

Report of the 2020/2021 Deep-water species age reading exchange

Black scabbardfish (*Aphanopus carbo*) Event 315

Greater forkbeard (*Phycis blennoides*) Event 316

Ling (*Molva molva*) Event 317

Blue ling (*Molva dypterygia*) Event 318

Greater silver smelt (*Argentina silus*) Event 319

Tusk (*Brosme brosme*) Event 320

Blackspot seabream (*Pagellus bogaraveo*) Event 321

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1 Executive summary

Based on the work realized during WKAMDEEP1 (2013), the Working Group on Biological Parameters (WGBIOP 2017) identified the need for a follow-up workshop on age estimation methods of deep-water species. WKAMDEEP2 took place in 2018 during which the ageing of seven deep-water species was reviewed: blackspot seabream (*Pagellus bogaraveo*), tusk (*Brosme brosme*), greater silver smelt (*Argentina silus*), blue ling (*Molva dypterygia*), ling (*Molva molva*), greater forkbeard (*Phycis blennoides*) and black scabbardfish (*Aphanopus carbo*). The aims of the workshop in 2018 (WKAMDEEP2) were to assemble a group of experts to further develop the ageing protocols and assess the precision of age readings of these species. For each species, an easy-to-use ageing manual was agreed upon by all participants. These manuals are considered necessary and sufficient for a generic age reader of deep-water fish to provide reasonably accurate and precise age estimates. During WKAMDEEP2, an exchange of 50 otolith images per species was conducted. To continue to improve both the quality and the capacity of age readings of deep-water species, WKAMDEEP2 recommended that small exchanges of the same material were to be carried out after two and four years, before arranging a third workshop, WKAMDEEP3, in 2023. The small-scale exchange in 2020/2021 was carried out according to the recommendations of WKAMDEEP2, but unfortunately the results from the exchange got delayed due to COVID-19. The images used in 2020/2021 were the same as in 2018, enabling analyses of internal consistency for each reader participating in both 2018 and 2020/2021. The exchange was carried out according to the recommendations of WGBIOP, using the SmartDots European tool for the interpretation of otolith images. The overall results for all age readers and species combined showed relatively low precision, compared to other species, with a weighted average Coefficient of Variation (CV) of 20% (from 9% to 29% according to species), a weighted average Percent Agreement (PA) based on modal ages of 47% (from 34% to 69% according to species) and an Average Percent Error (APE) of 16% (from 6% to 30% according to species).

2 Participant list

A total of 17 readers from Portugal, Greece, Norway, Iceland, Spain, Faroe Islands, France, Italy, and Denmark participated in the exchange of deep-water species. (Table 2.1).

Table 2.1: Participants overview.

Country	Name	Email	Black scabbardfish (Event 315)	Greater forkbeard (Event 316)	Ling (Event 317)	Blue ling (Event 318)	Greater silver smelt (Event 319)	Tusk (Event 320)	Blackspot seabream (Event 321)
Portugal	Inês Farias	ifarias@ipma.pt	R01 PT	X	X	X	X	X	R02 PT
Greece	Katerina Anastasopoulou	kanast@hcmr.gr	R02 GR	R04 GR	R06 GR	R03 GR	R05 GR	R04 GR	R01 GR
Norway	Hege Øverbø Hansen	hegeha@imr.no	R03 NO	R03 NO	R01 NO	R04 NO	R01 NO	R03 NO	R03 NO
Norway	Lise Heggebakken	lise.heggebakken@hi.no	R04 NO	R05 NO	R08 NO	R06 NO	R04 NO	R01 IS	R04 NO
Iceland	Auður Bjarnadóttir	audur.bjarnadottir@hafogvatn.is	R04 IS	R07 IS	R02 IS	R05 IS	R02 IS	R05 NO	R04 IS
Norway	Torfinn Erling Larsen	torfinn.erling.larsen@hi.no	R06 NO	R06 NO	R09 NO	R02 NO	R06 NO	R06 NO	R06 NO
Spain	Maria Sainza	maria.sainza@ieo.es	R07 ES	R01 ES	R04 ES	R07 ES	R07 ES	R07 ES	R08 ES
Norway	Caroline Aas Tranang	caroline.aas.tranang@hi.no	R08 NO	R07 NO	R10 NO	R08 NO	R09 NO	R08 NO	R09 NO
Norway	Kristin Windsland	kristin.windsland@hi.no	R09 NO	R08 NO	R11 NO	R09 NO	R10 NO	R09 NO	R10 NO
Spain	Marina Fabeiro	fabeiro@iim.csic.es	R10 ES	R10 ES	R10 ES	R11 ES	R08 ES	R08 ES	R12 ES
Faroe Islands	Lis Larsen	LisL@hav.fo	R11 FO	R11 FO	R03 FO	R12 FO	R03 FO	R11 FO	R13 FO
Faroe Islands	Marit Pedersen	maritp@hav.fo	R12 FO	R12 FO	R05 FO	R13 FO	R12 FO	R02 FO	R14 FO
France	Solene Telliez	Solene.telliez@ifremer.fr	R13 FR	R13 FR	R13 FR	R01 FR	R13 FR	R13 FR	R15 FR
France	Geoffrey Bled Defruit	Geoffrey.Bled.Defruit@ifremer.fr	X	R02 FR	R07 FR	R10 FR	R11 FR	R12 FR	R11 FR
Italy	Michele Palmisano	palmisano@coispa.eu	X	X	X	X	X	X	R07 IT
Denmark	Helle Rasmussen	hr@aqua.dtu.dk	X	X	R14 DK	X	X	X	
France	Celina Chantre	celina.chantre@ifremer.fr	X	X	X	X	X	X	R16 FR

3 Introduction

3.1 Background

The exchange was a follow-up on two previous workshops, WKAMDEEP1 from 2013 (ICES, 2013) and WKAMDEEP2 from 2018 (ICES, 2019). The workshop in 2013 (WKAMDEEP1) provided a review of validation and corroboration work on each species, as well as a discussion on the procedures used by individual laboratories and recommendations for further development. Since there are very few age readers of most deep-water species, sometimes just one, the 2013 workshop decided that age readers of any of these species should preferably consider themselves as experts on the whole group of slow growing deep-water fish. It was believed that this would facilitate age reading comparisons as a measure of quality assurance. The aim of the 2018 workshop (WKAMDEEP2) was to assemble this group of experts to further develop the competence and capacity regarding age reading of this group of fish. Since several laboratories recruited new age readers around 2018, and there has been a general increase in research effort on vulnerable species, it was consented that the most pressing issue at the workshop in 2018 was to develop easy-to-use species-specific age reading manuals, which would allow any generic deep-water age reading expert to take part in age reading on any specific species. The species-specific age reading manuals were completed shortly after the workshop in 2018 and were available for the age readers to use while ageing the otoliths in the 2020/2021 exchange (ICES, 2019).

For all the species represented in this exchange, the ICES Working Group on Biology and Assessment of Deep-sea fisheries (WGDEEP) gives advice for the different stocks. Table 3.1 provides an overview of for which species there are age-based assessments. Even if the age data is not used directly in the assessment model, most of the species are considered data poor or data limited, hence the trends in length-and weight at age are paid attention to and considered.

Table 3.1 Overview of ageing data used for stock assessment for each species.

Species	Latin name	Ageing data used for stock assessment
Black scabbardfish	<i>Aphanopus carbo</i>	No
Greater forkbeard	<i>Phycis blennoides</i>	No
Ling	<i>Molva molva</i>	Yes
Blue ling	<i>Molva dypterygia</i>	Yes
Greater silver smelt	<i>Argentina silus</i>	Yes
Tusk	<i>Brosme brosme</i>	Yes
Blackspot seabream	<i>Pagellus bogaraveo</i>	No

3.2 Implementation of the small-scale exchange

The small-scale exchange of deep-water species was, according to the recommendations of WKAMDEEP2, initiated two years after the workshop. The exchange opened in November 2020 and closed on 15th of March 2021. Unfortunately, the analysis of the results got delayed about a year, due to challenges related both to COVID-19 and to the work staff's priorities.

The report first gives a short overview of the results from all the species in the deep-water species exchange, and afterwards the complementary results for all the different species are presented. At the end, the internal consistency results for age readers participating in both the 2018 workshop and the 2020/2021 exchange are provided.

4 Methods

In this small-scale exchange, all age readings were done using images of the calcified structure, either the whole or the sectioned otolith, depending on the species (Table 4.1) and no physical otoliths were exchanged between readers. The images used were the same as those prepared for the workshop in 2018, enabling internal consistency analyses for readers who participated in both the workshop and the small-scale exchange.

Table 4.1: Number of otoliths and preparation method for each species

Species	Latin name	Sampling number	Otolith preparation
Black scabbardfish	<i>Aphanopus carbo</i>	50	Transverse sections
Greater forkbeard	<i>Phycis blennoides</i>	50	Transverse sections
Ling	<i>Molva molva</i>	50/29	Transverse sections/whole otoliths
Blue ling	<i>Molva dypterygia</i>	50	Transverse sections
Greater silver smelt	<i>Argentina silus</i>	50	Whole otoliths
Tusk	<i>Brosme brosme</i>	50	Whole otoliths
Blackspot seabream	<i>Pagellus bogaraveo</i>	50	Whole otoliths

Before the SmartDots tool analyses, each reader was ranked based on their years of experience with age reading in general and age reading of each species. The readers were also categorized as either advanced or basic. If a reader is “advanced”, they are considered well trained and they provide ages for stock assessment or similar purposes. The SmartDots tool uses the ranking of readers in the analysis for weighing purposes.

4.1 Bias of age reading

The bias of age reading among readers for each deep-water species was analyzed using the SmartDots tool (<https://www.ices.dk/data/tools/Pages/smartdots.aspx>), as recommended by WGBIOP as a standard tool for exchanges and analyses of the results (ICES, 2017). From SmartDots, a reporting module runs the analyses via an R script to produce a R Markdown document, and excel sheets, which gives easy access to the results from the exchange. For this report, seven events were analyzed (Event 315-321). The analyses follow traditional methods where the level of accuracy compared to modal age was indicated by Percent Agreement (PA), bias tests and plots. The level of precision, i.e., the reproducibility of age estimates, was indicated by the Coefficient of Variation (CV). The tables and plots presented in the results are from the Guus Eltink Excel sheet ‘Age Reading Comparisons’ (Eltink,

A.T.G.W, 2000). Additional analyses of age data included were the Average Percent Error (APE) and Age Error Matrices (AEM).

4.1.1 Percent Agreement (PA)

The Percent Agreement (PA) is the ratio between the total number of age readings in agreement with modal age and the total number of age readings for that sample per reader and modal age:

$$PA = \frac{n_{modalage}}{n_{total}} * 100$$

4.1.2 Coefficient of Variation (CV)

The CV is calculated as the ratio between the standard deviation (σ) and mean value (μ) per reader and modal age:

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

4.1.3 Average Percent Error (APE)

APE was calculated based on the method outlined by Beamish & Fournier (1981). This method is not independent of fish age and thus provides a better estimate of precision. As the calculations of both CV and APE pose problems if the mean age is close to 0, all observations for which the modal age was 0 were omitted from the CV and APE calculations.

The Average Percent Error is calculated per sample 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 .

4.1.4 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, first including all readers and then only the “advanced” readers.

4.1.5 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 fish per reader.

5 Overview of samples and readers

An overview of the samples, including sampling year, area, strata, quarter, number of samples, modal age, and length range, for each species are presented together with the expertise level of and reader code for each participant.

5.1 Black scabbardfish

Table 5.1.1: Overview of samples used for the black scabbardfish exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2015	27.5.b	27.5.b	3	50	4-9	780-1090 mm

For black scabbardfish, only one reader was classified as “advanced”, but for SmartDots to be able to do comparative analyses all readers were considered “advanced” (Table 5.1.2)

Table 5.1.2: Reader overview for the black scabbardfish exchange.

Reader code	Expertise
R01 PT	Advanced
R02 GR	Advanced
R03 NO	Advanced
R04 IS	Advanced
R04 NO	Advanced
R06 NO	Advanced
R07 ES	Advanced
R08 NO	Advanced
R09 NO	Advanced
R10 ES	Advanced
R11 FO	Advanced
R12 FO	Advanced
R13 FR	Advanced

5.2 Greater forkbeard

Table 5.2.1: Overview of samples used for the greater forkbeard exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2016	27.7	27.7	2	6	4-5	445-565 mm
2017	27.7	27.7	1	4	3-4	445-530 mm
2017	27.7	27.7	2	2	3-4	330-340 mm
2017	27.7.c	27.7.c	3	24	1-6	165-680 mm
2017	27.8	27.8	3	4	1-3	140-370 mm
2017	27.8	27.8	4	10	1-5	265-585 mm

Table 5.2: Reader overview for the greater forkbeard exchange.

Reader code	Expertise
R01 ES	Advanced
R02 FR	Advanced
R03 NO	Basic
R04 GR	Basic
R05 NO	Basic
R06 NO	Basic
R07 IS	Basic
R07 NO	Basic
R08 NO	Basic
R10 ES	Basic
R11 FO	Basic
R12 FO	Basic
R13 FR	Basic

5.3 Ling

Table 5.3.1: Overview of samples used for the ling exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2009	27.7.c	27.7.c	4	1	8	900 mm
2013	27.7	27.7	1	3	8-9	870-900 mm
2015	27.7	27.7	2	1	6	660 mm
2015	27.7.c	27.7.c	3	7	2-8	255-950 mm
2016	27.7	27.7	2	6	5-7	595-740 mm
2016	27.7	27.7	4	2	7	755-770 mm
2016	27.7.c	27.7.c	3	5	2-4	360-545 mm
2017	27.5.a	27.5.a	2	10	7-12	65-110 mm
2017	27.5.a	27.5.a	4	10	7-11	70-100 mm
2017	27.7	27.7	1	8	4-11	530-1030 mm
2017	27.7	27.7	2	10	4-7	480-810 mm
2017	27.7	27.7	3	3	6-7	630-830 mm
2017	27.7	27.7	4	3	8-9	910-955 mm
2017	27.7.c	27.7.c	3	1	6	795 mm
2018	27.5.a	27.5.a	1	9	7-10	80-100 mm

Table 5.3.2: Reader overview for the ling exchange.

Reader code	Expertise
R01 NO	Advanced
R02 IS	Advanced
R03 FO	Advanced
R04 ES	Advanced
R05 FO	Advanced
R06 GR	Basic
R07 FR	Basic
R08 NO	Basic
R09 NO	Basic
R10 ES	Basic
R10 NO	Basic
R11 NO	Basic
R13 FR	Basic
R14 DK	Advanced

5.4 Blue ling

Table 5.4.1: Overview of samples used for the blue ling exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2017	27.6.a	27.6.a	1	50	4-31	710-1300 mm

Table 5.4.2: Reader overview for the blue ling exchange.

Reader code	Expertise
R01 FR	Advanced
R02 NO	Basic
R03 GR	Basic
R04 NO	Advanced
R05 IS	Basic
R06 NO	Basic
R07 ES	Basic
R08 NO	Basic
R09 NO	Basic
R10 FR	Basic
R11 ES	Basic
R12 FO	Basic
R13 FO	Basic

5.5 Greater silver smelt

Table 5.5.1: Overview of samples used for the greater silver smelt exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2016	27.2.a	27.2.a	1	50	3-14	235-465 mm

Table 5.5.2: Reader overview for the greater silver smelt exchange.

Reader code	Expertise
R01 NO	Advanced
R02 IS	Advanced
R03 FO	Advanced
R04 NO	Basic
R05 GR	Basic
R06 NO	Basic
R07 ES	Basic
R08 ES	Basic
R09 NO	Basic
R10 NO	Basic
R11 FR	Basic
R12 FO	Basic
R13 FR	Basic

5.6 Tusk

Table 5.6.1: Overview of samples used for the tusk exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2010	27.2.a	27.2.a	1	50	6-13	350-700 mm

Table 5.6.2: Reader overview for the tusk exchange.

Reader code	Expertise
R01 IS	Advanced
R02 FO	Advanced
R03 NO	Advanced
R04 GR	Basic
R05 NO	Basic
R06 NO	Basic
R07 ES	Basic
R08 ES	Basic
R08 NO	Basic
R09 NO	Basic
R11 FO	Basic
R12 FR	Basic
R13 FR	Basic

5.7 Blackspot seabream

Table 5.7.1: Overview of samples used for the blackspot seabream exchange.

Year	ICES area	Strata	Quarter	Number of samples	Modal age range	Length range
2008	missing	AL	3	20	3-7	190-260 mm
2010	missing	AL	2	15	5-10	290-400 mm
2010	missing	AL	4	15	4-9	245-415 mm

Table 5.7.2: Reader overview for the blackspot seabream exchange.

Reader code	Expertise
R01 GR	Advanced
R02 PT	Advanced
R03 NO	Basic
R04 IS	Basic
R04 NO	Basic
R06 NO	Basic
R07 IT	Basic
R08 ES	Basic
R09 NO	Basic
R10 NO	Basic
R11 FR	Basic
R12 ES	Basic
R13 FO	Basic
R14 FO	Basic
R15 FR	Basic

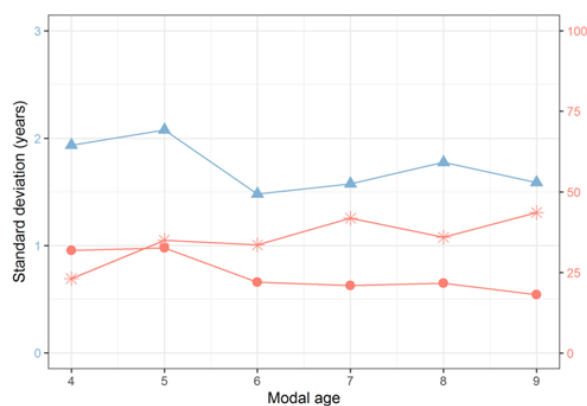
6 Results of age readings

The results of the age reading exchange for deep-water species showed that the weighted average Percent Agreement (PA) based on modal ages for all readers combined was 47% (from 34% to 69% according to species), the weighted average Coefficient of Variation (CV) was 20% (from 9% to 29% according to species) and the Average Percent Error (APE) was 16% (from 6% to 47% according to species). The average CV was lower or equal compared to the previous exchange for all species apart from tusk, but the precision of age reading is still low compared to other species. However, for deep-water species, a CV around 20% is considered fairly good, thus for ling, blue ling, greater silver smelt and tusk with CVs between 9 and 18%, the precision should be considered as very good (Table 6.0 and Figure 6.0). The Percent Agreements (PA) were the same or had slightly increased since 2018.

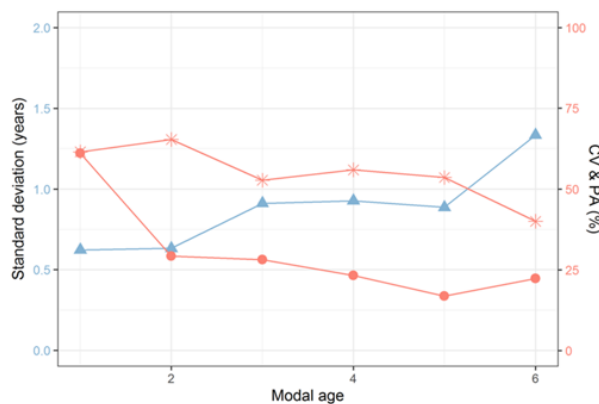
For most species, the precision (CV) was fairly equal throughout the modal age range, with a slight decrease with increasing age. For blue ling however, there was a sudden increase in the CV after modal age 20 (Figure 6.0)

Table 6.0: Summary of statistics, PA, CV and APE for all species in year 2018 and 2020/2021

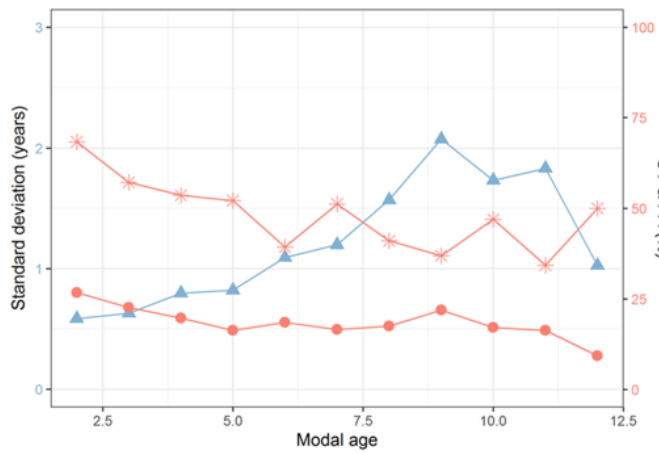
Species	No of readers 2018/2020	PA (%) 2018/2020	CV (%) 2018/2020	APE (%) 2018/2020
Black scabbardfish	11 / 13	37 / 38	26 / 23	- / 17
Greater forkbeard	12 / 13	55 / 55	34 / 29	- / 20
Ling	12 / 14	46 / 48	22 / 18	- / 13
Blue ling	12 / 13	35 / 34	17 / 17	- / 13
Greater silver smelt	12 / 13	69 / 69	9 / 9	- / 6
Tusk	11 / 13	48 / 44	12 / 15	- / 11
Blackspot seabream	12 / 13	35 / 39	31 / 26	- / 19



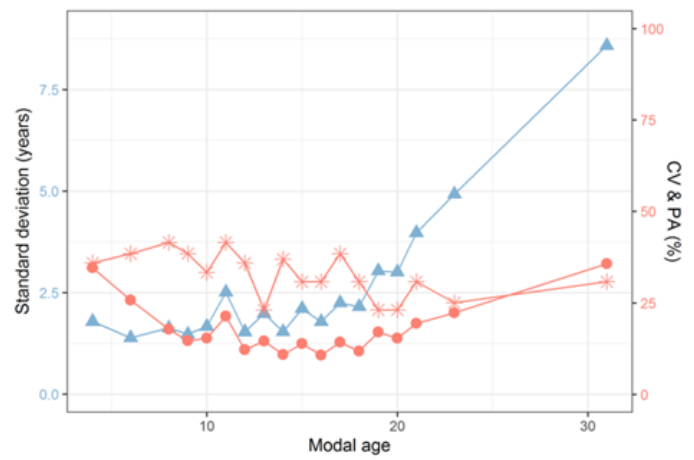
Black scabbardfish



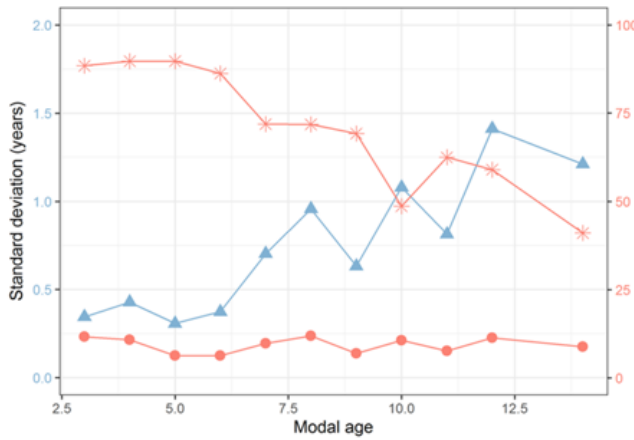
Greater forkbeard



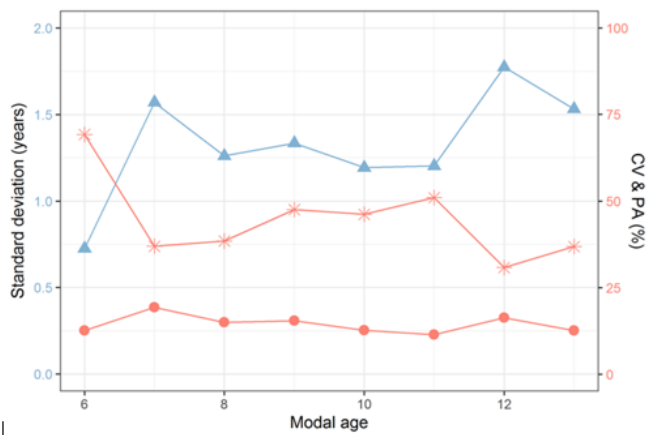
Ling



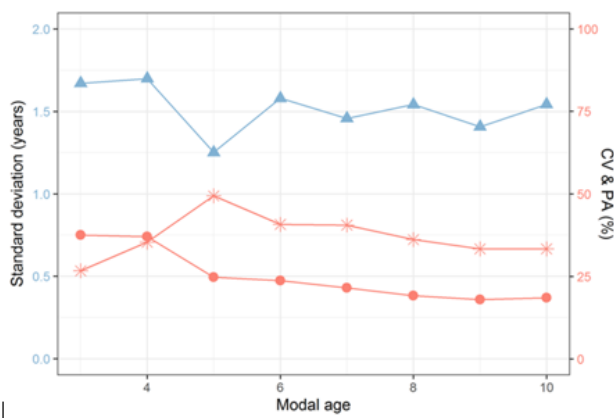
Blue ling



Greater silver smelt



Tusk



Blackspot seabream

Measure

- CV
- ✱ PA
- ▲ STDEV

Figure 6.0: CV, PA and STDEV (standard deviation) plotted against modal age for each species for 2020.

6.1 Black scabbardfish

All readers included

The weighted average CV for all readers combined was 23%, the PA based on modal ages was 38 % and the APE was 17 % (Table 6.1.1, Table 6.1.2, Table 6.1.3, and Figure 6.1.1).

Table 6.1.1: The CV per modal age and reader, all readers combined per modal age and the weighted mean of the cv per reader.

Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
4	-	-	-	-	-	-	-	-	-	-	-	-	-	32 %
5	27 %	11 %	31 %	22 %	10 %	40 %	17 %	16 %	27 %	20 %	17 %	39 %	26 %	33 %
6	18 %	17 %	19 %	19 %	6 %	16 %	15 %	15 %	35 %	17 %	18 %	21 %	15 %	22 %
7	10 %	20 %	16 %	19 %	16 %	16 %	10 %	13 %	21 %	10 %	15 %	18 %	14 %	21 %
8	11 %	8 %	16 %	14 %	17 %	23 %	5 %	6 %	17 %	12 %	14 %	17 %	16 %	22 %
9	22 %	21 %	11 %	6 %	8 %	17 %	10 %	4 %	21 %	8 %	11 %	25 %	30 %	18 %
Weighted Mean	17 %	16 %	19 %	17 %	12 %	21 %	12 %	12 %	25 %	14 %	15 %	22 %	19 %	23 %

Table 6.1.2: Percent Agreement (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	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
4	100 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	100 %	0 %	0 %	0 %	100 %	23 %
5	12 %	75 %	38 %	12 %	75 %	14 %	12 %	25 %	50 %	25 %	25 %	40 %	50 %	35 %
6	54 %	54 %	46 %	15 %	85 %	0 %	8 %	31 %	23 %	46 %	15 %	8 %	46 %	34 %
7	69 %	44 %	62 %	25 %	50 %	0 %	56 %	19 %	31 %	69 %	38 %	25 %	56 %	42 %
8	33 %	0 %	50 %	17 %	33 %	17 %	83 %	50 %	33 %	67 %	67 %	0 %	17 %	36 %
9	33 %	33 %	17 %	50 %	50 %	17 %	33 %	83 %	33 %	50 %	67 %	67 %	33 %	44 %
Weighted Mean	48 %	44 %	46 %	22 %	60 %	6 %	36 %	34 %	34 %	52 %	36 %	23 %	46 %	38 %

Table 6.1.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
4	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	25 %
5	23 %	5 %	24 %	17 %	8 %	32 %	15 %	13 %	20 %	15 %	14 %	34 %	21 %	25 %
6	12 %	12 %	15 %	16 %	4 %	11 %	8 %	13 %	27 %	15 %	13 %	18 %	12 %	17 %
7	5 %	15 %	13 %	16 %	10 %	13 %	8 %	10 %	18 %	5 %	11 %	15 %	12 %	16 %
8	8 %	8 %	14 %	11 %	14 %	17 %	3 %	6 %	14 %	7 %	10 %	15 %	12 %	16 %
9	18 %	14 %	9 %	5 %	7 %	13 %	7 %	3 %	18 %	6 %	7 %	14 %	25 %	12 %
Weighted Mean	12 %	11 %	15 %	14 %	8 %	16 %	8 %	10 %	20 %	10 %	11 %	17 %	15 %	17 %

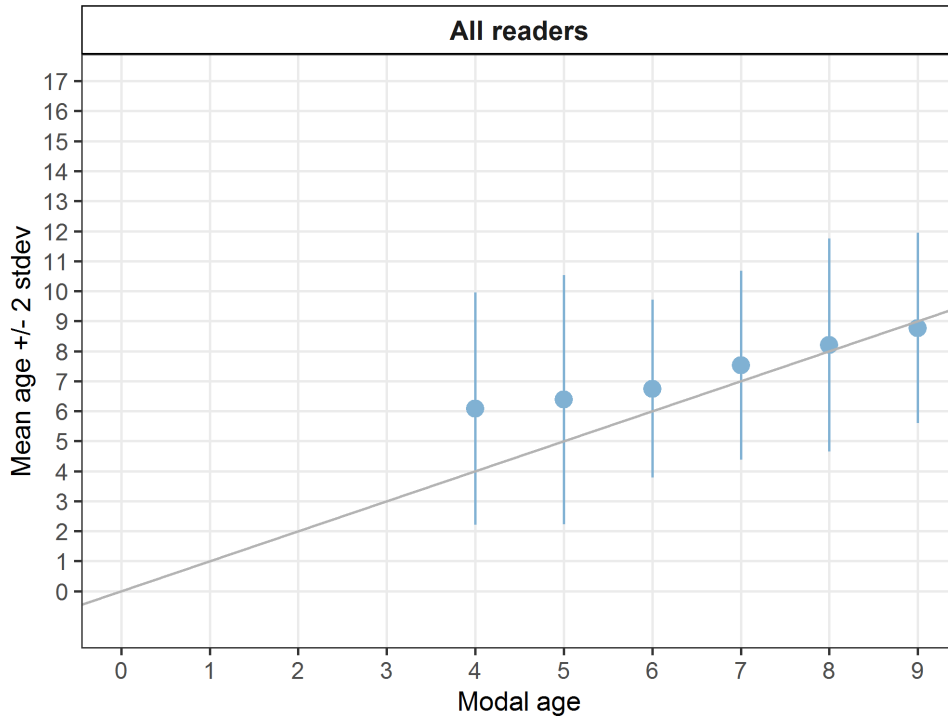


Figure 6.1.1: Age bias plot for all readers. Mean age recorded +/- 2 SD of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to the modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

The 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 and finally (Table 6.1.4 and Figure 6.1.2).

Table 6.1.4: The relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader.

Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
4	0.00	1.00	5.00	4.00	1.00	6.00	2.00	2.00	0.00	1.00	3.00	2.00	0.00	2.08
5	0.50	0.00	1.88	3.25	-0.25	4.57	1.75	0.62	0.50	1.38	1.38	2.40	0.75	1.44
6	0.08	-0.31	0.77	2.15	-0.15	2.64	1.08	1.31	-0.31	0.54	1.23	0.54	0.38	0.76
7	0.00	-0.69	0.81	1.69	-0.06	3.31	0.38	1.19	-0.81	0.00	0.44	0.94	-0.38	0.52
8	-0.83	-1.50	1.33	2.17	-0.67	3.17	0.17	0.50	-0.67	0.17	0.67	-0.17	-1.67	0.21
9	-1.67	-0.83	0.17	0.50	0.67	1.33	0.00	0.17	-1.67	0.17	0.17	-0.17	-1.83	-0.23
Weighted Mean	-0.20	-0.56	1.04	2.02	-0.08	3.13	0.74	0.94	-0.54	0.42	0.84	0.72	-0.32	0.63

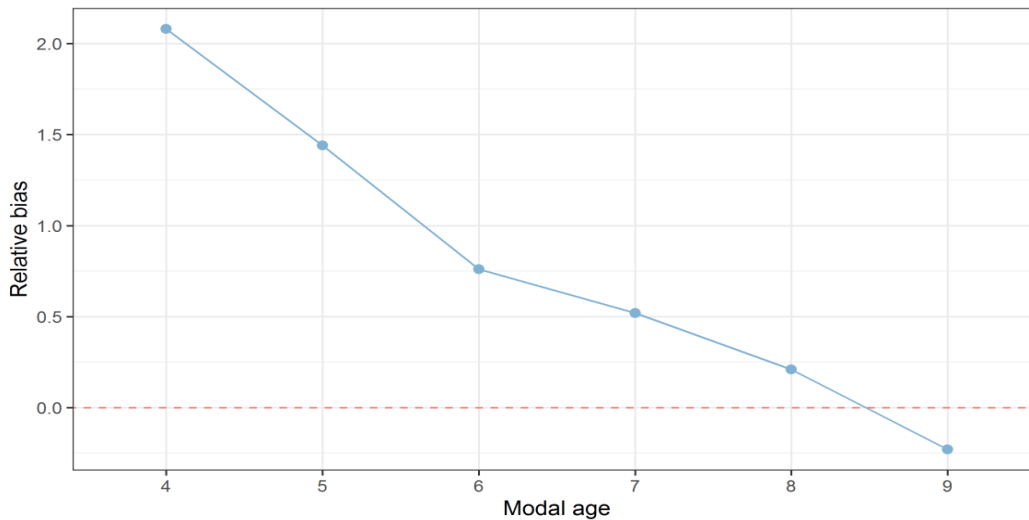


Figure 6.1.2: The relative bias by modal age as estimated by all age readers combined.

For each reader pair compared, the differences between the readings per otolith are found and the frequency of each occurring difference is obtained (Table 6.1.5).

Table 6.1.5: 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 ($p < 0.01$)

Comparison	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR
R01 PT	-	-	**	**	-	**	**	**	-	*	**	**	-
R02 GR	-	-	**	**	*	**	**	**	-	**	**	**	-
R03 NO	**	**	-	**	**	**	-	-	**	*	-	-	**
R04 IS	**	**	**	-	**	**	**	**	**	**	**	**	**
R04 NO	-	*	**	**	-	**	**	**	-	**	**	**	-
R06 NO	**	**	**	**	**	-	**	**	**	**	**	**	**
R07 ES	**	**	-	**	**	**	-	-	**	*	-	-	**
R08 NO	**	**	-	**	**	**	-	-	**	*	-	-	**
R09 NO	-	-	**	**	-	**	**	**	-	**	**	**	-
R10 ES	*	**	*	**	**	**	*	*	**	-	-	-	**
R11 FO	**	**	-	**	**	**	-	-	**	-	-	-	**
R12 FO	**	**	-	**	**	**	-	-	**	-	-	-	**
R13 FR	-	-	**	**	-	**	**	**	-	**	**	**	-
Modal age	-	**	**	**	-	**	**	**	*	**	**	**	-

Advanced readers

For black scabbardfish, all age readers were defined as “advanced readers”, hence the result for the advanced readers equals the previous results (Table 6.1.1-6.1.5 and Figure 6.1.1-6.1.2).

Age error matrices are calculated per area and only based on the age readings of the advanced readers.

Table 6.1.6: Age Error MatixAge Error Matix (AEM) for 27.5.b. The AEM shows the proportional distribution of age readings for each modal age. Age column should sum to one but due to rounding there might be small deviations in some cases. Only advanced readers are used for calculating the AEM.

strata	Modal age	4	5	6	7	8	9
27.5.b	Age 3	-	0.01	0.005988	-	-	-
27.5.b	Age 4	0.23077	0.08	0.035928	0.014423	-	0.01282
27.5.b	Age 5	0.23077	0.35	0.125749	0.057692	0.01282	0.05128
27.5.b	Age 6	0.23077	0.21	0.335329	0.120192	0.15385	0.05128
27.5.b	Age 7	0.07692	0.11	0.209581	0.418269	0.15385	0.01282
27.5.b	Age 8	0.07692	0.11	0.179641	0.173077	0.35897	0.16667
27.5.b	Age 9	0.07692	0.04	0.059880	0.100962	0.15385	0.43590
27.5.b	Age 10	0.07692	0.04	0.035928	0.062500	0.03846	0.19231
27.5.b	Age 11	-	0.03	0.005988	0.033654	0.08974	0.05128
27.5.b	Age 12	-	0.01	0.005988	0.009615	0.01282	0.01282
27.5.b	Age 13	-	-	-	0.009615	0.01282	0.01282
27.5.b	Age 15	-	-	-	-	0.01282	-
27.5.b	Age 16	-	0.01	-	-	-	-

For additional age reading results and otolith growth analysis, please see Annex 10.1.

Internal consistency

Nine of the age readers aging the black scabbardfish otoliths in 2020/2021, also aged them in 2018. The average ages and internal CV for each reader, the age-plot and the box plot for each reader is shown in Table 6.1.10, Figure 6.1.4 and Figure 6.1.5. For black scabbardfish, the internal consistency varies a bit depending on the age reader, with a CV ranging from 8.8% to 34.1%.

Table 6.1.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	Portugal	Norway1	Norway2	Norway3	Spain	Norway4	Norway5
Average age 2018	8.9	8.4	4.3	7.0	6.9	7.4	7.4	6.1	6.4
Average age 2020	6.2	8.7	6.5	7.8	6.6	9.9	7.5	7.7	6.2
CV	26.7	11.0	34.1	10.6	8.8	28.2	10.3	17.6	14.2

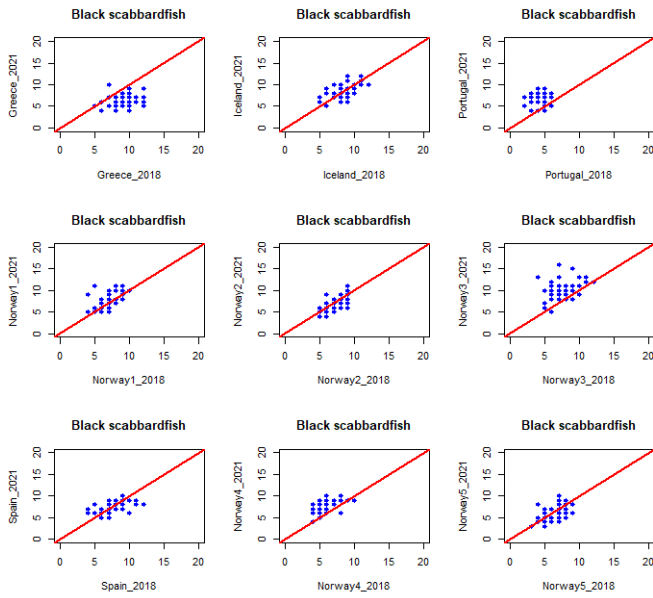


Figure 6.1.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

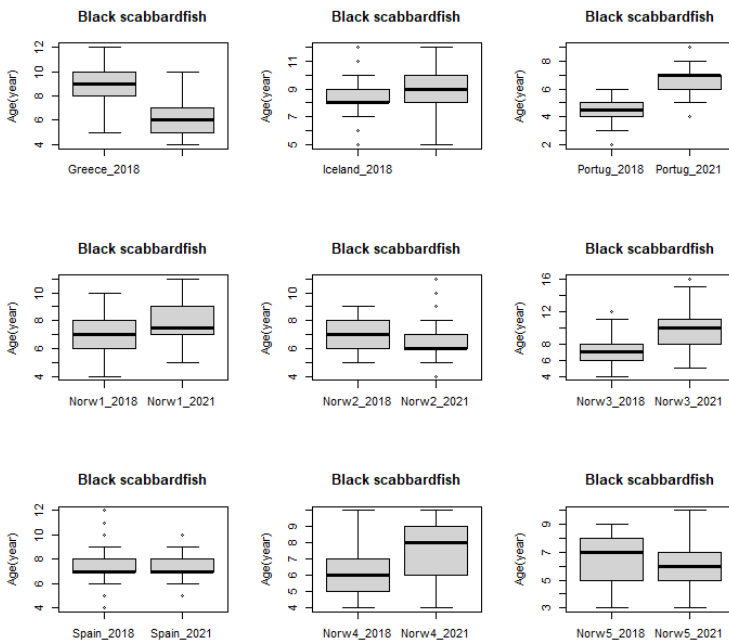


Figure 6.1.5: Age distribution per reader in 2018 and 2020.

6.2 Greater forkbeard

All readers included

The weighted average CV for all readers was 29%, the PA based on modal ages was 55 % and APE was 20 % (Table 6.2.1, Table 6.2.2, Table 6.2.3, and Figure 6.2.1).

Table 6.2.1: 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. A rank is also assigned to each reader.

Modal age	R01 ES	R02 FR	R03 NO	R04 GR	R05 NO	R06 NO	R07 IS	R07 NO	R08 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
1	-	83 %	94 %	-	36 %	73 %	37 %	37 %	-	37 %	37 %	36 %	0 %	61 %
2	65 %	22 %	0 %	31 %	22 %	33 %	19 %	0 %	0 %	22 %	22 %	14 %	22 %	29 %
3	32 %	22 %	27 %	28 %	25 %	16 %	22 %	19 %	13 %	15 %	19 %	29 %	12 %	28 %
4	21 %	35 %	21 %	13 %	17 %	15 %	16 %	0 %	14 %	27 %	17 %	22 %	16 %	23 %
5	15 %	11 %	12 %	9 %	14 %	19 %	10 %	12 %	16 %	14 %	13 %	16 %	11 %	17 %
6	17 %	19 %	10 %	20 %	14 %	23 %	21 %	0 %	7 %	21 %	26 %	23 %	10 %	22 %
Weighted Mean	27 %	32 %	28 %	18 %	21 %	28 %	19 %	12 %	12 %	22 %	21 %	23 %	12 %	29 %

The Percent 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. A rank is also assigned to each reader.

Table 6.2.2: Percent 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. A rank is also assigned to each reader.

Modal age	R01 ES	R02 FR	R03 NO	R04 GR	R05 NO	R06 NO	R07 IS	R07 NO	R08 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
1	50 %	62 %	50 %	50 %	50 %	62 %	75 %	75 %	25 %	75 %	75 %	50 %	100 %	62 %
2	33 %	83 %	100 %	67 %	50 %	67 %	33 %	100 %	100 %	67 %	67 %	17 %	67 %	65 %
3	29 %	43 %	29 %	43 %	43 %	57 %	57 %	71 %	86 %	43 %	71 %	29 %	86 %	53 %
4	18 %	27 %	45 %	73 %	55 %	55 %	64 %	100 %	64 %	45 %	82 %	36 %	64 %	56 %
5	38 %	31 %	69 %	69 %	38 %	54 %	77 %	69 %	38 %	31 %	62 %	33 %	85 %	54 %
6	20 %	0 %	40 %	40 %	40 %	40 %	20 %	100 %	80 %	40 %	20 %	20 %	60 %	40 %
Weighted Mean	32 %	40 %	56 %	60 %	46 %	56 %	60 %	84 %	60 %	48 %	66 %	33 %	78 %	55 %

Table 6.2.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 ES	R02 FR	R03 NO	R04 GR	R05 NO	R06 NO	R07 IS	R07 NO	R08 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
1	-	75 %	75 %	-	33 %	50 %	30 %	30 %	-	30 %	30 %	33 %	0 %	39 %
2	48 %	15 %	0 %	27 %	20 %	27 %	17 %	0 %	0 %	19 %	19 %	10 %	19 %	21 %
3	23 %	20 %	22 %	23 %	21 %	14 %	16 %	10 %	9 %	14 %	10 %	24 %	8 %	21 %
4	12 %	28 %	15 %	8 %	12 %	13 %	9 %	0 %	13 %	19 %	8 %	15 %	12 %	14 %
5	12 %	10 %	10 %	8 %	10 %	17 %	6 %	6 %	13 %	12 %	8 %	11 %	7 %	13 %
6	13 %	14 %	9 %	16 %	11 %	17 %	16 %	0 %	5 %	18 %	20 %	17 %	9 %	15 %
Weighted Mean	19 %	27 %	22 %	14 %	17 %	22 %	14 %	8 %	9 %	18 %	14 %	18 %	9 %	20 %

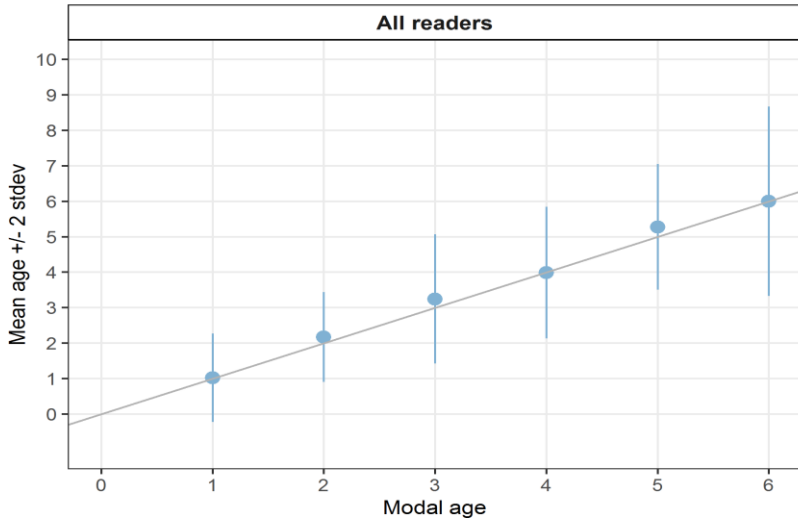


Figure 6.2.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

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 and finally (Table 6.2.4 and Figure 6.2.2).

Table 6.2.4: Relative bias table represents the relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 ES	R02 FR	R03 NO	R04 GR	R05 NO	R06 NO	R07 IS	R07 NO	R08 NO	R10 ES	R11 FO	R12 FO	R13 FR	all
1	-0.50	-0.38	-0.25	-0.50	0.50	-0.12	0.25	0.25	0.00	0.25	0.25	0.50	0.00	0.02
2	-0.83	-0.17	0.00	-0.33	0.50	0.50	0.67	0.00	0.00	0.33	0.33	0.83	0.33	0.17
3	-0.86	-0.57	0.57	0.43	1.00	0.43	0.14	0.00	-0.14	0.57	0.00	1.43	0.14	0.24
4	-1.00	-1.18	0.27	0.09	0.09	0.55	0.00	0.00	-0.36	0.45	0.09	1.00	-0.18	-0.01
5	-0.69	-0.69	0.38	0.31	0.77	0.92	0.08	0.00	0.15	1.08	0.08	1.00	0.23	0.28
6	-1.20	-1.40	-0.60	-0.40	1.00	0.60	-0.60	0.00	0.20	1.80	0.00	1.00	-0.40	0.00
Weighted Mean	-0.82	-0.74	0.14	0.00	0.60	0.52	0.10	0.04	-0.04	0.72	0.12	0.96	0.04	0.13

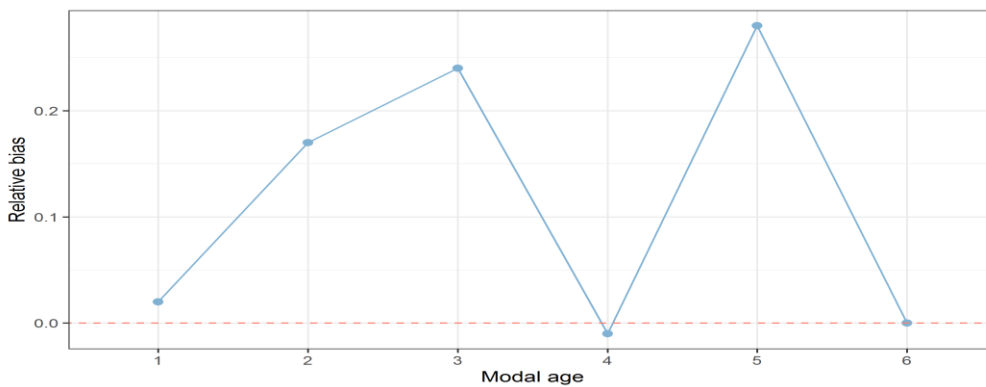


Figure 6.2.2: The relative bias by modal age as estimated by all age readers combined.

For each pair that is being compared, the differences between the readings per image are found and the frequency of each occurring difference is obtained (Table 6.2.5).

*Table 6.2.5: 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 ($p<0.01$)*

Comparison	R01 ES	R02 FR	R03 NO	R04 GR	R05 NO	R06 NO	R07 IS	R07 NO	R08 NO	R10 ES	R11 FO	R12 FO	R13 FR
R01 ES	-	-	**	**	**	**	**	**	**	**	**	**	**
R02 FR	-	-	**	**	**	**	**	**	**	**	**	**	**
R03 NO	**	**	-	-	**	*	-	-	-	**	-	**	-
R04 GR	**	**	-	-	**	**	-	-	-	**	-	**	-
R05 NO	**	**	**	**	-	-	**	**	**	-	**	*	**
R06 NO	**	**	*	**	-	-	*	**	**	-	*	*	**
R07 IS	**	**	-	-	**	*	-	-	-	**	-	**	-
R07 NO	**	**	-	-	**	**	-	-	-	**	-	**	-
R08 NO	**	**	-	-	**	**	-	-	-	**	-	**	-
R10 ES	**	**	**	**	-	-	**	**	**	-	**	-	**
R11 FO	**	**	-	-	**	*	-	-	-	**	-	**	-
R12 FO	**	**	**	**	*	*	**	**	**	-	**	-	**
R13 FR	**	**	-	-	**	**	-	-	-	**	-	**	-
Modal age	**	**	-	-	**	**	-	-	-	**	-	**	-

Advanced readers

For greater forkbeard, two age readers were defined as “advanced readers”. Their weighted average CV was 19% and the PA based on modal ages was 83% (Table 6.2.6, Table 6.2.7, and Figure 6.2.3).

Table 6.2.6: 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. A rank is also assigned to each reader.

Modal age	R01 ES	R02 FR	all
0	-	-	-
1	55 %	38 %	45 %
2	16 %	16 %	15 %
3	21 %	14 %	17 %
4	9 %	10 %	10 %
5	9 %	0 %	6 %
Weighted Mean	22 %	16 %	19 %

Table 6.2.7: Percent 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. A rank is also assigned to each reader.

Modal age	R01 ES	R02 FR	all
0	100 %	60 %	80 %
1	89 %	67 %	78 %
2	89 %	89 %	89 %
3	89 %	78 %	83 %
4	85 %	77 %	81 %
5	80 %	100 %	90 %
Weighted Mean	88 %	78 %	83 %

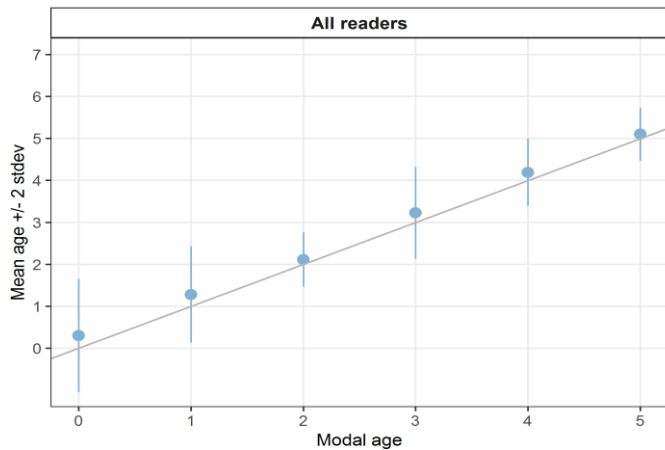


Figure 6.2.3: Age bias plot for advanced readers.

Table 6.2.8: Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 ES	R02 FR	all
0	0.00	0.60	0.30
1	0.22	0.33	0.28
2	0.11	0.11	0.11
3	0.22	0.22	0.22
4	0.15	0.23	0.19
5	0.20	0.00	0.10
Weighted Mean	0.16	0.24	0.20

For additional age reading results and otolith growth analysis, please see Annex 10.2.

Internal consistency

Nine of the age readers aging the greater forkbeard otoliths in 2020/2021, had also aged them in 2018. The average age in both years for each age reader, the internal CV for the reader, the age-plot and the box plot for each reader is shown in Table 6.2.10, Figure 6.2.4 and Figure 6.2.5. For greater forkbeard, the internal consistency had a CV between 11.1% and 22.3%. The average age was quite consistent, with the highest difference in mean age between the two exchanges being one year.

Table 6.2.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	France	Norway1	Norway2	Norway3	Spain	Norway4	Norway5
Average age 2018	3.0	4.3	2.9	3.6	3.7	3.4	3.8	3.9	3.6
Average age 2020	3.6	3.7	2.9	3.7	4.2	4.1	2.8	3.6	3.6
CV	16.1	13.8	12.9	13.4	19.5	22.3	12.8	11.1	18.7

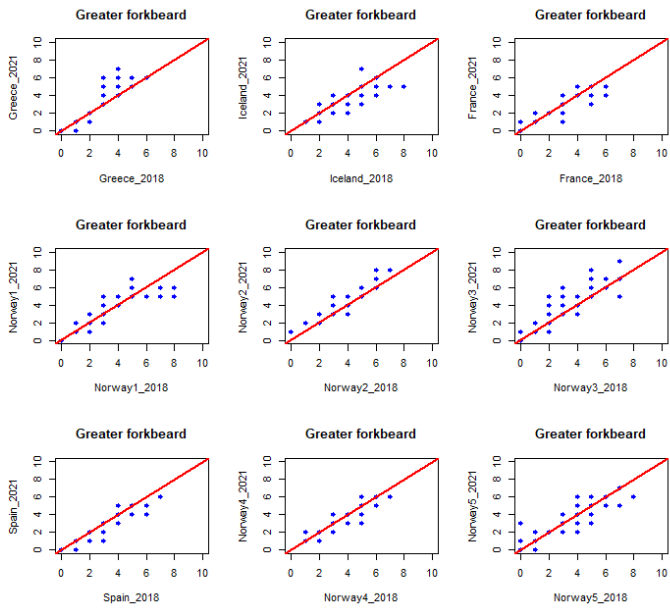


Figure 6.2.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

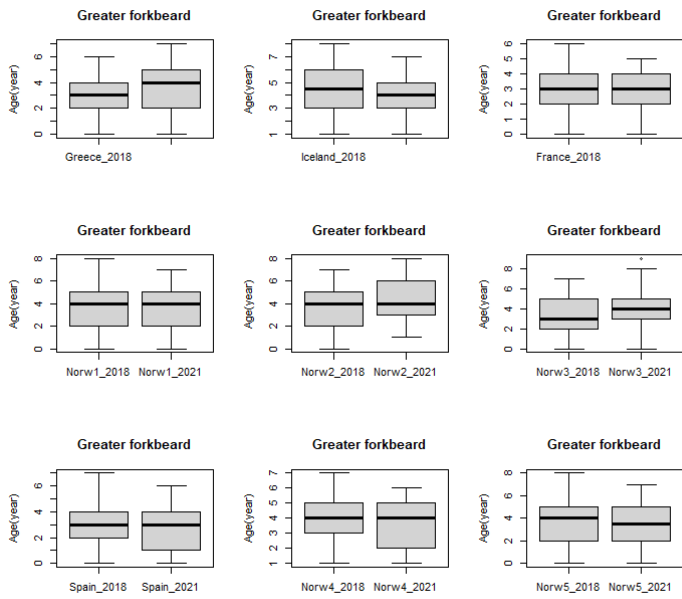


Figure 6.2.5: Boxplot for each age reader for the years 2018 and 2020.

8	43 %	64 %	50 %	57 %	50 %	50 %	36 %	21 %	14 %	36 %	54 %	14 %	43 %	43 %	41 %
9	33 %	17 %	50 %	50 %	50 %	50 %	50 %	50 %	0 %	17 %	33 %	33 %	50 %	33 %	37 %
10	57 %	14 %	57 %	29 %	57 %	71 %	43 %	71 %	0 %	43 %	57 %	71 %	43 %	43 %	47 %
11	40 %	0 %	20 %	80 %	40 %	60 %	40 %	0 %	20 %	60 %	20 %	40 %	20 %	40 %	34 %
12	0 %	0 %	100 %	0 %	0 %	100 %	100 %	100 %	100 %	0 %	100 %	0 %	100 %	0 %	50 %
Weighted Mean	43 %	49 %	49 %	61 %	58 %	65 %	52 %	41 %	35 %	54 %	40 %	34 %	51 %	34 %	48 %

Table 6.3.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R06 GR	R07 FR	R08 NO	R09 NO	R10 ES	R10 NO	R11 NO	R13 FR	R14 DK	all
2	34 %	25 %	18 %	0 %	20 %	11 %	0 %	20 %	0 %	11 %	24 %	27 %	0 %	8 %	20 %
3	0 %	0 %	14 %	0 %	14 %	0 %	0 %	0 %	20 %	0 %	0 %	0 %	0 %	14 %	18 %
4	14 %	9 %	9 %	10 %	11 %	0 %	21 %	8 %	0 %	0 %	12 %	0 %	20 %	9 %	13 %
5	15 %	11 %	6 %	4 %	11 %	6 %	9 %	9 %	14 %	11 %	10 %	11 %	7 %	14 %	11 %
6	16 %	14 %	9 %	11 %	12 %	7 %	11 %	12 %	8 %	14 %	16 %	17 %	12 %	13 %	14 %
7	8 %	6 %	9 %	8 %	6 %	13 %	9 %	11 %	20 %	13 %	17 %	7 %	12 %	13 %	11 %
8	16 %	7 %	8 %	8 %	7 %	12 %	13 %	13 %	11 %	11 %	10 %	14 %	13 %	17 %	13 %
9	21 %	9 %	35 %	6 %	7 %	8 %	5 %	14 %	9 %	11 %	10 %	7 %	19 %	23 %	15 %
10	5 %	9 %	5 %	13 %	9 %	8 %	12 %	11 %	12 %	12 %	6 %	6 %	11 %	8 %	11 %
11	14 %	7 %	7 %	6 %	5 %	7 %	14 %	3 %	11 %	8 %	3 %	11 %	20 %	11 %	12 %
12	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	8 %
Weighted Mean	15 %	10 %	11 %	7 %	9 %	9 %	10 %	11 %	11 %	11 %	12 %	11 %	11 %	13 %	13 %

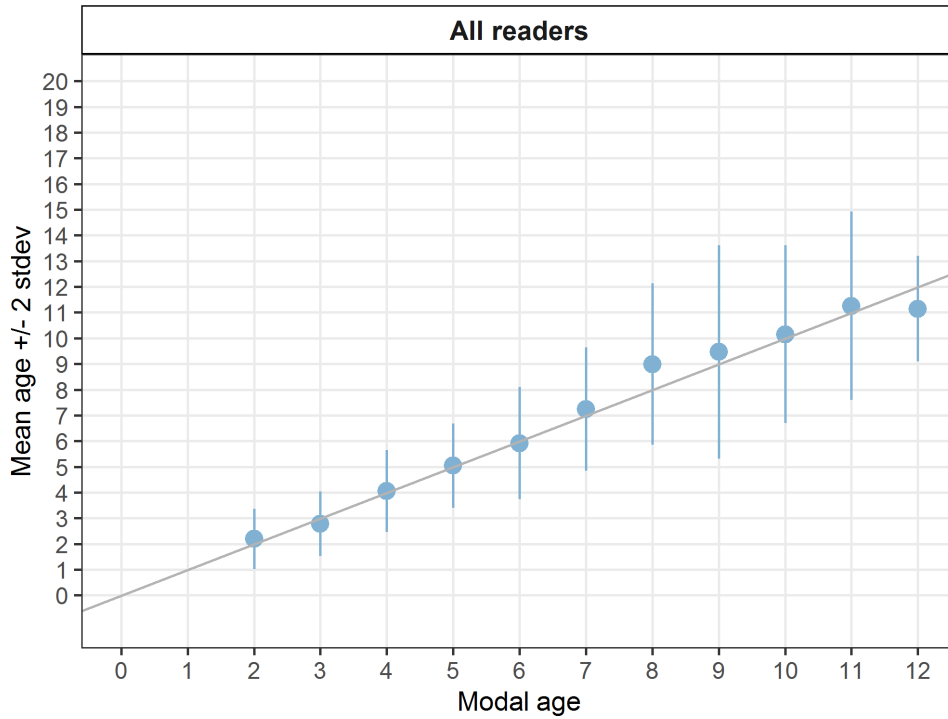


Figure 6.3.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

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 and finally (Table 6.3.4 and Figure 6.3.2).

Table 6.3.4: Relative bias table represents the relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R06 GR	R07 FR	R08 NO	R09 NO	R10 ES	R10 NO	R11 NO	R13 FR	R14 DK	all
2	-0.57	0.57	0.29	0.00	0.43	0.14	0.00	0.43	0.00	0.14	-0.29	0.43	0.00	1.14	0.19
3	-1.00	0.00	0.50	-1.00	0.50	0.00	-1.00	0.00	-0.50	0.00	0.00	0.00	-1.00	0.50	-
															0.21
4	-0.50	0.25	0.25	-0.25	0.50	0.00	0.25	0.75	0.00	0.00	-0.75	-1.00	-0.25	1.50	0.05
5	-0.60	0.10	0.80	0.10	0.60	0.20	0.30	0.50	0.30	-0.20	-1.00	-0.80	0.20	0.10	0.04
6	-0.50	-0.25	0.25	-0.75	0.50	-0.12	0.38	0.25	0.75	-0.38	-1.25	-1.25	0.38	0.88	-
															0.08
7	0.20	-0.27	0.47	-0.20	0.29	0.27	0.40	0.53	1.40	0.20	0.00	0.07	0.33	-0.27	0.24
8	1.00	0.07	0.71	0.29	0.64	0.79	0.86	1.86	3.21	0.93	0.38	1.00	0.71	1.36	0.99
9	0.83	-0.67	-1.67	0.17	0.00	0.83	0.50	1.50	3.33	0.33	0.17	0.33	0.50	0.33	0.46
10	-0.14	-1.43	-0.14	-0.71	-0.71	0.57	0.86	0.86	3.71	-0.71	0.00	0.43	0.43	-0.86	0.15
11	-0.20	-1.80	-0.40	0.40	-0.60	-0.20	-0.40	2.00	2.40	0.80	1.00	0.00	0.60	0.00	0.26
12	-3.00	-2.00	0.00	-1.00	-2.00	0.00	0.00	0.00	0.00	-1.00	0.00	-1.00	0.00	-2.00	-
															0.86
Weighted Mean	-0.01	-0.30	0.23	-0.13	0.24	0.32	0.38	0.91	1.67	0.15	-0.18	0.00	0.33	0.41	0.29

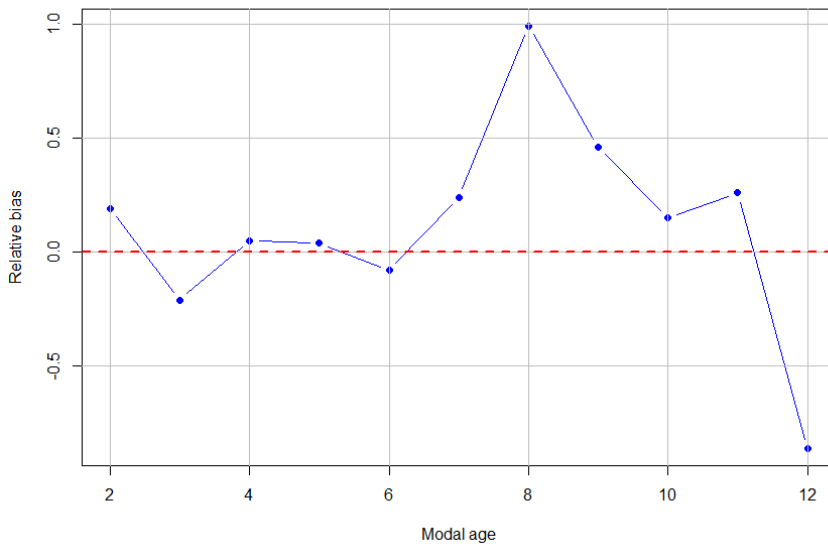


Figure 6.3.2: The relative bias by modal age as estimated by all age readers combined.

For each pair that is being compared, the differences between the readings per image are found and the frequency of each occurring difference is obtained (Table 6.3.5).

Table 6.3.5: 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 ($p < 0.01$)

Comparison	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R06 GR	R07 FR	R08 NO	R09 NO	R10 ES	R10 NO	R11 NO	R13 FR	R14 DK
R01 NO	-	-	**	-	-	*	**	**	**	-	-	-	-	*
R02 IS	-	-	**	-	**	**	**	**	**	**	-	-	**	**
R03 FO	**	**	-	**	-	-	-	**	**	-	**	-	-	-
R04 ES	-	-	**	-	**	**	**	**	**	*	-	-	*	*
R05 FO	-	**	-	**	-	-	-	**	**	-	*	-	-	-
R06 GR	*	**	-	**	-	-	-	**	**	-	**	*	-	-
R07 FR	**	**	-	**	-	-	-	**	**	-	**	*	-	-
R08 NO	**	**	**	**	**	**	**	-	**	**	**	**	**	*
R09 NO	**	**	**	**	**	**	**	**	-	**	**	**	**	**
R10 ES	-	**	-	*	-	-	-	**	**	-	*	-	-	-
R10 NO	-	-	**	-	*	**	**	**	**	*	-	-	*	*
R11 NO	-	-	-	-	-	*	*	**	**	-	-	-	-	-
R13 FR	-	**	-	*	-	-	-	**	**	-	*	-	-	-
R14 DK	*	**	-	*	-	-	-	*	**	-	*	-	-	-
Modal age	-	*	**	-	*	**	**	**	**	-	-	-	-	-

Advanced readers

For ling, six age readers were defined as “advanced readers”. The weighted average CV is 17% and the PA based on modal ages for all advanced readers is 53% (Table 6.3.6, Table 6.3.7, and Figure 6.3.3).

