	1	0	1	3	0	0	1	0	0	1	0	0	1	0	0	64	-	-
HOM_GSA20_02	111	U	15/05/2024	20	0	0	0	0	0	1	0	2	1	1	1	3	1	1	1	0	1	1	1	1	1	0	1	55	97	73
HOM_GSA20_03	67	U	15/05/2024	20	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	82	-	-
HOM_GSA20_04	266	F	17/06/2024	20	4	6	5	3	3	5	4	7	3	3	6	11	3	6	3	5	6	4	6	4	4	6	3	27	39	29
HOM_GSA20_05	204	M	21/05/2024	20	5	7	3	3	2	6	3	8	2	3	8	14	4	5	3	7	7	4	6	4	4	-	3	24	54	40
HOM_GSA20_06	223	M	21/05/2024	20	2	1	2	1	1	3	1	13	2	2	2	7	3	1	2	2	2	1	2	2	2	2	2	55	104	56
HOM_GSA20_07	226	F	21/05/2024	20	2	2	2	2	1	3	2	2	2	2	2	4	3	2	2	2	2	1	2	2	2	2	2	77	29	16
HOM_GSA20_08	259	F	21/05/2024	20	4	6	5	4	2	7	4	7	3	4	6	9	4	6	3	5	6	4	3	3	6	4	4	32	35	29
HOM_GSA20_09	282	F	21/05/2024	20	4	4	4	3	2	6	4	4	3	4	4	8	4	5	3	4	4	4	3	3	4	4	4	59	30	16
HOM_GSA20_10	293	M	21/05/2024	20	6	6	7	4	4	7	5	5	-	4	6	8	5	4	3	5	6	4	4	3	4	5	4	33	27	21
HOM_GSA20_11	306	F	21/05/2024	20	5	7	7	4	4	7	4	12	2	5	5	8	7	5	4	6	5	5	5	4	7	5	5	36	36	26
HOM_GSA20_12	329	M	21/05/2024	20	7	7	7	4	3	7	5	8	2	3	4	11	5	5	3	6	4	-	6	4	8	6	7	19	39	32
HOM_GSA20_13	250	M	22/05/2024	20	7	7	5	3	3	6	5	9	2	3	6	9	5	6	3	6	6	5	7	3	7	4	3	23	37	30
HOM_GSA20_14	252	M	22/05/2024	20	3	4	4	3	3	7	4	3	3	3	5	8	4	3	2	4	5	-	4	3	3	3	3	48	37	26
HOM_GSA20_15	286	M	22/05/2024	20	5	5	4	4	4	6	4	7	3	4	5	6	5	4	3	4	5	4	6	3	4	4	4	45	24	19
HOM_GSA20_16	65	U	24/07/2024	20	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1	0	0	1	0	0	0	0	0	82	-	-
HOM_GSA20_17	92	U	24/07/2024	20	0	0	0	0	0	1	0	0	1	0	0	3	0	0	1	0	0	1	0	0	0	0	0	77	-	-
HOM_GSA20_18	81	U	17/07/2024	20	0	0	0	0	0	1	0	0	1	1	1	1	1	0	1	1	0	1	0	0	1	0	0	55	-	-
HOM_GSA20_19	102	M	24/07/2024	20	0	0	0	0	0	1	0	0	1	0	1	3	0	0	1	0	0	1	0	0	1	0	0	68	-	-
HOM_GSA20_20	121	M	24/07/2024	20	0	0	0	1	0	1	0	0	1	0	0	2	1	0	1	0	0	0	1	1	0	0	0	64	-	-
HOM_GSA20_21	112	U	24/07/2024	20	0	0	0	0	0	1	0	0	1	0	0	3	1	0	1	0	0	1	0	0	0	0	0	73	-	-
HOM_GSA20_22	147	F	18/07/2024	20	1	1	0	1	1	1	1	11	1	1	1	5	1	1	1	1	1	2	2	1	1	1	1	77	135	72
HOM_GSA20_23	161	F	18/07/2024	20	1	1	1	2	1	2	1	0	1	1	1	11	2	1	2	2	1	1	2	2	3	1	1	55	118	58
HOM_GSA20_24	182	F	21/07/2024	20	1	2	2	2	1	2	1	0	1	2	1	8	2	1	2	1	1	2	-	2	2	2	2	52	85	44
HOM_GSA20_25	206	F	21/07/2024	20	3	2	2	2	2	4	3	0	2	2	2	4	3	2	2	2	2	2	2	2	3	3	2	64	36	27
HOM_GSA20_26	226	F	21/07/2024	20	2	2	2	2	2	4	2	3	2	2	1	3	3	2	2	3	2	2	1	2	3	2	2	64	31	23
HOM_GSA20_27	247	F	21/07/2024	20	4	5	4	4	4	6	5	5	2	5	5	4	6	5	4	5	5	5	3	3	6	5	5	45	22	18
HOM_GSA20_28	277	F	23/10/2024	20	6	6	5	5	4	7	6	9	-	6	7	6	8	5	4	6	6	8	7	3	6	-	6	40	24	17
HOM_GSA20_29	297	F	29/10/2024	20	5	5	7	6	4	7	4	11	-	6	7	7	8	3	5	7	6	8	7	3	6	-	7	30	31	23
HOM_GSA20_30	305	F	29/10/2024	20	2	7	8	8	4	7	4	9	2	7	7	9	8	3	4	6	7	-	5	4	4	-	7	25	39	34
ICES_8_01	215	M	08/11/2005	8	4	5	4	2	3	4	4	6	3	6	7	8	4	3	4	5	-	-	4	4	4	4	4	50	32	24
ICES_8_02	225	F	08/11/2005	8	4	4	4	4	4	4	4	5	3	4	5	6	4	3	3	5	-	3	4	3	4	4	4	57	19	12
ICES_8_03	225	F	08/11/2005	8	4	4	4	4	4	4	4	4	5	4	5	7	4	4	4	4	-	4	4	4	4	4	4	86	17	10
ICES_8_04	225	F	08/11/2005	8	5	4	4	5	4	3	4	5	4	4	5	10	4	3	3	5	-	5	4	4	5	4	4	48	32	20
ICES_8_05	225	U	08/11/2005	8	5	5	3	4	4	5	5	6	3	4	6	8	5	3	4	7	-	7	5	4	4	5	5	33	28	21
ICES_8_06	225	F	08/11/2005	8	5	4	3	4	4	4	5	4	3	4	5	9	4	4	4	5	-	6	4	4	4	5	4	57	28	18
ICES_8_07	225	M	08/11/2005	8	5	4	4	4	4	4	4	7	5	4	7	11	4	4	4	4	-	6	5	4	4	4	4	67	35	24
ICES_8_08	225	M	08/11/2005	8	4	4	4	4	4	4	4	4	4	4	6	7	4	4	4	4	-	5	5	4	4	4	4	81	18	12
ICES_8_09	225	U	08/11/2005	8	5	5	3	5	4	4	5	5	5	4	5	7	4	5	4	5	-	5	4	4	4	5	5	52	17	14
ICES_8_10	225	F	08/11/2005	8	5	4	3	5	4	4	4	4	5	4	5	9	4	5	4	4	-	4	4	4	4	4	4	67	26	16
ICES_8_11	215	M	08/11/2005	8	5	4	3	5	4	4	4	4	4	4	5	7	4	4	3	4	-	3	3	4	4	4	4	62	22	13
ICES_8_12	225	F	08/11/2005	8	4	4	3	4	4	4	4	4	5	4	5	9	4	4	3	4	-	4	4	3	4	4	4	71	29	15
ICES_8_13	225	F	08/11/2005	8	5	4	4	5	4	4	4	5	5	4	6	9	4	4	4	5	-	4	5	4	4	5	4	57	25	16
ICES_8_14	225	M	08/11/2005	8	4	4	3	4	4	4	4	5	4	4	5	11	4	4	4	4	-	4	4	4	4	4	4	81	36	17
ICES_8_15	225	U	08/11/2005	8	3	2	3	2	3	3	5	3	2	2	5	15	3	2	2	3	-	3	4	3	3	3	3	52	79	40
ICES_8_16	225	M	08/11/2005	8	5	4	3	4	4	5	4	7	4	4	6	19	4	4	4	4	-	4	4	4	4	4	4	71	66	32
ICES_8_17	225	F	08/11/2005	8	5	4	3	5	4	4	4	5	4	4	5	11	4	4	4	5	-	5	4	4	4	5	4	57	34	19
ICES_8_18	225	F	08/11/2005	8	5	4	3	5	4	4	4	8	5	4	6	13	4	4	4	5	-	5	5	4	5	5	4	43	41	22
ICES_8_19	225	F	08/11/2005	8	4	4	4	4	4	4	4	4	3	4	5	12	4	4	3	5	-	4	4	4	4	4	4	76	41	19
ICES_8_20	215	F	08/11/2005	8	3	3	3	3	2	2	2	6	4	2	3	8	3	3	3	3	-	2	3	3	3	3	3	62	44	25
ICES_8_21	225	U	08/11/2005	8	4	4	3	4	4	4	4	5	4	4	6	15	4	4	4	5	-	4	6	4	4	4	4	71	51	26
ICES_8_22	225	M	08/11/2005	8	4	4	3	4	4	4	4	5	4	3	6	11	4	4	4	5	-	4	3	4	4	4	4	67	38	21
ICES_8_23	225	M	08/11/2005	8	5	4	4	5	4	4	4	11	5	4	5	9	4	4	4	4	-	5	6	4	4	4	4	62	37	23
ICES_8_24	225	M	08/11/2005	8	5	5	4	4	5	4	5	7	4	5	7	10	5	5	5	7	-	5	7	4	5	4	5	48	28	20

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	Modal age	PA %	CV %	APE %
ICES_8_25	225	M	08/11/2005	8	4	4	4	4	4	4	4	6	3	3	6	8	4	4	5	5	-	4	4	3	4	4	4	62	27	18
ICES_8_26	225	M	08/11/2005	8	5	4	4	4	4	4	4	6	5	4	5	16	4	4	4	4	-	4	5	4	4	4	4	71	54	25

Number of age readings by modal age

Table 6.3: 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.

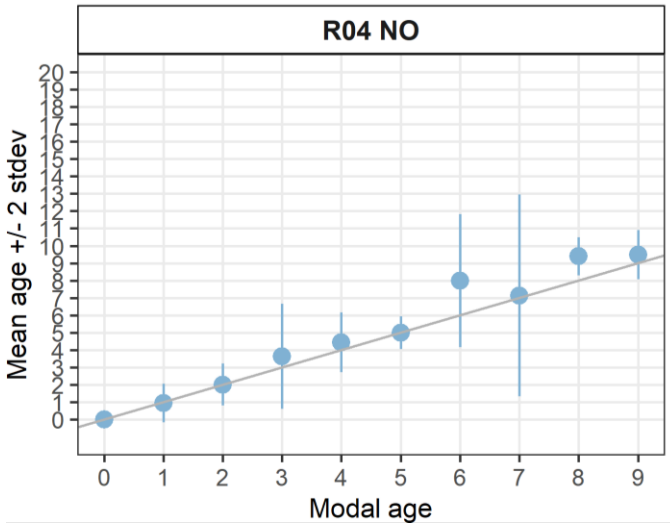
Modal age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	total
0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	220
1	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	14	17	17	17	17	16	370
2	34	34	34	34	34	34	34	34	34	34	33	34	34	34	34	34	28	30	31	34	34	32	732
3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	24	29	32	33	33	28	707
4	42	42	42	42	42	42	42	42	41	42	42	42	42	41	42	42	19	41	42	42	42	41	897
5	10	10	10	10	10	10	10	9	10	10	10	10	10	9	10	10	5	8	10	9	10	8	208
6	7	7	7	7	7	7	7	7	5	7	7	7	7	7	7	7	2	6	7	7	7	1	140
7	7	7	7	7	7	7	7	7	5	7	7	7	7	7	7	7	3	4	7	7	7	2	140
8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	4	5	5	5	0	99
9	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1	2	2	2	0	39
Total	**167**	**167**	**167**	**167**	**167**	**167**	**167**	**166**	**162**	**167**	**166**	**167**	**167**	**165**	**167**	**167**	**105**	**150**	**163**	**166**	**167**	**138**	**3552**

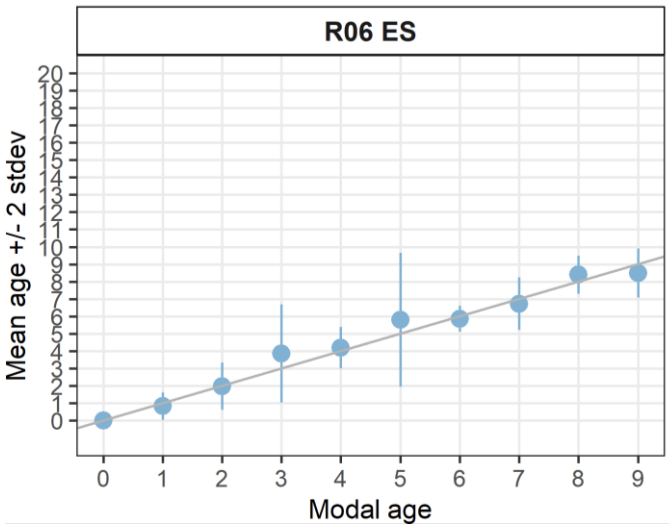
Number of age readings by age

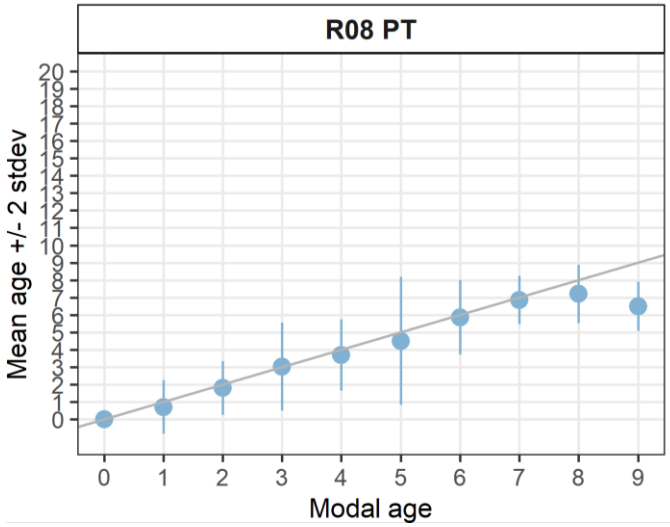
Table 6.4: Age composition by reader gives a summary of number of readings per reader and age. The total numbers of readings by age and by reader are also presented.

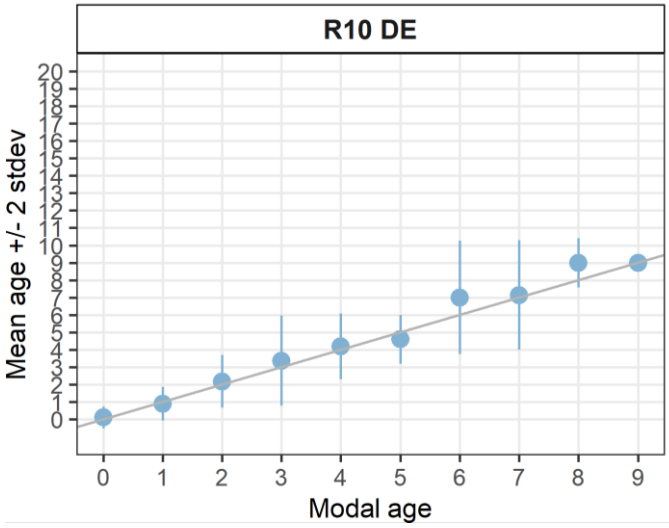
Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES	total
0	13	13	19	12	15	3	11	15	0	8	4	0	6	9	1	10	11	2	9	8	6	14	189
1	18	21	18	18	18	33	17	2	21	23	26	3	17	27	17	11	14	24	20	11	16	14	389
2	31	23	33	32	37	35	24	15	50	33	19	6	31	32	40	22	20	24	30	34	31	26	628
3	22	24	40	26	32	23	29	20	40	32	18	11	35	32	51	30	16	27	32	56	38	25	659
4	32	41	25	38	41	34	52	29	28	37	18	15	47	40	41	33	20	34	28	45	55	43	776
5	25	17	5	17	2	6	19	28	13	12	30	14	10	15	9	29	12	19	14	10	8	11	325
6	5	10	11	3	7	10	10	15	1	9	19	10	6	8	6	13	10	6	8	2	8	4	181
7	6	9	12	7	6	11	5	13	4	4	14	15	8	1	2	12	2	6	7	0	3	1	148
8	2	5	4	6	3	7	0	12	4	8	5	20	7	1	0	4	0	6	6	0	2	0	102
9	6	3	0	7	5	2	0	10	1	1	3	17	0	0	0	3	0	2	6	0	0	0	66
10	6	0	0	1	1	1	0	2	0	0	6	9	0	0	0	0	0	0	2	0	0	0	28
11	1	1	0	0	0	2	0	3	0	0	2	14	0	0	0	0	0	0	0	0	0	0	23
12	0	0	0	0	0	0	0	1	0	0	1	6	0	0	0	0	0	0	0	0	0	0	8
13	0	0	0	0	0	0	0	1	0	0	1	10	0	0	0	0	0	0	1	0	0	0	13
14	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5
15	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
16	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
18	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
19	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Total	**167**	**167**	**167**	**167**	**167**	**167**	**167**	**166**	**162**	**167**	**166**	**167**	**167**	**165**	**167**	**167**	**105**	**150**	**163**	**166**	**167**	**138**	**3552**

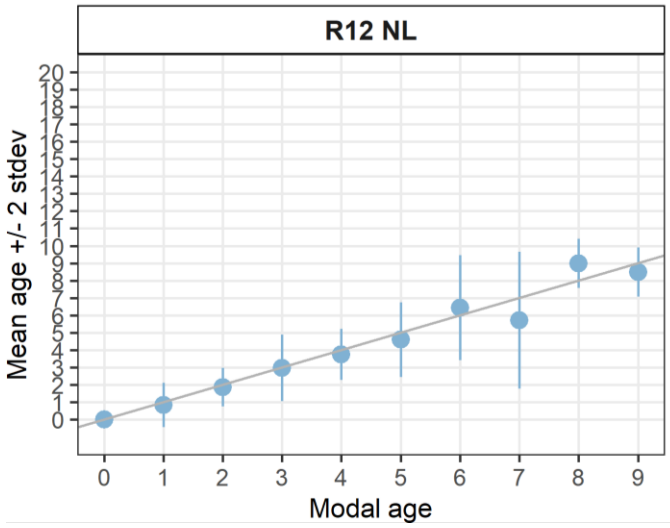
Separate age bias plots by reader

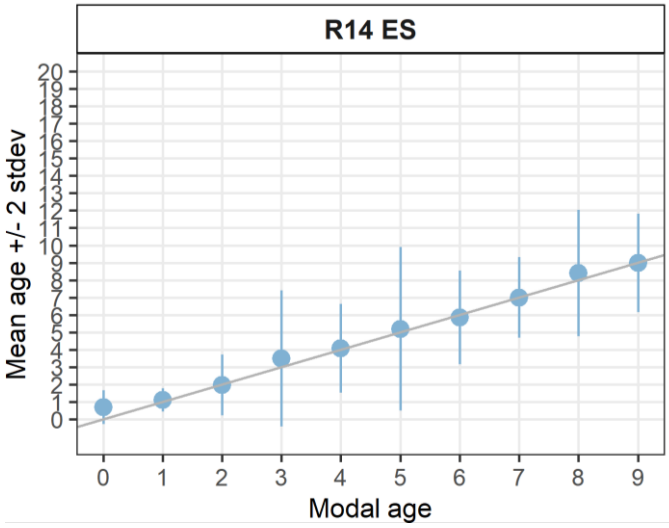


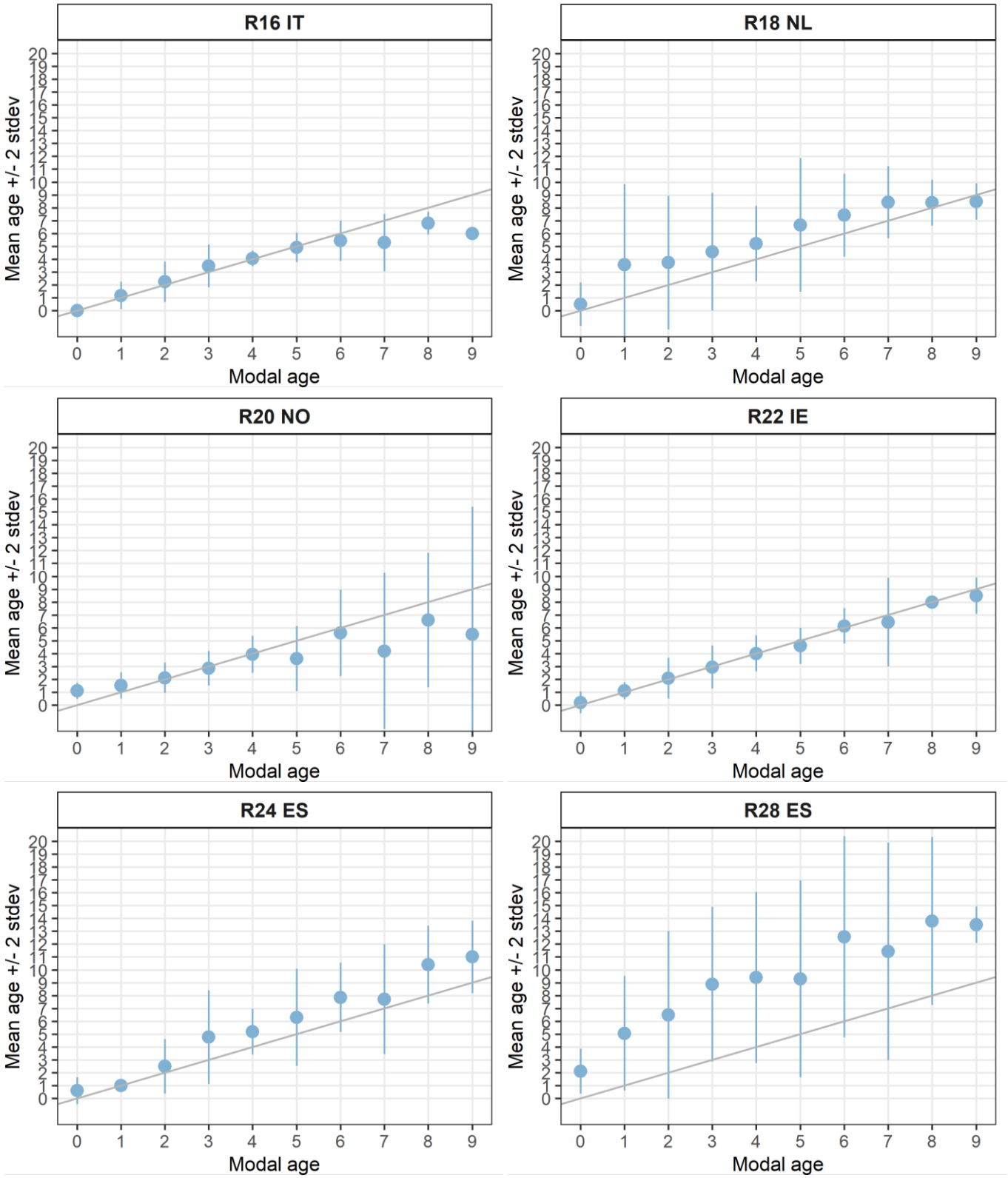


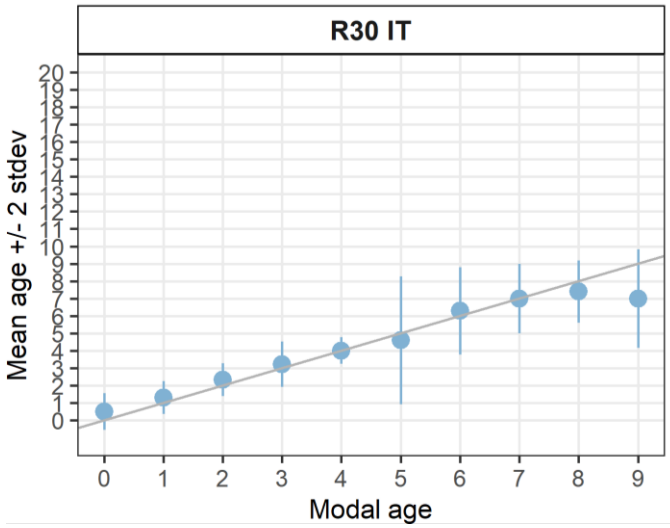


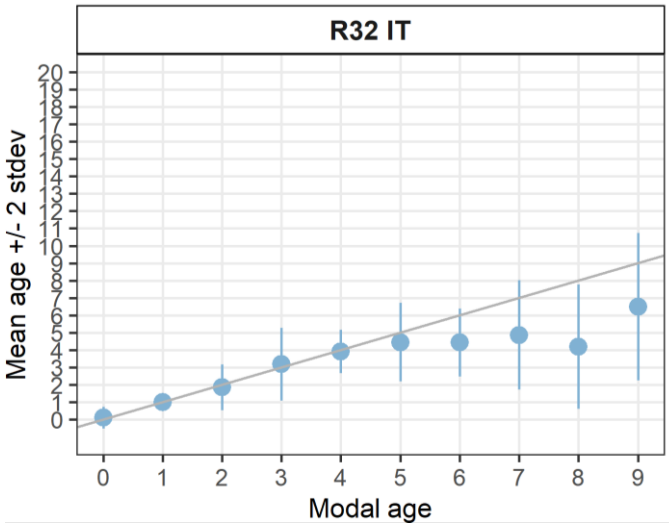


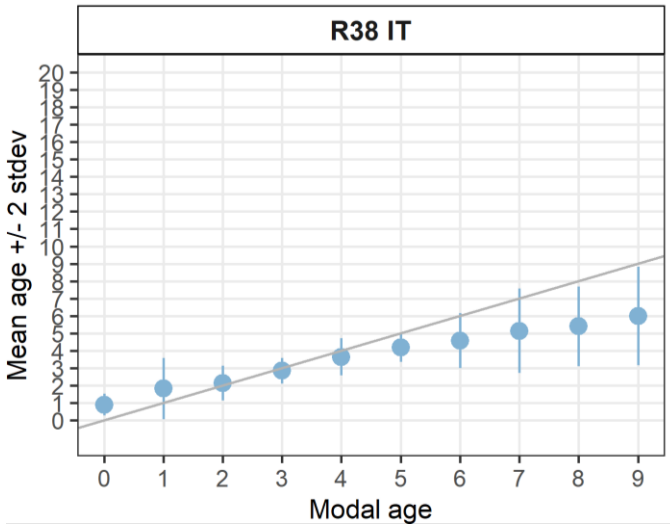


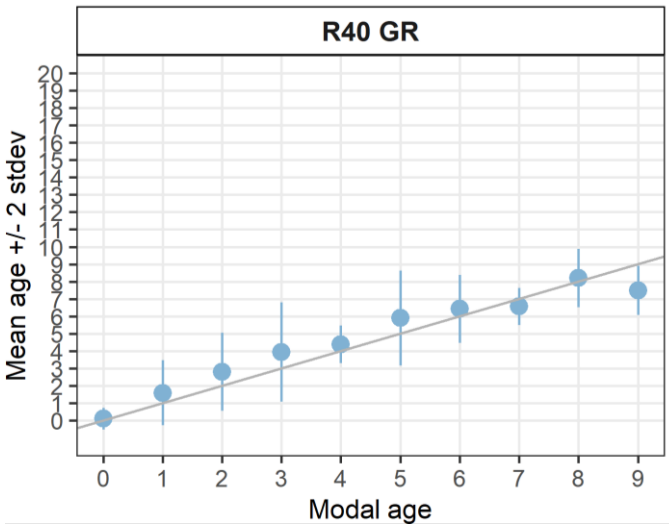


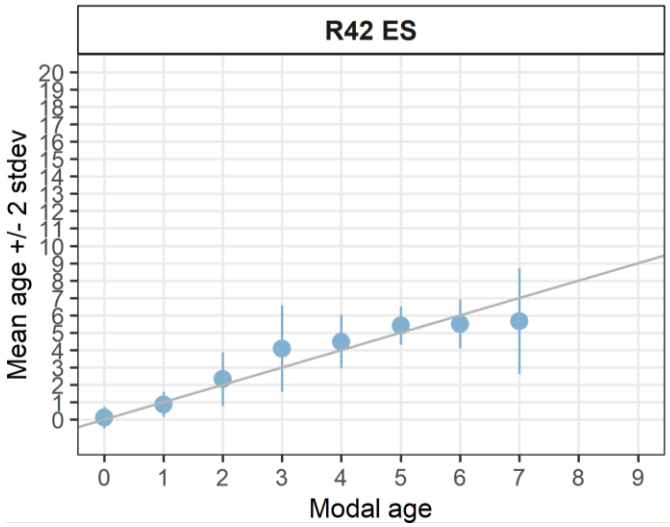

R16 IT
R18 NL
R20 NO
R22 IE
R24 ES
R28 ES
Mean age +/- 2 stdev
Modal age

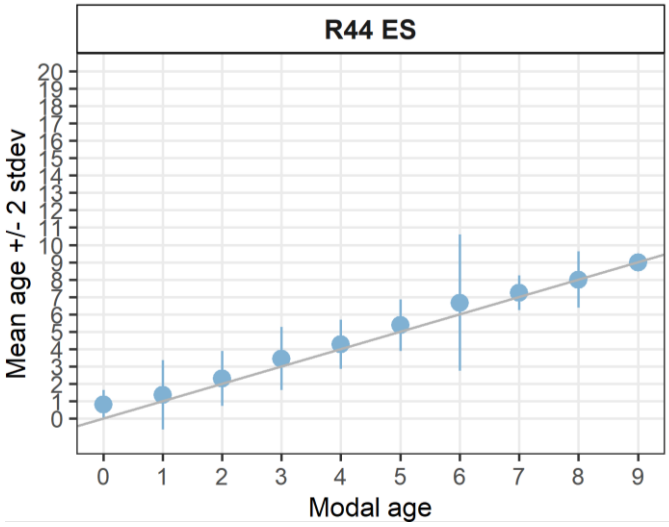

R30 IT
Mean age +/- 2 stdev
Modal age

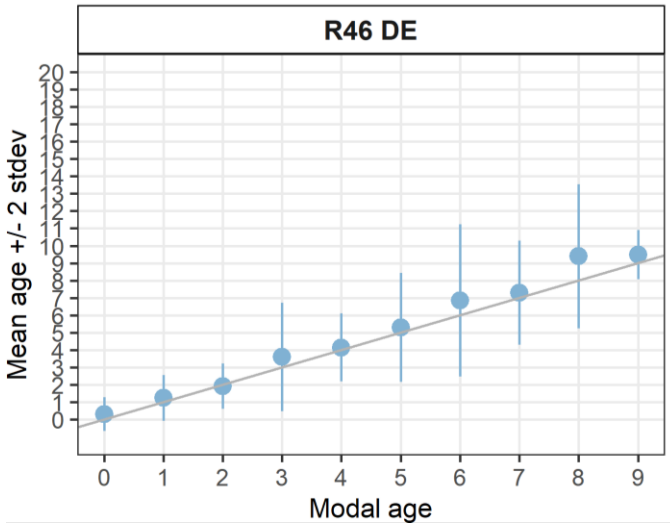

R32 IT
Mean age +/- 2 stdev
Modal age

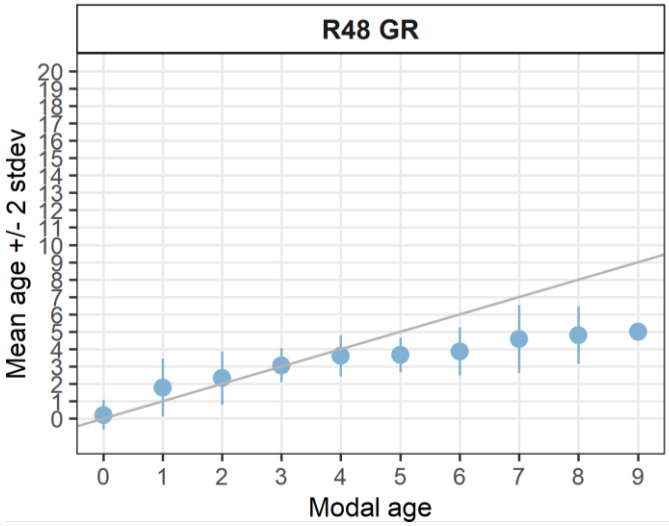

R38 IT
Mean age +/- 2 stdev
Modal age

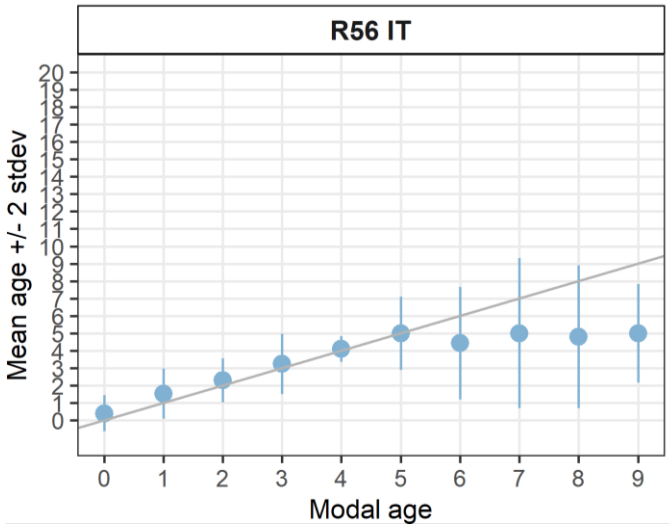

R40 GR
Mean age +/- 2 stdev
Modal age

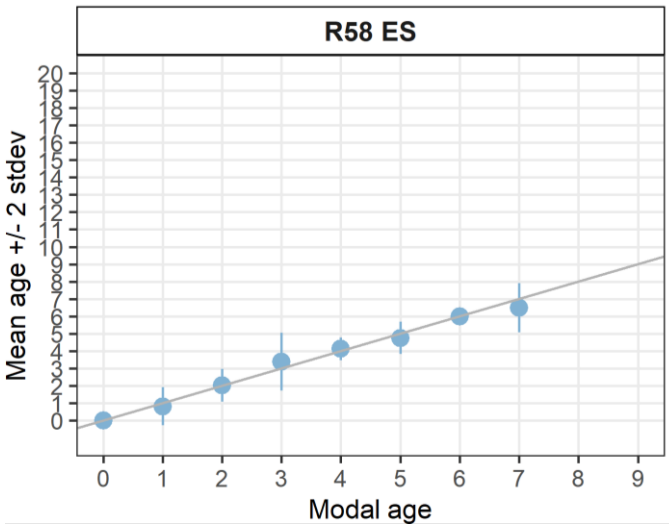

R42 ES
Mean age +/- 2 stdev
Modal age


R44 ES
Mean age +/- 2 stdev
Modal age


R46 DE
Mean age +/- 2 stdev
Modal age


R48 GR
Mean age +/- 2 stdev
Modal age


R56 IT
Mean age +/- 2 stdev
Modal age


R58 ES
Mean age +/- 2 stdev
Modal age

Statistics by modal age plot (STDEV, CV and PA)