Table 6.3.6: 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. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK	all
2	36 %	28 %	30 %	0 %	21 %	14 %	32 %
3	-	-	-	-	-	-	27 %
4	15 %	11 %	12 %	18 %	12 %	16 %	17 %
5	17 %	11 %	9 %	7 %	13 %	25 %	18 %
6	22 %	15 %	13 %	13 %	13 %	14 %	16 %
7	17 %	6 %	12 %	11 %	9 %	16 %	13 %
8	21 %	12 %	10 %	11 %	9 %	20 %	16 %
9	16 %	6 %	6 %	6 %	7 %	13 %	10 %
10	24 %	8 %	45 %	11 %	0 %	21 %	22 %
11	10 %	6 %	6 %	0 %	6 %	5 %	9 %
12	-	-	-	-	-	-	12 %
Weighted Mean	21 %	12 %	16 %	9 %	10 %	17 %	17 %

Table 6.3.7: Percent 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. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK	all
2	50 %	50 %	62 %	100 %	50 %	0 %	52 %
3	0 %	100 %	100 %	0 %	0 %	100 %	50 %
4	60 %	80 %	60 %	60 %	40 %	20 %	53 %
5	38 %	75 %	12 %	88 %	50 %	25 %	48 %
6	27 %	55 %	55 %	45 %	64 %	73 %	53 %
7	60 %	80 %	53 %	67 %	71 %	47 %	63 %
8	36 %	71 %	50 %	64 %	50 %	43 %	52 %
9	33 %	33 %	67 %	67 %	67 %	33 %	50 %
10	29 %	43 %	57 %	29 %	100 %	43 %	50 %
11	67 %	0 %	33 %	100 %	33 %	67 %	50 %
12	100 %	0 %	100 %	0 %	0 %	0 %	33 %
Weighted Mean	43 %	61 %	52 %	65 %	59 %	41 %	53 %

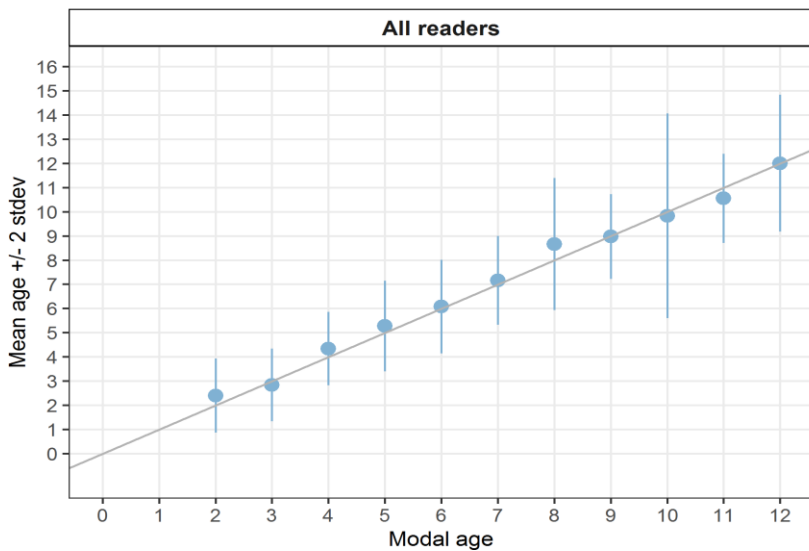


Figure 6.3.3: Age bias plot for advanced readers.

Table 6.3.8: Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK	all
2	-0.50	0.62	0.50	0.00	0.50	1.25	0.40
3	-1.00	0.00	0.00	-1.00	1.00	0.00	-0.17
4	-0.40	0.20	0.40	0.00	0.60	1.20	0.33
5	-0.75	0.00	1.00	0.12	0.62	0.62	0.27
6	-0.09	0.00	0.36	-0.64	0.55	0.27	0.08
7	0.47	-0.20	0.53	0.00	0.36	-0.20	0.16
8	1.14	0.00	0.71	0.21	0.64	1.29	0.67
9	-0.33	-0.67	0.33	0.33	0.00	0.17	-0.03
10	0.14	-0.71	-1.00	0.29	0.00	0.29	-0.17
11	0.67	-1.67	-0.67	0.00	-0.67	-0.33	-0.44
12	0.00	-2.00	0.00	1.00	-1.00	2.00	0.00
Weighted Mean	0.13	-0.16	0.37	0.01	0.38	0.54	0.21

For additional age reading results and otolith growth analysis, please see Annex 10.3.

Internal consistency

Nine of the age readers aging the ling otoliths in 2020/2021, did also age the same otoliths in 2018. The average age in both years for each age reader, the internal CV for the reader, the age-plot and the box plot for each reader is shown in Table 6.3.10, Figure 6.3.4 and Figure 6.3.5. For ling, the internal consistency varies from 7.1 to 15.9% for eight of the readers, while one reader had a CV of 34.9%. The difference in average age varies from 0.3 years to 2.9 years at the most.

Table 6.3.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	France	Norway1	Norway2	Norway3	Spain	Norway4	Norway5
Average age 2018	6.6	8.1	6.7	6.4	4.9	8.0	7.0	7.2	7.2
Average age 2020	7.2	6.6	7.2	6.8	7.8	8.5	6.7	6.7	6.9
CV	11.4	15.9	8.4	13.0	34.9	11.2	7.1	11.7	14.0

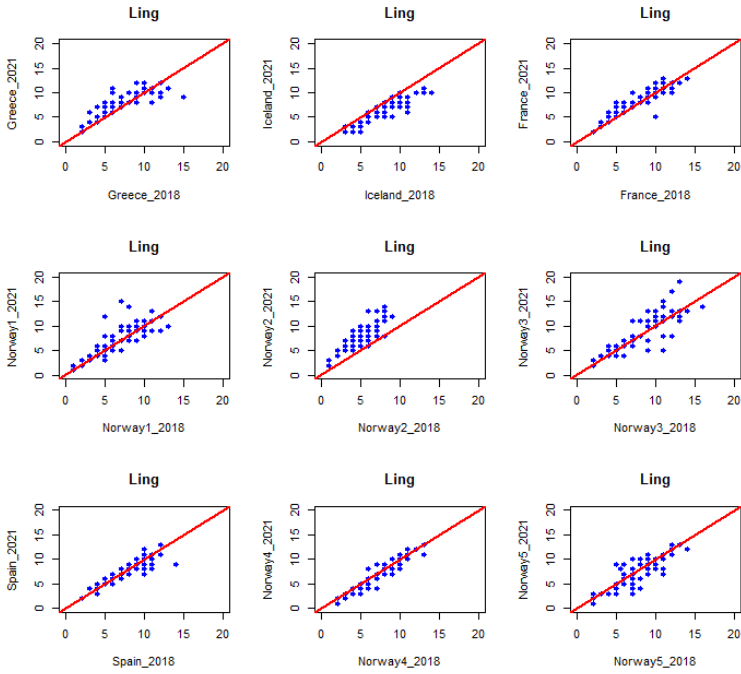


Figure 6.3.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

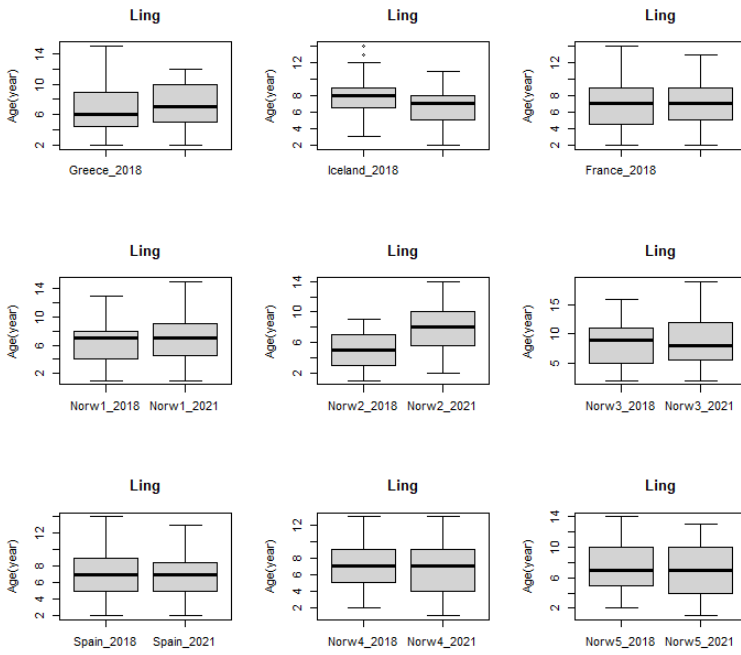


Figure 6.3.5: Boxplot for each age reader for the years 2018 and 2020.

6.4 Blue ling

All readers included

The weighted average CV for all readers is 17%, the PA based on modal ages is 34 % and APE is 13 % (Table 6.4.1, Table 6.4.2, Table 6.4.3, and Figure 6.4.1).

Table 6.4.1: 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. A rank is also assigned to each reader.

Modal age	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO	all
4	49 %	16 %	9 %	13 %	27 %	0 %	22 %	16 %	16 %	16 %	22 %	25 %	23 %	35 %
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	26 %
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	12 %	8 %	6 %	10 %	9 %	22 %	14 %	5 %	22 %	5 %	24 %	11 %	9 %	18 %
9	9 %	11 %	14 %	10 %	6 %	24 %	11 %	0 %	17 %	0 %	13 %	6 %	6 %	15 %
10	5 %	5 %	10 %	5 %	12 %	10 %	16 %	10 %	13 %	25 %	8 %	11 %	16 %	15 %
11	20 %	19 %	11 %	24 %	9 %	19 %	14 %	33 %	24 %	25 %	24 %	4 %	7 %	21 %
12	8 %	11 %	22 %	0 %	13 %	0 %	8 %	5 %	4 %	5 %	11 %	5 %	4 %	12 %
13	11 %	4 %	5 %	8 %	18 %	14 %	12 %	9 %	12 %	22 %	7 %	5 %	13 %	15 %
14	3 %	9 %	9 %	9 %	7 %	0 %	3 %	7 %	9 %	7 %	3 %	15 %	7 %	11 %
15	4 %	9 %	15 %	0 %	17 %	10 %	4 %	7 %	6 %	4 %	9 %	31 %	16 %	14 %
16	-	-	-	-	-	-	-	-	-	-	-	-	-	11 %
17	0 %	8 %	17 %	0 %	6 %	5 %	9 %	9 %	8 %	9 %	20 %	5 %	0 %	14 %
18	3 %	6 %	11 %	3 %	7 %	9 %	5 %	6 %	8 %	3 %	5 %	0 %	12 %	12 %
19	4 %	14 %	0 %	7 %	12 %	4 %	8 %	0 %	3 %	8 %	0 %	4 %	20 %	17 %
20	3 %	5 %	8 %	8 %	8 %	13 %	0 %	10 %	5 %	6 %	4 %	9 %	3 %	15 %
21	0 %	3 %	15 %	6 %	0 %	15 %	6 %	3 %	3 %	11 %	11 %	39 %	6 %	19 %
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	22 %
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	-	-	-	-	36 %
Weighted Mean	10 %	10 %	10 %	9 %	11 %	11 %	10 %	10 %	12 %	11 %	13 %	11 %	10 %	17 %

The Percent 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. A rank is also assigned to each reader.

Table 6.4.2: Percent 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. A rank is also assigned to each reader.

Modal age	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO	all
4	0 %	67 %	0 %	67 %	0 %	0 %	33 %	67 %	67 %	67 %	33 %	67 %	0 %	36 %
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	100 %	0 %	0 %	0 %	0 %	100 %	0 %	0 %	0 %	0 %	100 %	100 %	100 %	38 %
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	20 %	0 %	80 %	40 %	60 %	40 %	40 %	80 %	0 %	80 %	20 %	80 %	0 %	42 %

9	0 %	0 %	67 %	33 %	67 %	0 %	33 %	100 %	0 %	100 %	0 %	33 %	67 %	38 %
10	0 %	0 %	33 %	0 %	67 %	33 %	67 %	33 %	33 %	33 %	0 %	67 %	67 %	33 %
11	67 %	17 %	17 %	50 %	33 %	50 %	67 %	20 %	17 %	0 %	50 %	83 %	67 %	42 %
12	0 %	33 %	33 %	100 %	0 %	100 %	33 %	67 %	0 %	67 %	0 %	33 %	0 %	36 %
13	0 %	0 %	0 %	0 %	0 %	33 %	67 %	67 %	33 %	33 %	0 %	33 %	33 %	23 %
14	80 %	0 %	20 %	40 %	0 %	100 %	80 %	80 %	0 %	20 %	0 %	40 %	20 %	37 %
15	33 %	33 %	33 %	100 %	0 %	33 %	0 %	33 %	0 %	67 %	0 %	33 %	33 %	31 %
16	0 %	0 %	100 %	100 %	0 %	0 %	0 %	0 %	100 %	100 %	0 %	0 %	0 %	31 %
17	100 %	50 %	0 %	100 %	0 %	0 %	50 %	50 %	50 %	0 %	0 %	0 %	100 %	38 %
18	0 %	0 %	0 %	67 %	0 %	33 %	33 %	33 %	33 %	67 %	0 %	100 %	33 %	31 %
19	50 %	0 %	0 %	50 %	0 %	50 %	50 %	100 %	0 %	0 %	0 %	0 %	0 %	23 %
20	67 %	33 %	0 %	33 %	0 %	33 %	100 %	33 %	0 %	0 %	0 %	0 %	0 %	23 %
21	100 %	0 %	0 %	0 %	0 %	50 %	50 %	50 %	0 %	50 %	0 %	50 %	50 %	31 %
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	0 %	0 %	0 %	100 %	0 %	100 %	0 %	0 %	0 %	100 %	0 %	0 %	-	25 %
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	100 %	100 %	0 %	100 %	0 %	0 %	0 %	0 %	100 %	0 %	0 %	0 %	0 %	31 %
Weighted Mean	38 %	16 %	24 %	50 %	18 %	44 %	48 %	53 %	18 %	42 %	12 %	48 %	33 %	34 %

Table 6.4.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO	all
4	38 %	12 %	7 %	10 %	20 %	0 %	17 %	12 %	12 %	12 %	17 %	19 %	17 %	28 %
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	21 %
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	9 %	6 %	4 %	7 %	5 %	18 %	11 %	4 %	16 %	4 %	16 %	8 %	8 %	13 %
9	6 %	8 %	11 %	7 %	5 %	18 %	9 %	0 %	11 %	0 %	10 %	5 %	5 %	11 %
10	4 %	4 %	7 %	4 %	10 %	8 %	12 %	7 %	10 %	17 %	5 %	8 %	12 %	12 %
11	16 %	12 %	8 %	16 %	7 %	16 %	9 %	23 %	16 %	15 %	16 %	2 %	6 %	15 %
12	7 %	8 %	16 %	0 %	10 %	0 %	5 %	4 %	3 %	4 %	8 %	4 %	3 %	9 %
13	8 %	3 %	4 %	6 %	13 %	11 %	10 %	7 %	9 %	17 %	5 %	4 %	9 %	12 %
14	2 %	6 %	6 %	7 %	5 %	0 %	2 %	5 %	6 %	5 %	2 %	11 %	6 %	8 %
15	3 %	7 %	10 %	0 %	11 %	7 %	3 %	4 %	4 %	3 %	6 %	21 %	12 %	10 %
16	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	8 %
17	0 %	6 %	12 %	0 %	4 %	3 %	6 %	6 %	6 %	7 %	14 %	3 %	0 %	11 %
18	2 %	4 %	8 %	2 %	4 %	7 %	4 %	4 %	6 %	3 %	3 %	0 %	9 %	9 %
19	3 %	10 %	0 %	5 %	8 %	3 %	6 %	0 %	2 %	6 %	0 %	3 %	14 %	13 %
20	2 %	4 %	6 %	5 %	6 %	10 %	0 %	7 %	4 %	5 %	3 %	7 %	2 %	12 %
21	0 %	2 %	10 %	4 %	0 %	11 %	5 %	2 %	2 %	8 %	8 %	27 %	5 %	14 %
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	-	18 %

24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	32%
Weighted Mean	7%	6%	7%	6%	7%	8%	7%	6%	8%	7%	8%	8%	7%	13%

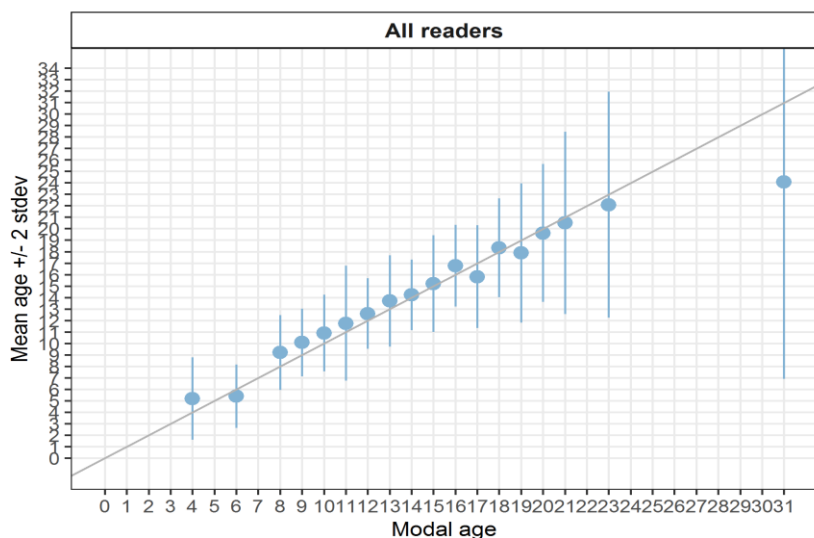


Figure 6.4.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

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 and finally (Table 6.4.4 and Figure 6.4.2).

Table 6.4.4: Relative bias table represents the relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO	all
4	3.00	-0.33	2.67	0.33	3.67	1.00	1.33	-0.33	-0.33	-0.33	1.33	0.67	2.67	1.18
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	0.00	-2.00	1.00	-1.00	2.00	0.00	-1.00	-2.00	-2.00	-3.00	0.00	0.00	0.00	- 0.62
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	1.40	2.20	-0.20	0.80	0.00	1.80	1.20	0.20	3.20	0.20	2.80	0.40	1.60	1.20
9	2.00	1.67	-0.67	1.00	0.33	2.00	1.33	0.00	3.00	0.00	2.33	0.67	0.33	1.08
10	1.33	2.67	0.00	1.67	-0.67	1.33	1.00	0.00	1.67	-2.00	3.00	0.67	1.00	0.90
11	1.50	2.17	-1.67	1.83	-1.00	1.17	0.83	0.40	2.67	-0.67	1.83	0.17	0.50	0.75
12	1.67	1.67	-2.33	0.00	-0.67	0.00	1.00	-0.33	1.67	0.33	2.33	0.67	1.67	0.59

13	0.67	1.67	-1.33	1.67	-1.33	1.67	1.00	-0.67	2.00	-1.00	3.33	-0.67	2.00	0.69
14	0.20	1.60	-1.20	1.20	-1.80	0.00	0.20	-0.40	1.40	-1.20	2.20	-0.60	1.40	0.23
15	0.67	1.33	-2.00	0.00	-3.00	0.33	1.33	0.00	2.00	-0.33	2.33	-0.33	0.33	0.21
16	4.00	3.00	0.00	0.00	-3.00	1.00	2.00	1.00	0.00	0.00	1.00	-1.00	2.00	0.77
17	0.00	1.00	-4.50	0.00	-5.50	-1.50	-1.00	-1.00	1.00	-2.00	0.50	-2.50	0.00	-
														1.19
18	1.67	2.33	-3.67	0.33	-3.00	2.00	1.00	0.00	1.67	-0.33	3.00	0.00	-0.67	0.33
19	0.50	1.00	-7.00	1.00	-7.00	-0.50	-1.00	0.00	1.50	-2.00	2.00	-1.50	-1.50	-
														1.12
20	0.33	1.33	-5.67	0.33	-5.67	1.00	0.00	1.67	2.33	-1.67	3.00	-3.33	1.33	-
														0.38
21	0.00	1.50	-6.50	2.00	-8.00	2.50	1.00	0.50	1.50	-1.50	4.00	-4.50	1.00	-
														0.50
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	3.00	2.00	-11.00	0.00	-7.00	0.00	2.00	1.00	4.00	0.00	3.00	-8.00	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	0.00	0.00	-20.00	0.00	-	-1.00	-14.00	-1.00	0.00	-5.00	2.00	-15.00	-20.00	-
					16.00									6.92
Weighted Mean	1.18	1.58	-2.44	0.84	-2.22	0.90	0.46	-0.00	1.82	-0.88	2.34	-0.92	0.51	0.27

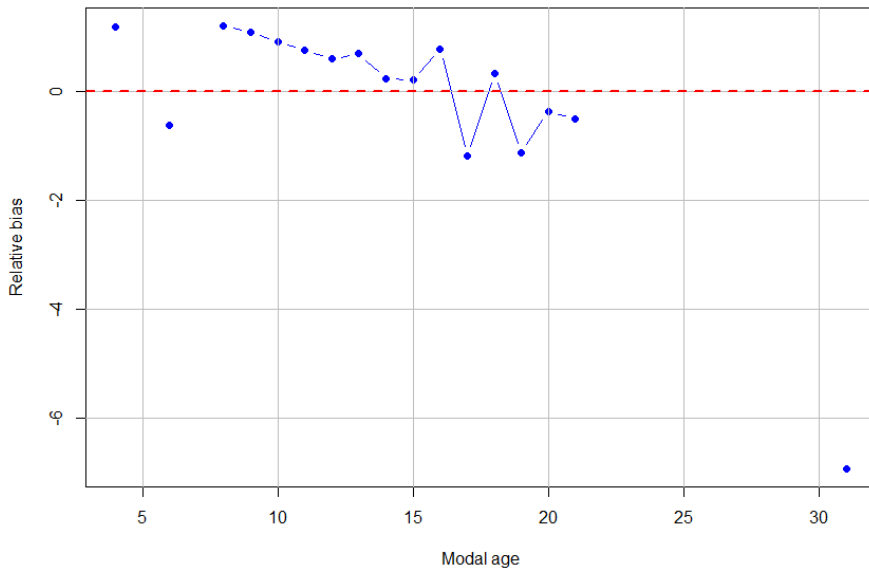


Figure 6.4.2: The relative bias by modal age as estimated by all age readers combined.

For each pair that is being compared, the differences between the readings per image are found and the frequency of each occurring difference is obtained (Table 6.4.5).

Table 6.4.5: 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 ($p<0.01$)

Comparison	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO
R01 FR	-	*	**	-	**	-	*	**	**	**	**	**	-
R02 NO	*	-	**	**	**	*	**	**	-	**	**	**	**
R03 GR	**	**	-	**	-	**	**	**	**	**	**	**	**
R04 NO	-	**	**	-	**	-	-	**	**	**	**	**	-
R05 IS	**	**	-	**	-	**	**	**	**	**	**	**	**
R06 NO	-	*	**	-	**	-	-	**	**	**	**	**	-
R07 ES	*	**	**	-	**	-	-	**	**	**	**	**	-
R08 NO	**	**	**	**	**	**	**	-	**	**	**	-	**
R09 NO	**	-	**	**	**	**	**	**	-	**	-	**	*
R10 FR	**	**	**	**	**	**	**	**	**	-	**	-	**
R11 ES	**	**	**	**	**	**	**	**	-	**	-	**	**
R12 FO	**	**	**	**	**	**	**	-	**	-	**	-	**
R13 FO	-	**	**	-	**	-	-	**	*	**	**	**	-
Modal age	**	**	**	**	**	**	**	-	**	**	**	-	**

Advanced readers

For blue ling, two age readers were defined as “advanced readers”. The weighted average CV is 8% and the PA based on modal ages for all advanced readers is 62% (Table 6.4.6, Table 6.4.7, and Figure 6.4.3).

Table 6.4.6: 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. A rank is also assigned to each reader.

Modal age	R01 FR	R04 NO	all
3	-	-	35 %
4	0 %	0 %	44 %
5	-	-	13 %
6	-	-	-
7	-	-	-
8	8 %	0 %	6 %
9	9 %	5 %	9 %
10	-	-	0 %
11	9 %	6 %	7 %
12	9 %	8 %	9 %
13	-	-	-
14	0 %	6 %	5 %
15	4 %	6 %	5 %
16	-	-	16 %
17	0 %	7 %	5 %
18	4 %	0 %	5 %
19	3 %	0 %	3 %
20	3 %	5 %	4 %
21	0 %	6 %	6 %
22	-	-	-
23	-	-	9 %
24	-	-	-
25	-	-	-
26	-	-	-
27	-	-	-
28	-	-	-
29	-	-	-
30	-	-	-
31	-	-	0 %
Weighted Mean	5 %	5 %	8 %

Table 6.4.7: Percent 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. A rank is also assigned to each reader.

Modal age	R01 FR	R04 NO	all
3	100 %	0 %	50 %
4	0 %	100 %	50 %
5	0 %	100 %	50 %
6	-	-	-
7	-	-	-
8	50 %	100 %	75 %
9	25 %	75 %	50 %
10	100 %	100 %	100 %
11	67 %	56 %	61 %
12	25 %	75 %	50 %
13	-	-	-
14	100 %	60 %	80 %
15	60 %	60 %	60 %
16	0 %	100 %	50 %
17	100 %	67 %	83 %
18	0 %	100 %	50 %
19	33 %	100 %	67 %
20	67 %	33 %	50 %
21	100 %	0 %	50 %
22	-	-	-
23	0 %	100 %	50 %
24	-	-	-
25	-	-	-
26	-	-	-
27	-	-	-
28	-	-	-
29	-	-	-
30	-	-	-
31	100 %	100 %	100 %
Weighted Mean	56 %	68 %	62 %

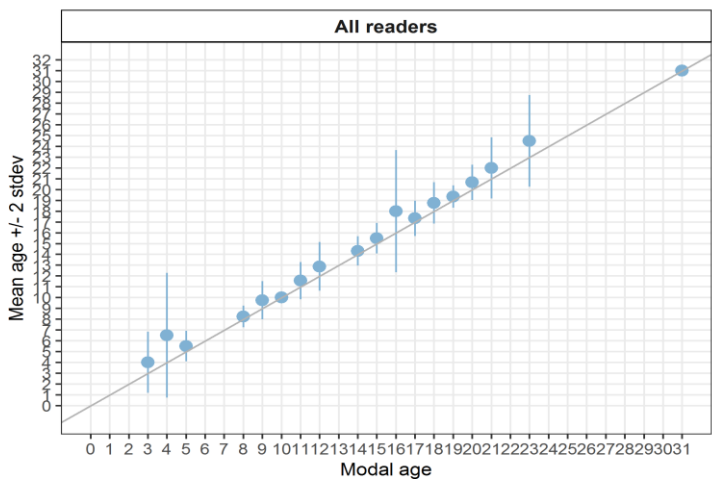


Figure 6.4.3: Age bias plot for advanced readers.

Table 6.4.8: Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 FR	R04 NO	all
3	0.00	2.00	1.00
4	5.00	0.00	2.50
5	1.00	0.00	0.50
6	-	-	-
7	-	-	-
8	0.50	0.00	0.25
9	1.25	0.25	0.75
10	0.00	0.00	0.00
11	0.56	0.56	0.56
12	1.25	0.50	0.88
13	-	-	-
14	0.00	0.60	0.30
15	0.40	0.60	0.50
16	4.00	0.00	2.00
17	0.00	0.67	0.33
18	1.50	0.00	0.75
19	0.67	0.00	0.33
20	0.33	1.00	0.67
21	0.00	2.00	1.00
22	-	-	-
23	3.00	0.00	1.50
24	-	-	-
25	-	-	-
26	-	-	-
27	-	-	-
28	-	-	-
29	-	-	-
30	-	-	-
31	0.00	0.00	0.00
Weighted Mean	0.84	0.50	0.67

For additional age reading results and otolith growth analysis, please see Annex 10.4.

Internal consistency

Nine of the age readers aging the blue ling otoliths in 2020/2021, did also age the same otoliths in 2018. The average age in both years for each age reader, the internal CV for the reader, the age-plot and the box plot for each reader is shown in Table 6.4.10, Figure 6.4.4 and Figure 6.4.5. For blue ling, the internal consistency is good, with a CV between 3.8% and 10.5%. However, the average age shows a difference in 1.5 years at the highest, but it is worth noticing that the average age is a lot higher as well then for some of the other species in this exchange.

Table 6.4.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	France	Norway1	Norway2	Norway3	Spain	Norway4	Norway5
Average age 2018	12.2	12.7	14.0	13.7	15.1	15.0	14.0	13.7	14.5
Average age 2020	10.9	11.2	12.5	14.2	14.3	15.0	13.8	13.4	15.2
CV	10.5	10.3	10.2	6.1	6.4	3.8	6.8	8.2	7.7

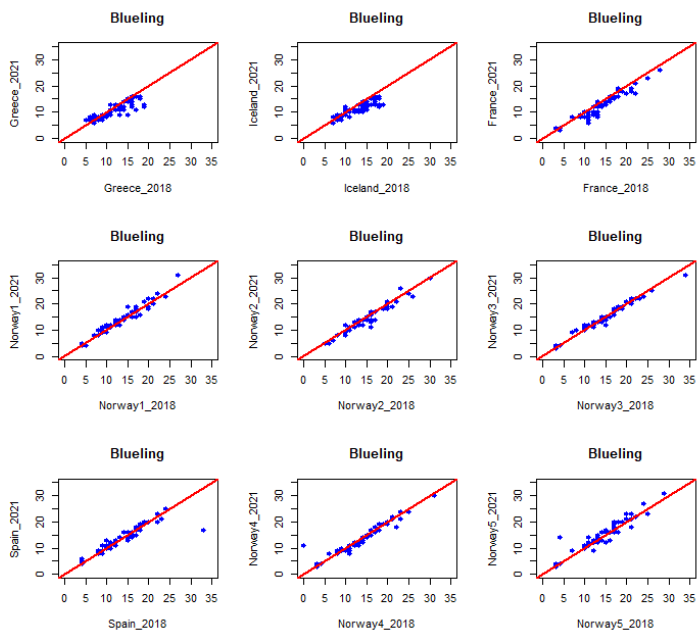


Figure 6.4.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

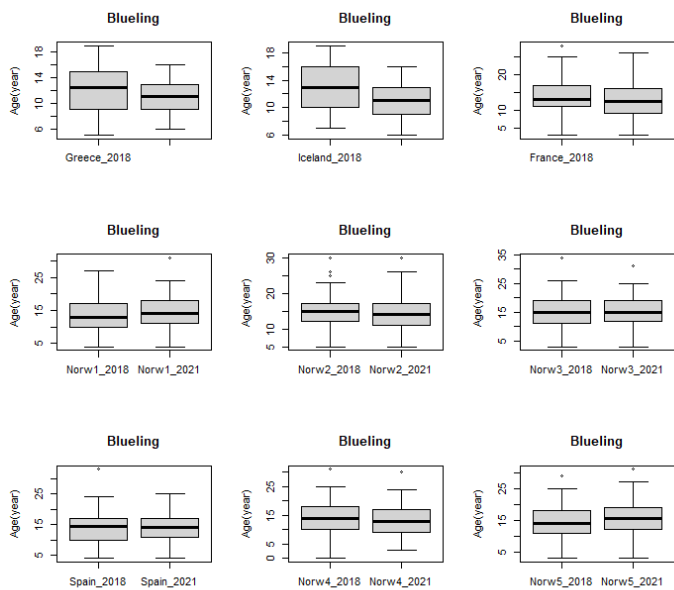


Figure 6.4.5: Boxplot for each age reader for the years 2018 and 2020.

6.5 Greater silver smelt

All readers included

The weighted average CV for all readers is 9%, the PA based on modal ages is 69 % and APE is 6 % (Table 6.5.1, Table 6.5.2, Table 6.5.3, and Figure 6.5.1).

Table 6.5.1: 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. A rank is also assigned to each reader.

Modal age	R01		R03		R04		R05		R06		R09		R10		R12		all
	NO	R02 IS	FO	NO	GR	NO	R07 ES	R08 ES	NO	NO	R11 FR	FO	R13 FR				
3	0 %	0 %	20 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	12 %	
4	25 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	11 %	
5	0 %	0 %	12 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	6 %	
6	0 %	0 %	8 %	0 %	8 %	0 %	8 %	10 %	0 %	0 %	0 %	9 %	0 %	0 %	6 %		
7	0 %	0 %	11 %	8 %	7 %	12 %	5 %	12 %	11 %	7 %	15 %	6 %	12 %	10 %			
8	14 %	6 %	6 %	4 %	7 %	18 %	13 %	18 %	14 %	12 %	0 %	7 %	16 %	12 %			
9	8 %	6 %	11 %	6 %	7 %	4 %	7 %	7 %	4 %	6 %	4 %	10 %	4 %	7 %			
10	4 %	8 %	10 %	11 %	6 %	11 %	10 %	18 %	8 %	7 %	9 %	9 %	8 %	11 %			
11	5 %	8 %	10 %	4 %	9 %	0 %	9 %	9 %	0 %	0 %	5 %	9 %	0 %	8 %			
12	5 %	10 %	9 %	13 %	5 %	0 %	5 %	5 %	14 %	13 %	13 %	20 %	9 %	11 %			
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
14	16 %	4 %	4 %	4 %	5 %	4 %	9 %	4 %	4 %	4 %	4 %	4 %	4 %	9 %			
Weighted Mean	7 %	4 %	9 %	5 %	6 %	6 %	7 %	10 %	6 %	5 %	5 %	7 %	7 %	9 %			

The Percent 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. A rank is also assigned to each reader.

Table 6.5.2: Percent 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. A rank is also assigned to each reader.

Modal age	R01		R03		R04		R05		R06		R09		R10		R12		all
	NO	R02 IS	FO	NO	GR	NO	R07 ES	R08 ES	NO	NO	R11 FR	FO	R13 FR				
3	100 %	100 %	50 %	100 %	100 %	100 %	100 %	0 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	88 %	
4	67 %	100 %	100 %	100 %	100 %	100 %	100 %	0 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	90 %	
5	100 %	100 %	67 %	100 %	100 %	100 %	100 %	0 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	90 %	
6	100 %	100 %	75 %	100 %	75 %	100 %	75 %	25 %	100 %	100 %	100 %	75 %	100 %	86 %			
7	100 %	100 %	71 %	71 %	57 %	60 %	86 %	29 %	71 %	71 %	71 %	86 %	57 %	72 %			
8	75 %	75 %	75 %	88 %	75 %	86 %	88 %	12 %	75 %	62 %	100 %	50 %	75 %	72 %			
9	50 %	67 %	67 %	67 %	67 %	83 %	67 %	67 %	83 %	50 %	83 %	67 %	83 %	69 %			
10	83 %	50 %	33 %	50 %	50 %	67 %	50 %	33 %	67 %	50 %	17 %	40 %	50 %	49 %			
11	60 %	40 %	20 %	80 %	20 %	100 %	60 %	20 %	100 %	100 %	60 %	60 %	100 %	62 %			
12	67 %	67 %	33 %	67 %	33 %	100 %	67 %	67 %	33 %	67 %	67 %	33 %	67 %	59 %			
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
14	33 %	33 %	0 %	67 %	0 %	67 %	33 %	33 %	67 %	67 %	0 %	67 %	67 %	41 %			
Weighted Mean	76 %	74 %	56 %	78 %	60 %	86 %	74 %	28 %	80 %	74 %	72 %	67 %	78 %	69 %			

Table 6.4.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 NO	R05 GR	R06 NO	R07 ES	R08 ES	R09 NO	R10 NO	R11 FR	R12 FO	R13 FR	all
3	0%	0%	14%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%
4	19%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%
5	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%
6	0%	0%	6%	0%	6%	0%	6%	7%	0%	0%	0%	7%	0%	3%
7	0%	0%	8%	4%	7%	9%	3%	10%	8%	6%	11%	4%	11%	7%
8	8%	5%	5%	3%	3%	11%	8%	12%	8%	6%	0%	7%	11%	6%
9	6%	5%	9%	5%	4%	3%	4%	4%	3%	5%	3%	8%	3%	5%
10	3%	6%	8%	8%	5%	8%	8%	12%	6%	5%	7%	7%	6%	8%
11	5%	6%	8%	3%	7%	0%	7%	7%	0%	0%	4%	7%	0%	6%
12	4%	8%	7%	10%	4%	0%	4%	4%	10%	10%	10%	15%	7%	9%
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	12%	3%	3%	3%	4%	3%	7%	3%	3%	3%	3%	3%	3%	7%
Weighted Mean	5%	3%	7%	4%	4%	4%	5%	7%	4%	4%	4%	6%	5%	6%

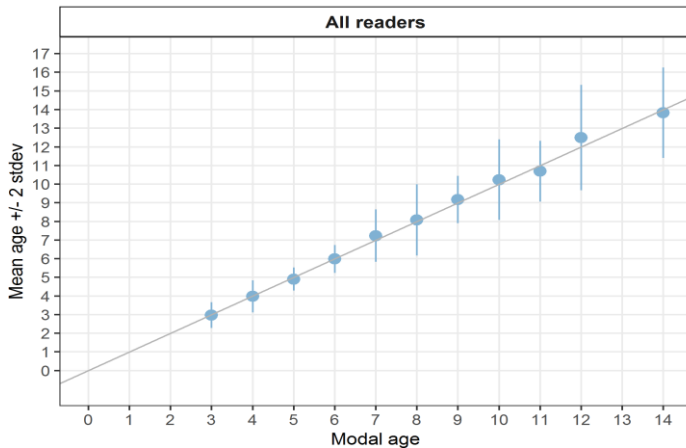


Figure 6.5.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

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 and finally (Table 6.5.4 and Figure 6.5.2).

Table 6.5.4: Relative bias table represents the relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 NO	R05 GR	R06 NO	R07 ES	R08 ES	R09 NO	R10 NO	R11 FR	R12 FO	R13 FR	all
3	0.00	0.00	0.50	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	-0.04
4	0.67	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	-0.03
5	0.00	0.00	-0.33	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	-0.10

6	0.00	0.00	0.25	0.00	0.25	0.00	0.25	-0.75	0.00	0.00	0.00	-0.25	0.00	-0.02
7	0.00	0.00	0.43	0.00	0.43	0.60	0.14	-0.43	0.43	0.29	0.57	-0.14	0.71	0.23
8	0.25	-0.25	0.25	-0.12	0.00	0.57	0.38	-0.38	0.25	0.00	0.00	-0.50	0.62	0.08
9	0.17	0.33	0.67	0.33	0.00	0.17	0.00	0.00	0.17	0.50	0.17	-0.50	0.17	0.17
10	0.17	-0.17	1.17	-0.33	-0.50	0.67	0.33	-0.17	0.50	0.17	1.33	-0.80	0.67	0.23
11	-0.40	-0.80	0.60	-0.20	-1.20	0.00	-0.60	-1.20	0.00	0.00	0.40	-0.60	0.00	-0.31
12	0.33	-0.67	1.33	1.00	-0.67	0.00	-0.33	-0.33	2.00	1.00	1.00	1.00	0.67	0.49
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-0.67	-0.67	1.33	0.33	-2.33	0.33	-1.33	-0.67	-0.33	-0.33	1.33	0.33	0.33	-0.18
Weighted Mean	0.06	-0.18	0.56	0.04	-0.28	0.26	-0.02	-0.54	0.28	0.16	0.44	-0.24	0.36	0.07

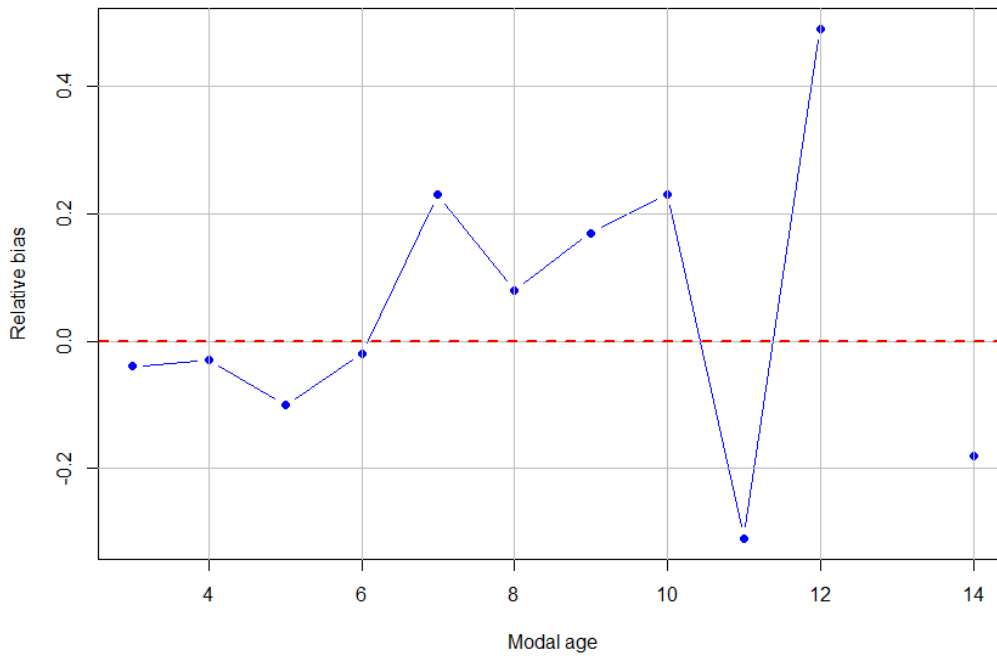


Figure 6.5.2: The relative bias by modal age as estimated by all age readers combined.

For each pair that is being compared, the differences between the readings per image are found and the frequency of each occurring difference is obtained (Table 6.5.5).

Table 6.5.5: 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 ($p<0.01$)

Comparison	R01 NO	R02 IS	R03 FO	R04 NO	R05 GR	R06 NO	R07 ES	R08 ES	R09 NO	R10 NO	R11 FR	R12 FO	R13 FR
R01 NO	-	-	**	-	*	-	-	**	-	-	*	*	*
R02 IS	-	-	**	-	-	**	-	*	**	**	**	-	**
R03 FO	**	**	-	**	**	*	**	**	*	**	-	**	-
R04 NO	-	-	**	-	*	-	-	**	*	-	**	*	*
R05 GR	*	-	**	*	-	**	*	-	**	**	**	-	**
R06 NO	-	**	*	-	**	-	*	**	-	-	-	*	-
R07 ES	-	-	**	-	*	-	-	**	*	-	**	-	**
R08 ES	**	*	**	**	-	**	**	-	**	**	**	*	**
R09 NO	-	**	*	*	**	-	*	**	-	-	-	**	-

R10 NO	-	**	**	-	**	-	-	**	-	-	*	**	-
R11 FR	*	**	-	**	**	-	**	**	-	*	-	**	-
R12 FO	*	-	**	*	-	*	-	*	**	**	**	-	**
R13 FR	*	**	-	*	**	-	**	**	-	-	-	**	-
Modal age	-	-	**	-	*	*	-	**	*	-	**	*	**

Advanced readers

For greater silver smelt, three age readers were defined as “advanced readers”. The weighted average CV is 10% and the PA based on modal ages for all advanced readers is 75% (Table 6.5.6, Table 6.5.7, and Figure 6.5.3).

Table 6.5.6: 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. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	all
3	0 %	0 %	20 %	13 %
4	25 %	0 %	0 %	16 %
5	0 %	0 %	12 %	7 %
6	0 %	0 %	8 %	5 %
7	0 %	0 %	11 %	7 %
8	13 %	11 %	6 %	10 %
9	6 %	0 %	11 %	9 %
10	7 %	5 %	15 %	12 %
11	0 %	15 %	17 %	14 %
12	6 %	0 %	11 %	7 %
13	-	-	-	-
14	-	-	-	4 %
15	-	-	-	8 %
Weighted Mean	6 %	4 %	11 %	10 %

Table 6.5.7: Percent 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. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	all
3	100 %	100 %	50 %	83 %
4	67 %	100 %	100 %	89 %
5	100 %	100 %	67 %	89 %
6	100 %	100 %	75 %	92 %
7	100 %	100 %	71 %	90 %
8	78 %	67 %	67 %	70 %
9	60 %	100 %	40 %	67 %
10	78 %	78 %	33 %	63 %
11	100 %	50 %	25 %	58 %
12	50 %	100 %	50 %	67 %
13	-	-	-	-
14	100 %	100 %	0 %	67 %
15	100 %	0 %	100 %	67 %
Weighted Mean	84 %	84 %	56 %	75 %

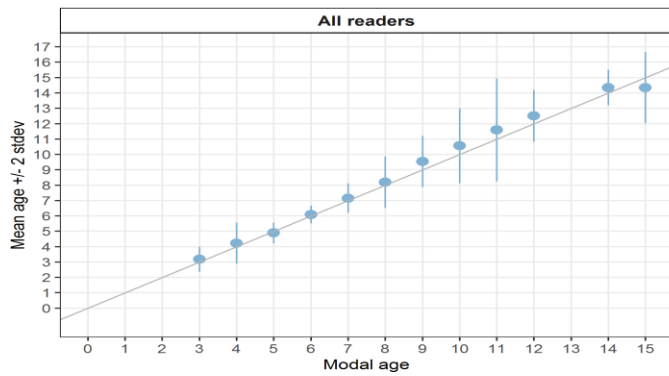


Figure 6.5.3: Age bias plot for advanced readers.

Table 6.5.8: Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 NO	R02 IS	R03 FO	all
3	0.00	0.00	0.50	0.17
4	0.67	0.00	0.00	0.22
5	0.00	0.00	-0.33	-0.11
6	0.00	0.00	0.25	0.08
7	0.00	0.00	0.43	0.14
8	0.22	0.00	0.33	0.19
9	0.40	0.00	1.20	0.53
10	0.33	0.00	1.33	0.56
11	0.00	0.00	1.75	0.58
12	0.50	0.00	1.00	0.50
13	-	-	-	-
14	0.00	0.00	1.00	0.33
15	0.00	-2.00	0.00	-0.67
Weighted Mean	0.20	-0.04	0.70	0.29

For additional age reading results and otolith growth analysis, please see Annex 10.5.

Internal consistency

Nine of the age readers aging the greater silver smelt otoliths in 2020/2021, did also age the same otoliths in 2018. The average age in both years for each age reader, the internal CV for the reader, the age-plot and the box plot for each reader is shown in Table 6.5.10, Figure 6.5.4 and Figure 6.5.5. For greater silver smelt, the internal consistency is excellent. The CV only varies from 1.1% to 6.4%. The difference in average age varies only between 0.1 to 0.5 years.

Table 6.5.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	France	Norway1	Norway2	Norway3	Spain	Norway4	Norway5
Average age 2018	8.3	8.5	8.3	8.4	8.9	8.4	8.6	8.7	8.5
Average age 2020	8.1	8.2	8.8	8.4	8.4	8.5	8.3	8.6	8.5
CV	3.5	3.7	6.4	3.1	4.2	2.1	6.1	1.1	3.3

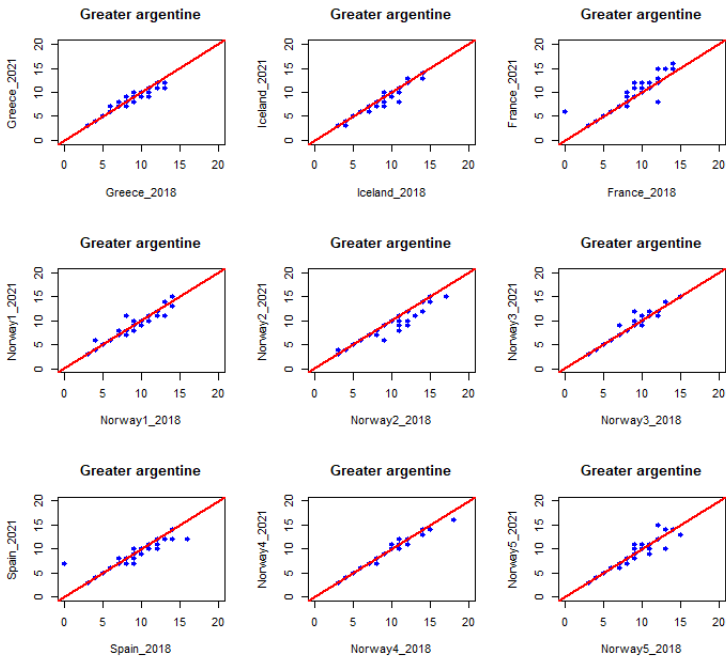


Figure 6.5.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

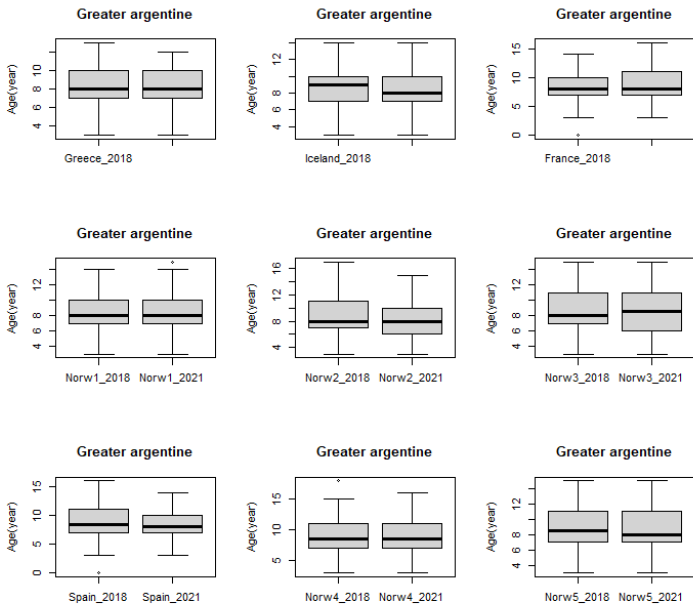


Figure 6.5.5: Boxplot for each age reader for the years 2018 and 2020.

6.6 Tusk

All readers included

The weighted average CV for all readers is 15%, the PA based on modal ages is 44 % and APE is 11 % (Table 6.6.1, Table 6.6.2, Table 6.6.3, and Figure 6.6.1).

Table 6.6.1: 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. A rank is also assigned to each reader.

Modal age	R01 IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR	all
6	-	-	-	-	-	-	-	-	-	-	-	-	-	13 %
7	0 %	15 %	12 %	21 %	13 %	17 %	5 %	13 %	22 %	14 %	10 %	10 %	17 %	19 %
8	10 %	16 %	13 %	16 %	13 %	15 %	16 %	13 %	15 %	8 %	9 %	7 %	10 %	15 %
9	12 %	16 %	15 %	10 %	13 %	16 %	9 %	12 %	12 %	13 %	11 %	13 %	9 %	15 %
10	5 %	13 %	7 %	7 %	8 %	8 %	0 %	5 %	5 %	10 %	11 %	14 %	7 %	13 %
11	10 %	14 %	5 %	7 %	0 %	8 %	11 %	10 %	4 %	0 %	12 %	6 %	8 %	11 %
12	11 %	29 %	18 %	11 %	0 %	11 %	10 %	11 %	5 %	5 %	5 %	11 %	5 %	16 %
13	5 %	9 %	14 %	7 %	8 %	4 %	5 %	17 %	0 %	4 %	13 %	14 %	0 %	13 %
Weighted Mean	9 %	16 %	12 %	11 %	10 %	13 %	8 %	11 %	10 %	10 %	10 %	11 %	9 %	15 %

The Percent 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. A rank is also assigned to each reader.

Table 6.6.2: Percent 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. A rank is also assigned to each reader.

Modal age	R01 IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR	all
6	0 %	100 %	100 %	0 %	100 %	100 %	100 %	100 %	100 %	100 %	0 %	100 %	0 %	69 %
7	100 %	60 %	20 %	80 %	20 %	0 %	0 %	20 %	40 %	60 %	20 %	60 %	0 %	37 %
8	50 %	25 %	50 %	12 %	50 %	25 %	50 %	25 %	25 %	62 %	62 %	50 %	12 %	38 %
9	12 %	18 %	41 %	6 %	53 %	59 %	76 %	53 %	65 %	65 %	71 %	41 %	59 %	48 %
10	0 %	22 %	44 %	0 %	44 %	44 %	100 %	78 %	56 %	89 %	22 %	33 %	67 %	46 %
11	0 %	50 %	75 %	0 %	100 %	50 %	50 %	75 %	75 %	100 %	0 %	33 %	50 %	51 %
12	0 %	33 %	0 %	0 %	0 %	33 %	67 %	33 %	67 %	67 %	33 %	0 %	67 %	31 %
13	0 %	67 %	0 %	0 %	33 %	33 %	33 %	33 %	100 %	67 %	33 %	67 %	0 %	37 %
Weighted Mean	22 %	32 %	40 %	12 %	48 %	42 %	64 %	50 %	58 %	72 %	44 %	43 %	42 %	44 %

Table 6.6.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR	all
6	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	9 %
7	0 %	10 %	10 %	15 %	9 %	12 %	4 %	10 %	18 %	12 %	8 %	6 %	14 %	15 %
8	8 %	12 %	10 %	13 %	10 %	12 %	11 %	9 %	11 %	6 %	7 %	7 %	8 %	12 %
9	9 %	14 %	12 %	7 %	9 %	11 %	5 %	8 %	8 %	9 %	6 %	10 %	7 %	11 %
10	4 %	11 %	6 %	7 %	6 %	6 %	0 %	4 %	5 %	6 %	8 %	11 %	6 %	10 %
11	8 %	10 %	3 %	6 %	0 %	6 %	8 %	7 %	3 %	0 %	9 %	4 %	6 %	9 %
12	7 %	22 %	13 %	7 %	0 %	8 %	8 %	8 %	4 %	4 %	4 %	7 %	4 %	13 %

13	4 %	7 %	10 %	5 %	5 %	3 %	4 %	13 %	0 %	3 %	10 %	11 %	0 %	11 %
Weighted Mean	6 %	12 %	10 %	8 %	7 %	9 %	5 %	8 %	8 %	7 %	7 %	8 %	7 %	11 %

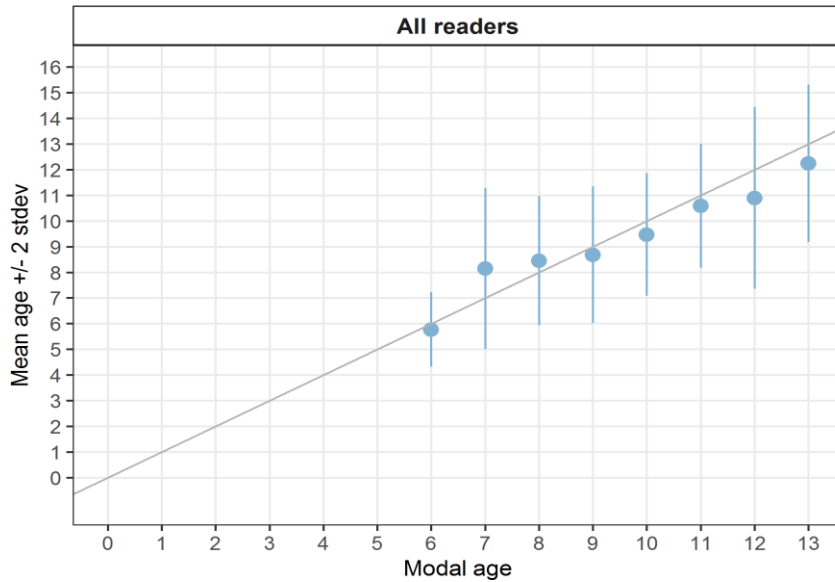


Figure 6.6.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

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 and finally (Table 6.6.4 and Figure 6.6.2).

Table 6.6.4: Relative bias table represents the relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR	all
6	-1.00	0.00	0.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	1.00	-0.23
7	0.00	0.20	0.40	-0.60	1.20	3.40	1.80	1.60	2.00	0.80	1.20	0.00	2.80	1.14
8	-0.62	0.00	0.50	-0.62	0.88	1.62	1.00	0.75	1.00	-0.12	0.50	-0.50	1.50	0.45
9	-1.18	-1.47	-0.65	-1.82	0.24	0.76	0.24	-0.18	0.47	-0.29	0.12	-0.94	0.59	-0.32
10	-1.78	-1.56	-0.33	-2.44	0.11	0.78	0.00	-0.22	0.44	-0.33	-0.78	-1.22	0.44	-0.53
11	-1.75	-1.00	-0.25	-2.50	0.00	0.75	0.25	-0.50	0.25	0.00	-0.75	-0.67	0.75	-0.42
12	-3.00	-3.00	-0.33	-3.00	-1.00	1.33	-0.67	-1.33	0.33	-0.33	-0.67	-3.00	0.33	-1.10
13	-2.33	-0.67	-2.33	-3.50	0.00	0.67	-0.67	-0.67	0.00	0.33	-1.67	-1.00	1.00	-0.83
Weighted Mean	-1.30	-1.06	-0.34	-1.82	0.30	1.18	0.36	0.02	0.64	-0.10	-0.12	-0.92	0.96	-0.17

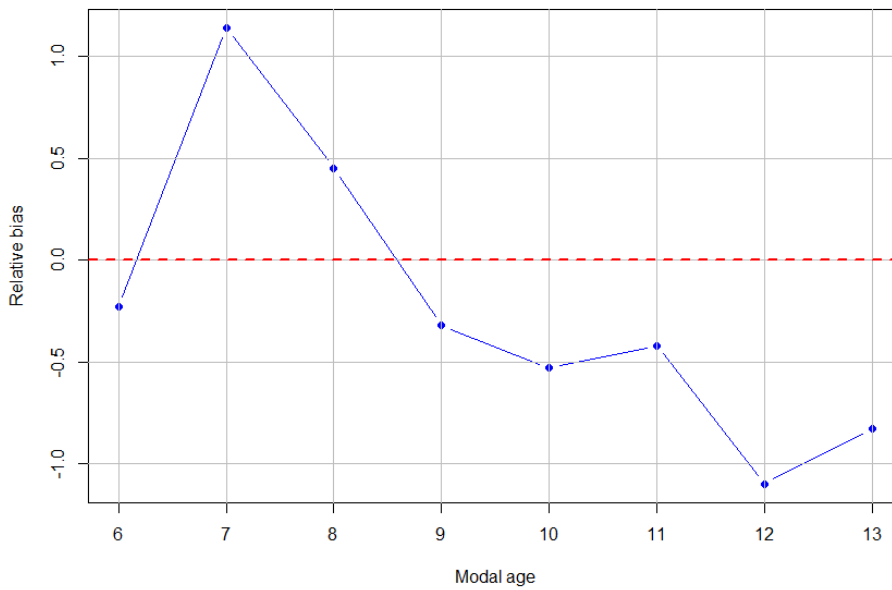


Figure 6.6.2: The relative bias by modal age as estimated by all age readers combined.

For each pair that is being compared, the differences between the readings per image are found and the frequency of each occurring difference is obtained (Table 6.6.5).

Table 6.6.5: 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 ($p<0.01$)

Comparison	R01												
	IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR
R01 IS	-	-	**	**	**	**	**	**	**	**	**	*	**
R02 FO	-	-	*	**	**	**	**	**	**	**	**	-	**
R03 NO	**	*	-	**	**	**	**	-	**	-	-	**	**
R04 GR	**	**	**	-	**	**	**	**	**	**	**	**	**
R05 NO	**	**	**	**	-	**	-	-	*	-	*	**	**
R06 NO	**	**	**	**	**	-	**	**	**	**	**	**	-
R07 ES	**	**	**	**	-	**	-	*	-	*	**	**	**
R08 ES	**	**	-	**	-	**	*	-	**	-	-	**	**
R08 NO	**	**	**	**	*	**	-	**	-	**	**	**	*
R09 NO	**	**	-	**	-	**	*	-	**	-	-	**	**
R11 FO	**	**	-	**	*	**	**	-	**	-	-	**	**
R12 FR	*	-	**	**	**	**	**	**	**	**	**	-	**
R13 FR	**	**	**	**	**	-	**	**	*	**	**	**	-
Modal age	**	**	-	**	-	**	*	-	**	-	-	**	**

Advanced readers

For tusk, three age readers were defined as “advanced readers”. The weighted average CV is 14% and the PA based on modal ages for all advanced readers is 53% (Table 6.6.6, Table 6.6.7, and Figure 6.6.3).

Table 6.6.6: 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. A rank is also assigned to each reader.

Modal age	R01 IS	R02 FO	R03 NO	all
6	16 %	17 %	22 %	20 %
7	8 %	8 %	23 %	18 %
8	8 %	10 %	12 %	12 %
9	9 %	11 %	9 %	10 %
10	0 %	9 %	6 %	8 %
11	5 %	9 %	5 %	9 %
Weighted Mean	9 %	10 %	16 %	14 %

Table 6.6.7: Percent 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. A rank is also assigned to each reader.

Modal age	R01 IS	R02 FO	R03 NO	all
6	25 %	88 %	25 %	46 %
7	53 %	87 %	27 %	56 %
8	60 %	60 %	33 %	51 %
9	33 %	50 %	83 %	56 %
10	100 %	33 %	67 %	67 %
11	67 %	33 %	67 %	56 %
Weighted Mean	52 %	68 %	40 %	53 %

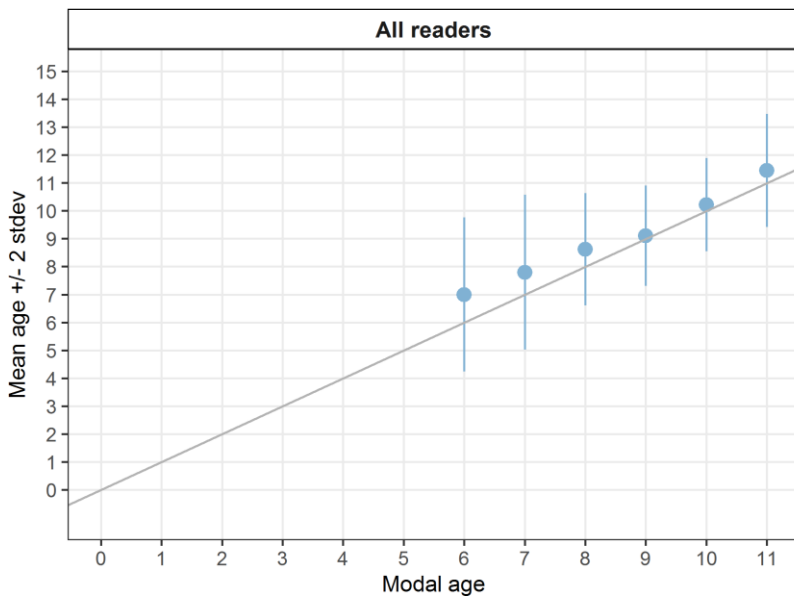


Figure 6.6.3: Age bias plot for advanced readers.

Table 6.6.8: Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 IS	R02 FO	R03 NO	all
6	0.88	0.38	1.75	1.00
7	0.53	0.20	1.67	0.80
8	0.00	0.60	1.27	0.62
9	-0.33	0.33	0.33	0.11
10	0.00	1.00	-0.33	0.22
11	-0.33	1.33	0.33	0.44
Weighted Mean	0.24	0.48	1.20	0.64

For additional age reading results and otolith growth analysis, please see Annex 10.6.

Internal consistency

Eight of the age readers aging the tusk otoliths in 2020/2021, did also age the same otoliths in 2018. The average age in both years for each age reader, the internal CV for the reader, the age-plot and the box plot for each reader is shown in Table 6.6.10, Figure 6.6.4 and Figure 6.6.5. For tusk, the internal consistency for six readers was satisfying, with a CV from 5.8% to 7.7%, but two readers had higher CVs. The average age ranged from 7.5 years until 10.5 years.

Table 6.6.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	France	Norway1	Norway2	Norway3	Norway4	Norway5
Average age 2018	9.9	9.6	9.0	8.9	9.2	10.0	9.2	9.9
Average age 2020	7.5	8.0	8.4	9.0	9.6	10.5	10.0	9.2
CV	20.1	14.0	7.2	7.6	5.8	6.6	7.7	7.0

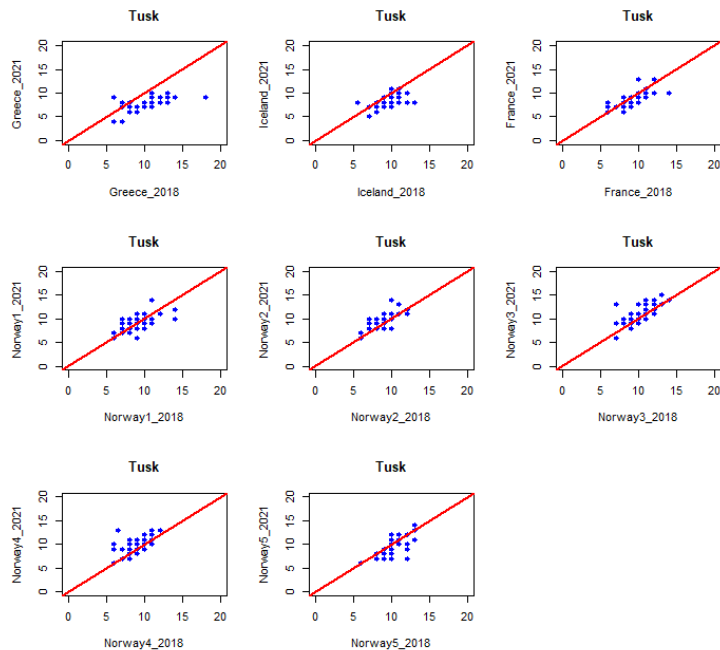


Figure 6.6.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

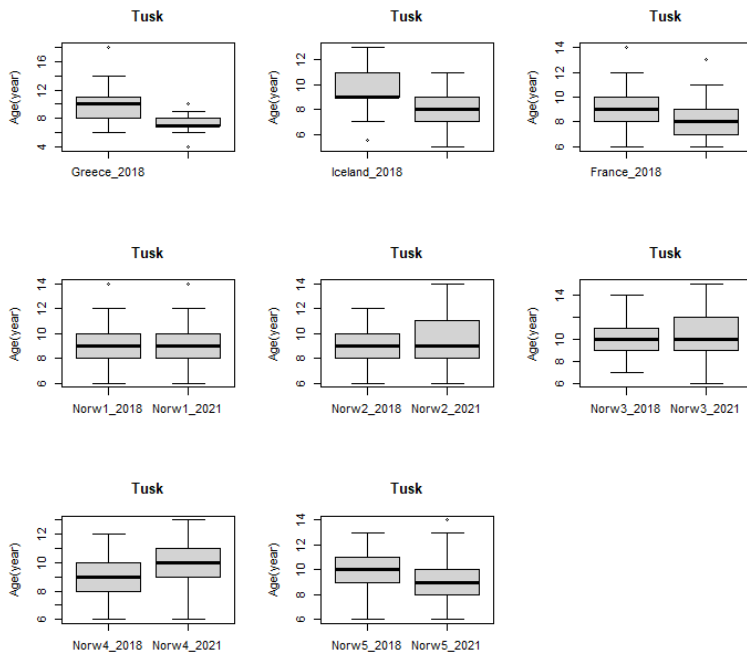


Figure 6.6.5: Boxplot for each age reader for the years 2018 and 2020.