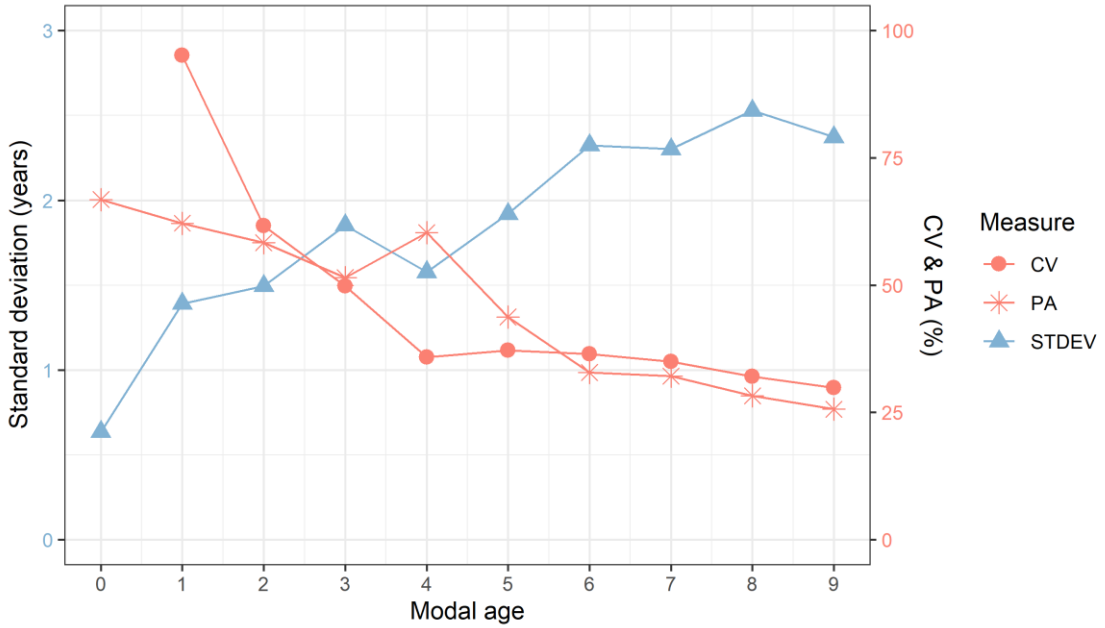


Figure 6.1: CV, PA and (STDEV (standard deviation) are plotted against modal age

Distribution of age reading errors

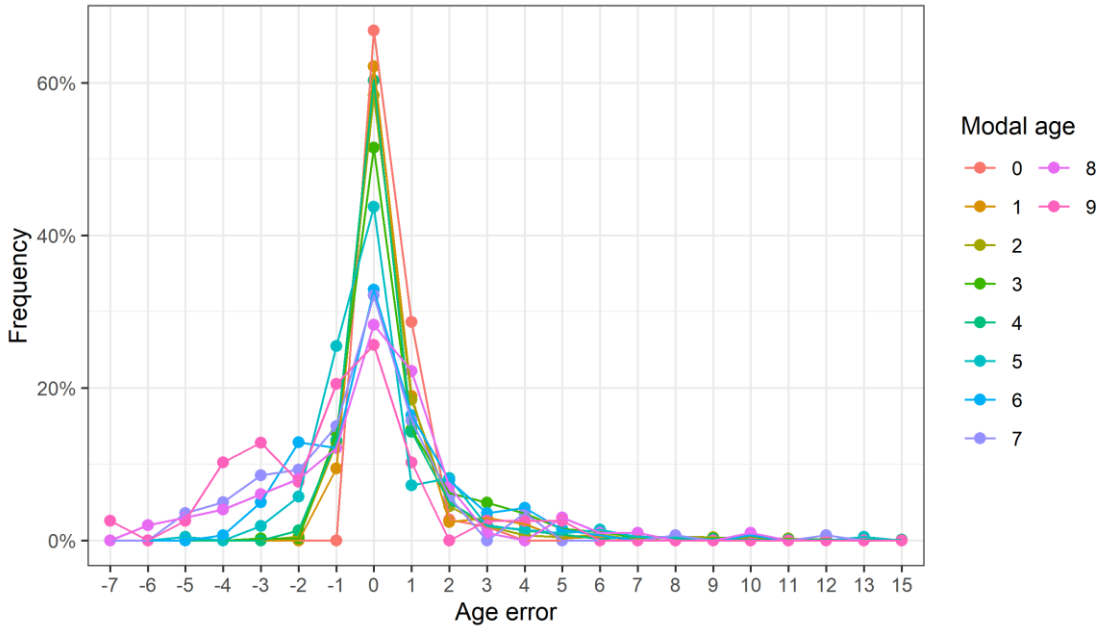


Figure 6.2: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias, if the age reading errors are normally distributed. The distributions are skewed, if relative bias occurs.

Relative bias for all readers

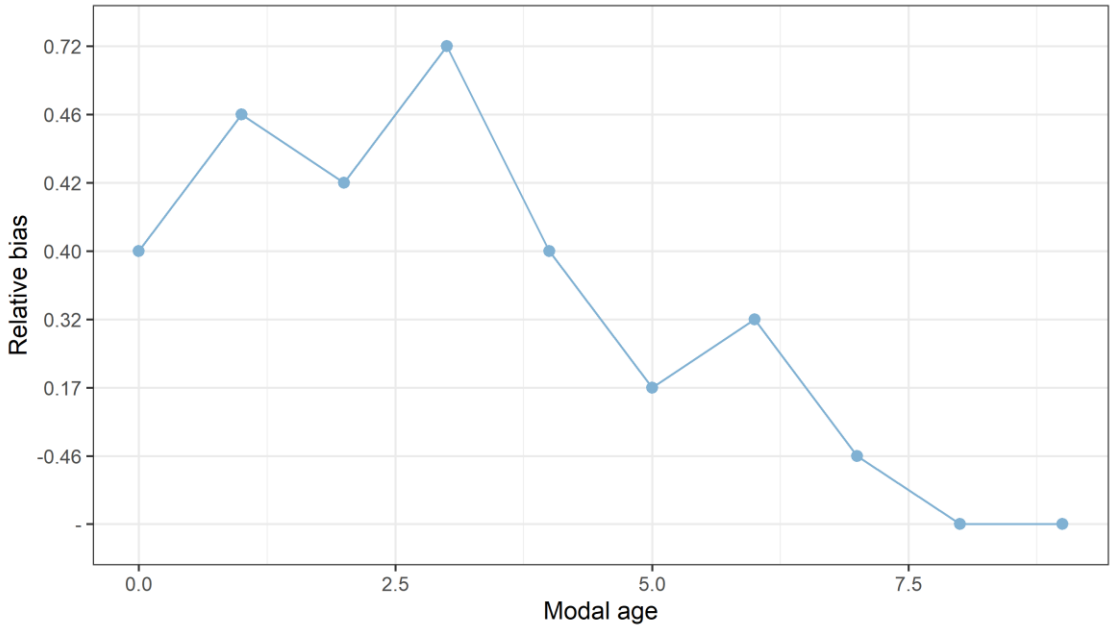


Figure 6.3: The relative bias by modal age as estimated by all age readers combined.

Mean length at age by reader

Table 6.5: Mean fish total length (mm) at age per reader is calculated per reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R42 ES	R44 ES	R46 DE	R48 GR	R56 IT	R58 ES
0	101	101	114	100	106	86	100	144	-	98	98	-	129	97	67	102	98	116	94	94	97	104
1	162	166	174	165	168	147	161	139	123	151	144	86	131	163	126	144	150	135	160	130	138	167
2	205	203	210	204	210	210	194	164	222	208	192	118	191	219	197	194	194	196	199	197	211	198
3	234	217	231	234	239	240	216	216	239	234	211	144	227	250	237	209	212	228	232	242	229	219
4	239	239	246	237	244	237	252	221	243	239	246	186	246	250	254	236	248	247	238	252	251	242
5	243	266	270	245	275	293	269	237	236	282	238	208	272	267	302	249	255	237	253	327	281	246
6	303	313	330	311	321	298	334	249	320	303	254	234	335	315	344	290	267	243	278	362	298	280
7	308	309	340	334	352	304	361	267	345	330	266	219	330	350	350	311	254	331	296	-	310	345
8	362	354	345	337	335	319	-	281	358	359	323	241	323	325	-	358	-	328	354	-	344	-
9	341	353	-	355	359	348	-	304	325	325	335	245	-	-	-	340	-	325	345	-	-	-
10	360	-	-	360	340	370	-	340	-	-	353	250	-	-	-	-	-	-	345	-	-	-
11	345	335	-	-	-	348	-	223	-	-	340	254	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	306	-	-	370	251	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	223	-	-	360	290	-	-	-	-	-	-	360	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	295	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	285	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	288	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	255	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	338	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	272	-	-	-	-	-	-	-	-	-	-
Weighted Mean	**228**	**228**	**228**	**228**	**228**	**228**	**228**	**227**	**226**	**228**	**228**	**228**	**228**	**227**	**228**	**228**	**206**	**222**	**228**	**227**	**228**	**210**

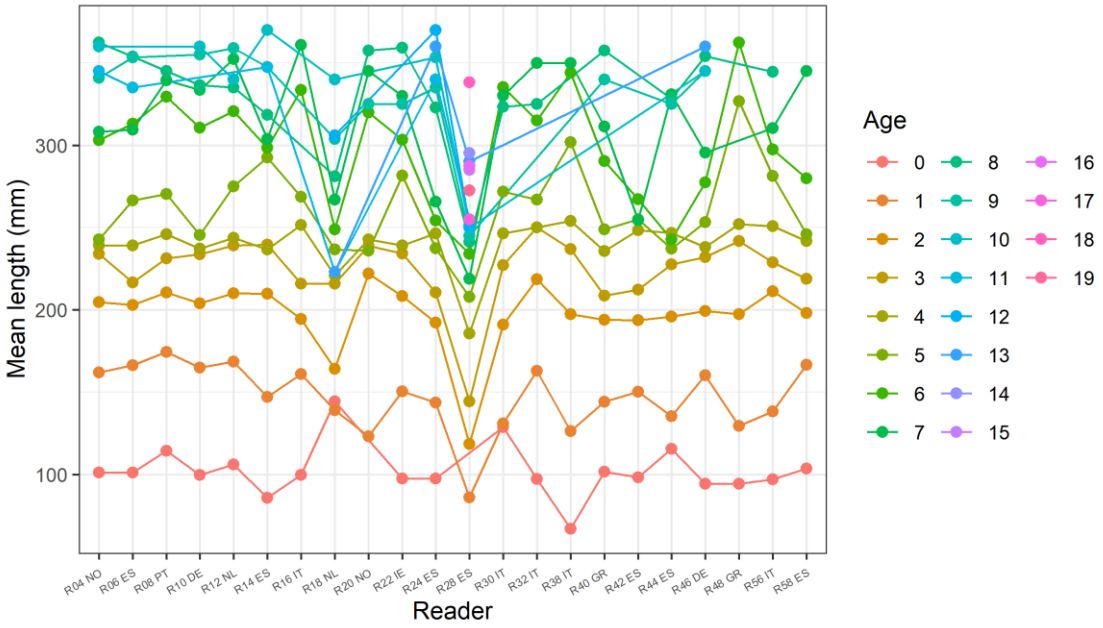


Figure 6.4: The mean fish length at age as estimated by each age reader.

6.1.2 Advanced readers – whole otoliths

Summary statistics

Table 6.6: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
167	41 %	56 %	26 %

Table 6.7: Data overview including modal age and statistics per sample.

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	Modal age	PA %	CV %	APE %
274A_2024_38301_003	350	F	31/01/2024	27.4.a	10	6	6	9	7	6	4	6	3	7	8	6	36	31	23
274A_2024_38301_004	300	M	31/01/2024	27.4.a	4	4	5	7	3	7	5	3	2	3	6	3	27	38	32
274A_2024_38301_007	340	M	31/01/2024	27.4.a	9	8	7	9	10	8	7	9	7	8	10	9	27	13	11
274A_2024_38301_009	340	M	31/01/2024	27.4.a	6	5	7	7	6	6	4	5	3	4	6	6	36	24	20
274A_2024_38301_013	355	F	31/01/2024	27.4.a	9	8	6	7	6	6	4	8	3	5	10	6	27	32	26
274A_2024_38301_014	350	F	31/01/2024	27.4.a	8	7	6	8	7	7	7	7	8	8	8	7	45	9	8
274A_2024_38301_015	375	M	31/01/2024	27.4.a	10	9	7	9	9	9	7	9	8	8	10	9	45	12	10
274A_2024_38301_023	325	M	31/01/2024	27.4.a	7	6	6	7	5	8	4	5	4	6	6	6	36	21	16
274A_2024_38304_009	250	F	12/02/2024	27.6.a	4	3	3	5	3	8	3	3	2	3	5	3	55	44	32
274A_2024_38304_011	320	M	12/02/2024	27.6.a	9	7	6	8	8	9	6	7	-	7	9	9	30	15	13
274A_2024_38304_021	325	M	12/02/2024	27.6.a	9	9	6	9	8	8	6	8	9	9	10	9	45	15	12
274A_2024_38304_023	320	M	12/02/2024	27.6.a	7	6	6	7	6	8	5	6	6	6	7	6	55	13	10
274A_2024_38304_025	290	M	12/02/2024	27.6.a	7	5	4	6	6	8	4	6	3	5	7	6	27	27	22
274A_2023_38309_007	335	M	20/01/2023	27.4.a	5	11	8	5	7	11	6	10	2	5	11	5	27	42	35
274A_2023_38309_011	360	M	20/01/2023	27.4.a	10	9	8	10	8	11	7	9	2	8	13	8	27	32	21
274A_2023_38309_013	375	M	20/01/2023	27.4.a	8	7	7	8	7	7	5	8	2	8	8	8	45	27	18
274A_2023_38309_015	370	M	20/01/2023	27.4.a	10	8	7	9	9	10	6	9	2	8	12	9	27	32	22
274A_2023_38309_016	380	M	20/01/2023	27.4.a	9	8	8	9	9	8	7	7	8	8	10	8	45	11	9
274A_2024_86650_002	360	F	19/09/2024	27.4.a	10	6	7	7	7	5	6	8	7	6	9	7	36	20	15
274A_2024_86650_003	325	F	19/09/2024	27.4.a	9	8	6	8	9	6	6	8	8	8	9	8	45	15	12
274A_2024_86650_007	345	F	19/09/2024	27.4.a	10	6	7	9	9	6	6	10	-	7	10	6	30	22	20
274A_2024_86650_010	345	F	19/09/2024	27.4.a	6	5	6	6	6	4	5	-	4	5	7	6	40	18	15
274A_2024_86650_019	335	F	19/09/2024	27.4.a	7	6	6	7	6	5	6	7	7	6	8	6	45	13	10
274A_2024_86650_029	345	F	19/09/2024	27.4.a	11	7	7	8	7	5	6	9	7	6	11	7	36	26	20
GSA11TT01	104	U	19/07/2016	11.1	0	0	0	0	0	1	1	0	1	1	1	0	55	-	-
GSA11TT02	115	U	19/07/2016	11.1	0	0	0	0	0	1	1	0	1	1	1	0	55	-	-
GSA11TT03	134	F	09/03/2020	11.1	1	1	0	1	0	1	1	2	1	1	1	1	73	59	36
GSA11TT04	175	F	09/03/2020	11.1	1	2	1	4	1	1	2	2	2	2	3	2	45	49	35
GSA11TT05	189	F	09/03/2020	11.1	2	3	1	3	2	1	3	4	3	3	3	3	55	37	30
GSA11TT06	182	F	09/03/2020	11.1	2	3	2	3	2	2	4	3	2	3	3	2	45	26	22
GSA11TT07	180	F	09/03/2020	11.1	2	1	1	4	2	1	3	4	2	3	2	2	36	49	39
GSA11TT08	216	F	09/03/2020	11.1	2	3	2	3	2	2	3	3	2	3	3	3	55	21	19
GSA11TT09	218	F	09/03/2020	11.1	2	2	2	3	2	1	3	4	2	3	3	2	45	33	28
GSA11TT10	136	M	09/03/2020	11.1	2	2	1	2	1	1	3	2	2	3	2	2	55	37	26
GSA11TT11	142	M	11/02/2016	11.1	1	1	0	1	0	1	2	9	1	1	1	1	64	153	86
GSA11TT12	140	M	14/12/2021	11.1	1	2	0	2	1	1	2	2	1	1	2	1	45	49	42
GSA11TT13	156	M	14/12/2023	11.1	1	1	1	2	2	1	2	5	1	1	2	1	55	69	46
GSA11TT14	168	M	14/12/2023	11.1	1	1	1	2	2	1	2	8	1	1	2	1	55	102	55
GSA11TT15	272	F	27/07/2020	11.1	4	4	4	4	3	4	4	4	4	4	5	4	82	11	5
GSA11TT16	172	F	28/03/2025	11.1	1	1	1	1	2	1	2	2	2	2	1	1	55	36	34
GSA11TT17	179	M	28/03/2025	11.1	1	1	1	1	2	2	2	7	2	1	1	1	55	92	52
GSA11TT21	260	M	02/04/2025	11.1	3	4	3	3	2	2	4	0	2	5	-	3	30	50	37
GSA11TT22	247	F	02/04/2025	11.1	4	4	3	4	3	3	5	0	3	4	5	4	36	40	28
GSA11TT23	207	F	02/04/2025	11.1	2	2	1	3	2	2	3	2	2	2	5	2	64	43	30
GSA11TT24	235	F	02/04/2025	11.1	3	3	2	3	3	2	3	3	3	2	7	3	64	44	23
GSA11TT25	214	F	02/04/2025	11.1	2	2	2	2	2	2	3	2	2	2	3	2	82	19	14

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	Modal age	PA %	CV %	APE %
GSA11TT26	167	F	02/04/2025	11.1	1	1	1	1	1	1	2	1	1	1	1	1	91	28	15
GSA11TT27	188	F	02/04/2025	11.1	1	1	1	1	2	2	2	3	2	2	2	2	55	37	31
GSA11TT28	249	M	02/04/2025	11.1	3	3	3	5	3	3	5	0	2	3	5	3	55	46	31
GSA11TT29	182	M	02/04/2025	11.1	2	3	2	4	3	2	3	4	2	2	4	2	45	31	26
GSA11TT30	190	M	02/04/2025	11.1	2	1	1	2	1	2	2	2	2	2	3	2	64	33	25
HOM_8c_20210901_N106	256	F	01/09/2021	27.8.c	3	4	2	3	4	2	3	4	4	3	3	3	45	24	19
HOM_8c_20211104_N005	195	M	04/11/2021	27.8.c	2	2	2	1	2	1	1	3	2	2	1	2	55	37	31
HOM_8c_20211104_N031	208	F	04/11/2021	27.8.c	3	3	2	2	3	2	3	3	3	2	3	3	64	19	18
HOM_8c_20221013_N021	207	F	13/10/2022	27.8.c	3	3	2	2	3	2	3	3	3	2	3	3	64	19	18
HOM_8c_20221013_N083	201	M	13/10/2022	27.8.c	2	2	2	1	2	2	2	3	2	1	2	2	73	28	17
HOM_8c_20240425_N008	256	F	25/04/2024	27.8.c	5	4	4	5	4	4	5	6	4	6	7	4	45	21	17
HOM_8c_20240731_N022	265	M	31/07/2024	27.8.c	3	5	4	3	3	4	3	5	2	3	6	3	45	32	26
HOM_8c_20240801_N042	219	M	01/08/2024	27.8.c	2	2	3	2	2	2	2	5	3	2	2	2	73	38	27
HOM_8c_20240801_N058	233	M	01/08/2024	27.8.c	2	2	2	2	2	2	2	5	3	2	2	2	82	39	25
HOM_8c_20240801_N071	210	F	01/08/2024	27.8.c	2	3	3	2	2	2	2	6	3	2	2	2	64	46	31
HOM_8c_20240801_N074	216	M	01/08/2024	27.8.c	3	4	3	3	3	3	3	8	3	3	7	3	73	46	34
HOM_8c_CAREVA0322_L001_N029	260	M	20/03/2022	27.8.c	4	4	3	4	4	4	4	4	5	4	4	4	82	11	5
HOM_8c_CAREVA0322_L001_N046	222	F	20/03/2022	27.8.c	4	3	2	4	3	3	3	4	4	4	4	4	55	20	17
HOM_8c_CAREVA0322_L001_N057	183	F	20/03/2022	27.8.c	2	2	1	2	2	2	2	4	3	3	2	2	64	35	25
HOM_8c_CAREVA0322_L001_N078	211	F	20/03/2022	27.8.c	4	3	2	4	3	3	3	7	4	4	4	4	45	34	23
HOM_8c_CAREVA0322_L004_N018	246	M	23/03/2022	27.8.c	4	4	2	4	3	3	4	6	4	4	4	4	64	26	16
HOM_8c_CAREVA0322_L004_N042	249	M	23/03/2022	27.8.c	5	5	3	5	4	4	5	5	4	5	7	5	55	21	15
HOM_8c_CAREVA0322_L004_N043	261	F	23/03/2022	27.8.c	5	5	3	5	4	4	5	5	5	5	5	5	73	15	11
HOM_8c_CAREVA0322_L004_N064	205	F	23/03/2022	27.8.c	3	2	2	3	2	2	2	3	2	3	2	2	64	21	20
HOM_8c_CAREVA0322_L004_N080	232	F	23/03/2022	27.8.c	5	4	3	4	3	3	4	4	4	4	5	4	55	18	13
HOM_8c_CAREVA0322_L004_N087	245	M	23/03/2022	27.8.c	5	4	3	5	3	3	4	4	4	5	6	4	36	23	19
HOM_8c_CAREVA0322_L006_N022	193	U	30/03/2022	27.8.c	2	2	1	2	2	2	2	2	2	2	2	2	91	16	9
HOM_8c_CAREVA0322_L006_N024	145	U	30/03/2022	27.8.c	1	1	0	1	1	1	1	2	2	2	1	1	64	51	38
HOM_8c_DEM21_L061_N003	260	F	04/10/2021	27.8.c	5	5	4	4	4	3	4	5	5	3	5	5	45	18	15
HOM_8c_DEM21_L092_N004	247	M	04/10/2021	27.8.c	4	4	3	4	4	3	4	4	4	3	4	4	73	13	11
HOM_8c_DEM21_L104_N005	252	M	07/11/2021	27.8.c	4	4	3	4	4	3	4	4	4	3	4	4	73	13	11
HOM_8c_DEM22_L023_N006	210	F	22/09/2022	27.8.c	2	3	2	2	3	2	3	3	3	2	2	2	55	21	20
HOM_8c_DEM22_L070_N009	125	U	05/10/2022	27.8.c	0	0	0	0	0	0	0	2	2	1	1	0	64	-	-
HOM_8c_PELACUS0422_L020_N033	254	M	27/04/2022	27.8.c	4	4	3	4	4	4	4	4	4	4	4	4	91	8	4
HOM_8c_PELACUS0422_L025_N032	224	M	29/04/2022	27.8.c	4	3	3	3	3	3	3	3	3	4	5	3	73	20	16
HOM_9aN_20240312_N041	255	F	12/03/2024	27.9.a	3	4	3	3	3	3	4	5	3	4	4	3	55	19	17
HOM_9aN_20240312_N091	260	F	12/03/2024	27.9.a	6	5	4	5	6	4	5	6	5	5	6	5	45	14	11
HOM_9aN_20240523_N006	228	F	23/05/2024	27.9.a	4	3	3	4	4	2	4	5	3	4	5	4	45	24	19
HOM_9aN_20240523_N008	219	F	23/05/2024	27.9.a	4	3	2	3	3	3	3	3	3	3	5	3	73	24	15
HOM_9aN_20240523_N010	226	F	23/05/2024	27.9.a	3	2	3	2	3	2	2	6	3	2	6	2	45	49	34
HOM_9aN_20240523_N020	217	M	23/05/2024	27.9.a	3	2	2	2	3	2	2	3	3	3	3	3	55	21	19
HOM_9aN_20240523_N024	235	M	23/05/2024	27.9.a	3	3	2	2	3	2	3	4	4	3	4	3	45	26	18
HOM_9aN_20240523_N029	246	M	23/05/2024	27.9.a	4	4	3	4	4	4	4	5	4	4	5	4	73	13	8
HOM_9aN_20240523_N035	243	F	23/05/2024	27.9.a	3	2	2	2	2	4	4	4	2	2	3	2	55	33	29
HOM_9aN_20240523_N048	234	M	23/05/2024	27.9.a	2	3	3	2	2	3	3	8	2	2	3	2	45	58	30
HOM_9aN_20240605_N013	156	F	05/06/2024	27.9.a	1	1	2	1	1	1	1	4	2	1	1	1	73	64	45
HOM_9aN_20240605_N014	157	F	05/06/2024	27.9.a	1	1	2	1	1	1	1	5	2	1	1	1	73	79	51
HOM_9aN_20240605_N020	149	F	05/06/2024	27.9.a	2	1	1	1	1	1	1	4	2	1	1	1	73	64	45
HOM_9aN_20240605_N023	147	U	05/06/2024	27.9.a	2	1	0	1	1	1	1	3	2	1	1	1	64	62	45
HOM_9aN_20240605_N028	163	U	05/06/2024	27.9.a	1	1	1	1	1	1	1	4	2	1	1	1	82	68	44

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	Modal age	PA %	CV %	APE %
HOM_9aN_DEM24_L001_N007	110	U	20/09/2024	27.9.a	0	0	0	0	0	1	0	2	1	0	1	0	64	-	-
HOM_9aN_DEM24_L001_N019	184	F	20/09/2024	27.9.a	1	1	2	1	1	1	1	5	2	1	1	1	73	79	51
HOM_9aN_DEM24_L001_N027	182	F	20/09/2024	27.9.a	3	3	2	3	2	2	3	5	3	2	3	3	55	31	21
HOM_9aN_DEM24_L006_N030	191	M	21/09/2024	27.9.a	2	2	2	2	2	1	1	5	2	1	2	2	64	55	27
HOM_9aN_DEM24_L006_N031	225	F	21/09/2024	27.9.a	2	3	3	3	2	2	2	6	3	2	3	2	45	41	26
HOM_9aN_DEM24_L006_N033	258	F	21/09/2024	27.9.a	2	4	4	2	2	2	4	8	3	3	4	2	36	51	35
HOM_9aN_DEM24_L006_N035	246	M	21/09/2024	27.9.a	3	3	2	3	2	3	3	6	3	2	4	3	55	37	22
HOM_9aN_DEM24_L006_N036	265	M	21/09/2024	27.9.a	4	5	4	3	3	3	4	5	3	3	7	3	45	32	23
HOM_9aN_DEM24_L006_N037	268	F	21/09/2024	27.9.a	3	4	4	3	3	3	3	5	4	3	4	3	55	19	17
HOM_9aN_DEM24_L006_N040	275	M	21/09/2024	27.9.a	3	5	6	3	4	3	4	9	2	3	4	3	36	46	32
HOM_9aN_DEM24_L016_N013	185	F	23/09/2024	27.9.a	2	1	1	2	1	1	1	2	2	1	2	1	55	36	34
HOM_9aN_DEM24_L016_N019	205	F	23/09/2024	27.9.a	4	4	3	4	3	2	4	4	4	3	4	4	64	19	16
HOM_9aN_DEM24_L016_N020	210	F	23/09/2024	27.9.a	4	3	3	2	2	2	3	4	3	2	3	3	45	27	21
HOM_9aN_DEM24_L016_N022	210	F	23/09/2024	27.9.a	2	2	3	2	2	2	2	7	3	2	4	2	64	55	37
HOM_9aN_DEM24_L017_N013	211	M	23/09/2024	27.9.a	2	3	2	2	2	2	3	3	3	2	3	2	55	21	20
HOM_GSA20_01	111	M	15/05/2024	20	0	0	0	0	0	1	0	1	1	0	1	0	64	-	-
HOM_GSA20_02	111	U	15/05/2024	20	0	0	0	0	0	1	0	2	1	1	1	0	55	-	-
HOM_GSA20_03	67	U	15/05/2024	20	0	0	0	0	0	0	0	0	1	0	1	0	82	-	-
HOM_GSA20_04	266	F	17/06/2024	20	4	6	5	3	3	5	4	7	3	3	6	3	36	32	27
HOM_GSA20_05	204	M	21/05/2024	20	5	7	3	3	2	6	3	8	2	3	8	3	36	51	45
HOM_GSA20_06	223	M	21/05/2024	20	2	1	2	1	1	3	1	13	2	2	2	2	45	127	70
HOM_GSA20_07	226	F	21/05/2024	20	2	2	2	2	1	3	2	2	2	2	2	2	82	22	9
HOM_GSA20_08	259	F	21/05/2024	20	4	6	5	4	2	7	4	7	3	4	6	4	36	34	28
HOM_GSA20_09	282	F	21/05/2024	20	4	4	4	3	2	6	4	4	3	4	4	4	64	26	16
HOM_GSA20_10	293	M	21/05/2024	20	6	6	7	4	4	7	5	5	-	4	6	6	30	22	19
HOM_GSA20_11	306	F	21/05/2024	20	5	7	7	4	4	7	4	12	2	5	5	7	27	46	34
HOM_GSA20_12	329	M	21/05/2024	20	7	7	7	4	3	7	5	8	2	3	4	7	36	40	35
HOM_GSA20_13	250	M	22/05/2024	20	7	7	5	3	3	6	5	9	2	3	6	3	27	43	34
HOM_GSA20_14	252	M	22/05/2024	20	3	4	4	3	3	7	4	3	3	3	5	3	55	33	23
HOM_GSA20_15	286	M	22/05/2024	20	5	5	4	4	4	6	4	7	3	4	5	4	45	24	19
HOM_GSA20_16	65	U	24/07/2024	20	0	0	0	0	0	0	0	0	1	0	0	0	91	-	-
HOM_GSA20_17	92	U	24/07/2024	20	0	0	0	0	0	1	0	0	1	0	0	0	82	-	-
HOM_GSA20_18	81	U	17/07/2024	20	0	0	0	0	0	1	0	0	1	1	1	0	64	-	-
HOM_GSA20_19	102	M	24/07/2024	20	0	0	0	0	0	1	0	0	1	0	1	0	73	-	-
HOM_GSA20_20	121	M	24/07/2024	20	0	0	0	1	0	1	0	0	1	0	0	0	73	-	-
HOM_GSA20_21	112	U	24/07/2024	20	0	0	0	0	0	1	0	0	1	0	0	0	82	-	-
HOM_GSA20_22	147	F	18/07/2024	20	1	1	0	1	1	1	1	11	1	1	1	1	82	168	92
HOM_GSA20_23	161	F	18/07/2024	20	1	1	1	2	1	2	1	0	1	1	1	1	73	49	30
HOM_GSA20_24	182	F	21/07/2024	20	1	2	2	2	1	2	1	0	1	2	1	2	45	49	42
HOM_GSA20_25	206	F	21/07/2024	20	3	2	2	2	2	4	3	0	2	2	2	2	64	45	29
HOM_GSA20_26	226	F	21/07/2024	20	2	2	2	2	2	4	2	3	2	2	1	2	73	34	22
HOM_GSA20_27	247	F	21/07/2024	20	4	5	4	4	4	6	5	5	2	5	5	5	45	23	17
HOM_GSA20_28	277	F	23/10/2024	20	6	6	5	5	4	7	6	9	-	6	7	6	40	22	15
HOM_GSA20_29	297	F	29/10/2024	20	5	5	7	6	4	7	4	11	-	6	7	7	30	33	23
HOM_GSA20_30	305	F	29/10/2024	20	2	7	8	8	4	7	4	9	2	7	7	7	36	42	36
ICES_8_01	215	M	08/11/2005	8	4	5	4	2	3	4	4	6	3	6	7	4	36	34	27
ICES_8_02	225	F	08/11/2005	8	4	4	4	4	4	4	4	5	3	4	5	4	73	13	8
ICES_8_03	225	F	08/11/2005	8	4	4	4	4	4	4	4	4	5	4	5	4	82	10	7
ICES_8_04	225	F	08/11/2005	8	5	4	4	5	4	3	4	5	4	4	5	4	55	15	12
ICES_8_05	225	U	08/11/2005	8	5	5	3	4	4	5	5	6	3	4	6	5	36	23	19

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	Modal age	PA %	CV %	APE %
ICES_8_06	225	F	08/11/2005	8	5	4	3	4	4	4	5	4	3	4	5	4	55	17	12
ICES_8_07	225	M	08/11/2005	8	5	4	4	4	4	4	4	7	5	4	7	4	64	25	20
ICES_8_08	225	M	08/11/2005	8	4	4	4	4	4	4	4	4	4	4	6	4	91	14	8
ICES_8_09	225	U	08/11/2005	8	5	5	3	5	4	4	5	5	5	4	5	5	64	15	13
ICES_8_10	225	F	08/11/2005	8	5	4	3	5	4	4	4	4	5	4	5	4	55	15	12
ICES_8_11	215	M	08/11/2005	8	5	4	3	5	4	4	4	4	4	4	5	4	64	14	11
ICES_8_12	225	F	08/11/2005	8	4	4	3	4	4	4	4	4	5	4	5	4	73	13	8
ICES_8_13	225	F	08/11/2005	8	5	4	4	5	4	4	4	5	5	4	6	4	55	15	13
ICES_8_14	225	M	08/11/2005	8	4	4	3	4	4	4	4	5	4	4	5	4	73	13	8
ICES_8_15	225	U	08/11/2005	8	3	2	3	2	3	3	5	3	2	2	5	3	45	37	24
ICES_8_16	225	M	08/11/2005	8	5	4	3	4	4	5	4	7	4	4	6	4	55	25	19
ICES_8_17	225	F	08/11/2005	8	5	4	3	5	4	4	4	5	4	4	5	4	55	15	12
ICES_8_18	225	F	08/11/2005	8	5	4	3	5	4	4	4	8	5	4	6	4	45	29	21
ICES_8_19	225	F	08/11/2005	8	4	4	4	4	4	4	4	4	3	4	5	4	82	11	5
ICES_8_20	215	F	08/11/2005	8	3	3	3	3	2	2	2	6	4	2	3	3	45	39	24
ICES_8_21	225	U	08/11/2005	8	4	4	3	4	4	4	4	5	4	4	6	4	73	18	11
ICES_8_22	225	M	08/11/2005	8	4	4	3	4	4	4	4	5	4	3	6	4	64	20	13
ICES_8_23	225	M	08/11/2005	8	5	4	4	5	4	4	4	11	5	4	5	4	55	41	22
ICES_8_24	225	M	08/11/2005	8	5	5	4	4	5	4	5	7	4	5	7	5	45	22	15
ICES_8_25	225	M	08/11/2005	8	4	4	4	4	4	4	4	6	3	3	6	4	64	23	16
ICES_8_26	225	M	08/11/2005	8	5	4	4	4	4	4	4	6	5	4	5	4	64	15	13

List of multimodal cases

Table 6.8: List of cases for which multiple modes where obtained when all readers are considered. The column NModes_trad shows the number of multiple modes for each SampleID when all readers are given the same expertise weight.