6.7 Blackspot seabream

All readers included

The weighted average CV for all readers is 26%, the PA based on modal ages is 39 % and APE is 19 % (Table 6.7.1, Table 6.7.2, Table 6.7.3, and Figure 6.7.1).

Table 6.7.1: 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. A rank is also assigned to each reader.

Modal age	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR	all
3	23 %	34 %	8 %	8 %	12 %	33 %	9 %	11 %	16 %	38 %	22 %	9 %	14 %	0 %	14 %	38 %
4	90 %	38 %	22 %	17 %	40 %	40 %	12 %	26 %	26 %	25 %	24 %	19 %	13 %	24 %	20 %	37 %
5	34 %	30 %	24 %	12 %	19 %	38 %	22 %	12 %	17 %	25 %	11 %	23 %	17 %	22 %	9 %	25 %
6	35 %	29 %	16 %	13 %	27 %	25 %	20 %	11 %	7 %	12 %	20 %	9 %	11 %	26 %	7 %	24 %
7	29 %	27 %	8 %	15 %	18 %	18 %	9 %	16 %	20 %	32 %	20 %	13 %	19 %	29 %	8 %	21 %
8	20 %	16 %	15 %	9 %	9 %	16 %	8 %	6 %	8 %	21 %	23 %	16 %	17 %	29 %	18 %	19 %
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18 %

10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	%
																	19
Weighted Mean	39 %	28 %	16 %	13 %	21 %	28 %	14 %	14 %	16 %	26 %	19 %	16 %	16 %	23 %	12 %		26 %

The Percent 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. A rank is also assigned to each reader.

Table 6.7.2: Percent 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. A rank is also assigned to each reader.

Modal age	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR	all
3	40 %	40 %	0 %	0 %	20 %	20 %	0 %	0 %	60 %	40 %	0 %	0 %	80 %	100 %	0 %	27 %
4	0 %	43 %	25 %	0 %	50 %	0 %	57 %	38 %	50 %	25 %	50 %	43 %	75 %	62 %	12 %	35 %
5	18 %	18 %	55 %	18 %	64 %	27 %	64 %	55 %	64 %	36 %	64 %	70 %	64 %	55 %	73 %	49 %
6	17 %	0 %	33 %	33 %	33 %	33 %	0 %	17 %	83 %	50 %	40 %	67 %	67 %	40 %	83 %	41 %
7	30 %	22 %	70 %	50 %	40 %	0 %	56 %	60 %	20 %	40 %	20 %	60 %	50 %	20 %	70 %	41 %
8	25 %	12 %	25 %	50 %	50 %	38 %	62 %	75 %	0 %	50 %	38 %	14 %	38 %	25 %	38 %	36 %
9	100 %	0 %	0 %	0 %	100 %	0 %	0 %	100 %	0 %	0 %	0 %	0 %	100 %	100 %	0 %	33 %
10	100 %	0 %	100 %	0 %	0 %	0 %	100 %	100 %	0 %	0 %	0 %	0 %	0 %	100 %	0 %	33 %
Weighted Mean	24 %	22 %	40 %	26 %	46 %	18 %	47 %	48 %	42 %	38 %	37 %	43 %	60 %	49 %	48 %	39 %

Table 6.7.3: Average Percent Error (APE) table represents the APE per modal age and reader, the APE of all readers combined per modal age and a weighted mean of APE per reader.

Modal age	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR	all
3	20 %	26 %	7 %	7 %	8 %	25 %	7 %	8 %	14 %	29 %	18 %	6 %	10 %	0 %	11 %	32 %
4	55 %	29 %	18 %	13 %	24 %	30 %	11 %	15 %	17 %	17 %	19 %	15 %	6 %	17 %	12 %	28 %
5	27 %	21 %	16 %	8 %	15 %	29 %	18 %	11 %	12 %	18 %	10 %	17 %	10 %	14 %	8 %	16 %
6	29 %	22 %	13 %	11 %	24 %	17 %	11 %	9 %	5 %	9 %	16 %	7 %	6 %	21 %	5 %	17 %
7	21 %	19 %	5 %	12 %	11 %	12 %	7 %	9 %	12 %	24 %	16 %	8 %	15 %	21 %	5 %	15 %
8	16 %	12 %	11 %	7 %	7 %	13 %	5 %	5 %	7 %	17 %	19 %	12 %	12 %	22 %	14 %	14 %
9	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	14 %
10	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	17 %
Weighted Mean	27 %	20 %	12 %	9 %	14 %	20 %	10 %	9 %	11 %	18 %	15 %	11 %	10 %	16 %	9 %	19 %

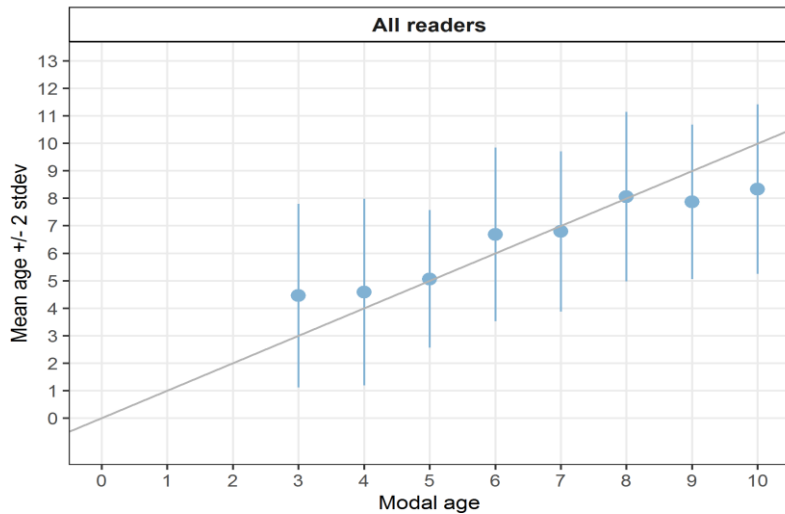


Figure 6.7.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

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 and finally (Table 6.7.4 and Figure 6.7.2).

Table 6.7.4: Relative bias table represents the relative bias per modal age per reader, the relative bias of all readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR	all
3	-0.60	0.40	3.60	3.60	0.80	2.80	1.80	1.20	0.40	-0.80	2.80	2.20	0.20	0.00	3.40	1.45
4	-0.25	-1.00	1.75	2.25	1.12	1.43	0.43	1.00	-0.12	-1.00	0.50	0.86	0.00	-0.25	2.00	0.58
5	-1.00	-0.91	0.18	1.09	0.45	0.73	0.55	0.55	-0.27	-1.00	-0.36	0.70	-0.09	0.09	0.27	0.06
6	1.50	0.00	0.50	0.33	2.33	1.33	1.00	1.33	-0.17	0.17	-1.00	0.33	0.00	2.20	-0.17	0.65
7	-0.40	0.00	0.10	-0.50	0.00	1.70	0.22	0.00	-1.20	-1.40	-1.10	-0.10	-0.40	0.10	-0.10	-
																0.21
8	-0.25	0.75	1.00	-0.25	0.62	1.38	0.12	0.25	-1.62	-1.12	-1.50	1.14	0.12	0.62	-0.25	0.07
9	0.00	-1.00	-3.00	-1.00	0.00	1.00	-1.00	0.00	-3.00	-2.00	-4.00	-1.00	0.00	0.00	-2.00	-
																1.13
10	0.00	-1.00	0.00	-4.00	-1.00	-1.00	0.00	0.00	-4.00	-3.00	-3.00	-3.00	-2.00	0.00	-3.00	-
																1.67
Weighted Mean	-0.26	-0.24	0.86	0.76	0.72	1.39	0.53	0.60	-0.70	-1.00	-0.43	0.64	-0.10	0.33	0.54	0.24

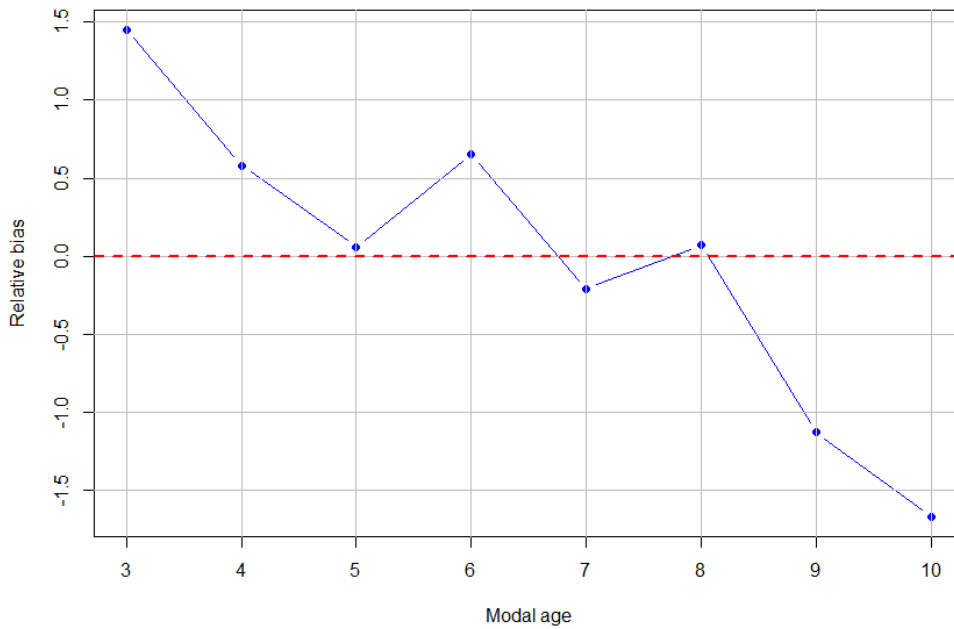


Figure 6.7.2: The relative bias by modal age as estimated by all age readers combined.

For each pair that is being compared, the differences between the readings per image are found and the frequency of each occurring difference is obtained (Table 6.7.5).

Table 6.7.5: 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 ($p<0.01$)

Comparison	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR
R01 GR	-	*	**	*	**	**	**	**	-	-	-	**	-	**	*
R02 PT	*	-	**	**	**	**	**	**	*	**	-	**	-	-	*
R03 NO	**	**	-	-	-	-	-	-	**	**	**	-	**	-	-
R04 IS	*	**	-	-	-	*	-	-	**	**	**	-	**	-	-
R04 NO	**	**	-	-	-	*	-	-	**	**	**	-	**	-	-
R06 NO	**	**	-	*	*	-	**	*	**	**	**	*	**	**	**
R07 IT	**	**	-	-	-	**	-	-	**	**	**	-	**	-	-
R08 ES	**	**	-	-	-	*	-	-	**	**	**	-	**	-	-
R09 NO	-	*	**	**	**	**	**	**	-	-	-	**	**	**	**
R10 NO	-	**	**	**	**	**	**	**	-	-	*	**	**	**	**
R11 FR	-	-	**	**	**	**	**	**	-	*	-	**	-	-	**
R12 ES	**	**	-	-	-	*	-	-	**	**	**	-	**	-	-
R13 FO	-	-	**	**	**	**	**	**	**	**	-	**	-	-	*
R14 FO	**	-	-	-	-	**	-	-	**	**	-	-	-	-	-
R15 FR	*	*	-	-	-	**	-	-	**	**	**	-	*	-	-
Modal age	-	-	**	**	**	**	**	**	**	**	-	**	-	-	*

Advanced readers

For blackspot seabream, two age readers were defined as “advanced readers”. The weighted average CV is 18% and the PA based on modal ages for all advanced readers is 63% (Table 6.7.6, Table 6.7.7, and Figure 6.7.3).

Table 6.7.6: 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. A rank is also assigned to each reader.

Modal age	R01 GR	R02 PT	all
1	-	-	47 %
2	17 %	32 %	34 %
3	0 %	20 %	18 %
4	17 %	0 %	16 %
5	18 %	19 %	18 %
6	0 %	12 %	15 %
7	16 %	14 %	14 %
8	5 %	6 %	6 %
9	-	-	7 %
10	0 %	-	6 %
11	-	-	-
12	-	-	-
Weighted Mean	9 %	16 %	18 %

Table 6.7.7: Percent 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. A rank is also assigned to each reader.

Modal age	R01 GR	R02 PT	all
1	0 %	100 %	50 %
2	88 %	25 %	56 %
3	100 %	56 %	78 %
4	40 %	100 %	70 %
5	75 %	50 %	62 %
6	100 %	0 %	50 %
7	67 %	33 %	50 %
8	86 %	40 %	67 %
9	0 %	100 %	50 %
10	100 %	0 %	67 %
11	100 %	-	100 %
12	100 %	-	100 %
Weighted Mean	80 %	44 %	63 %

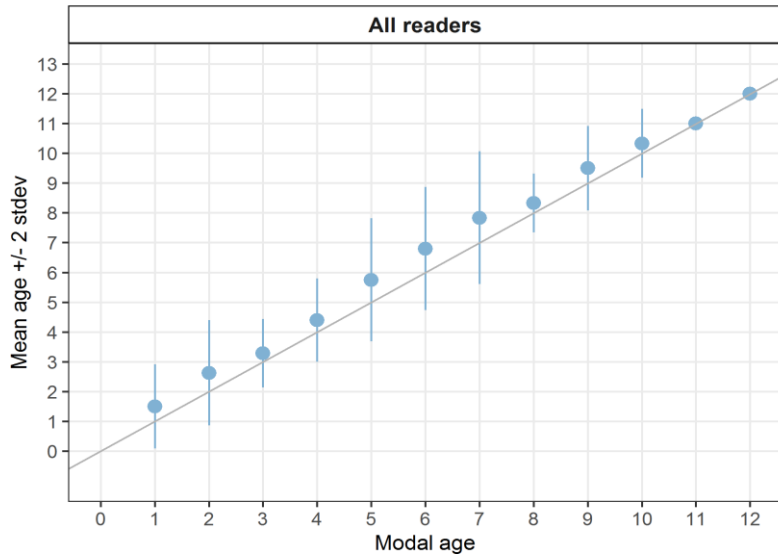


Figure 6.7.3: Age bias plot for advanced readers.

Table 6.7.8: Relative bias table represents the relative bias per modal age and advanced reader, the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per reader. A rank is also assigned to each reader.

Modal age	R01 GR	R02 PT	all
1	1.00	0.00	0.50
2	0.12	1.12	0.62
3	0.00	0.56	0.28
4	0.80	0.00	0.40
5	0.50	1.00	0.75
6	0.00	1.60	0.80
7	0.67	1.00	0.83
8	0.14	0.60	0.37
9	1.00	0.00	0.50
10	0.00	1.00	0.50
11	0.00	-	-
12	0.00	-	-
Weighted Mean	0.28	0.80	0.55

For additional age reading results and otolith growth analysis, please see Annex 10.7.

Internal consistency

Ten of the age readers aging the blackspot seabream otoliths in 2020/2021, did also age the same otoliths in 2018. The average age in both years for each age reader, the internal CV for the reader, the age-plot and the box plot for each reader is shown in Table 6.7.10, Figure 6.7.4 and Figure 6.7.5. For blackspot seabream, the internal consistency varies, depending on the age reader. The lowest CV was 4.5%, and the highest 20.9%. The difference in average age for each reader is from 0.0 years to 1.9 years.

Table 6.7.10: Average age in 2018 and 2020 in addition to CV for each age reader.

Age readers	Greece	Iceland	France	Portugal	Norway1	Norway2	Norway3	Spain	Norway4	Norway5
Average age 2018	5.6	8.5	5.8	4.4	6.2	5.2	5.6	5.6	5.8	5.1
Average age 2020	5.6	6.6	5.4	5.6	6.7	6.5	7.2	6.4	5.1	4.8
CV	4.5	17.9	7.2	20.0	20.2	17.3	20.9	12.7	20.9	15.2

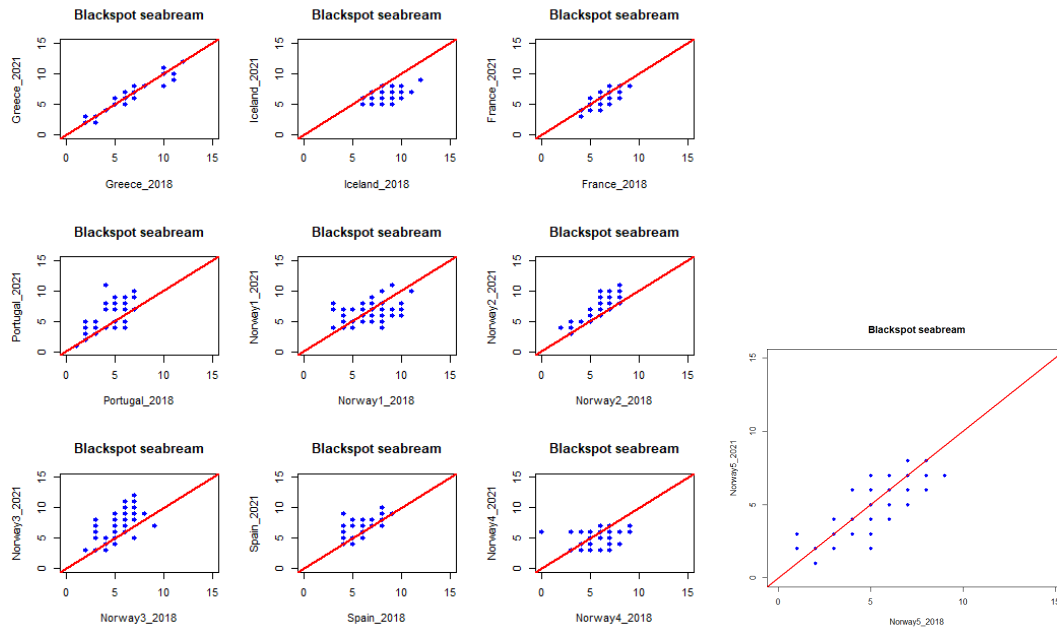


Figure 6.7.4: Age reading in 2018 plotted against age reading in 2020 for each reader.

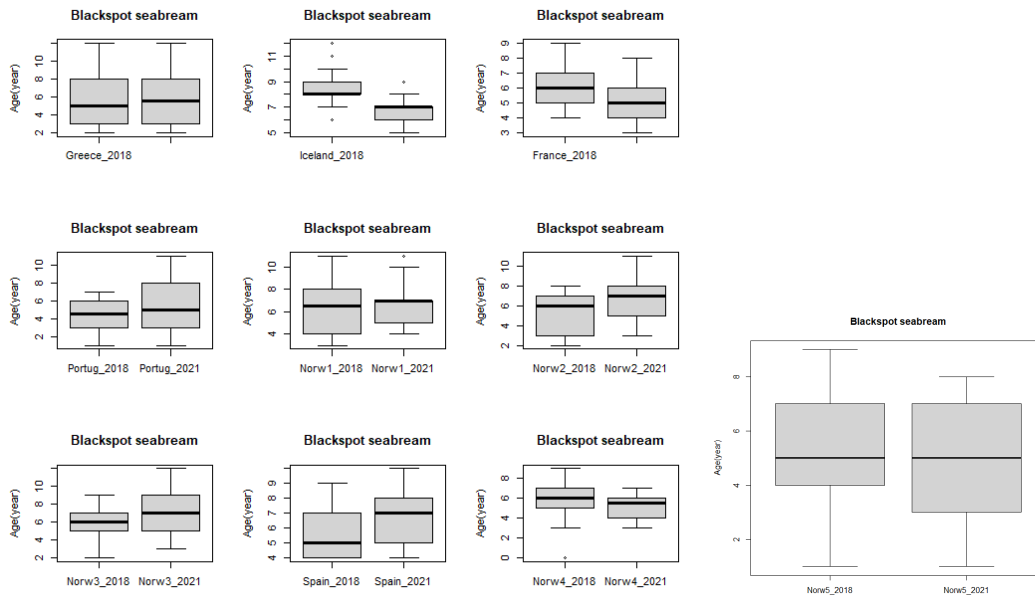


Figure 6.7.5: Boxplot for each age reader for the years 2018 and 2020.

7 Summary

7.1 Black scabbardfish

The results from 2020/2021 showed an improvement from the 2018 exchange. The Coefficient of Variation (CV) in 2020/2021 was 23% versus 26% in 2018. The Percent Agreement (PA) was 38% versus 37%, the Average Percent Error (APE) was 17 % in the 2020/2021 exchange. The CV in 2020/2021 decreased with modal age. The internal consistency varied with a CV between 8.8% and 34.1%.

7.2 Greater forkbeard

For greater forkbeard, the results from 2020/2021 showed an improvement compared to the 2018 exchange. The Coefficient of Variation (CV) in 2020/2021 was 29% versus 34% in 2018. For Percent Agreement (PA) the percentage was the same, 55% in both exchanges. The Average Percent Error (APE) was 20 % in the 2020/2021 exchange. The CV was quite high for modal age 1, but markedly lower for modal age 2 and slightly decreasing thereafter. The internal consistency varied with a CV between 11.1% to 22.3%.

7.3 Ling

The results from the 2020/2021 exchange for ling had improved from 2018. The CV was lower (18% versus 22%) and the PA had increased from 46% in 2018 to 48% in 2020/2021. The Average Percent Error (APE) was 13 % in the 2020/2021 exchange. The CV in 2020/2021 was decreasing with modal age. The internal consistency ranged from a CV of 7.1% to 34.9%.

7.4 Blue ling

In 2020/2021 both the CV and the PA was unchanged from 2018 with values of 17 and 34% respectively, Average Percent Error (APE) was 13 % in the 2020/2021 exchange. The CV in 2020/2021 was highest for the lowest modal ages and quite consistent for the rest. The internal consistency was excellent, with a CV between 3.8% and 10.5%.

7.5 Greater silver smelt

For greater silver smelt, the results from 2020/2021 were equally good as the results from the 2018 exchange. The CV for both years was 9% and the PA was 69%. The Average Percent Error (APE) was 6% in the 2020/2021 exchange. The CV in 2020/2021 was between 6 and 12% for all modal ages. The internal consistency was excellent! The CV varied from 1.1% to 6.4%.

7.6 Tusk

The results from 2020/2021 revealed a decrease in both precision and accuracy compared to the 2018 exchange. The Coefficient of Variation (CV) in 2020/2021 was 15% versus 12% in 2018. The Percent Agreement (PA) was 44% versus 48% and the Average Percent Error (APE) was 11 % in the 2020/2021 exchange. The CV in 2020/2021 was similar for all modal ages. The internal consistency varied with a CV ranging from 5.8% to 20.1%.

7.7 Blackspot seabream

For blackspot seabream, the results from 2020/2021 showed an improvement compared to the 2018 exchange. The Coefficient of Variation (CV) in 2020/2021 was 26% versus 31% in 2018. The Percent Agreement (PA) was 39% and 35%, respectively. The Average Percent Error (APE) was 19% in the 2020/2021 exchange. The CV in 2020/2021 decreased with modal age. The internal consistency varied with a CV between 4.5% and 20.9%.

8 Conclusion

Overall, the results from the deep-water species otolith exchange were good. For six out of seven species in this exchange, the Coefficient of Variation (CV) was improved or unchanged from the previous exchange. Considering that in 2018, some otoliths from each species were discussed and aged in plenary during the workshop prior to individual ageing, the results from the 2020/2021 exchange were good. During the exchange in 2020/2021, no plenary was conducted before the age readers started the exchange, nor did the age readers discuss the images and annotations. The only available help the age readers had access to, were the species-specific age reading manuals reviewed and agreed upon during the 2018 workshop.

According to the agreement of WKAMDEEP2 in 2018, a new workshop should be planned for 2023, with two exchanges in between using the otolith images prepared in 2018, to assess potential drifting of the age readers. If an exchange is to be implemented, it might be a good idea to invite all the age readers of deep-water species to a discussion and a review of the age reading of each species prior to the exchange. However, the images are not of the best quality, and it has been questioned whether a second exchange using the same material would be useful or necessary regarding improvement of age reading. Instead, a new workshop should be planned, where the age readers can discuss and execute age readings using physical otoliths and new sets of images.

Continued age reading workshops and otolith exchanges of these deep-water species are important for many reasons. Many of the species have only one or a few readers, hence ICES workshops and exchanges provide a platform for discussion, continuity, and maintenance of expertise. Many of these species are considered to be data-poor or data-limited, thus any age data available is of great value and is currently used indirectly to monitor trends in stock assessments. If a species is re-categorized or new assessment models require age data, reliable age data over a time period would be beneficial. For some stocks of ling, greater silver smelt and tusk, age data are used directly in assessment models.

Based on the conclusion and considerations regarding this group of deep-water species, we highly recommend that a new workshop should be arranged within 2 years (2024-2025).

9 References

Beamish, R.J., and D.A.Fournier. 1981. A method for comparing the precision of a set of age determinations. *Can. J. Fish. Aquat. Sci.* 38: 982-983.

Eltink, A.T.G.W., 2000. Age reading comparisons (MS Excel workbook version 10 October 2000). Internet: <http://www.efan.no>

ICES, 2013. Workshop on Age Estimation Methods of Deep-water Species (WKAMDEEP), 21-25 October 2013, Mallorca, Spain. ICES CM 2013/ACOM:83. 81pp.

ICES, 2014. Report of the Workshop on Statistical Analysis of Biological Calibration Studies (WKSABCAL), 13-18 October 2014, Lisbon, Portugal. ICES CM 2014/ACOM:35. 82pp. <https://doi.org/10.17895/ices.pub.19283189>.

ICES, 2017. Report of the Working Group on Biological Parameters (WGBIOP), 2-6 October 2017, Sardinia, Italy. ICES cm 2017/SSGIEOM:08. 129pp.

ICES, 2019. Workshop on Age Estimation Methods of Deep-Water Species (WKAMDEEP2), 17-21 September 2018, Cadiz, Spain. ICES CM 2018/EOSG:27. 31pp.

SmartDots tool: <https://www.ices.dk/data/tools/Pages/smartdots.aspx>

10 Annex: Additional results

10.1 Results black scabbardfish

All readers

Data Overview

Table 10.1.1: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	Length	Sex	Catch date	ICES area	R0		R0		R0		R0		R1		R1		Modal age	P A %	C V %	AP E %	
							1 PT	2 GR	3 NO	4 IS	6 NO	8 NO	7 ES	9 NO	0 ES	1 FO	2 FO	3 FR					
6006	315	-	894	-	01/09/2015	27.5.b	7	7	7	8	7	8	6	7	6	7	5	10	7	7	5	1	10
					00:00:00																4	7	
6007	315	-	793	-	01/09/2015	27.5.b	6	5	11	10	4	12	8	5	8	5	5	5	8	5	3	3	32
					00:00:00																8	7	
6008	315	-	887	-	01/09/2015	27.5.b	4	5	6	6	5	7	5	6	5	5	5	-	5	5	5	1	11
					00:00:00																8	5	
6009	315	-	910	-	01/09/2015	27.5.b	4	6	7	6	6	-	7	8	5	8	5	8	7	6	2	2	17
					00:00:00																5	0	
6010	315	-	994	-	01/09/2015	27.5.b	7	7	7	10	7	11	8	9	7	7	7	10	7	7	6	1	15
					00:00:00																2	8	
6011	315	-	926	-	01/09/2015	27.5.b	6	6	8	9	6	8	7	7	6	8	7	8	7	6	3	1	11
					00:00:00																1	4	
6012	315	-	1039	-	01/09/2015	27.5.b	7	9	10	7	10	12	9	9	7	7	10	10	8	7	3	1	14
					00:00:00																1	8	
6013	315	-	916	-	01/09/2015	27.5.b	5	6	6	8	6	8	9	9	5	7	7	8	7	6	2	1	15
					00:00:00																3	9	
6014	315	-	914	-	01/09/2015	27.5.b	7	7	7	7	6	8	7	9	6	7	6	7	7	7	6	1	7
					00:00:00																2	2	
6015	315	-	879	-	01/09/2015	27.5.b	7	5	8	9	5	16	8	5	7	7	6	10	8	5	2	3	25
					00:00:00																3	8	
6016	315	-	952	-	01/09/2015	27.5.b	6	6	7	8	6	10	7	9	6	8	6	7	8	6	3	1	15
					00:00:00																8	8	
6017	315	-	1047	-	01/09/2015	27.5.b	5	10	8	9	11	11	9	9	8	9	11	9	8	9	3	1	12
					00:00:00																8	8	
6018	315	-	977	-	01/09/2015	27.5.b	4	6	5	8	5	5	6	6	5	6	6	11	5	5	3	3	18
					00:00:00																8	0	

00:00:00																					
601	315	-	946	-	01/09/2015	27.5	5	6	6	8	6	8	7	6	5	6	10	8	5	6	3 2 18
9																					8 3
00:00:00																					
602	315	-	979	-	01/09/2015	27.5	8	7	10	11	9	11	8	9	8	8	8	9	7	8	3 1 12
0																					8 5
00:00:00																					
602	315	-	926	-	01/09/2015	27.5	7	7	8	9	7	11	8	8	9	9	7	7	6	7	3 1 13
1																					8 7
00:00:00																					
602	315	-	917	-	01/09/2015	27.5	7	6	7	7	5	8	7	8	5	7	8	7	5	7	4 1 13
2																					6 7
00:00:00																					
602	315	-	950	-	01/09/2015	27.5	5	7	7	10	6	13	7	10	5	6	8	8	7	7	3 3 22
3																					1 0
00:00:00																					
602	315	-	990	-	01/09/2015	27.5	6	7	7	8	7	9	8	9	7	6	8	9	6	7	3 1 13
4																					1 5
00:00:00																					
602	315	-	916	-	01/09/2015	27.5	4	5	5	9	5	-	6	7	3	7	7	6	5	5	3 2 22
5																					3 8
00:00:00																					
602	315	-	942	-	01/09/2015	27.5	8	6	7	12	7	11	8	7	7	6	8	9	7	7	3 2 16
6																					8 3
00:00:00																					
602	315	-	946	-	01/09/2015	27.5	6	7	8	9	6	9	8	8	6	8	8	9	8	8	4 1 12
7																					6 4
00:00:00																					
602	315	-	101	-	01/09/2015	27.5	9	9	10	10	9	13	10	9	9	9	9	9	9	9	6 1 8
8	6																				9 2
00:00:00																					
602	315	-	936	-	01/09/2015	27.5	6	6	7	10	6	9	7	8	4	6	8	7	6	6	3 2 17
9																					8 2
00:00:00																					
603	315	-	908	-	01/09/2015	27.5	7	6	8	9	6	11	7	8	5	7	7	6	7	7	3 2 15
0																					8 1
00:00:00																					
603	315	-	863	-	01/09/2015	27.5	8	8	10	11	6	9	7	6	9	6	7	5	8	6	2 2 18
1																					3 3
00:00:00																					
603	315	-	988	-	01/09/2015	27.5	8	7	11	9	8	11	7	9	8	7	7	9	8	7	3 1 13
2																					1 7
00:00:00																					
603	315	-	100	-	01/09/2015	27.5	8	8	9	9	9	11	8	10	6	8	9	9	9	9	4 1 10
3	7																				6 4
00:00:00																					
603	315	-	933	-	01/09/2015	27.5	7	6	11	8	8	13	9	9	8	10	11	7	6	8	2 2 19
4																					3 4
00:00:00																					
603	315	-	973	-	01/09/2015	27.5	8	6	11	12	8	15	8	9	9	8	8	9	6	8	3 2 19
5																					8 7
00:00:00																					
603	315	-	912	-	01/09/2015	27.5	7	7	8	11	6	8	8	8	6	7	9	6	5	8	3 2 16
6																					1 1
00:00:00																					
603	315	-	892	-	01/09/2015	27.5	6	5	8	9	6	8	9	7	10	8	9	5	6	6	2 2 19
7																					3 2
00:00:00																					
603	315	-	950	-	01/09/2015	27.5	8	5	6	10	6	-	7	8	7	6	7	7	6	6	3 1 13

8				015	.b															3	9		
				00:00:00																			
603	315	-	891	-	01/09/2	27.5	6	5	10	10	9	9	8	9	9	10	8	5	4	9	3	2	22
9					015	.b															1	7	
					00:00:00																		
604	315	-	905	-	01/09/2	27.5	8	6	9	11	7	9	7	8	6	7	8	6	7	7	3	1	15
0					015	.b															1	9	
					00:00:00																		
604	315	-	791	-	01/09/2	27.5	7	4	6	6	5	8	5	6	6	5	6	4	5	6	3	2	16
1					015	.b															8	0	
					00:00:00																		
604	315	-	100	-	01/09/2	27.5	7	9	10	10	10	8	10	9	6	9	9	9	8	9	3	1	11
2			7		015	.b															8	4	
					00:00:00																		
604	315	-	896	-	01/09/2	27.5	6	5	5	7	6	7	6	7	4	6	7	6	6	6	4	1	10
3					015	.b															6	5	
					00:00:00																		
604	315	-	921	-	01/09/2	27.5	7	6	8	10	7	11	8	8	7	8	8	7	6	8	3	1	13
4					015	.b															8	8	
					00:00:00																		
604	315	-	852	-	01/09/2	27.5	6	5	6	7	5	8	7	6	3	6	7	5	6	6	3	2	15
5					015	.b															8	1	
					00:00:00																		
604	315	-	967	-	01/09/2	27.5	7	4	7	7	7	13	7	9	4	7	8	8	7	7	5	3	18
6					015	.b															4	0	
					00:00:00																		
604	315	-	876	-	01/09/2	27.5	7	5	7	6	7	10	7	7	5	8	7	6	5	7	4	2	15
7					015	.b															6	1	
					00:00:00																		
604	315	-	109	-	01/09/2	27.5	9	8	8	9	10	10	9	9	6	10	9	12	5	9	3	2	14
8			0		015	.b															8	0	
					00:00:00																		
604	315	-	889	-	01/09/2	27.5	7	4	9	10	8	10	7	8	7	7	8	8	7	7	3	2	14
9					015	.b															8	0	
					00:00:00																		
605	315	-	782	-	01/09/2	27.5	5	4	5	5	4	6	6	4	5	6	7	5	4	5	3	1	14
0					015	.b															8	9	
					00:00:00																		
605	315	-	893	-	01/09/2	27.5	4	5	9	8	5	10	6	6	4	5	7	6	4	4	2	3	25
1					015	.b															3	2	
					00:00:00																		
605	315	-	945	-	01/09/2	27.5	6	6	6	7	6	12	7	8	4	5	8	7	6	6	3	2	19
2					015	.b															8	8	
					00:00:00																		
605	315	-	909	-	01/09/2	27.5	7	6	7	9	6	10	8	6	5	7	7	7	5	7	3	2	15
3					015	.b															8	1	
					00:00:00																		
605	315	-	892	-	01/09/2	27.5	6	5	7	10	5	10	8	6	5	9	7	-	6	5	2	2	21
4					015	.b															5	7	
					00:00:00																		
605	315	-	860	-	01/09/2	27.5	8	5	8	9	5	11	7	6	6	6	8	-	5	5	2	2	21
5					015	.b															5	7	
					00:00:00																		

Table 10.1.2: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR	total
4	1	1	1	1	1	1	1	1	1	1	1	1	1	13
5	8	8	8	8	8	7	8	8	8	8	8	5	8	100

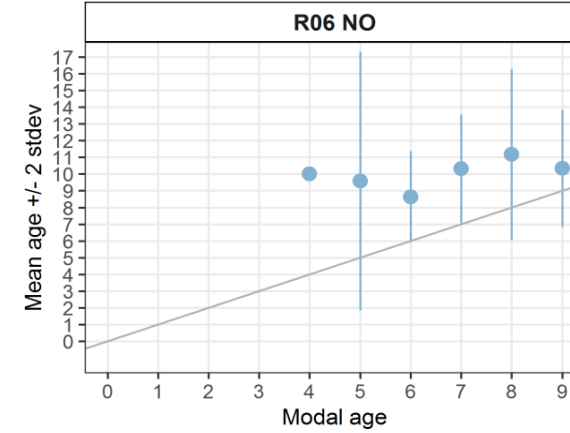
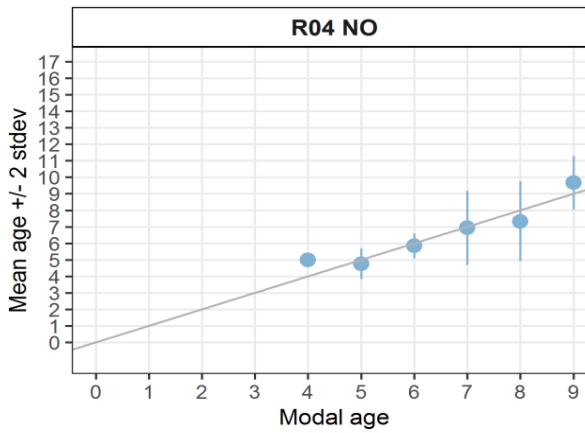
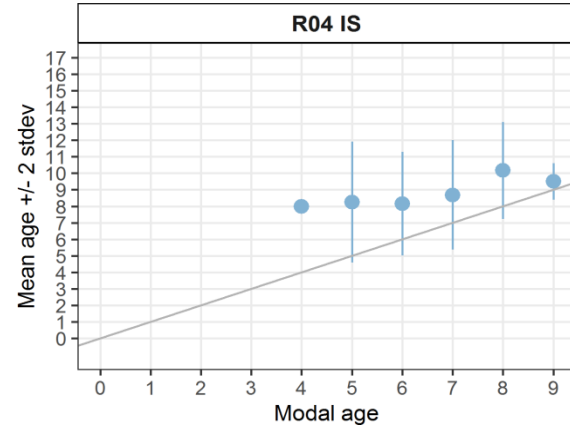
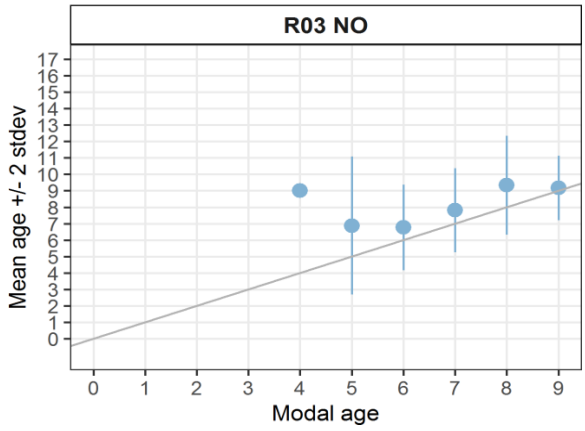
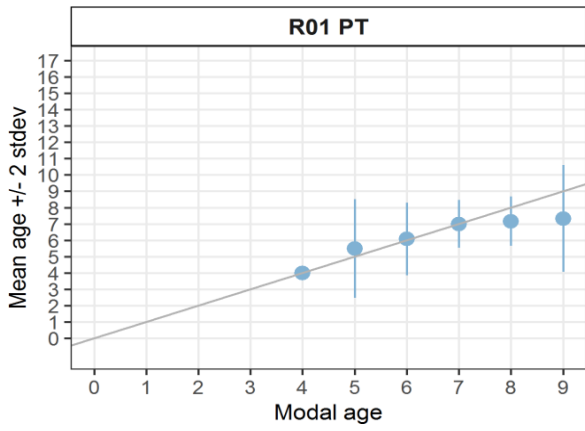
6	13	13	13	13	13	11	13	13	13	13	13	13	13	167
7	16	16	16	16	16	16	16	16	16	16	16	16	16	208
8	6	6	6	6	6	6	6	6	6	6	6	6	6	78
9	6	6	6	6	6	6	6	6	6	6	6	6	6	78
Total	50	50	50	50	50	47	50	50	50	50	50	47	50	644

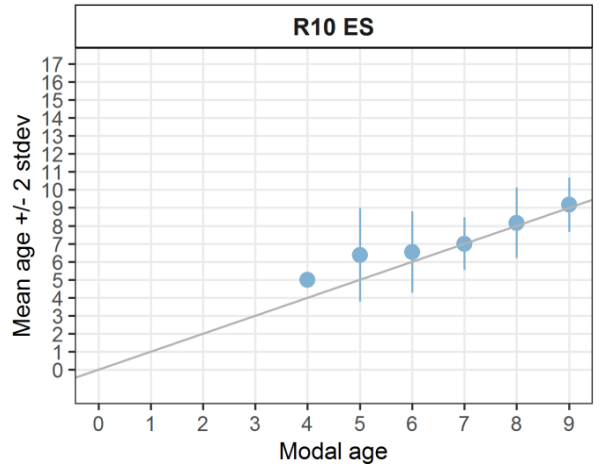
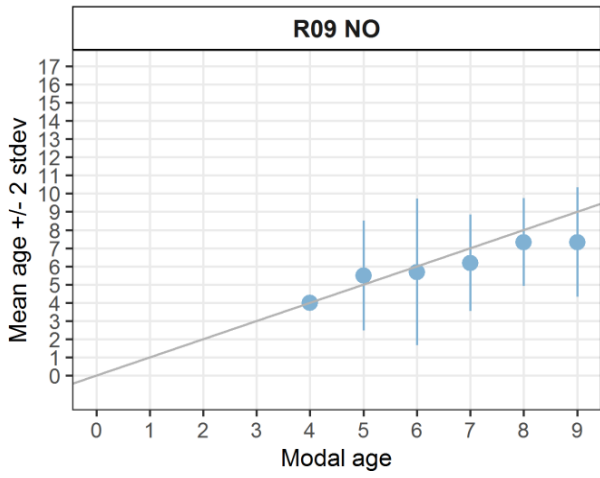
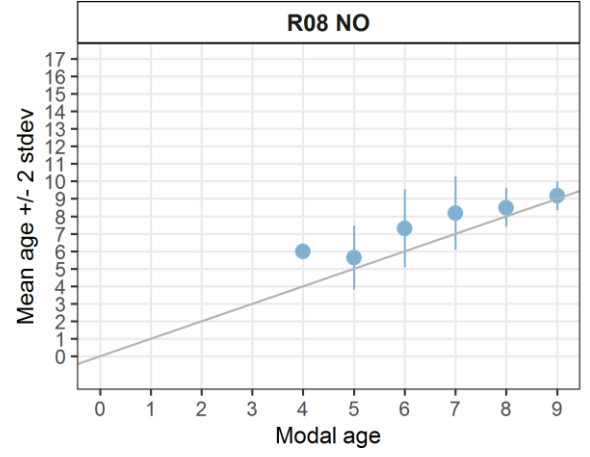
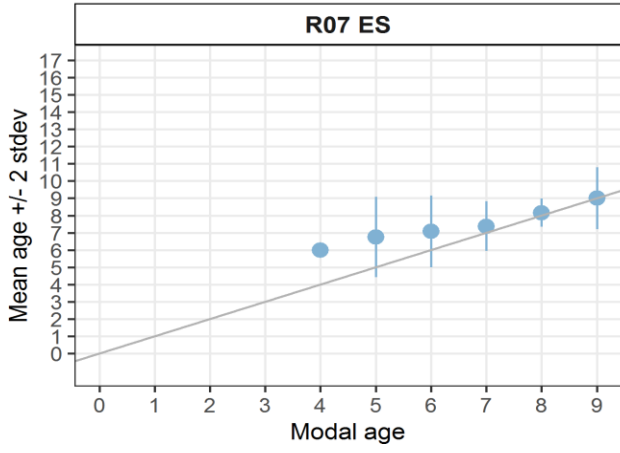
Table 10.1.3: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR
3	0	0	0	0	0	0	0	0	2	0	0	0	0
4	5	4	0	0	2	0	0	1	5	0	0	1	3
5	5	13	4	1	10	1	2	2	12	5	4	6	11
6	12	16	7	4	17	1	6	10	12	12	5	7	12
7	17	10	14	7	9	2	19	7	8	15	16	10	13
8	9	3	11	8	4	11	15	12	5	10	15	7	9
9	2	3	4	13	4	6	6	16	5	5	6	10	2
10	0	1	6	11	3	7	2	2	1	3	2	4	0
11	0	0	4	4	1	10	0	0	0	0	2	1	0
12	0	0	0	2	0	3	0	0	0	0	0	1	0
13	0	0	0	0	0	4	0	0	0	0	0	0	0
15	0	0	0	0	0	1	0	0	0	0	0	0	0
16	0	0	0	0	0	1	0	0	0	0	0	0	0
Total	50	50	50	50	50	47	50	50	50	50	50	47	50

Table 10.1.4: Mean 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	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR
3	-	-	-	-	-	-	-	-	884	-	-	-	-
4	917 mm	857 mm	-	-	788 mm	-	-	782	927	-	-	791 mm	855 mm
5	928 mm	883 mm	893	782	886 mm	977	839 mm	836	906	862	871	846 mm	916 mm
6	909 mm	932 mm	898	866	922 mm	782	893 mm	887	934	912	903	901 mm	926 mm
7	922 mm	949 mm	932	933	935 mm	892	919 mm	906	950	930	905	930 mm	930 mm
8	941 mm	987 mm	937	938	946 mm	906	930 mm	922	948	938	934	929 mm	946 mm
9	1053	1021	924	946	973 mm	922	986 mm	981	934	978	987	990 mm	1012
10	-	1047	966	931	1045	929	1012	978	892	971	992	952 mm	-
11	-	-	922	915	1047	957	-	-	-	-	990	977 mm	-
12	-	-	-	958	-	926	-	-	-	-	-	1090	-
13	-	-	-	-	-	966	-	-	-	-	-	-	-
15	-	-	-	-	-	973	-	-	-	-	-	-	-
16	-	-	-	-	-	879	-	-	-	-	-	-	-
Weighted Mean	928 mm	928 mm	928	928	928 mm	928	928 mm	928	928	928	928	931 mm	928 mm





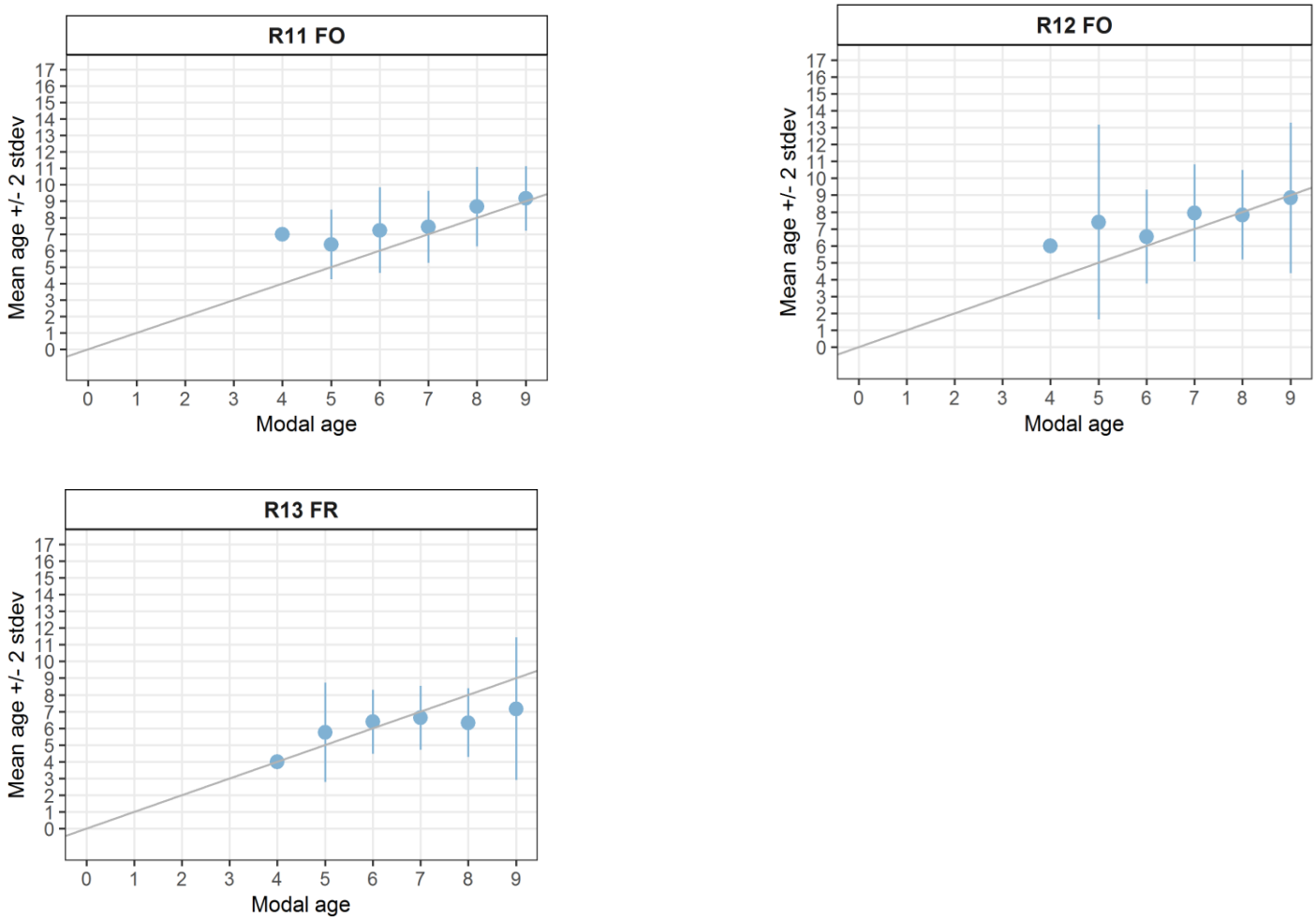


Figure 10.1.1: Age bias plot for each reader. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

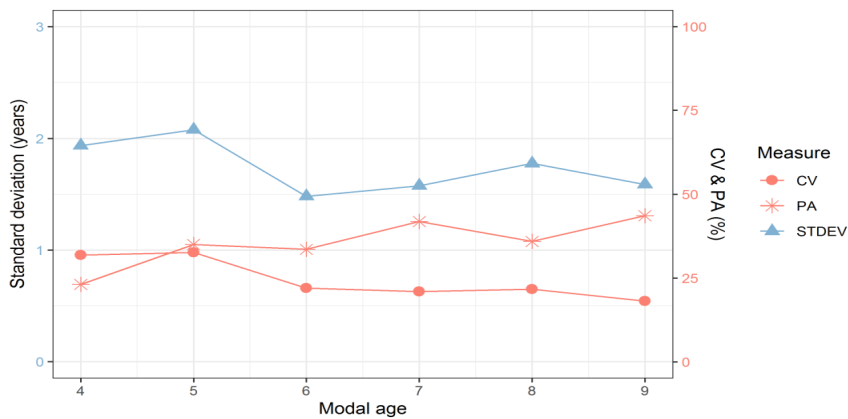


Figure 10.1.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

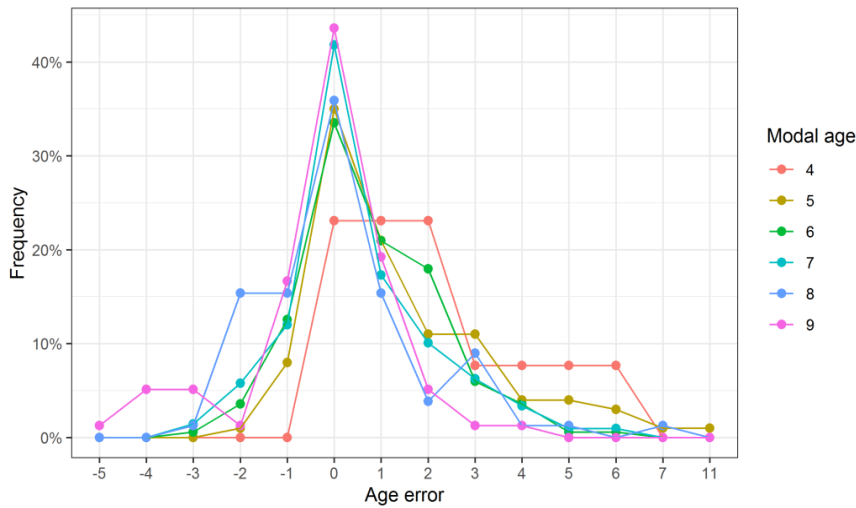


Figure 10.1.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

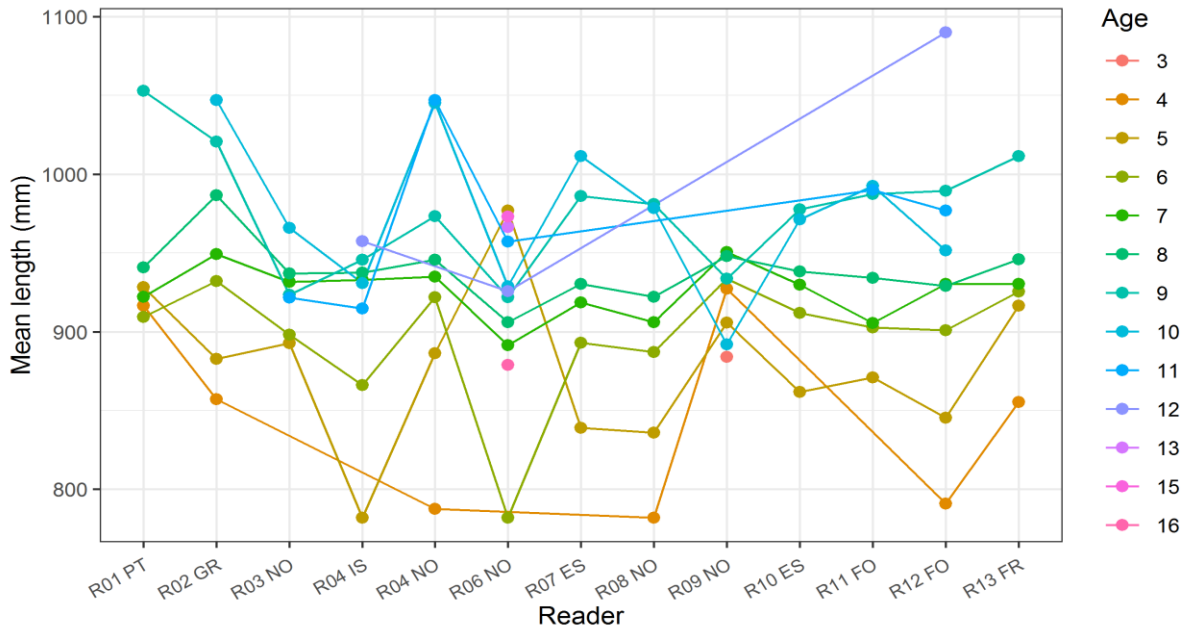


Figure 10.1.4: The mean length at age as estimated by each age reader.

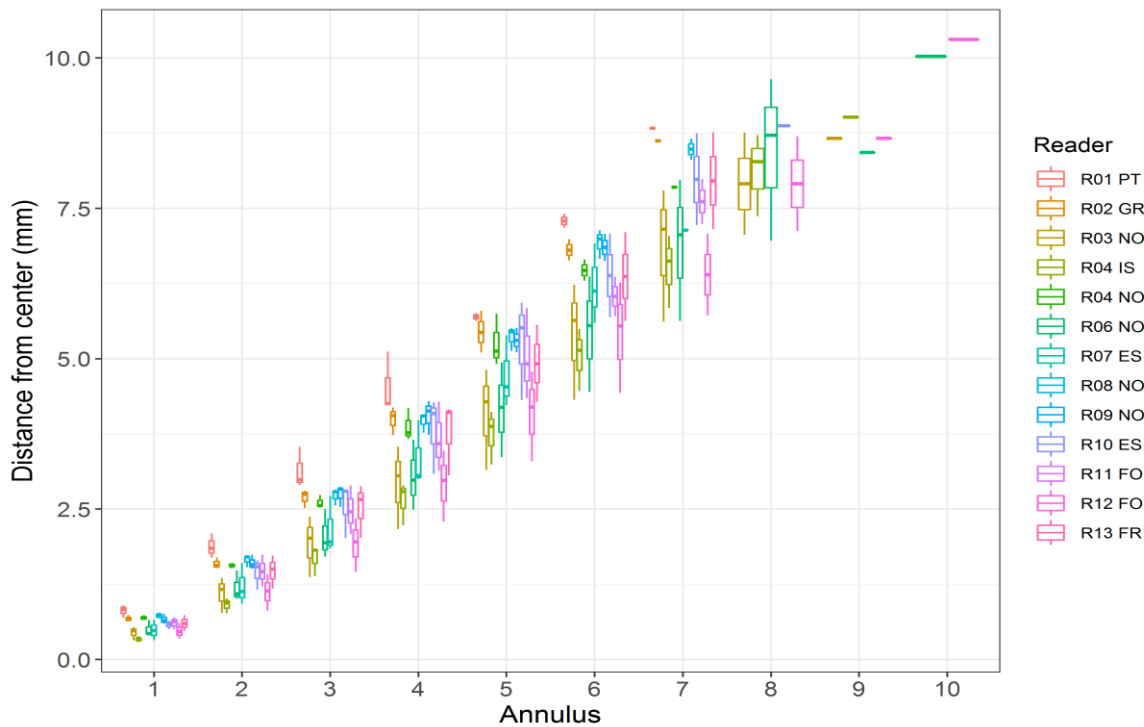


Figure 10.1.5: Plot of average distance from the centre to the winter rings for all readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.1.5: Data overview including modal age and statistics per sample.

Fis h ID	Eve nt ID	Ima ge ID	leng th	se x	Catch date	ICES area	R0		R0		R0		R0		R0		R1 0	R1 1	R1 2	R1 3	Mod al age	P A %	C V %	AP E %
							1 PT	2 GR	3 O	4 IS	6 O	7 O	8 ES	9 O										
600 6	315	-	894	-	01/09/2 015	27.5 .b	7	7	7	8	7	8	6	7	6	7	5	10	7	7	5	1	10	
					00:00:00																4	7		
600 7	315	-	793	-	01/09/2 015	27.5 .b	6	5	11	10	4	12	8	5	8	5	5	5	8	5	3	3	32	
					00:00:00																8	7		
600 8	315	-	887	-	01/09/2 015	27.5 .b	4	5	6	6	5	7	5	6	5	5	5	-	5	5	5	1	11	
					00:00:00																8	5		
600 9	315	-	910	-	01/09/2 015	27.5 .b	4	6	7	6	6	-	7	8	5	8	5	8	7	6	2	2	17	
					00:00:00																5	0		
601 0	315	-	994	-	01/09/2 015	27.5 .b	7	7	7	10	7	11	8	9	7	7	7	10	7	7	6	1	15	
																					2	8		

00:00:00																					
601	315	-	926	-	01/09/2015	27.5	6	6	8	9	6	8	7	7	6	8	7	8	7	6	3 1 11
1					.b																1 4
00:00:00																					
601	315	-	103	-	01/09/2015	27.5	7	9	10	7	10	12	9	9	7	7	10	10	8	7	3 1 14
2			9		.b																1 8
00:00:00																					
601	315	-	916	-	01/09/2015	27.5	5	6	6	8	6	8	9	9	5	7	7	8	7	6	2 1 15
3					.b																3 9
00:00:00																					
601	315	-	914	-	01/09/2015	27.5	7	7	7	7	6	8	7	9	6	7	6	7	7	7	6 1 7
4					.b																2 2
00:00:00																					
601	315	-	879	-	01/09/2015	27.5	7	5	8	9	5	16	8	5	7	7	6	10	8	5	2 3 25
5					.b																3 8
00:00:00																					
601	315	-	952	-	01/09/2015	27.5	6	6	7	8	6	10	7	9	6	8	6	7	8	6	3 1 15
6					.b																8 8
00:00:00																					
601	315	-	104	-	01/09/2015	27.5	5	10	8	9	11	11	9	9	8	9	11	9	8	9	3 1 12
7			7		.b																8 8
00:00:00																					
601	315	-	977	-	01/09/2015	27.5	4	6	5	8	5	5	6	6	5	6	6	11	5	5	3 3 18
8					.b																8 0
00:00:00																					
601	315	-	946	-	01/09/2015	27.5	5	6	6	8	6	8	7	6	5	6	10	8	5	6	3 2 18
9					.b																8 3
00:00:00																					
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0					.b																8 5
00:00:00																					
602	315	-	926	-	01/09/2015	27.5	7	7	8	9	7	11	8	8	9	9	7	7	6	7	3 1 13
1					.b																8 7
00:00:00																					
602	315	-	917	-	01/09/2015	27.5	7	6	7	7	5	8	7	8	5	7	8	7	5	7	4 1 13
2					.b																6 7
00:00:00																					
602	315	-	950	-	01/09/2015	27.5	5	7	7	10	6	13	7	10	5	6	8	8	7	7	3 3 22
3					.b																1 0
00:00:00																					
602	315	-	990	-	01/09/2015	27.5	6	7	7	8	7	9	8	9	7	6	8	9	6	7	3 1 13
4					.b																1 5
00:00:00																					
602	315	-	916	-	01/09/2015	27.5	4	5	5	9	5	-	6	7	3	7	7	6	5	5	3 2 22
5					.b																3 8
00:00:00																					
602	315	-	942	-	01/09/2015	27.5	8	6	7	12	7	11	8	7	7	6	8	9	7	7	3 2 16
6					.b																8 3
00:00:00																					
602	315	-	946	-	01/09/2015	27.5	6	7	8	9	6	9	8	8	6	8	8	9	8	8	4 1 12
7					.b																6 4
00:00:00																					
602	315	-	101	-	01/09/2015	27.5	9	9	10	10	9	13	10	9	9	9	9	9	9	9	6 1 8
8			6		.b																9 2
00:00:00																					
602	315	-	936	-	01/09/2015	27.5	6	6	7	10	6	9	7	8	4	6	8	7	6	6	3 2 17
9					.b																8 2
00:00:00																					
603	315	-	908	-	01/09/2015	27.5	7	6	8	9	6	11	7	8	5	7	7	6	7	7	3 2 15

0					015	.b															8	1	
603	315	-	863	-	01/09/2	27.5	8	8	10	11	6	9	7	6	9	6	7	5	8	6	2	2	18
1					015	.b															3	3	
603	315	-	988	-	01/09/2	27.5	8	7	11	9	8	11	7	9	8	7	7	9	8	7	3	1	13
2					015	.b															1	7	
603	315	-	100	-	01/09/2	27.5	8	8	9	9	9	11	8	10	6	8	9	9	9	9	4	1	10
3			7		015	.b															6	4	
603	315	-	933	-	01/09/2	27.5	7	6	11	8	8	13	9	9	8	10	11	7	6	8	2	2	19
4					015	.b															3	4	
603	315	-	973	-	01/09/2	27.5	8	6	11	12	8	15	8	9	9	8	8	9	6	8	3	2	19
5					015	.b															8	7	
603	315	-	912	-	01/09/2	27.5	7	7	8	11	6	8	8	8	6	7	9	6	5	8	3	2	16
6					015	.b															1	1	
603	315	-	892	-	01/09/2	27.5	6	5	8	9	6	8	9	7	10	8	9	5	6	6	2	2	19
7					015	.b															3	2	
603	315	-	950	-	01/09/2	27.5	8	5	6	10	6	-	7	8	7	6	7	7	6	6	3	1	13
8					015	.b															3	9	
603	315	-	891	-	01/09/2	27.5	6	5	10	10	9	9	8	9	9	10	8	5	4	9	3	2	22
9					015	.b															1	7	
604	315	-	905	-	01/09/2	27.5	8	6	9	11	7	9	7	8	6	7	8	6	7	7	3	1	15
0					015	.b															1	9	
604	315	-	791	-	01/09/2	27.5	7	4	6	6	5	8	5	6	6	5	6	4	5	6	3	2	16
1					015	.b															8	0	
604	315	-	100	-	01/09/2	27.5	7	9	10	10	10	8	10	9	6	9	9	9	8	9	3	1	11
2			7		015	.b															8	4	
604	315	-	896	-	01/09/2	27.5	6	5	5	7	6	7	6	7	4	6	7	6	6	6	4	1	10
3					015	.b															6	5	
604	315	-	921	-	01/09/2	27.5	7	6	8	10	7	11	8	8	7	8	8	7	6	8	3	1	13
4					015	.b															8	8	
604	315	-	852	-	01/09/2	27.5	6	5	6	7	5	8	7	6	3	6	7	5	6	6	3	2	15
5					015	.b															8	1	
604	315	-	967	-	01/09/2	27.5	7	4	7	7	7	13	7	9	4	7	8	8	7	7	5	3	18
6					015	.b															4	0	
604	315	-	876	-	01/09/2	27.5	7	5	7	6	7	10	7	7	5	8	7	6	5	7	4	2	15
7					015	.b															6	1	
604	315	-	109	-	01/09/2	27.5	9	8	8	9	10	10	9	9	6	10	9	12	5	9	3	2	14
8			0		015	.b															8	0	
604	315	-	889	-	01/09/2	27.5	7	4	9	10	8	10	7	8	7	7	8	8	7	7	3	2	14
9					015	.b															8	0	
					00:00:00																		

605 0	315	-	782	-	01/09/2 015	27.5 .b	5	4	5	5	4	6	6	4	5	6	7	5	4	5	3	1	14
00:00:00																							
605 1	315	-	893	-	01/09/2 015	27.5 .b	4	5	9	8	5	10	6	6	4	5	7	6	4	4	2	3	25
00:00:00																							
605 2	315	-	945	-	01/09/2 015	27.5 .b	6	6	6	7	6	12	7	8	4	5	8	7	6	6	3	2	19
00:00:00																							
605 3	315	-	909	-	01/09/2 015	27.5 .b	7	6	7	9	6	10	8	6	5	7	7	7	5	7	3	2	15
00:00:00																							
605 4	315	-	892	-	01/09/2 015	27.5 .b	6	5	7	10	5	10	8	6	5	9	7	-	6	5	2	2	21
00:00:00																							
605 5	315	-	860	-	01/09/2 015	27.5 .b	8	5	8	9	5	11	7	6	6	6	8	-	5	5	2	2	21
00:00:00																							

Table 10.1.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR	total
4	1	1	1	1	1	1	1	1	1	1	1	1	1	13
5	8	8	8	8	8	7	8	8	8	8	8	5	8	100
6	13	13	13	13	13	11	13	13	13	13	13	13	13	167
7	16	16	16	16	16	16	16	16	16	16	16	16	16	208
8	6	6	6	6	6	6	6	6	6	6	6	6	6	78
9	6	6	6	6	6	6	6	6	6	6	6	6	6	78
Total	50	50	50	50	50	47	50	50	50	50	50	47	50	644

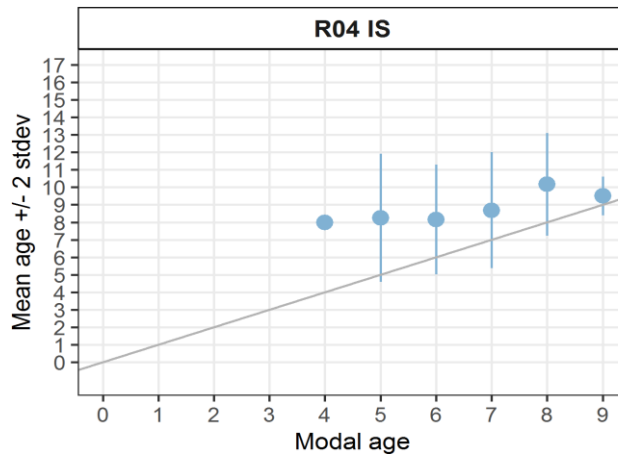
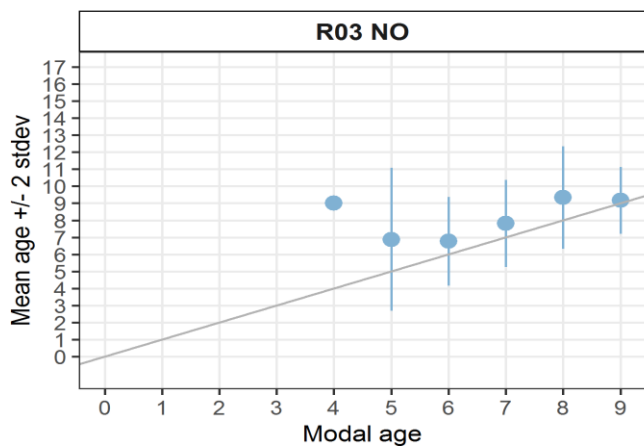
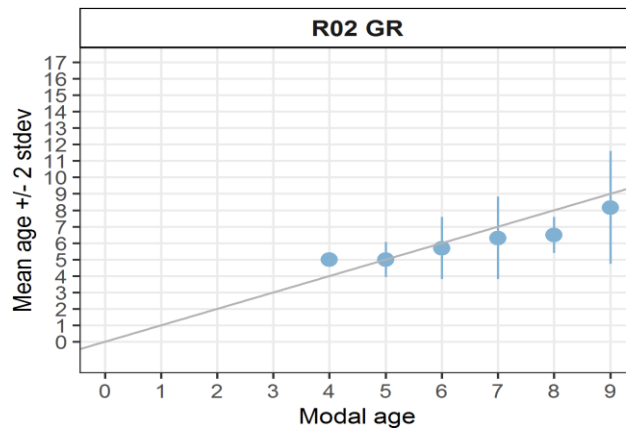
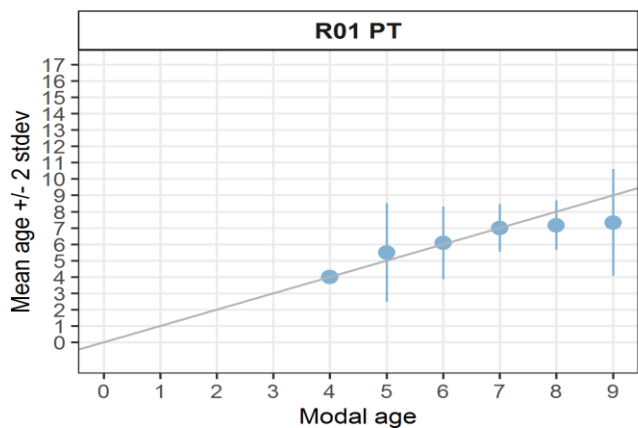
Table 10.1.7: Age composition by reader gives a summary of number of readings per reader.