NModes_trad	SampleID
2	274A_2023_38309_007
3	274A_2024_38301_007
2	274A_2024_38301_014
2	274A_2024_38304_011
2	274A_2024_86650_007
2	GSA11TT06
2	GSA11TT12
2	GSA11TT21
2	GSA11TT22
2	HOM_9aN_20240523_N048
2	HOM_9aN_DEM24_L006_N031
2	HOM_9aN_DEM24_L006_N033
2	HOM_GSA20_10
3	HOM_GSA20_11
2	**HOM_GSA20_24**

Number of age readings by modal age

Table 6.9: 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.

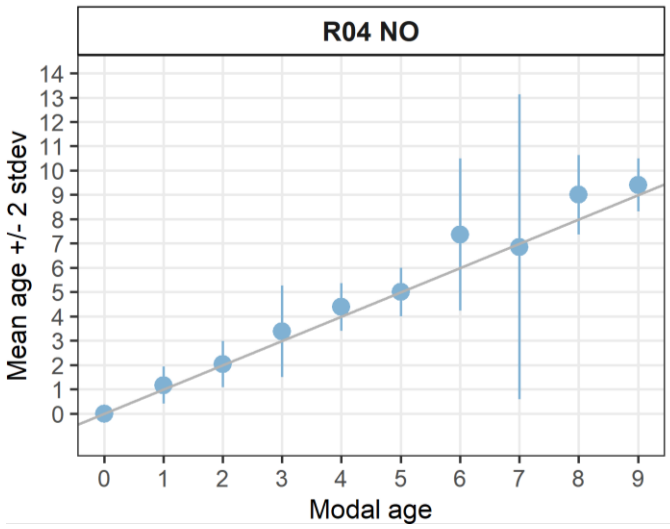
Modal age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	total
0	13	13	13	13	13	13	13	13	13	13	13	**143**
1	18	18	18	18	18	18	18	18	18	18	18	**198**
2	32	32	32	32	32	32	32	32	32	32	32	**352**
3	29	29	29	29	29	29	29	29	29	29	28	**318**
4	39	39	39	39	39	39	39	39	39	39	39	**429**
5	9	9	9	9	9	9	9	9	9	9	9	**99**
6	11	11	11	11	11	11	11	10	8	11	11	**117**
7	7	7	7	7	7	7	7	7	6	7	7	**76**
8	4	4	4	4	4	4	4	4	4	4	4	**44**
9	5	5	5	5	5	5	5	5	4	5	5	**54**
Total	**167**	**167**	**167**	**167**	**167**	**167**	**167**	**166**	**162**	**167**	**166**	**1830**

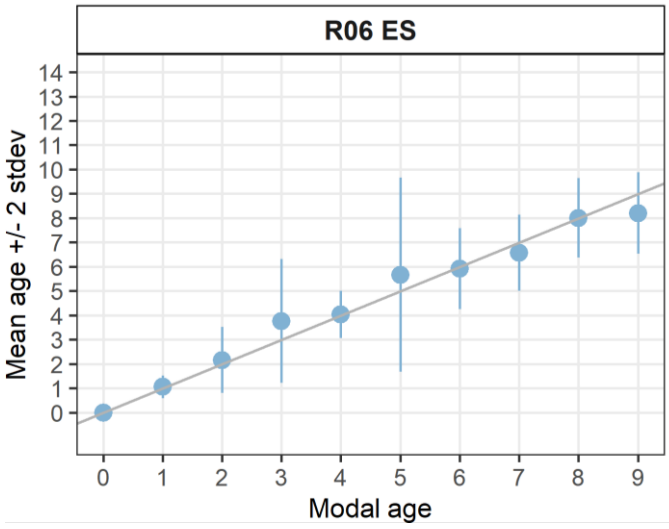
Number of age readings by age

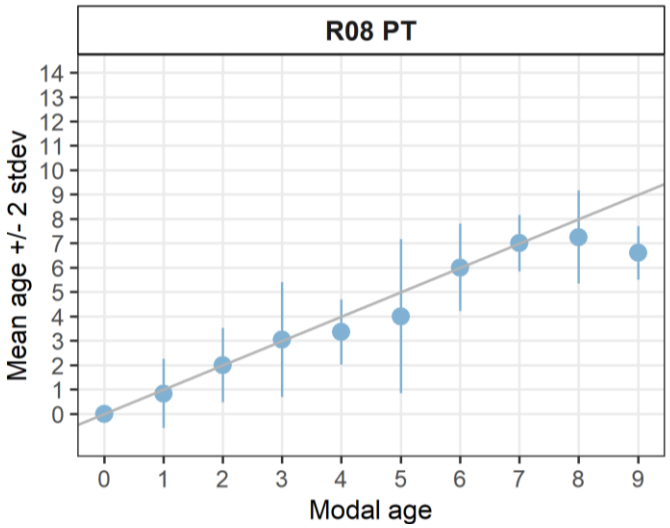
Table 6.10: Age composition by reader gives a summary of number of readings per reader and age. The total numbers of readings by age and by reader are also presented.

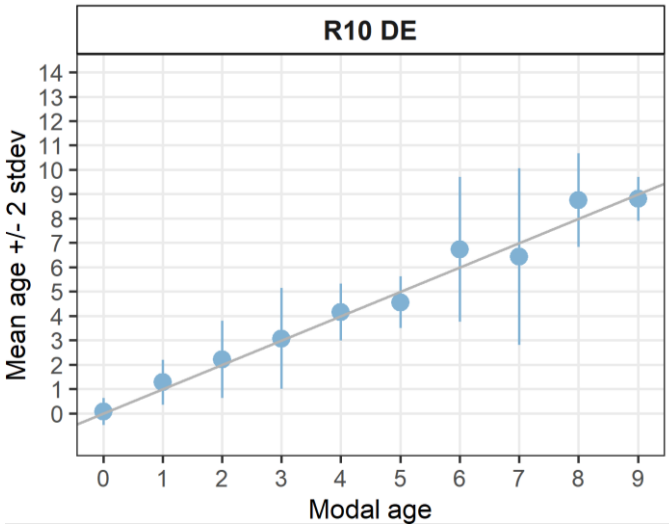
Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	total
0	13	13	19	12	15	3	11	15	0	8	4	113
1	18	21	18	18	18	33	17	2	21	23	26	215
2	31	23	33	32	37	35	24	15	50	33	19	332
3	22	24	40	26	32	23	29	20	40	32	18	306
4	32	41	25	38	41	34	52	29	28	37	18	375
5	25	17	5	17	2	6	19	28	13	12	30	174
6	5	10	11	3	7	10	10	15	1	9	19	100
7	6	9	12	7	6	11	5	13	4	4	14	91
8	2	5	4	6	3	7	0	12	4	8	5	56
9	6	3	0	7	5	2	0	10	1	1	3	38
10	6	0	0	1	1	1	0	2	0	0	6	17
11	1	1	0	0	0	2	0	3	0	0	2	9
12	0	0	0	0	0	0	0	1	0	0	1	2
13	0	0	0	0	0	0	0	1	0	0	1	2
Total	**167**	**167**	**167**	**167**	**167**	**167**	**167**	**166**	**162**	**167**	**166**	**1830**

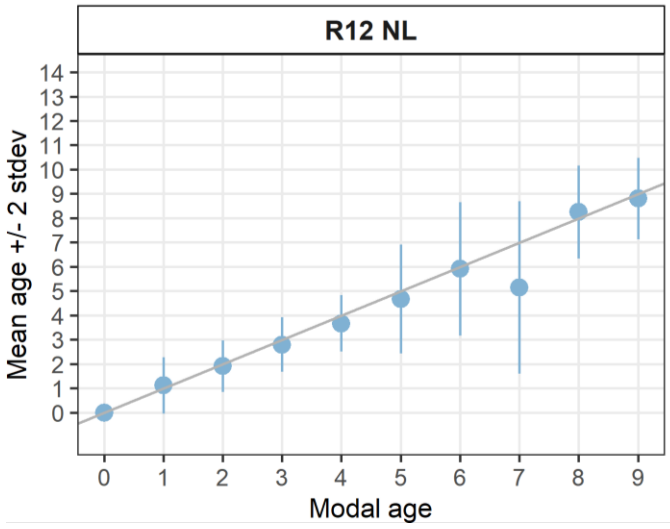
Separate age bias plots by reader

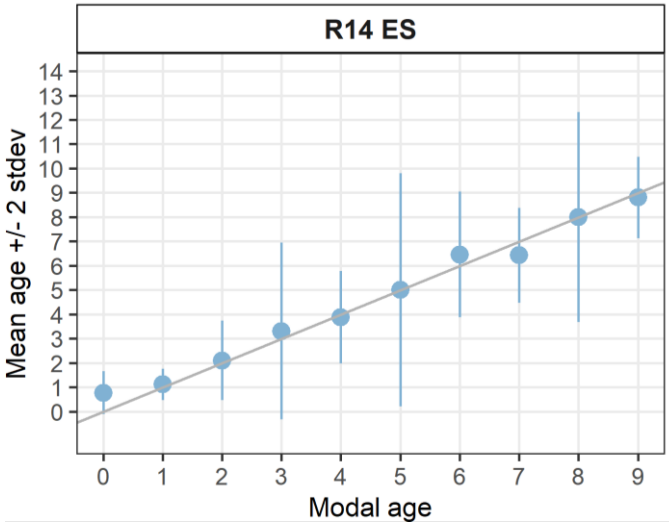


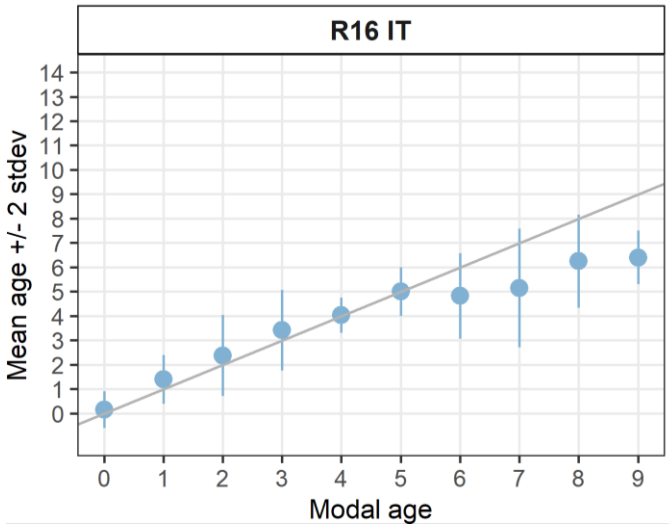


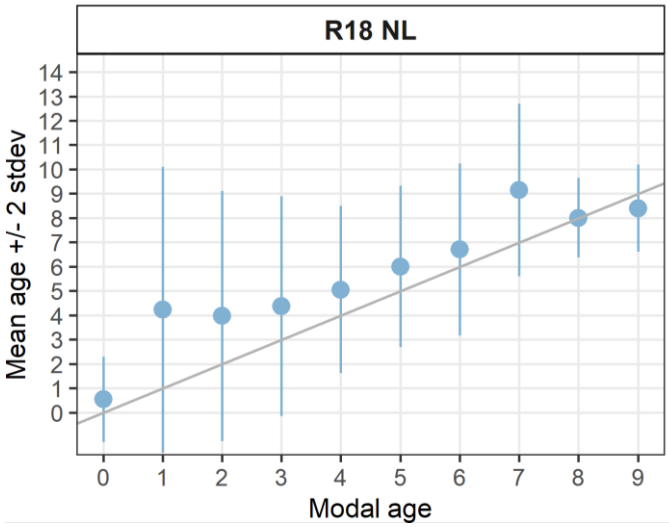


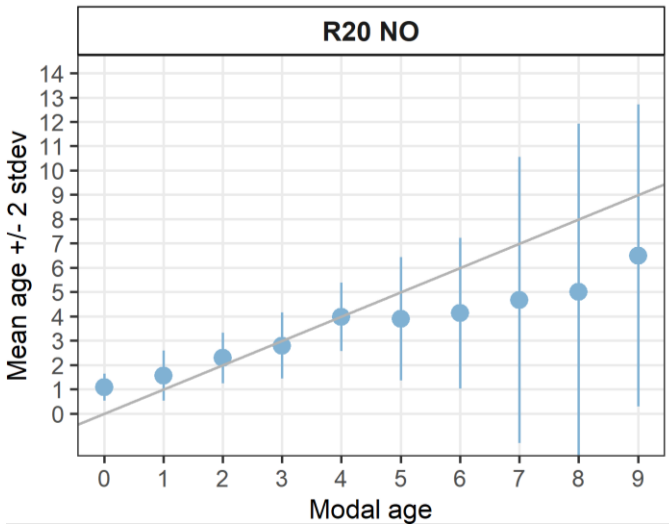


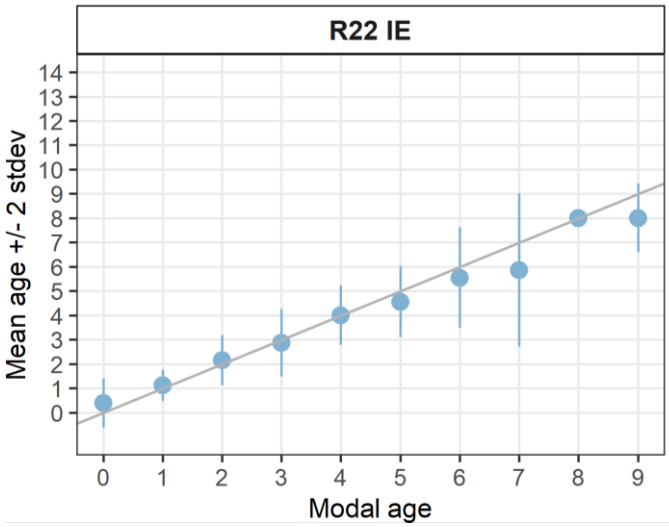


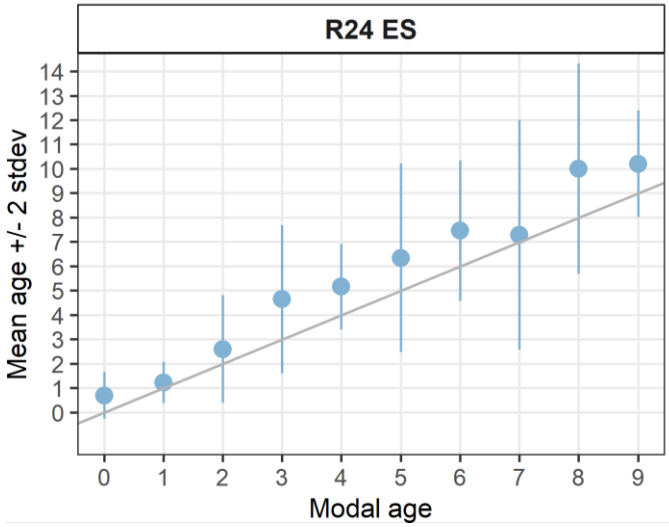



R16 IT
Mean age +/- 2 stdev
Modal age


R18 NL
Mean age +/- 2 stdev
Modal age


R20 NO
Mean age +/- 2 stdev
Modal age


R22 IE
Mean age +/- 2 stdev
Modal age


R24 ES
Mean age +/- 2 stdev
Modal age

Statistics by modal age plot (STDEV, CV and PA)

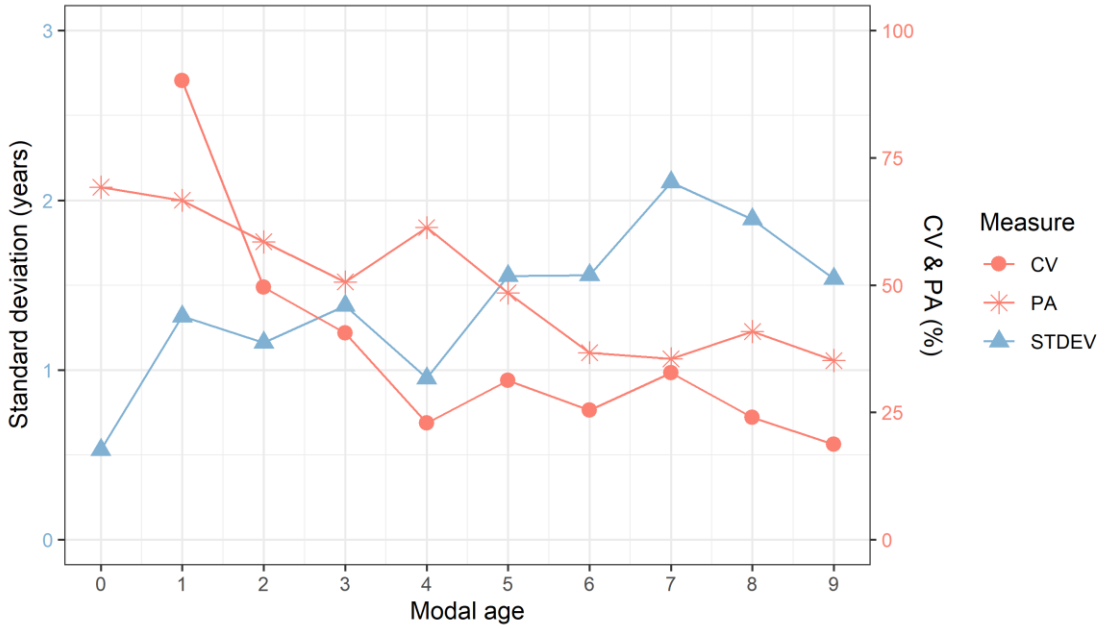


Figure 6.5: CV, PA and (STDEV (standard deviation) are plotted against modal age

Distribution of age reading errors

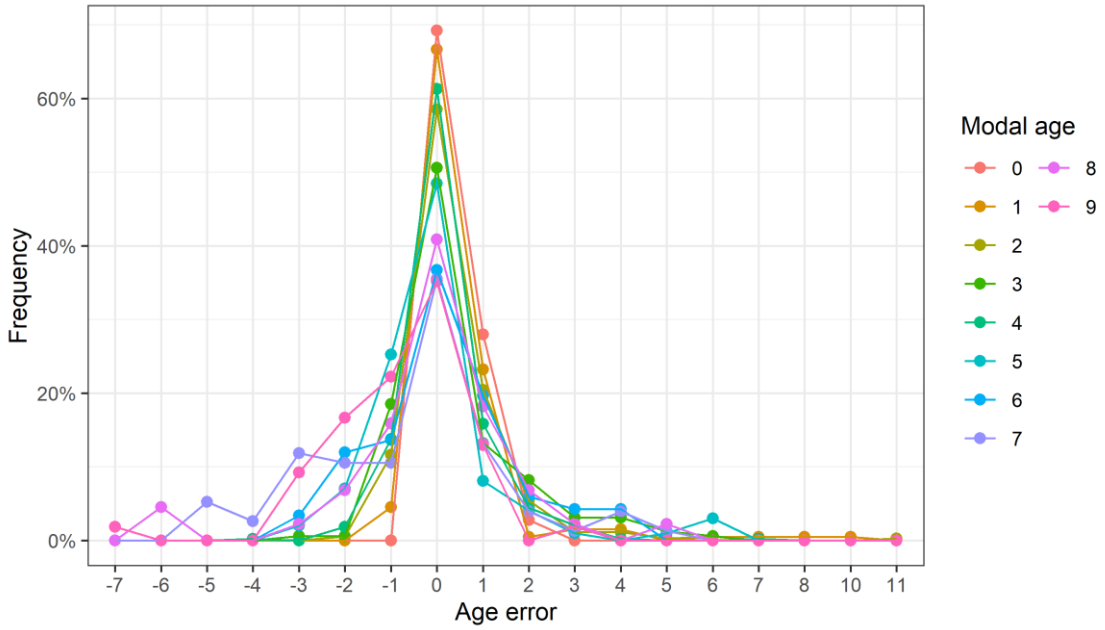


Figure 6.6: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias, if the age reading errors are normally distributed. The distributions are skewed, if relative bias occurs.

Relative bias for all readers

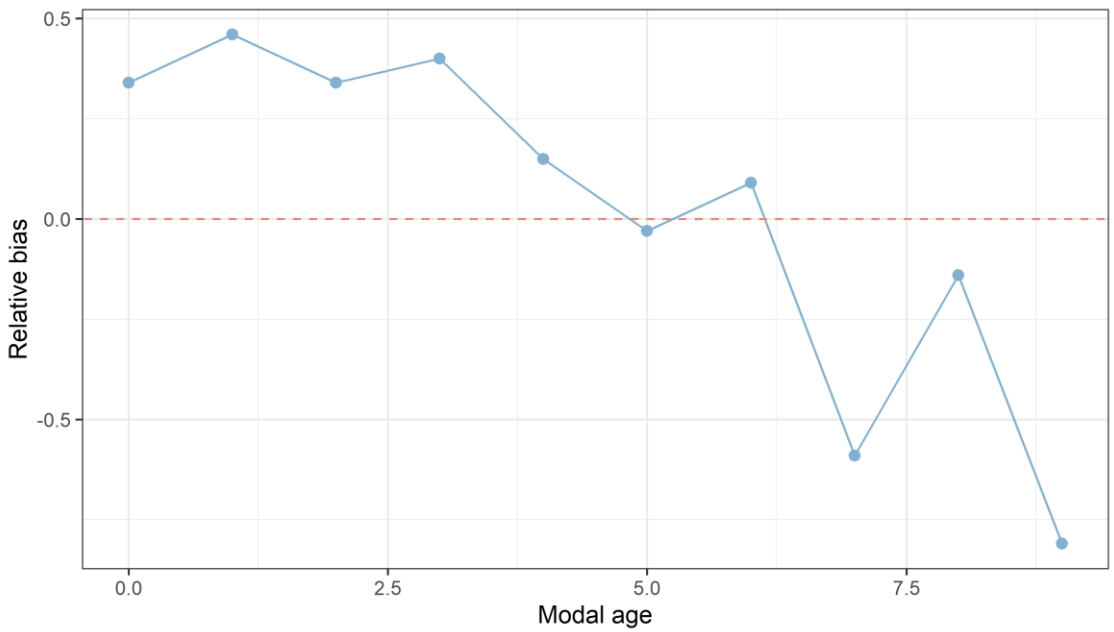


Figure 6.7: The relative bias by modal age as estimated by all age readers combined.

Mean length at age by reader

Table 6.9: Mean fish total length (mm) at age per reader is calculated per reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES
0	101	101	114	100	106	86	100	144	-	98	98
1	162	166	174	165	168	147	161	139	123	151	144
2	205	203	210	204	210	210	194	164	222	208	192
3	234	217	231	234	239	240	216	216	239	234	211
4	239	239	246	237	244	237	252	221	243	239	246
5	243	266	270	245	275	293	269	237	236	282	238
6	303	313	330	311	321	298	334	249	320	303	254
7	308	309	340	334	352	304	361	267	345	330	266
8	362	354	345	337	335	319	-	281	358	359	323
9	341	353	-	355	359	348	-	304	325	325	335
10	360	-	-	360	340	370	-	340	-	-	353
11	345	335	-	-	-	348	-	223	-	-	340
12	-	-	-	-	-	-	-	306	-	-	370
13	-	-	-	-	-	-	-	223	-	-	360
Weighted Mean	**228**	**228**	**228**	**228**	**228**	**228**	**228**	**227**	**226**	**228**	**228**

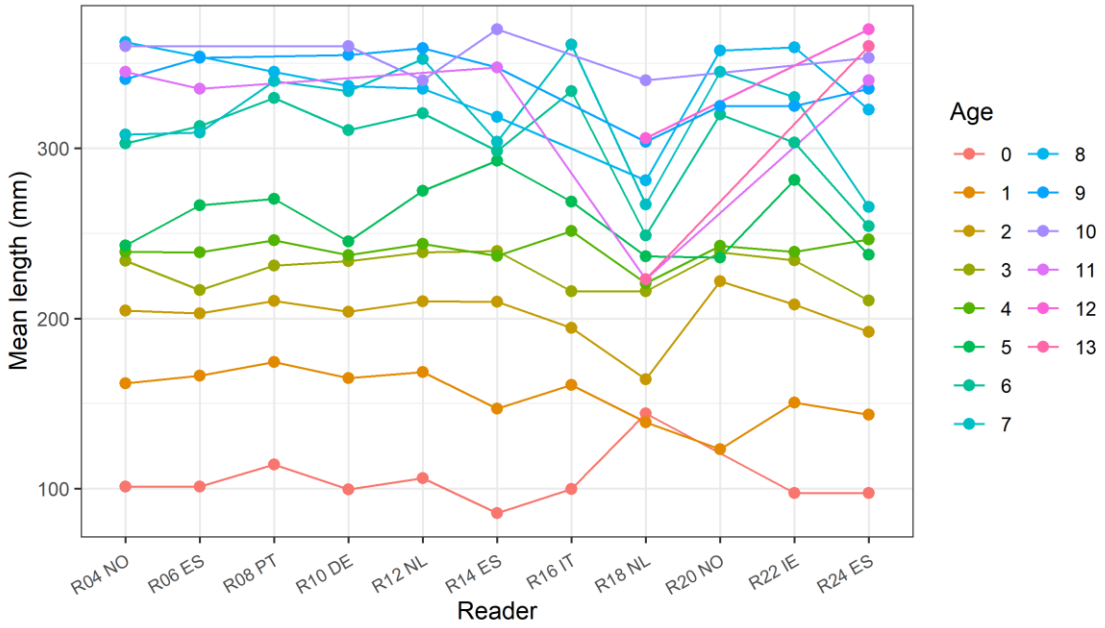


Figure 6.8: The mean fish length at age as estimated by each age reader.

6.1.3 All readers - sliced otoliths

Summary statistics

Table 6.10: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
54	21 %	48 %	14 %

Table 6.11: Data overview including modal age and statistics per sample.