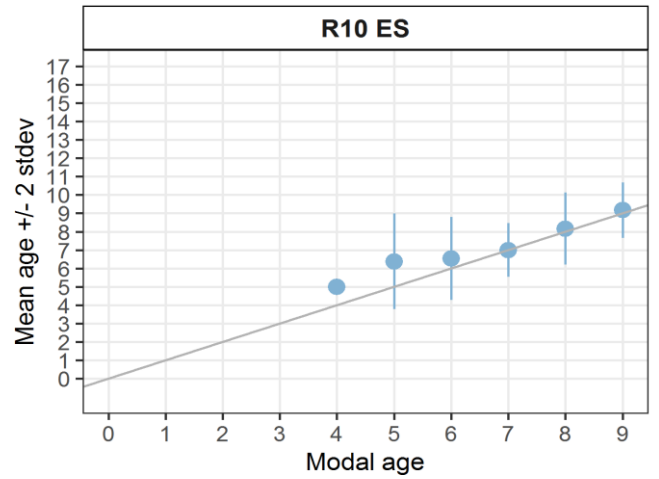
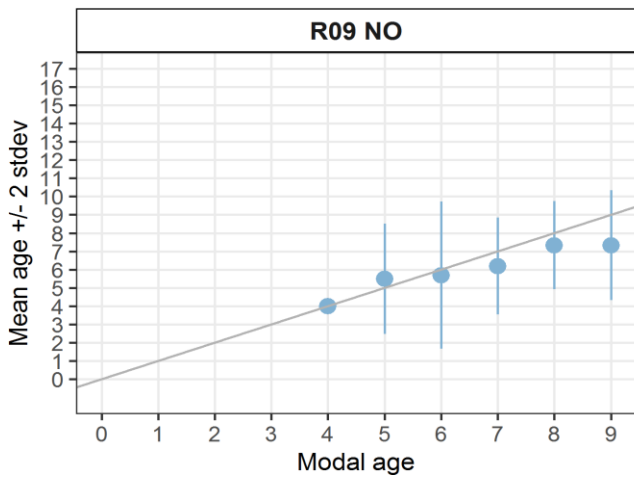
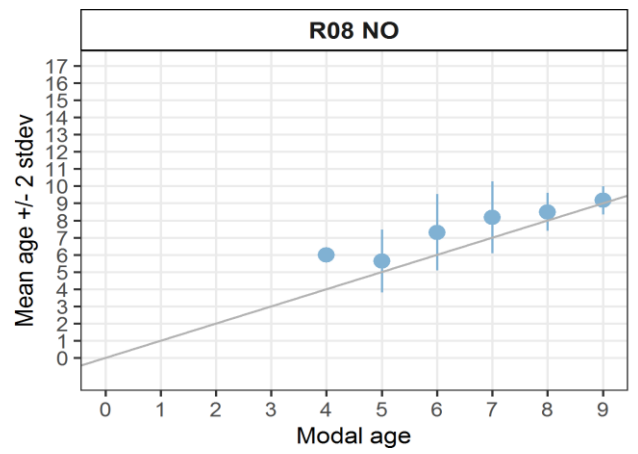
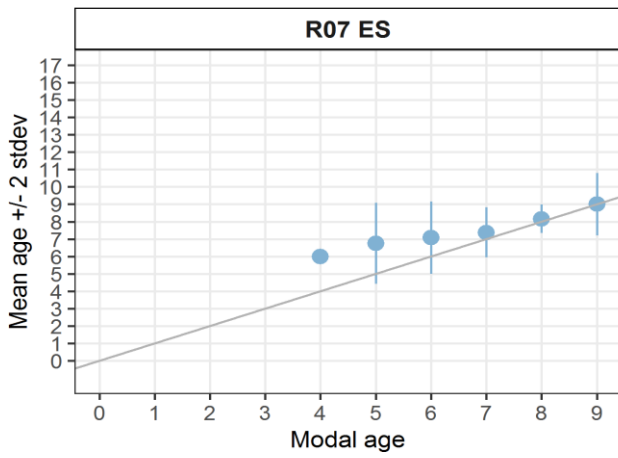
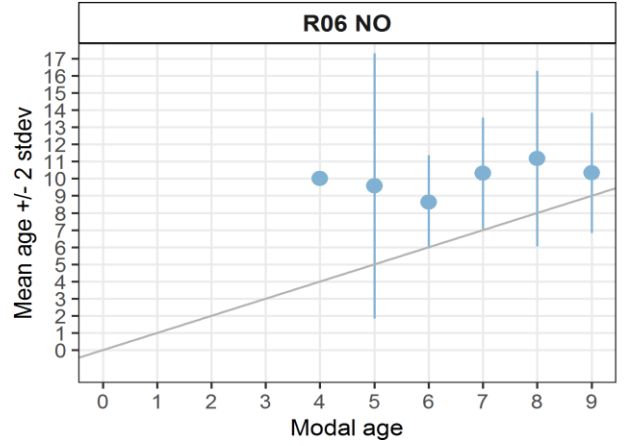
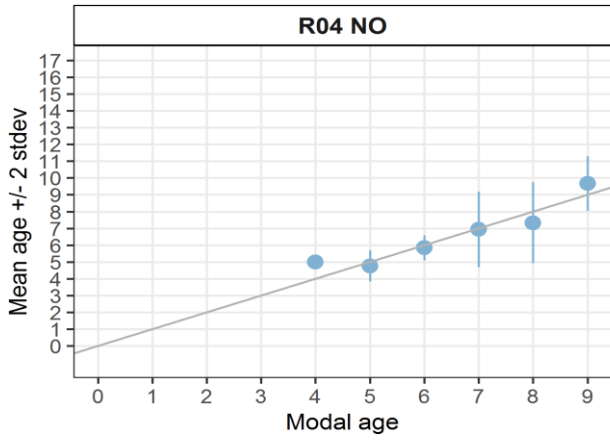
Modal age	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR
3	0	0	0	0	0	0	0	0	2	0	0	0	0
4	5	4	0	0	2	0	0	1	5	0	0	1	3
5	5	13	4	1	10	1	2	2	12	5	4	6	11
6	12	16	7	4	17	1	6	10	12	12	5	7	12
7	17	10	14	7	9	2	19	7	8	15	16	10	13
8	9	3	11	8	4	11	15	12	5	10	15	7	9
9	2	3	4	13	4	6	6	16	5	5	6	10	2
10	0	1	6	11	3	7	2	2	1	3	2	4	0
11	0	0	4	4	1	10	0	0	0	0	2	1	0
12	0	0	0	2	0	3	0	0	0	0	0	1	0
13	0	0	0	0	0	4	0	0	0	0	0	0	0
15	0	0	0	0	0	1	0	0	0	0	0	0	0
16	0	0	0	0	0	1	0	0	0	0	0	0	0
Total	50	50	50	50	50	47	50	50	50	50	50	47	50

Table 10.1.8: Mean 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	R01 PT	R02 GR	R03 NO	R04 IS	R04 NO	R06 NO	R07 ES	R08 NO	R09 NO	R10 ES	R11 FO	R12 FO	R13 FR
3	-	-	-	-	-	-	-	-	884	-	-	-	-
									mm				
4	917 mm	857 mm	-	-	788 mm	-	-	782	927	-	-	791 mm	855 mm
								mm	mm				
5	928 mm	883 mm	893	782	886 mm	977	839 mm	836	906	862	871	846 mm	916 mm
			mm	mm		mm		mm	mm	mm	mm		

6	909 mm	932 mm	898 mm	866 mm	922 mm	782 mm	893 mm	887 mm	934 mm	912 mm	903 mm	901 mm	926 mm
7	922 mm	949 mm	932 mm	933 mm	935 mm	892 mm	919 mm	906 mm	950 mm	930 mm	905 mm	930 mm	930 mm
8	941 mm	987 mm	937 mm	938 mm	946 mm	906 mm	930 mm	922 mm	948 mm	938 mm	934 mm	929 mm	946 mm
9	1053 mm	1021 mm	924 mm	946 mm	973 mm	922 mm	986 mm	981 mm	934 mm	978 mm	987 mm	990 mm	1012 mm
10	-	1047 mm	966 mm	931 mm	1045 mm	929 mm	1012 mm	978 mm	892 mm	971 mm	992 mm	952 mm	-
11	-	-	922 mm	915 mm	1047 mm	957 mm	-	-	-	-	990 mm	977 mm	-
12	-	-	-	958 mm	-	926 mm	-	-	-	-	-	1090 mm	-
13	-	-	-	-	-	966 mm	-	-	-	-	-	-	-
15	-	-	-	-	-	973 mm	-	-	-	-	-	-	-
16	-	-	-	-	-	879 mm	-	-	-	-	-	-	-
Weighted Mean	928 mm	928 mm	928 mm	928 mm	928 mm	928 mm	928 mm	928 mm	928 mm	928 mm	928 mm	931 mm	928 mm





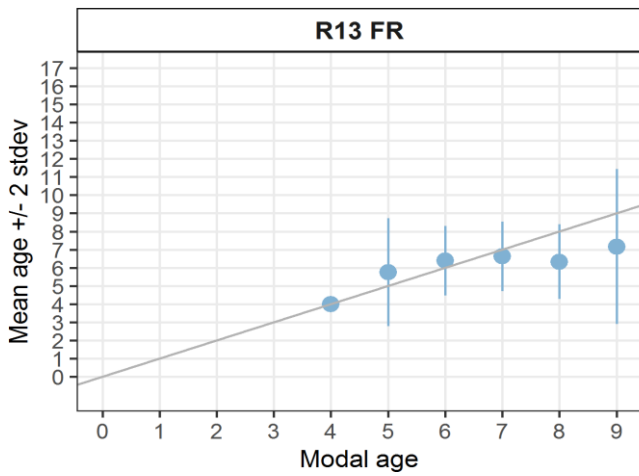
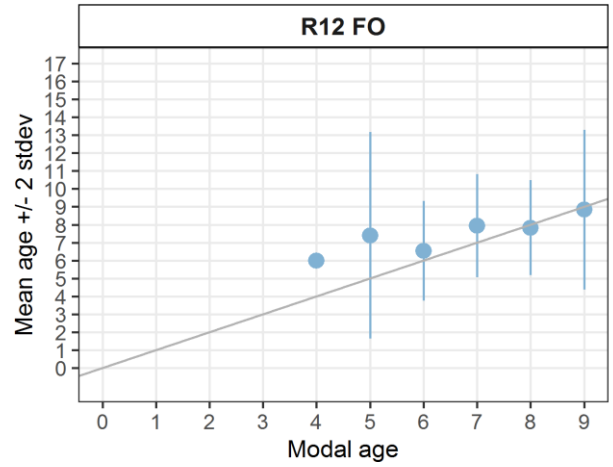
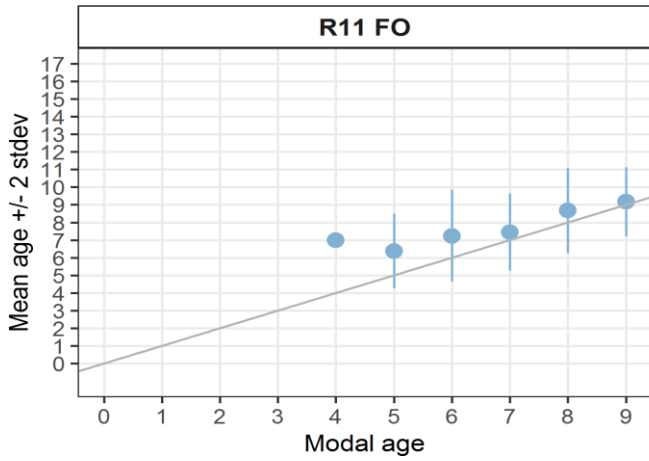


Figure 10.1.6: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

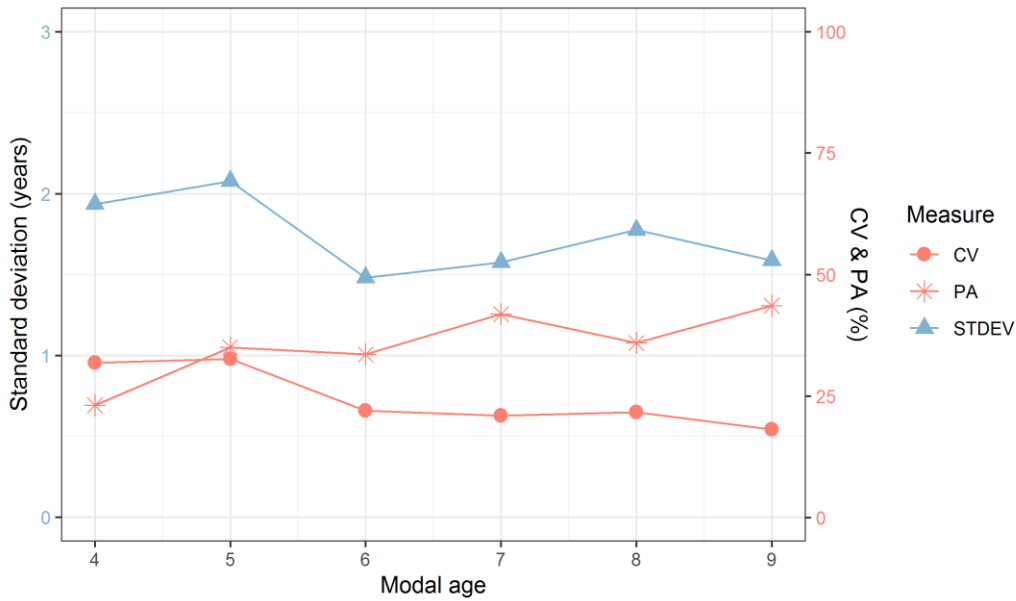


Figure 10.1.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

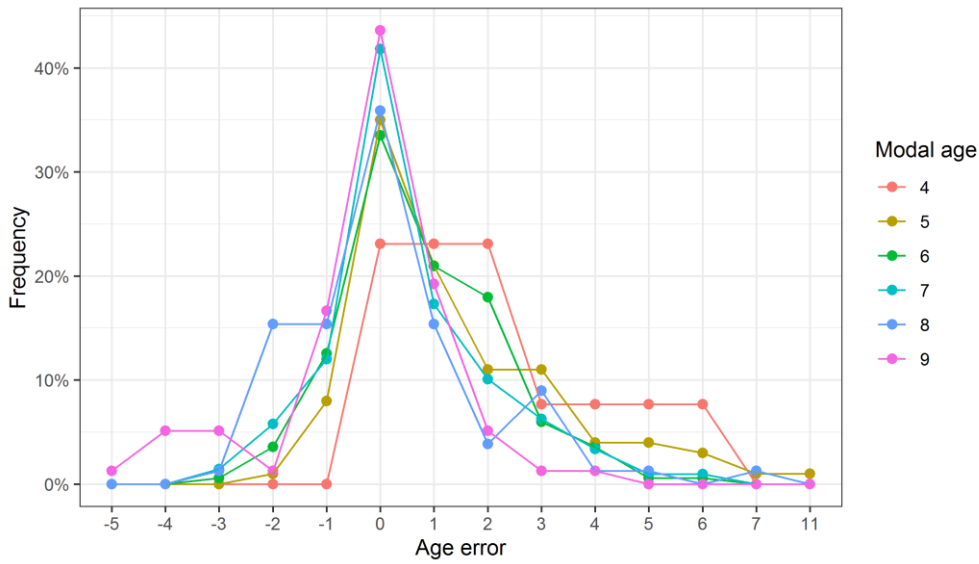


Figure 10.1.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

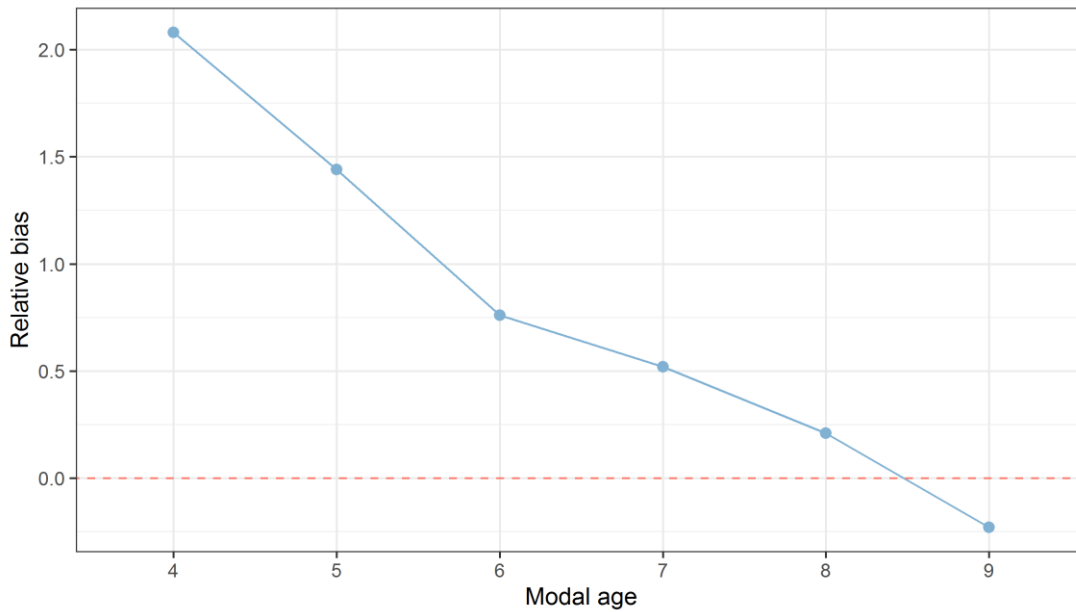


Figure 10.1.9: The relative bias by modal age as estimated by all age readers combined.

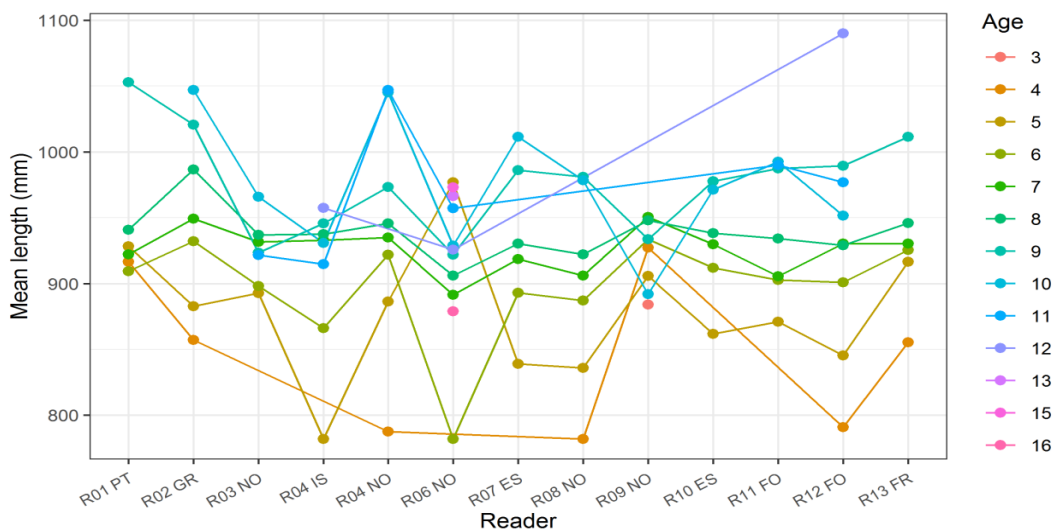


Figure 10.1.10: The mean length at age as estimated by each age reader.

10.2 Results greater forkbeard

All readers

Data Overview

Table 10.2.1: Data overview including modal age and statistics per sample.

Fis	Eve	Ima	leng	se	Catch	ICES	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R1	R1	R1	R1	Mod	P	C	AP
h	nt	ge	th	x	date	area	1	2	3	4	5	6	7	7	8	0	1	2	3	al	A	V	E	

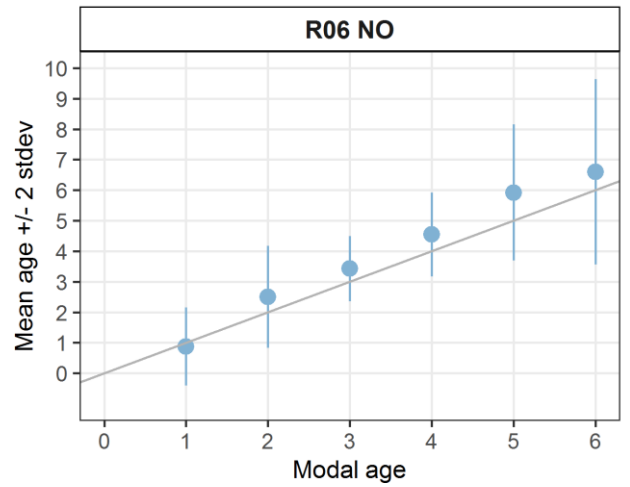
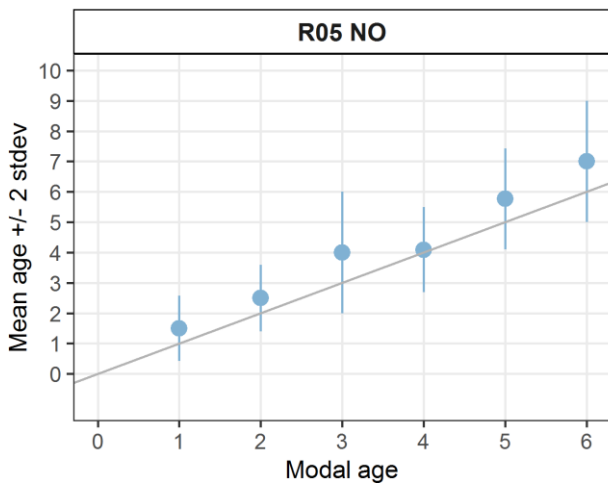
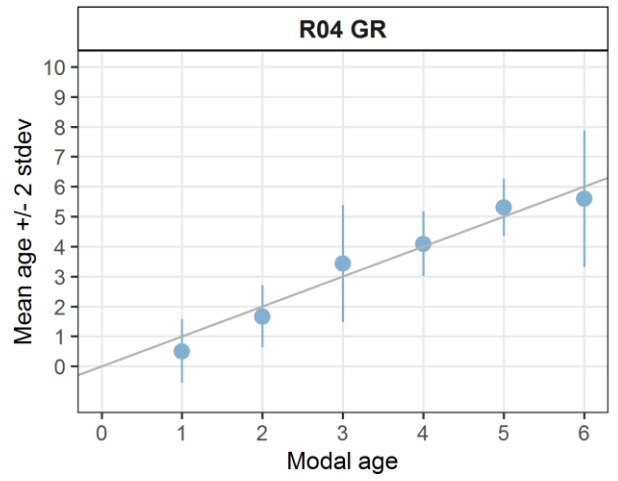
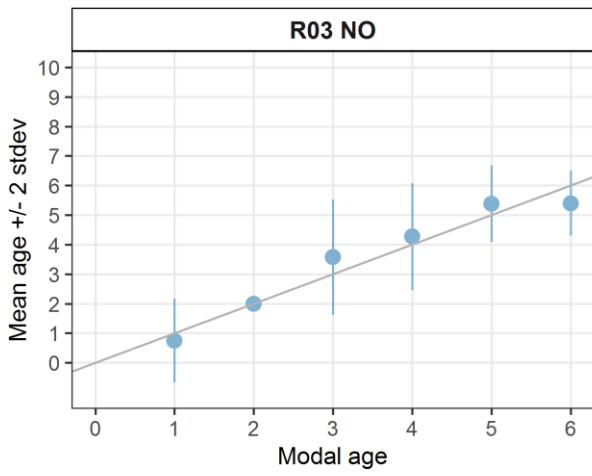
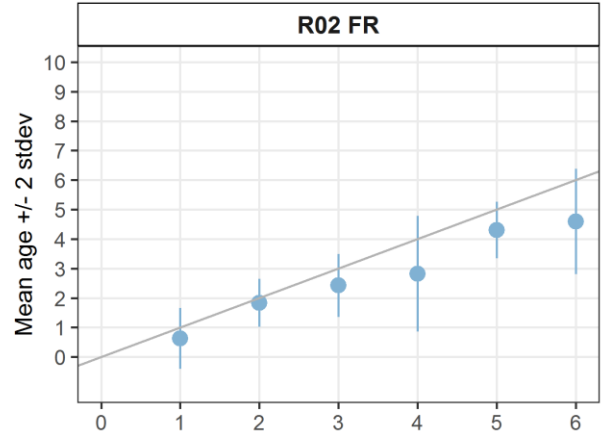
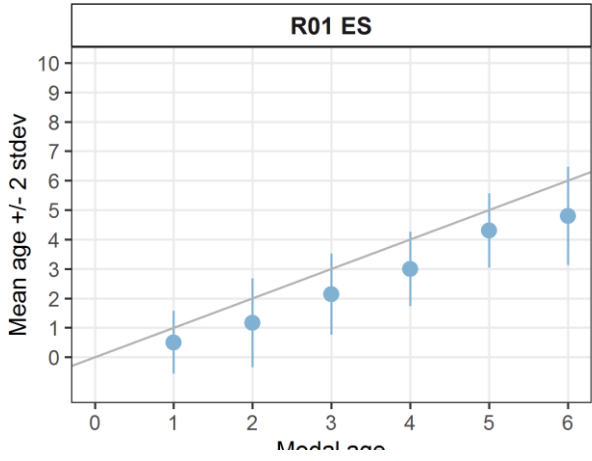
ID	ID	ID				ES	FR	N O	GR	N O	N O	IS	N O	N O	ES	FO	FO	FR	age	%	%	%	
412 9	316	-	505	-	04/05/2 016 00:00:00	27.7	5	4	6	5	6	5	5	6	7	5	6	5	5	5	4	1	12
413 0	316	-	474	-	04/05/2 016 00:00:00	27.7	3	2	4	4	4	3	4	4	5	4	4	4	4	6	9	1	14
413 1	316	-	443	-	04/05/2 016 00:00:00	27.7	3	3	5	4	3	4	3	4	7	4	4	3	4	4	6	2	18
413 2	316	-	567	-	04/05/2 016 00:00:00	27.7	4	4	5	5	6	5	5	6	7	5	5	5	5	6	2	1	11
413 3	316	-	559	-	04/05/2 016 00:00:00	27.7	5	4	5	6	6	5	5	6	5	6	6	5	5	4	6	1	11
413 4	316	-	522	-	04/05/2 016 00:00:00	27.7	5	5	5	5	6	7	5	6	7	5	6	7	5	4	6	1	12
413 5	316	-	465	-	21/03/2 017 00:00:00	27.7	3	3	5	4	4	6	4	4	4	4	5	5	4	5	4	2	15
413 6	316	-	447	-	21/03/2 017 00:00:00	27.7	3	3	4	4	5	5	4	4	3	4	4	4	3	5	4	1	14
413 7	316	-	521	-	21/03/2 017 00:00:00	27.7	3	3	4	5	5	4	4	4	3	4	3	6	3	3	8	2	18
413 8	316	-	530	-	21/03/2 017 00:00:00	27.7	3	1	2	5	3	4	4	4	3	4	4	7	3	4	8	4	28
413 9	316	-	329	-	18/05/2 017 00:00:00	27.7	2	2	4	3	4	5	4	4	2	3	4	4	4	5	4	2	24
414 0	316	-	340	-	18/05/2 017 00:00:00	27.7	2	2	2	3	3	4	3	2	3	3	3	4	4	4	6	2	19
414 1	316	-	327	-	20/09/2 017 00:00:00	27.8	2	2	2	2	3	3	3	2	2	2	3	3	3	2	4	2	20
414 2	316	-	138	-	20/09/2 017 00:00:00	27.8	0	0	0	0	1	0	1	1	0	1	1	1	1	1	5	9	92
414 3	316	-	150	-	20/09/2 017 00:00:00	27.8	0	0	0	0	1	0	1	1	0	1	1	1	1	1	5	9	92
414 4	316	-	371	-	28/09/2 017 00:00:00	27.8	2	3	3	3	3	3	4	3	3	3	3	3	3	8	5	1	5
414 5	316	-	572	-	07/10/2 017 00:00:00	27.8	3	4	5	5	5	5	6	4	4	5	5	5	5	6	2	1	12
414 6	316	-	386	-	07/10/2 017 00:00:00	27.8	2	2	2	2	2	2	3	2	2	3	2	3	3	2	9	2	18
414 7	316	-	401	-	07/10/2 017 00:00:00	27.8	4	4	5	4	4	4	5	4	4	5	4	5	4	6	9	1	10

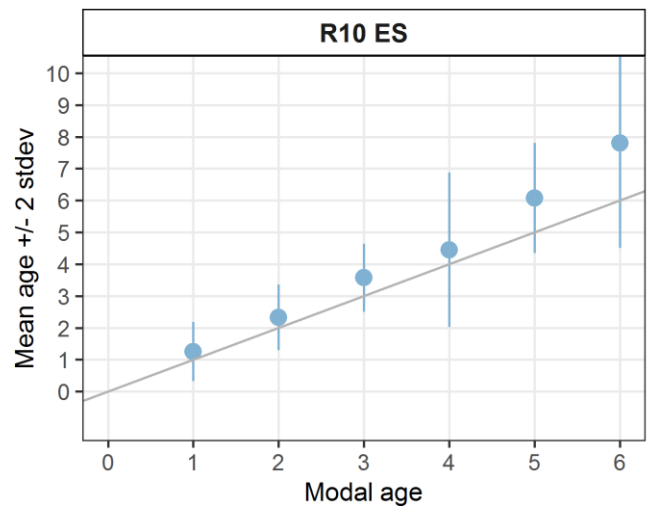
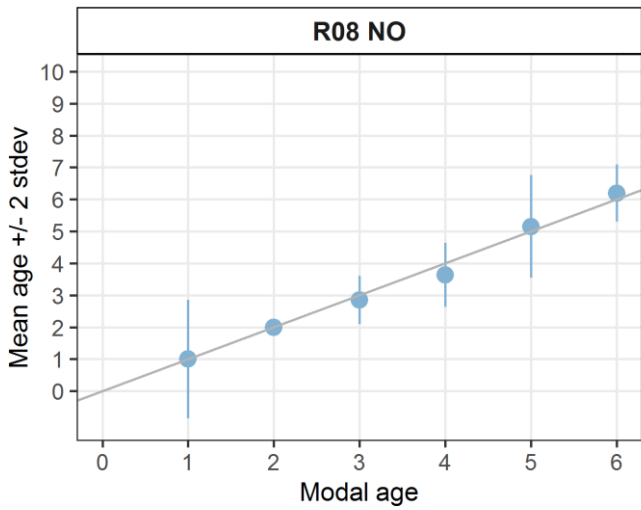
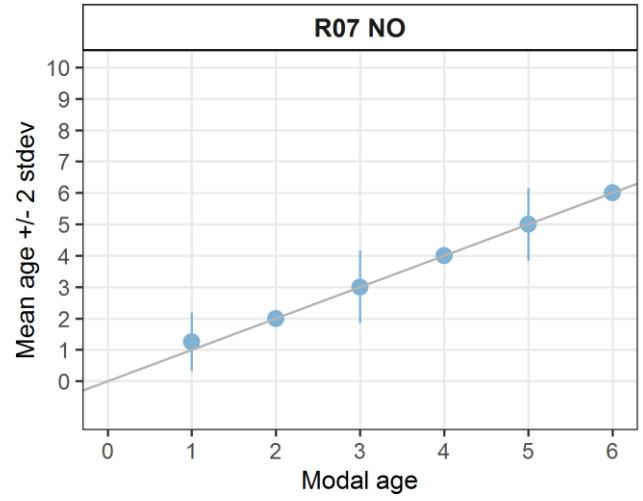
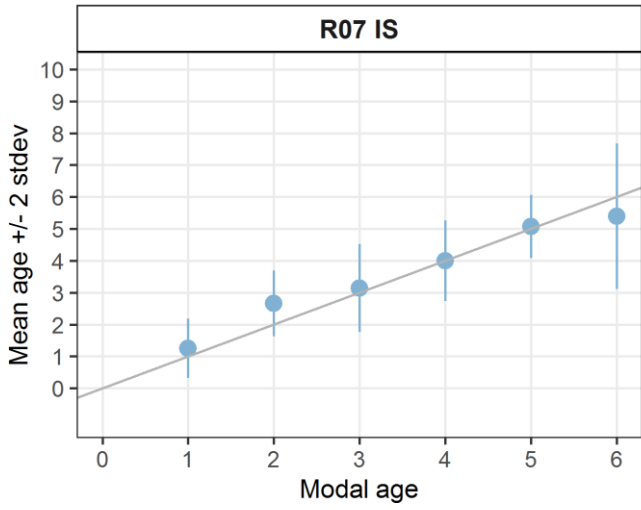
414 8	316	-	287	-	13/10/2 017	27.8	1	2	2	1	2	2	2	2	2	2	2	2	2	2	8	2	14
					00:00:00																5	0	
414 9	316	-	266	-	14/10/2 017	27.8	1	1	1	1	2	1	2	2	2	1	2	1	1	1	6	3	34
					00:00:00																2	7	
415 0	316	-	350	-	17/10/2 017	27.8	1	2	2	2	3	2	3	2	2	2	2	3	2	2	6	2	18
					00:00:00																9	6	
415 1	316	-	585	-	19/10/2 017	27.8	4	4	5	5	5	5	6	5	4	6	4	6	5	5	4	1	12
					00:00:00																6	5	
415 2	316	-	330	-	19/10/2 017	27.8	1	2	3	2	3	3	3	3	3	3	2	3	3	3	6	2	20
					00:00:00																9	5	
415 3	316	-	509	-	19/10/2 017	27.8	3	3	4	4	5	4	3	3	3	4	4	4	3	3	4	1	16
					00:00:00																6	8	
415 4	316	-	332	-	20/10/2 017	27.8	1	1	1	1	2	1	2	2	2	2	1	2	1	1	5	3	34
					00:00:00																4	6	
415 5	316	-	632	-	27/08/2 017	27.7 .c	4	4	5	6	8	8	5	5	5	6	6	8	6	5	3	2	19
					00:00:00																1	4	
415 6	316	-	561	-	27/08/2 017	27.7 .c	5	5	5	5	6	7	5	5	5	7	5	7	5	5	6	1	13
					00:00:00																9	6	
415 7	316	-	335	-	27/08/2 017	27.7 .c	1	1	2	2	3	4	3	2	2	3	3	3	2	2	3	3	30
					00:00:00																8	6	
415 8	316	-	602	-	27/08/2 017	27.7 .c	6	5	6	6	7	9	6	6	7	9	6	7	5	6	4	1	15
					00:00:00																6	9	
415 9	316	-	573	-	27/08/2 017	27.7 .c	3	3	4	4	5	5	4	4	3	5	4	5	4	4	4	1	14
					00:00:00																6	9	
416 0	316	-	680	-	27/08/2 017	27.7 .c	5	5	5	6	8	7	7	6	6	9	8	9	6	6	3	2	18
					00:00:00																1	1	
416 1	316	-	670	-	28/08/2 017	27.7 .c	5	3	6	7	8	5	5	6	6	9	7	8	6	6	3	2	19
					00:00:00																1	6	
416 2	316	-	565	-	28/08/2 017	27.7 .c	4	4	5	5	5	5	5	5	5	6	5	5	5	5	7	1	6
					00:00:00																7	0	
416 3	316	-	542	-	29/08/2 017	27.7 .c	4	5	6	5	5	6	5	5	5	6	5	6	5	5	6	1	9
					00:00:00																2	1	
416 4	316	-	165	-	29/08/2 017	27.7 .c	0	0	0	0	1	1	1	1	0	1	1	2	1	1	5	9	77
					00:00:00																4	1	
416 5	316	-	423	-	29/08/2 017	27.7 .c	3	4	4	4	5	5	5	4	4	4	4	5	4	4	6	1	11
					00:00:00																2	4	
416 6	316	-	285	-	30/08/2 017	27.7 .c	0	2	2	1	2	2	2	2	2	2	2	3	2	2	7	3	22
					00:00:00																7	7	
416 7	316	-	170	-	31/08/2 017	27.7 .c	0	1	1	0	1	1	1	1	1	1	1	1	1	1	8	4	31
																					5	4	

8	0	0	0	0	3	1	0	0	0	0	1	2	0
9	0	0	0	0	0	1	0	0	0	3	0	1	0
Total	50	50	50	50	50	50	50	50	50	50	50	49	50

Table 10.2.4: Mean 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	R01 ES	R02 FR	R03 NO	R04 GR	R05 NO	R06 NO	R07 IS	R07 NO	R08 NO	R10 ES	R11 FO	R12 FO	R13 FR
0	182 mm	151 mm	151 mm	156 mm	-	144 mm	-	-	151 mm	-	-	-	-
1	310 mm	317 mm	268 mm	292 mm	156 mm	242 mm	201 mm	201 mm	224 mm	194 mm	206 mm	181 mm	226 mm
2	378 mm	365 mm	346 mm	346 mm	306 mm	323 mm	316 mm	323 mm	331 mm	316 mm	316 mm	273 mm	314 mm
3	496 mm	500 mm	350 mm	363 mm	378 mm	375 mm	393 mm	412 mm	445 mm	352 mm	384 mm	341 mm	428 mm
4	550 mm	550 mm	464 mm	455 mm	450 mm	460 mm	497 mm	490 mm	495 mm	463 mm	489 mm	424 mm	448 mm
5	584 mm	558 mm	534 mm	553 mm	526 mm	536 mm	535 mm	564 mm	567 mm	546 mm	542 mm	486 mm	560 mm
6	602 mm	-	582 mm	616 mm	534 mm	494 mm	586 mm	572 mm	562 mm	549 mm	602 mm	528 mm	599 mm
7	-	-	533 mm	670 mm	602 mm	577 mm	680 mm	-	602 mm	531 mm	670 mm	582 mm	522 mm
8	-	-	-	-	661 mm	632 mm	-	-	-	-	680 mm	651 mm	-
9	-	-	-	-	-	602 mm	-	-	-	651 mm	-	680 mm	-
Weighted Mean	442 mm	442 mm	442 mm	442 mm	442 mm	442 mm	442 mm	442 mm	442 mm	442 mm	442 mm	438 mm	442 mm





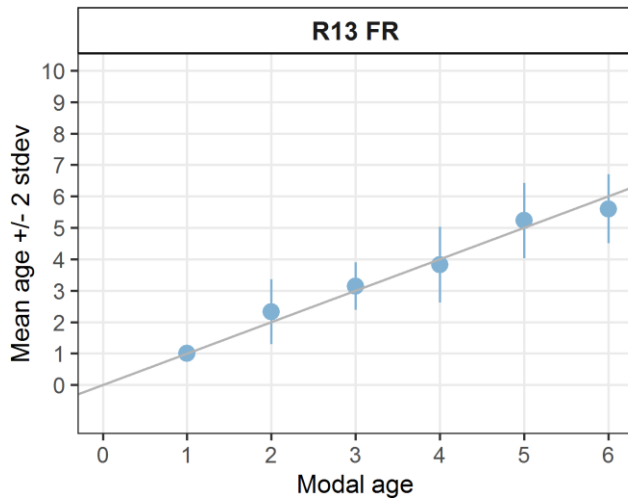
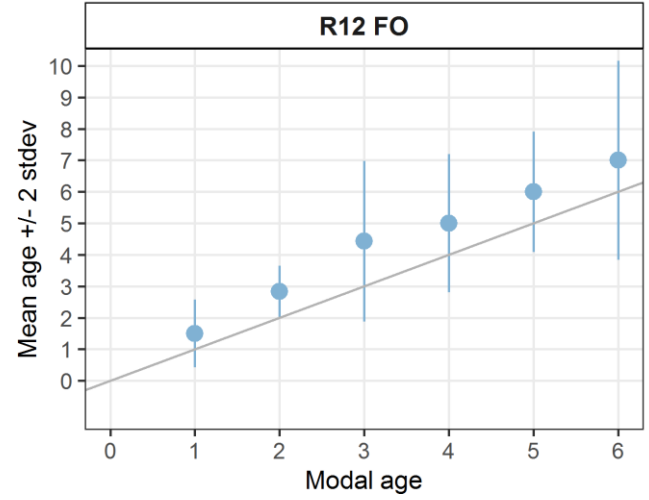
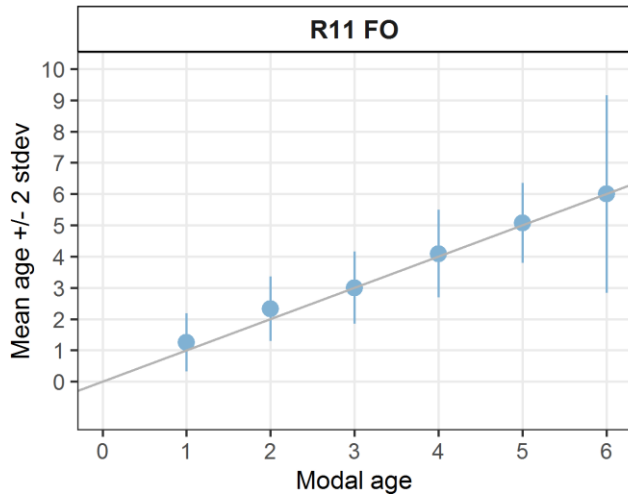


Figure 10.2.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

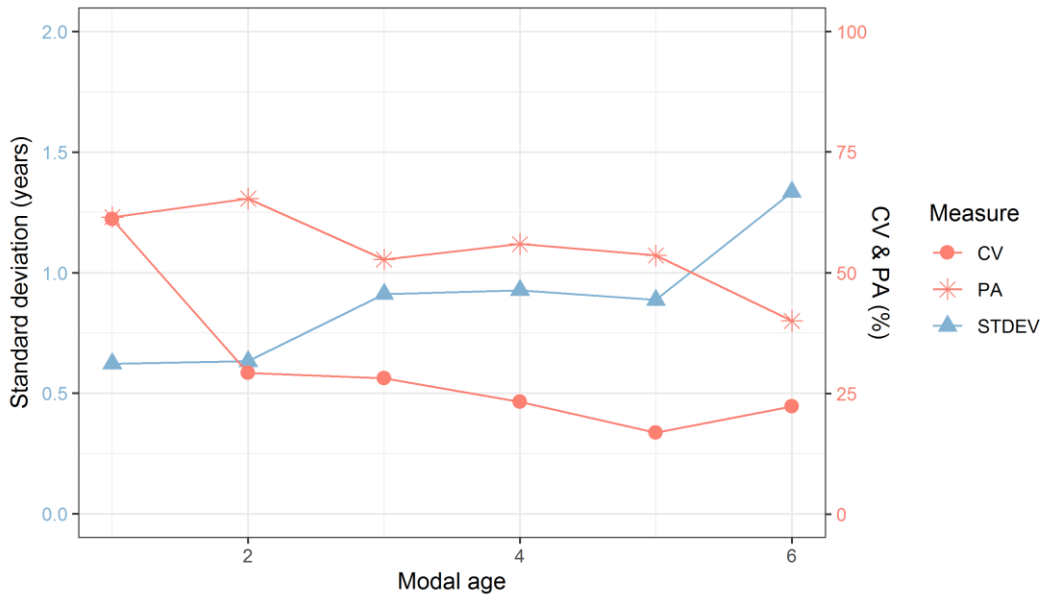


Figure 10.2.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

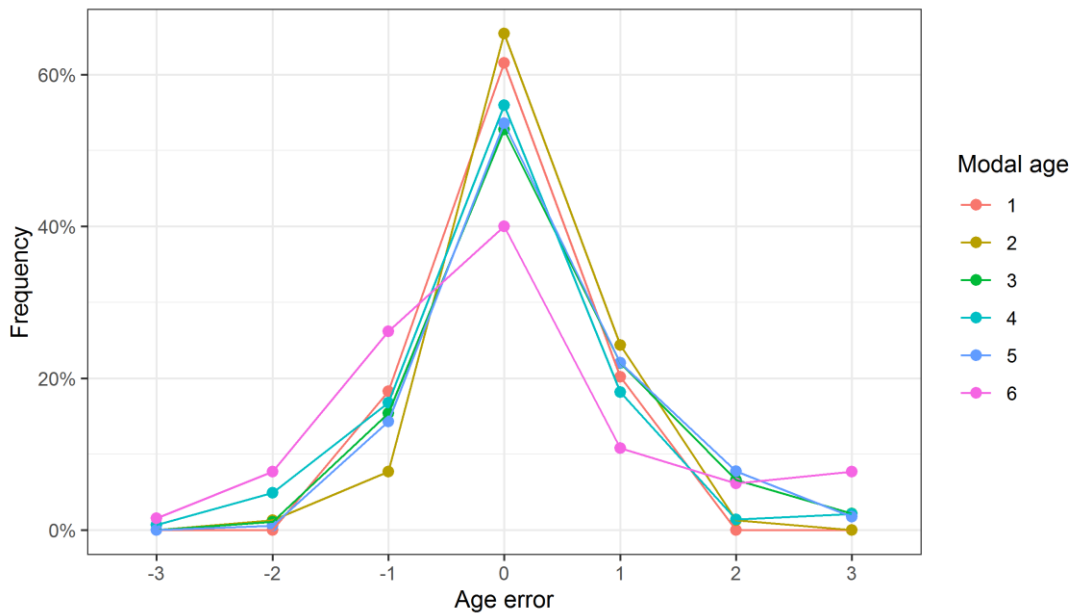


Figure 10.2.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

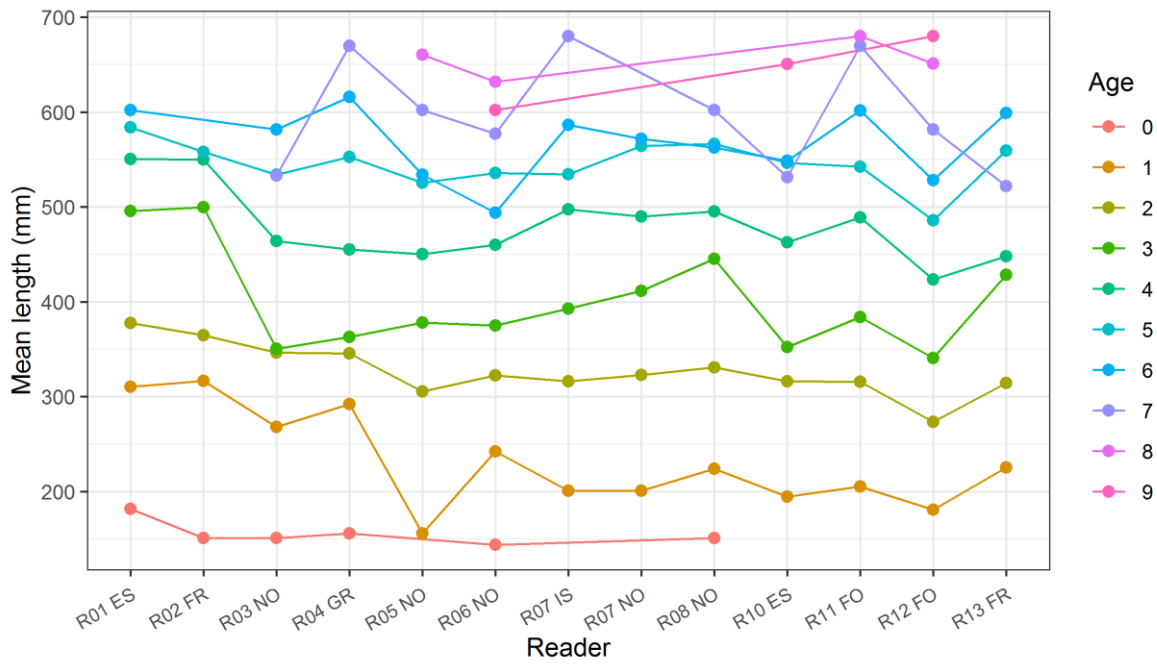


Figure 10.2.4: The mean length at age as estimated by each age reader.

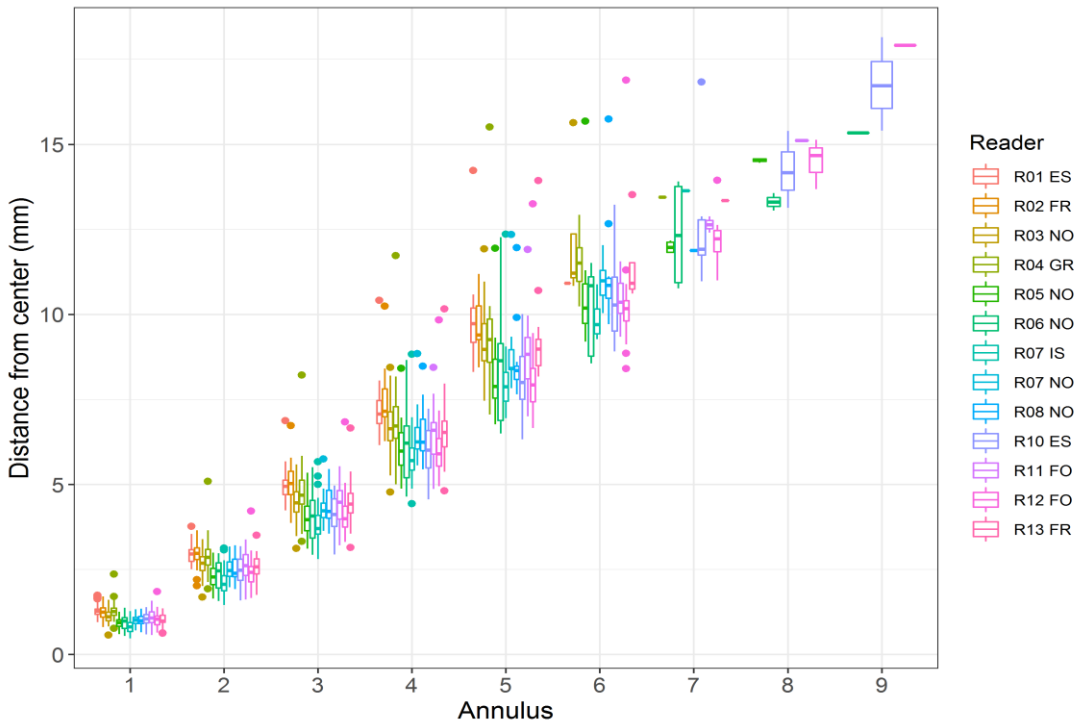


Figure 10.2.5: Plot of average distance from the centre to the winter rings for all readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.2.5: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	length	sex	Catch date	ICES area	R01 ES	R02 FR	Modal age	PA %	CV %	APE %
4129	316	-	505	-	04/05/2016 00:00:00	27.7	5	4	4	50	16	11
4130	316	-	474	-	04/05/2016 00:00:00	27.7	3	2	2	50	28	20
4131	316	-	443	-	04/05/2016 00:00:00	27.7	3	3	3	100	0	0
4132	316	-	567	-	04/05/2016 00:00:00	27.7	4	4	4	100	0	0
4133	316	-	559	-	04/05/2016 00:00:00	27.7	5	4	4	50	16	11
4134	316	-	522	-	04/05/2016 00:00:00	27.7	5	5	5	100	0	0
4135	316	-	465	-	21/03/2017 00:00:00	27.7	3	3	3	100	0	0
4136	316	-	447	-	21/03/2017 00:00:00	27.7	3	3	3	100	0	0
4137	316	-	521	-	21/03/2017 00:00:00	27.7	3	3	3	100	0	0
4138	316	-	530	-	21/03/2017 00:00:00	27.7	3	1	1	50	71	50
4139	316	-	329	-	18/05/2017 00:00:00	27.7	2	2	2	100	0	0
4140	316	-	340	-	18/05/2017 00:00:00	27.7	2	2	2	100	0	0
4141	316	-	327	-	20/09/2017 00:00:00	27.8	2	2	2	100	0	0
4142	316	-	138	-	20/09/2017 00:00:00	27.8	0	0	0	100	-	-
4143	316	-	150	-	20/09/2017 00:00:00	27.8	0	0	0	100	-	-
4144	316	-	371	-	28/09/2017 00:00:00	27.8	2	3	2	50	28	20
4145	316	-	572	-	07/10/2017 00:00:00	27.8	3	4	3	50	20	14
4146	316	-	386	-	07/10/2017 00:00:00	27.8	2	2	2	100	0	0
4147	316	-	401	-	07/10/2017 00:00:00	27.8	4	4	4	100	0	0
4148	316	-	287	-	13/10/2017 00:00:00	27.8	1	2	1	50	47	33
4149	316	-	266	-	14/10/2017 00:00:00	27.8	1	1	1	100	0	0
4150	316	-	350	-	17/10/2017 00:00:00	27.8	1	2	1	50	47	33
4151	316	-	585	-	19/10/2017 00:00:00	27.8	4	4	4	100	0	0
4152	316	-	330	-	19/10/2017 00:00:00	27.8	1	2	1	50	47	33
4153	316	-	509	-	19/10/2017 00:00:00	27.8	3	3	3	100	0	0
4154	316	-	332	-	20/10/2017 00:00:00	27.8	1	1	1	100	0	0
4155	316	-	632	-	27/08/2017 00:00:00	27.7.c	4	4	4	100	0	0
4156	316	-	561	-	27/08/2017 00:00:00	27.7.c	5	5	5	100	0	0
4157	316	-	335	-	27/08/2017 00:00:00	27.7.c	1	1	1	100	0	0
4158	316	-	602	-	27/08/2017 00:00:00	27.7.c	6	5	5	50	13	9
4159	316	-	573	-	27/08/2017 00:00:00	27.7.c	3	3	3	100	0	0
4160	316	-	680	-	27/08/2017 00:00:00	27.7.c	5	5	5	100	0	0
4161	316	-	670	-	28/08/2017 00:00:00	27.7.c	5	3	3	50	35	25
4162	316	-	565	-	28/08/2017 00:00:00	27.7.c	4	4	4	100	0	0
4163	316	-	542	-	29/08/2017 00:00:00	27.7.c	4	5	4	50	16	11
4164	316	-	165	-	29/08/2017 00:00:00	27.7.c	0	0	0	100	-	-
4165	316	-	423	-	29/08/2017 00:00:00	27.7.c	3	4	3	50	20	14
4166	316	-	285	-	30/08/2017 00:00:00	27.7.c	0	2	0	50	-	-
4167	316	-	170	-	31/08/2017 00:00:00	27.7.c	0	1	0	50	-	-
4168	316	-	590	-	31/08/2017 00:00:00	27.7.c	5	5	5	100	0	0
4169	316	-	633	-	01/09/2017 00:00:00	27.7.c	4	4	4	100	0	0
4170	316	-	305	-	01/09/2017 00:00:00	27.7.c	1	1	1	100	0	0
4171	316	-	412	-	06/09/2017 00:00:00	27.7.c	2	2	2	100	0	0
4172	316	-	533	-	15/09/2017 00:00:00	27.7.c	4	4	4	100	0	0
4173	316	-	436	-	15/09/2017 00:00:00	27.7.c	2	2	2	100	0	0
4174	316	-	420	-	15/09/2017 00:00:00	27.7.c	2	2	2	100	0	0
4175	316	-	278	-	16/09/2017 00:00:00	27.7.c	1	1	1	100	0	0
4176	316	-	414	-	16/09/2017 00:00:00	27.7.c	4	5	4	50	16	11
4177	316	-	626	-	17/09/2017 00:00:00	27.7.c	4	4	4	100	0	0
4178	316	-	555	-	20/09/2017 00:00:00	27.7.c	4	5	4	50	16	11

Table 10.2.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 ES	R02 FR	total
0	5	5	10
1	9	9	18
2	9	9	18
3	9	9	18
4	13	13	26
5	5	5	10
Total	50	50	100

Table 10.2.7: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 ES	R02 FR
0	5	3
1	8	7
2	8	12
3	10	8
4	11	12
5	7	8
6	1	0
Total	50	50

Table 10.2.8: Mean 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	R01 ES	R02 FR
0	182 mm	151 mm
1	310 mm	317 mm
2	378 mm	365 mm
3	496 mm	500 mm
4	550 mm	550 mm
5	584 mm	558 mm
6	602 mm	-
Weighted Mean	442 mm	442 mm

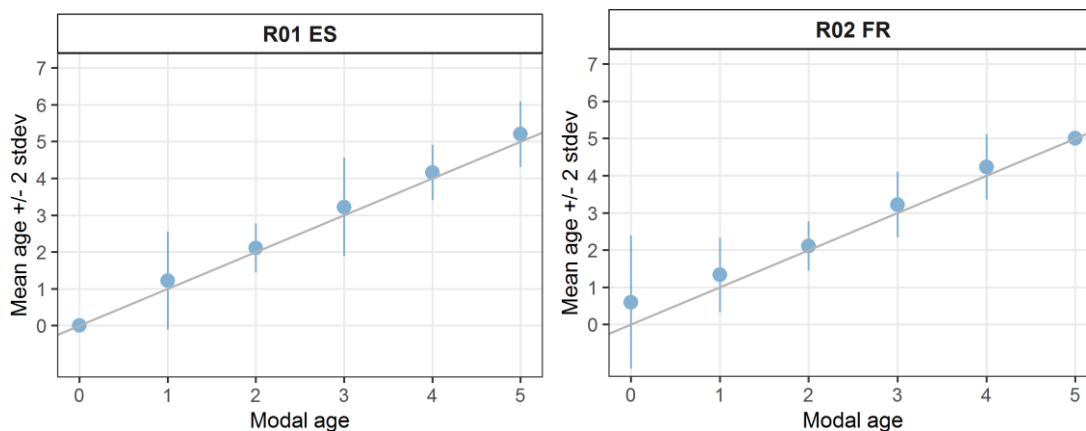


Figure 10.2.6: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

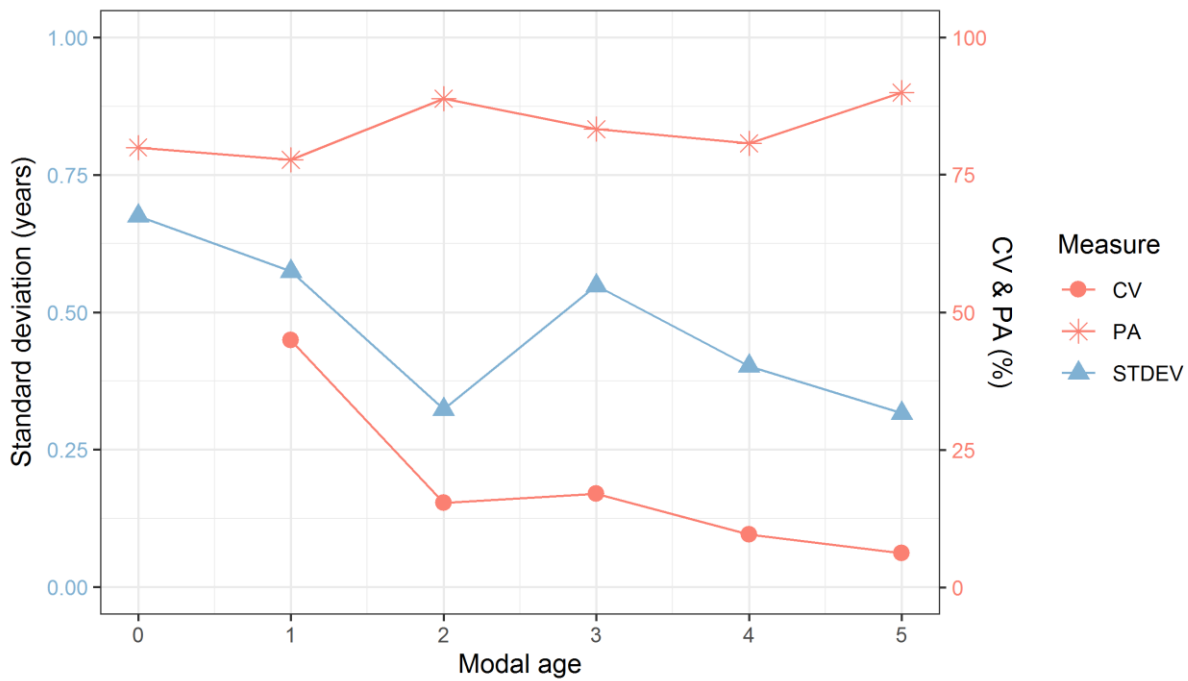


Figure 10.2.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

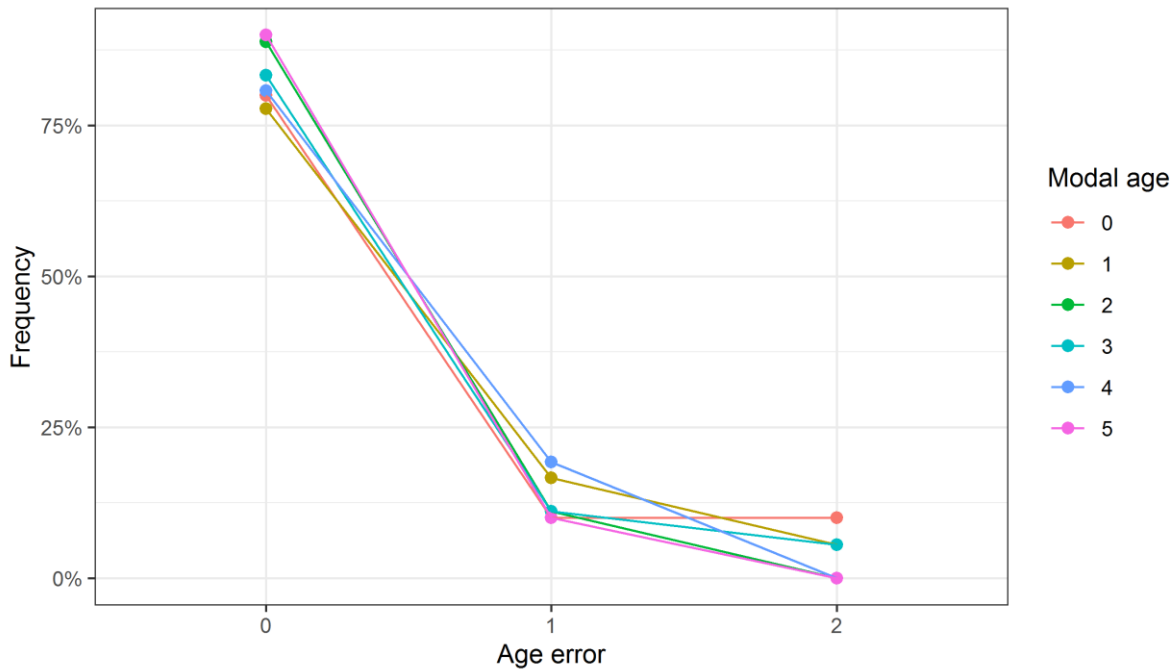


Figure 10.2.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

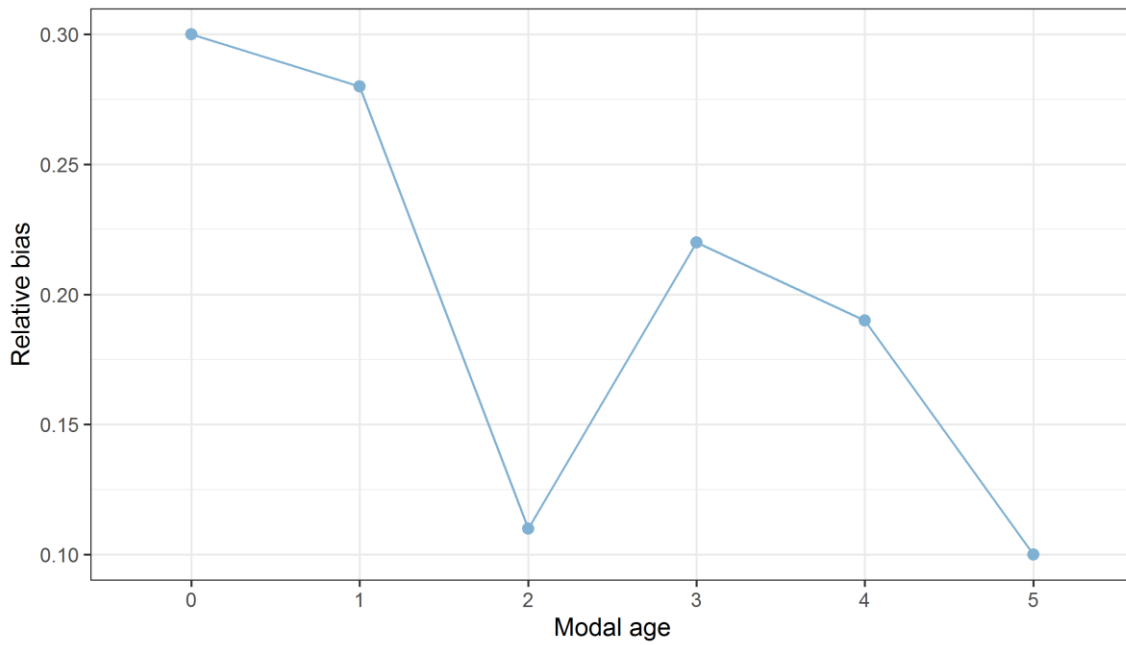


Figure 10.2.9: The relative bias by modal age as estimated by all age readers combined.