Sample ID	Total length (mm)	sex	Catch date	ICES area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	Modal age	PA %	CV %	APE %
274A_38301_003slice	350	F	31/01/2024	27.4.a	10	11	9	10	10	9	4	10	10	10	11	16	9	9	9	9	11	11	5	10	9	10	33	24	14
274A_38301_004slice	300	M	31/01/2024	27.4.a	4	6	7	4	7	4	3	7	5	7	10	14	4	5	5	5	8	6	4	4	4	4	33	43	31
274A_38301_007slice	340	M	31/01/2024	27.4.a	10	10	9	10	10	8	6	10	10	10	9	12	7	9	8	9	11	10	6	8	10	10	43	17	13
274A_38301_009slice	340	M	31/01/2024	27.4.a	6	7	8	7	8	6	5	7	7	7	7	10	6	6	7	6	8	6	6	6	6	6	43	16	12
274A_38301_013slice	355	F	31/01/2024	27.4.a	13	16	11	14	14	13	6	13	14	14	14	20	13	14	15	12	14	13	7	15	13	14	33	21	13
274A_38301_014slice	350	F	31/01/2024	27.4.a	11	10	8	11	10	10	4	9	11	11	11	10	9	9	10	9	10	9	5	9	10	10	33	20	13
274A_38301_015slice	375	M	31/01/2024	27.4.a	10	11	10	10	10	10	5	10	11	10	11	13	10	10	11	9	10	10	6	9	10	10	57	17	10
274A_38301_023slice	325	M	31/01/2024	27.4.a	8	8	8	7	8	7	5	8	8	8	9	17	7	7	7	7	9	7	5	7	7	7	43	30	16
274A_38304_009slice	250	F	31/01/2024	27.6.a	4	4	3	4	4	3	3	4	5	4	4	9	4	3	5	4	-	4	3	3	4	4	55	33	17
274A_38304_011slice	320	M	12/02/2024	27.6.a	10	11	7	10	10	8	7	11	12	10	11	13	10	9	10	10	11	10	5	11	10	10	43	18	13
274A_38304_021slice	325	M	12/02/2024	27.6.a	10	10	8	10	10	9	6	11	11	10	11	12	10	9	9	10	11	10	6	10	10	10	48	15	11
274A_38304_023slice	320	M	12/02/2024	27.6.a	6	10	7	6	7	6	5	6	6	6	7	12	6	6	9	6	10	6	5	5	6	6	52	27	20
274A_38304_025slice	290	M	12/02/2024	27.6.a	6	10	6	6	8	8	5	8	6	7	8	17	7	7	12	8	9	7	4	6	8	8	29	35	23
274A_38309_007slice	335	M	12/02/2024	27.4.a	4	4	4	4	4	4	3	4	4	4	5	6	4	4	4	4	5	4	4	4	4	4	81	14	8
274A_38309_011slice	360	M	20/01/2023	27.4.a	15	15	13	14	15	15	6	14	16	16	16	16	14	15	15	11	15	14	-	16	14	15	35	16	10
274A_38309_013slice	375	M	20/01/2023	27.4.a	4	5	9	5	4	5	4	4	4	4	6	9	4	4	4	4	6	4	-	4	4	4	65	32	23
274A_38309_015slice	370	M	20/01/2023	27.4.a	5	6	7	6	6	6	4	5	5	5	7	7	5	6	6	6	7	5	-	5	5	5	40	15	13
274A_38309_016slice	380	M	20/01/2023	27.4.a	5	5	8	6	5	5	3	5	6	5	6	7	5	6	5	5	5	5	-	5	5	5	65	18	13
274A_86650_002slice	360	F	20/01/2023	27.4.a	13	14	11	12	14	17	6	12	14	12	13	13	11	12	12	12	14	12	5	13	13	12	33	21	13
274A_86650_003slice	325	F	19/09/2024	27.4.a	11	13	10	10	14	17	7	9	12	11	15	15	11	10	11	13	11	9	5	10	13	11	24	24	18
274A_86650_007slice	345	F	19/09/2024	27.4.a	10	10	9	10	11	11	6	9	12	10	11	12	10	10	11	10	11	10	5	10	10	10	48	17	10
274A_86650_010slice	345	F	19/09/2024	27.4.a	8	10	8	7	10	7	5	6	11	7	9	12	8	8	7	8	9	8	4	8	8	8	38	23	15
274A_86650_019slice	335	F	19/09/2024	27.4.a	8	8	8	7	8	7	5	7	9	7	8	12	8	8	9	8	9	8	4	7	8	8	48	20	13
274A_86650_029slice	345	F	19/09/2024	27.4.a	10	10	10	10	11	11	6	9	11	10	10	15	10	9	13	10	10	10	5	10	10	10	57	20	10
HOM_2023_Q1_6a_57916_002	320	F	19/09/2024	27.6.a	9	9	7	9	9	8	5	8	9	9	10	10	7	9	8	7	8	9	5	9	8	9	43	17	13
HOM_2023_Q1_6a_57916_003	330	F	26/02/2023	27.6.a	9	9	7	9	9	8	5	9	10	9	10	11	8	9	10	8	8	8	6	8	-	9	35	16	12
HOM_2023_Q1_6a_57916_004	320	F	26/02/2023	27.6.a	8	8	7	8	8	7	6	8	9	8	9	10	7	6	8	7	9	9	6	7	7	8	33	14	12
HOM_2023_Q1_6a_57916_005	290	F	26/02/2023	27.6.a	6	6	5	6	6	6	5	6	7	6	7	11	6	6	6	6	7	7	5	6	6	6	62	20	11
HOM_2023_Q1_6a_57916_008	330	M	26/02/2023	27.6.a	9	9	9	9	9	8	5	9	11	9	10	11	8	8	8	8	9	9	6	8	7	9	43	16	12
HOM_2023_Q1_6a_57916_011	350	F	26/02/2023	27.6.a	15	15	13	15	15	13	8	12	16	15	16	15	13	13	9	12	-	14	6	11	9	15	30	22	17
HOM_2023_Q1_6a_57916_013	310	M	26/02/2023	27.6.a	9	9	8	9	9	9	5	9	10	9	10	12	9	8	8	8	11	9	5	9	9	9	52	18	11
HOM_2023_Q1_6a_57916_014	310	M	26/02/2023	27.6.a	9	9	8	9	9	9	8	9	10	9	9	11	9	8	8	8	10	9	6	8	8	9	48	12	8
HOM_2023_Q1_6a_57916_017	300	M	26/02/2023	27.6.a	6	7	7	6	6	6	5	6	6	6	9	8	6	6	6	5	9	7	6	6	6	6	62	17	12
HOM_2023_Q1_6a_57916_020	290	M	26/02/2023	27.6.a	5	5	5	5	5	4	4	5	5	5	5	8	4	5	4	5	5	5	4	5	4	5	67	18	10
HOM_2023_Q1_6a_57916_022	360	F	26/02/2023	27.6.a	15	14	13	15	14	14	8	15	16	15	16	17	14	12	13	14	17	15	6	16	14	14	29	19	12
HOM_2023_Q1_6a_57916_026	310	M	26/02/2023	27.6.a	8	9	9	9	9	9	6	9	10	9	11	17	8	6	9	8	-	9	6	9	-	9	53	26	14
HOM_2023_Q1_6a_57916_028	280	F	26/02/2023	27.6.a	6	6	5	6	6	6	5	6	6	6	6	9	6	6	6	6	6	6	5	6	6	6	81	13	5
HOM_2023_Q1_6a_57916_033	360	F	26/02/2023	27.6.a	15	15	12	15	16	12	7	15	16	15	15	17	13	12	9	9	-	15	7	12	8	15	35	25	21
HOM_2023_Q1_6a_57916_039	260	M	26/02/2023	27.6.a	5	5	4	5	5	5	4	5	5	5	6	8	5	5	5	5	5	5	4	5	5	5	76	16	7
HOM_2023_Q4_6a_59527_001	300	F	26/02/2023	27.6.a	7	7	7	7	7	7	4	7	7	6	8	6	6	5	6	7	-	7	6	7	6	7	55	14	11
HOM_2023_Q4_6a_59527_003	320	M	19/11/2023	27.6.a	7	10	9	8	9	9	5	9	9	8	10	12	8	8	7	7	9	9	6	8	6	9	33	19	15
HOM_2023_Q4_6a_59527_005	290	F	19/11/2023	27.6.a	7	7	6	6	6	6	4	6	7	6	7	9	6	4	6	6	6	7	5	7	6	6	52	17	12

Sample ID	Total length (mm)	sex	Catch date	ICES area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	Modal age	PA %	CV %	APE %
HOM_2023_Q4_6a_59527_006	300	F	19/11/2023	27.6.a	7	7	7	6	7	7	4	6	7	6	8	8	8	7	7	6	7	8	5	7	7	7	52	15	11
HOM_2023_Q4_6a_59527_007	340	F	19/11/2023	27.6.a	9	9	9	8	9	8	4	8	9	9	9	8	7	8	7	7	9	9	6	9	7	9	48	16	12
HOM_2023_Q4_6a_59527_008	280	M	19/11/2023	27.6.a	6	6	6	5	6	6	4	5	6	5	6	8	5	5	5	5	6	6	5	5	5	5	48	15	12
HOM_2023_Q4_6a_59527_011	280	F	19/11/2023	27.6.a	4	5	4	4	4	4	4	4	5	4	4	4	4	4	4	4	7	4	4	5	4	4	81	17	11
HOM_2023_Q4_6a_59527_016	290	M	19/11/2023	27.6.a	7	7	5	6	7	7	5	7	7	6	7	6	6	6	7	6	8	7	5	7	6	7	48	13	11
HOM_2023_Q4_6a_59527_017	340	M	19/11/2023	27.6.a	12	12	10	12	12	11	5	11	12	12	12	14	11	10	11	9	12	12	7	13	11	12	43	18	12
HOM_2023_Q4_6a_59527_020	280	M	19/11/2023	27.6.a	6	6	6	5	6	5	4	5	6	6	6	6	6	5	5	5	7	5	5	5	6	6	48	12	11
HOM_2023_Q4_6a_59527_021	320	M	19/11/2023	27.6.a	8	9	8	9	9	8	6	8	9	9	9	8	8	6	8	8	9	9	6	8	7	8	43	13	9
HOM_2023_Q4_6a_59527_022	310	M	19/11/2023	27.6.a	9	10	9	9	9	9	5	8	10	9	12	9	8	8	10	8	12	10	6	10	9	9	38	18	12
HOM_2023_Q4_6a_59527_023	280	M	19/11/2023	27.6.a	6	7	6	6	7	6	3	5	7	7	7	7	6	5	7	6	-	7	4	7	7	7	50	18	14
HOM_2023_Q4_6a_59527_027	280	F	19/11/2023	27.6.a	6	7	6	6	6	6	4	6	7	6	7	6	6	6	6	6	8	7	5	7	6	6	62	13	9
HOM_2023_Q4_6a_59527_029	330	F	19/11/2023	27.6.a	9	9	9	9	9	9	5	9	11	9	10	9	8	9	9	9	10	10	7	10	8	9	57	14	8

Number of age readings by modal age

Table 6.12: 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.

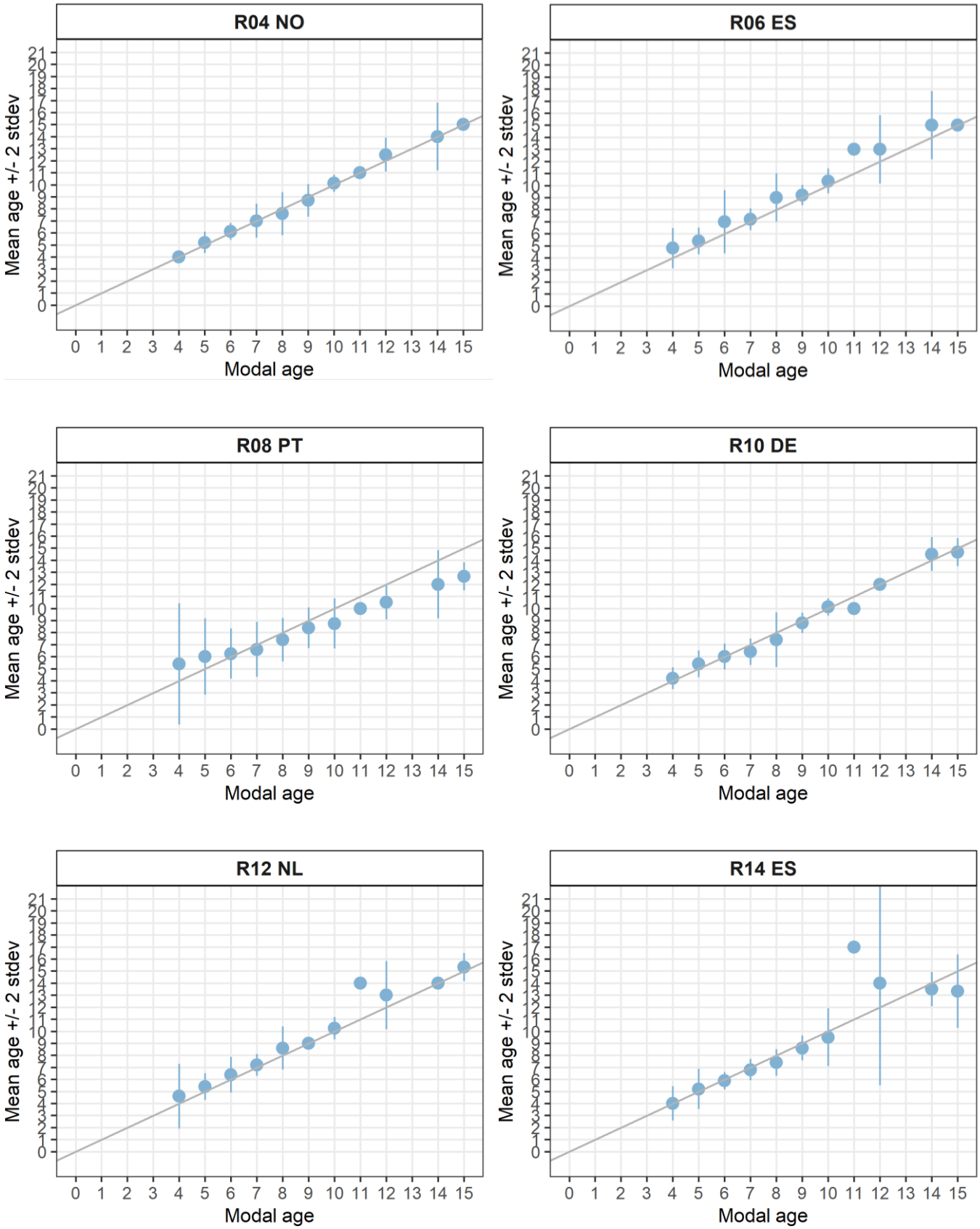
Modal age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	total
4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4	5	5	103
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	103
6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	168
7	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	103
8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	105
9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	8	207
10	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	168
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21
12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	42
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	42
15	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	2	3	3	60
Total	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**48**	**54**	**50**	**54**	**52**	**1122**

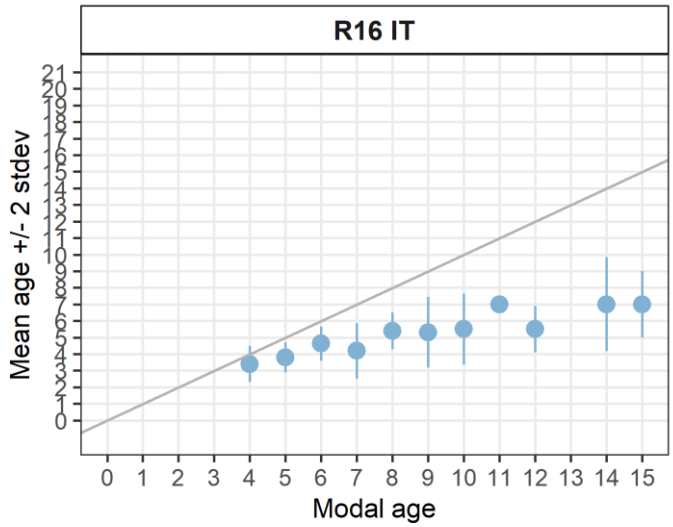
Number of age readings by age

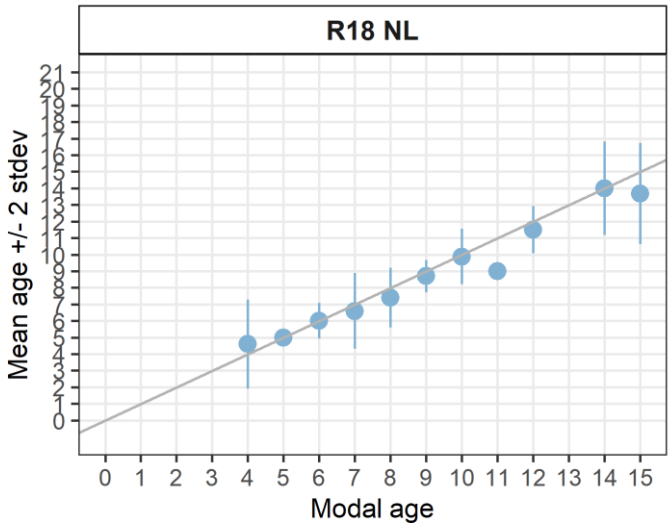
Table 6.13: Age composition by reader gives a summary of number of readings per reader and age. The total numbers of readings by age and by reader are also presented.

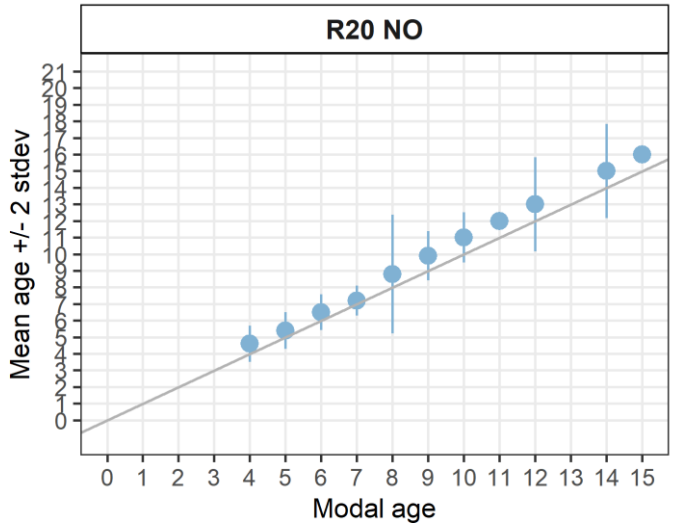
Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT	total
3	0	0	1	0	0	1	5	0	0	0	0	0	0	1	0	0	0	0	1	1	0	10
4	5	2	3	4	4	4	14	4	2	4	2	1	6	4	4	4	0	4	9	3	6	89
5	4	5	4	5	3	4	19	7	6	5	2	0	4	7	6	7	4	5	19	8	4	128
6	10	6	6	12	8	10	10	8	7	10	6	5	11	12	7	10	4	5	17	5	11	180
7	5	8	10	5	6	7	3	5	8	6	8	3	6	3	8	6	5	9	4	9	7	131
8	6	3	10	3	5	8	3	7	1	3	4	7	10	8	7	10	6	4	0	7	7	119
9	8	9	10	9	11	8	0	11	6	10	8	6	4	9	8	7	10	11	0	6	4	155
10	7	10	4	8	7	2	0	3	7	7	8	4	5	4	4	4	6	8	0	7	7	112
11	2	3	2	1	2	3	0	3	7	2	7	4	3	0	4	1	7	1	0	2	1	55
12	1	1	1	2	1	1	0	2	4	2	2	8	0	3	2	3	2	2	0	1	0	38
13	2	1	3	0	0	2	0	1	0	0	1	3	3	1	2	1	0	1	0	2	3	26
14	0	2	0	2	4	1	0	1	2	1	1	2	2	1	0	1	2	2	0	0	2	26
15	4	3	0	3	2	1	0	2	0	3	2	3	0	1	2	0	1	2	0	1	0	30
16	0	1	0	0	1	0	0	0	4	1	3	2	0	0	0	0	0	0	0	2	0	14
17	0	0	0	0	0	2	0	0	0	0	0	5	0	0	0	0	1	0	0	0	0	8
20	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Total	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**48**	**54**	**50**	**54**	**52**	**1122**

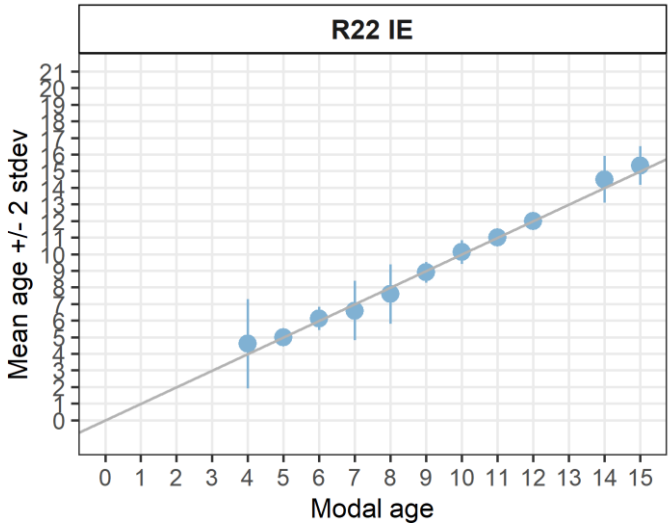
Separate age bias plots by reader

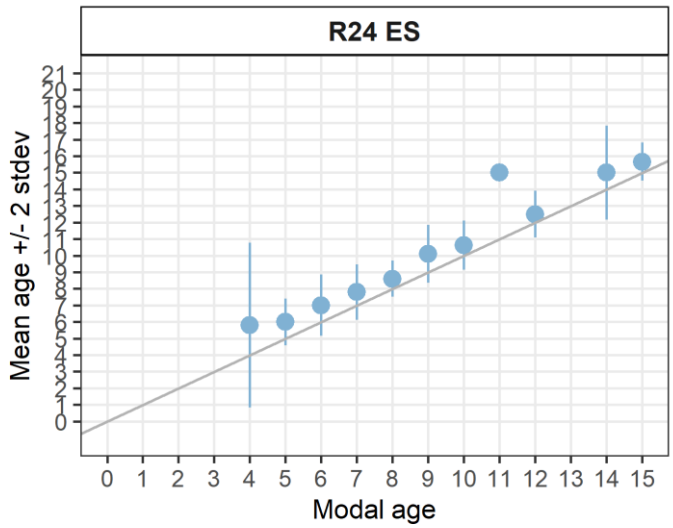


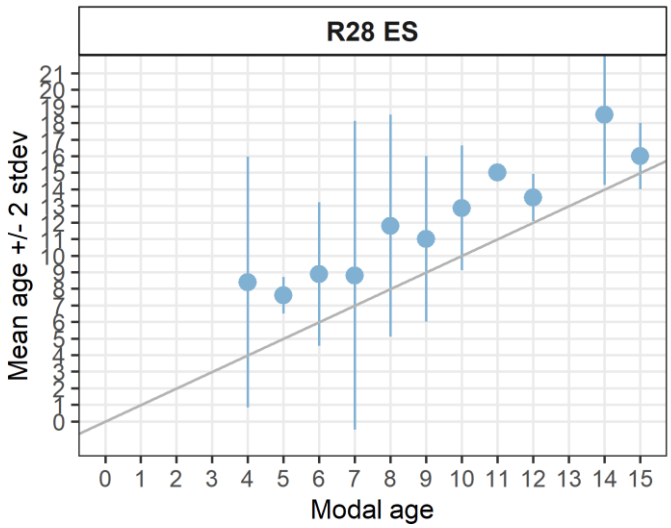

R16 IT
Mean age +/- 2 stdev
Modal age

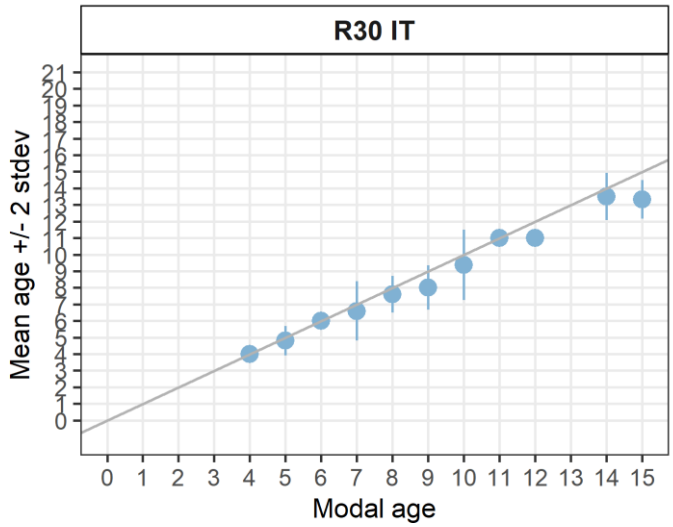

R18 NL
Mean age +/- 2 stdev
Modal age

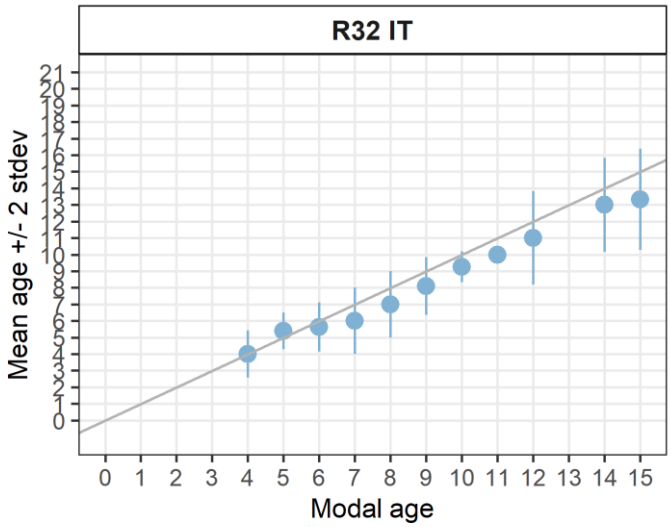

R20 NO
Mean age +/- 2 stdev
Modal age

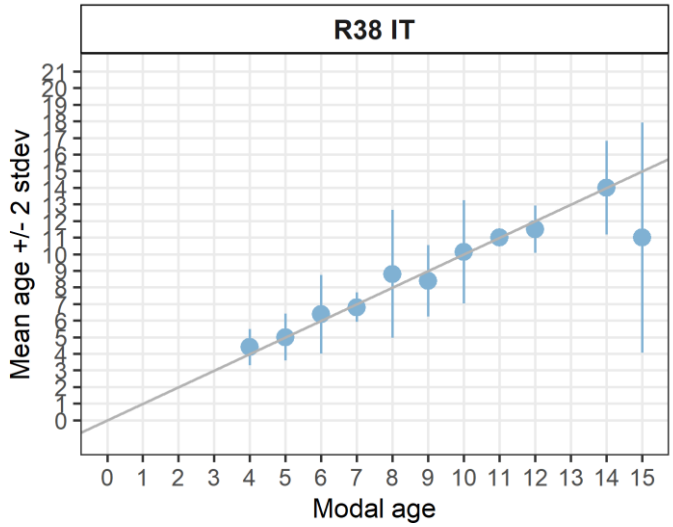

R22 IE
Mean age +/- 2 stdev
Modal age

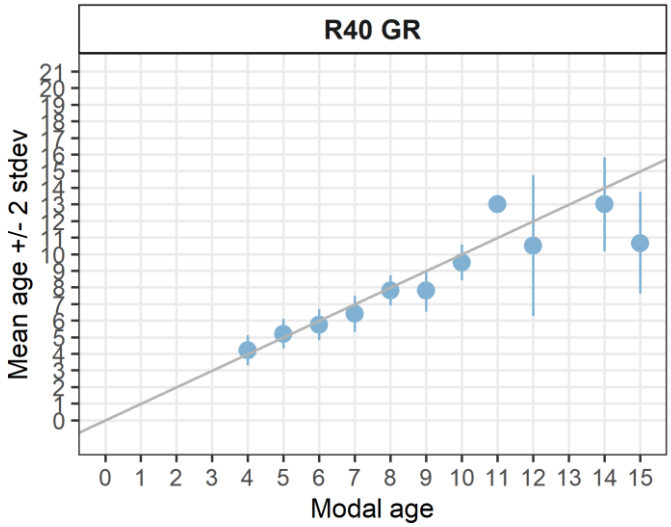

R24 ES
Mean age +/- 2 stdev
Modal age

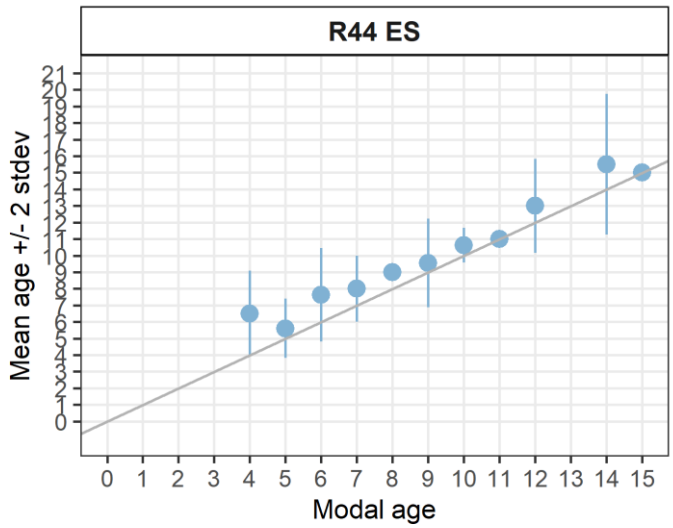

R28 ES
Mean age +/- 2 stdev
Modal age

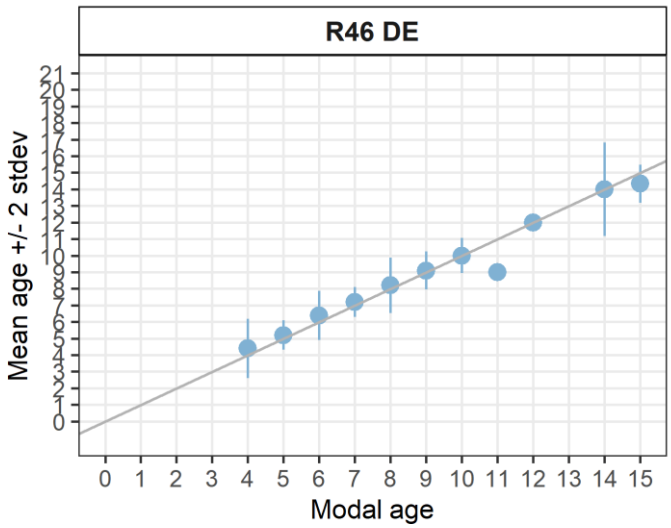

R30 IT
Mean age +/- 2 stdev
Modal age

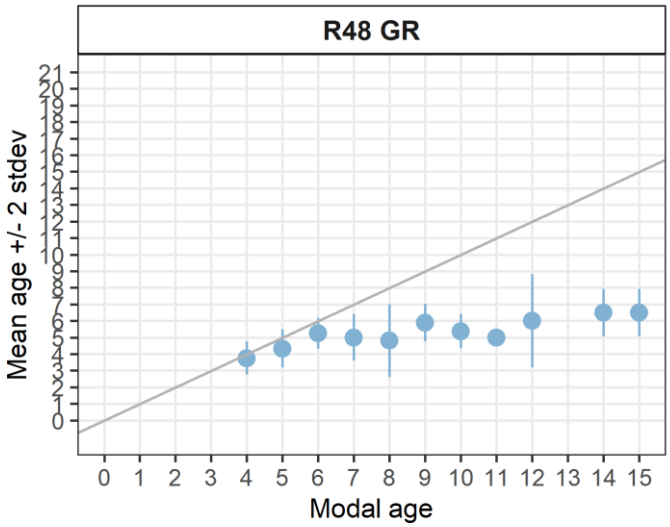

R32 IT
Mean age +/- 2 stdev
Modal age

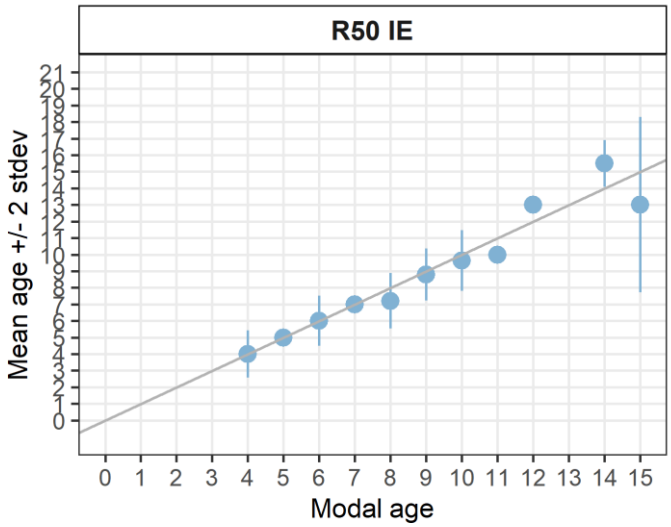

R38 IT
Mean age +/- 2 stdev
Modal age

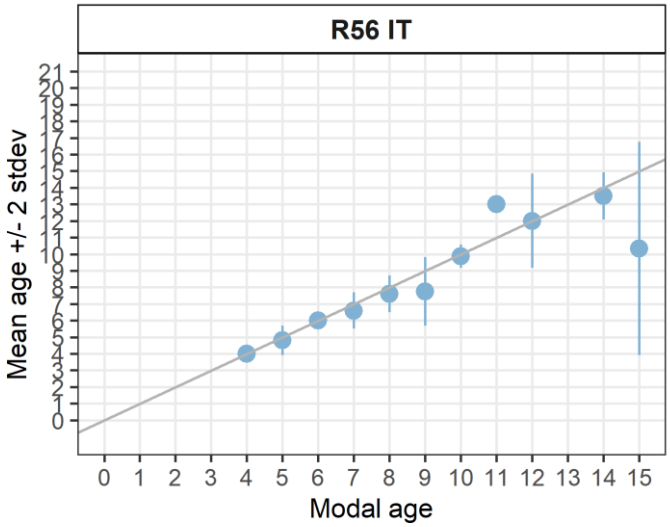

R40 GR
Mean age +/- 2 stdev
Modal age


R44 ES
Mean age +/- 2 stdev
Modal age


R46 DE
Mean age +/- 2 stdev
Modal age


R48 GR
Mean age +/- 2 stdev
Modal age


R50 IE
Mean age +/- 2 stdev
Modal age


R56 IT
Mean age +/- 2 stdev
Modal age

Statistics by modal age plot (STDEV, CV and PA)

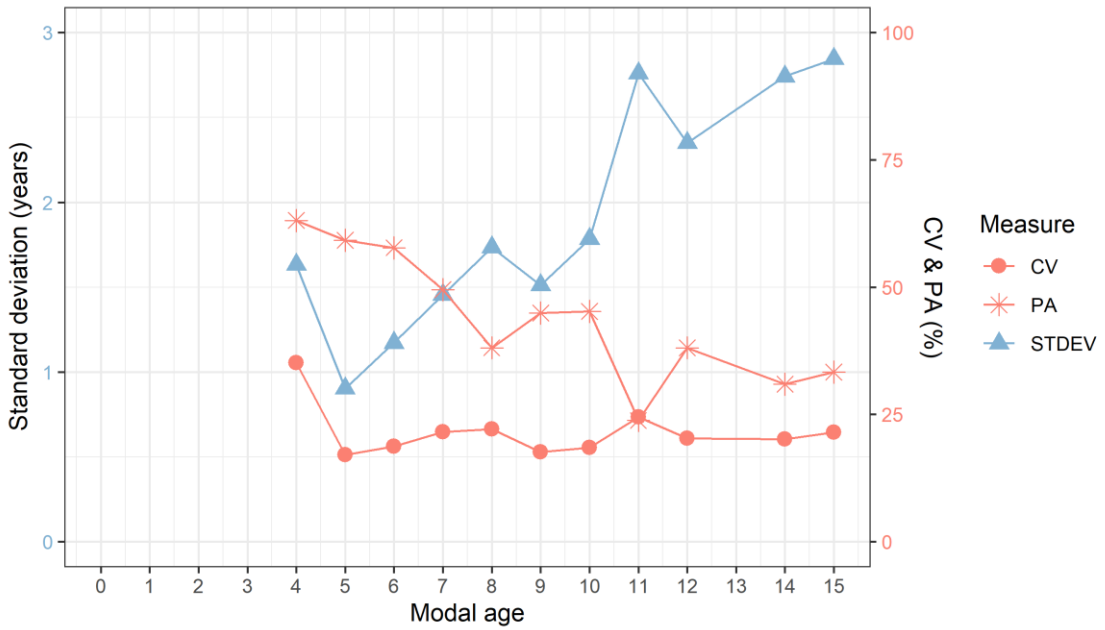


Figure 6.9: CV, PA and (STDEV (standard deviation) are plotted against modal age

Distribution of age reading errors

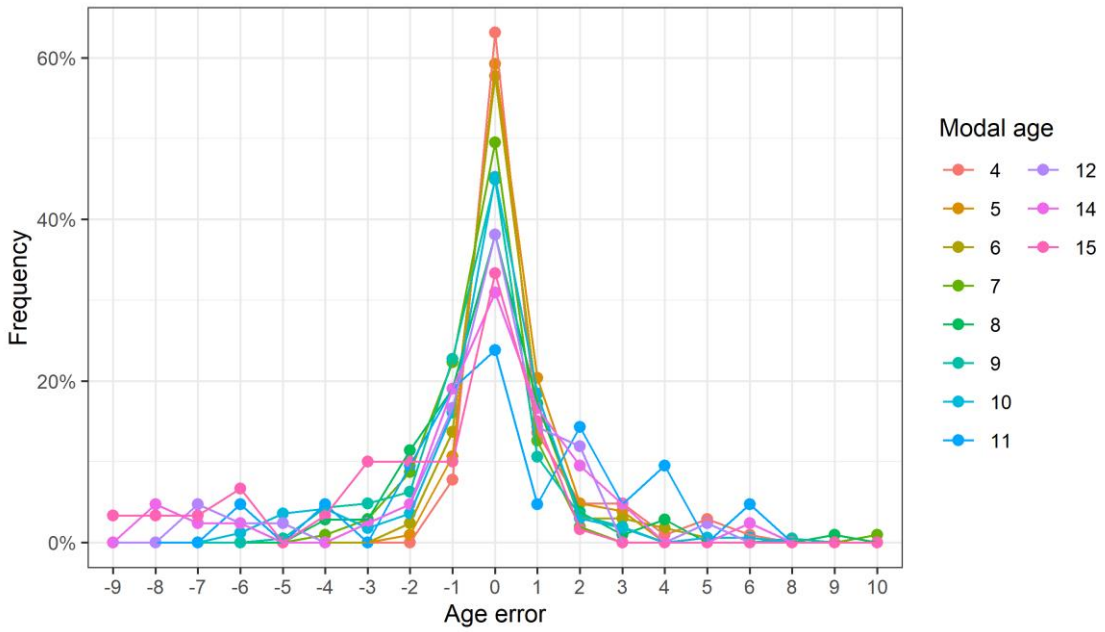


Figure 6.10: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias, if the age reading errors are normally distributed. The distributions are skewed, if relative bias occurs.