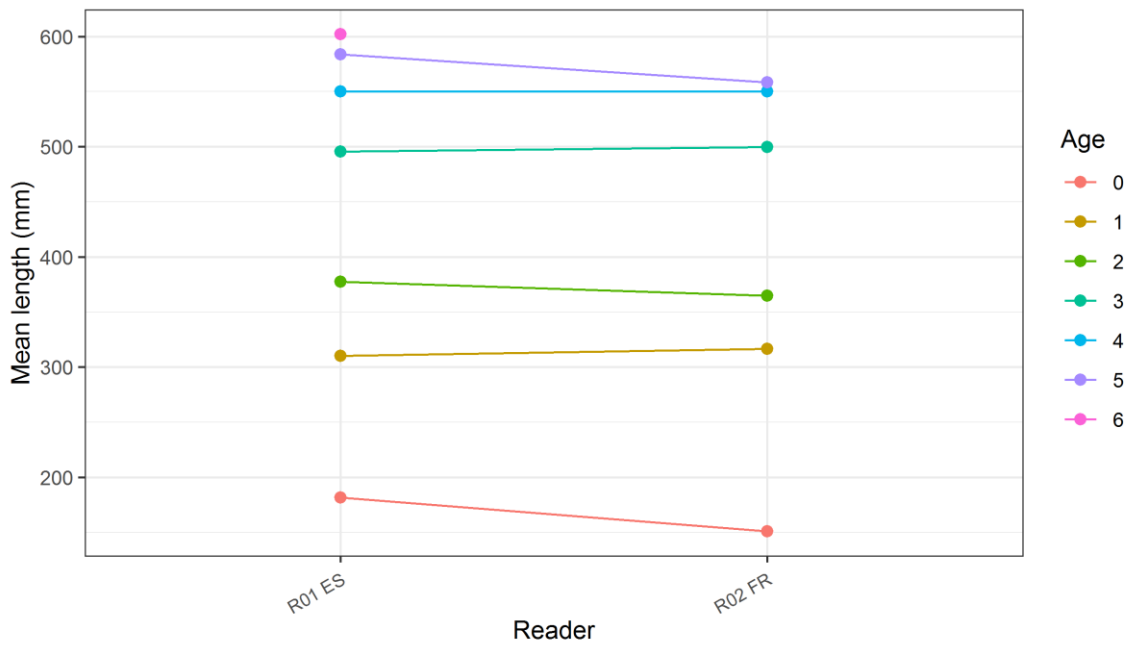


Figure 10.2.10: The mean length at age as estimated by each age reader.

10.3 Results ling

All readers

Data Overview

Table 10.3.1: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	Length	Sex	Catch date	ICES area	R0 1 N	R0 2 IS	R0 3 FO	R0 4 FES	R0 5 FEO	R0 6 FGR	R0 7 FRO	R0 8 FNO	R0 9 FNO	R1 0 FES	R1 1 FNO	R1 3 FRO	R1 4 FDK	Modal age	P A %	C V %	AP E %	
4429	317	-	902	-	11/10/2009	27.7.c	10	8	9	8	9	8	9	8	13	8	8	8	10	12	8	50	18	13
4430	317	-	899	-	19/03/2013	27.7	14	11	9	8	10	8	12	14	13	10	8	13	12	13	8	21	20	17
4431	317	-	868	-	19/03/2013	27.7	12	8	11	7	8	8	11	9	12	9	9	10	11	12	8	21	18	15
4432	317	-	876	-	19/03/2013	27.7	15	10	0	9	10	9	10	12	14	9	9	8	15	15	9	29	38	27
4433	317	-	662	-	29/04/2015	27.7	8	6	6	5	6	6	8	5	7	4	4	4	7	8	6	29	24	19
4434	317	-	949	-	08/09/2015	27.7.c	8	8	9	8	10	8	8	8	11	8	8	6	8	11	8	64	16	12
4435	317	-	336	-	22/09/2015	27.7.c	1	2	3	2	2	2	2	2	2	2	2	3	2	3	2	71	25	17
4436	317	-	255	-	22/09/2015	27.7.c	1	2	2	2	2	2	2	2	2	2	1	2	2	3	2	79	25	14
4437	317	-	269	-	22/09/2015	27.7.c	1	2	2	2	2	2	2	2	2	2	1	1	2	3	2	71	29	20
4438	317	-	307	-	22/09/2015	27.7.c	1	2	2	2	2	2	2	2	2	2	2	3	2	3	2	79	23	13
4439	317	-	348	-	22/09/2015	27.7.c	2	3	2	2	3	2	2	3	2	2	2	3	2	3	2	64	21	19
44	317	-	395	-	22/09/2015	27.7	2	3	4	2	3	3	2	3	2	3	3	3	2	4	3	52	20	20

40					015	.c														0	5			
					00:00:0																			
					0																			
44	317	-	714	-	03/05/2	27.7	7	6	7	6	7	6	7	6	5	5	5	7	8	8	7	3	1	13
41					016																	6	6	
					00:00:0																			
					0																			
44	317	-	649	-	03/05/2	27.7	6	7	6	5	7	6	8	6	8	5	4	7	7	7	7	3	1	15
42					016																	6	8	
					00:00:0																			
					0																			
44	317	-	595	-	03/05/2	27.7	5	6	6	5	6	6	5	5	6	3	3	5	5	6	5	4	2	14
43					016																	3	0	
					00:00:0																			
					0																			
44	317	-	604	-	03/05/2	27.7	6	6	6	5	6	6	7	6	7	4	5	7	7	8	6	4	1	12
44					016																	3	7	
					00:00:0																			
					0																			
44	317	-	726	-	03/05/2	27.7	7	6	7	7	7	7	7	8	10	8	7	9	9	9	7	5	1	12
45					016																	0	5	
					00:00:0																			
					0																			
44	317	-	739	-	03/05/2	27.7	7	7	7	7	7	7	7	7	7	7	6	6	8	7	7	7	7	4
46					016																	9		
					00:00:0																			
					0																			
44	317	-	770	-	29/11/2	27.7	8	7	8	6	7	6	8	7	7	7	6	7	8	6	7	4	1	8
47					016																	3	1	
					00:00:0																			
					0																			
44	317	-	755	-	29/11/2	27.7	10	7	7	8	7	7	9	7	8	9	6	8	10	7	7	4	1	13
48					016																	3	6	
					00:00:0																			
					0																			
44	317	-	546	-	16/09/2	27.7	3	4	4	4	4	4	3	4	4	4	4	3	3	5	4	6	1	12
49					016	.c																4	5	
					00:00:0																			
					0																			
44	317	-	456	-	20/09/2	27.7	2	3	3	2	4	3	2	3	3	3	3	3	2	3	3	6	2	16
50					016	.c																4	1	
					00:00:0																			
					0																			
44	317	-	358	-	20/09/2	27.7	2	3	2	2	3	2	2	3	2	2	2	2	2	3	2	7	2	18
51					016	.c																1	1	
					00:00:0																			
					0																			
44	317	-	401	-	24/09/2	27.7	2	4	3	2	3	3	2	3	2	3	2	3	2	4	2	4	2	23
52					016	.c																3	7	
					00:00:0																			
					0																			
44	317	-	520	-	25/09/2	27.7	3	4	4	3	4	4	4	5	4	4	3	3	3	5	4	5	1	15
53					016	.c																0	8	
					00:00:0																			
					0																			
44	317	-	588	-	14/03/2	27.7	5	5	7	6	6	6	6	7	6	7	4	5	7	7	6	3	1	12
54					017																	6	6	
					00:00:0																			
					0																			

44 55	317	-	530	-	14/03/2 017 00:00:0 0	27.7	4	4	5	4	5	4	4	5	4	4	3	3	5	6	4	5	1	15
44 56	317	-	570	-	14/03/2 017 00:00:0 0	27.7	6	4	7	4	6	5	5	5	6	6	4	3	5	6	6	3	2	17
44 57	317	-	654	-	14/03/2 017 00:00:0 0	27.7	5	5	6	5	6	6	7	6	8	6	4	4	6	8	6	4	2	15
44 58	317	-	610	-	14/03/2 017 00:00:0 0	27.7	6	6	6	5	6	5	7	6	7	5	4	5	7	5	5	3	1	13
44 59	317	-	103 0	-	14/03/2 017 00:00:0 0	27.7	12	10	12	13	11	9	12	14	11	14	11	8	17	14	11	2	1	14
44 60	317	-	990	-	14/03/2 017 00:00:0 0	27.7	7	8	8	8	9	8	8	9	8	7	7	7	8	8	8	5	8	6
44 61	317	-	938	-	14/03/2 017 00:00:0 0	27.7	8	9	10	9	9	8	9	9	8	11	8	7	8	10	8	3	1	9
44 62	317	-	480	-	18/05/2 017 00:00:0 0	27.7	4	5	4	4	5	4	6	5	4	4	3	3	4	6	4	5	2	17
44 63	317	-	550	-	18/05/2 017 00:00:0 0	27.7	5	5	6	5	5	5	5	6	5	5	4	4	5	6	5	6	1	8
44 64	317	-	515	-	18/05/2 017 00:00:0 0	27.7	4	4	6	5	5	5	5	5	4	5	3	5	5	5	5	6	1	12
44 65	317	-	680	-	18/05/2 017 00:00:0 0	27.7	4	5	6	5	7	6	5	6	6	6	5	4	5	5	5	4	1	13
44 66	317	-	552	-	18/05/2 017 00:00:0 0	27.7	4	5	6	5	5	5	5	5	5	5	4	3	5	6	5	6	1	11
44 67	317	-	690	-	18/05/2 017 00:00:0 0	27.7	5	5	6	6	6	5	6	6	5	5	5	4	5	6	5	5	1	10
44 68	317	-	808	-	18/05/2 017 00:00:0 0	27.7	6	7	9	7	7	7	7	8	7	6	6	6	7	7	7	5	1	8
44 69	317	-	500	-	18/05/2 017 00:00:0	27.7	4	4	5	5	5	5	5	5	4	5	4	4	5	4	5	5	1	11

44	317	-	545	-	0	18/05/2	27.7	4	5	6	5	5	5	5	6	5	5	4	4	5	4	5	5	1	10
70					0	017																	7	4	
					00:00:0																				
44	317	-	622	-	0	18/05/2	27.7	3	6	5	5	6	5	5	6	4	4	4	5	4	5	4	1	15	
71					0	017																	3	9	
					00:00:0																				
44	317	-	768	-	0	24/08/2	27.7	5	7	6	6	8	7	6	7	7	6	5	5	7	6	6	3	1	12
72					0	017																	6	5	
					00:00:0																				
44	317	-	630	-	0	24/08/2	27.7	4	6	5	5	6	5	6	7	7	6	6	5	5	6	6	4	1	12
73					0	017																	3	5	
					00:00:0																				
44	317	-	829	-	0	24/08/2	27.7	7	7	8	7	8	6	8	8	8	7	9	7	7	7	7	5	1	9
74					0	017																	0	0	
					00:00:0																				
44	317	-	956	-	0	23/11/2	27.7	11	8	9	10	10	9	10	13	14	10	9	10	9	9	9	3	1	11
75					0	017																	6	6	
					00:00:0																				
44	317	-	925	-	0	23/11/2	27.7	8	8	8	7	9	8	8	10	11	10	9	9	9	8	8	4	1	10
76					0	017																	3	2	
					00:00:0																				
44	317	-	910	-	0	23/11/2	27.7	7	8	8	8	9	7	8	10	11	8	8	10	9	8	8	5	1	11
77					0	017																	0	4	
					00:00:0																				
44	317	-	797	-	0	03/09/2	27.7	5	7	7	6	8	6	6	7	6	6	6	5	7	6	6	5	1	10
78					0	017	.c																0	3	
					00:00:0																				
44	317	-	64	-	0	01/06/2	27.5	7	7	7	7	7	7	6	7	8	7	7	7	7	6	7	7	7	4
79					0	017	.a																9		
					00:00:0																				
44	317	-	87	-	0	01/06/2	27.5	8	8	9	10	8	10	9	11	13	10	11	10	9	8	8	2	1	12
80					0	017	.a																9	5	
					00:00:0																				
44	317	-	91	-	0	01/06/2	27.5	7	8	10	11	10	11	7	13	13	11	12	11	8	9	11	2	2	16
81					0	017	.a																9	0	
					00:00:0																				
44	317	-	95	-	0	01/06/2	27.5	11	9	10	11	10	11	11	12	13	11	12	11	10	11	11	5	9	6
82					0	017	.a																0		
					00:00:0																				
44	317	-	100	-	0	01/06/2	27.5	9	9	10	10	9	11	9	11	12	10	11	10	9	10	9	3	1	7
83					0	017	.a																6	0	
					00:00:0																				
44	317	-	87	-	0	01/06/2	27.5	10	9	10	12	10	10	9	10	13	11	10	10	10	9	10	5	1	7
84					0	017	.a																7	1	
					00:00:0																				

					00:00:0																			
					0																			
44	317	-	88	-	01/06/2	27.5	8	7	8	10	8	10	8	9	10	10	8	9	8	7	8	4	1	11
85					017	.a															3	3		
					00:00:0																			
					0																			
44	317	-	104	-	01/06/2	27.5	11	9	11	11	10	12	11	13	13	12	13	13	11	10	11	3	1	9
86					017	.a															6	1		
					00:00:0																			
					0																			
44	317	-	109	-	01/06/2	27.5	9	10	12	11	10	12	12	12	12	11	12	11	12	10	12	5	9	8
87					017	.a																0		
					00:00:0																			
					0																			
44	317	-	69	-	01/06/2	27.5	7	7	7	7	7	8	8	9	10	8	9	8	7	6	7	4	1	11
88					017	.a																3	4	
					00:00:0																			
					0																			
44	317	-	91	-	03/03/2	27.5	9	8	8	9	8	10	5	8	12	9	10	8	7	9	8	3	1	13
89					018	.a																6	9	
					00:00:0																			
					0																			
44	317	-	86	-	03/03/2	27.5	7	7	8	7	8	8	8	8	11	9	9	7	7	7	7	4	1	10
91					018	.a																3	4	
					00:00:0																			
					0																			
44	317	-	99	-	03/03/2	27.5	9	9	10	10	10	10	10	10	14	10	11	10	11	10	10	6	1	7
92					018	.a																4	2	
					00:00:0																			
					0																			
44	317	-	95	-	03/03/2	27.5	7	8	9	9	9	11	9	9	11	11	8	9	8	7	9	4	1	11
93					018	.a																3	5	
					00:00:0																			
					0																			
44	317	-	99	-	03/03/2	27.5	10	10	11	9	10	12	13	14	19	10	11	12	14	10	10	3	2	16
94					018	.a																6	2	
					00:00:0																			
					0																			
44	317	-	82	-	03/03/2	27.5	9	7	8	8	8	10	10	10	11	8	7	10	8	8	8	4	1	13
95					018	.a																3	5	
					00:00:0																			
					0																			
44	317	-	96	-	03/03/2	27.5	8	8	9	9	9	10	10	9	12	8	10	10	9	9	9	4	1	9
96					018	.a																3	2	
					00:00:0																			
					0																			
44	317	-	92	-	03/03/2	27.5	7	7	9	8	9	10	8	9	15	7	8	7	7	8	7	3	2	16
97					018	.a																6	5	
					00:00:0																			
					0																			
44	317	-	92	-	03/03/2	27.5	10	8	10	8	9	10	10	10	14	8	10	10	9	9	10	5	1	10
98					018	.a																0	6	
					00:00:0																			
					0																			
44	317	-	84	-	16/12/2	27.5	10	7	9	7	8	10	11	10	12	8	8	11	10	7	10	2	1	16
99					017	.a																9	8	
					00:00:0																			
					0																			
45	317	-	90	-	16/12/2	27.5	8	7	8	8	8	10	9	10	11	8	8	9	7	8	8	5	1	11

00				017	.a																		0	4	
				00:00:0																					
				0																					
45	317	-	82	-	16/12/2	27.5	9	8	9	9	8	10	10	10	11	8	10	10	10	10	10	10	5	1	8
01					017	.a																	0	0	
					00:00:0																				
				0																					
45	317	-	87	-	16/12/2	27.5	10	8	9	8	8	10	10	13	13	9	-	10	8	9	8	3	1	13	
02					017	.a																1	8		
					00:00:0																				
				0																					
45	317	-	100	-	16/12/2	27.5	11	9	10	10	10	12	13	12	13	10	10	10	9	9	10	4	1	11	
03					017	.a																3	3		
					00:00:0																				
				0																					
45	317	-	69	-	16/12/2	27.5	7	6	7	6	7	7	6	7	8	7	7	7	5	6	7	5	1	9	
04					017	.a																7	1		
					00:00:0																				
				0																					
45	317	-	101	-	16/12/2	27.5	7	6	8	7	-	10	7	9	7	9	9	6	6	5	7	3	2	17	
05					017	.a																1	0		
					00:00:0																				
				0																					
45	317	-	102	-	16/12/2	27.5	13	10	10	11	11	11	12	13	17	11	12	12	12	11	11	3	1	10	
06					017	.a																6	5		
					00:00:0																				
				0																					
45	317	-	81	-	16/12/2	27.5	9	7	7	8	7	9	9	9	11	8	8	9	7	6	9	3	1	13	
07					017	.a																6	6		
					00:00:0																				
				0																					
45	317	-	78	-	16/12/2	27.5	8	7	7	7	7	7	7	7	7	7	7	7	7	5	7	8	9	4	
08					017	.a																6			
					00:00:0																				
				0																					

Table 10.3.2: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R06 GR	R07 FR	R08 NO	R09 NO	R10 ES	R10 NO	R11 NO	R13 FR	R14 DK	total
2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	98
3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	56
5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	140
6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	112
7	15	15	15	15	14	15	15	15	15	15	15	15	15	15	209
8	14	14	14	14	14	14	14	14	14	14	13	14	14	14	195
9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	84
10	7	7	7	7	7	7	7	7	7	7	7	7	7	7	98
11	5	5	5	5	5	5	5	5	5	5	5	5	5	5	70
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
Total	79	79	79	79	78	79	79	79	79	79	78	79	79	79	1104

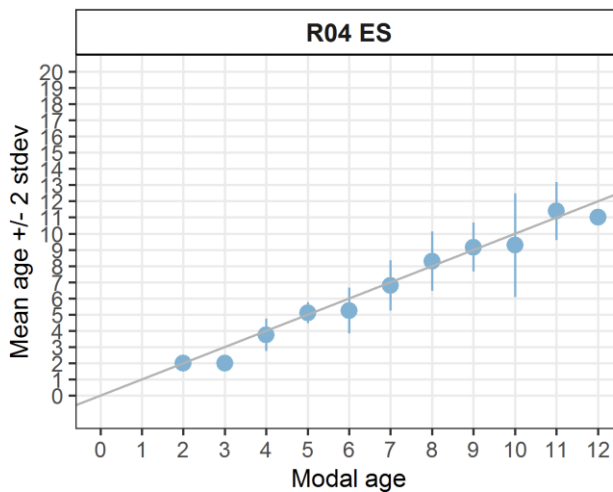
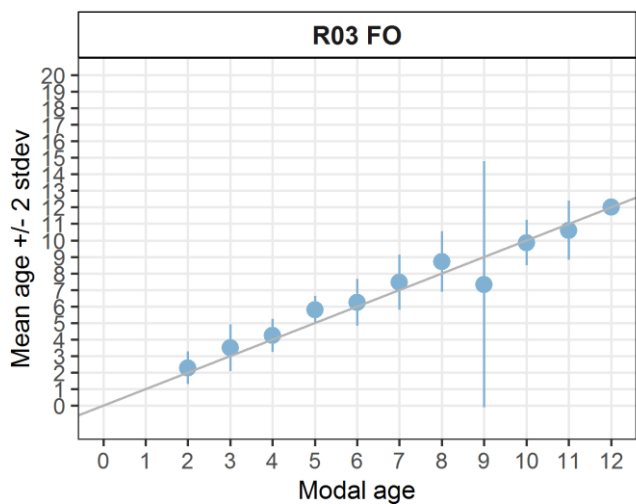
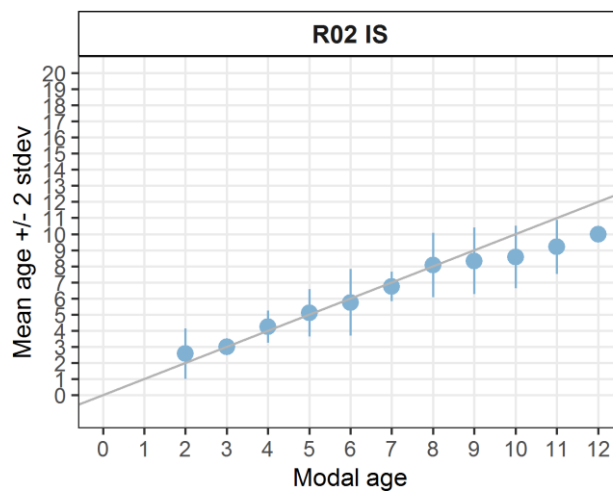
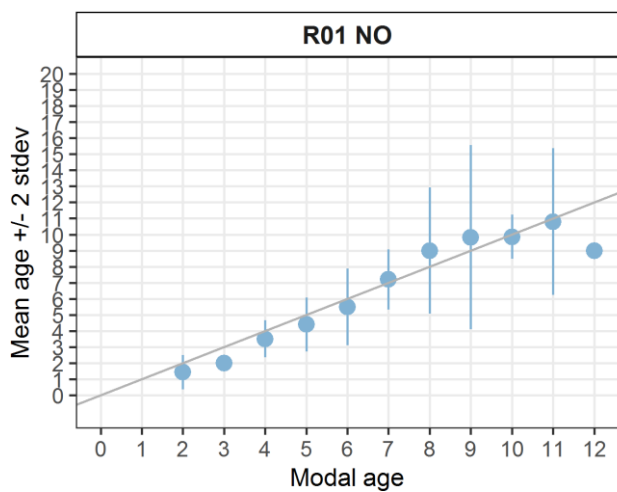
Table 10.3.3: Age composition by reader gives a summary of number of readings per reader.

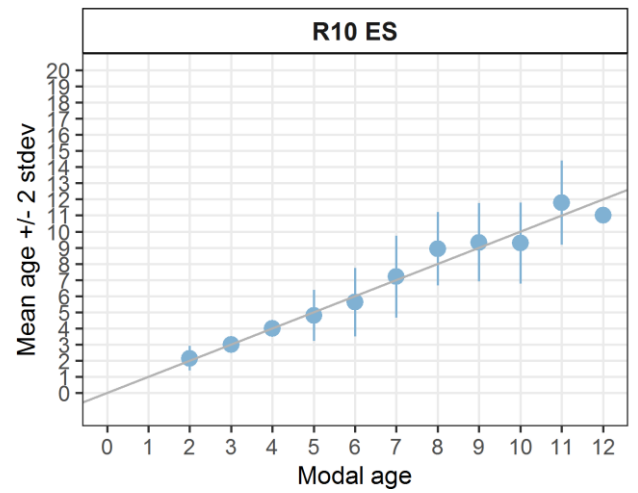
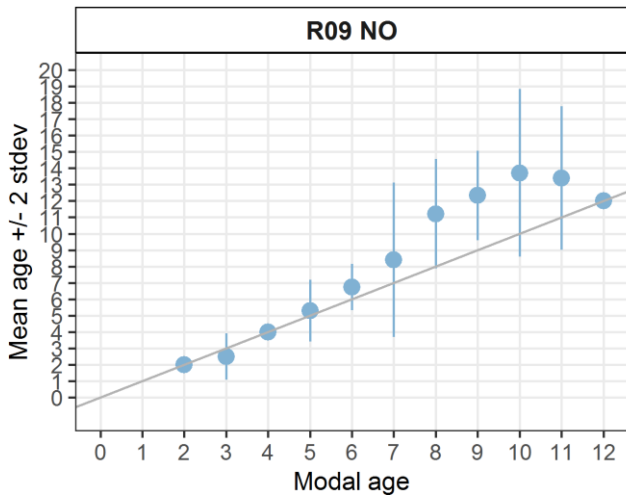
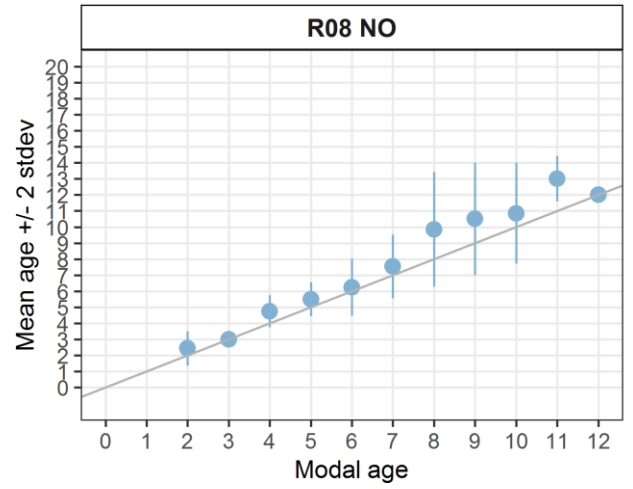
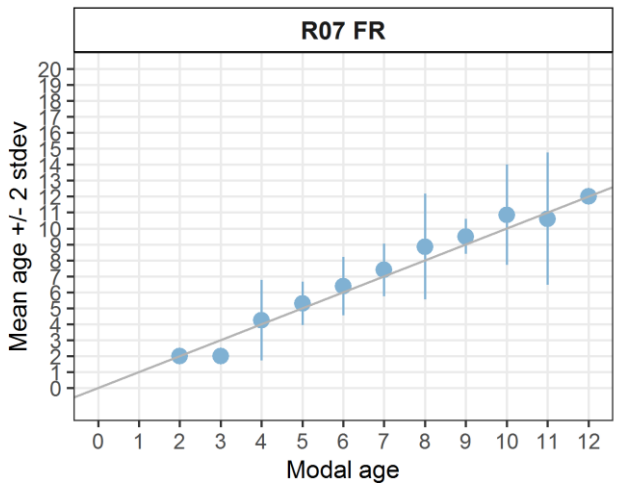
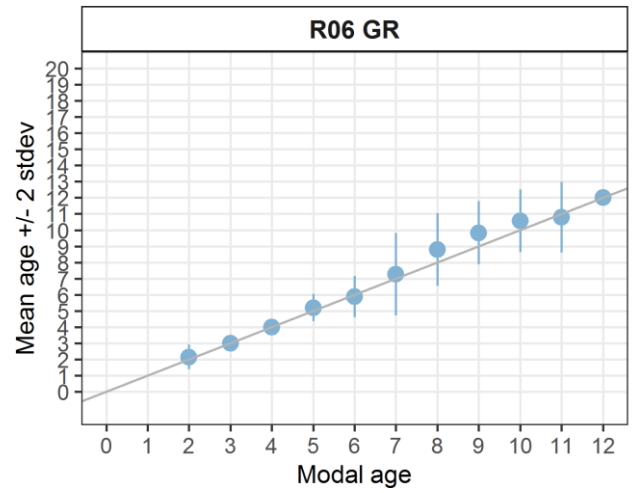
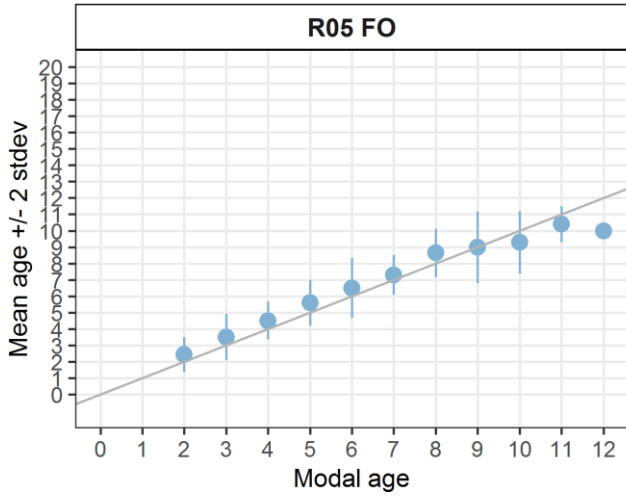
Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R06 GR	R07 FR	R08 NO	R09 NO	R10 ES	R10 NO	R11 NO	R13 FR	R14 DK
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
1	4	0	0	0	0	0	0	0	0	0	2	1	0	0
2	5	4	5	9	4	6	9	4	8	6	5	2	9	0
3	3	4	3	1	4	3	1	5	1	4	7	12	2	7
4	8	7	4	4	3	4	2	1	6	7	12	8	1	5
5	7	8	4	14	7	10	10	10	5	9	5	7	13	7
6	5	10	13	7	10	11	8	9	6	7	6	4	2	15
7	14	18	12	12	13	9	10	10	10	9	6	12	17	10
8	10	15	11	12	13	9	12	7	8	12	11	6	11	11
9	7	7	12	7	10	4	9	10	0	7	8	6	9	9
10	7	5	9	6	12	14	8	9	3	9	6	13	6	7
11	4	1	3	5	2	5	4	2	10	7	5	4	3	3
12	2	0	2	1	0	4	4	4	6	1	4	2	3	2
13	1	0	0	1	0	0	2	5	9	0	1	2	0	1
14	1	0	0	0	0	0	0	3	4	1	0	0	1	1
15	1	0	0	0	0	0	0	0	1	0	0	0	1	1
17	0	0	0	0	0	0	0	0	1	0	0	0	1	0
19	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Total	79	79	79	79	78	79	79	79	79	79	78	79	79	79

Table 10.3.4: Mean 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	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R06 GR	R07 FR	R08 NO	R09 NO	R10 ES	R10 NO	R11 NO	R13 FR	R14 DK
0	-	-	876 mm	-	-	-	-	-	-	-	-	-	-	-
1	292 mm	-	-	-	-	-	-	-	-	-	262 mm	269 mm	-	-
2	392 mm	292 mm	307 mm	347 mm	292 mm	312 mm	347 mm	292 mm	334 mm	312 mm	350 mm	306 mm	347 mm	-
3	563 mm	389 mm	398 mm	520 mm	376 mm	417 mm	546 mm	392 mm	456 mm	462 mm	499 mm	453 mm	533 mm	333 mm
4	554 mm	512 mm	485 mm	532 mm	507 mm	519 mm	525 mm	546 mm	515 mm	566 mm	587 mm	613 mm	480 mm	493 mm
5	663 mm	592 mm	570 mm	598 mm	525 mm	578 mm	522 mm	555 mm	610 mm	592 mm	691 mm	643 mm	542 mm	436 mm
6	648 mm	533 mm	621 mm	628 mm	622 mm	686 mm	511 mm	633 mm	642 mm	701 mm	750 mm	649 mm	378 mm	481 mm
7	398 mm	385 mm	438 mm	448 mm	477 mm	546 mm	512 mm	526 mm	577 mm	469 mm	335 mm	490 mm	410 mm	472 mm
8	468 mm	481 mm	451 mm	494 mm	311 mm	736 mm	585 mm	627 mm	618 mm	347 mm	466 mm	620 mm	504 mm	528 mm
9	92 mm	218 mm	428 mm	325 mm	514 mm	736 mm	348 mm	342 mm	-	409 mm	589 mm	334 mm	444 mm	258 mm
10	301 mm	443 mm	189 mm	238 mm	372 mm	90 mm	296 mm	272 mm	294 mm	373 mm	91 mm	280 mm	334 mm	219 mm
11	314 mm	899 mm	357 mm	100 mm	566 mm	97 mm	288 mm	94 mm	433 mm	217 mm	283 mm	95 mm	357 mm	382 mm
12	949 mm	-	570 mm	87 mm	-	103 mm	535 mm	295 mm	225 mm	104 mm	99 mm	100 mm	370 mm	885 mm
13	102 mm	-	-	1030 mm	-	-	100 mm	268 mm	272 mm	-	104 mm	502 mm	-	899 mm
14	899 mm	-	-	-	-	-	-	676 mm	506 mm	1030 mm	-	-	99 mm	1030 mm

15	876	-	-	-	-	-	-	-	-	92	-	-	-	876	876
	mm									mm				mm	mm
17	-	-	-	-	-	-	-	-	-	102	-	-	-	1030	-
										mm				mm	
19	-	-	-	-	-	-	-	-	-	99	-	-	-	-	-
										mm					
Weighted Mean	445	445	445	445	450	445	445	445	445	445	445	450	445	445	445
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm





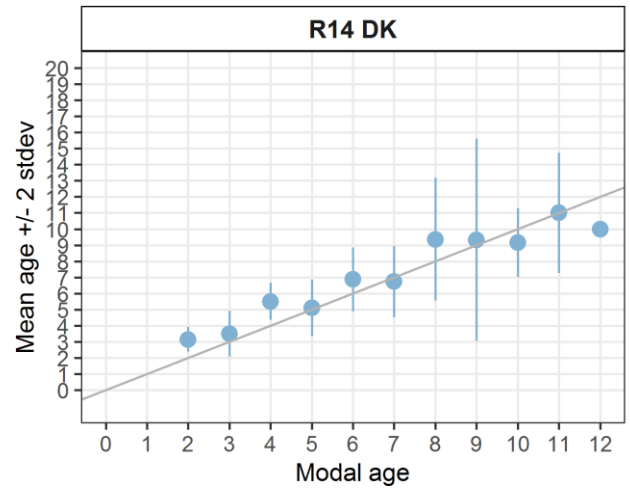
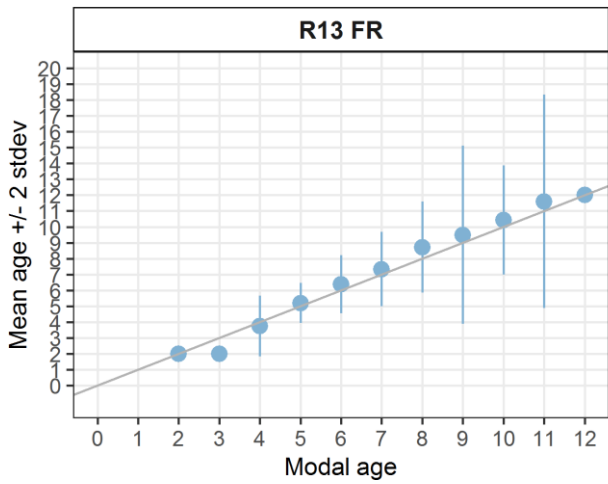
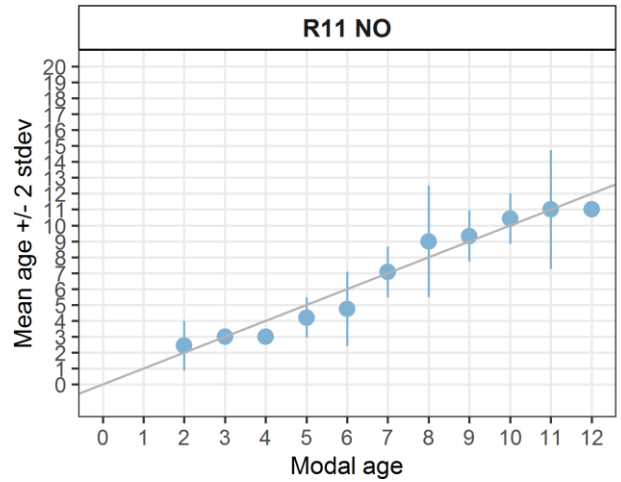
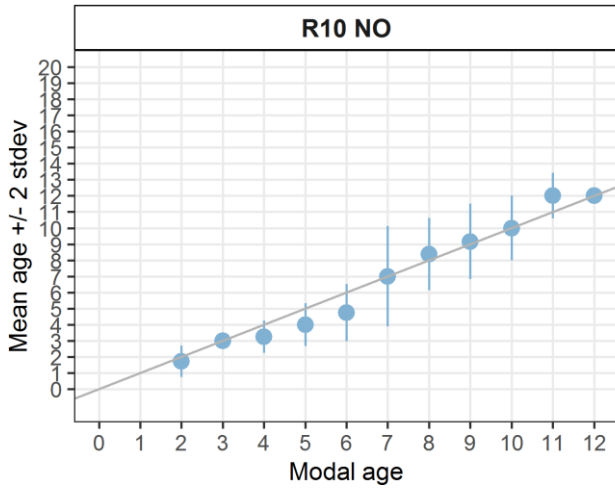


Figure 10.3.1: Age bias plot for all readers. Mean age recorded ± 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

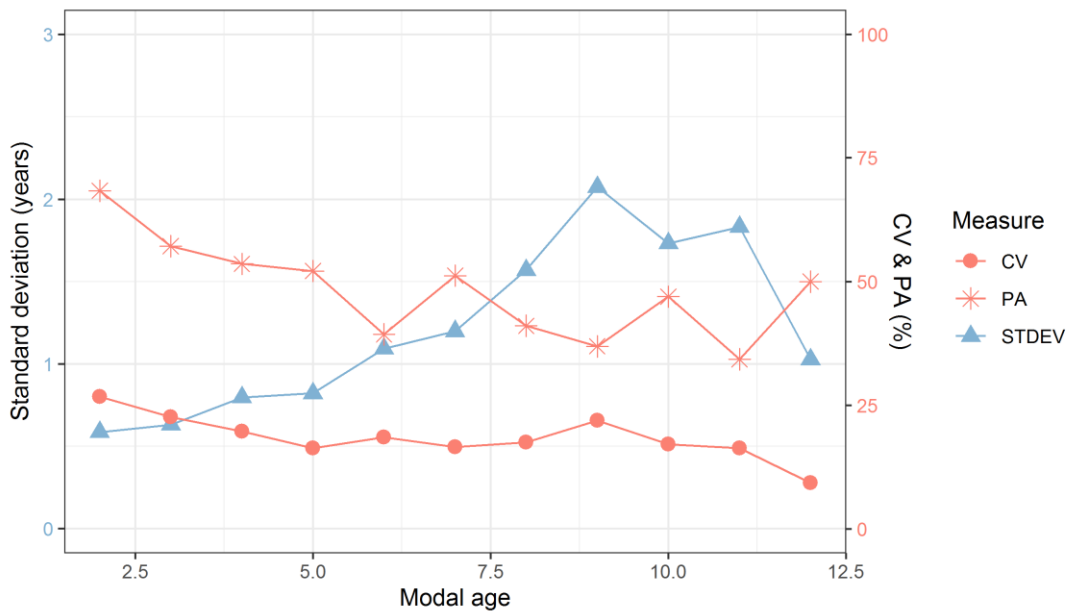


Figure 10.3.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

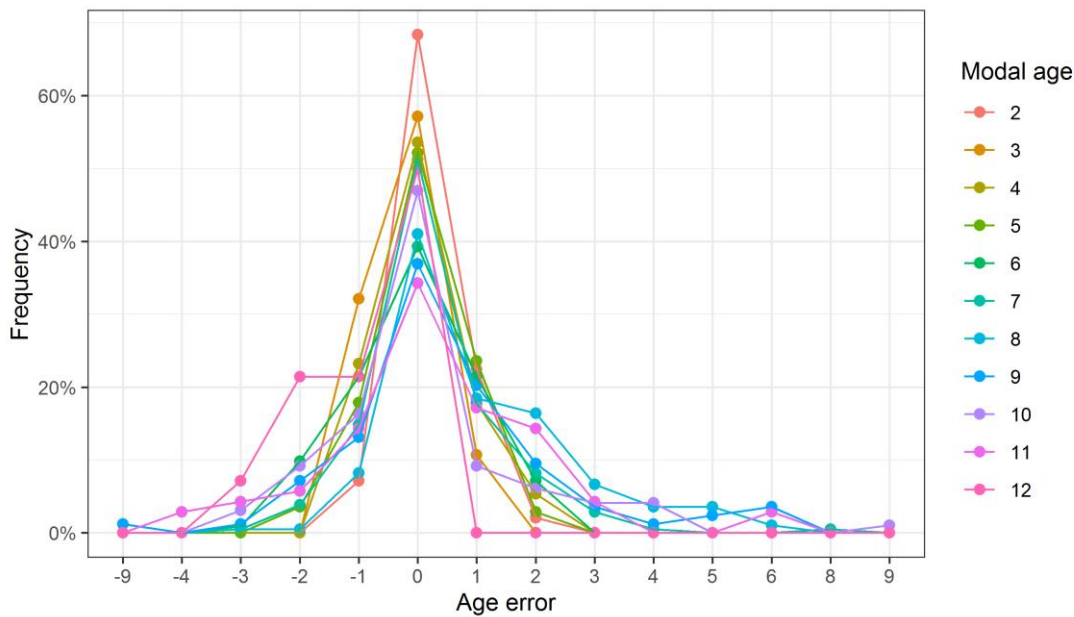


Figure 10.3.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

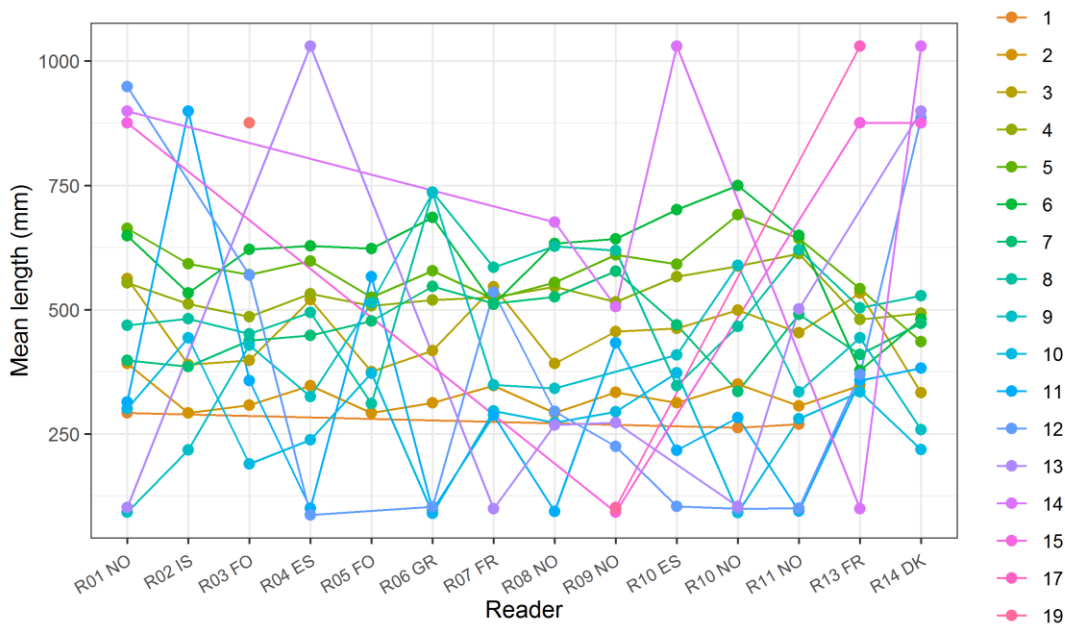


Figure 10.3.4: The mean length at age as estimated by each age reader.

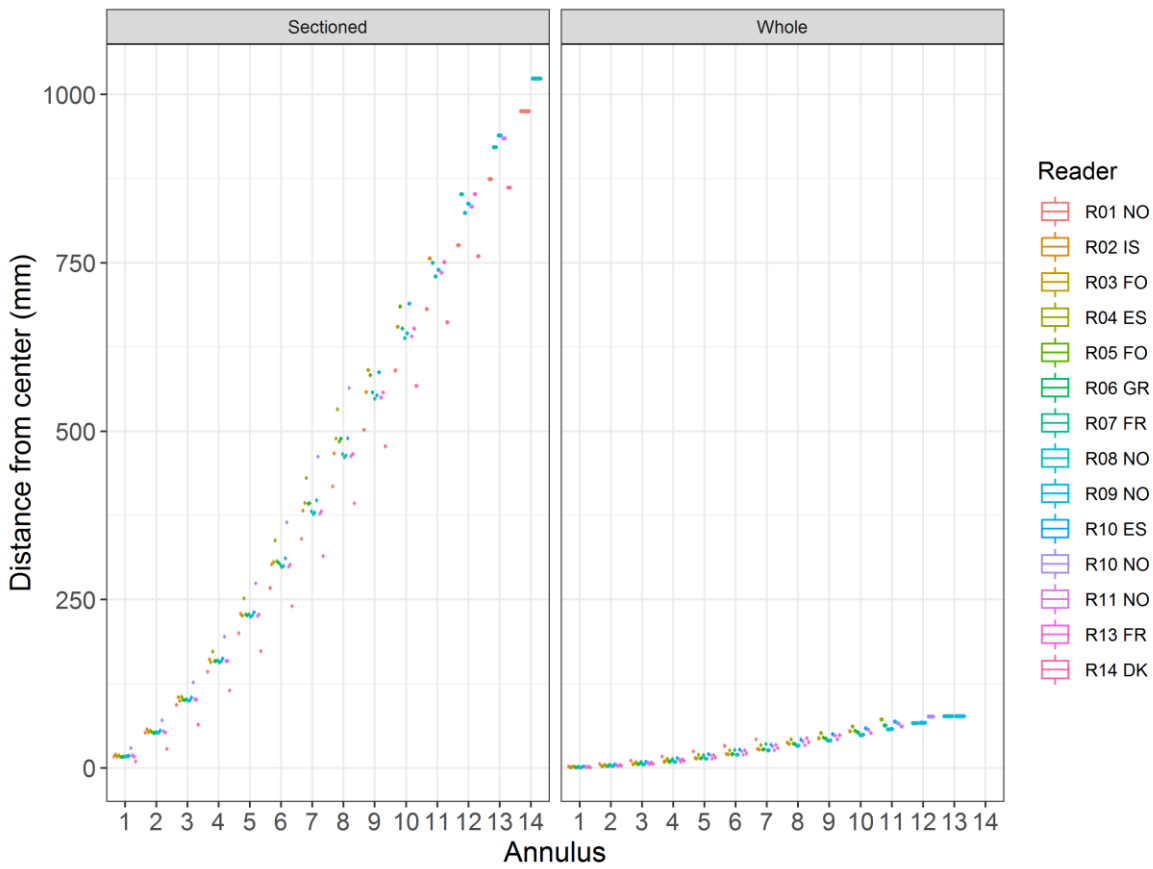


Figure 10.3.5: Plot of average distance from the centre to the winter rings for advanced readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.3.5: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	length	sex	Catch date	ICES area	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK	Modal age	PA %	CV %	APE %
4429	317	-	902	-	11/10/2009 00:00:00	27.7.c	10	8	9	8	9	12	8	33	16	12
4430	317	-	899	-	19/03/2013 00:00:00	27.7	14	11	9	8	10	13	8	17	21	17
4431	317	-	868	-	19/03/2013 00:00:00	27.7	12	8	11	7	8	12	8	33	23	21
4432	317	-	876	-	19/03/2013 00:00:00	27.7	15	10	0	9	10	15	10	33	56	36
4433	317	-	662	-	29/04/2015 00:00:00	27.7	8	6	6	5	6	8	6	50	19	15
4434	317	-	949	-	08/09/2015 00:00:00	27.7.c	8	8	9	8	10	11	8	50	14	11
4435	317	-	336	-	22/09/2015 00:00:00	27.7.c	1	2	3	2	2	3	2	50	35	26
4436	317	-	255	-	22/09/2015 00:00:00	27.7.c	1	2	2	2	2	3	2	67	32	17
4437	317	-	269	-	22/09/2015 00:00:00	27.7.c	1	2	2	2	2	3	2	67	32	17
4438	317	-	307	-	22/09/2015 00:00:00	27.7.c	1	2	2	2	2	3	2	67	32	17
4439	317	-	348	-	22/09/2015 00:00:00	27.7.c	2	3	2	2	3	3	2	50	22	20
4440	317	-	395	-	22/09/2015 00:00:00	27.7.c	2	3	4	2	3	4	2	33	30	22
4441	317	-	714	-	03/05/2016 00:00:00	27.7	7	6	7	6	7	8	7	50	11	8
4442	317	-	649	-	03/05/2016 00:00:00	27.7	6	7	6	5	7	7	7	50	13	11
4443	317	-	595	-	03/05/2016 00:00:00	27.7	5	6	6	5	6	6	6	67	9	8
4444	317	-	604	-	03/05/2016 00:00:00	27.7	6	6	6	5	6	8	6	67	16	10
4445	317	-	726	-	03/05/2016 00:00:00	27.7	7	6	7	7	7	9	7	67	14	9
4446	317	-	739	-	03/05/2016 00:00:00	27.7	7	7	7	7	7	7	7	100	0	0
4447	317	-	770	-	29/11/2016 00:00:00	27.7	8	7	8	6	7	6	6	33	13	10
4448	317	-	755	-	29/11/2016 00:00:00	27.7	10	7	7	8	7	7	7	67	16	12
4449	317	-	546	-	16/09/2016 00:00:00	27.7.c	3	4	4	4	4	5	4	67	16	8
4450	317	-	456	-	20/09/2016 00:00:00	27.7.c	2	3	3	2	4	3	3	50	27	20
4451	317	-	358	-	20/09/2016 00:00:00	27.7.c	2	3	2	2	3	3	2	50	22	20
4452	317	-	401	-	24/09/2016 00:00:00	27.7.c	2	4	3	2	3	4	2	33	30	22
4453	317	-	520	-	25/09/2016	27.7.c	3	4	4	3	4	5	4	50	20	14

					00:00:00											
4454	317	-	588	-	14/03/2017	27.7	5	5	7	6	6	7	5	33	15	11
					00:00:00											
4455	317	-	530	-	14/03/2017	27.7	4	4	5	4	5	6	4	50	17	14
					00:00:00											
4456	317	-	570	-	14/03/2017	27.7	6	4	7	4	6	6	6	50	22	18
					00:00:00											
4457	317	-	654	-	14/03/2017	27.7	5	5	6	5	6	8	5	50	20	14
					00:00:00											
4458	317	-	610	-	14/03/2017	27.7	6	6	6	5	6	5	6	67	9	8
					00:00:00											
4459	317	-	1030	-	14/03/2017	27.7	12	10	12	13	11	14	12	33	12	8
					00:00:00											
4460	317	-	990	-	14/03/2017	27.7	7	8	8	8	9	8	8	67	8	4
					00:00:00											
4461	317	-	938	-	14/03/2017	27.7	8	9	10	9	9	10	9	50	8	6
					00:00:00											
4462	317	-	480	-	18/05/2017	27.7	4	5	4	4	5	6	4	50	17	14
					00:00:00											
4463	317	-	550	-	18/05/2017	27.7	5	5	6	5	5	6	5	67	10	8
					00:00:00											
4464	317	-	515	-	18/05/2017	27.7	4	4	6	5	5	5	5	50	16	11
					00:00:00											
4465	317	-	680	-	18/05/2017	27.7	4	5	6	5	7	5	5	50	19	15
					00:00:00											
4466	317	-	552	-	18/05/2017	27.7	4	5	6	5	5	6	5	50	15	11
					00:00:00											
4467	317	-	690	-	18/05/2017	27.7	5	5	6	6	6	6	6	67	9	8
					00:00:00											
4468	317	-	808	-	18/05/2017	27.7	6	7	9	7	7	7	7	67	14	9
					00:00:00											
4469	317	-	500	-	18/05/2017	27.7	4	4	5	5	5	4	4	50	12	11
					00:00:00											
4470	317	-	545	-	18/05/2017	27.7	4	5	6	5	5	4	5	50	16	11
					00:00:00											
4471	317	-	622	-	18/05/2017	27.7	3	6	5	5	6	4	5	33	24	18
					00:00:00											
4472	317	-	768	-	24/08/2017	27.7	5	7	6	6	8	6	6	50	16	12
					00:00:00											
4473	317	-	630	-	24/08/2017	27.7	4	6	5	5	6	6	6	50	15	12
					00:00:00											
4474	317	-	829	-	24/08/2017	27.7	7	7	8	7	8	7	7	67	7	6
					00:00:00											
4475	317	-	956	-	23/11/2017	27.7	11	8	9	10	10	9	9	33	11	9
					00:00:00											
4476	317	-	925	-	23/11/2017	27.7	8	8	8	7	9	8	8	67	8	4
					00:00:00											
4477	317	-	910	-	23/11/2017	27.7	7	8	8	8	9	8	8	67	8	4
					00:00:00											
4478	317	-	797	-	03/09/2017	27.7.c	5	7	7	6	8	6	6	33	16	13
					00:00:00											
4479	317	-	64	-	01/06/2017	27.5.a	7	7	7	7	7	6	7	83	6	4
					00:00:00											
4480	317	-	87	-	01/06/2017	27.5.a	8	8	9	10	8	8	8	67	10	8
					00:00:00											
4481	317	-	91	-	01/06/2017	27.5.a	7	8	10	11	10	9	10	33	16	13
					00:00:00											
4482	317	-	95	-	01/06/2017	27.5.a	11	9	10	11	10	11	11	50	8	6
					00:00:00											

4483	317	-	100	-	01/06/2017 00:00:00	27.5.a	9	9	10	10	9	10	9	50	6	5
4484	317	-	87	-	01/06/2017 00:00:00	27.5.a	10	9	10	12	10	9	10	50	11	7
4485	317	-	88	-	01/06/2017 00:00:00	27.5.a	8	7	8	10	8	7	8	50	14	8
4486	317	-	104	-	01/06/2017 00:00:00	27.5.a	11	9	11	11	10	10	11	50	8	6
4487	317	-	109	-	01/06/2017 00:00:00	27.5.a	9	10	12	11	10	10	10	50	10	8
4488	317	-	69	-	01/06/2017 00:00:00	27.5.a	7	7	7	7	7	6	7	83	6	4
4489	317	-	91	-	03/03/2018 00:00:00	27.5.a	9	8	8	9	8	9	8	50	6	6
4491	317	-	86	-	03/03/2018 00:00:00	27.5.a	7	7	8	7	8	7	7	67	7	6
4492	317	-	99	-	03/03/2018 00:00:00	27.5.a	9	9	10	10	10	10	10	67	5	5
4493	317	-	95	-	03/03/2018 00:00:00	27.5.a	7	8	9	9	9	7	9	50	12	10
4494	317	-	99	-	03/03/2018 00:00:00	27.5.a	10	10	11	9	10	10	10	67	6	3
4495	317	-	82	-	03/03/2018 00:00:00	27.5.a	9	7	8	8	8	8	8	67	8	4
4496	317	-	96	-	03/03/2018 00:00:00	27.5.a	8	8	9	9	9	9	9	67	6	5
4497	317	-	92	-	03/03/2018 00:00:00	27.5.a	7	7	9	8	9	8	7	33	11	8
4498	317	-	92	-	03/03/2018 00:00:00	27.5.a	10	8	10	8	9	9	8	33	10	7
4499	317	-	84	-	16/12/2017 00:00:00	27.5.a	10	7	9	7	8	7	7	50	16	12
4500	317	-	90	-	16/12/2017 00:00:00	27.5.a	8	7	8	8	8	8	8	83	5	4
4501	317	-	82	-	16/12/2017 00:00:00	27.5.a	9	8	9	9	8	10	9	50	9	6
4502	317	-	87	-	16/12/2017 00:00:00	27.5.a	10	8	9	8	8	9	8	50	9	8
4503	317	-	100	-	16/12/2017 00:00:00	27.5.a	11	9	10	10	10	9	10	50	8	6
4504	317	-	69	-	16/12/2017 00:00:00	27.5.a	7	6	7	6	7	6	6	50	8	8
4505	317	-	101	-	16/12/2017 00:00:00	27.5.a	7	6	8	7	-	5	7	40	17	13
4506	317	-	102	-	16/12/2017 00:00:00	27.5.a	13	10	10	11	11	11	11	50	10	6
4507	317	-	81	-	16/12/2017 00:00:00	27.5.a	9	7	7	8	7	6	7	50	14	11
4508	317	-	78	-	16/12/2017 00:00:00	27.5.a	8	7	7	7	7	5	7	67	14	9

Table 10.3.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK	total
2	8	8	8	8	8	8	48
3	1	1	1	1	1	1	6
4	5	5	5	5	5	5	30

5	8	8	8	8	8	8	48
6	11	11	11	11	11	11	66
7	15	15	15	15	14	15	89
8	14	14	14	14	14	14	84
9	6	6	6	6	6	6	36
10	7	7	7	7	7	7	42
11	3	3	3	3	3	3	18
12	1	1	1	1	1	1	6
Total	79	79	79	79	78	79	473

Table 10.3.7: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK
0	0	0	1	0	0	0
1	4	0	0	0	0	0
2	5	4	5	9	4	0
3	3	4	3	1	4	7
4	8	7	4	4	3	5
5	7	8	4	14	7	7
6	5	10	13	7	10	15
7	14	18	12	12	13	10
8	10	15	11	12	13	11
9	7	7	12	7	10	9
10	7	5	9	6	12	7
11	4	1	3	5	2	3
12	2	0	2	1	0	2
13	1	0	0	1	0	1
14	1	0	0	0	0	1
15	1	0	0	0	0	1
Total	79	79	79	79	78	79

Table 10.3.8: Mean 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	R01 NO	R02 IS	R03 FO	R04 ES	R05 FO	R14 DK
0	-	-	876 mm	-	-	-
1	292 mm	-	-	-	-	-
2	392 mm	292 mm	307 mm	347 mm	292 mm	-
3	563 mm	389 mm	398 mm	520 mm	376 mm	333 mm
4	554 mm	512 mm	485 mm	532 mm	507 mm	493 mm
5	663 mm	592 mm	570 mm	598 mm	525 mm	436 mm
6	648 mm	533 mm	621 mm	628 mm	622 mm	481 mm
7	398 mm	385 mm	438 mm	448 mm	477 mm	472 mm
8	468 mm	481 mm	451 mm	494 mm	311 mm	528 mm
9	92 mm	218 mm	428 mm	325 mm	514 mm	258 mm
10	301 mm	443 mm	189 mm	238 mm	372 mm	219 mm
11	314 mm	899 mm	357 mm	100 mm	566 mm	382 mm
12	949 mm	-	570 mm	87 mm	-	885 mm
13	102 mm	-	-	1030 mm	-	899 mm
14	899 mm	-	-	-	-	1030 mm
15	876 mm	-	-	-	-	876 mm
Weighted Mean	445 mm	445 mm	445 mm	445 mm	450 mm	445 mm

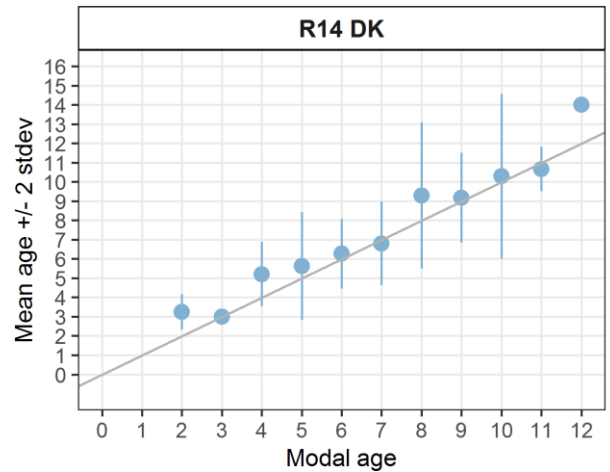
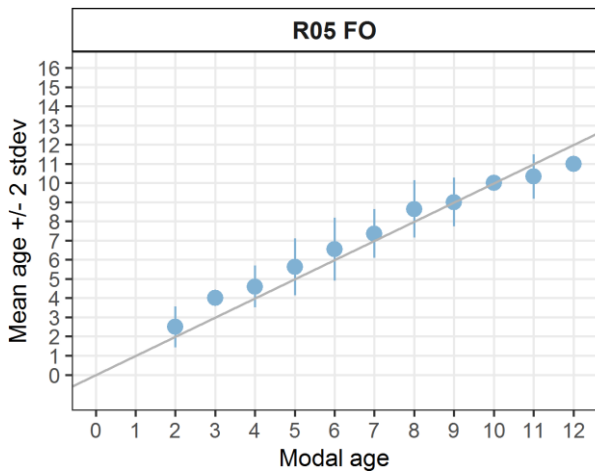
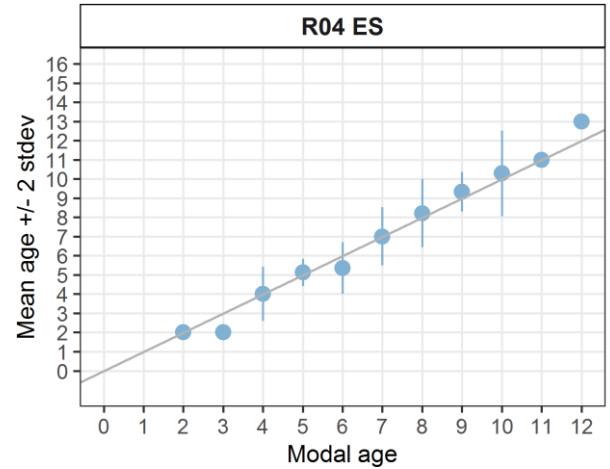
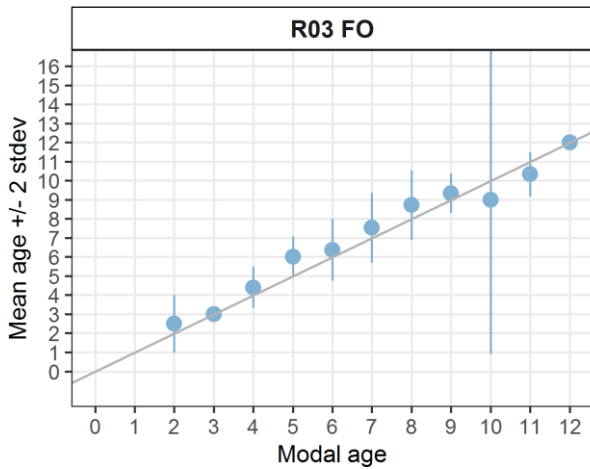
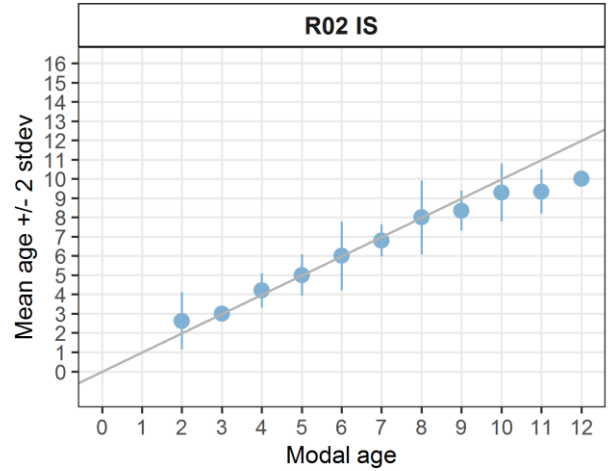
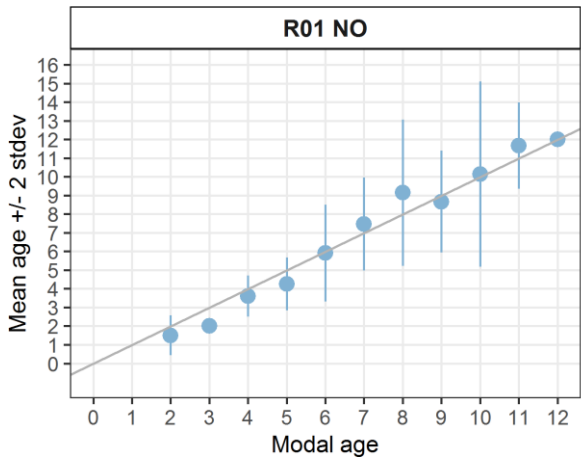


Figure 10.3.6: Age bias plot for advanced readers. Mean age recorded \pm 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

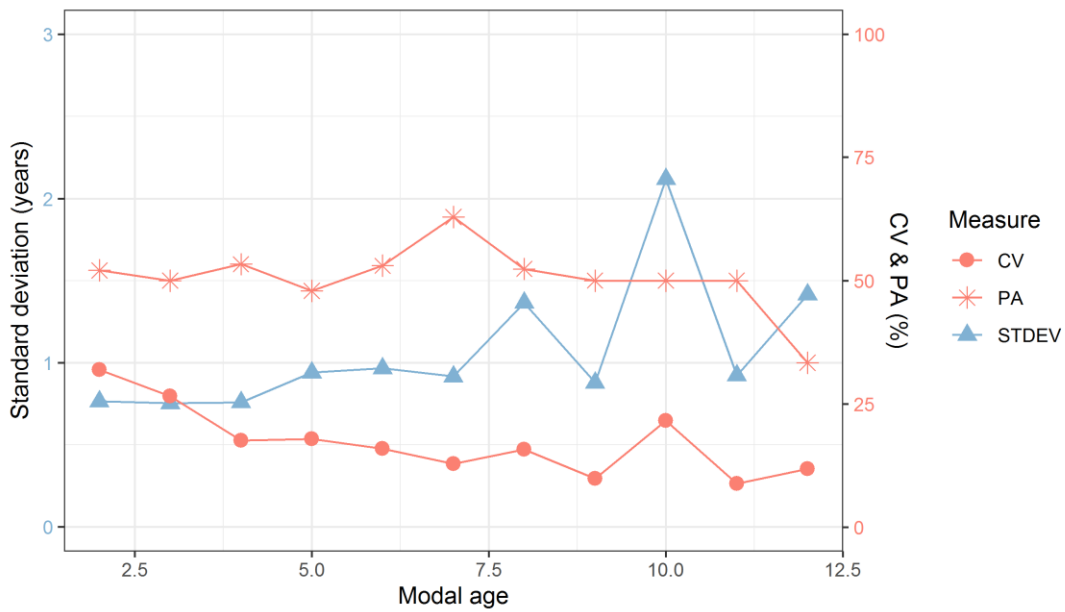


Figure 10.3.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

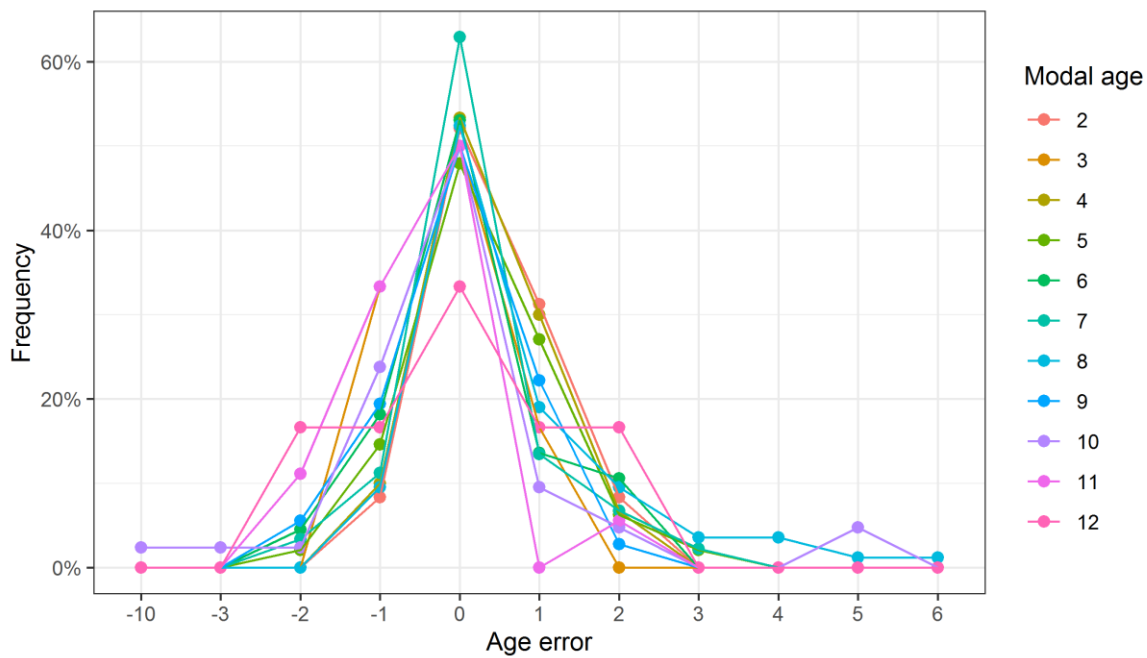


Figure 10.3.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

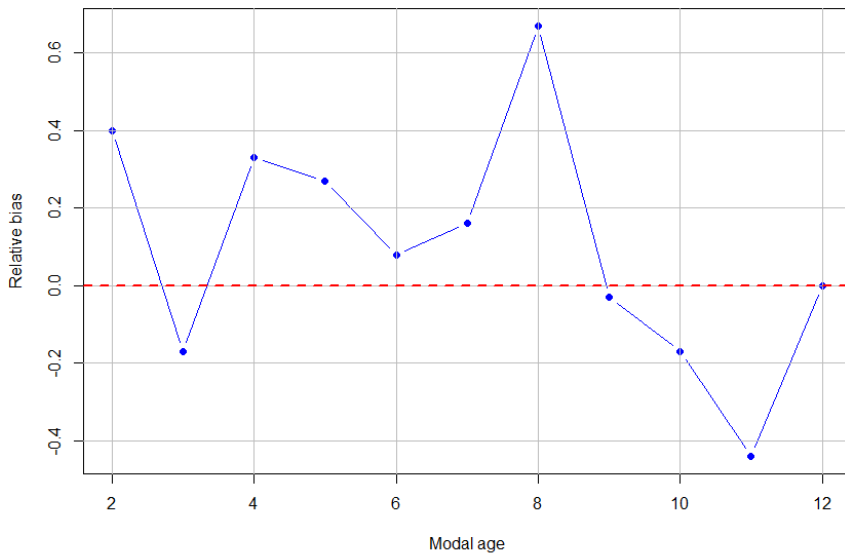


Figure 10.3.9: The relative bias by modal age as estimated by all age readers combined.

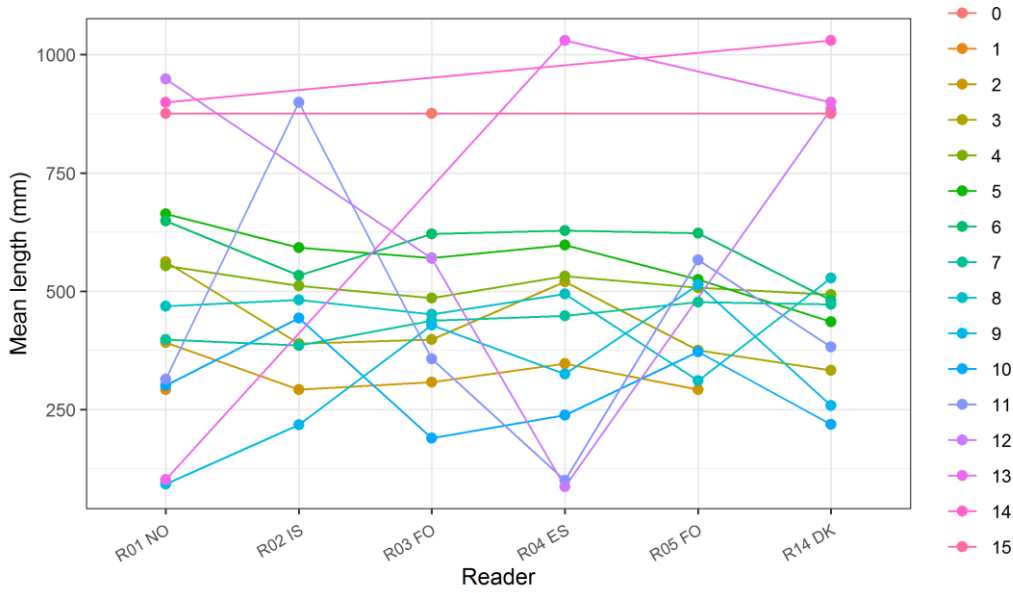


Figure 10.3.10: The mean length at age as estimated by each age reader.

10.4 Results blue ling

All readers

Data Overview

Table 10.4.1: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	Length	Sex	Catch date	ICES area	R0		R0		R0		R0		R0		R1	R1	R1	R1	Modal age	P A %	C V %	AP E %
							R0 1	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	R0 8	R0 9	R0 0								
4509	318	-	1080	-	24/03/2017	27.6.a	11	12	11	12	11	11	11	11	12	10	11	12	11	11	62	5	4	
					00:00:00																			
4510	318	-	1110	-	24/03/2017	27.6.a	14	15	12	14	11	13	13	13	16	14	15	12	15	13	23	1	9	
					00:00:00																			
4511	318	-	1170	-	24/03/2017	27.6.a	13	12	12	12	11	12	14	12	13	12	14	13	14	12	46	8	6	
					00:00:00																			
4512	318	-	1200	-	24/03/2017	27.6.a	14	15	14	16	13	14	15	14	16	14	17	16	16	14	38	8	7	
					00:00:00																			
4513	318	-	1150	-	24/03/2017	27.6.a	15	18	13	17	13	14	14	14	16	13	16	14	17	14	31	1	10	
					00:00:00																			
4514	318	-	1270	-	24/03/2017	27.6.a	20	22	13	22	15	19	20	20	21	17	22	18	21	20	23	1	11	
					00:00:00																			
4515	318	-	900	-	24/03/2017	27.6.a	10	10	9	10	9	8	9	9	10	9	10	9	9	9	54	7	6	
					00:00:00																			
4516	318	-	950	-	24/03/2017	27.6.a	31	31	11	31	15	30	17	30	31	26	33	16	11	31	31	3	32	
					00:00:00																			
4517	318	-	980	-	24/03/2017	27.6.a	17	18	9	19	11	16	15	18	20	15	19	11	11	11	23	2	20	
					00:00:00																			
4518	318	-	710	-	24/03/2017	27.6.a	9	3	6	4	7	5	6	3	4	4	6	4	8	4	31	3	29	
					00:00:00																			
4519	318	-	760	-	24/03/2017	27.6.a	9	4	7	4	10	5	6	4	3	4	6	6	7	4	31	3	28	
					00:00:00																			
4520	318	-	770	-	24/03/2017	27.6.a	6	4	7	5	8	6	5	4	4	3	6	6	6	6	38	2	21	
					00:00:00																			
4521	318	-	780	-	24/03/2017	27.6.a	3	4	7	5	6	5	4	4	4	3	4	4	5	4	46	2	20	
					00:00:00																			
4522	318	-	920	-	24/03/2017	27.6.a	11	12	10	12	10	12	10	11	13	6	13	12	10	10	31	1	12	
					00:00:00																			
4523	318	-	960	-	24/03/2017	27.6.a	11	13	10	13	10	11	11	-	13	7	12	11	11	11	42	1	10	
					00:00:00																			

452	318	-	970	-	24/03/2017	27.6	19	18	12	19	13	18	17	19	20	16	21	17	15	19	2	1	12
4					00:00:00	.a															3	5	
452	318	-	920	-	24/03/2017	27.6	11	13	9	12	8	10	10	9	10	8	12	10	10	10	3	1	11
5					00:00:00	.a															8	5	
452	318	-	990	-	24/03/2017	27.6	17	17	11	17	11	15	15	15	17	14	15	14	17	17	3	1	10
6					00:00:00	.a															8	4	
452	318	-	107	-	24/03/2017	27.6	20	22	12	21	11	19	19	19	21	18	21	18	20	19	2	1	13
7			0		00:00:00	.a															3	8	
452	318	-	112	-	24/03/2017	27.6	17	19	14	17	12	16	17	17	19	16	20	15	17	17	3	1	9
8			0		00:00:00	.a															8	3	
452	318	-	123	-	24/03/2017	27.6	21	22	13	22	13	21	21	22	22	21	23	21	23	21	3	1	11
9			0		00:00:00	.a															8	6	
453	318	-	125	-	24/03/2017	27.6	20	19	16	16	13	17	18	17	16	16	17	15	18	16	3	1	8
0			0		00:00:00	.a															1	1	
453	318	-	130	-	24/03/2017	27.6	16	18	15	15	12	17	17	16	18	15	19	19	18	15	2	1	10
1			0		00:00:00	.a															3	2	
453	318	-	890	-	24/03/2017	27.6	10	11	8	9	8	13	10	8	9	9	15	10	11	8	2	2	15
2					00:00:00	.a															3	0	
453	318	-	108	-	24/03/2017	27.6	12	14	11	14	10	14	13	11	13	9	17	12	13	13	2	1	13
3			0		00:00:00	.a															3	6	
453	318	-	111	-	24/03/2017	27.6	14	15	13	15	11	14	14	14	16	12	16	12	15	14	3	1	8
4			0		00:00:00	.a															1	1	
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5			0		00:00:00	.a															3	2	
453	318	-	118	-	24/03/2017	27.6	12	13	11	11	10	12	13	10	12	10	14	10	13	10	3	1	10
6			0		00:00:00	.a															1	2	
453	318	-	124	-	24/03/2017	27.6	21	22	15	20	13	20	20	21	23	19	23	15	22	20	2	1	13
7			0		00:00:00	.a															3	7	
453	318	-	126	-	24/03/2017	27.6	21	23	16	24	13	26	23	21	23	18	27	12	21	21	2	2	18
8			0		00:00:00	.a															3	3	
453	318	-	930	-	24/03/2017	27.6	11	12	9	11	9	10	11	9	11	10	11	11	13	11	4	1	9
9					00:00:00	.a															6	1	
454	318	-	940	-	24/03/2017	27.6	14	15	11	14	12	14	14	14	13	13	16	14	15	14	4	9	7
0					00:00:00	.a															6		
454	318	-	970	-	24/03/2017	27.6	14	11	9	11	10	11	11	10	12	10	11	11	11	11	5	1	7
1					00:00:00	.a															4	1	
454	318	-	103	-	24/03/2017	27.6	15	15	12	16	14	17	16	13	16	13	17	13	17	13	2	1	10
2			0		00:00:00	.a															3	2	
454	318	-	106	-	24/03/2017	27.6	14	15	13	14	12	14	14	12	16	12	16	11	14	14	3	1	9
3			0		00:00:00	.a															8	1	

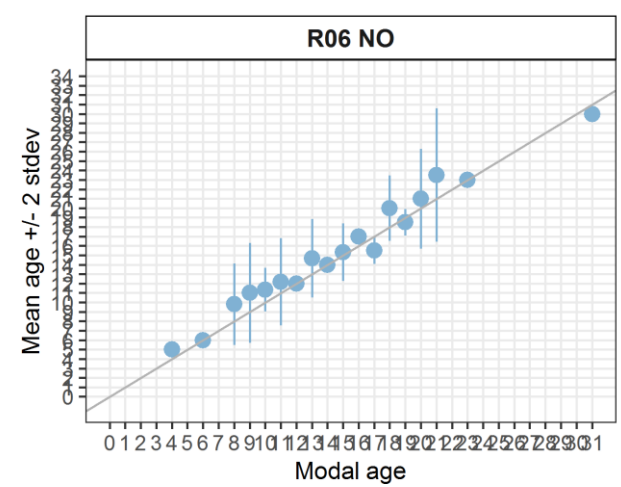
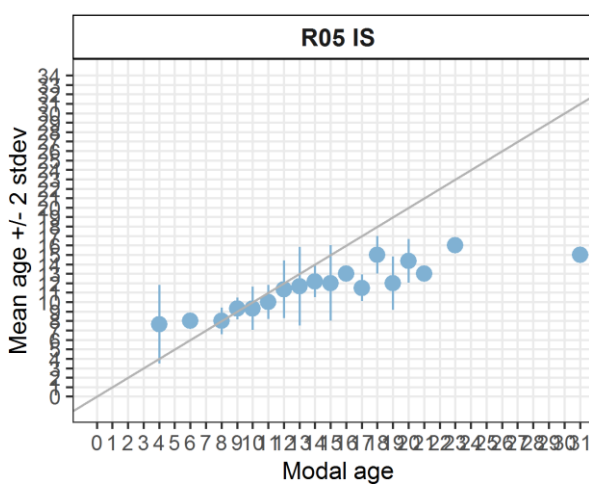
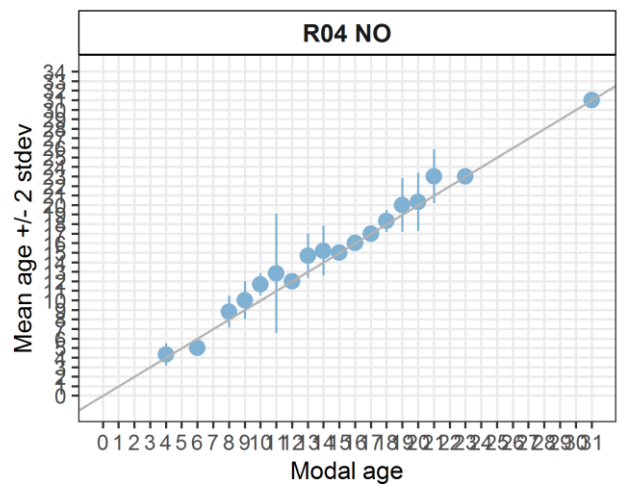
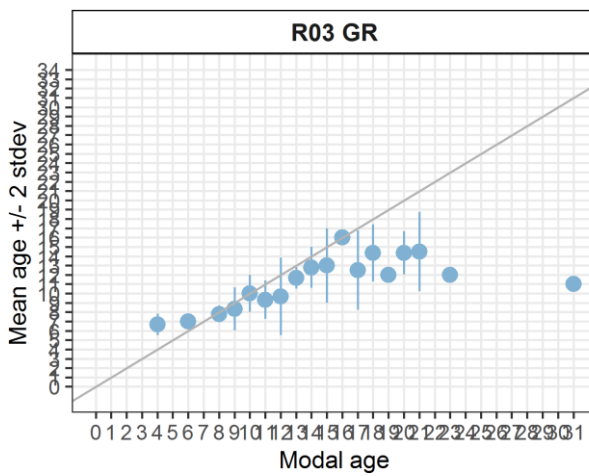
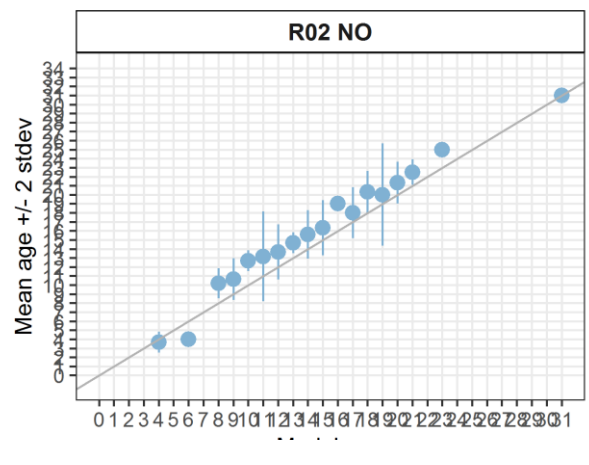
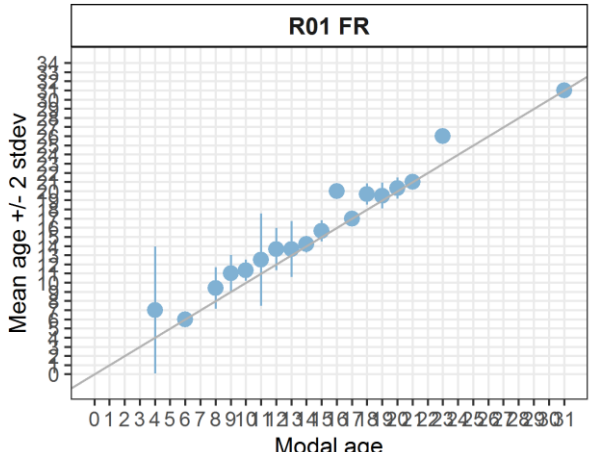
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13	3	3	3	3	3	3	3	3	3	3	3	3	3	39
14	5	5	5	5	5	5	5	5	5	5	5	5	5	65
15	3	3	3	3	3	3	3	3	3	3	3	3	3	39
16	1	1	1	1	1	1	1	1	1	1	1	1	1	13
17	2	2	2	2	2	2	2	2	2	2	2	2	2	26
18	3	3	3	3	3	3	3	3	3	3	3	3	3	39
19	2	2	2	2	2	2	2	2	2	2	2	2	2	26
20	3	3	3	3	3	3	3	3	3	3	3	3	3	39
21	2	2	2	2	2	2	2	2	2	2	2	2	2	26
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	1	1	1	1	1	1	1	1	1	1	1	1	0	12
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Total	50	50	50	50	50	50	50	49	50	50	50	50	49	648

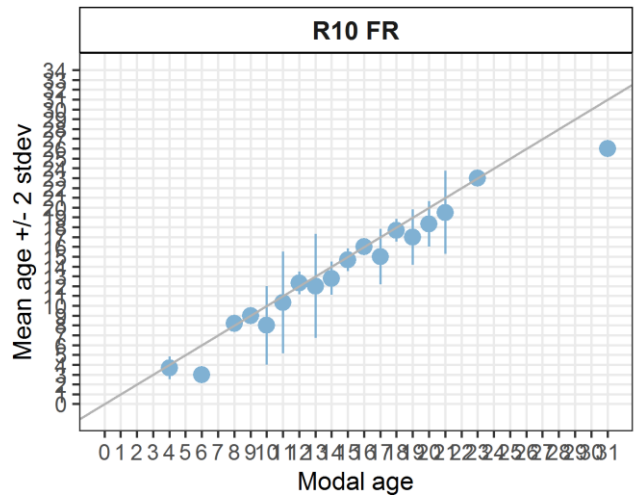
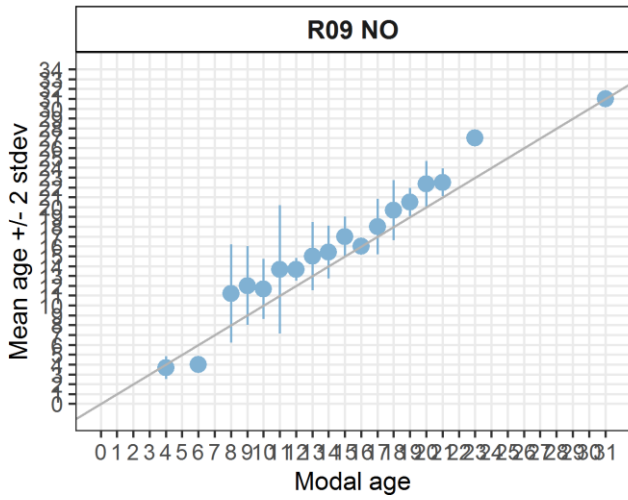
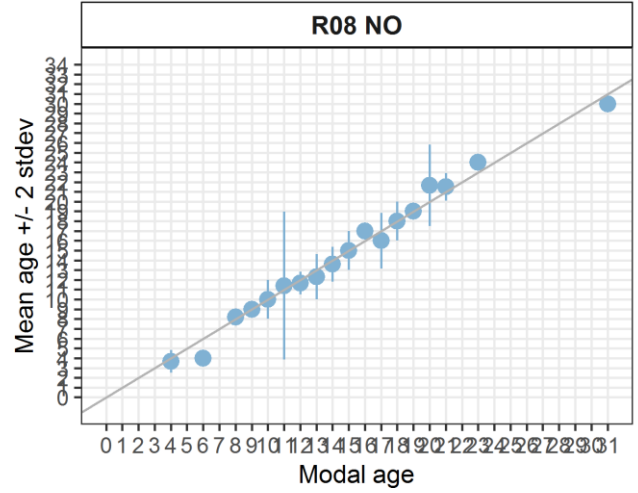
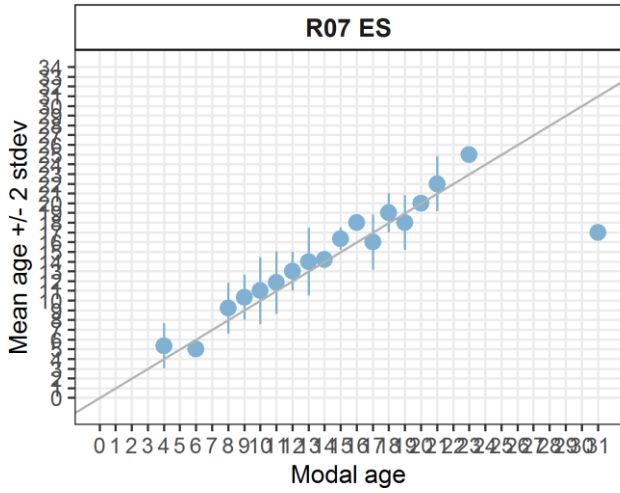
Table 10.4.3: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO
3	1	1	0	0	0	0	0	1	1	2	0	0	0
4	0	3	0	2	0	0	1	3	3	2	1	2	0
5	0	0	0	2	0	3	1	0	0	0	0	0	1
6	1	0	1	0	1	1	2	0	0	1	3	2	1
7	0	0	5	0	2	0	0	0	0	1	0	0	1
8	1	0	6	2	5	3	2	4	0	5	1	4	1
9	4	1	7	3	5	1	2	7	2	5	0	1	5
10	2	4	2	2	9	2	3	2	2	5	3	6	4
11	8	3	7	5	7	4	7	4	2	0	5	6	6
12	3	5	6	6	4	6	2	3	5	4	2	7	1
13	2	4	7	1	8	3	4	2	5	4	4	3	5
14	6	2	3	4	3	8	5	5	4	4	2	3	3
15	4	8	3	4	4	2	3	2	1	3	3	5	6
16	2	1	3	3	2	2	3	1	8	3	6	2	1
17	3	1	0	3	0	3	4	3	2	2	5	2	4
18	0	4	0	2	0	2	2	2	2	4	0	5	3
19	2	3	0	4	0	2	2	3	1	2	2	1	1
20	6	1	0	1	0	1	4	1	3	0	2	0	1
21	3	2	0	1	0	3	1	2	3	1	3	1	3
22	0	4	0	2	0	0	0	1	1	0	2	0	1
23	0	1	0	1	0	1	1	0	3	1	2	0	1
24	0	0	0	1	0	1	0	2	0	0	1	0	0
25	0	1	0	0	0	0	1	0	0	0	0	0	0
26	1	0	0	0	0	1	0	0	0	1	1	0	0
27	0	0	0	0	0	0	0	0	1	0	1	0	0
30	0	0	0	0	0	1	0	1	0	0	0	0	0
31	1	1	0	1	0	0	0	0	1	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	1	0	0
Total	50	50	50	50	50	50	50	49	50	50	50	50	49

Table 10.4.4: Mean 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	R01 FR	R02 NO	R03 GR	R04 NO	R05 IS	R06 NO	R07 ES	R08 NO	R09 NO	R10 FR	R11 ES	R12 FO	R13 FO
3	780 mm	710 mm	-	-	-	-	-	710 mm	760 mm	775 mm	-	-	-
4	-	770 mm	-	735 mm	-	-	780 mm	770 mm	753 mm	735 mm	780 mm	745 mm	-
5	-	-	-	775 mm	-	750 mm	770 mm	-	-	-	-	-	780 mm
6	770 mm	-	710 mm	-	780 mm	770 mm	735 mm	-	-	920 mm	747 mm	765 mm	770 mm
7	-	-	812 mm	-	800 mm	-	-	-	-	960 mm	-	-	760 mm
8	880 mm	-	885 mm	885 mm	862 mm	890 mm	890 mm	872 mm	-	884 mm	880 mm	875 mm	710 mm
9	798 mm	880 mm	929 mm	903 mm	882 mm	900 mm	895 mm	896 mm	890 mm	930 mm	-	900 mm	872 mm
10	895 mm	888 mm	940 mm	865 mm	957 mm	925 mm	910 mm	1075 mm	910 mm	1000 mm	897 mm	947 mm	915 mm
11	934 mm	897 mm	1019 mm	956 mm	1073 mm	960 mm	936 mm	998 mm	915 mm	-	934 mm	957 mm	972 mm
12	1040 mm	1004 mm	1073 mm	990 mm	1105 mm	1007 mm	890 mm	1057 mm	1006 mm	1070 mm	940 mm	1067 mm	840 mm
13	1055 mm	975 mm	1119 mm	960 mm	1155 mm	953 mm	1070 mm	1070 mm	1014 mm	1008 mm	898 mm	1047 mm	1008 mm
14	1065 mm	995 mm	1113 mm	1048 mm	1073 mm	1051 mm	1086 mm	1062 mm	888 mm	1052 mm	1175 mm	1027 mm	1047 mm
15	1000 mm	1038 mm	1250 mm	1088 mm	1102 mm	950 mm	1057 mm	1010 mm	830 mm	1103 mm	997 mm	1146 mm	1023 mm
16	1165 mm	1030 mm	1223 mm	1160 mm	1055 mm	1050 mm	990 mm	1300 mm	1102 mm	1113 mm	1038 mm	1075 mm	1200 mm
17	1030 mm	990 mm	-	1087 mm	-	1193 mm	1085 mm	1117 mm	1010 mm	1215 mm	1094 mm	1090 mm	1072 mm
18	-	1100 mm	-	1000 mm	-	975 mm	1115 mm	1070 mm	1230 mm	1082 mm	-	1100 mm	1190 mm
19	975 mm	1117 mm	-	1080 mm	-	1170 mm	1045 mm	1020 mm	1120 mm	1225 mm	1140 mm	1300 mm	1160 mm
20	1163 mm	1210 mm	-	1240 mm	-	1240 mm	1220 mm	1270 mm	977 mm	-	1050 mm	-	1070 mm
21	1243 mm	1090 mm	-	1070 mm	-	1137 mm	1230 mm	1250 mm	1120 mm	1230 mm	1020 mm	1230 mm	1247 mm
22	-	1202 mm	-	1250 mm	-	-	-	1230 mm	1230 mm	-	1215 mm	-	1240 mm
23	-	1260 mm	-	1090 mm	-	1090 mm	1260 mm	-	1237 mm	1090 mm	1235 mm	-	1230 mm
24	-	-	-	1260 mm	-	1210 mm	-	1150 mm	-	-	1210 mm	-	-
25	-	1090 mm	-	-	-	-	1090 mm	-	-	-	-	-	-
26	1090 mm	-	-	-	-	1260 mm	-	-	-	950 mm	1090 mm	-	-
27	-	-	-	-	-	-	-	-	1090 mm	-	1260 mm	-	-
30	-	-	-	-	-	950 mm	-	950 mm	-	-	-	-	-
31	950 mm	950 mm	-	950 mm	-	-	-	-	950 mm	-	-	-	-
33	-	-	-	-	-	-	-	-	-	-	950 mm	-	-
Weighted Mean	1012 mm	1012 mm	1012 mm	1012 mm	1012 mm	1012 mm	1012 mm	1013 mm	1012 mm	1012 mm	1012 mm	1012 mm	1011 mm





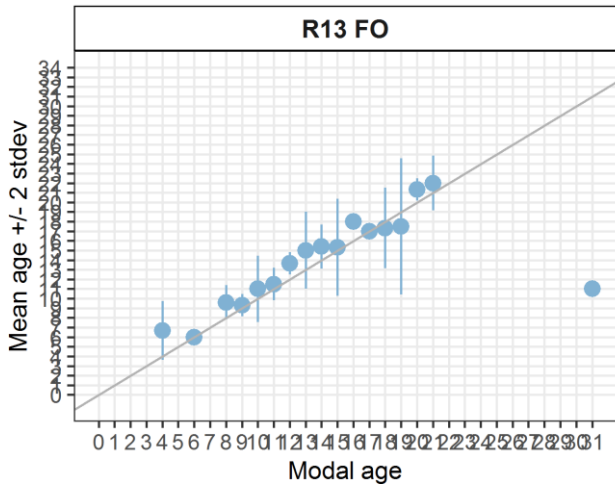
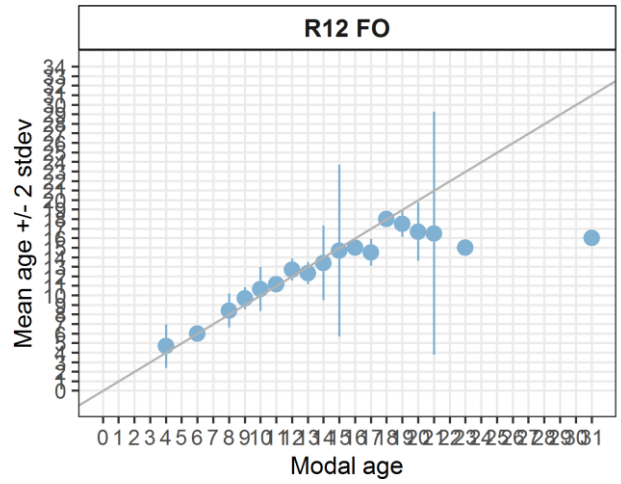
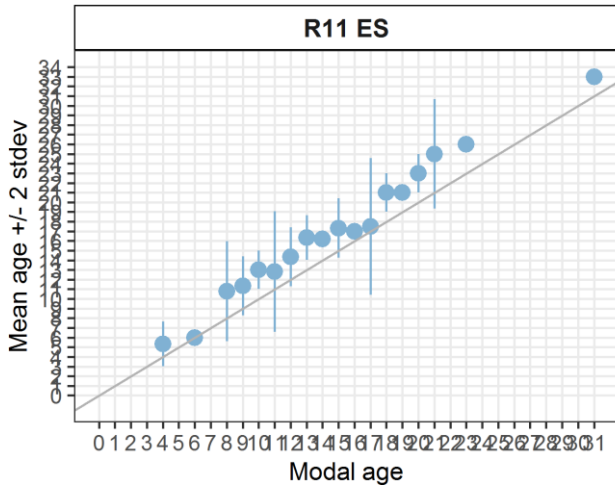


Figure 10.4.1: Age bias plot for advanced readers. Mean age recorded \pm 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

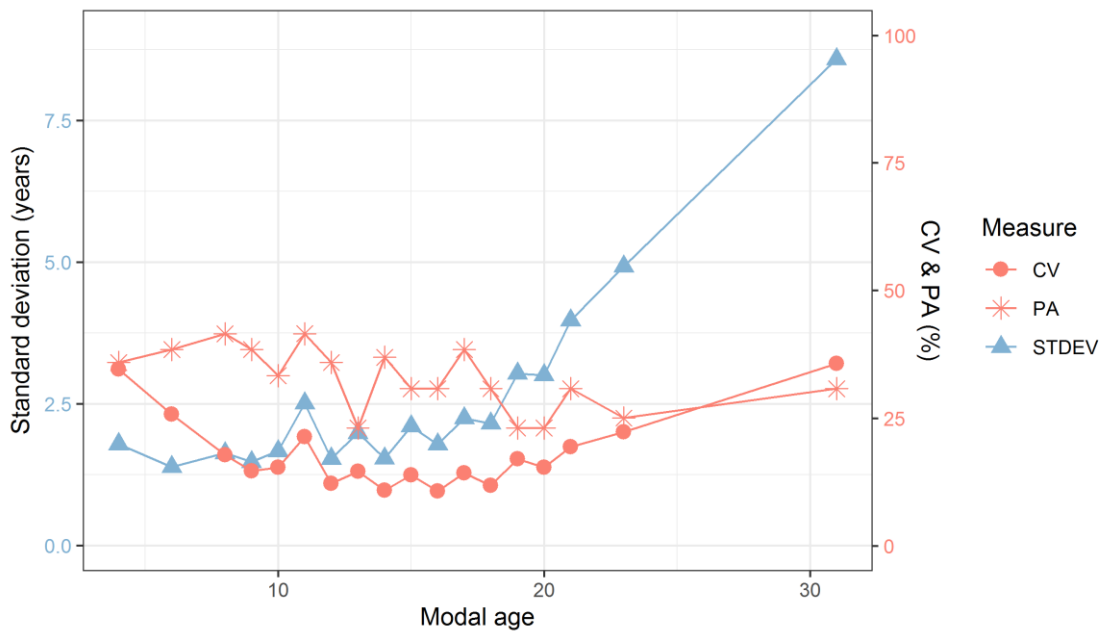


Figure 10.4.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

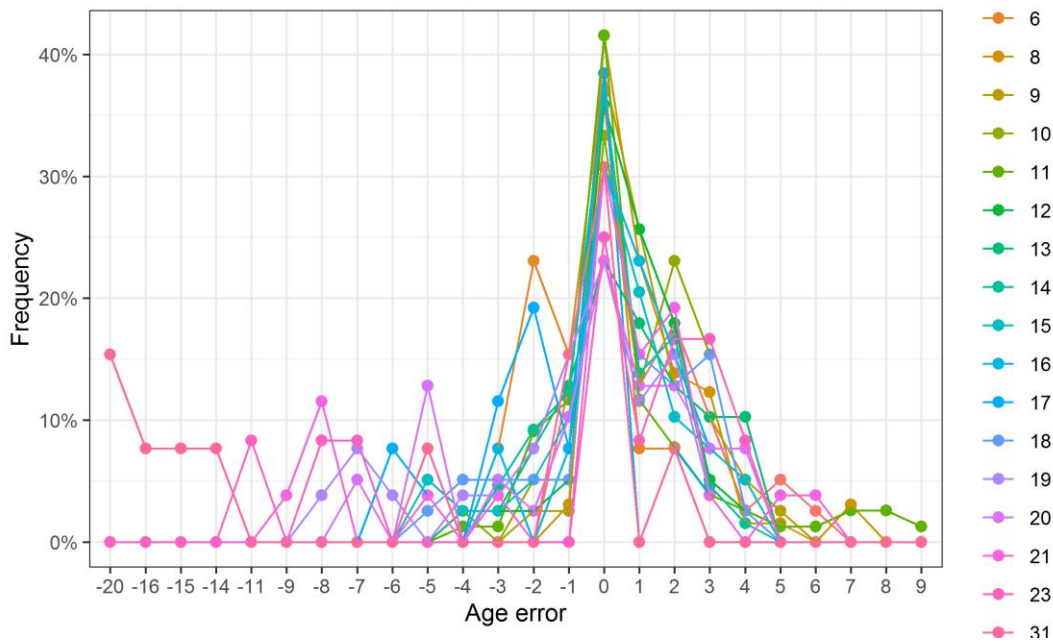


Figure 10.4.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

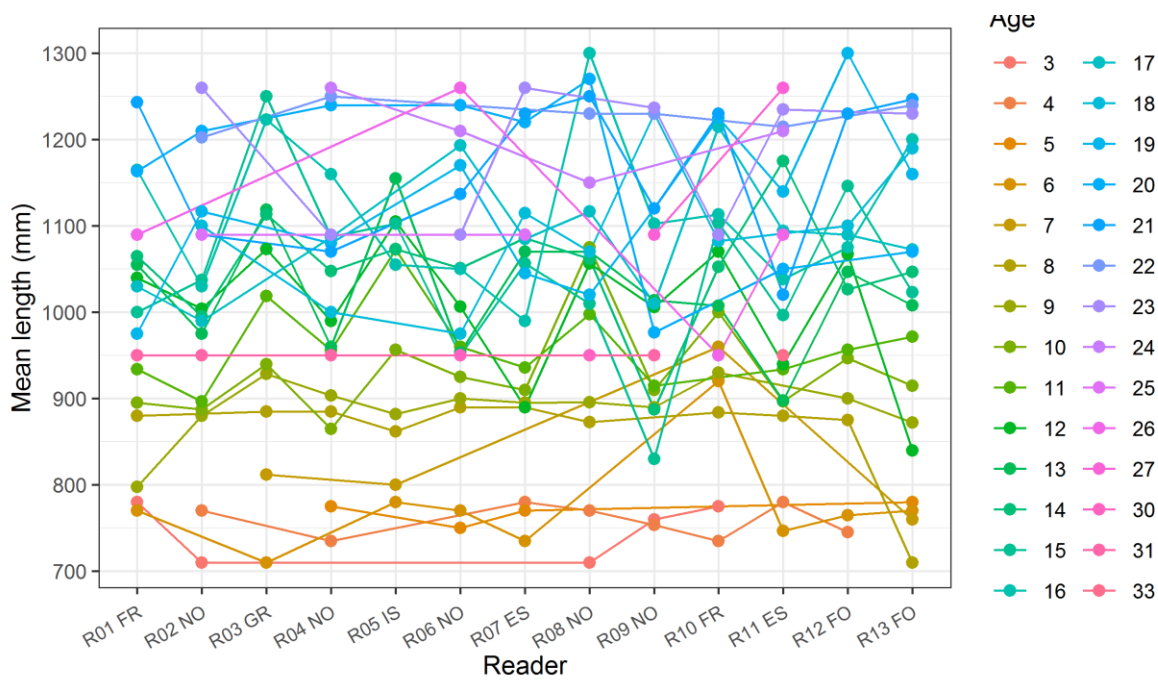


Figure 10.4.4: The mean length at age as estimated by each age reader.

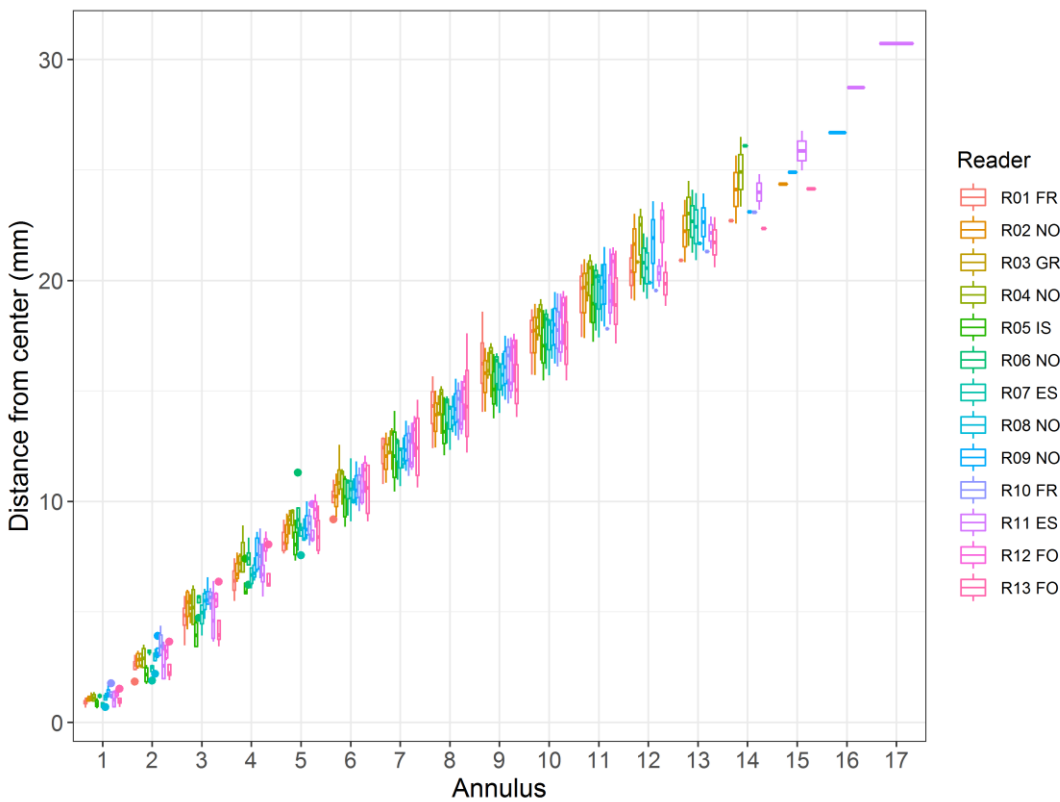


Figure 10.4.5: Plot of average distance from the centre to the winter rings for advanced readers by strata. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.4.5: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	length	sex	Catch date	ICES area	R01 FR	R04 NO	Modal age	PA %	CV %	APE %
4509	318	-	1080	-	24/03/2017 00:00:00	27.6.a	11	12	11	50	6	4
4510	318	-	1110	-	24/03/2017 00:00:00	27.6.a	14	14	14	100	0	0
4511	318	-	1170	-	24/03/2017 00:00:00	27.6.a	13	12	12	50	6	4
4512	318	-	1200	-	24/03/2017 00:00:00	27.6.a	14	16	14	50	9	7
4513	318	-	1150	-	24/03/2017 00:00:00	27.6.a	15	17	15	50	9	6
4514	318	-	1270	-	24/03/2017 00:00:00	27.6.a	20	22	20	50	7	5
4515	318	-	900	-	24/03/2017 00:00:00	27.6.a	10	10	10	100	0	0
4516	318	-	950	-	24/03/2017 00:00:00	27.6.a	31	31	31	100	0	0
4517	318	-	980	-	24/03/2017 00:00:00	27.6.a	17	19	17	50	8	6
4518	318	-	710	-	24/03/2017 00:00:00	27.6.a	9	4	4	50	54	38
4519	318	-	760	-	24/03/2017 00:00:00	27.6.a	9	4	4	50	54	38
4520	318	-	770	-	24/03/2017 00:00:00	27.6.a	6	5	5	50	13	9
4521	318	-	780	-	24/03/2017 00:00:00	27.6.a	3	5	3	50	35	25
4522	318	-	920	-	24/03/2017 00:00:00	27.6.a	11	12	11	50	6	4
4523	318	-	960	-	24/03/2017 00:00:00	27.6.a	11	13	11	50	12	8
4524	318	-	970	-	24/03/2017 00:00:00	27.6.a	19	19	19	100	0	0
4525	318	-	920	-	24/03/2017 00:00:00	27.6.a	11	12	11	50	6	4
4526	318	-	990	-	24/03/2017 00:00:00	27.6.a	17	17	17	100	0	0
4527	318	-	1070	-	24/03/2017 00:00:00	27.6.a	20	21	20	50	3	2
4528	318	-	1120	-	24/03/2017 00:00:00	27.6.a	17	17	17	100	0	0
4529	318	-	1230	-	24/03/2017 00:00:00	27.6.a	21	22	21	50	3	2
4530	318	-	1250	-	24/03/2017 00:00:00	27.6.a	20	16	16	50	16	11
4531	318	-	1300	-	24/03/2017 00:00:00	27.6.a	16	15	15	50	5	3
4532	318	-	890	-	24/03/2017 00:00:00	27.6.a	10	9	9	50	7	5
4533	318	-	1080	-	24/03/2017 00:00:00	27.6.a	12	14	12	50	11	8
4534	318	-	1110	-	24/03/2017 00:00:00	27.6.a	14	15	14	50	5	3
4535	318	-	1160	-	24/03/2017 00:00:00	27.6.a	20	19	19	50	4	3
4536	318	-	1180	-	24/03/2017 00:00:00	27.6.a	12	11	11	50	6	4
4537	318	-	1240	-	24/03/2017 00:00:00	27.6.a	21	20	20	50	3	2
4538	318	-	1260	-	24/03/2017 00:00:00	27.6.a	21	24	21	50	9	7
4539	318	-	930	-	24/03/2017 00:00:00	27.6.a	11	11	11	100	0	0
4540	318	-	940	-	24/03/2017 00:00:00	27.6.a	14	14	14	100	0	0
4541	318	-	970	-	24/03/2017 00:00:00	27.6.a	14	11	11	50	17	12
4542	318	-	1030	-	24/03/2017 00:00:00	27.6.a	15	16	15	50	5	3
4543	318	-	1060	-	24/03/2017 00:00:00	27.6.a	14	14	14	100	0	0
4544	318	-	830	-	24/03/2017 00:00:00	27.6.a	9	10	9	50	7	5
4545	318	-	840	-	24/03/2017 00:00:00	27.6.a	11	11	11	100	0	0
4546	318	-	860	-	24/03/2017 00:00:00	27.6.a	12	11	11	50	6	4
4547	318	-	880	-	24/03/2017 00:00:00	27.6.a	8	8	8	100	0	0
4548	318	-	900	-	24/03/2017 00:00:00	27.6.a	11	9	9	50	14	10
4549	318	-	910	-	24/03/2017 00:00:00	27.6.a	15	15	15	100	0	0
4550	318	-	920	-	24/03/2017 00:00:00	27.6.a	11	9	9	50	14	10
4551	318	-	940	-	24/03/2017 00:00:00	27.6.a	13	12	12	50	6	4
4552	318	-	980	-	24/03/2017 00:00:00	27.6.a	19	18	18	50	4	3
4553	318	-	1020	-	24/03/2017 00:00:00	27.6.a	20	18	18	50	7	5
4554	318	-	1030	-	24/03/2017 00:00:00	27.6.a	16	15	15	50	5	3
4555	318	-	1090	-	24/03/2017 00:00:00	27.6.a	26	23	23	50	9	6
4556	318	-	1210	-	24/03/2017 00:00:00	27.6.a	20	19	19	50	4	3

4557	318	-	890	-	24/03/2017 00:00:00	27.6.a	9	8	8	50	8	6
4558	318	-	910	-	24/03/2017 00:00:00	27.6.a	15	12	12	50	16	11

Table 10.4.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 FR	R04 NO	total
3	1	1	2
4	2	2	4
5	1	1	2
6	0	0	0
7	0	0	0
8	2	2	4
9	4	4	8
10	1	1	2
11	9	9	18
12	4	4	8
13	0	0	0
14	5	5	10
15	5	5	10
16	1	1	2
17	3	3	6
18	2	2	4
19	3	3	6
20	3	3	6
21	2	2	4
22	0	0	0
23	1	1	2
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
31	1	1	2
Total	50	50	100

Table 10.4.7: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 FR	R04 NO
3	1	0
4	0	2
5	0	2
6	1	0
8	1	2
9	4	3
10	2	2
11	8	5
12	3	6
13	2	1
14	6	4
15	4	4
16	2	3
17	3	3
18	0	2
19	2	4
20	6	1

21	3	1
22	0	2
23	0	1
24	0	1
26	1	0
31	1	1
Total	50	50

Table 10.4.8: Mean 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	R01 FR	R04 NO
3	780 mm	-
4	-	735 mm
5	-	775 mm
6	770 mm	-
8	880 mm	885 mm
9	798 mm	903 mm
10	895 mm	865 mm
11	934 mm	956 mm
12	1040 mm	990 mm
13	1055 mm	960 mm
14	1065 mm	1048 mm
15	1000 mm	1088 mm
16	1165 mm	1160 mm
17	1030 mm	1087 mm
18	-	1000 mm
19	975 mm	1080 mm
20	1163 mm	1240 mm
21	1243 mm	1070 mm
22	-	1250 mm
23	-	1090 mm
24	-	1260 mm
26	1090 mm	-
31	950 mm	950 mm
Weighted Mean	1012 mm	1012 mm

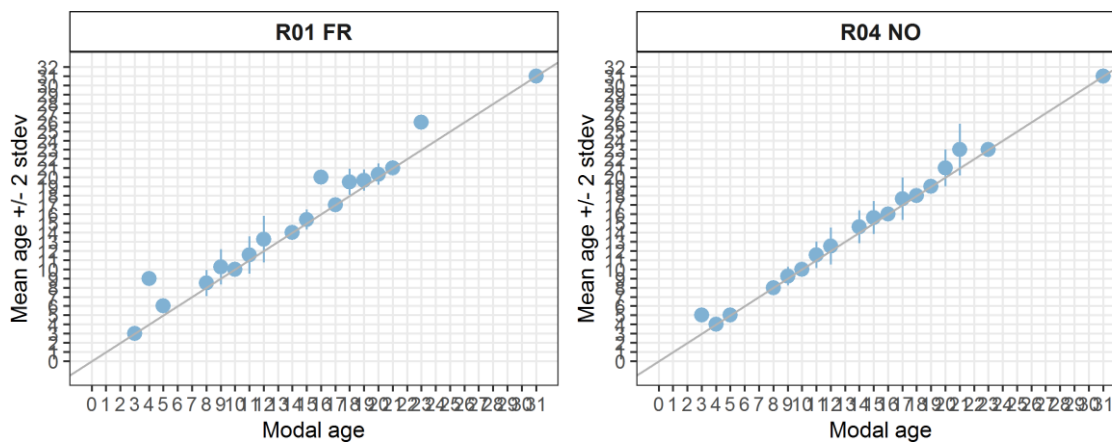


Figure 10.4.6: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

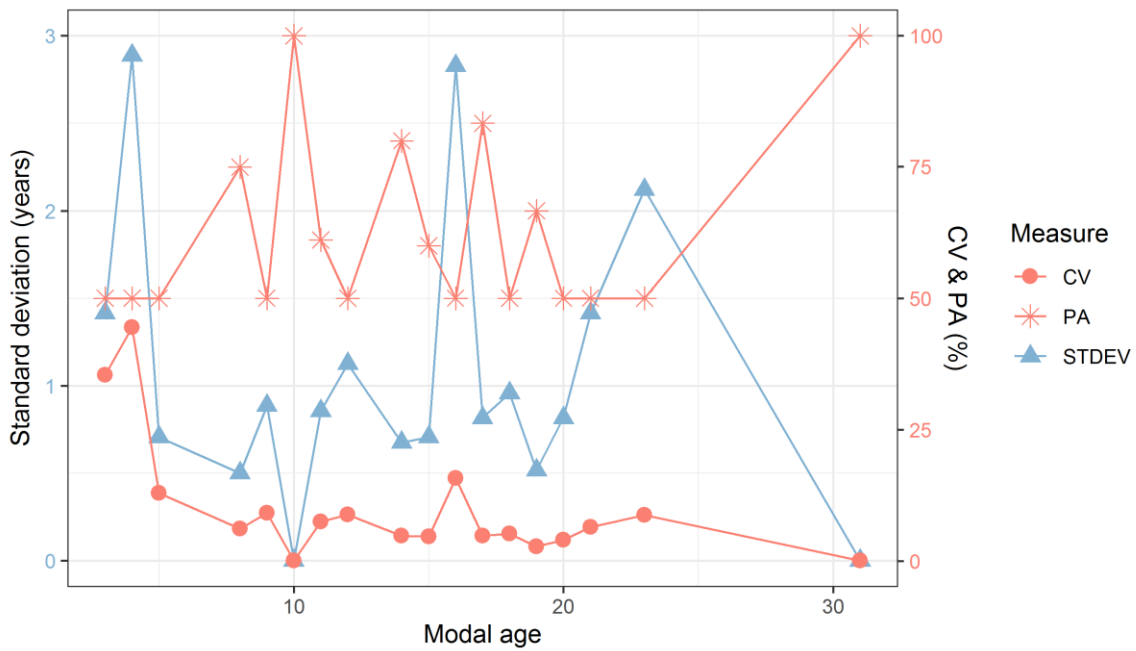


Figure 10.4.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

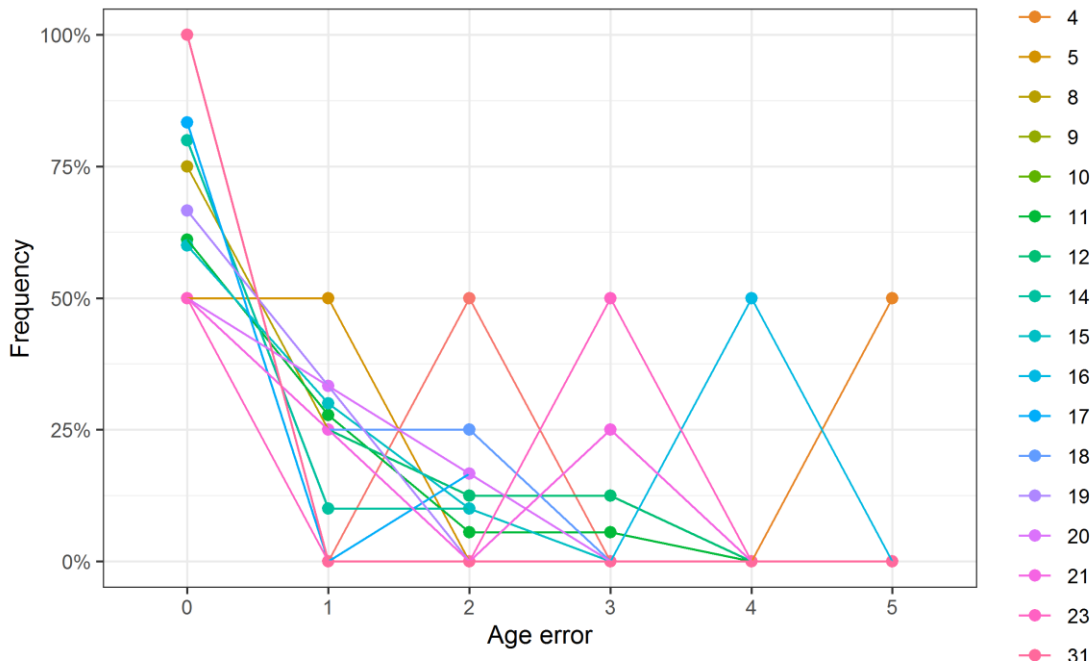


Figure 10.4.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

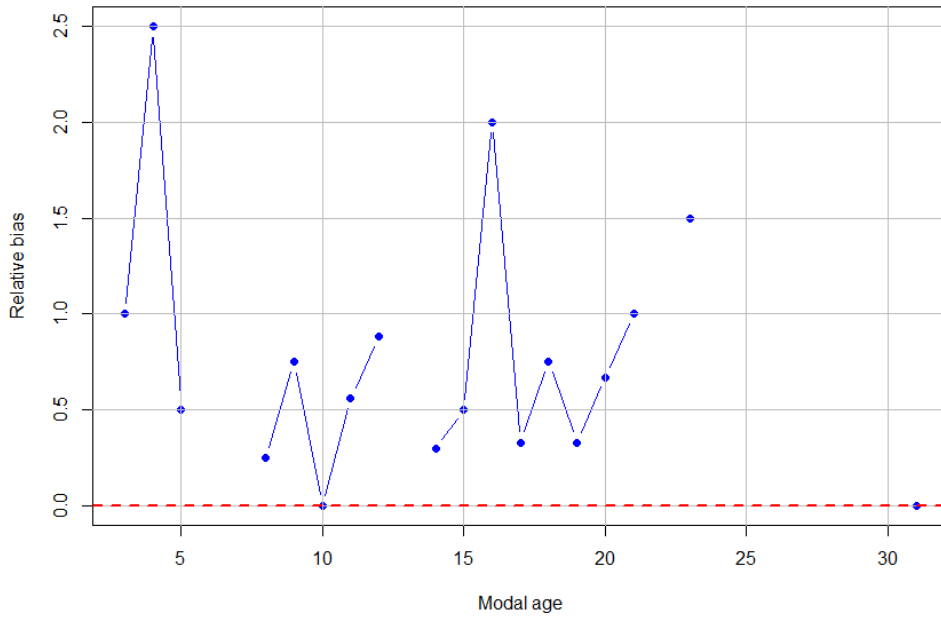


Figure 10.4.9: The relative bias by modal age as estimated by all age readers combined.

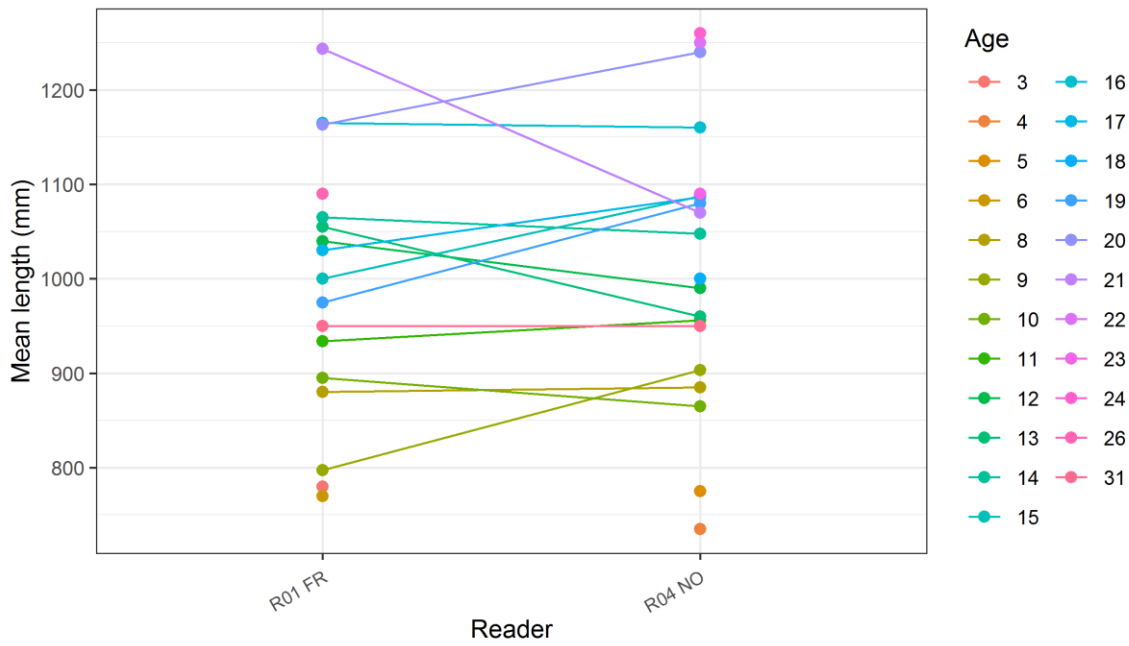


Figure 10.4.10: The mean length at age as estimated by each age reader.