Relative bias for all readers

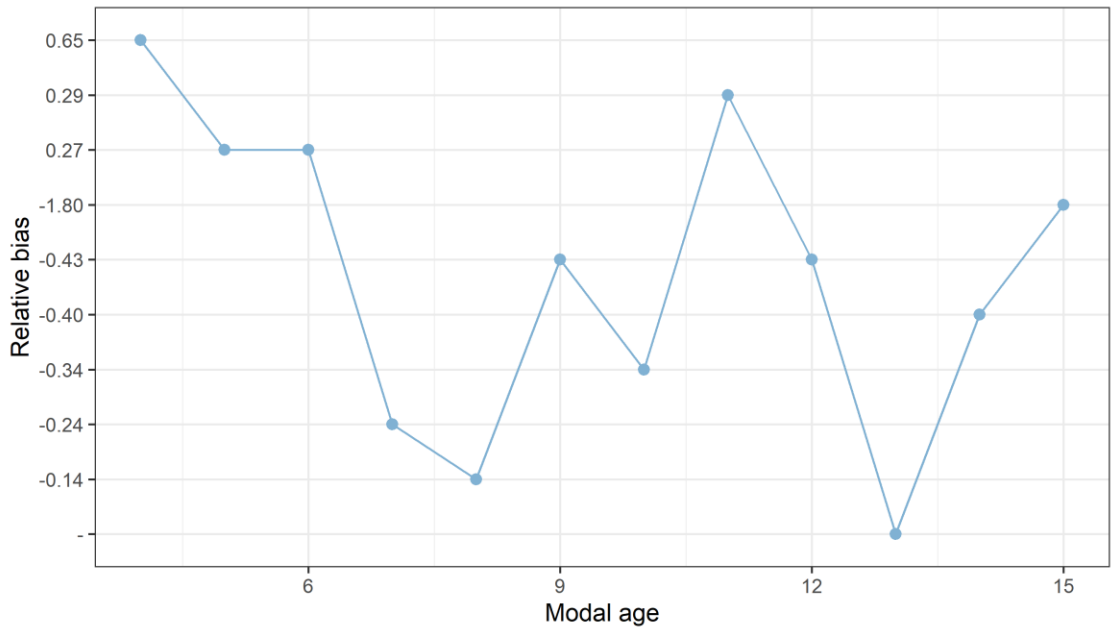


Figure 6.11: The relative bias by modal age as estimated by all age readers combined.

Mean length at age by reader

Table 6.14: Mean fish total length (mm) at age per reader is calculated per reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	R28 ES	R30 IT	R32 IT	R38 IT	R40 GR	R44 ES	R46 DE	R48 GR	R50 IE	R56 IT
3	-	-	250	-	-	250	309	-	-	-	-	-	-	250	-	-	-	-	250	250	-
4	308	292	292	291	310	301	310	310	355	310	265	280	305	320	320	310	-	310	302	337	305
5	325	317	288	297	310	324	320	306	292	316	312	-	322	284	292	299	316	316	314	308	322
6	294	300	283	306	296	303	338	301	304	293	309	297	295	317	301	304	306	304	328	300	299
7	300	298	318	329	298	316	335	313	296	315	308	343	322	305	318	321	304	294	346	302	316
8	326	327	334	327	322	324	340	318	325	322	306	299	323	325	321	319	310	328	-	328	327
9	322	322	335	319	321	321	-	328	326	321	325	306	330	334	335	349	322	323	-	334	330
10	343	329	346	341	344	362	-	355	323	343	323	332	342	346	328	334	338	336	-	333	343
11	338	348	358	350	345	343	-	328	343	338	339	315	342	-	346	360	331	350	-	335	340
12	340	340	360	350	340	360	-	355	332	350	325	330	-	360	325	355	325	350	-	360	-
13	358	325	357	-	-	352	-	355	-	-	360	352	355	350	352	325	-	355	-	350	347
14	-	360	-	358	350	360	-	360	358	355	355	320	360	355	-	360	358	355	-	-	360
15	358	357	-	357	355	360	-	360	-	357	342	340	-	360	358	-	360	360	-	355	-
16	-	355	-	-	360	-	-	-	358	360	357	355	-	-	-	-	-	-	-	360	-
17	-	-	-	-	-	342	-	-	-	-	-	329	-	-	-	-	360	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	355	-	-	-	-	-	-	-	-	-
Weighted Mean	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**323**	**322**	**318**	**322**	**322**

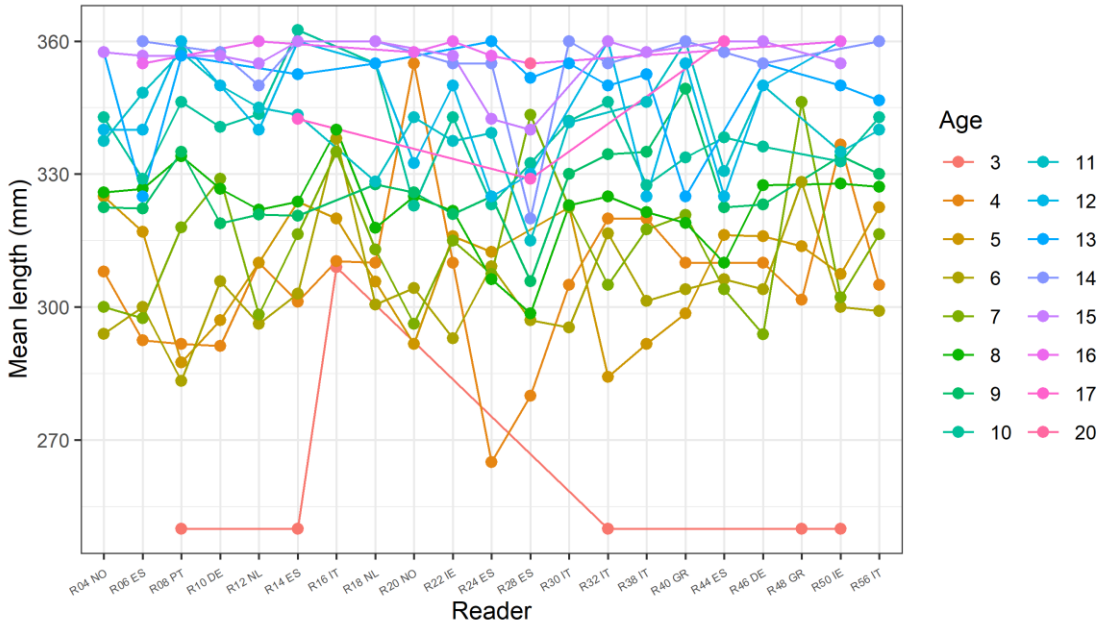


Figure 6.12: The mean fish length at age as estimated by each age reader.

6.1.4 Advanced readers – sliced otoliths

All samples included

Summary statistics

Table 6.15: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
54	18 %	55 %	11 %

Table 6.16: Data overview including modal age and statistics per sample.

Sample ID	Total length (mm)	sex	Catch date	ICES area	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	Modal age	PA %	CV %	APE %
274A_38301_003slice	350	F	31/01/2024	27.4.a	10	11	9	10	10	9	4	10	10	10	11	10	55	20	12
274A_38301_004slice	300	M	31/01/2024	27.4.a	4	6	7	4	7	4	3	7	5	7	10	7	36	35	28
274A_38301_007slice	340	M	31/01/2024	27.4.a	10	10	9	10	10	8	6	10	10	10	9	10	64	14	10
274A_38301_009slice	340	M	31/01/2024	27.4.a	6	7	8	7	8	6	5	7	7	7	7	7	55	13	9
274A_38301_013slice	355	F	31/01/2024	27.4.a	13	16	11	14	14	13	6	13	14	14	14	14	45	20	12
274A_38301_014slice	350	F	31/01/2024	27.4.a	11	10	8	11	10	10	4	9	11	11	11	11	45	22	15
274A_38301_015slice	375	M	31/01/2024	27.4.a	10	11	10	10	10	10	5	10	11	10	11	10	64	17	9
274A_38301_023slice	325	M	31/01/2024	27.4.a	8	8	8	7	8	7	5	8	8	8	9	8	64	13	9
274A_38304_009slice	250	F	31/01/2024	27.6.a	4	4	3	4	4	3	3	4	5	4	4	4	64	16	12
274A_38304_011slice	320	M	12/02/2024	27.6.a	10	11	7	10	10	8	7	11	12	10	11	10	36	17	13
274A_38304_021slice	325	M	12/02/2024	27.6.a	10	10	8	10	10	9	6	11	11	10	11	10	45	16	11
274A_38304_023slice	320	M	12/02/2024	27.6.a	6	10	7	6	7	6	5	6	6	6	7	6	55	20	13
274A_38304_025slice	290	M	12/02/2024	27.6.a	6	10	6	6	8	8	5	8	6	7	8	6	36	20	17
274A_38309_007slice	335	M	12/02/2024	27.4.a	4	4	4	4	4	4	3	4	4	4	5	4	82	11	5
274A_38309_011slice	360	M	20/01/2023	27.4.a	15	15	13	14	15	15	6	14	16	16	16	15	36	20	12
274A_38309_013slice	375	M	20/01/2023	27.4.a	4	5	9	5	4	5	4	4	4	4	6	4	55	31	20
274A_38309_015slice	370	M	20/01/2023	27.4.a	5	6	7	6	6	6	4	5	5	5	7	6	36	16	13
274A_38309_016slice	380	M	20/01/2023	27.4.a	5	5	8	6	5	5	3	5	6	5	6	5	55	22	15
274A_86650_002slice	360	F	20/01/2023	27.4.a	13	14	11	12	14	17	6	12	14	12	13	14	27	21	14
274A_86650_003slice	325	F	19/09/2024	27.4.a	11	13	10	10	14	17	7	9	12	11	15	10	18	24	19
274A_86650_007slice	345	F	19/09/2024	27.4.a	10	10	9	10	11	11	6	9	12	10	11	10	36	16	11
274A_86650_010slice	345	F	19/09/2024	27.4.a	8	10	8	7	10	7	5	6	11	7	9	7	27	23	18
274A_86650_019slice	335	F	19/09/2024	27.4.a	8	8	8	7	8	7	5	7	9	7	8	8	45	14	10
274A_86650_029slice	345	F	19/09/2024	27.4.a	10	10	10	10	11	11	6	9	11	10	10	10	55	14	9
HOM_2023_Q1_6a_57916_002	320	F	19/09/2024	27.6.a	9	9	7	9	9	8	5	8	9	9	10	9	55	16	12
HOM_2023_Q1_6a_57916_003	330	F	26/02/2023	27.6.a	9	9	7	9	9	8	5	9	10	9	10	9	55	17	12
HOM_2023_Q1_6a_57916_004	320	F	26/02/2023	27.6.a	8	8	7	8	8	7	6	8	9	8	9	8	55	11	8
HOM_2023_Q1_6a_57916_005	290	F	26/02/2023	27.6.a	6	6	5	6	6	6	5	6	7	6	7	6	64	11	6
HOM_2023_Q1_6a_57916_008	330	M	26/02/2023	27.6.a	9	9	9	9	9	8	5	9	11	9	10	9	64	17	10
HOM_2023_Q1_6a_57916_011	350	F	26/02/2023	27.6.a	15	15	13	15	15	13	8	12	16	15	16	15	45	17	13
HOM_2023_Q1_6a_57916_013	310	M	26/02/2023	27.6.a	9	9	8	9	9	9	5	9	10	9	10	9	64	15	9
HOM_2023_Q1_6a_57916_014	310	M	26/02/2023	27.6.a	9	9	8	9	9	9	8	9	10	9	9	9	73	6	4
HOM_2023_Q1_6a_57916_017	300	M	26/02/2023	27.6.a	6	7	7	6	6	6	5	6	6	6	9	6	64	16	11
HOM_2023_Q1_6a_57916_020	290	M	26/02/2023	27.6.a	5	5	5	5	5	4	4	5	5	5	5	5	82	8	6
HOM_2023_Q1_6a_57916_022	360	F	26/02/2023	27.6.a	15	14	13	15	14	14	8	15	16	15	16	15	36	16	10
HOM_2023_Q1_6a_57916_026	310	M	26/02/2023	27.6.a	8	9	9	9	9	9	6	9	10	9	11	9	64	14	8
HOM_2023_Q1_6a_57916_028	280	F	26/02/2023	27.6.a	6	6	5	6	6	6	5	6	6	6	6	6	82	7	5
HOM_2023_Q1_6a_57916_033	360	F	26/02/2023	27.6.a	15	15	12	15	16	12	7	15	16	15	15	15	55	19	14
HOM_2023_Q1_6a_57916_039	260	M	26/02/2023	27.6.a	5	5	4	5	5	5	4	5	5	5	6	5	73	11	7
HOM_2023_Q4_6a_59527_001	300	F	26/02/2023	27.6.a	7	7	7	7	7	7	4	7	7	6	8	7	73	15	9
HOM_2023_Q4_6a_59527_003	320	M	19/11/2023	27.6.a	7	10	9	8	9	9	5	9	9	8	10	9	45	17	13
HOM_2023_Q4_6a_59527_005	290	F	19/11/2023	27.6.a	7	7	6	6	6	6	4	6	7	6	7	6	55	14	10
HOM_2023_Q4_6a_59527_006	300	F	19/11/2023	27.6.a	7	7	7	6	7	7	4	6	7	6	8	7	55	16	12
HOM_2023_Q4_6a_59527_007	340	F	19/11/2023	27.6.a	9	9	9	8	9	8	4	8	9	9	9	9	64	18	11
HOM_2023_Q4_6a_59527_008	280	M	19/11/2023	27.6.a	6	6	6	5	6	6	4	5	6	5	6	6	64	12	10
HOM_2023_Q4_6a_59527_011	280	F	19/11/2023	27.6.a	4	5	4	4	4	4	4	4	5	4	4	4	82	10	7
HOM_2023_Q4_6a_59527_016	290	M	19/11/2023	27.6.a	7	7	5	6	7	7	5	7	7	6	7	7	64	13	11
HOM_2023_Q4_6a_59527_017	340	M	19/11/2023	27.6.a	12	12	10	12	12	11	5	11	12	12	12	12	64	19	12
HOM_2023_Q4_6a_59527_020	280	M	19/11/2023	27.6.a	6	6	6	5	6	5	4	5	6	6	6	6	64	12	10
HOM_2023_Q4_6a_59527_021	320	M	19/11/2023	27.6.a	8	9	8	9	9	8	6	8	9	9	9	9	55	11	8
HOM_2023_Q4_6a_59527_022	310	M	19/11/2023	27.6.a	9	10	9	9	9	9	5	8	10	9	12	9	55	19	10
HOM_2023_Q4_6a_59527_023	280	M	19/11/2023	27.6.a	6	7	6	6	7	6	3	5	7	7	7	7	45	20	14
HOM_2023_Q4_6a_59527_027	280	F	19/11/2023	27.6.a	6	7	6	6	6	6	4	6	7	6	7	6	64	14	8
HOM_2023_Q4_6a_59527_029	330	F	19/11/2023	27.6.a	9	9	9	9	9	9	5	9	11	9	10	9	73	16	8

List of multimodal cases

Table 6.17: List of cases for which multiple modes where obtained when all readers are considered. The column NModes_trad shows the number of multiple modes for each SampleID when all readers are given the same expertise weight.

NModes_trad	SampleID
2	274A_38304_025slice
2	274A_38309_015slice
2	274A_86650_002slice
2	**274A_86650_003slice**

Number of age readings by modal age

Table 6.18: 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.

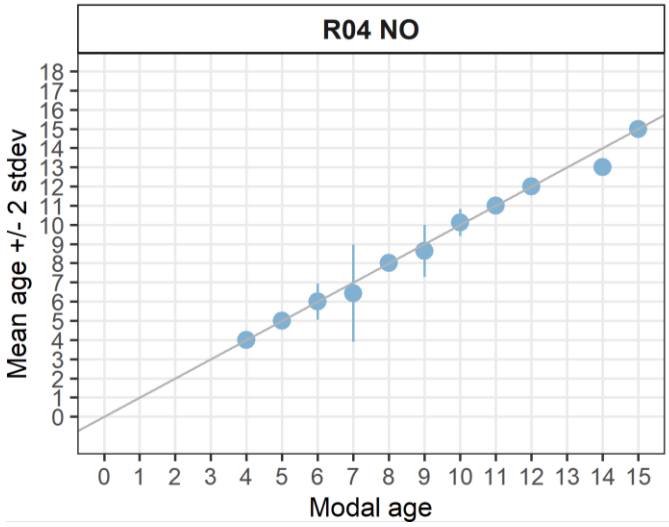
Modal age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	total
4	4	4	4	4	4	4	4	4	4	4	4	44
5	3	3	3	3	3	3	3	3	3	3	3	33
6	10	10	10	10	10	10	10	10	10	10	10	110
7	7	7	7	7	7	7	7	7	7	7	7	77
8	3	3	3	3	3	3	3	3	3	3	3	33
9	11	11	11	11	11	11	11	11	11	11	11	121
10	8	8	8	8	8	8	8	8	8	8	8	88
11	1	1	1	1	1	1	1	1	1	1	1	11
12	1	1	1	1	1	1	1	1	1	1	1	11
13	0	0	0	0	0	0	0	0	0	0	0	0
14	2	2	2	2	2	2	2	2	2	2	2	22
15	4	4	4	4	4	4	4	4	4	4	4	44
Total	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**594**

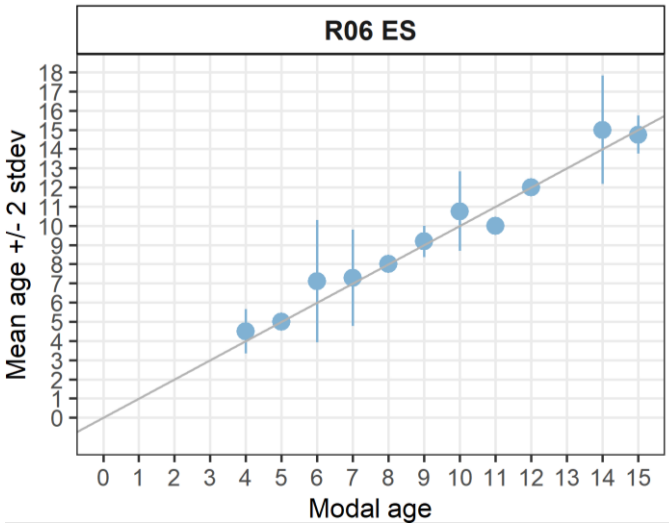
Number of age readings by age

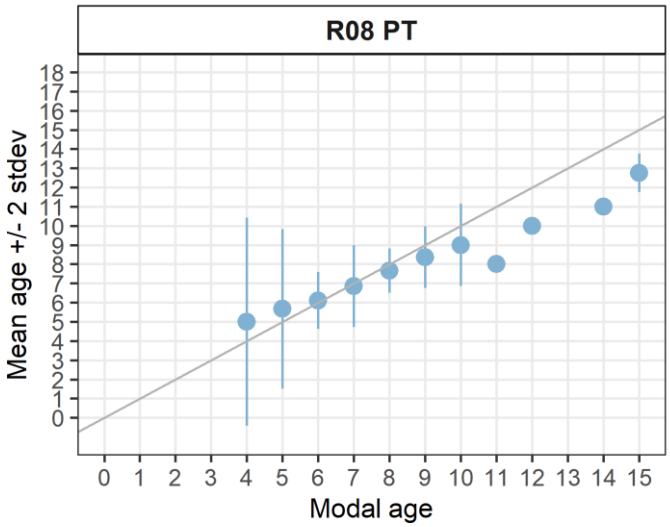
Table 6.19: Age composition by reader gives a summary of number of readings per reader and age. The total numbers of readings by age and by reader are also presented.

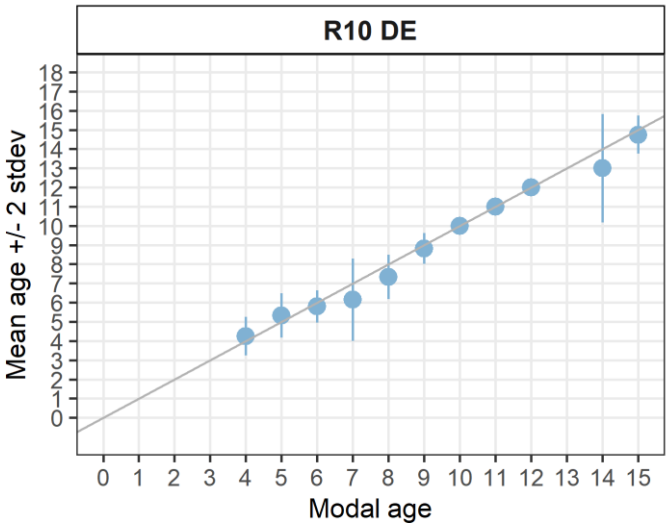
Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES	total
3	0	0	1	0	0	1	5	0	0	0	0	7
4	5	2	3	4	4	4	14	4	2	4	2	48
5	4	5	4	5	3	4	19	7	6	5	2	64
6	10	6	6	12	8	10	10	8	7	10	6	93
7	5	8	10	5	6	7	3	5	8	6	8	71
8	6	3	10	3	5	8	3	7	1	3	4	53
9	8	9	10	9	11	8	0	11	6	10	8	90
10	7	10	4	8	7	2	0	3	7	7	8	63
11	2	3	2	1	2	3	0	3	7	2	7	32
12	1	1	1	2	1	1	0	2	4	2	2	17
13	2	1	3	0	0	2	0	1	0	0	1	10
14	0	2	0	2	4	1	0	1	2	1	1	14
15	4	3	0	3	2	1	0	2	0	3	2	20
16	0	1	0	0	1	0	0	0	4	1	3	10
17	0	0	0	0	0	2	0	0	0	0	0	2
Total	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**54**	**594**

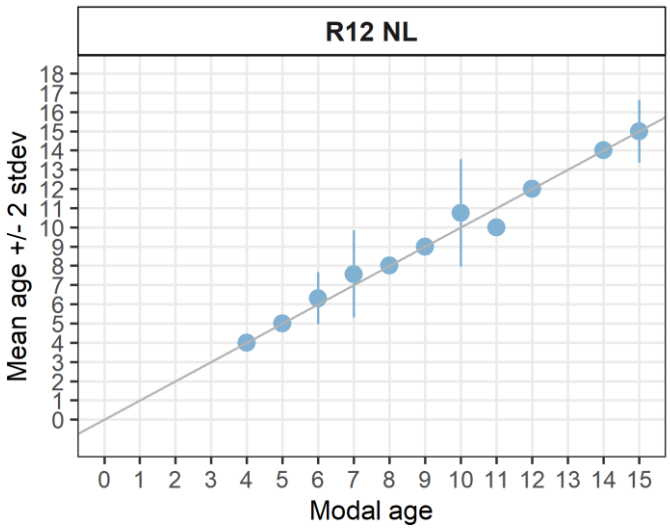
Separate age bias plots by reader

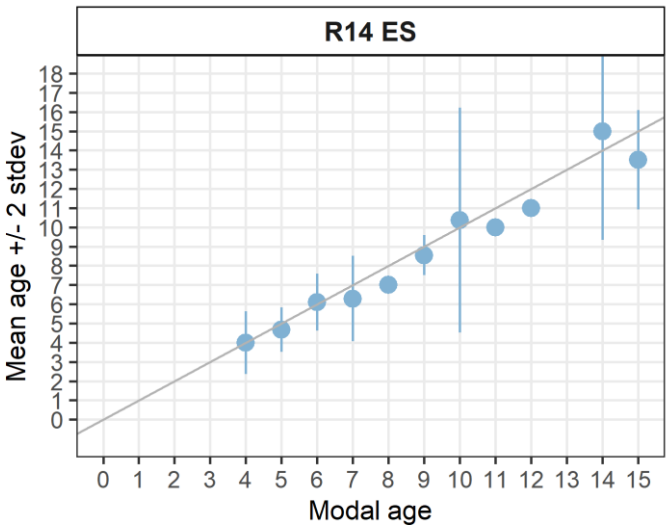


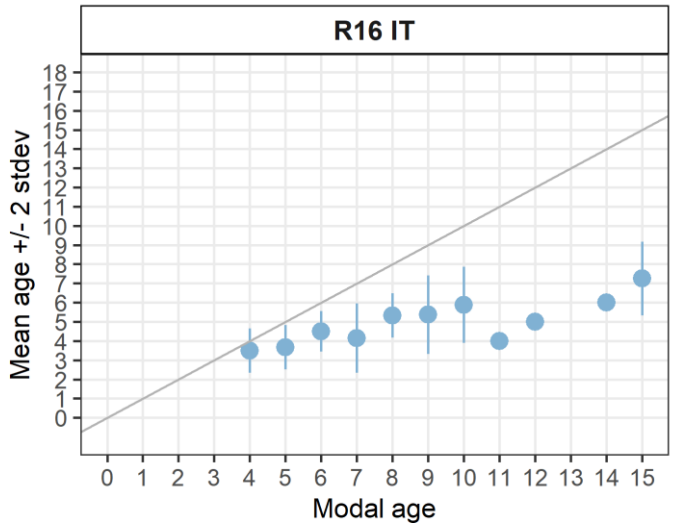


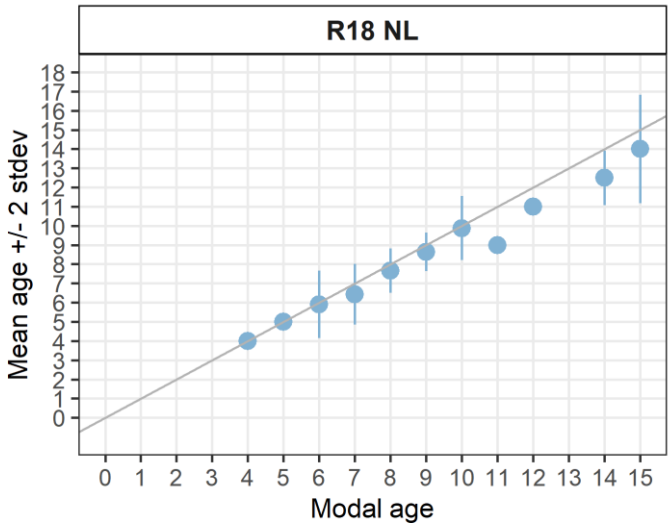


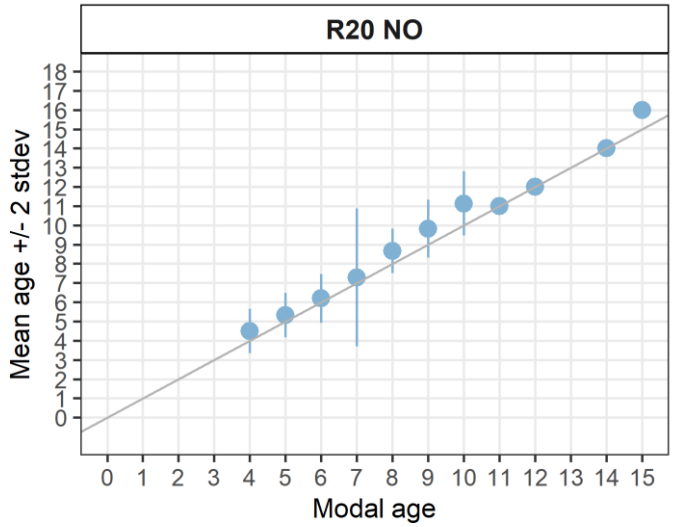


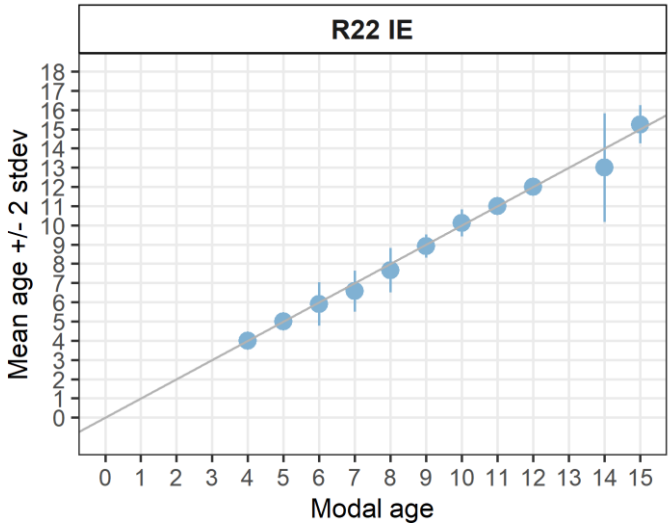


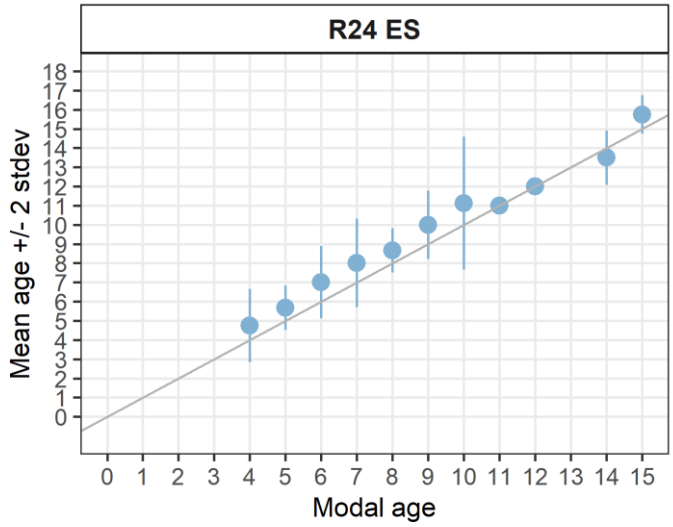



R16 IT
Mean age +/- 2 stdev
Modal age


R18 NL
Mean age +/- 2 stdev
Modal age


R20 NO
Mean age +/- 2 stdev
Modal age


R22 IE
Mean age +/- 2 stdev
Modal age


R24 ES
Mean age +/- 2 stdev
Modal age

Statistics by modal age plot (STDEV, CV and PA)

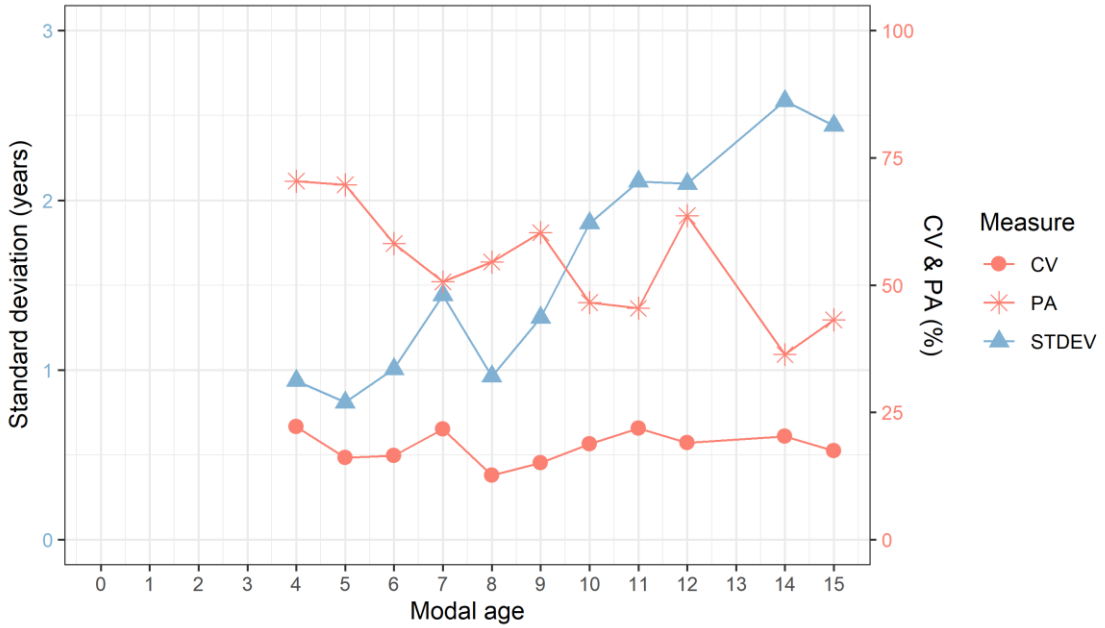


Figure 6.13: CV, PA and (STDEV (standard deviation) are plotted against modal age

Distribution of age reading errors

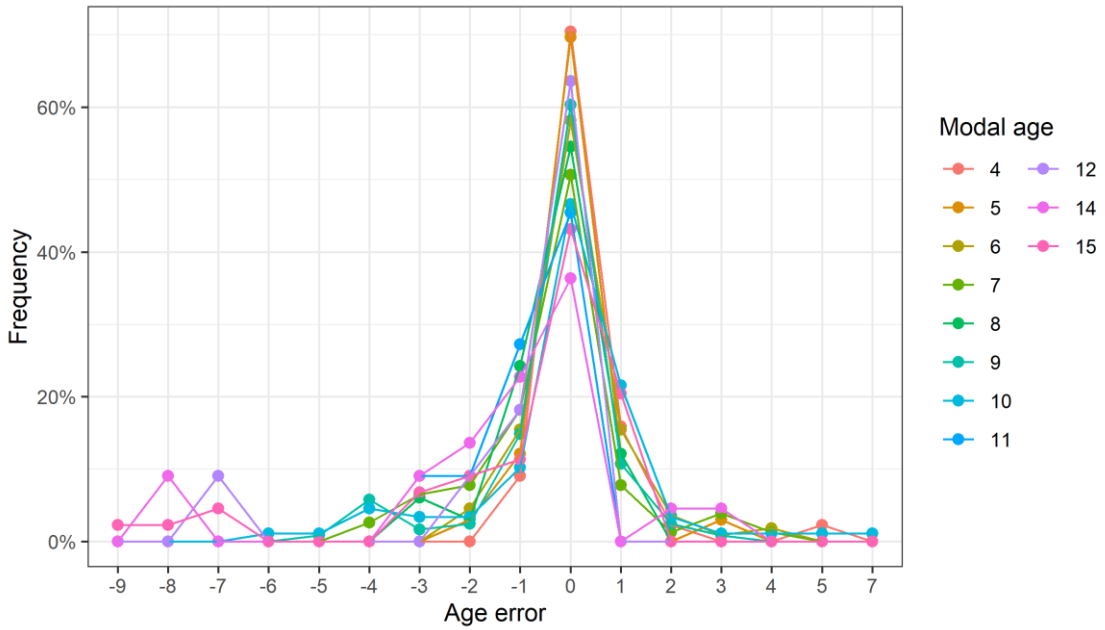


Figure 6.14: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias, if the age reading errors are normally distributed. The distributions are skewed, if relative bias occurs.

Relative bias for all readers

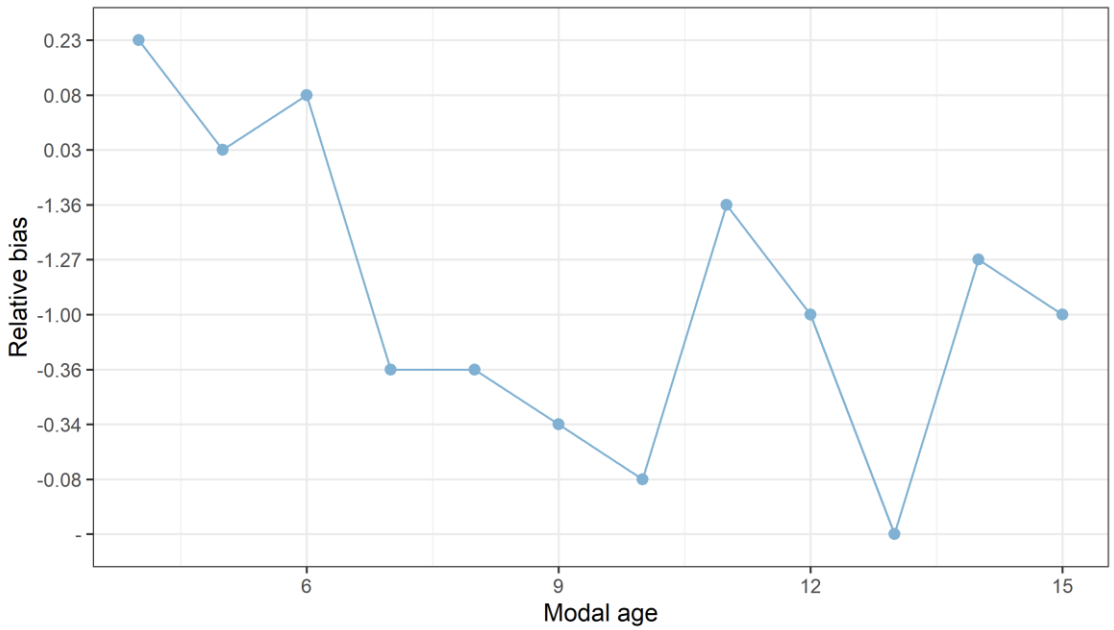


Figure 6.15: The relative bias by modal age as estimated by all age readers combined.

Mean length at age by reader

Table 6.20: Mean fish total length (mm) at age per reader is calculated per reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R04 NO	R06 ES	R08 PT	R10 DE	R12 NL	R14 ES	R16 IT	R18 NL	R20 NO	R22 IE	R24 ES
3	-	-	250	-	-	250	309	-	-	-	-
4	308	292	292	291	310	301	310	310	355	310	265
5	325	317	288	297	310	324	320	306	292	316	312
6	294	300	283	306	296	303	338	301	304	293	309
7	300	298	318	329	298	316	335	313	296	315	308
8	326	327	334	327	322	324	340	318	325	322	306
9	322	322	335	319	321	321	-	328	326	321	325
10	343	329	346	341	344	362	-	355	323	343	323
11	338	348	358	350	345	343	-	328	343	338	339
12	340	340	360	350	340	360	-	355	332	350	325
13	358	325	357	-	-	352	-	355	-	-	360
14	-	360	-	358	350	360	-	360	358	355	355
15	358	357	-	357	355	360	-	360	-	357	342
16	-	355	-	-	360	-	-	-	358	360	357
17	-	-	-	-	-	342	-	-	-	-	-
Weighted Mean	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**	**322**

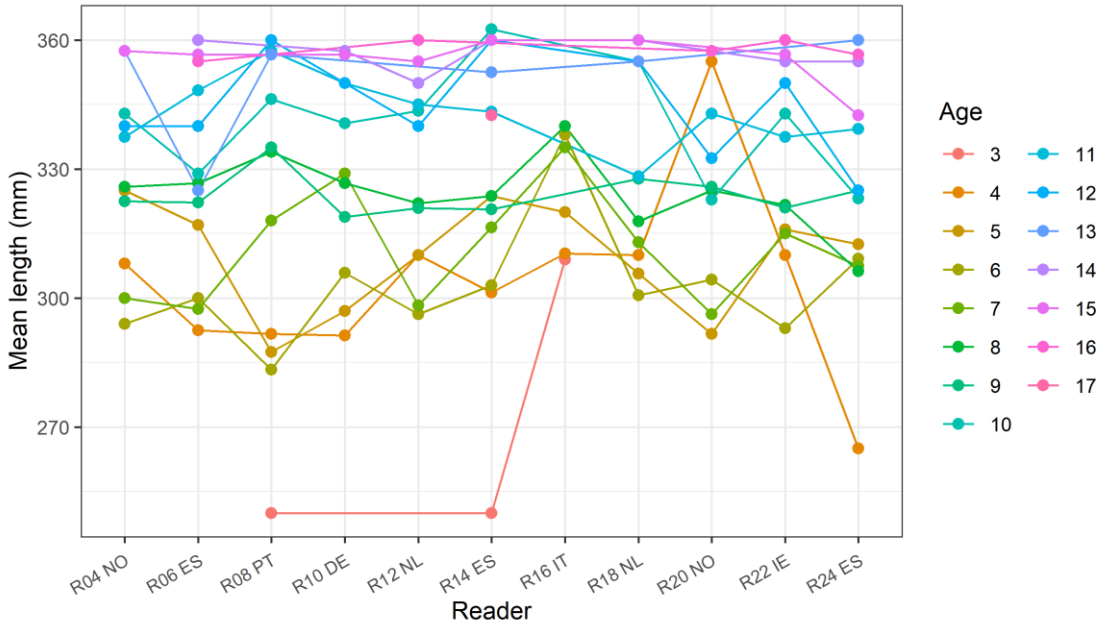


Figure 6.16: The mean fish length at age as estimated by each age reader.

6.1 Results *T. mediterraneus* (Event-ID 2927)

Summary statistics

Table 6.21: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
103	42	55	31

Table 6.22: Data overview including modal age and statistics per sample.

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	Modal age	PA %	CV %	APE %
HMM2015_P41_I038	142	U	18/07/2015	1.0	1	1	2	1	2	2	3	1	1	1	2	2	1	1	1	1	60	44	38
HMM2015_P41_I041	150	M	18/07/2015	1.0	3	1	1	2	2	3	3	2	2	1	2	3	-	1	1	2	36	43	34
HMM2015_P41_I044	150	U	18/07/2015	1.0	2	1	1	1	1	2	3	1	1	1	1	2	1	1	1	1	73	46	37
HMM2015_P41_I046	160	F	18/07/2015	1.0	3	2	2	3	3	3	3	2	2	1	3	-	2	2	2	2	50	27	23
HMM2015_P41_I055	133	U	18/07/2015	1.0	2	0	1	1	1	2	2	1	2	1	1	3	-	1	2	1	50	53	44
HMM2015_P42_I034	160	F	18/07/2015	1.0	2	2	2	3	2	1	3	2	2	1	2	3	2	2	2	2	67	29	18
HMM2015_P42_I047	117	U	18/07/2015	1.0	1	1	1	2	1	1	2	1	1	1	1	3	1	1	2	1	73	46	37
HMM2015_P42_I049	122	U	18/07/2015	1.0	1	1	1	2	1	1	3	1	1	1	1	3	1	1	1	1	80	54	40
HMM2015_P43_I008	172	F	19/07/2015	1.0	3	2	2	3	3	2	3	3	2	1	-	3	2	1	2	3	43	32	27
HMM2015_P43_I021	220	F	19/07/2015	1.0	4	3	6	4	3	3	5	3	3	1	5	3	3	2	5	3	47	37	29
HMM2015_P43_I049	250	M	19/07/2015	1.0	3	2	3	3	3	3	3	3	4	1	-	3	3	3	3	3	79	23	14
HMM2015_P55_I006	80	U	24/07/2015	1.0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	93	-	-
HMM2015_P55_I007	90	U	24/07/2015	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	-	-
HMM2015_P55_I008	77	U	24/07/2015	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	-	-
HMM2015_P55_I011	95	U	24/07/2015	1.0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	93	-	-
HMM2014_P11_I083	205	M	28/06/2014	6.0	3	2	2	3	2	2	4	-	2	1	2	3	2	2	2	2	64	32	24
HMM2014_P11_I085	215	M	28/06/2014	6.0	2	2	2	3	2	2	3	-	2	1	-	3	2	2	2	2	69	26	18
HMM2014_P11_I088	148	M	28/06/2014	6.0	3	1	2	3	2	1	3	-	2	1	1	2	2	1	1	1	43	45	38
HMM2014_P11_I089	141	F	28/06/2014	6.0	2	1	2	2	2	1	3	-	2	1	1	2	2	1	1	2	50	39	34
HMM2014_P11_I090	139	U	28/06/2014	6.0	2	1	1	3	1	1	3	-	1	0	1	2	2	1	1	1	57	60	49
HMM2014_P11_I091	125	U	28/06/2014	6.0	2	-	1	3	2	1	3	-	2	0	1	2	2	1	2	2	46	51	41
HMM2014_P11_I093	125	U	28/06/2014	6.0	2	1	1	2	1	2	3	-	2	0	1	2	1	1	2	2	43	51	43
HMM2014_P11_I094	173	F	28/06/2014	6.0	3	2	3	1	2	2	2	-	3	1	-	2	2	2	2	2	62	31	21
HMM2014_P11_I095	160	M	28/06/2014	6.0	1	2	2	1	1	2	3	2	2	0	2	2	2	1	2	2	60	43	35
HMM2014_P11_I096	60	U	28/06/2014	6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	-	-
HMM2014_P11_I097	130	U	28/06/2014	6.0	2	2	2	2	1	2	2	2	2	0	2	2	2	1	2	2	80	34	25
HMM2014_P11_I098	135	U	28/06/2014	6.0	2	1	2	1	1	1	2	1	2	0	2	2	2	1	1	1	47	45	40
HMM2014_P11_I100	137	U	28/06/2014	6.0	2	1	2	1	1	1	3	1	2	1	1	2	1	1	1	1	67	45	38
HMM2014_P11_I111	130	U	28/06/2014	6.0	1	1	1	2	1	1	3	1	2	0	1	2	2	1	1	1	60	54	43
HMM2014_P11_I113	119	U	28/06/2014	6.0	2	1	2	1	1	1	3	1	1	0	1	2	2	1	2	1	53	53	44
HMM2014_P27_I092	115	U	09/07/2014	6.0	1	-	1	1	0	0	2	1	1	0	2	2	1	1	1	1	57	68	43
HMM2014_P27_I001	297	M	09/07/2014	6.0	4	3	4	4	3	4	3	3	4	3	4	3	2	4	2	4	47	22	19
HMM2014_P27_I040	185	F	09/07/2014	6.0	3	3	3	4	4	2	3	3	4	1	3	3	2	2	2	3	47	31	24
HMM2014_P27_I073	155	U	09/07/2014	6.0	1	-	1	1	1	-	3	2	2	1	-	2	1	1	-	1	64	47	40
HMM2014_P27_I086	120	U	09/07/2014	6.0	1	1	1	1	0	0	1	1	2	0	0	2	1	1	1	1	60	74	53
HMM2014_P27_I085	133	U	09/07/2014	6.0	1	1	1	1	1	1	2	1	1	1	-	2	1	1	1	1	86	32	21
HMM2014_P27_I018	320	M	09/07/2014	6.0	4	4	3	5	4	4	5	4	6	2	4	3	2	-	3	4	43	30	22
HMM2014_P27_I062	171	F	09/07/2014	6.0	3	-	2	-	3	-	-	3	-	1	-	2	-	-	-	3	50	35	29
HMM2014_P27_I021	235	F	09/07/2014	6.0	3	3	2	2	2	2	3	3	2	1	3	3	2	1	2	2	47	31	26

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	Modal age	PA %	CV %	APE %
HMM2014_P27_I019	250	M	09/07/2014	6.0	4	3	4	4	3	3	5	3	3	1	3	3	4	-	3	3	57	28	20
HMM2014_P27_I022	340	M	09/07/2014	6.0	5	4	2	5	3	6	6	3	7	2	4	3	4	-	3	3	29	38	30
HMM2014_P27_I068	192	M	09/07/2014	6.0	5	-	2	4	3	-	4	2	6	1	3	3	-	2	3	3	33	44	33
HMM2014_P27_I008	267	F	09/07/2014	6.0	5	-	3	-	5	4	-	3	3	2	-	3	2	-	4	3	40	32	26
HMM2014_P27_I033	274	M	09/07/2014	6.0	7	-	4	6	6	4	5	3	5	1	4	3	2	3	3	3	29	42	32
GSA11TM01	112	U	11/12/2015	11.1	2	3	1	0	0	0	3	4	2	1	2	3	3	1	1	0	20	74	63
GSA11TM02	137	U	11/12/2015	11.1	2	-	1	0	1	0	3	5	1	1	0	3	1	1	-	1	46	99	75
GSA11TM03	158	U	08/03/2016	11.1	4	4	2	1	3	0	4	5	3	1	3	3	3	2	3	3	40	49	37
GSA11TM04	153	U	21/07/2020	11.1	0	1	0	0	0	1	2	1	1	1	0	2	0	0	0	0	53	-	-
GSA11TM05	156	U	21/07/2020	11.1	0	1	0	0	1	0	2	1	1	1	0	2	1	0	0	0	47	-	-
GSA11TM06	143	F	28/07/2015	11.1	2	-	1	2	1	1	2	2	1	1	1	3	-	1	0	1	54	55	45
GSA11TM07	141	F	08/03/2016	11.1	2	1	1	0	1	0	4	3	2	1	1	3	1	1	-	1	50	77	62
GSA11TM08	192	F	22/07/2015	11.1	3	2	1	1	2	2	-	4	2	1	-	3	-	1	-	2	36	50	36
GSA11TM09	226	F	22/07/2015	11.1	4	-	-	3	2	2	4	4	1	2	-	3	-	2	-	2	40	39	33
GSA11TM10	239	F	22/07/2015	11.1	4	3	3	4	2	2	5	4	2	2	3	4	2	2	2	2	47	35	30
GSA11TM11	155	M	09/09/2020	11.1	5	5	5	5	6	3	7	5	4	4	4	3	5	-	5	5	50	23	17
GSA11TM12	171	M	09/09/2020	11.1	3	3	1	1	2	1	3	3	2	1	1	3	2	2	2	3	33	42	33
GSA11TM13	184	M	21/07/2020	11.1	2	2	2	2	2	2	3	3	1	1	2	3	2	2	2	2	67	29	18
GSA11TM14	196	M	22/07/2015	11.1	2	2	3	3	3	1	3	4	2	1	-	3	2	2	2	2	43	36	29
GSA11TM15	278	M	09/03/2019	11.1	4	-	-	3	2	3	6	3	2	3	4	3	3	2	3	3	54	34	22
GSA11TM16	211	M	24/03/2025	11.1	4	2	2	5	2	3	7	4	3	2	3	3	3	2	3	3	40	43	30
GSA11TM17	195	M	24/03/2025	11.1	3	2	2	3	2	1	7	2	2	1	3	3	2	2	2	2	53	57	36
GSA11TM18	208	M	24/03/2025	11.1	3	3	2	3	2	1	5	2	2	1	2	3	2	2	4	2	47	43	34
GSA11TM19	208	F	24/03/2025	11.1	2	2	2	2	2	2	7	3	2	2	-	3	2	2	1	2	71	58	34
GSA11TM20	219	M	24/03/2025	11.1	3	2	2	1	2	2	4	3	2	1	2	3	2	2	3	2	53	35	27
GSA11TM21	267	F	28/03/2025	11.1	-	-	-	5	8	5	4	7	6	6	-	4	3	-	4	4	30	30	24
GSA11TM22	245	F	28/03/2025	11.1	3	3	2	3	3	3	4	5	2	3	2	4	2	2	3	3	47	30	21
GSA11TM23	234	M	28/03/2025	11.1	4	4	4	7	4	3	3	4	3	2	2	3	3	2	3	3	40	37	26
GSA11TM24	243	F	28/03/2025	11.1	3	4	3	4	3	3	4	3	3	2	3	3	3	3	2	3	67	19	12
GSA11TM25	202	M	28/03/2025	11.1	2	2	2	2	1	1	3	2	1	1	2	3	-	-	2	2	54	37	28
GSA11TM26	244	F	28/03/2025	11.1	3	4	-	5	5	3	4	3	3	2	3	3	-	2	4	3	46	28	23
GSA11TM27	215	F	28/03/2025	11.1	4	4	1	2	1	2	5	3	2	1	3	3	-	2	6	2	29	55	44
GSA11TM28	229	F	28/03/2025	11.1	3	3	3	3	3	2	4	2	3	2	3	3	3	3	3	3	73	18	12
GSA11TM29	222	F	28/03/2025	11.1	3	3	4	3	3	2	5	2	3	2	4	3	4	2	3	3	47	29	21
HMM_GSA20_01	142	F	23/05/2024	20.0	-	3	1	-	1	-	4	3	2	4	-	3	-	-	5	3	33	47	36
HMM_GSA20_02	222	M	21/05/2024	20.0	4	3	1	4	2	-	5	3	3	3	3	3	-	2	5	3	46	36	26
HMM_GSA20_03	233	F	01/06/2024	20.0	4	-	2	-	2	-	5	2	2	3	4	3	3	2	5	2	42	38	31
HMM_GSA20_04	244	M	24/05/2024	20.0	3	-	2	3	2	3	6	2	2	3	2	3	-	2	3	3	46	39	26
HMM_GSA20_05	256	M	24/05/2024	20.0	4	3	3	-	2	3	4	-	2	3	3	3	3	2	4	3	54	24	15
HMM_GSA20_06	266	F	24/05/2024	20.0	-	5	-	-	5	5	-	-	6	5	-	3	-	-	3	5	57	25	20
HMM_GSA20_07	296	M	21/05/2024	20.0	-	-	5	5	4	6	5	-	5	6	4	3	5	4	4	5	42	19	15
HMM_GSA20_08	301	M	21/05/2024	20.0	6	6	-	5	5	6	6	-	6	7	3	4	6	-	5	6	50	20	16
HMM_GSA20_09	321	F	24/05/2024	20.0	7	-	6	6	7	6	6	-	7	7	9	3	7	-	7	7	50	21	14

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	Modal age	PA %	CV %	APE %
HMM_GSA20_10	338	F	21/05/2024	20.0	6	6	5	6	6	6	5	-	6	7	6	3	6	4	5	6	57	19	14
HMM_GSA20_11	331	M	01/06/2024	20.0	7	6	4	7	6	6	5	-	7	7	6	3	7	3	5	7	36	26	21
HMM_GSA20_12	360	M	26/06/2024	20.0	5	-	-	5	5	6	6	-	6	7	4	3	5	-	4	5	36	22	17
HMM_GSA20_13	206	F	17/06/2024	20.0	4	4	2	2	2	2	5	-	2	2	2	2	3	2	3	2	64	38	31
HMM_GSA20_14	380	M	23/05/2024	20.0	5	6	5	7	5	5	6	-	6	7	5	0	6	6	5	5	43	32	19
HMM_GSA20_15	402	M	06/06/2024	20.0	5	6	6	6	5	6	4	-	5	8	4	4	5	4	4	4	36	23	17
HMM_GSA20_16	67	U	25/07/2024	20.0	0	0	0	0	0	0	1	-	0	0	0	0	0	0	0	0	93	-	-
HMM_GSA20_17	78	U	20/07/2024	20.0	0	1	0	0	0	0	2	-	0	0	1	0	1	0	0	0	71	-	-
HMM_GSA20_18	77	U	20/07/2024	20.0	0	0	0	0	0	0	2	-	0	0	0	0	0	0	0	0	93	-	-
HMM_GSA20_19	70	U	23/07/2024	20.0	0	0	0	0	0	0	2	-	0	0	1	0	0	0	0	0	86	-	-
HMM_GSA20_20	108	F	18/07/2024	20.0	0	0	1	0	0	0	2	-	0	1	2	0	2	0	0	0	64	-	-
HMM_GSA20_21	125	U	18/07/2024	20.0	0	1	1	0	0	0	2	-	1	1	1	1	1	1	0	1	57	86	71
HMM_GSA20_22	144	M	18/07/2024	20.0	0	1	1	0	0	0	2	-	1	1	2	1	0	1	0	0	43	-	-
HMM_GSA20_23	181	U	17/09/2024	20.0	3	-	0	2	2	-	-	-	1	4	-	3	-	2	-	2	38	59	43
HMM_GSA20_24	208	M	16/09/2024	20.0	3	3	1	2	2	1	4	-	2	2	-	3	3	2	1	2	38	42	33
HMM_GSA20_25	256	F	26/08/2024	20.0	2	-	2	2	2	3	4	-	3	4	-	3	2	2	2	2	58	31	26
HMM_GSA20_26	306	M	26/08/2024	20.0	5	5	4	4	4	5	5	-	5	5	5	4	5	4	5	5	64	11	10
HMM_GSA20_27	341	M	26/08/2024	20.0	8	8	8	7	7	6	7	-	8	8	8	4	7	-	5	8	46	18	13
HMM_GSA20_28	298	M	26/08/2024	20.0	5	5	5	5	5	4	5	-	6	6	6	4	5	-	5	5	62	13	8
HMM_GSA20_29	375	M	26/08/2024	20.0	7	-	5	5	6	6	6	-	5	6	7	4	6	-	5	6	42	16	13
HMM_GSA20_30	384	F	20/09/2024	20.0	6	5	-	6	3	-	4	-	6	8	-	3	-	-	-	6	38	34	27

Number of age readings by modal age

Table 6.23: 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.

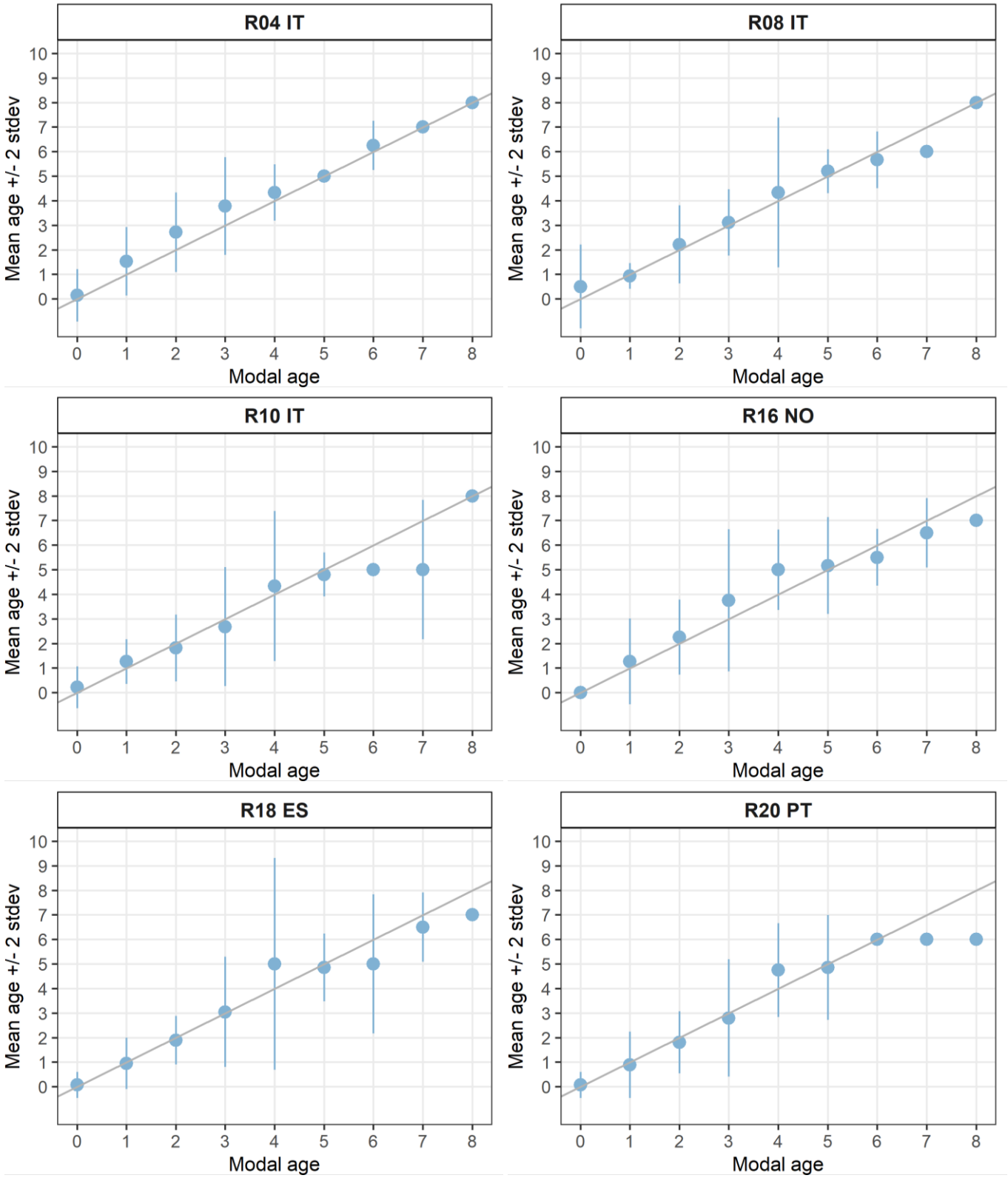
Modal age	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	total
0	14	14	14	14	14	14	14	8	14	14	14	14	14	14	14	204
1	19	15	19	19	19	18	19	16	19	19	17	19	17	19	16	270
2	28	23	27	27	28	26	26	18	28	28	19	27	22	27	25	379
3	23	18	22	20	24	20	22	23	23	24	19	24	18	19	23	322
4	3	3	3	4	4	4	4	3	4	4	3	4	4	2	4	53
5	5	5	5	6	7	7	6	1	7	7	6	7	6	3	7	85
6	4	3	2	4	4	3	4	0	4	4	3	4	3	1	3	46
7	2	1	2	2	2	2	2	0	2	2	2	2	2	1	2	26
8	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	13
Total	**99**	**83**	**95**	**97**	**103**	**95**	**98**	**69**	**102**	**103**	**84**	**102**	**87**	**86**	**95**	**1398**

Number of age readings by age

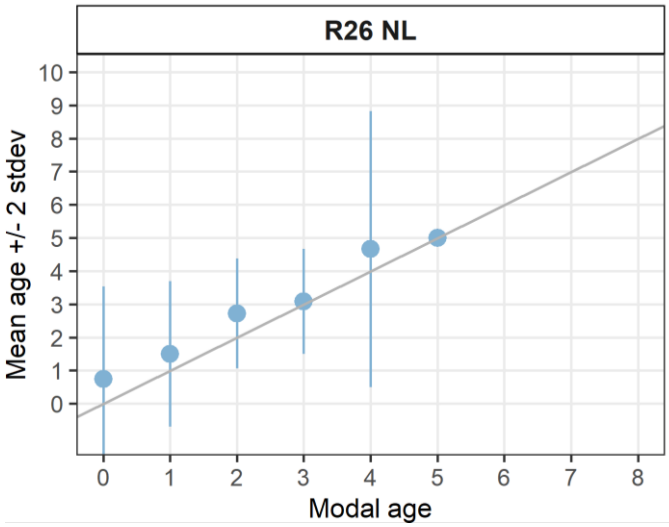
Table 6.24: Age composition by reader gives a summary of number of readings per reader and age. The total numbers of readings by age and by reader are also presented.