10.5 Results greater silver smelt

All readers

Data Overview

Table 10.5.1: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	Length	Sex	Catch date	ICES area	R0			R0			R0			R0			R1			Modal age	C PV %	APE %
							N1	R02	R03	N4	R05	R06	R07	R08	R09	R0N	R10	R11	R12	R13	R1FR			
4659	319	-	250	-	22/03/2016	27.2.a	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	92	7	4
4660	319	-	265	-	22/03/2016	27.2.a	6	4	4	4	4	4	4	4	3	4	4	4	4	4	4	85	16	7
4661	319	-	400	-	22/03/2016	27.2.a	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	10	0	0
4662	319	-	285	-	22/03/2016	27.2.a	5	5	4	5	5	5	5	4	5	5	5	5	5	5	5	85	8	5
4663	319	-	235	-	22/03/2016	27.2.a	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	92	9	5
4664	319	-	425	-	22/03/2016	27.2.a	9	9	11	10	10	9	9	9	9	10	9	9	9	9	9	69	7	6
4665	319	-	285	-	22/03/2016	27.2.a	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6	92	5	2
4666	319	-	310	-	22/03/2016	27.2.a	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	92	6	3
4667	319	-	275	-	22/03/2016	27.2.a	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	92	7	4
4668	319	-	235	-	22/03/2016	27.2.a	3	3	4	3	3	3	3	2	3	3	3	3	3	3	3	85	14	5
4669	319	-	405	-	22/03/2016	27.2.a	10	10	9	10	9	9	9	9	9	10	10	9	10	9	9	54	5	5
4670	319	-	435	-	22/03/2016	27.2.a	12	12	12	12	11	12	12	12	12	12	12	12	12	12	12	92	2	1
4671	319	-	340	-	27/03/2016	27.2.a	8	10	9	9	9	9	8	8	9	9	9	9	9	9	9	69	6	4
4672	319	-	410	-	27/03/2016	27.2.a	11	11	12	11	11	11	11	10	11	11	11	11	11	11	11	85	4	1
4673	319	-	440	-	27/03/2016	27.2.a	14	14	15	15	12	14	12	14	14	14	13	15	14	14	14	54	7	5

467 4	319	-	445	-	27/03/2 016	27.2 .a	10	9	11	10	10	10	10	10	10	10	10	10	10	69	5	4	
467 5	319	-	385	-	27/03/2 016	27.2 .a	10	10	10	11	9	11	9	9	11	11	11	9	11	11	46	9	8
467 6	319	-	380	-	27/03/2 016	27.2 .a	8	8	8	8	8	8	8	7	8	8	8	8	8	8	92	4	2
467 7	319	-	415	-	27/03/2 016	27.2 .a	15	13	15	14	12	14	12	13	14	14	16	15	14	14	38	9	6
467 8	319	-	465	-	27/03/2 016	27.2 .a	13	12	14	15	12	12	12	12	16	15	15	16	14	12	38	1	10
																						2	
467 9	319	-	395	-	27/03/2 016	27.2 .a	12	10	14	12	11	12	11	11	14	12	12	11	12	12	46	1	7
																						0	
468 0	319	-	345	-	27/03/2 016	27.2 .a	8	8	8	8	8	8	8	8	8	8	8	8	8	8	10	0	0
																						0	
468 1	319	-	330	-	27/03/2 016	27.2 .a	6	6	6	6	6	6	6	5	6	6	6	6	6	6	92	5	2
468 2	319	-	325	-	27/03/2 016	27.2 .a	7	7	7	7	7	7	7	6	7	7	7	7	7	7	92	4	2
468 3	319	-	340	-	27/03/2 016	27.2 .a	8	8	9	8	8	8	8	7	8	8	8	7	9	8	69	7	4
468 4	319	-	375	-	27/03/2 016	27.2 .a	11	13	16	14	11	15	14	13	13	14	15	14	15	14	31	1	8
																						1	
468 5	319	-	335	-	27/03/2 016	27.2 .a	7	7	7	7	8	7	7	6	7	7	7	7	7	7	85	6	2
468 6	319	-	290	-	27/03/2 016	27.2 .a	5	5	5	5	5	5	5	4	5	5	5	5	5	5	92	6	3
468 7	319	-	375	-	27/03/2 016	27.2 .a	11	11	12	10	10	11	11	10	11	11	12	11	11	11	62	6	4
468 8	319	-	270	-	27/03/2 016	27.2 .a	6	6	7	6	6	6	6	5	6	6	6	6	6	6	85	7	3
468 9	319	-	365	-	27/03/2 016	27.2 .a	10	10	13	11	9	11	10	9	11	11	12	10	11	11	38	1	8
																						1	
469 0	319	-	305	-	27/03/2 016	27.2 .a	7	7	7	7	7	7	7	6	7	7	7	6	7	7	85	5	4
469 1	319	-	350	-	27/03/2 016	27.2 .a	8	7	8	8	8	8	8	7	8	7	8	7	8	8	69	6	6
469 2	319	-	340	-	31/03/2 016	27.2 .a	10	11	13	10	10	12	12	11	11	10	13	10	12	10	38	1	9
																						0	
469 3	319	-	300	-	31/03/2 016	27.2 .a	9	9	9	9	8	9	10	9	9	10	9	7	9	9	69	9	5

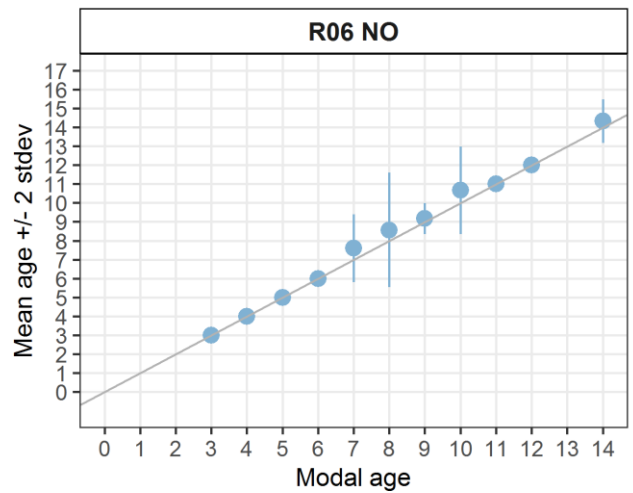
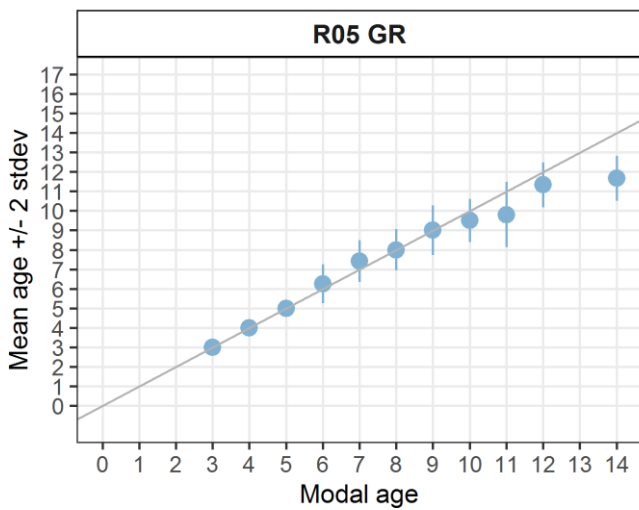
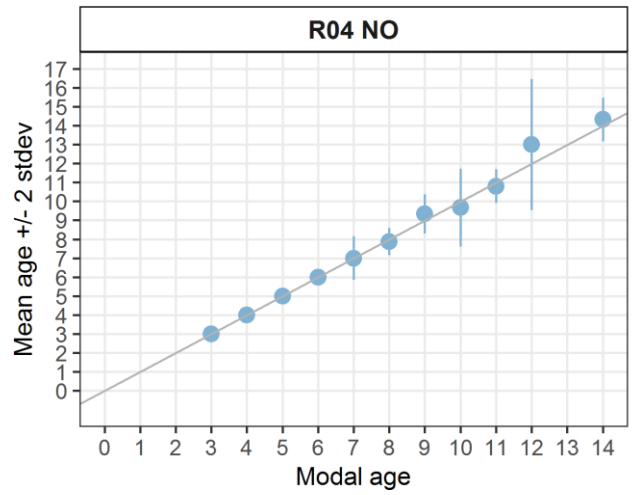
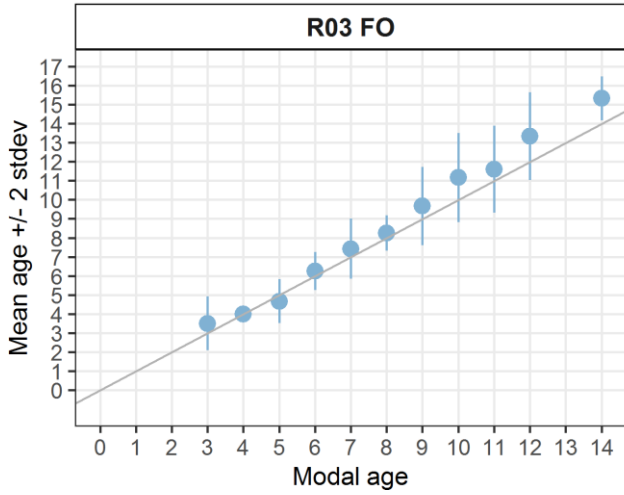
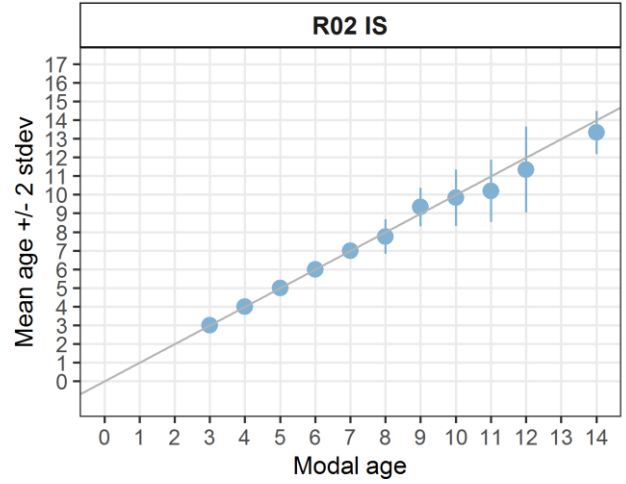
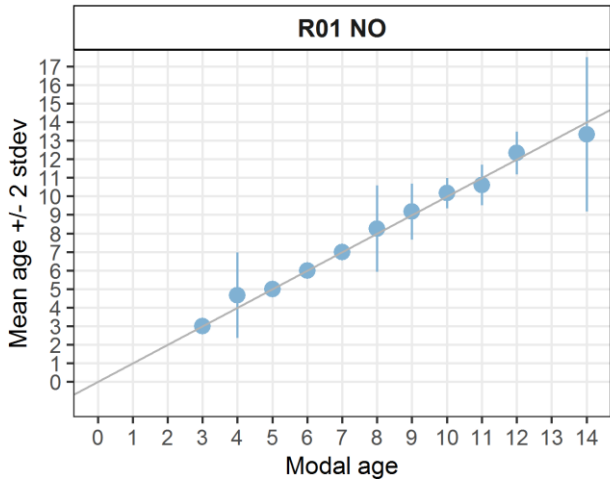
10	6	6	6	6	6	3	6	6	6	6	6	5	6	74
11	5	5	5	5	5	4	5	5	5	5	5	5	5	64
12	3	3	3	3	3	3	3	3	3	3	3	3	3	39
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	3	3	3	3	3	3	3	3	3	3	3	3	3	39
Total	50	50	50	50	50	42	50	50	50	50	50	49	50	641

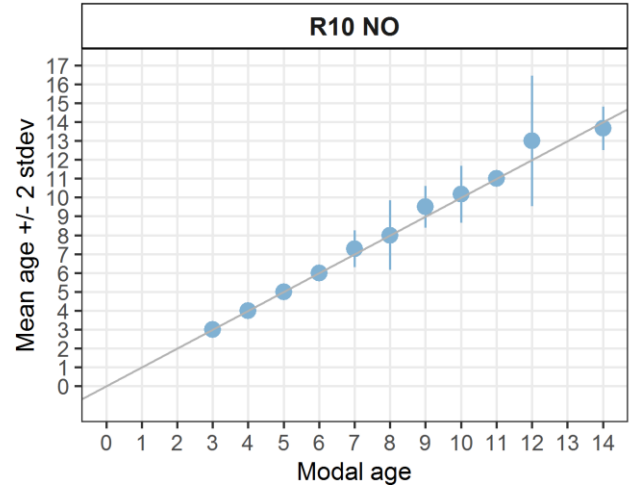
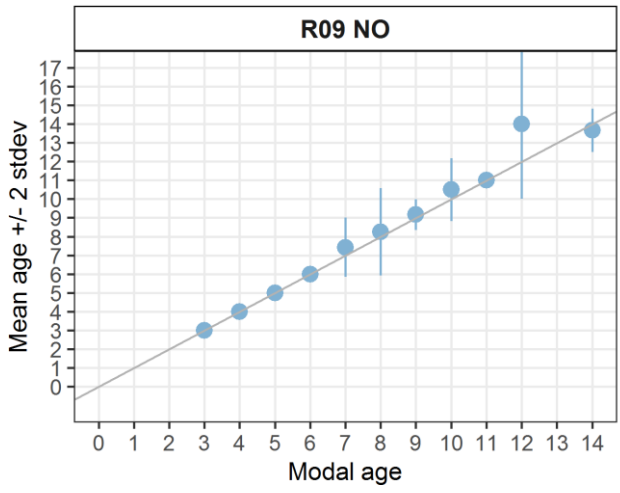
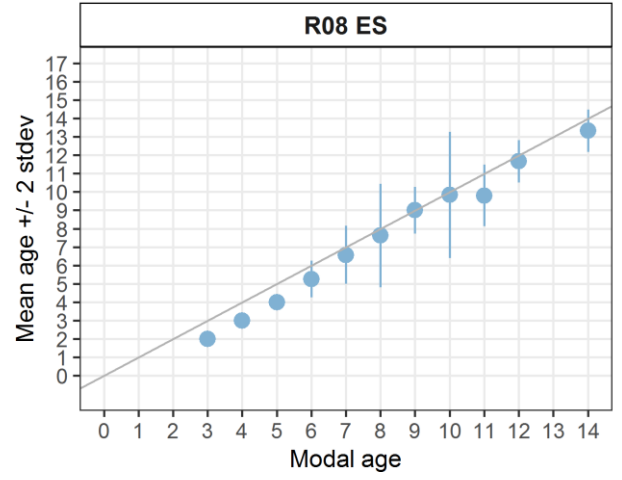
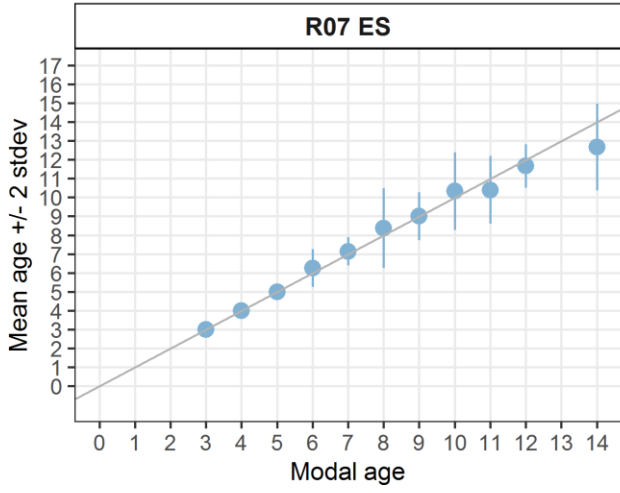
Table 10.5.3: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 NO	R02 IS	R03 FO	R04 NO	R05 GR	R06 NO	R07 ES	R08 ES	R09 NO	R10 NO	R11 FR	R12 FO	R13 FR
2	0	0	0	0	0	0	0	2	0	0	0	0	0
3	2	2	1	2	2	2	2	3	2	2	2	2	2
4	2	3	5	3	3	3	3	3	3	3	3	3	3
5	3	3	2	3	3	3	3	3	3	3	3	4	3
6	5	4	3	5	3	3	3	5	4	4	4	4	4
7	8	9	6	6	6	3	7	9	6	7	5	11	4
8	7	6	7	9	10	7	9	3	7	7	9	6	7
9	3	7	7	5	10	6	6	7	6	4	5	7	8
10	9	8	3	6	6	3	5	5	5	7	3	3	4
11	6	3	5	5	4	4	6	4	7	7	6	4	7
12	2	2	4	2	3	5	5	3	2	2	5	1	4
13	1	2	2	0	0	0	0	2	1	1	1	0	0
14	1	1	2	2	0	2	1	1	3	2	0	2	3
15	1	0	2	2	0	1	0	0	0	1	3	1	1
16	0	0	1	0	0	0	0	0	1	0	1	1	0
Total	50	50	50	50	50	42	50	50	50	50	50	49	50

Table 10.5.4: Mean 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	R01 NO	R02 IS	R03 FO	R04 NO	R05 GR	R06 NO	R07 ES	R08 ES	R09 NO	R10 NO	R11 FR	R12 FO	R13 FR
2	-	-	-	-	-	-	-	235 mm	-	-	-	-	-
3	235 mm	235 mm	235 mm	235 mm	235 mm	235 mm	235 mm	263 mm	235 mm	235 mm	235 mm	235 mm	235 mm
4	262 mm	263 mm	262 mm	263 mm	263 mm	263 mm	263 mm	295 mm	263 mm	263 mm	263 mm	263 mm	263 mm
5	295 mm	295 mm	300 mm	295 mm	295 mm	295 mm	295 mm	295 mm	295 mm	295 mm	295 mm	292 mm	295 mm
6	287 mm	292 mm	300 mm	293 mm	295 mm	295 mm	295 mm	314 mm	292 mm	292 mm	292 mm	298 mm	292 mm
7	317 mm	319 mm	308 mm	317 mm	306 mm	322 mm	318 mm	332 mm	313 mm	319 mm	316 mm	319 mm	321 mm
8	346 mm	347 mm	337 mm	339 mm	337 mm	345 mm	336 mm	327 mm	343 mm	341 mm	337 mm	349 mm	337 mm
9	375 mm	373 mm	351 mm	355 mm	358 mm	368 mm	378 mm	373 mm	368 mm	349 mm	365 mm	380 mm	350 mm
10	367 mm	374 mm	352 mm	387 mm	395 mm	378 mm	377 mm	393 mm	361 mm	368 mm	347 mm	383 mm	369 mm
11	379 mm	375 mm	389 mm	389 mm	404 mm	384 mm	371 mm	362 mm	370 mm	385 mm	388 mm	391 mm	385 mm
12	415 mm	450 mm	405 mm	415 mm	440 mm	393 mm	419 mm	433 mm	418 mm	415 mm	394 mm	435 mm	375 mm
13	465 mm	395 mm	352 mm	-	-	-	-	395 mm	375 mm	440 mm	340 mm	-	-
14	440 mm	440 mm	430 mm	395 mm	-	428 mm	375 mm	440 mm	417 mm	395 mm	-	408 mm	440 mm
15	415 mm	-	428 mm	452 mm	-	375 mm	-	-	-	465 mm	427 mm	415 mm	375 mm
16	-	-	375 mm	-	-	-	-	-	465 mm	-	415 mm	465 mm	-
Weighted Mean	342 mm	342 mm	342 mm	342 mm	342 mm	345 mm	342 mm	342 mm	342 mm	342 mm	342 mm	341 mm	342 mm





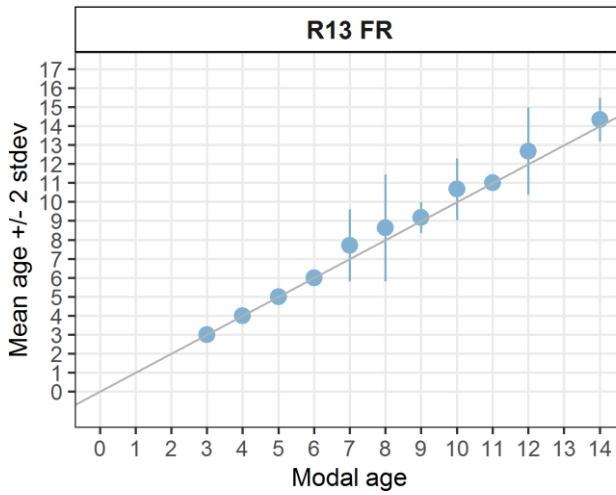
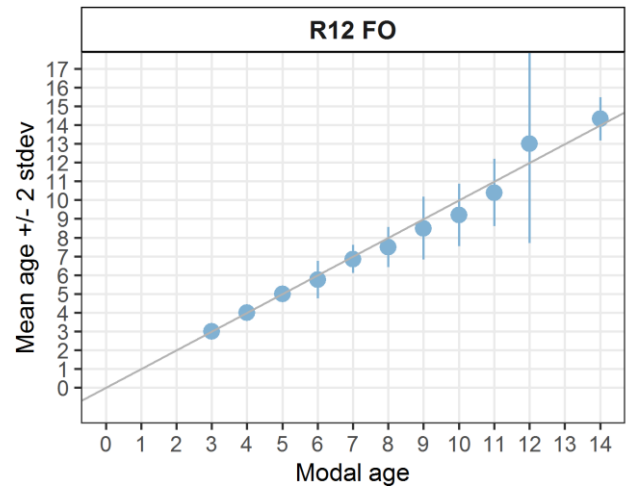
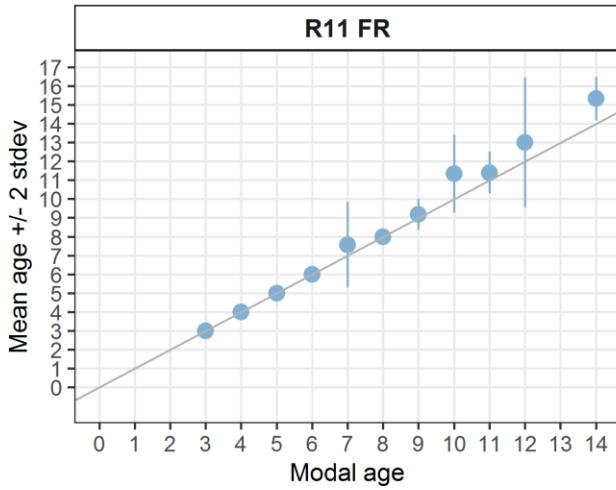


Figure 10.5.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

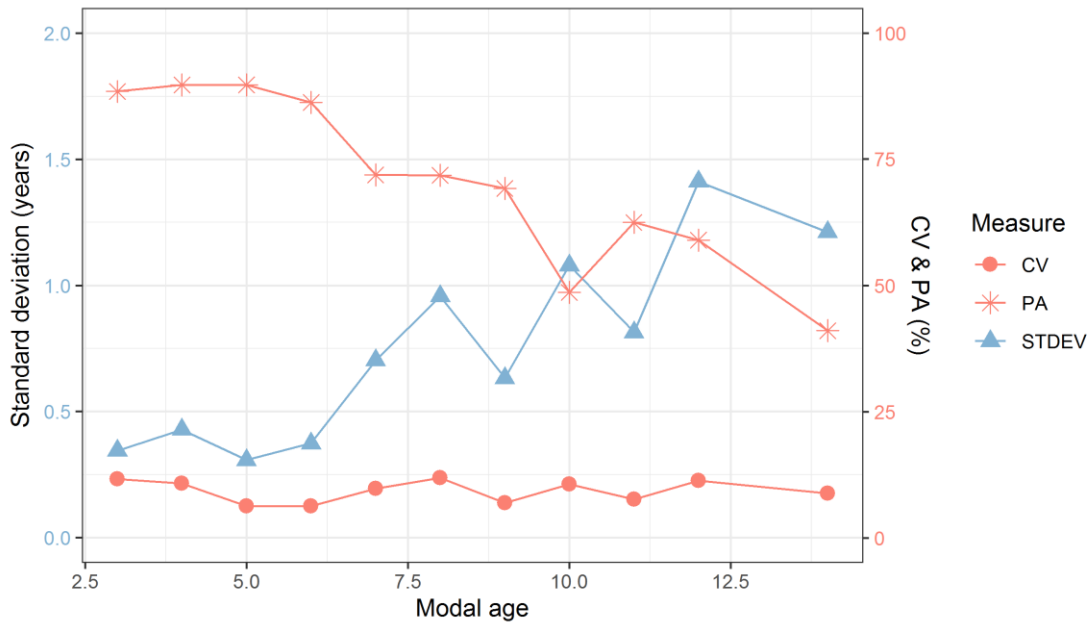


Figure 10.5.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

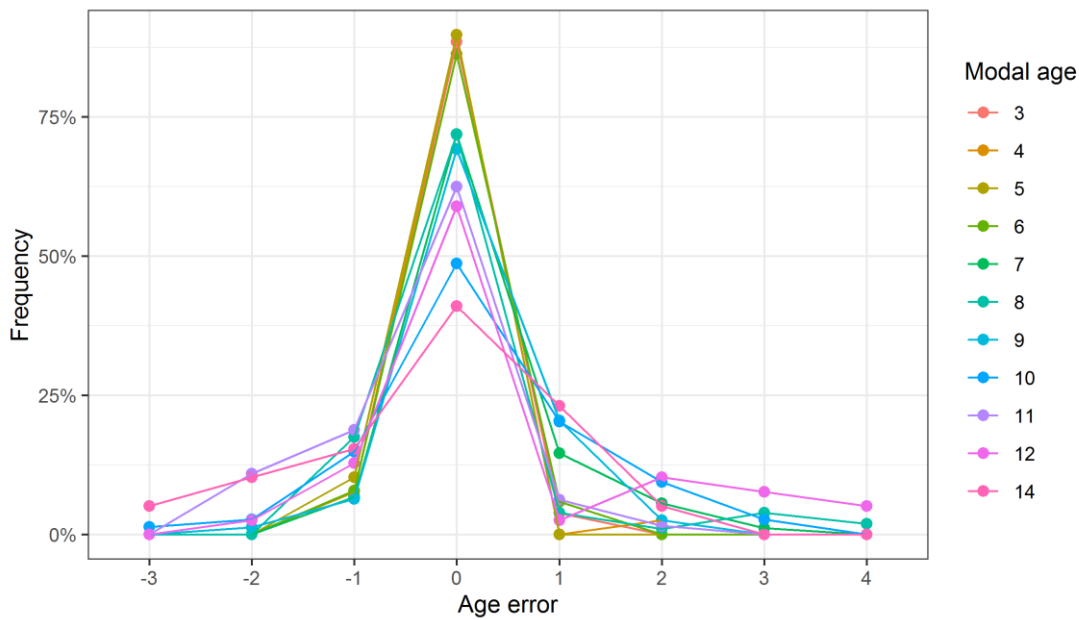


Figure 10.5.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

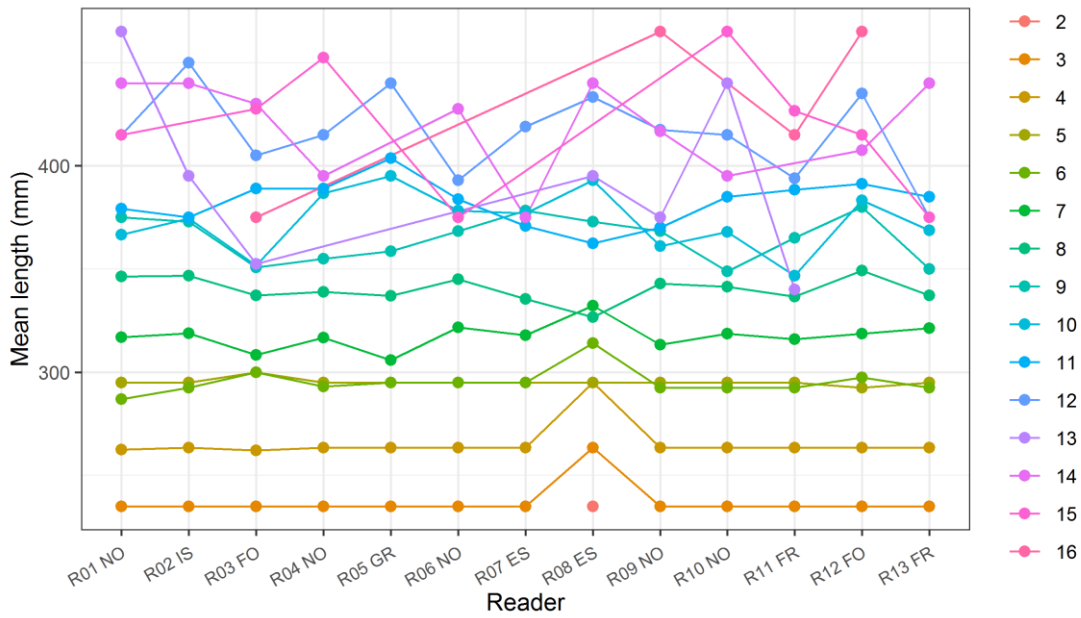


Figure 10.5.4: The mean length at age as estimated by each age reader.

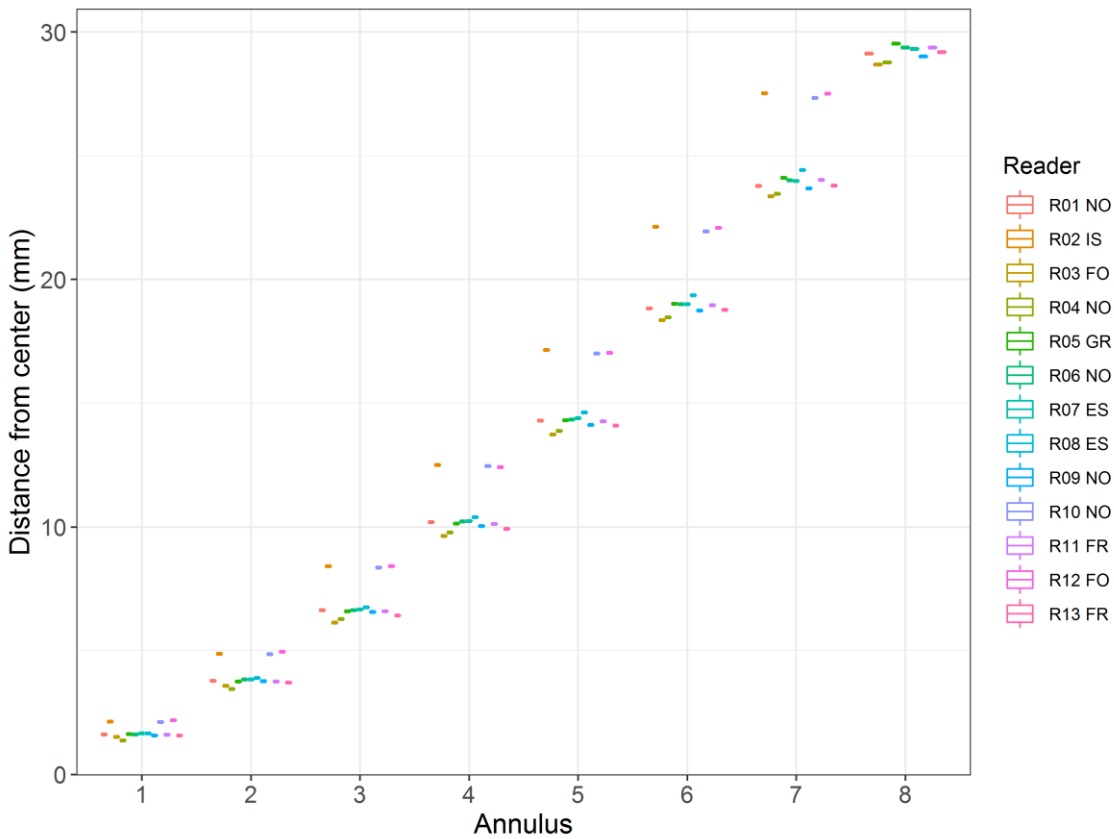


Figure 10.5.5: Plot of average distance from the centre to the winter rings for advanced readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.5.5: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	length	sex	Catch date	ICES area	R01 NO	R02 IS	R03 FO	Modal age	PA %	CV %	APE %
4659	319	-	250	-	22/03/2016 00:00:00	27.2.a	4	4	4	4	100	0	0
4660	319	-	265	-	22/03/2016 00:00:00	27.2.a	6	4	4	4	67	25	19
4661	319	-	400	-	22/03/2016 00:00:00	27.2.a	9	9	9	9	100	0	0
4662	319	-	285	-	22/03/2016 00:00:00	27.2.a	5	5	4	5	67	12	10
4663	319	-	235	-	22/03/2016 00:00:00	27.2.a	3	3	3	3	100	0	0
4664	319	-	425	-	22/03/2016 00:00:00	27.2.a	9	9	11	9	67	12	9
4665	319	-	285	-	22/03/2016 00:00:00	27.2.a	6	6	6	6	100	0	0
4666	319	-	310	-	22/03/2016 00:00:00	27.2.a	5	5	5	5	100	0	0
4667	319	-	275	-	22/03/2016 00:00:00	27.2.a	4	4	4	4	100	0	0
4668	319	-	235	-	22/03/2016 00:00:00	27.2.a	3	3	4	3	67	17	13
4669	319	-	405	-	22/03/2016 00:00:00	27.2.a	10	10	9	10	67	6	5
4670	319	-	435	-	22/03/2016 00:00:00	27.2.a	12	12	12	12	100	0	0
4671	319	-	340	-	27/03/2016 00:00:00	27.2.a	8	10	9	8	33	11	7
4672	319	-	410	-	27/03/2016 00:00:00	27.2.a	11	11	12	11	67	5	4
4673	319	-	440	-	27/03/2016 00:00:00	27.2.a	14	14	15	14	67	4	3
4674	319	-	445	-	27/03/2016 00:00:00	27.2.a	10	9	11	9	33	10	7
4675	319	-	385	-	27/03/2016 00:00:00	27.2.a	10	10	10	10	100	0	0
4676	319	-	380	-	27/03/2016 00:00:00	27.2.a	8	8	8	8	100	0	0
4677	319	-	415	-	27/03/2016 00:00:00	27.2.a	15	13	15	15	67	8	6
4678	319	-	465	-	27/03/2016 00:00:00	27.2.a	13	12	14	12	33	8	5
4679	319	-	395	-	27/03/2016 00:00:00	27.2.a	12	10	14	10	33	17	11
4680	319	-	345	-	27/03/2016 00:00:00	27.2.a	8	8	8	8	100	0	0
4681	319	-	330	-	27/03/2016 00:00:00	27.2.a	6	6	6	6	100	0	0
4682	319	-	325	-	27/03/2016 00:00:00	27.2.a	7	7	7	7	100	0	0
4683	319	-	340	-	27/03/2016 00:00:00	27.2.a	8	8	9	8	67	7	5
4684	319	-	375	-	27/03/2016 00:00:00	27.2.a	11	13	16	11	33	19	13
4685	319	-	335	-	27/03/2016 00:00:00	27.2.a	7	7	7	7	100	0	0
4686	319	-	290	-	27/03/2016 00:00:00	27.2.a	5	5	5	5	100	0	0
4687	319	-	375	-	27/03/2016 00:00:00	27.2.a	11	11	12	11	67	5	4
4688	319	-	270	-	27/03/2016 00:00:00	27.2.a	6	6	7	6	67	9	7
4689	319	-	365	-	27/03/2016 00:00:00	27.2.a	10	10	13	10	67	16	12
4690	319	-	305	-	27/03/2016 00:00:00	27.2.a	7	7	7	7	100	0	0
4691	319	-	350	-	27/03/2016 00:00:00	27.2.a	8	7	8	8	67	8	6
4692	319	-	340	-	31/03/2016 00:00:00	27.2.a	10	11	13	10	33	13	10
4693	319	-	300	-	31/03/2016 00:00:00	27.2.a	9	9	9	9	100	0	0
4694	319	-	340	-	31/03/2016 00:00:00	27.2.a	7	7	9	7	67	15	12
4695	319	-	315	-	31/03/2016 00:00:00	27.2.a	7	7	8	7	67	8	6
4696	319	-	300	-	31/03/2016 00:00:00	27.2.a	7	8	8	8	67	8	6
4697	319	-	360	-	31/03/2016 00:00:00	27.2.a	10	9	11	9	33	10	7
4698	319	-	330	-	31/03/2016 00:00:00	27.2.a	10	10	11	10	67	6	4
4699	319	-	385	-	31/03/2016 00:00:00	27.2.a	8	8	8	8	100	0	0
4700	319	-	330	-	31/03/2016 00:00:00	27.2.a	11	8	9	8	33	16	12
4701	319	-	285	-	31/03/2016 00:00:00	27.2.a	6	6	6	6	100	0	0
4702	319	-	285	-	31/03/2016 00:00:00	27.2.a	8	7	8	8	67	8	6
4703	319	-	320	-	31/03/2016 00:00:00	27.2.a	7	7	7	7	100	0	0
4704	319	-	385	-	31/03/2016 00:00:00	27.2.a	11	9	11	11	67	11	9
4705	319	-	295	-	31/03/2016 00:00:00	27.2.a	7	7	7	7	100	0	0
4706	319	-	400	-	31/03/2016 00:00:00	27.2.a	11	10	12	10	33	9	6
4707	319	-	375	-	31/03/2016 00:00:00	27.2.a	10	10	10	10	100	0	0
4708	319	-	295	-	31/03/2016 00:00:00	27.2.a	10	9	10	10	67	6	5

Table 10.5.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 NO	R02 IS	R03 FO	total
3	2	2	2	6
4	3	3	3	9
5	3	3	3	9
6	4	4	4	12
7	7	7	7	21
8	9	9	9	27
9	5	5	5	15
10	9	9	9	27
11	4	4	4	12
12	2	2	2	6
13	0	0	0	0
14	1	1	1	3
15	1	1	1	3
Total	50	50	50	150

Table 10.5.7: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 NO	R02 IS	R03 FO
3	2	2	1
4	2	3	5
5	3	3	2
6	5	4	3
7	8	9	6
8	7	6	7
9	3	7	7
10	9	8	3
11	6	3	5
12	2	2	4
13	1	2	2
14	1	1	2
15	1	0	2
16	0	0	1
Total	50	50	50

Table 10.5.8: Mean 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	R01 NO	R02 IS	R03 FO
3	235 mm	235 mm	235 mm
4	262 mm	263 mm	262 mm
5	295 mm	295 mm	300 mm
6	287 mm	292 mm	300 mm
7	317 mm	319 mm	308 mm
8	346 mm	347 mm	337 mm
9	375 mm	373 mm	351 mm
10	367 mm	374 mm	352 mm
11	379 mm	375 mm	389 mm
12	415 mm	450 mm	405 mm
13	465 mm	395 mm	352 mm
14	440 mm	440 mm	430 mm
15	415 mm	-	428 mm
16	-	-	375 mm
Weighted Mean	342 mm	342 mm	342 mm

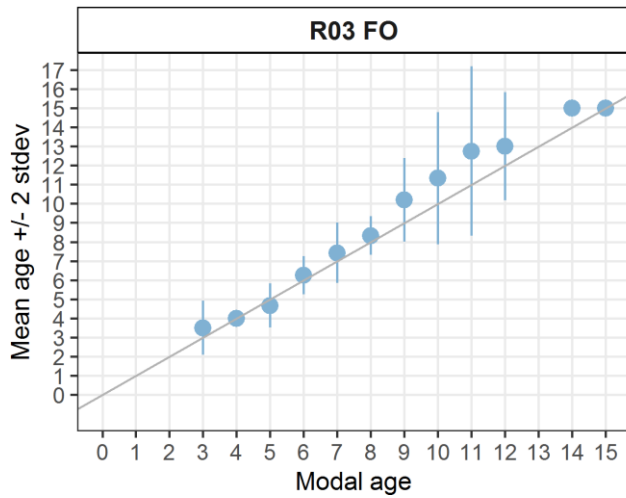
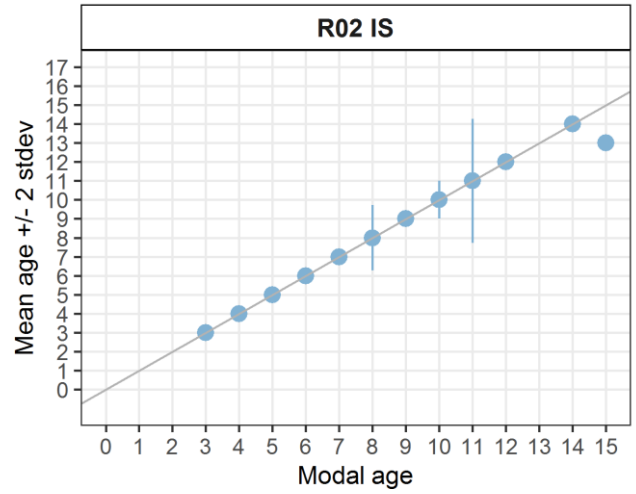
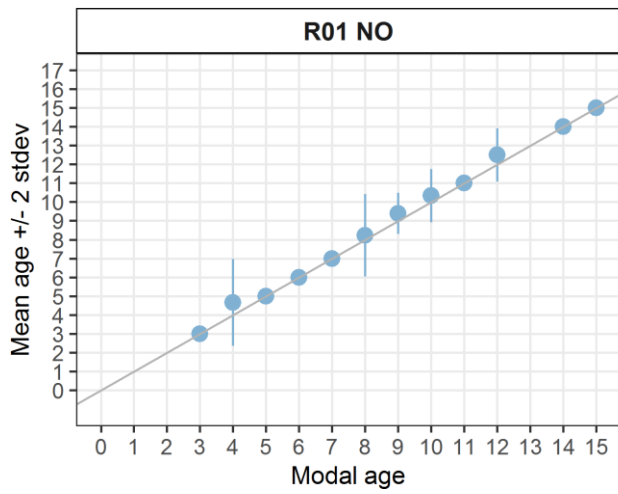


Figure 10.5.6: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

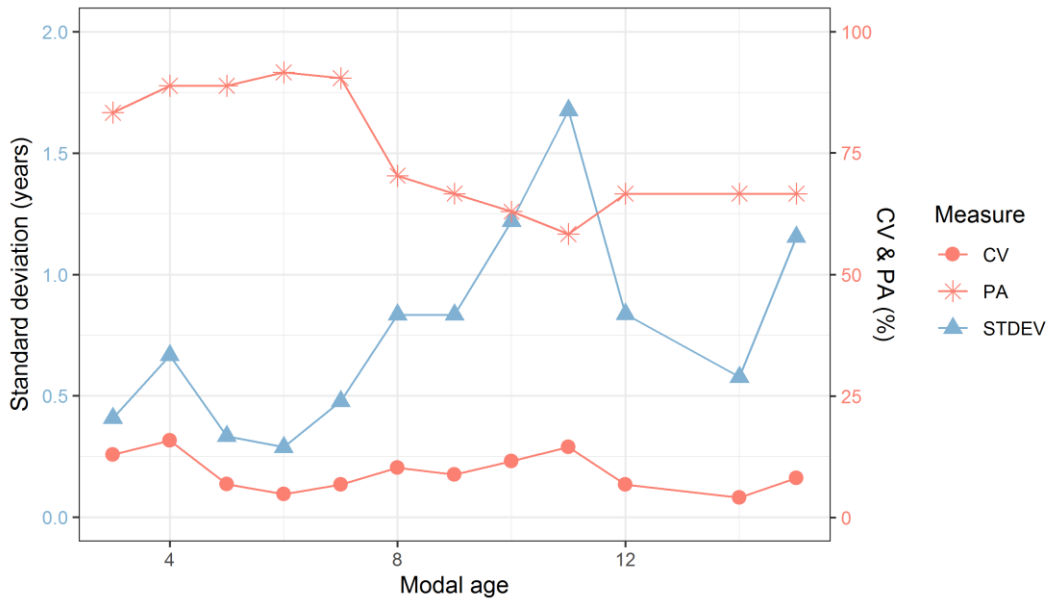


Figure 10.5.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

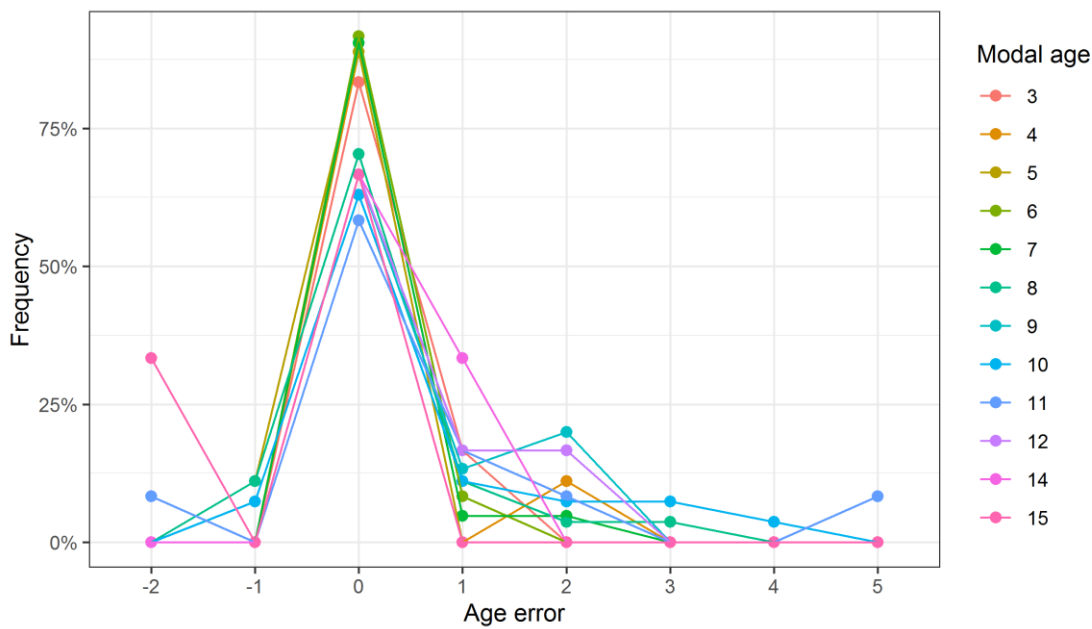


Figure 10.5.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

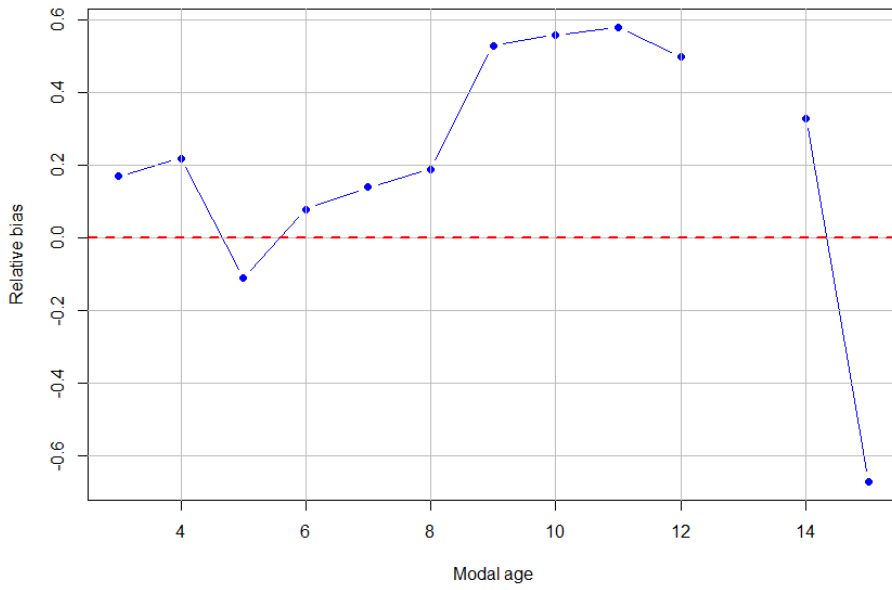


Figure 10.5.9: The relative bias by modal age as estimated by all age readers combined.

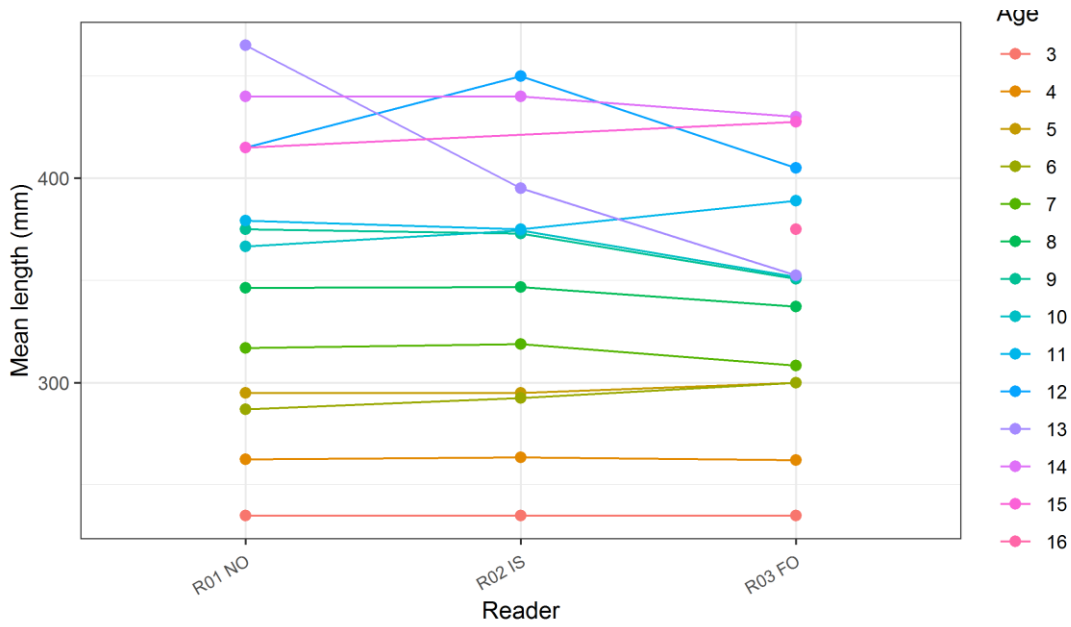


Figure 10.5.10: The mean length at age as estimated by each age reader.

10.6 Results tusk

All readers

Data Overview

Table 10.6.1: Data overview including modal age and statistics per sample.

Fis h ID	Eve nt ID	Ima ge ID	leng th	se x	Catch date	ICES area	R0			R0			R0			R0			R1 1	R1 2	R1 3	Mod al age	P A %	C V %	AP E %
							R0 1	R0 2	R0 3	R0 4	R0 5	R0 6	R0 7	R0 8	R0 9	R0 10	R0 11	R0 12							
4709	320	-	610	-	10/03/2010	27.2.a	11	13	11	-	13	14	12	10	13	14	11	13	14	13	33	11	10		
					00:00:00																				
4710	320	-	610	-	10/03/2010	27.2.a	10	11	11	9	11	13	13	11	12	11	10	11	12	11	46	10	7		
					00:00:00																				
4711	320	-	470	-	10/03/2010	27.2.a	7	7	7	4	7	11	8	9	9	8	6	8	7	31	22	16			
					00:00:00																				
4712	320	-	640	-	10/03/2010	27.2.a	11	13	12	10	12	13	12	14	13	13	10	13	14	13	38	11	9		
					00:00:00																				
4713	320	-	630	-	10/03/2010	27.2.a	10	12	10	9	11	13	12	10	12	11	11	9	12	12	31	11	9		
					00:00:00																				
4714	320	-	690	-	10/03/2010	27.2.a	10	11	10	9	11	11	11	11	11	11	9	10	11	11	62	7	6		
					00:00:00																				
4715	320	-	540	-	10/03/2010	27.2.a	7	7	6	8	8	9	9	9	10	8	11	7	9	9	31	17	13		
					00:00:00																				
4716	320	-	510	-	10/03/2010	27.2.a	8	10	9	8	10	11	10	10	11	10	10	8	10	10	54	11	9		
					00:00:00																				
4717	320	-	570	-	10/03/2010	27.2.a	8	10	8	9	9	12	12	11	11	8	9	8	11	8	31	16	14		
					00:00:00																				
4718	320	-	530	-	10/03/2010	27.2.a	8	9	7	7	9	10	9	9	9	7	9	8	10	9	46	12	10		
					00:00:00																				
4719	320	-	630	-	10/03/2010	27.2.a	10	11	9	9	14	14	13	13	13	13	13	10	14	13	38	16	14		
					00:00:00																				
4720	320	-	610	-	10/03/2010	27.2.a	8	9	10	9	11	11	8	9	10	7	8	7	10	8	23	15	12		
					00:00:00																				
4721	320	-	500	-	10/03/2010	27.2.a	7	8	8	7	9	8	8	8	8	7	8	7	9	8	54	9	7		
					00:00:00																				
4722	320	-	530	-	10/03/2010	27.2.a	8	9	10	7	12	11	10	9	10	12	9	9	11	9	31	15	12		
					00:00:00																				
4723	320	-	560	-	10/03/2010	27.2.a	9	8	8	8	10	10	10	9	9	9	9	7	9	9	46	10	8		
					00:00:00																				

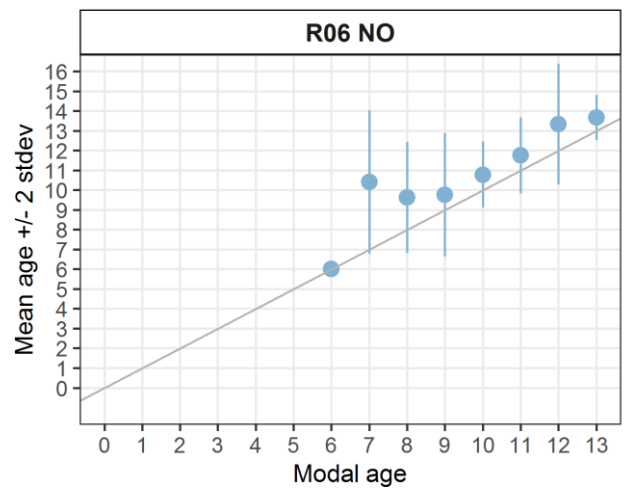
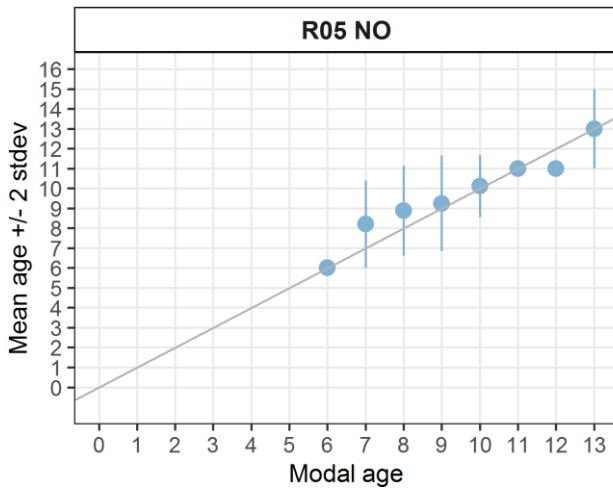
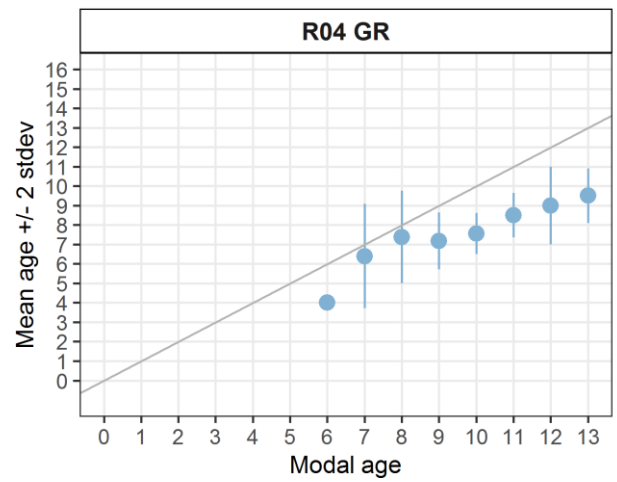
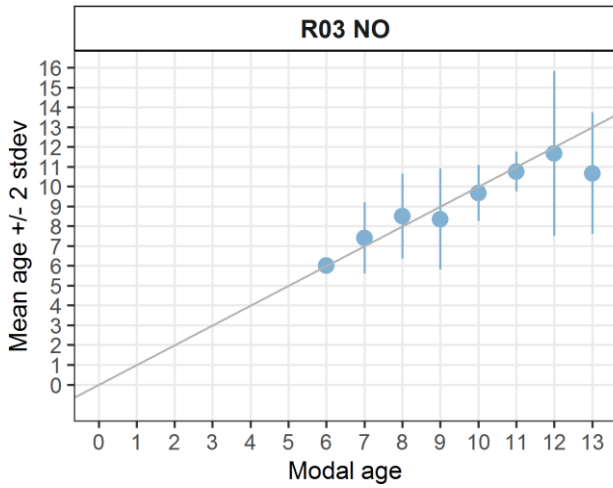
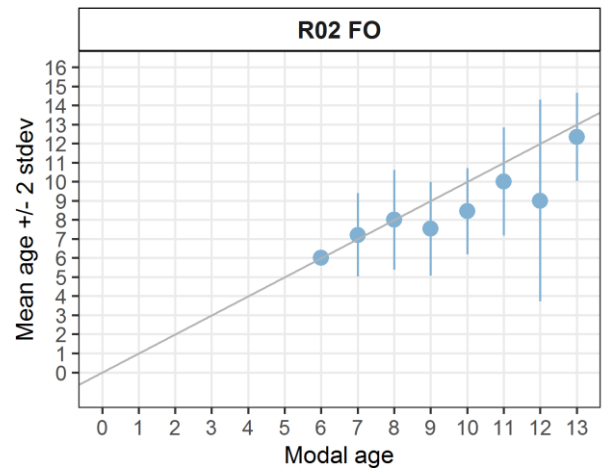
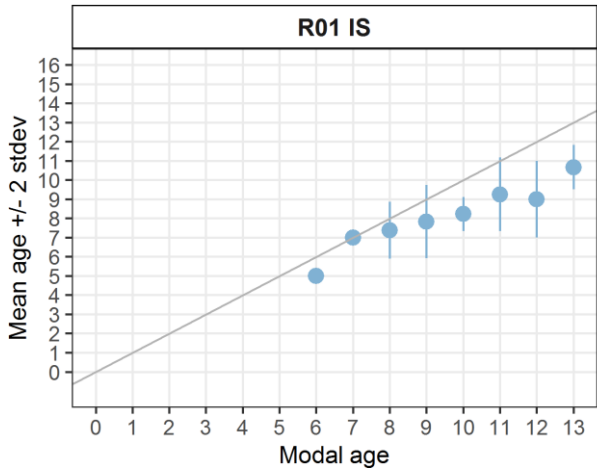
472 4	320	-	520	-	10/03/2 010	27.2 .a	7	9	6	7	8	10	9	8	7	7	7	7	9	7	4	1	13
																					6	5	
472 5	320	-	520	-	10/03/2 010	27.2 .a	8	7	7	7	9	9	9	8	10	7	9	8	9	9	3	1	10
																					8	2	
472 6	320	-	590	-	10/03/2 010	27.2 .a	8	10	9	8	11	12	10	10	11	10	9	10	11	10	3	1	9
																					8	2	
472 7	320	-	550	-	10/03/2 010	27.2 .a	7	7	8	7	10	13	9	10	11	7	9	7	12	7	3	2	19
																					8	3	
472 8	320	-	500	-	10/03/2 010	27.2 .a	8	9	9	7	8	9	9	8	8	8	8	8	9	8	5	8	6
																					4		
472 9	320	-	560	-	10/03/2 010	27.2 .a	8	9	9	8	11	10	10	10	11	7	8	7	10	10	3	1	13
																					1	5	
473 0	320	-	500	-	10/03/2 010	27.2 .a	8	8	10	7	9	11	10	10	11	10	11	9	11	10	3	1	11
																					1	4	
473 1	320	-	550	-	10/03/2 010	27.2 .a	9	10	11	8	11	11	10	9	11	11	10	-	11	11	5	1	8
																					0	0	
473 2	320	-	480	-	10/03/2 010	27.2 .a	8	7	10	6	10	10	8	7	9	8	8	7	10	8	3	1	14
																					1	7	
473 3	320	-	490	-	10/03/2 010	27.2 .a	9	7	10	7	10	11	10	9	10	10	9	9	10	10	4	1	10
																					6	3	
473 4	320	-	530	-	10/03/2 010	27.2 .a	8	7	14	10	11	15	12	12	13	12	11	10	13	12	2	2	15
																					3	0	
473 5	320	-	550	-	10/03/2 010	27.2 .a	8	8	11	8	11	12	11	11	11	11	12	10	13	11	4	1	12
																					6	5	
473 6	320	-	510	-	10/03/2 010	27.2 .a	7	7	8	7	8	8	9	9	11	7	8	7	11	7	3	1	13
																					8	7	
473 7	320	-	460	-	10/03/2 010	27.2 .a	8	6	11	7	9	13	9	9	9	9	8	9	12	9	4	2	14
																					6	1	
473 8	320	-	460	-	10/03/2 010	27.2 .a	7	6	8	7	8	10	9	7	7	9	9	8	9	7	3	1	12
																					1	4	
473 9	320	-	470	-	10/03/2 010	27.2 .a	8	6	9	7	9	9	9	8	8	9	9	8	10	9	4	1	10
																					6	2	
474 0	320	-	480	-	10/03/2 010	27.2 .a	7	7	9	8	8	9	9	7	9	9	9	9	9	9	6	1	9
																					2	0	
474 1	320	-	490	-	10/03/2 010	27.2 .a	6	6	7	7	9	8	8	8	9	7	9	6	9	9	3	1	14
																					1	6	
474 2	320	-	490	-	10/03/2 010	27.2 .a	8	7	11	7	11	12	10	10	10	10	8	10	12	10	3	1	14
																					8	8	
474 3	320	-	540	-	10/03/2 010	27.2 .a	9	8	11	8	11	12	10	10	12	12	12	8	12	12	3	1	14
																					8	6	

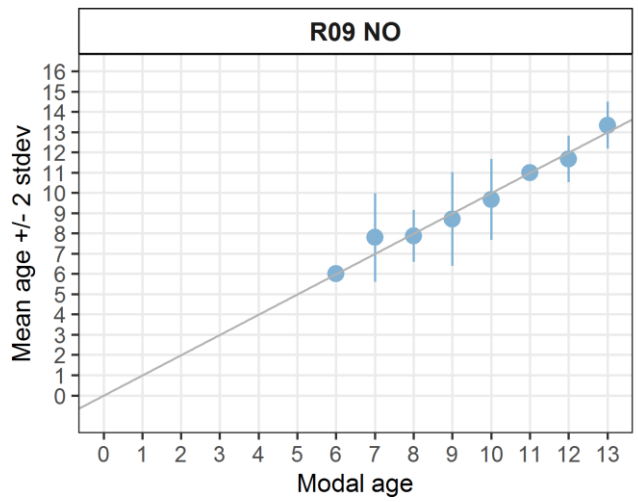
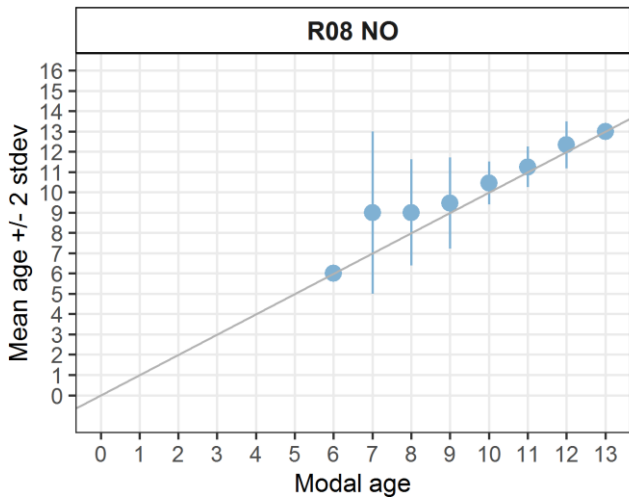
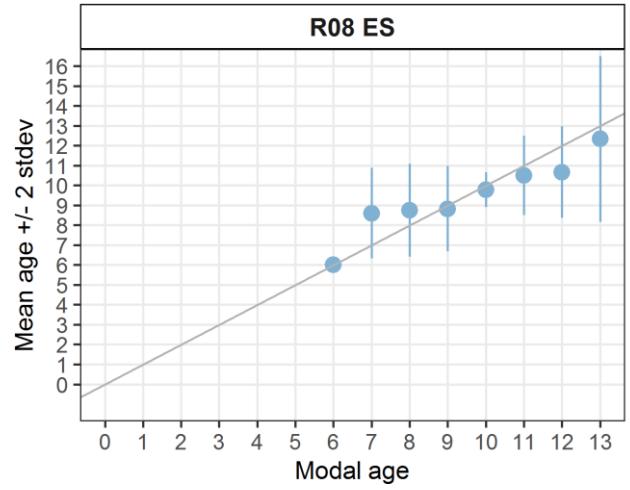
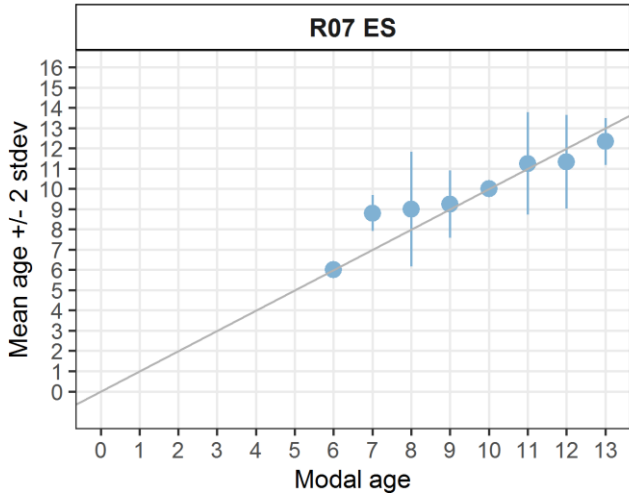
Table 10.6.3: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR
4	0	0	0	2	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	1	0	0
6	2	7	3	4	1	1	1	1	1	1	0	4	0
7	13	13	6	22	1	0	0	3	3	9	1	11	1
8	21	11	10	12	11	4	6	8	3	7	12	13	2
9	6	8	13	7	13	12	19	18	14	14	21	11	15
10	5	5	9	2	8	11	14	12	10	8	6	7	14
11	2	3	7	0	11	8	2	4	11	5	5	1	7
12	0	1	1	0	3	5	6	2	3	3	3	0	6
13	0	2	0	0	1	5	2	1	5	2	1	2	2
14	0	0	1	0	1	3	0	1	0	1	0	0	3
15	0	0	0	0	0	1	0	0	0	0	0	0	0
Total	50	50	50	49	50	50	50	50	50	50	50	49	50

Table 10.6.4: Mean 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	R01 IS	R02 FO	R03 NO	R04 GR	R05 NO	R06 NO	R07 ES	R08 ES	R08 NO	R09 NO	R11 FO	R12 FR	R13 FR
4	-	-	-	410	-	-	-	-	-	-	-	-	-
				mm									
5	350	-	-	-	-	-	-	-	-	-	350	-	-
	mm										mm		
6	445	451	470	445	350	350	350	350	350	350	-	460	-
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	
7	504	502	512	504	470	-	-	473	460	532	520	522	350
	mm	mm	mm	mm	mm			mm	mm	mm	mm	mm	mm
8	520	514	506	538	489	475	513	489	490	500	496	509	435
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
9	523	539	528	634	502	502	492	512	492	505	520	522	517
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
10	652	584	554	585	522	514	531	547	528	519	565	574	516
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
11	625	643	544	-	577	544	620	605	555	606	562	610	563
	mm	mm	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm
12	-	630	640	-	623	548	613	615	593	533	597	-	547
		mm	mm		mm	mm	mm	mm	mm	mm	mm		mm
13	-	625	-	-	610	578	620	630	622	635	630	625	540
		mm			mm	mm	mm	mm	mm	mm	mm	mm	mm
14	-	-	530	-	630	647	-	640	-	610	-	-	627
			mm		mm	mm		mm		mm			mm
15	-	-	-	-	-	530	-	-	-	-	-	-	-
						mm							
Weighted Mean	527	527	527	526	527	527	527	527	527	527	527	527	527
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm





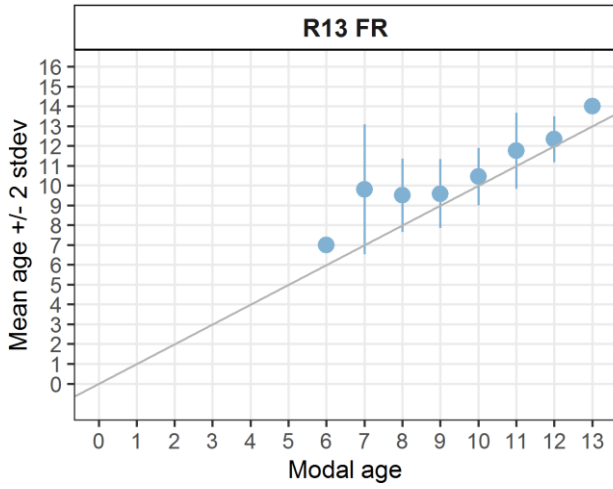
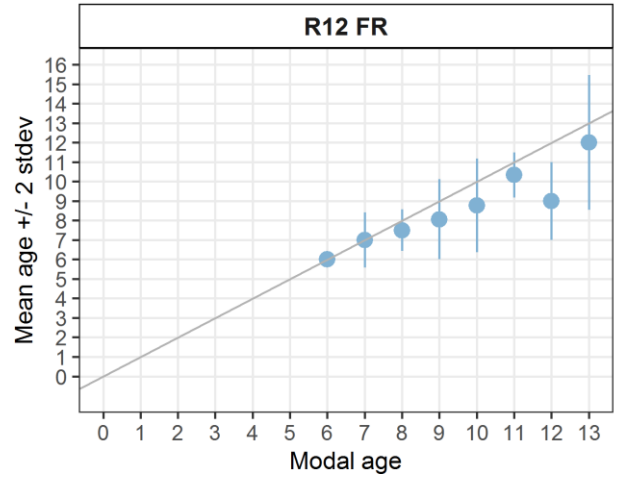
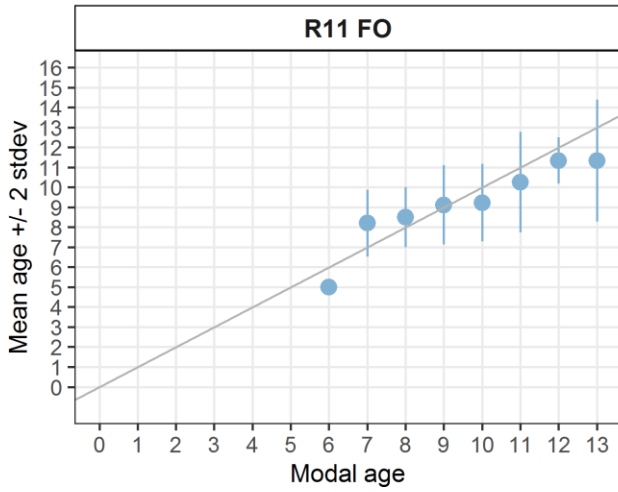


Figure 10.6.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

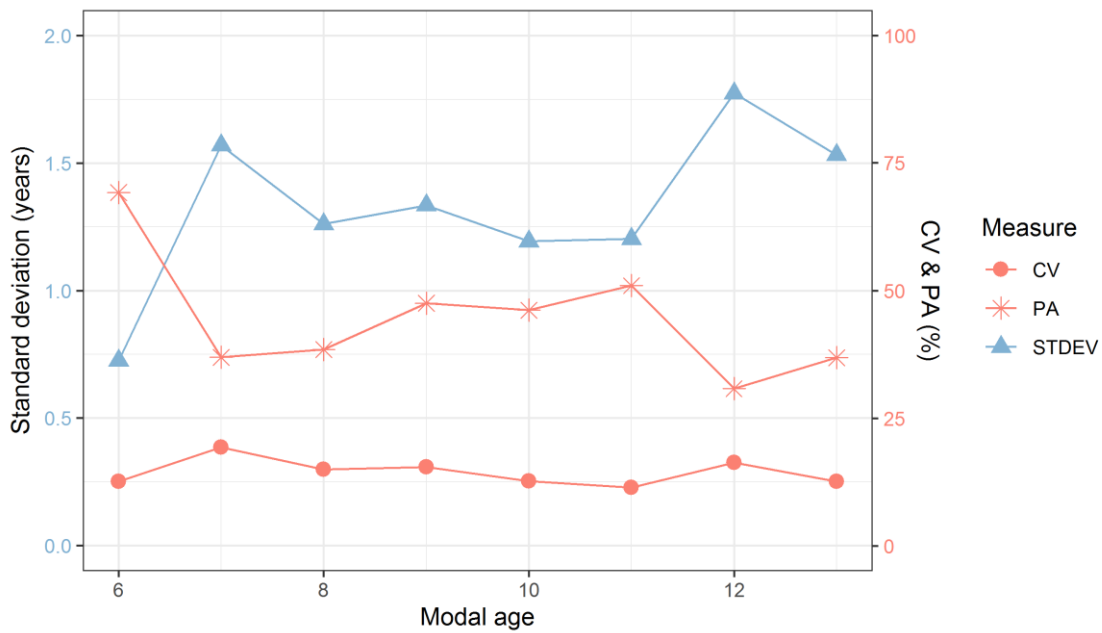


Figure 10.6.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

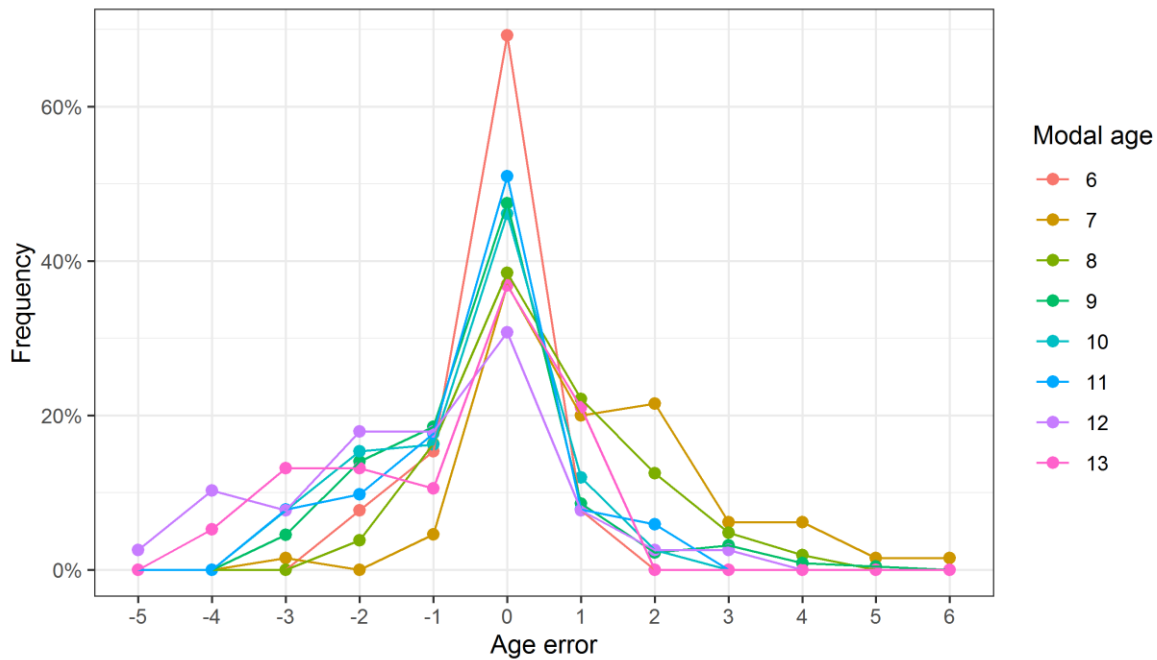


Figure 10.6.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

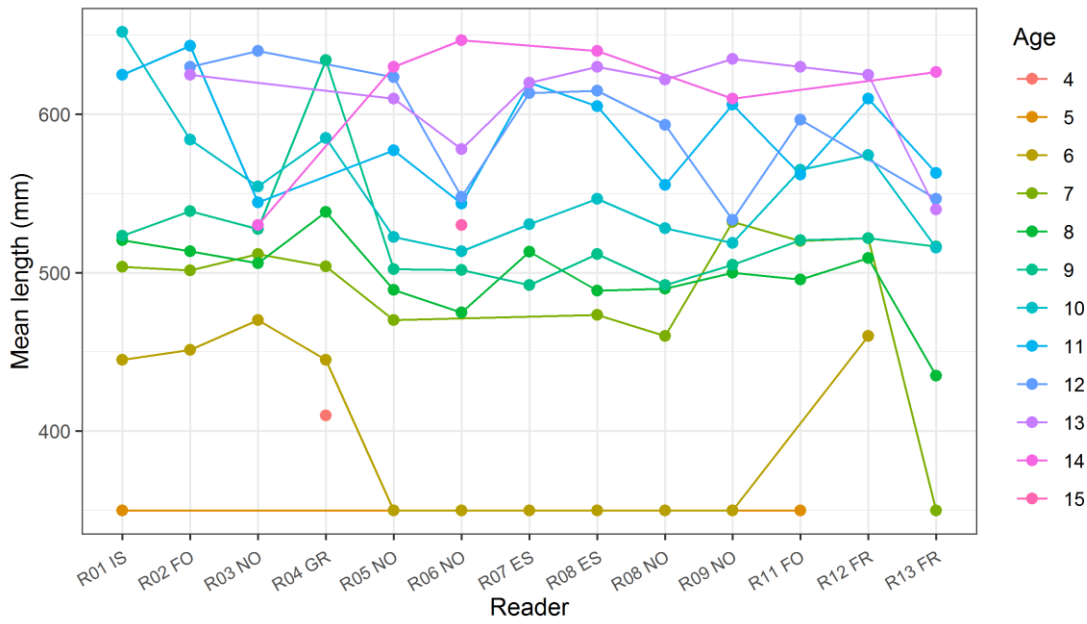


Figure 10.6.4: The mean length at age as estimated by each age reader.