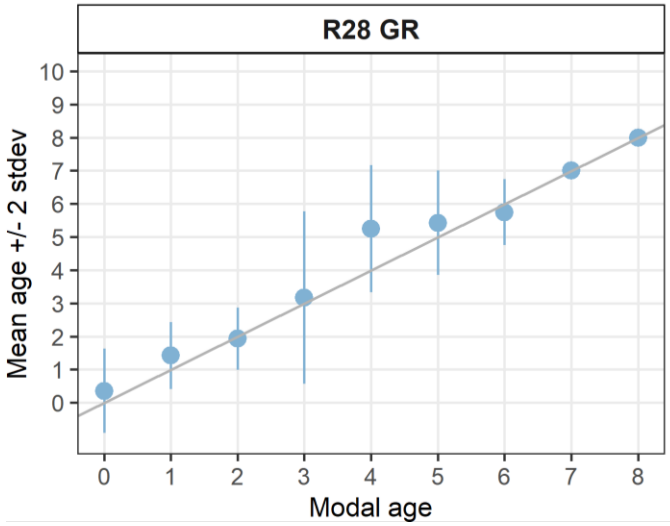
Age	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES	total
0	14	10	12	17	16	19	3	5	10	19	11	11	10	12	15	184
1	9	21	26	16	21	20	4	14	18	44	18	2	15	30	16	274
2	21	17	30	17	29	22	16	15	38	14	19	22	32	33	24	349
3	23	16	10	18	16	15	29	22	13	7	16	58	14	5	17	279
4	15	8	7	9	5	5	17	8	4	4	11	9	3	5	8	118
5	9	5	6	11	8	4	16	4	5	2	3	0	6	0	13	92
6	3	5	3	5	5	10	8	0	10	4	3	0	4	1	1	62
7	4	0	0	4	2	0	5	1	3	6	1	0	3	0	1	30
8	1	1	1	0	1	0	0	0	1	3	1	0	0	0	0	9
9	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Total	**99**	**83**	**95**	**97**	**103**	**95**	**98**	**69**	**102**	**103**	**84**	**102**	**87**	**86**	**95**	**1398**

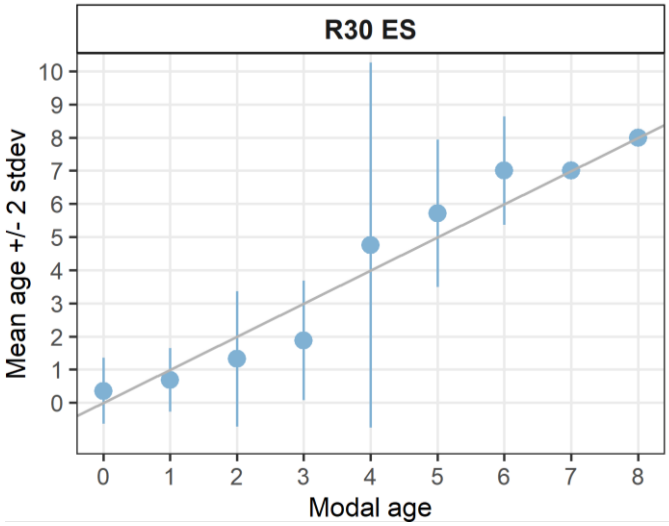
Separate age bias plots by reader

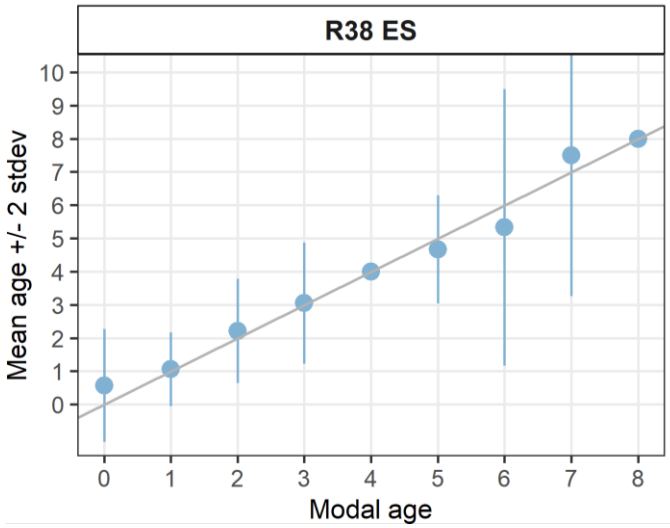


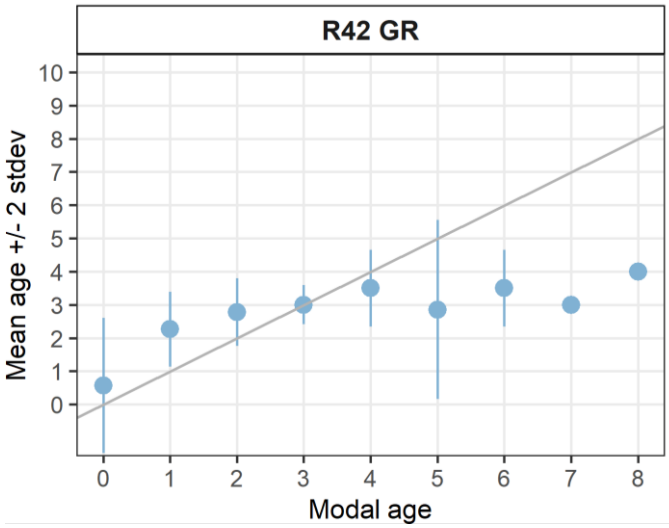
R22 IT
Mean age +/- 2 stdev
Modal age


R26 NL
Mean age +/- 2 stdev
Modal age

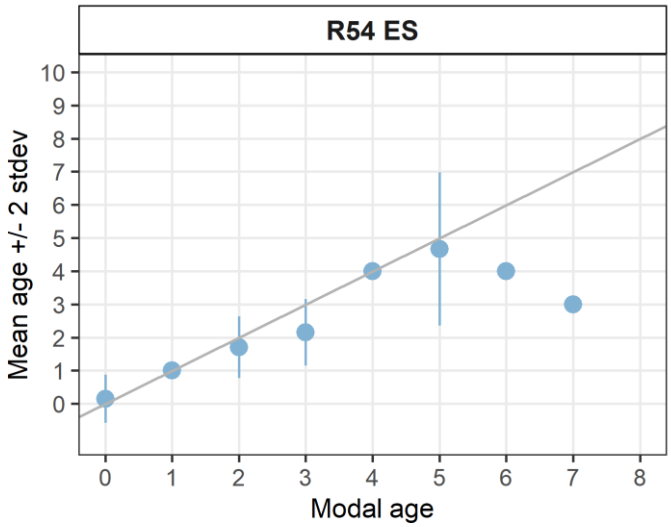

R28 GR
Mean age +/- 2 stdev
Modal age

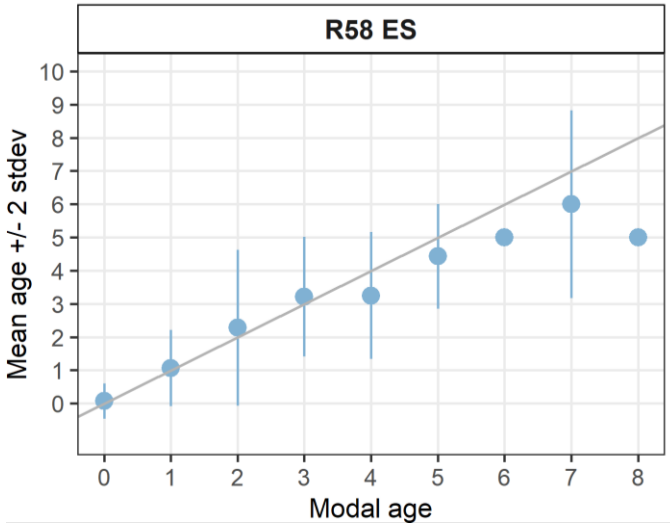

R30 ES
Mean age +/- 2 stdev
Modal age


R38 ES
Mean age +/- 2 stdev
Modal age


R42 GR
Mean age +/- 2 stdev
Modal age

R50 IT
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5
6
7
8
9
10


R54 ES
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5
6
7
8
9
10


R58 ES
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5
6
7
8
9
10

Statistics by modal age plot (STDEV, CV and PA)

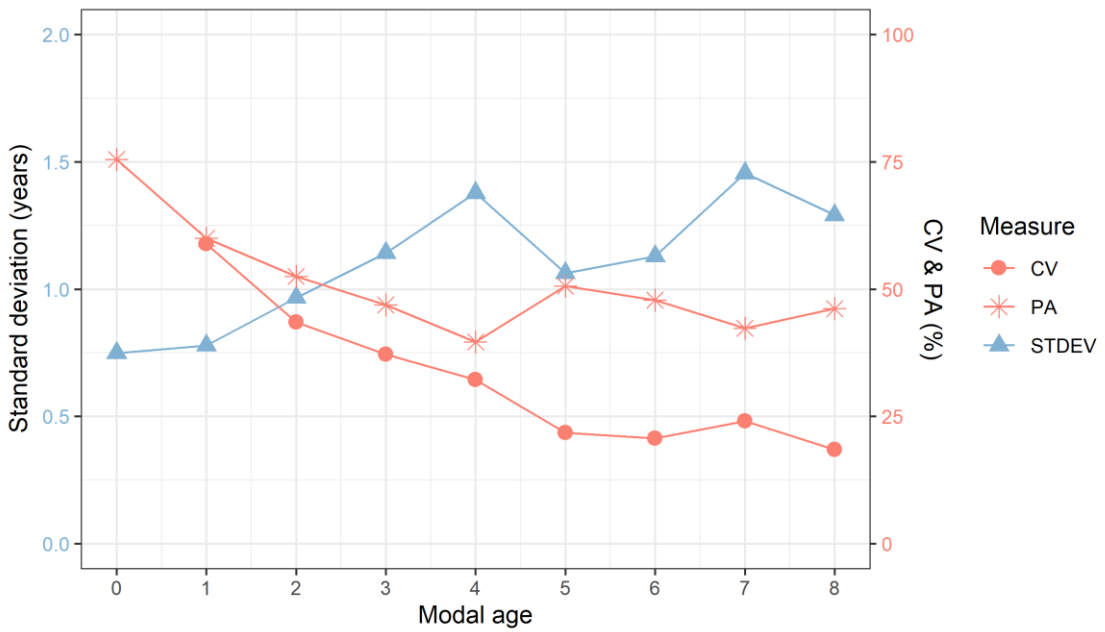


Figure 6.17: CV, PA and STDEV (standard deviation) are plotted against modal age

Distribution of age reading errors

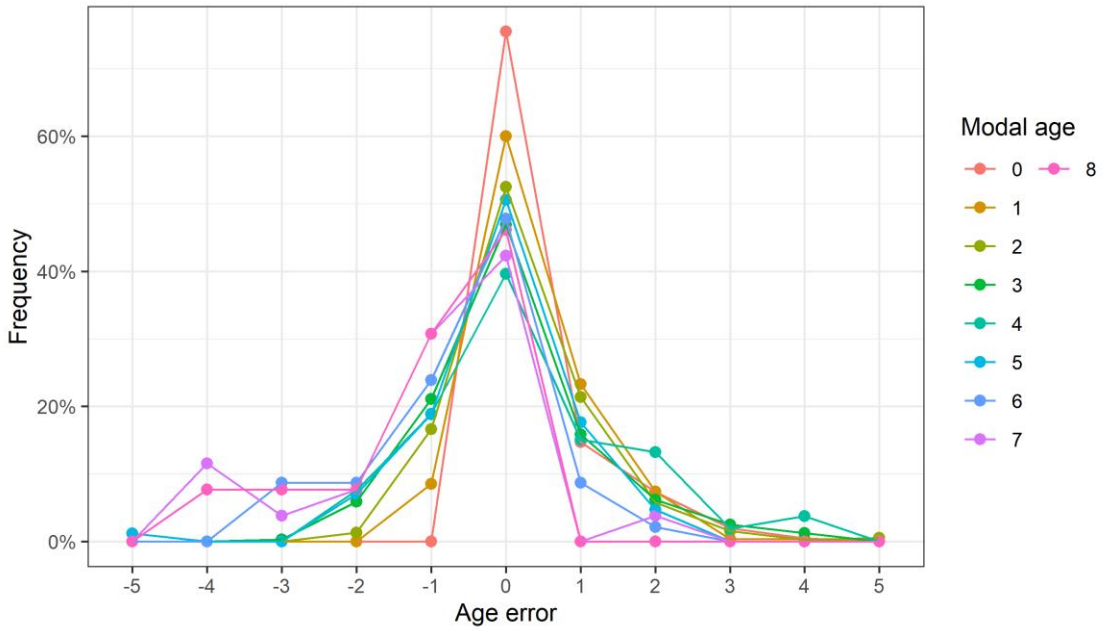


Figure 6.18: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias, if the age reading errors are normally distributed. The distributions are skewed, if relative bias occurs.

Relative bias for all readers

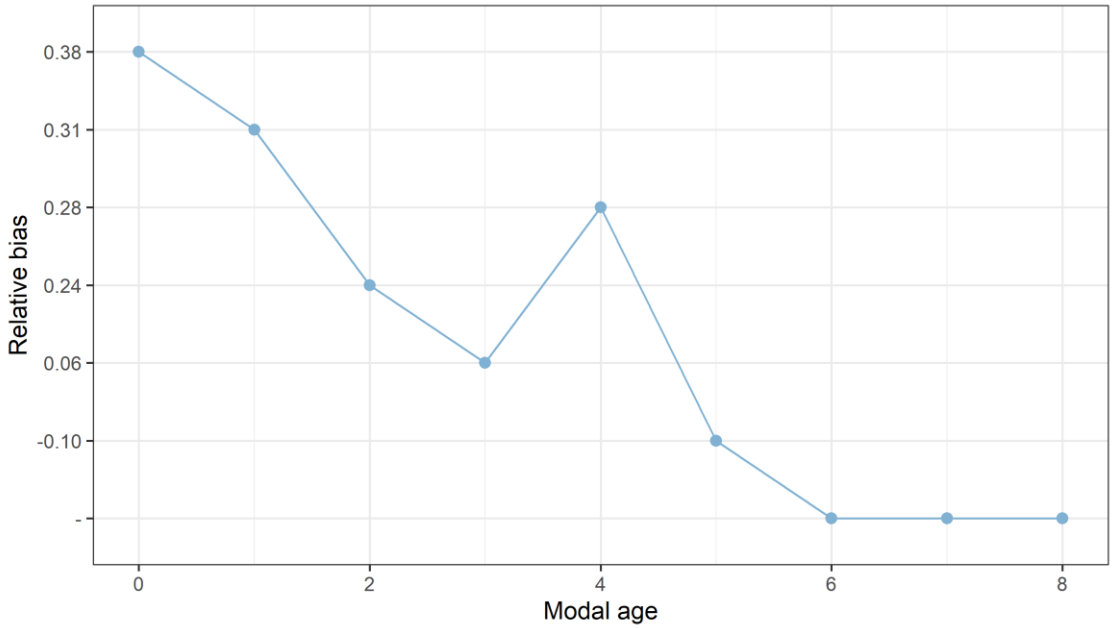


Figure 6.19: The relative bias by modal age as estimated by all age readers combined.

Mean length at age by reader

Table 6.25: Mean fish total length (mm) at age per reader is calculated per reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R04 IT	R08 IT	R10 IT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R38 ES	R42 GR	R50 IT	R54 ES	R58 ES
0	99	86	99	104	98	106	76	80	80	105	101	107	91	93	102
1	133	134	145	151	144	154	90	133	149	172	129	134	130	141	143
2	157	190	191	174	201	189	124	186	180	243	174	144	191	211	183
3	202	215	236	201	233	226	167	224	225	254	221	222	222	265	243
4	238	245	273	239	268	291	236	216	222	184	289	308	271	328	288
5	300	282	307	288	315	305	261	174	331	286	302	-	303	-	280
6	341	350	314	344	295	340	325	-	311	309	322	-	348	380	215
7	325	-	-	322	331	-	222	267	331	338	375	-	331	-	321
8	341	341	341	-	267	-	-	-	341	376	341	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	321	-	-	-	-
Weighted Mean	**196**	**190**	**190**	**197**	**198**	**197**	**197**	**184**	**198**	**198**	**195**	**199**	**197**	**182**	**198**

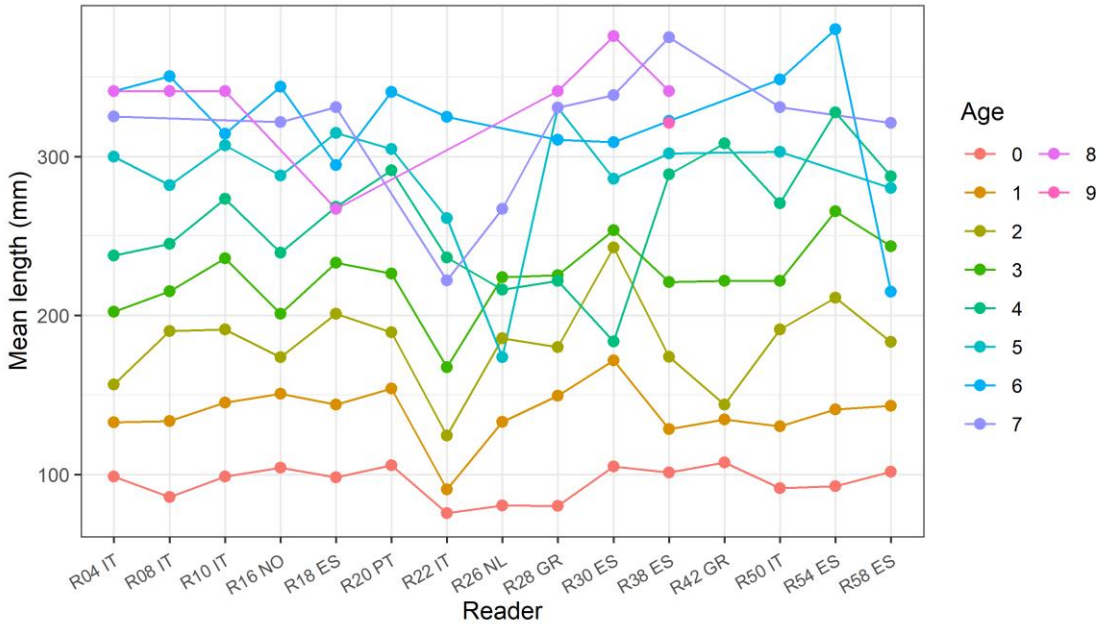


Figure 6.20: The mean fish length at age as estimated by each age reader.

6.2 Results Advanced reader

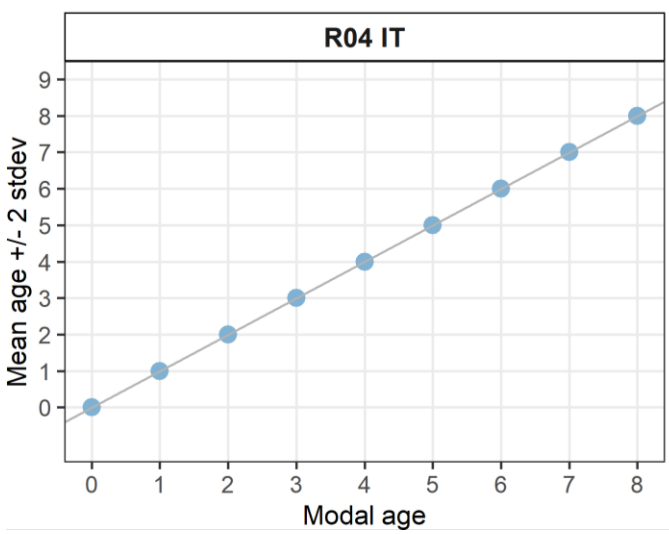
These additional results correspond to one unique reader with advanced expertise and, hence, precision measures are not presented.

Mean length at age by reader

Table 6.26: Mean fish total length (mm) at age per reader is calculated per advanced reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R04 IT
0	99
1	133
2	157
3	202
4	238
5	300
6	341
7	325
8	341
Weighted Mean	**196**

Age bias plot by reader



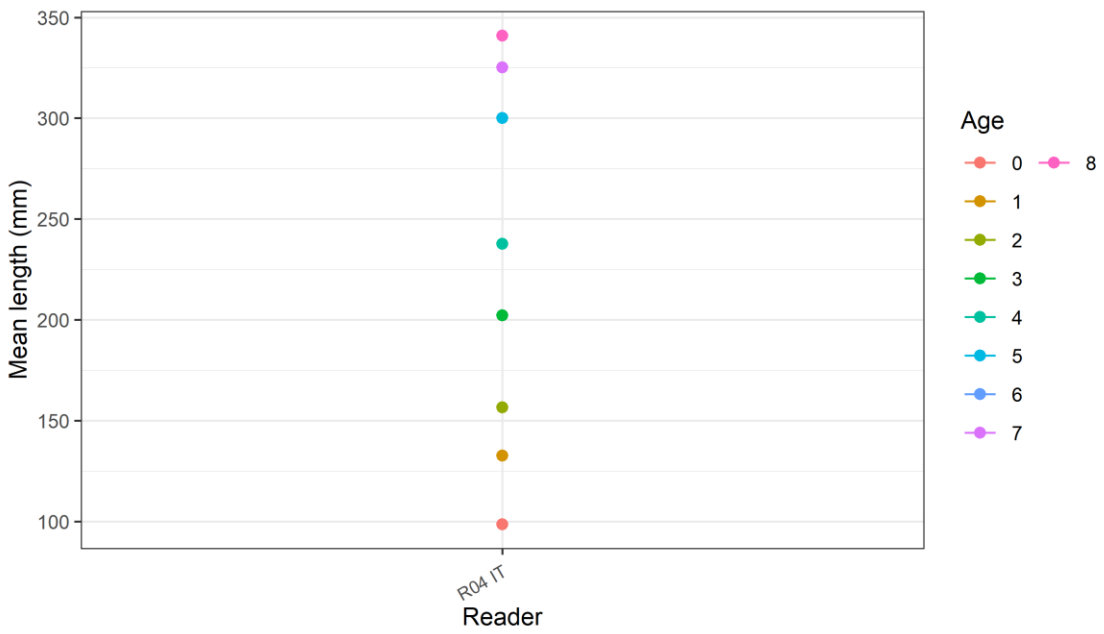


Figure 6.21: The mean fish total length (mm) at age as estimated by each age reader.

6.3 Results *T. picturatus* (Event-ID 2928)

Summary statistics

Table 6.27: Summary of statistics; PA (%), CV (%) and APE (%).

NSample	CV	PA	APE
81	39	50	29

Table 6.28: Data overview including modal age and statistics per sample.

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	Modal age	PA %	CV %	APE %
GSA9_TP_WHOLE_01	340	F	28/12/2018	9	-	2	7	6	3	5	5	4	6	6	4	2	8	2	2	3	2	27	46	39
GSA9_TP_WHOLE_02	330	F	28/12/2018	9	3	3	5	5	3	-	4	3	3	5	4	3	6	-	3	4	3	50	27	22
GSA9_TP_WHOLE_03	340	F	28/12/2018	9	3	3	6	5	3	-	4	3	4	4	4	3	5	3	3	4	3	47	25	20
GSA9_TP_WHOLE_04	355	F	28/12/2018	9	3	3	7	-	4	-	4	4	6	4	5	3	-	3	3	3	3	46	32	23
GSA9_TP_WHOLE_05	395	F	28/12/2018	9	-	4	7	4	4	4	4	4	6	6	5	4	5	3	4	4	4	60	23	19
GSA9_TP_WHOLE_06	415	F	28/12/2018	9	4	2	8	-	5	5	5	4	5	9	-	2	-	3	3	4	5	31	46	33
GSA9_TP_WHOLE_07	380	F	28/12/2018	9	4	3	6	-	5	4	5	4	6	6	4	3	8	3	3	-	4	29	33	27
GSA9_TP_WHOLE_08	415	F	28/12/2018	9	4	4	7	6	6	6	5	5	6	7	5	8	8	3	3	5	6	25	28	23
GSA9_TP_WHOLE_09	425	M	28/12/2018	9	-	4	7	6	6	6	4	5	7	9	5	5	8	3	-	5	5	29	29	22
GSA9_TP_WHOLE_10	420	F	28/12/2018	9	4	3	6	4	6	-	5	4	4	5	4	5	5	3	-	4	4	43	21	18
GSA9_TP_WHOLE_11	420	F	28/12/2018	9	4	3	6	-	5	5	4	4	6	7	4	3	-	3	-	5	4	31	28	23
GSA9_TP_WHOLE_12	385	F	28/12/2018	9	3	3	8	6	5	6	4	3	5	6	4	-	9	3	-	3	3	36	40	32
GSA9_TP_WHOLE_13	365	F	17/10/2020	9	3	4	7	4	4	4	4	4	4	6	4	4	8	3	3	5	4	56	32	23
GSA9_TP_WHOLE_14	420	F	17/10/2020	9	3	3	-	3	4	5	5	3	4	7	6	4	9	3	3	-	3	43	41	32
GSA9_TP_WHOLE_15	405	F	17/10/2020	9	3	5	8	6	5	4	5	4	2	6	6	-	7	3	-	5	5	29	33	25
GSA9_TP_WHOLE_16	365	F	17/10/2020	9	3	3	7	3	5	4	4	4	5	6	4	5	-	3	-	3	3	36	30	23
GSA9_TP_WHOLE_17	405	F	17/10/2020	9	3	3	6	2	4	-	4	4	3	5	5	-	-	3	-	3	3	42	30	24
GSA9_TP_WHOLE_18	425	M	17/10/2020	9	-	-	8	7	6	4	5	7	6	7	7	-	10	3	-	-	7	36	30	22
GSA9_TP_WHOLE_19	385	M	17/10/2020	9	4	-	8	5	5	-	5	5	4	6	5	-	-	3	-	-	5	50	27	16
GSA9_TP_WHOLE_20	410	M	17/10/2020	9	3	3	7	-	6	-	5	5	4	6	5	-	-	3	-	-	3	30	30	25
GSA9_TP_WHOLE_21	415	M	17/10/2020	9	5	4	7	5	5	4	4	5	4	7	6	-	8	3	-	5	5	36	27	21
GSA9_TP_WHOLE_22	405	M	17/10/2020	9	4	4	-	4	5	4	5	4	5	5	6	-	10	3	-	4	4	46	36	22
GSA9_TP_WHOLE_23	380	F	14/07/2021	9	-	-	8	3	4	4	3	3	5	5	5	-	-	3	2	-	3	36	40	29
GSA9_TP_WHOLE_24	455	F	14/07/2021	9	3	3	9	3	6	6	4	3	3	5	-	-	-	3	-	-	3	55	45	36
GSA9_TP_WHOLE_25	360	F	15/09/2016	9	1	4	7	3	6	5	4	5	4	-	6	-	6	4	-	4	4	38	34	26
GSA9_TP_WHOLE_26	410	F	15/09/2016	9	4	-	9	4	8	5	3	5	5	-	5	-	7	-	-	-	5	40	35	27
GSA9_TP_WHOLE_27	390	F	15/09/2016	9	2	-	9	-	6	-	3	3	3	-	5	-	-	-	2	-	3	38	59	46
GSA9_TP_WHOLE_28	370	F	15/09/2016	9	2	-	7	3	4	4	3	2	3	-	4	-	5	2	2	4	3	23	42	32
GSA9_TP_WHOLE_29	380	M	15/09/2016	9	-	3	8	2	5	6	3	3	2	-	4	-	-	2	-	-	3	30	52	41
GSA9_TP_WHOLE_30	395	F	15/09/2016	9	-	4	9	4	7	6	3	3	4	-	5	-	4	3	-	4	4	42	39	30
GSA9_TP_WHOLE_31	95	M	13/08/2016	9	0	0	4	0	0	0	1	0	0	0	0	-	0	0	0	0	0	87	-	-
GSA9_TP_WHOLE_32	100	M	13/08/2016	9	0	0	-	0	0	0	0	0	0	0	0	-	0	0	0	0	0	100	-	-
GSA9_TP_WHOLE_33	90	F	13/08/2016	9	0	0	-	0	0	0	0	0	0	0	0	-	0	0	0	0	0	100	-	-
GSA9_TP_WHOLE_34	95	F	13/08/2016	9	0	0	4	0	0	0	0	0	0	0	0	-	0	0	0	0	0	93	-	-
GSA9_TP_WHOLE_35	90	F	13/08/2016	9	0	0	4	0	0	0	0	0	0	0	0	-	0	0	0	0	0	93	-	-
GSA9_TP_WHOLE_36	85	M	13/08/2016	9	0	0	4	0	0	0	0	0	0	0	0	-	0	1	0	0	0	87	-	-
GSA9_TP_WHOLE_37	90	F	13/08/2016	9	0	0	4	0	0	0	0	0	0	0	0	-	0	0	0	0	0	93	-	-
GSA9_TP_WHOLE_38	80	U	02/05/2015	9	0	0	-	0	0	0	0	0	0	0	0	-	0	0	0	0	0	100	-	-
GSA9_TP_WHOLE_39	95	F	02/05/2015	9	0	0	-	0	0	0	0	0	0	0	0	-	0	1	0	0	0	93	-	-

Sample ID	Total length (mm)	sex	Catch date	ICES/GSA area	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	Modal age	PA %	CV %	APE %
GSA9_TP_WHOLE_40	230	F	26/06/2016	9	-	1	-	3	1	2	3	1	1	1	1	-	1	2	-	1	1	67	53	44
GSA9_TP_WHOLE_41	165	M	26/06/2016	9	-	1	6	2	2	2	1	1	1	1	1	-	1	2	1	1	1	64	81	50
GSA9_TP_WHOLE_42	265	F	26/06/2016	9	2	1	6	3	3	2	3	2	3	2	3	-	2	3	2	2	2	47	43	30
GSA9_TP_WHOLE_43	300	M	26/06/2016	9	2	2	6	3	3	-	2	3	2	2	4	-	2	3	-	2	2	54	42	30
GSA9_TP_WHOLE_44	270	M	26/06/2016	9	-	3	6	3	6	3	2	2	3	3	2	-	3	3	-	2	3	54	43	28
GSA9_TP_WHOLE_45	220	M	26/06/2016	9	1	1	5	-	3	2	2	1	1	1	2	-	1	2	-	1	1	54	66	47
GSA9_TP_WHOLE_46	185	M	26/06/2016	9	1	1	6	4	2	2	1	2	2	2	2	-	3	2	-	1	2	50	62	41
GSA9_TP_WHOLE_47	175	U	26/06/2016	9	1	1	5	2	2	1	2	1	1	1	1	-	1	2	-	1	1	64	69	47
GSA9_TP_WHOLE_48	190	M	26/06/2016	9	1	1	5	4	3	2	2	1	1	2	2	-	1	3	-	1	1	43	61	46
GSA9_TP_WHOLE_49	190	M	26/06/2016	9	1	1	5	2	2	2	2	1	1	1	1	-	2	2	-	1	1	50	62	42
GSA9_TP_WHOLE_50	165	M	26/06/2016	9	1	1	4	2	2	1	2	1	1	1	1	-	2	2	1	1	1	60	54	42
GSA9_TP_WHOLE_51	170	M	26/06/2016	9	1	1	6	2	2	-	2	1	1	1	1	-	2	2	1	1	1	57	77	48
TRAPIC_1S_01	410	F	30/03/2023	27.10.a.2	-	3	6	-	6	4	-	6	4	-	-	4	-	-	3	-	6	38	29	25
TRAPIC_1S_02	415	M	30/03/2023	27.10.a.2	-	3	6	-	5	4	5	5	3	-	4	4	-	3	-	5	5	36	24	20
TRAPIC_1S_03	435	F	30/03/2023	27.10.a.2	-	-	7	-	6	-	4	6	4	-	-	4	-	3	-	-	4	43	30	26
TRAPIC_1S_04	410	M	30/03/2023	27.10.a.2	-	4	6	-	9	4	6	4	5	-	3	5	-	3	3	4	4	33	37	27
TRAPIC_1S_05	430	M	30/03/2023	27.10.a.2	-	1	-	-	4	-	4	4	3	-	3	3	-	3	-	3	3	56	30	19
TRAPIC_1S_06	390	F	30/03/2023	27.10.a.2	-	3	7	4	6	4	6	4	4	-	3	5	5	3	3	-	4	31	30	25
TRAPIC_1S_07	395	M	30/03/2023	27.10.a.2	3	4	6	5	5	4	4	4	4	-	3	7	6	2	3	4	4	40	31	24
TRAPIC_1S_08	410	M	30/03/2023	27.10.a.2	-	-	6	4	5	-	-	5	4	-	5	3	-	3	3	4	5	30	25	20
TRAPIC_1S_09	395	M	30/03/2023	27.10.a.2	-	4	7	4	5	5	5	5	4	-	-	3	-	3	-	-	5	40	26	20
TRAPIC_1S_10	450	F	23/02/2023	27.10.a.2	-	5	7	6	6	6	5	4	5	7	4	5	7	3	4	-	5	29	24	20
TRAPIC_1S_11	400	F	23/02/2023	27.10.a.2	4	3	4	5	5	4	6	4	4	5	4	5	6	3	-	4	4	47	21	17
TRAPIC_1S_12	410	F	23/02/2023	27.10.a.2	4	4	5	5	5	4	5	4	4	-	4	5	7	3	4	5	4	47	20	15
TRAPIC_1S_13	450	F	23/02/2023	27.10.a.2	3	3	6	5	5	-	5	4	4	-	4	4	-	3	-	4	4	42	22	17
TRAPIC_1S_14	385	F	23/02/2023	27.10.a.2	3	3	4	3	5	-	4	4	4	-	-	5	-	3	-	-	3	40	21	17
TRAPIC_1S_15	375	F	23/02/2023	27.10.a.2	4	2	4	2	3	-	3	3	3	-	-	2	-	2	-	2	2	45	29	24
TRAPIC_2S_01	340	F	29/07/2022	27.10.a.2	-	-	6	-	5	7	6	5	2	-	-	4	-	4	-	-	6	25	32	24
TRAPIC_2S_02	330	F	29/07/2022	27.10.a.2	-	-	5	-	4	5	3	4	2	-	3	2	-	2	-	-	2	33	37	31
TRAPIC_2S_03	430	M	29/07/2022	27.10.a.2	-	-	5	3	4	-	4	4	2	-	4	3	-	3	-	-	4	44	25	20
TRAPIC_2S_04	330	F	29/07/2022	27.10.a.2	-	2	4	2	2	4	2	2	2	-	2	2	2	2	-	2	2	85	33	23
TRAPIC_2S_05	370	M	29/07/2022	27.10.a.2	-	3	5	2	3	3	5	3	3	-	3	3	4	2	-	2	3	54	31	22
TRAPIC_2S_06	325	M	29/07/2022	27.10.a.2	-	1	4	-	3	-	4	3	1	-	3	2	3	-	-	2	3	40	41	34
TRAPIC_2S_07	380	F	23/08/2022	27.10.a.2	-	5	6	4	3	5	4	4	3	-	5	3	-	3	-	3	3	42	26	21
TRAPIC_2S_08	345	F	23/08/2022	27.10.a.2	2	3	6	2	3	4	5	3	3	-	3	3	-	2	-	2	3	46	39	27
TRAPIC_2S_09	425	M	23/08/2022	27.10.a.2	-	4	3	-	4	5	4	3	3	-	3	3	-	2	-	4	3	45	24	20
TRAPIC_2S_10	355	F	23/08/2022	27.10.a.2	-	4	5	4	3	-	4	3	4	-	3	3	6	2	-	3	3	42	29	23
TRAPIC_2S_11	410	F	23/08/2022	27.10.a.2	-	4	6	3	6	5	6	6	4	-	-	3	6	3	3	-	6	42	30	27
TRAPIC_2S_12	330	F	23/08/2022	27.10.a.2	-	2	5	2	3	-	4	3	3	-	3	4	-	2	2	3	3	42	32	22
TRAPIC_2S_13	33	F	23/08/2022	27.10.a.2	-	3	5	3	4	3	3	3	2	-	3	3	5	2	3	3	3	64	28	19
TRAPIC_2S_14	400	M	23/08/2022	27.10.a.2	3	4	7	5	6	4	6	5	4	5	3	5	5	3	-	-	5	36	26	21
TRAPIC_2S_15	380	F	23/08/2022	27.10.a.2	4	3	6	5	7	4	6	5	4	5	3	5	-	3	3	4	4	27	28	23

Number of age readings by modal age

Table 6.29: 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.

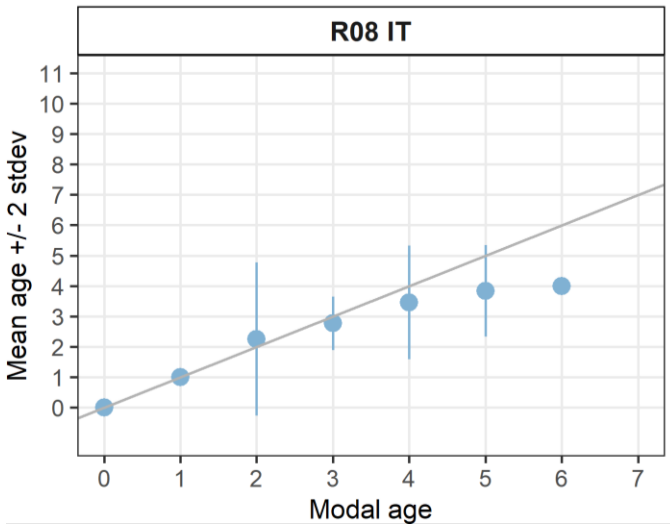
Modal age	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	total
0	9	9	5	9	9	9	9	9	9	9	9	0	9	9	9	9	131
1	6	8	7	7	8	7	8	8	8	8	8	0	8	8	3	8	110
2	4	6	7	6	7	5	7	7	7	4	6	4	5	7	2	6	90
3	13	21	22	18	24	13	24	24	24	11	22	15	10	21	9	17	288
4	11	15	16	13	17	13	17	17	17	8	16	14	11	17	8	13	223
5	6	8	11	9	11	9	10	11	11	7	9	7	6	10	3	6	134
6	1	3	4	2	4	4	3	4	4	1	1	4	2	3	3	1	44
7	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	11
Total	**50**	**70**	**73**	**65**	**81**	**61**	**79**	**81**	**81**	**49**	**72**	**44**	**52**	**76**	**37**	**60**	**1031**

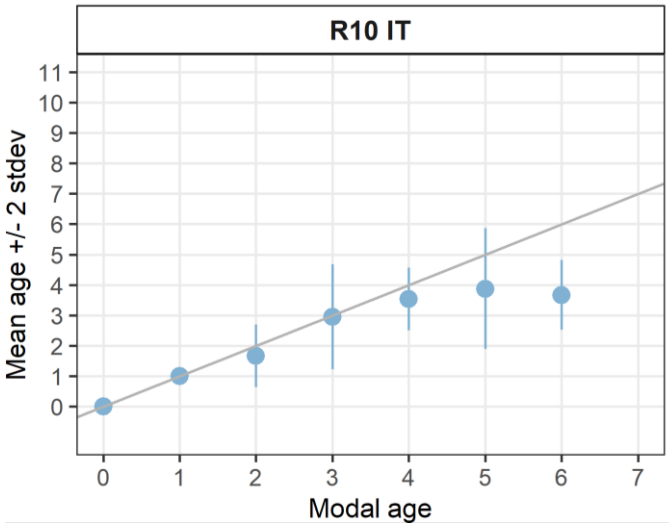
Number of age readings by age

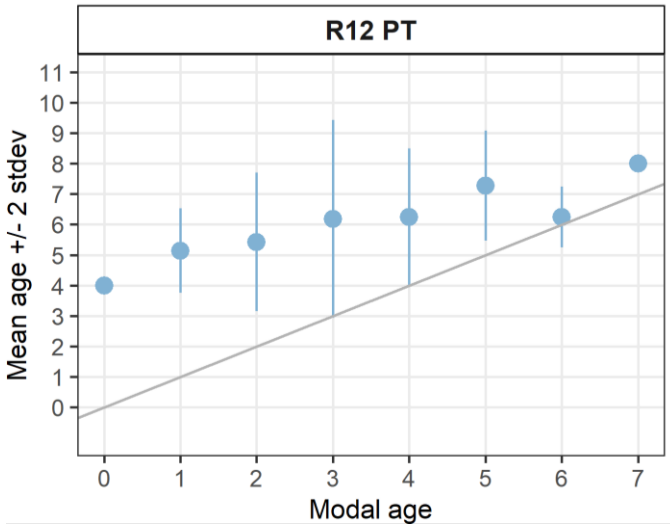
Table 6.30: Age composition by reader gives a summary of number of readings per reader and age. The total numbers of readings by age and by reader are also presented.

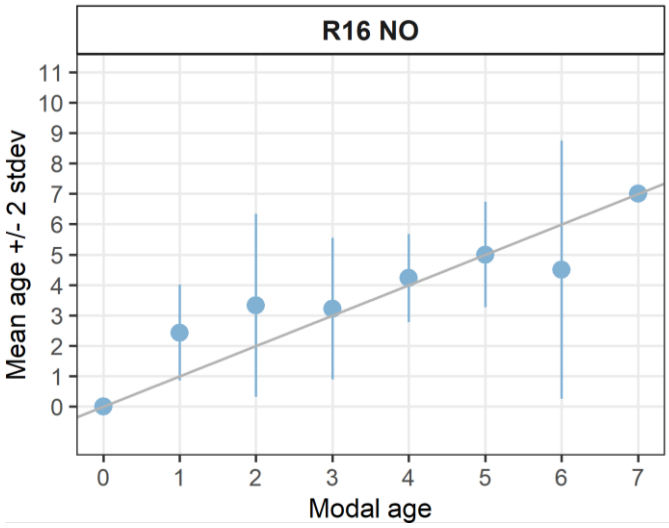
Age	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES	total
0	9	9	0	9	9	9	8	9	9	9	9	0	9	7	9	9	123
1	8	12	0	0	1	2	3	8	9	7	6	0	5	2	3	9	75
2	5	6	0	12	7	7	9	5	9	4	5	6	6	21	6	8	116
3	15	24	1	14	14	3	11	18	15	1	15	16	3	44	16	10	220
4	12	16	11	13	12	21	23	24	23	2	18	9	2	2	3	16	207
5	1	3	12	10	19	11	18	13	8	9	13	11	7	0	0	8	143
6	0	0	22	6	15	7	7	3	7	9	5	0	6	0	0	0	87
7	0	0	16	1	2	1	0	1	1	6	1	1	4	0	0	0	34
8	0	0	7	0	1	0	0	0	0	0	0	1	6	0	0	0	15
9	0	0	4	0	1	0	0	0	0	2	0	0	2	0	0	0	9
10	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Total	**50**	**70**	**73**	**65**	**81**	**61**	**79**	**81**	**81**	**49**	**72**	**44**	**52**	**76**	**37**	**60**	**1031**

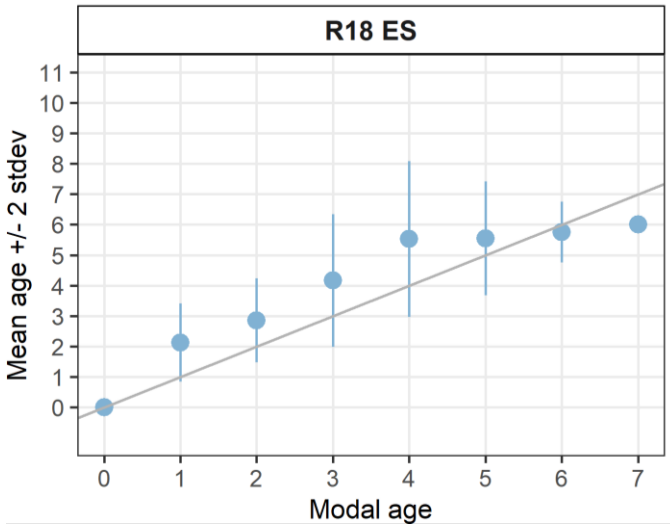
Separate age bias plots by reader

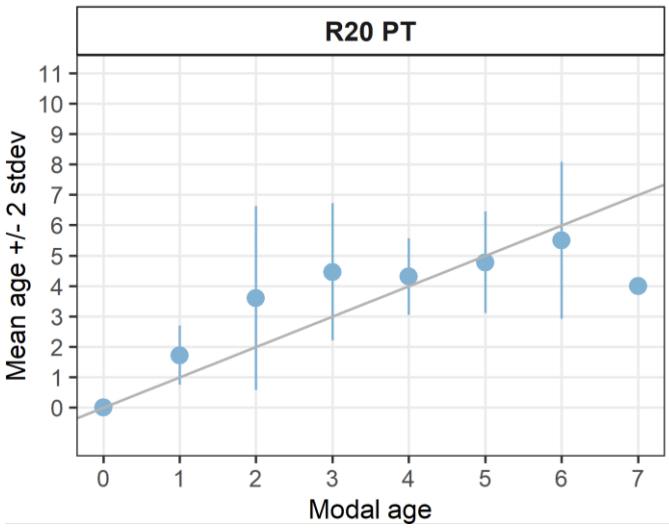




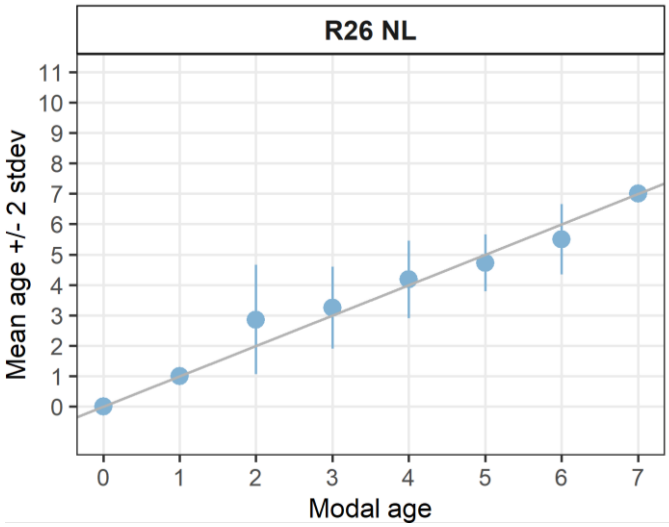


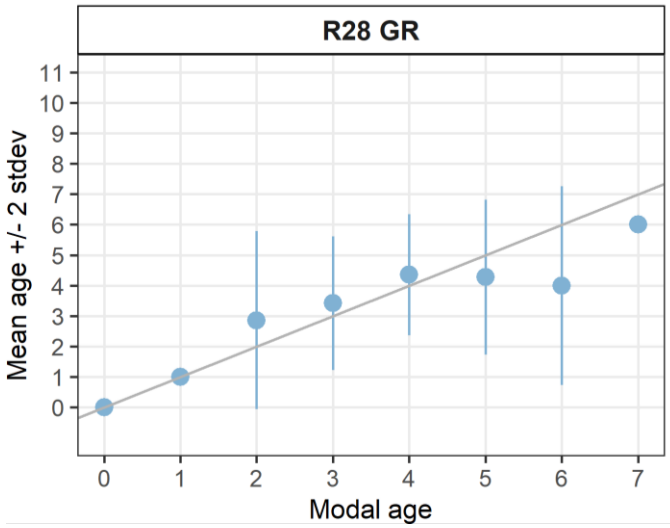


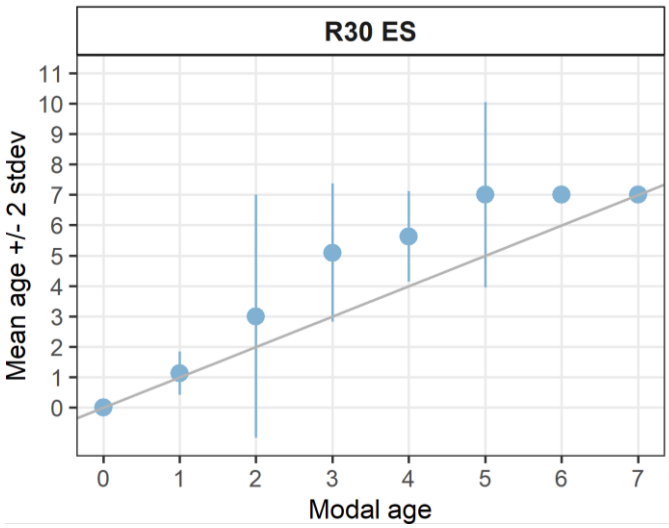


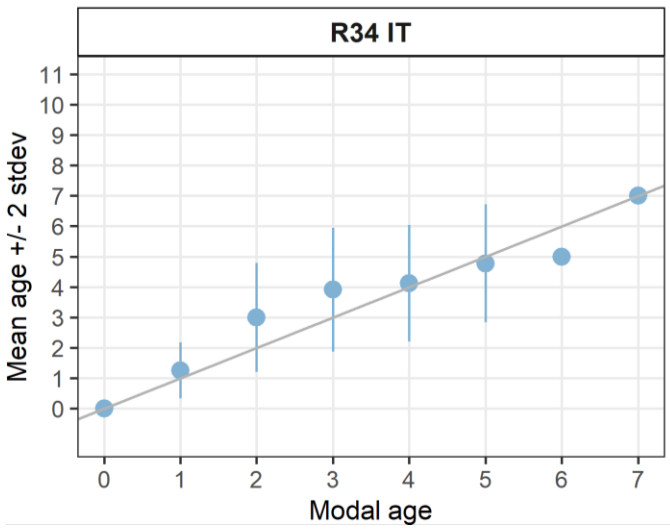


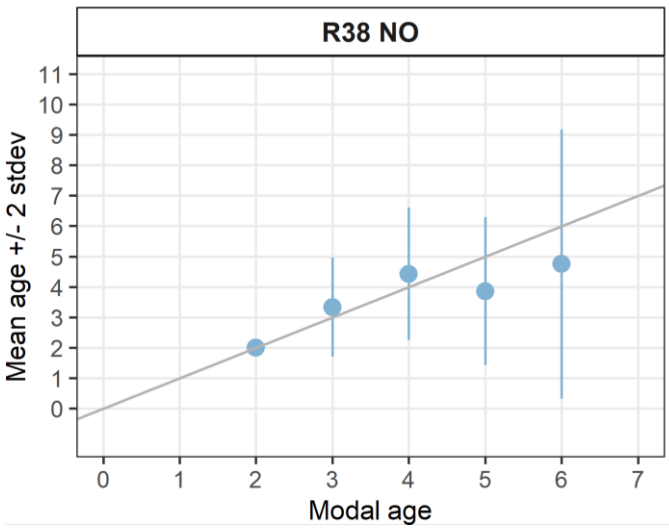
R22 IT
Mean age +/- 2 stdev
Modal age

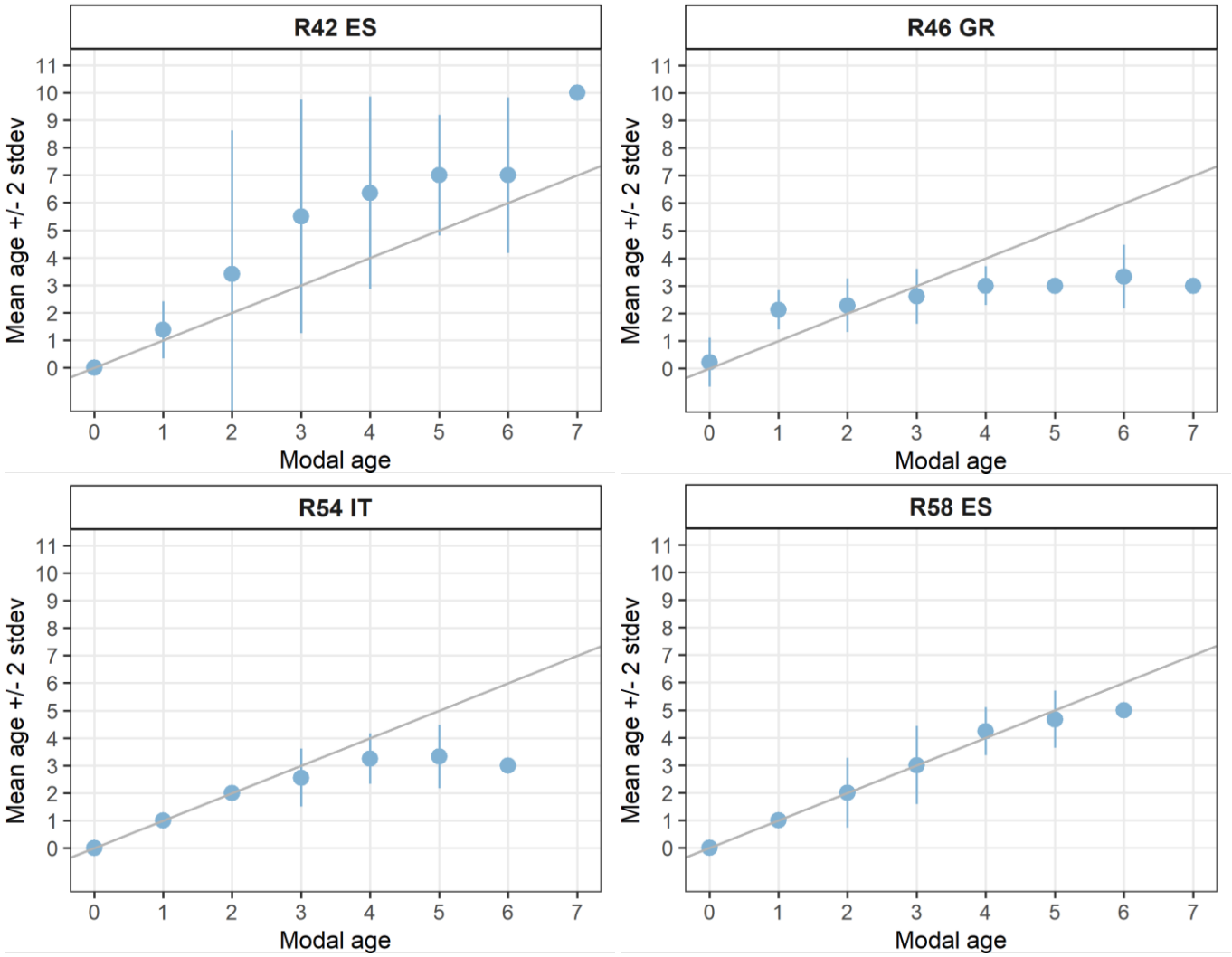

R26 NL
Mean age +/- 2 stdev
Modal age


R28 GR
Mean age +/- 2 stdev
Modal age


R30 ES
Mean age +/- 2 stdev
Modal age


R34 IT
Mean age +/- 2 stdev
Modal age


R38 NO
Mean age +/- 2 stdev
Modal age


R42 ES
R46 GR
R54 IT
R58 ES
Mean age +/- 2 stdev
Modal age
0
1
2
3
4
5
6
7
8
9
10
11

Statistics by modal age plot (STDEV, CV and PA)

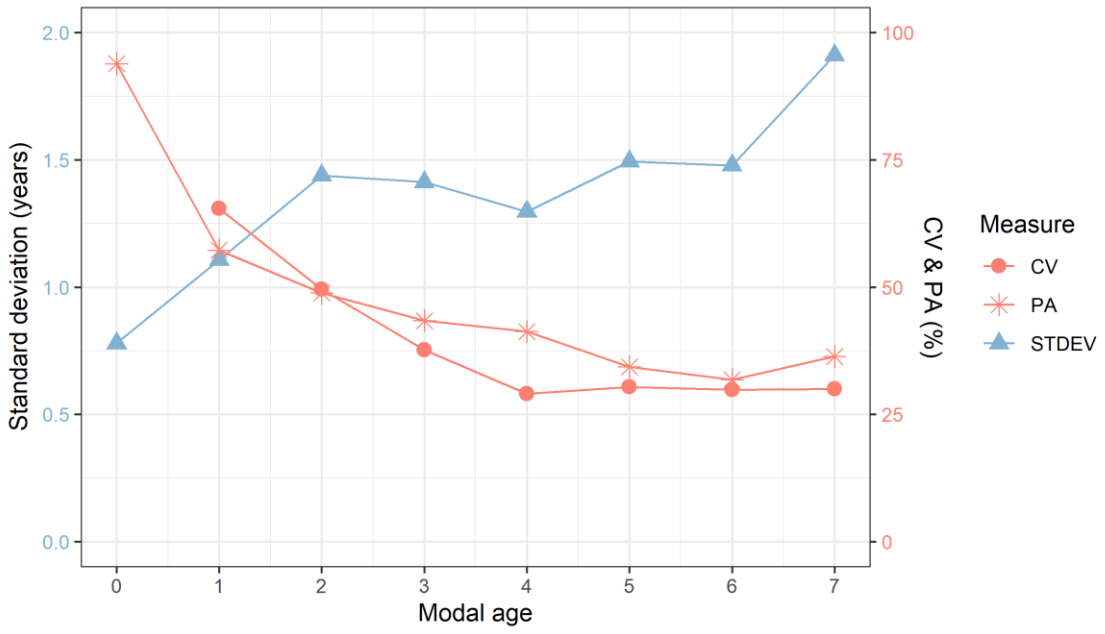


Figure 6.22: CV, PA and STDEV (standard deviation) are plotted against modal age

Distribution of age reading errors

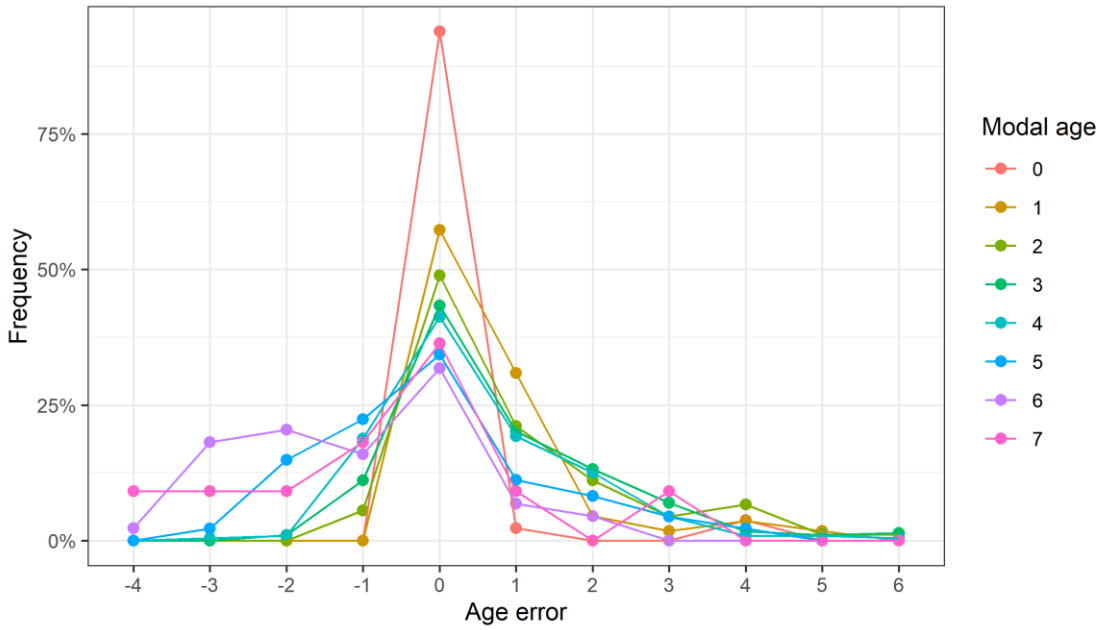


Figure 6.23: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias, if the age reading errors are normally distributed. The distributions are skewed, if relative bias occurs.

Relative bias for all readers

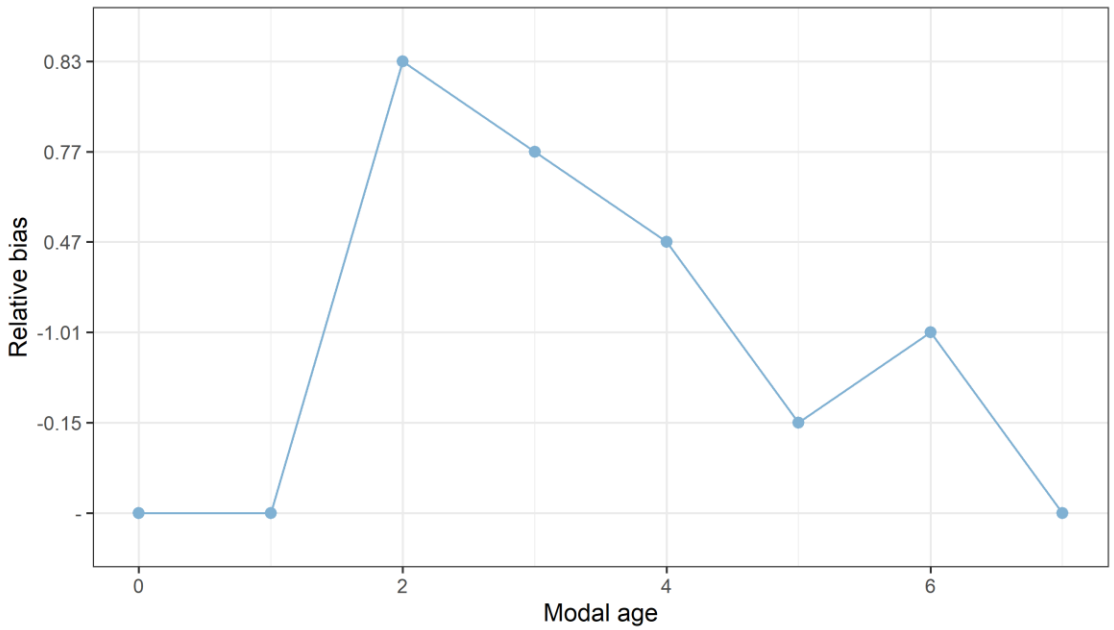


Figure 6.27: The relative bias by modal age as estimated by all age readers combined.

Mean length at age by reader

Table 6.31: Mean fish length at age per reader is calculated per reader and age (not modal age) and for all readers combined per age. A weighted mean is also given.

Age	R08 IT	R10 IT	R12 PT	R16 NO	R18 ES	R20 PT	R22 IT	R26 NL	R28 GR	R30 ES	R34 IT	R38 NO	R42 ES	R46 GR	R54 IT	R58 ES
0	91	91	-	91	91	91	91	91	91	91	91	-	91	91	91	91
1	207	226	-	-	230	170	148	188	203	188	182	-	196	90	167	188
2	334	348	-	283	197	206	223	284	304	235	239	352	237	280	346	322
3	391	371	425	334	319	224	323	352	370	270	346	363	260	391	366	338
4	401	398	221	361	362	390	387	397	397	348	386	396	382	350	418	394
5	415	412	280	390	398	391	403	397	402	397	397	403	335	-	-	409
6	-	-	348	403	404	415	390	418	390	381	401	-	375	-	-	-
7	-	-	393	425	388	340	-	425	425	424	425	395	419	-	-	-
8	-	-	396	-	410	-	-	-	-	-	-	415	390	-	-	-
9	-	-	412	-	410	-	-	-	-	420	-	-	402	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	415	-	-	-
Weighted Mean	**305**	**316**	**337**	**313**	**327**	**312**	**324**	**327**	**327**	**294**	**317**	**380**	**289**	**323**	**284**	**301**

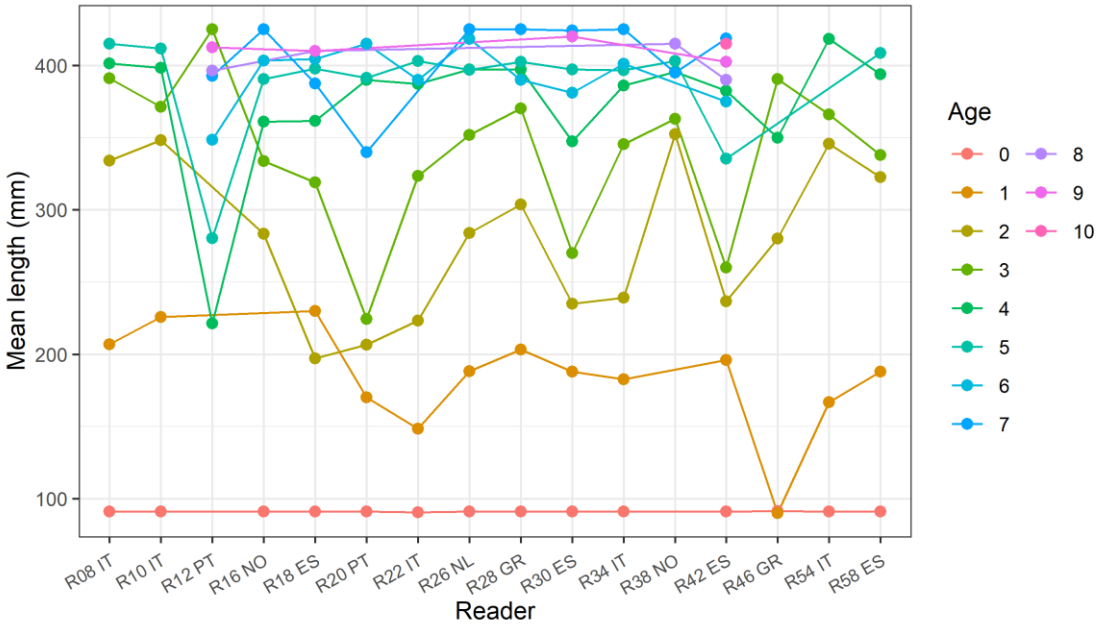


Figure 6.25: The mean fish length at age as estimated by each age reader.

7 Annex 3. Recommendations

A new workshop including the readers involved in the age interpretation of these *Trachurus* species using otoliths is recommended and approved in the WGBIOP 2025 (ICES, in prep).