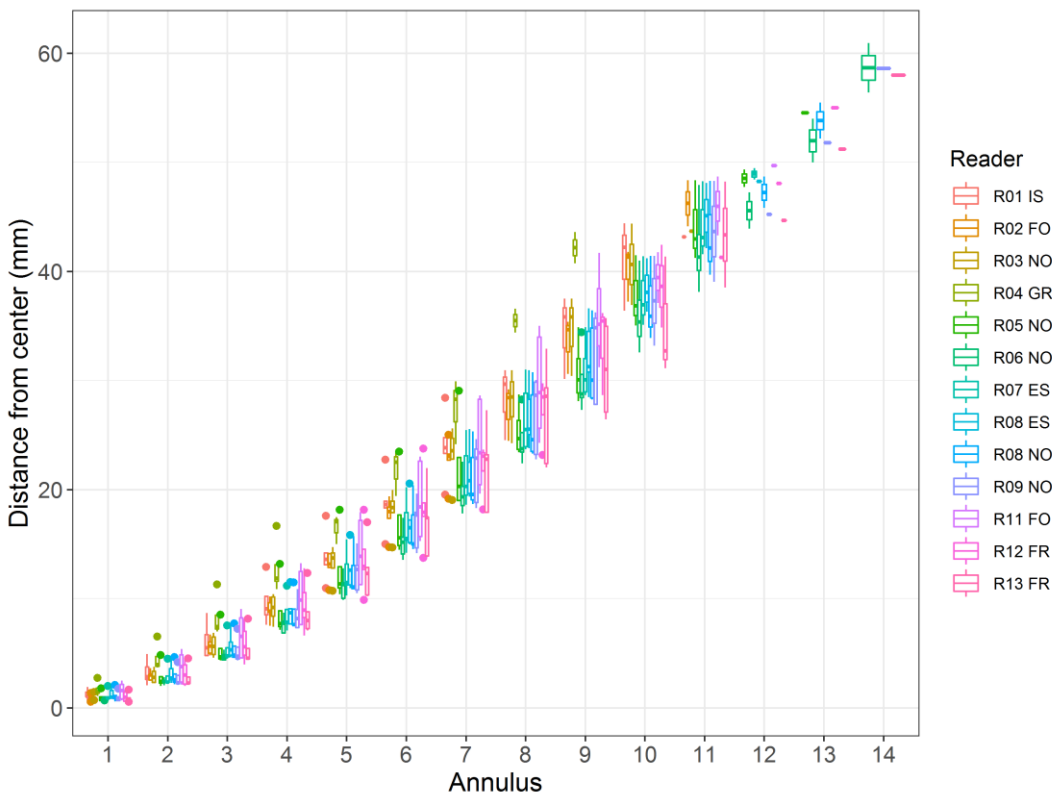


Figure 10.6.5: Plot of average distance from the centre to the winter rings for advanced readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.6.5: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	length	sex	Catch date	ICES area	R01 IS	R02 FO	R03 NO	Modal age	PA %	CV %	APE %
4709	320	-	610	-	10/03/2010 00:00:00	27.2.a	11	13	11	11	67	10	8
4710	320	-	610	-	10/03/2010 00:00:00	27.2.a	10	11	11	11	67	5	4
4711	320	-	470	-	10/03/2010 00:00:00	27.2.a	7	7	7	7	100	0	0
4712	320	-	640	-	10/03/2010 00:00:00	27.2.a	11	13	12	11	33	8	6
4713	320	-	630	-	10/03/2010 00:00:00	27.2.a	10	12	10	10	67	11	8
4714	320	-	690	-	10/03/2010 00:00:00	27.2.a	10	11	10	10	67	6	4
4715	320	-	540	-	10/03/2010 00:00:00	27.2.a	7	7	6	7	67	9	7
4716	320	-	510	-	10/03/2010 00:00:00	27.2.a	8	10	9	8	33	11	7
4717	320	-	570	-	10/03/2010 00:00:00	27.2.a	8	10	8	8	67	13	10
4718	320	-	530	-	10/03/2010 00:00:00	27.2.a	8	9	7	7	33	12	8
4719	320	-	630	-	10/03/2010 00:00:00	27.2.a	10	11	9	9	33	10	7
4720	320	-	610	-	10/03/2010 00:00:00	27.2.a	8	9	10	8	33	11	7
4721	320	-	500	-	10/03/2010 00:00:00	27.2.a	7	8	8	8	67	8	6
4722	320	-	530	-	10/03/2010 00:00:00	27.2.a	8	9	10	8	33	11	7
4723	320	-	560	-	10/03/2010 00:00:00	27.2.a	9	8	8	8	67	7	5
4724	320	-	520	-	10/03/2010 00:00:00	27.2.a	7	9	6	6	33	21	15
4725	320	-	520	-	10/03/2010 00:00:00	27.2.a	8	7	7	7	67	8	6
4726	320	-	590	-	10/03/2010 00:00:00	27.2.a	8	10	9	8	33	11	7
4727	320	-	550	-	10/03/2010 00:00:00	27.2.a	7	7	8	7	67	8	6
4728	320	-	500	-	10/03/2010 00:00:00	27.2.a	8	9	9	9	67	7	5
4729	320	-	560	-	10/03/2010 00:00:00	27.2.a	8	9	9	9	67	7	5
4730	320	-	500	-	10/03/2010 00:00:00	27.2.a	8	8	10	8	67	13	10
4731	320	-	550	-	10/03/2010 00:00:00	27.2.a	9	10	11	9	33	10	7
4732	320	-	480	-	10/03/2010 00:00:00	27.2.a	8	7	10	7	33	18	13
4733	320	-	490	-	10/03/2010 00:00:00	27.2.a	9	7	10	7	33	18	13
4734	320	-	530	-	10/03/2010 00:00:00	27.2.a	8	7	14	7	33	39	30
4735	320	-	550	-	10/03/2010 00:00:00	27.2.a	8	8	11	8	67	19	15
4736	320	-	510	-	10/03/2010 00:00:00	27.2.a	7	7	8	7	67	8	6
4737	320	-	460	-	10/03/2010 00:00:00	27.2.a	8	6	11	6	33	30	21
4738	320	-	460	-	10/03/2010 00:00:00	27.2.a	7	6	8	6	33	14	10
4739	320	-	470	-	10/03/2010 00:00:00	27.2.a	8	6	9	6	33	20	14
4740	320	-	480	-	10/03/2010 00:00:00	27.2.a	7	7	9	7	67	15	12
4741	320	-	490	-	10/03/2010 00:00:00	27.2.a	6	6	7	6	67	9	7
4742	320	-	490	-	10/03/2010 00:00:00	27.2.a	8	7	11	7	33	24	18
4743	320	-	540	-	10/03/2010 00:00:00	27.2.a	9	8	11	8	33	16	12
4744	320	-	480	-	10/03/2010 00:00:00	27.2.a	7	8	9	7	33	12	8
4745	320	-	520	-	10/03/2010 00:00:00	27.2.a	8	9	9	9	67	7	5
4746	320	-	470	-	10/03/2010 00:00:00	27.2.a	7	8	8	8	67	8	6
4747	320	-	540	-	10/03/2010 00:00:00	27.2.a	8	9	10	8	33	11	7
4748	320	-	350	-	10/03/2010 00:00:00	27.2.a	5	6	6	6	67	10	8
4749	320	-	530	-	10/03/2010 00:00:00	27.2.a	7	7	7	7	100	0	0
4750	320	-	500	-	10/03/2010 00:00:00	27.2.a	7	7	8	7	67	8	6
4751	320	-	510	-	10/03/2010 00:00:00	27.2.a	8	8	9	8	67	7	5
4752	320	-	430	-	10/03/2010 00:00:00	27.2.a	8	7	9	7	33	12	8
4753	320	-	530	-	10/03/2010 00:00:00	27.2.a	8	6	7	6	33	14	10
4754	320	-	520	-	10/03/2010 00:00:00	27.2.a	9	8	10	8	33	11	7
4755	320	-	480	-	10/03/2010 00:00:00	27.2.a	9	8	9	9	67	7	5
4756	320	-	400	-	10/03/2010 00:00:00	27.2.a	6	6	8	6	67	17	13
4757	320	-	540	-	10/03/2010 00:00:00	27.2.a	7	8	8	8	67	8	6
4758	320	-	700	-	10/03/2010 00:00:00	27.2.a	10	10	9	10	67	6	5

Table 10.6.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 IS	R02 FO	R03 NO	total
6	8	8	8	24
7	15	15	15	45
8	15	15	15	45
9	6	6	6	18
10	3	3	3	9
11	3	3	3	9
Total	50	50	50	150

Table 10.6.7: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 IS	R02 FO	R03 NO
5	1	0	0
6	2	7	3
7	13	13	6
8	21	11	10
9	6	8	13
10	5	5	9
11	2	3	7
12	0	1	1
13	0	2	0
14	0	0	1
Total	50	50	50

Table 10.6.8: Mean 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	R01 IS	R02 FO	R03 NO
5	350 mm	-	-
6	445 mm	451 mm	470 mm
7	504 mm	502 mm	512 mm
8	520 mm	514 mm	506 mm
9	523 mm	539 mm	528 mm
10	652 mm	584 mm	554 mm
11	625 mm	643 mm	544 mm
12	-	630 mm	640 mm
13	-	625 mm	-
14	-	-	530 mm
Weighted Mean	527 mm	527 mm	527 mm

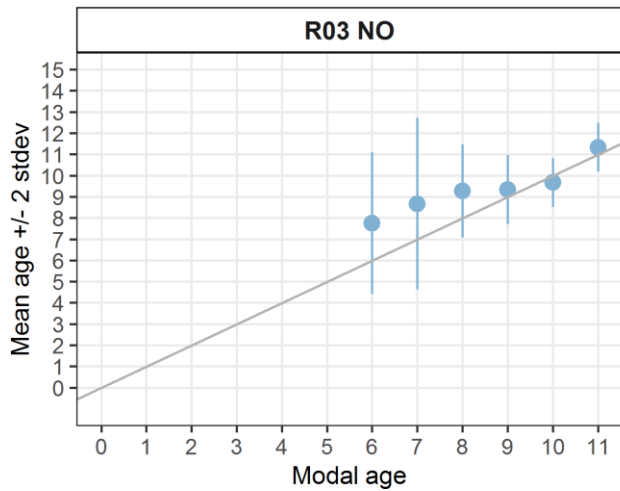
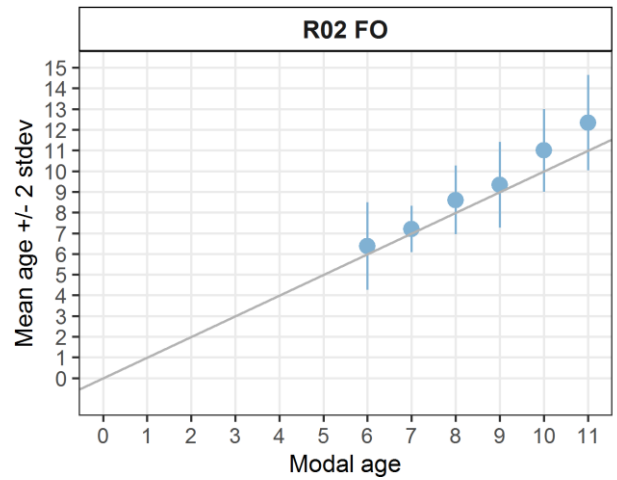
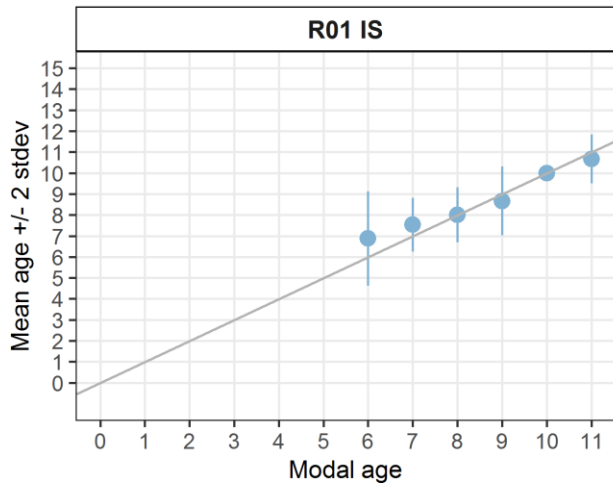


Figure 10.6.6: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

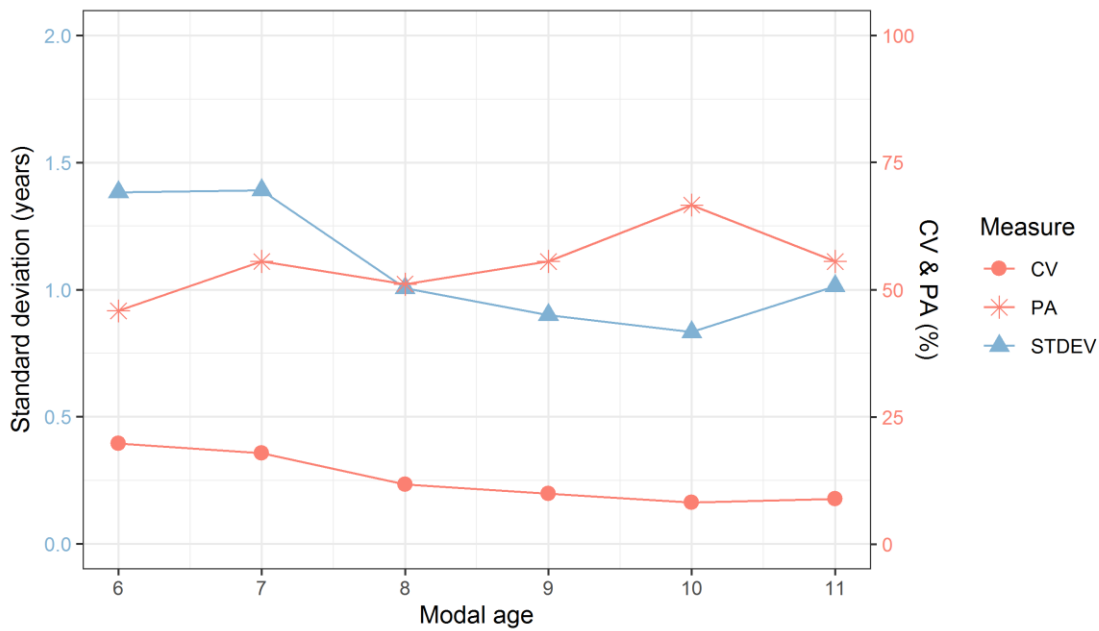


Figure 10.6.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

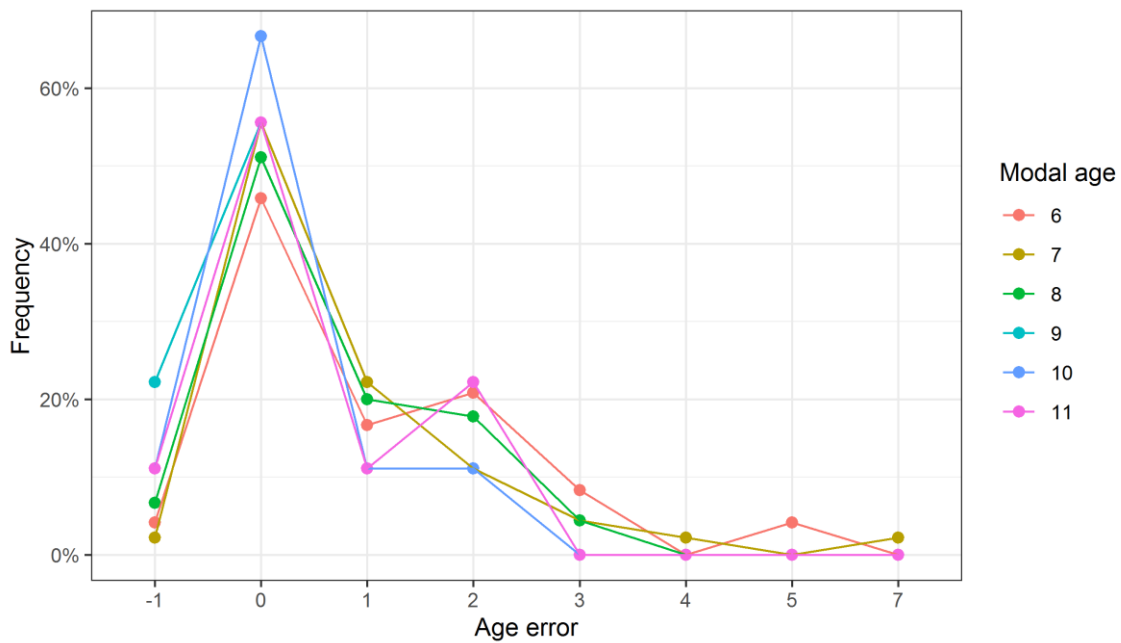


Figure 10.6.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

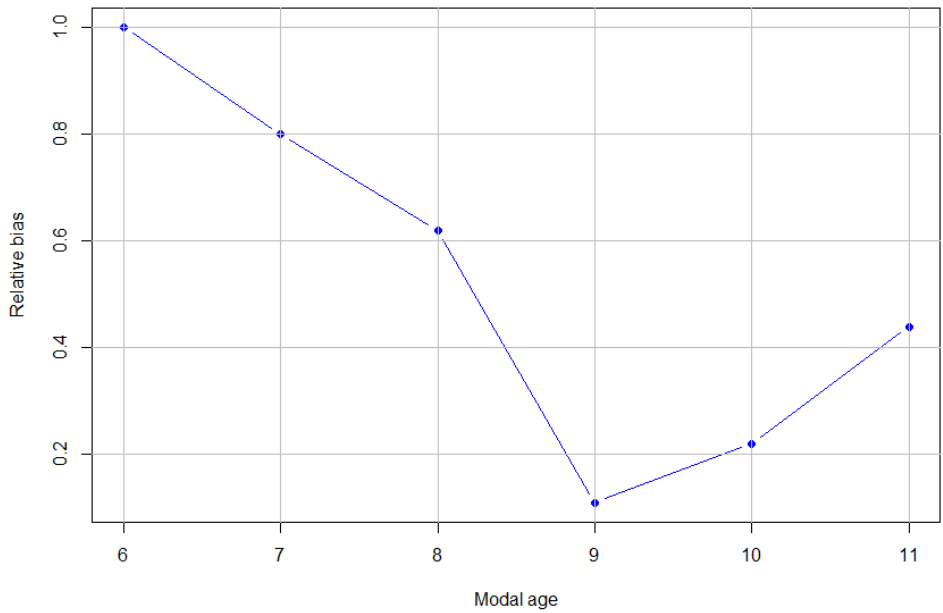


Figure 10.6.9: The relative bias by modal age as estimated by all age readers combined.

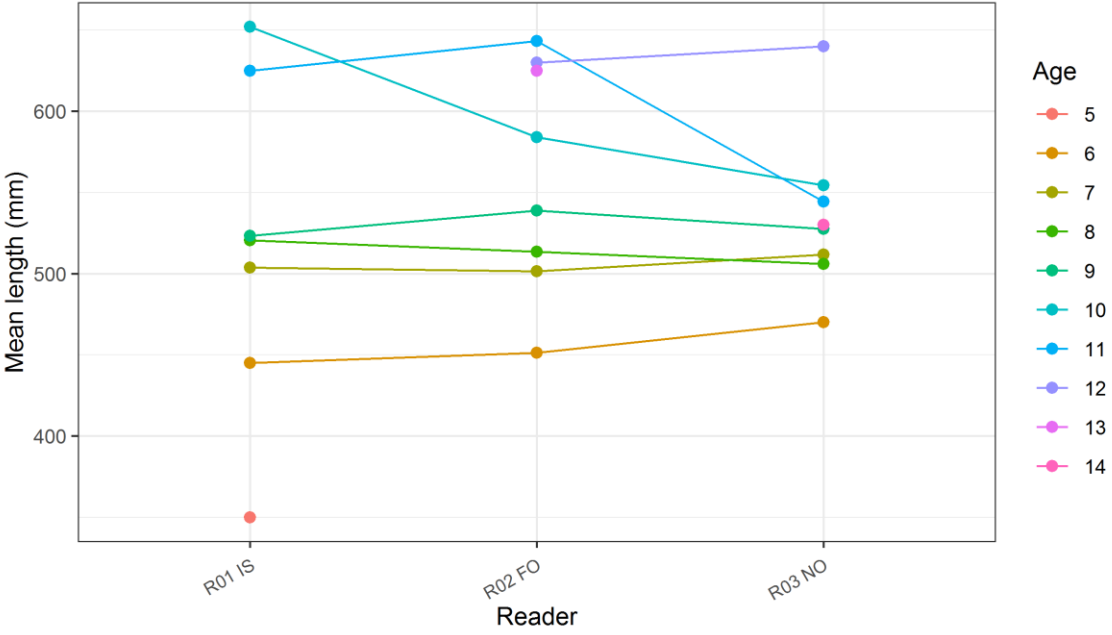


Figure 10.6.10: The mean length at age as estimated by each age reader.

10.7 Results blackspot seabream

All readers

Data Overview

Table 10.7.1: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	Length (gth)	Sex (x)	Catch date	ICES area	R01	R02	R03	R04	R06	R07	R08	R09	R10	R11	R12	R13	R14	R15	Modal age	P %	C %	A %	
5037	321	-	244	-	16/10/2010 00:00:00	missing	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	93	5	3	
5038	321	-	402	-	16/06/2010 00:00:00	missing	11	-	6	7	11	11	-	8	6	7	-	-	6	-	6	6	40	28	24
5039	321	-	340	-	16/06/2010 00:00:00	missing	6	4	7	5	7	8	7	6	5	5	5	-	4	4	6	5	29	23	19
5040	321	-	297	-	16/06/2010 00:00:00	missing	5	7	8	7	6	9	8	8	7	7	7	8	7	6	8	7	40	14	11
5041	321	-	385	-	16/06/2010 00:00:00	missing	8	7	7	6	7	9	8	7	6	7	8	7	7	7	7	7	60	11	8
5042	321	-	325	-	16/10/2010 00:00:00	missing	5	4	4	7	7	11	8	5	5	5	4	9	5	8	5	5	40	34	29
5043	321	-	296	-	16/10/2010 00:00:00	missing	5	4	6	7	6	6	7	7	6	7	6	6	6	6	6	6	60	13	8
5044	321	-	395	-	16/10/2010 00:00:00	missing	9	8	6	8	9	10	8	9	6	7	5	8	9	9	7	9	33	18	14
5045	321	-	334	-	16/10/2010 00:00:00	missing	7	5	6	6	8	9	7	7	5	7	6	7	5	5	7	7	40	18	15
5046	321	-	360	-	16/10/2010 00:00:00	missing	6	7	5	7	7	6	9	7	6	5	4	7	6	9	6	6	33	21	16
5047	321	-	324	-	16/10/2010 00:00:00	missing	6	7	5	6	7	7	7	6	6	5	5	7	5	5	6	5	33	14	11
50	321	-	285	-	16/10/	miss	5	7	7	5	6	7	5	6	5	6	6	6	5	6	6	6	4	1	10

48				2010	ing																7	3	
				00:00:00																			
50	321	-	413	-	16/10/2010	miss	12	-	6	7	10	7	-	8	6	3	4	-	4	5	8	4	1 3 30
49					00:00:00	ing																7 9	
					0																		
50	321	-	408	-	16/10/2010	miss	10	7	7	8	9	8	9	8	6	4	4	-	8	4	6	8	2 2 22
50					00:00:00	ing																9 8	
					0																		
50	321	-	334	-	16/10/2010	miss	7	8	8	8	8	8	7	8	6	8	6	9	7	7	6	8	4 1 10
51					00:00:00	ing																7 2	
					0																		
50	321	-	355	-	16/10/2010	miss	6	7	11	9	9	12	8	8	7	8	8	11	11	10	8	8	3 2 16
52					00:00:00	ing																3 0	
					0																		
50	321	-	407	-	16/10/2010	miss	10	11	8	7	10	11	8	8	6	6	5	9	7	12	10	8	2 2 21
53					00:00:00	ing																0 5	
					0																		
50	321	-	291	-	16/06/2010	miss	6	9	9	8	8	10	8	8	6	8	8	9	9	8	8	8	5 1 9
54					00:00:00	ing																3 3	
					0																		
50	321	-	368	-	16/06/2010	miss	8	9	10	7	9	9	8	8	7	8	8	11	7	11	9	8	3 1 12
55					00:00:00	ing																3 5	
					0																		
50	321	-	395	-	16/06/2010	miss	8	-	7	6	10	7	7	8	6	6	4	-	7	9	6	6	3 2 15
56					00:00:00	ing																1 2	
					0																		
50	321	-	396	-	16/06/2010	miss	10	-	8	6	10	7	7	8	6	6	5	-	6	11	5	6	3 2 22
57					00:00:00	ing																1 7	
					0																		
50	321	-	372	-	16/06/2010	miss	8	8	7	5	8	8	7	7	6	5	5	7	6	10	6	7	2 2 16
58					00:00:00	ing																7 0	
					0																		
50	321	-	376	-	16/06/2010	miss	8	9	8	7	8	10	6	8	7	6	5	8	7	7	7	7	3 1 13
59					00:00:00	ing																3 7	
					0																		
50	321	-	380	-	16/10/2010	miss	8	9	10	8	8	8	8	9	7	7	7	8	8	9	7	8	4 1 8
60					00:00:00	ing																7 1	
					0																		
50	321	-	333	-	16/06/2010	miss	7	8	7	8	8	9	8	7	6	7	5	7	8	9	7	7	4 1 11
61					00:00:00	ing																0 4	
					0																		
50	321	-	355	-	16/10/2010	miss	7	8	7	7	7	11	7	7	6	6	6	7	7	8	7	7	6 1 10
62					00:00:00	ing																0 7	
					0																		

50 63	321	-	365	-	16/06/ 2010 00:00:0 0	miss ing	8	-	7	5	7	8	-	7	6	3	4	6	8	8	7	7	3	2	20
50 64	321	-	326	-	16/06/ 2010 00:00:0 0	miss ing	7	10	9	7	8	9	9	9	6	6	6	7	8	8	8	8	2	1	13
50 65	321	-	395	-	16/06/ 2010 00:00:0 0	miss ing	10	9	10	6	9	9	10	10	6	7	7	7	8	10	7	10	3	1	17
50 66	321	-	317	-	16/06/ 2010 00:00:0 0	miss ing	6	8	7	7	7	9	7	8	6	6	7	7	7	8	6	7	4	1	9
50 67	321	-	210	-	16/08/ 2008 00:00:0 0	miss ing	3	5	5	6	5	5	5	5	3	3	5	5	5	5	5	5	7	1	14
50 68	321	-	198	-	16/08/ 2008 00:00:0 0	miss ing	2	5	6	7	4	7	5	4	3	2	6	5	3	3	7	3	2	3	32
50 69	321	-	220	-	16/08/ 2008 00:00:0 0	miss ing	3	3	7	6	5	6	4	4	4	3	6	5	4	4	7	4	3	2	25
50 70	321	-	205	-	16/08/ 2008 00:00:0 0	miss ing	2	3	8	7	4	6	5	5	4	2	5	5	3	4	6	5	2	3	30
50 71	321	-	196	-	16/08/ 2008 00:00:0 0	miss ing	2	4	7	8	4	9	5	4	4	4	6	5	4	3	6	4	4	3	29
50 72	321	-	215	-	16/08/ 2008 00:00:0 0	miss ing	2	1	6	6	4	-	5	4	3	2	4	6	4	2	6	4	2	4	35
50 73	321	-	192	-	16/08/ 2008 00:00:0 0	miss ing	2	3	6	7	4	8	5	4	4	1	7	5	3	3	7	3	2	4	37
50 74	321	-	230	-	16/08/ 2008 00:00:0 0	miss ing	3	4	5	6	5	5	5	5	4	2	4	4	4	4	6	4	4	2	19
50 75	321	-	210	-	16/08/ 2008 00:00:0 0	miss ing	3	4	7	6	4	6	5	5	4	2	7	6	3	3	7	3	2	3	29
50 76	321	-	225	-	16/08/ 2008 00:00:0 0	miss ing	3	4	4	5	5	5	4	5	4	3	3	4	5	4	5	4	4	1	15
50 77	321	-	194	-	16/08/ 2008 00:00:0	miss ing	2	3	7	7	4	5	4	4	3	3	5	5	3	3	6	3	3	3	29

50 78	321	-	218	-	0 16/08/ 2008 00:00:0	miss ing	3	3	4	5	4	3	4	5	3	3	4	4	4	4	4	4	5	1	14
50 79	321	-	193	-	0 16/08/ 2008 00:00:0	miss ing	2	3	7	7	4	5	7	4	3	2	6	5	4	3	7	7	2	4	34
50 80	321	-	205	-	0 16/08/ 2008 00:00:0	miss ing	2	2	7	7	4	3	4	5	3	4	5	6	3	4	6	4	2	3	31
50 81	321	-	200	-	0 16/08/ 2008 00:00:0	miss ing	3	2	7	6	3	3	5	4	3	3	4	5	4	3	5	3	4	3	27
50 82	321	-	248	-	0 16/08/ 2008 00:00:0	miss ing	3	3	5	7	5	4	5	6	5	4	5	6	5	4	5	5	4	2	17
50 83	321	-	250	-	0 16/08/ 2008 00:00:0	miss ing	4	4	5	6	5	4	5	5	5	4	4	5	5	5	5	5	6	1	10
50 84	321	-	237	-	0 16/08/ 2008 00:00:0	miss ing	3	3	4	6	5	4	5	5	4	3	5	5	5	5	5	5	5	2	17
50 85	321	-	258	-	0 16/08/ 2008 00:00:0	miss ing	4	4	4	6	5	5	5	6	5	4	4	5	6	6	5	5	4	1	13
50 86	321	-	250	-	0 16/08/ 2008 00:00:0	miss ing	3	3	5	6	5	4	5	7	5	4	4	5	6	5	5	5	4	2	17

Table 10.7.2: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

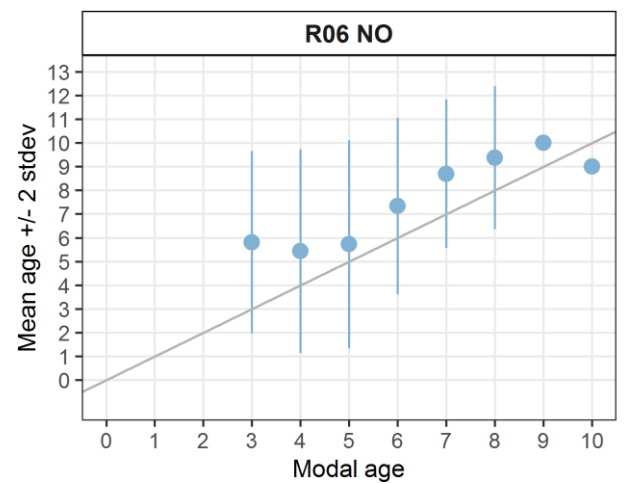
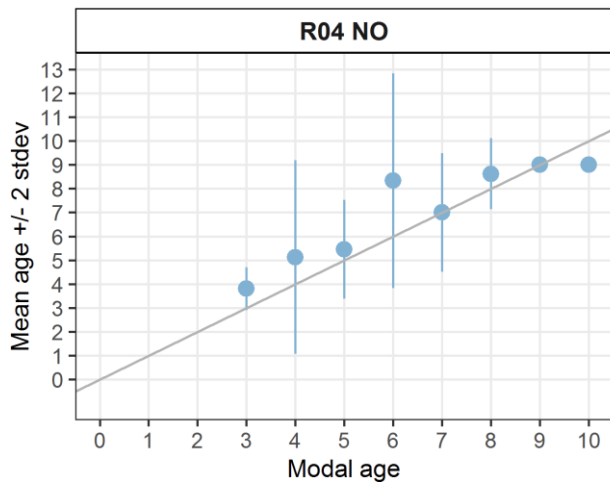
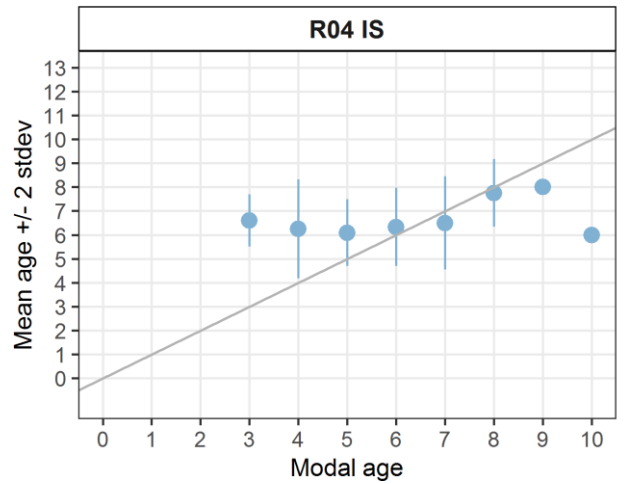
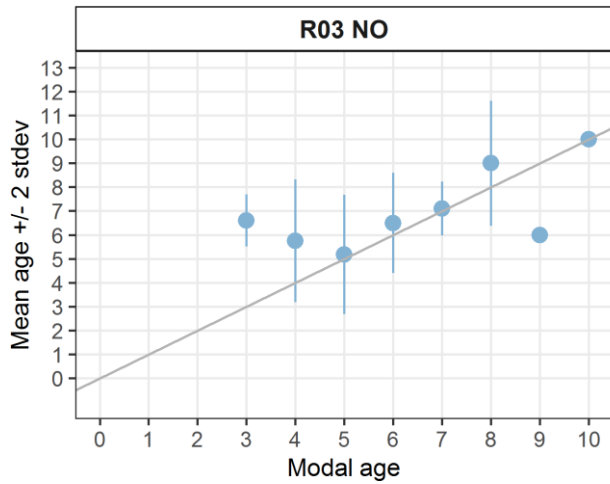
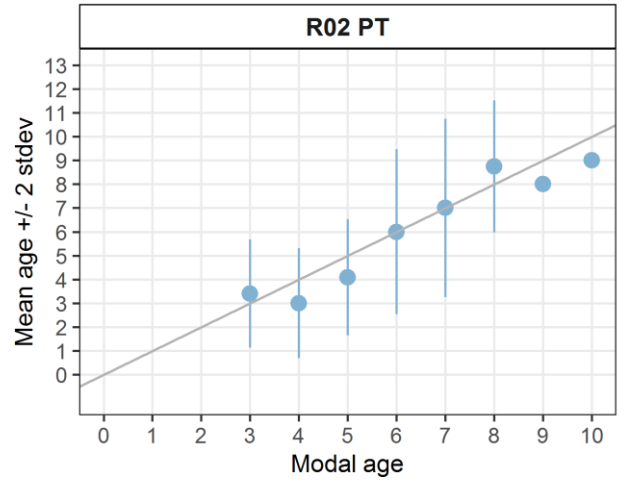
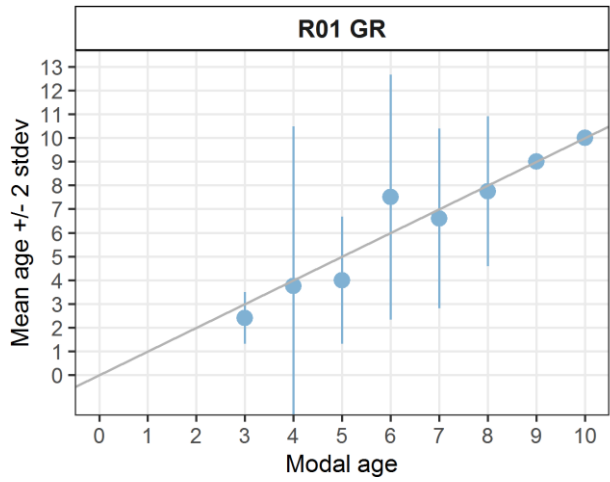
Modal age	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR	total
3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	75
4	8	7	8	8	8	7	7	8	8	8	8	7	8	8	8	116
5	11	11	11	11	11	11	11	11	11	11	11	10	11	11	11	164
6	6	3	6	6	6	6	5	6	6	6	5	3	6	5	6	81
7	10	9	10	10	10	10	9	10	10	10	10	10	10	10	10	148
8	8	8	8	8	8	8	8	8	8	8	8	7	8	8	8	119
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
Total	50	45	50	50	50	49	47	50	50	50	49	44	50	49	50	733

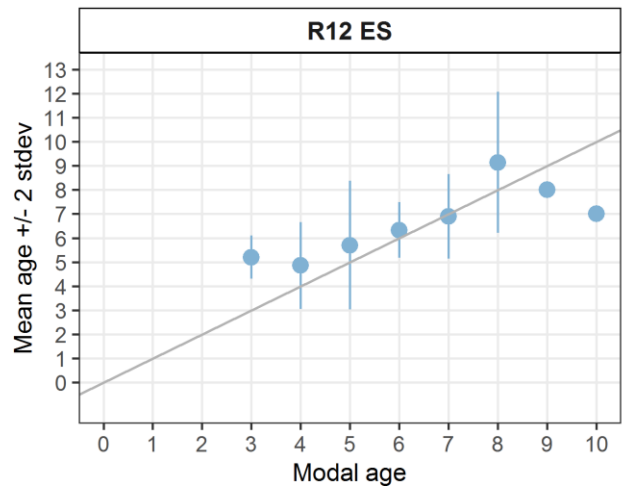
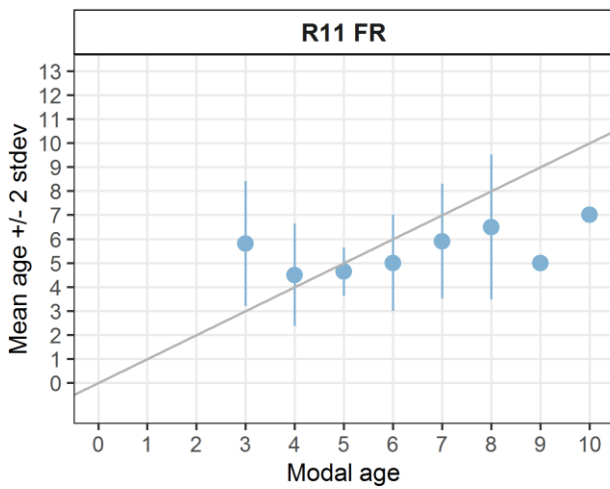
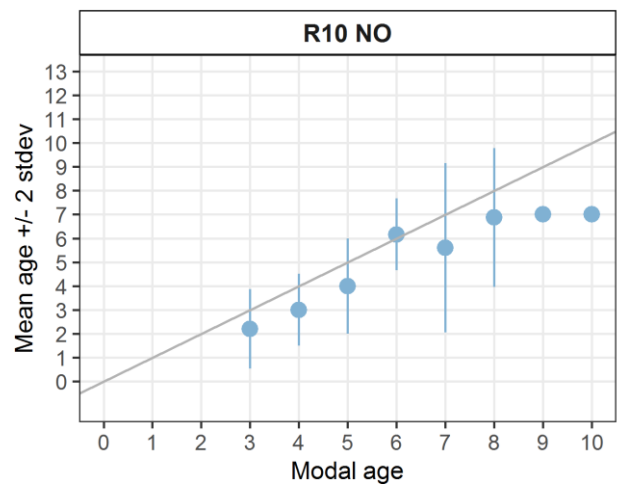
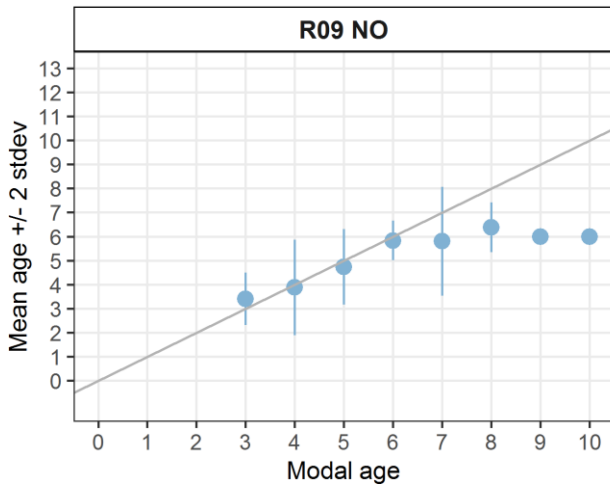
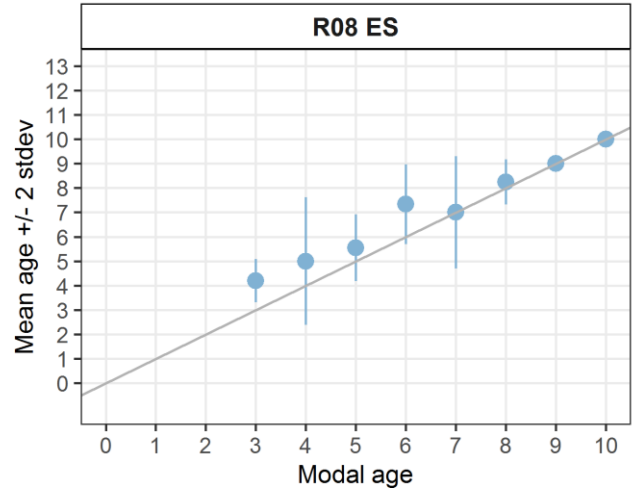
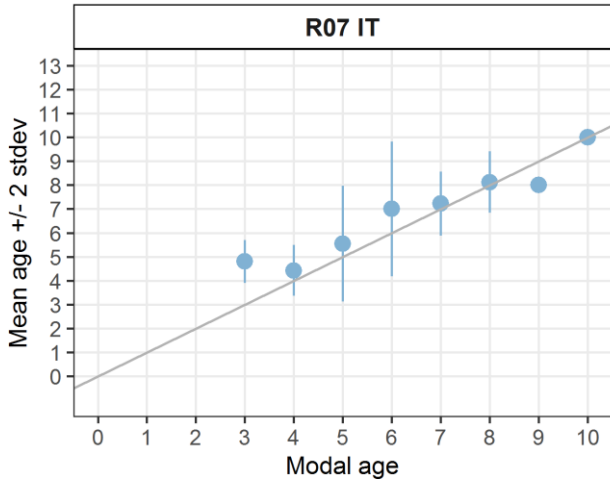
Table 10.7.3: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR
1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
2	8	2	0	0	0	0	0	0	0	6	0	0	0	1	0
3	10	9	0	0	1	3	0	0	8	9	1	0	6	7	0
4	2	9	5	0	10	4	6	8	8	7	13	3	9	9	1
5	5	4	8	7	10	7	15	11	9	6	15	14	10	8	11
6	6	0	8	16	3	5	1	5	20	8	10	7	7	4	17
7	5	7	17	19	8	6	11	9	5	9	6	10	9	3	14
8	7	6	6	7	8	7	10	13	0	4	4	4	6	6	5
9	1	5	2	1	5	9	3	3	0	0	0	4	2	5	1
10	4	1	3	0	4	3	1	1	0	0	0	0	0	3	1
11	1	1	1	0	1	4	0	0	0	0	0	2	1	2	0
12	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Total	50	45	50	50	50	49	47	50	50	50	49	44	50	49	50

Table 10.7.4: Mean 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	R01 GR	R02 PT	R03 NO	R04 IS	R04 NO	R06 NO	R07 IT	R08 ES	R09 NO	R10 NO	R11 FR	R12 ES	R13 FO	R14 FO	R15 FR
1	-	215	-	-	-	-	-	-	-	192	-	-	-	-	-
		mm								mm					
2	200	202	-	-	-	-	-	-	-	208	-	-	-	215	-
	mm	mm								mm				mm	
3	225	217	-	-	200	208	-	-	204	254	225	-	201	198	-
	mm	mm			mm	mm			mm	mm	mm		mm	mm	
4	254	259	253	-	203	246	218	201	214	259	299	224	247	255	218
	mm	mm	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
5	289	246	264	293	237	222	226	233	282	328	299	218	268	283	258
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	331	-	306	282	293	258	376	291	363	357	274	261	333	284	299
	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
7	336	345	293	299	346	335	332	339	355	357	298	350	359	365	309
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
8	377	351	336	334	343	342	354	366	-	337	350	362	368	330	336
	mm	mm	mm	mm	mm	mm	mm	mm		mm	mm	mm	mm	mm	mm
9	395	362	308	355	384	328	365	367	-	-	-	339	343	373	368
	mm	mm	mm	mm	mm	mm	mm	mm				mm	mm	mm	mm
10	402	326	381	-	403	354	395	395	-	-	-	-	-	374	407
	mm	mm	mm		mm	mm	mm	mm						mm	mm
11	402	407	355	-	402	372	-	-	-	-	-	362	355	382	-
	mm	mm	mm		mm	mm						mm	mm	mm	
12	413	-	-	-	-	355	-	-	-	-	-	-	-	407	-
	mm					mm								mm	
Weighted Mean	299	288	299	299	299	300	292	299	299	299	296	286	299	296	299
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm





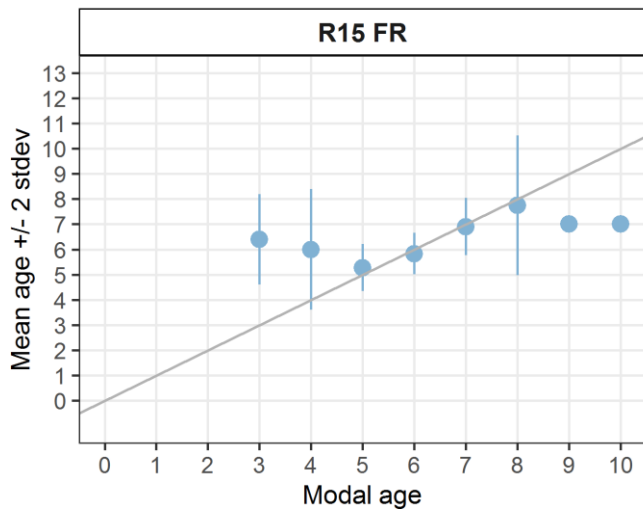
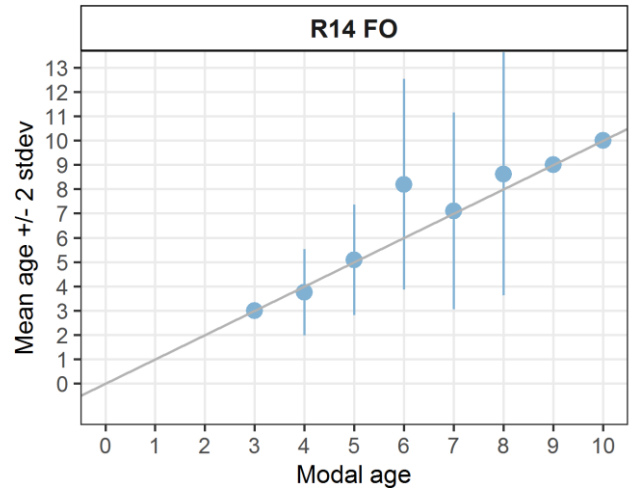
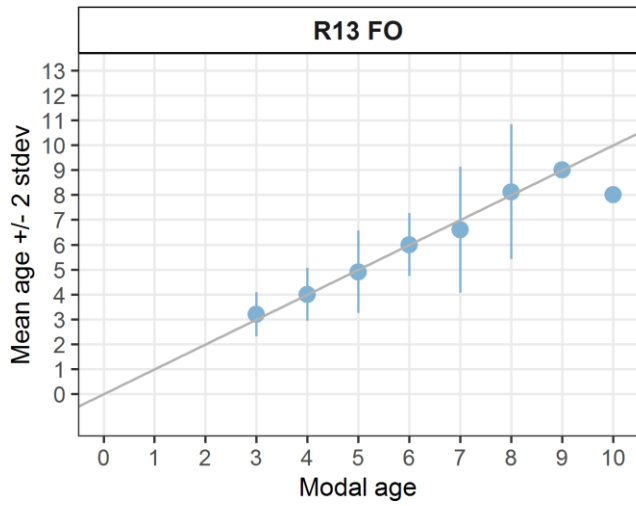


Figure 10.7.1: Age bias plot for all readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

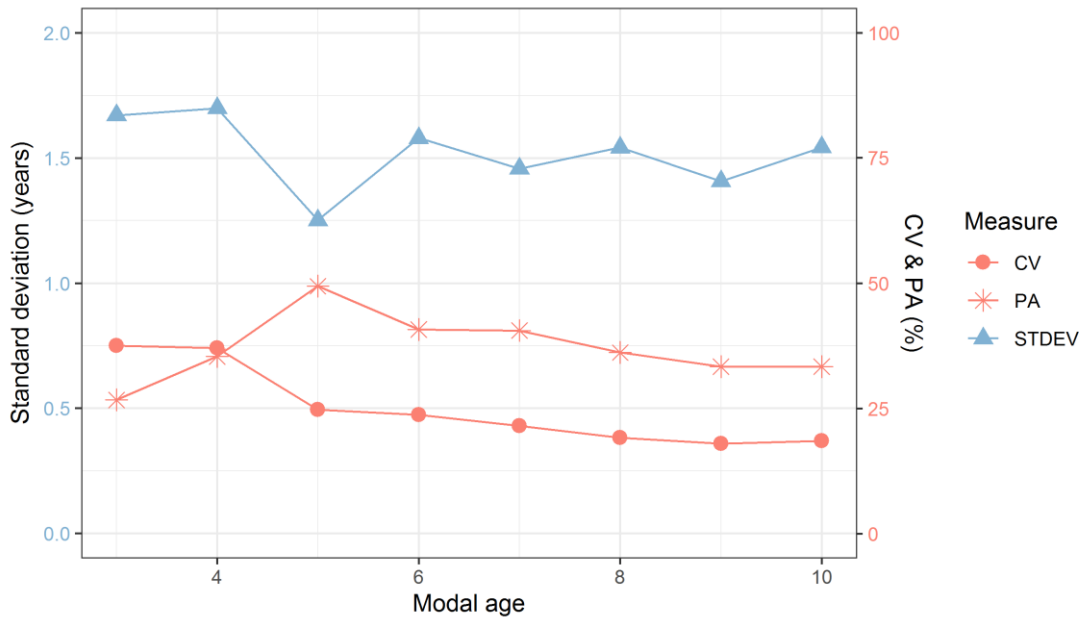


Figure 10.7.2: CV, PA and (STDEV (standard deviation) are plotted against modal age.

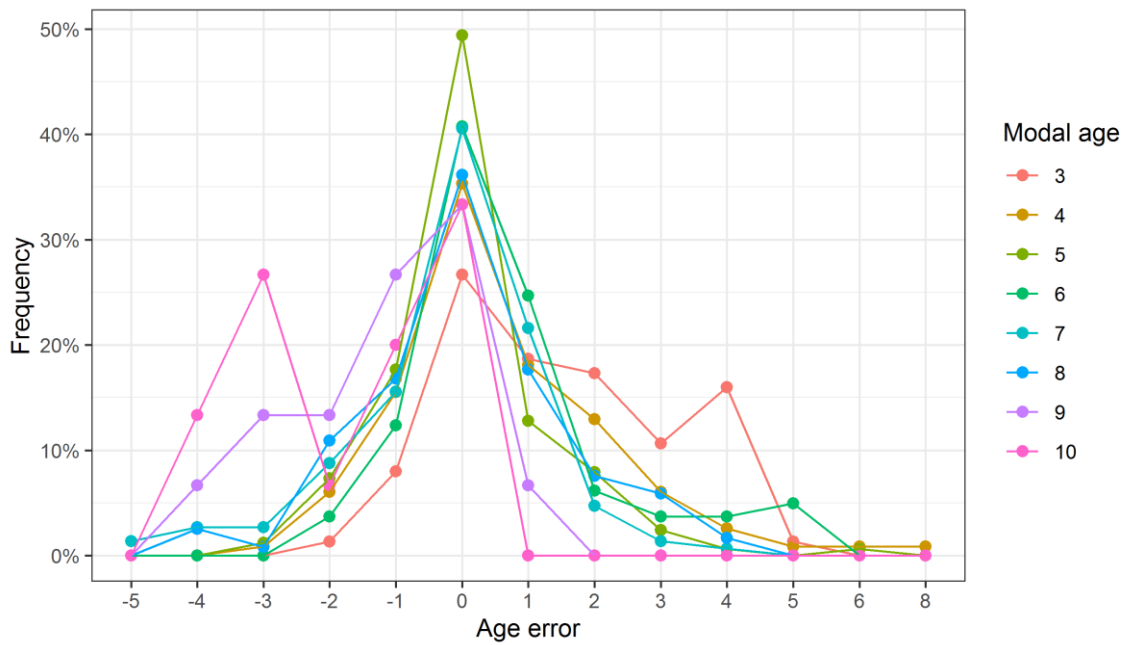


Figure 10.7.3: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

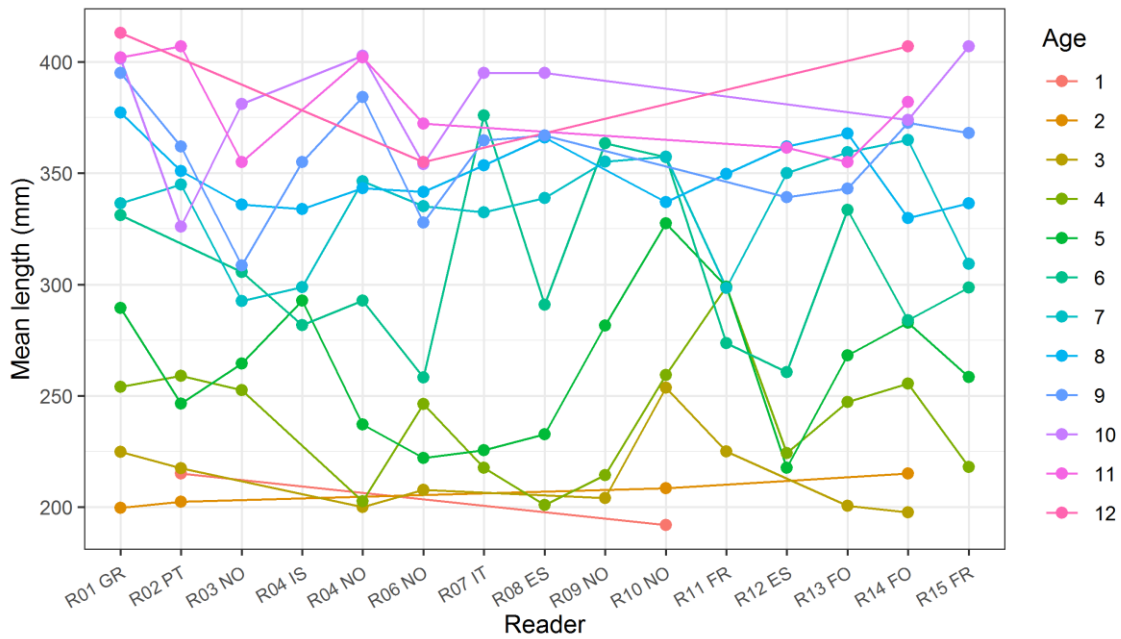


Figure 10.7.4: The mean length at age as estimated by each age reader.

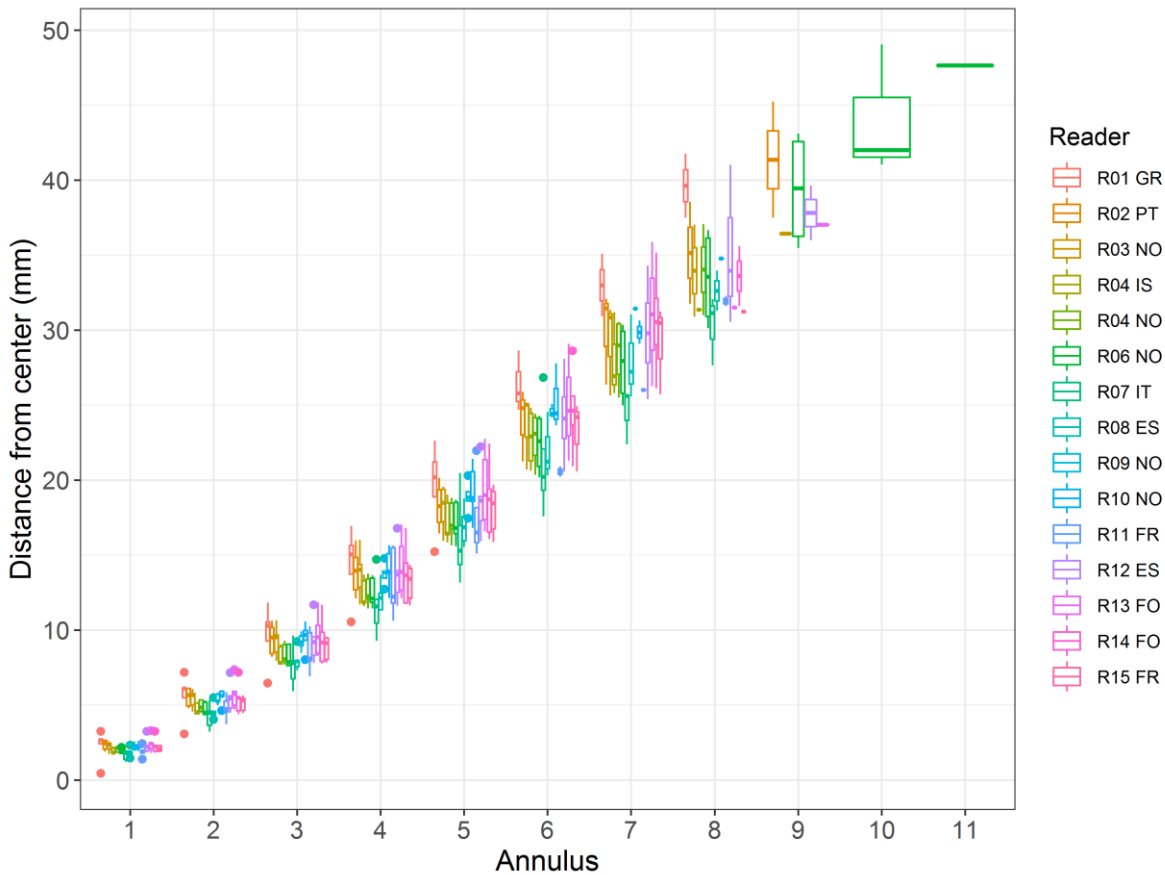


Figure 10.7.5: Plot of average distance from the centre to the winter rings for advanced readers by preparation method. The boxes represent the median, upper and lower box boundaries of the interquartile range, whiskers represent the minimum and maximum values, and the dots represent the outliers.

Advanced readers

All samples included

Data Overview

Table 10.7.5: Data overview including modal age and statistics per sample.

Fish ID	Event ID	Image ID	length	sex	Catch date	ICES area	R01 GR	R02 PT	Modal age	PA %	CV %	APE %
5037	321	-	244	-	16/10/2010 00:00:00	missing	5	5	5	100	0	0
5038	321	-	402	-	16/06/2010 00:00:00	missing	11	-	11	100	-	0
5039	321	-	340	-	16/06/2010 00:00:00	missing	6	4	4	50	28	20
5040	321	-	297	-	16/06/2010 00:00:00	missing	5	7	5	50	24	17
5041	321	-	385	-	16/06/2010 00:00:00	missing	8	7	7	50	9	7
5042	321	-	325	-	16/10/2010 00:00:00	missing	5	4	4	50	16	11
5043	321	-	296	-	16/10/2010 00:00:00	missing	5	4	4	50	16	11
5044	321	-	395	-	16/10/2010 00:00:00	missing	9	8	8	50	8	6
5045	321	-	334	-	16/10/2010 00:00:00	missing	7	5	5	50	24	17
5046	321	-	360	-	16/10/2010 00:00:00	missing	6	7	6	50	11	8
5047	321	-	324	-	16/10/2010 00:00:00	missing	6	7	6	50	11	8
5048	321	-	285	-	16/10/2010 00:00:00	missing	5	7	5	50	24	17
5049	321	-	413	-	16/10/2010 00:00:00	missing	12	-	12	100	-	0
5050	321	-	408	-	16/10/2010 00:00:00	missing	10	7	7	50	25	18
5051	321	-	334	-	16/10/2010 00:00:00	missing	7	8	7	50	9	7
5052	321	-	355	-	16/10/2010 00:00:00	missing	6	7	6	50	11	8
5053	321	-	407	-	16/10/2010 00:00:00	missing	10	11	10	50	7	5
5054	321	-	291	-	16/06/2010 00:00:00	missing	6	9	6	50	28	20
5055	321	-	368	-	16/06/2010 00:00:00	missing	8	9	8	50	8	6
5056	321	-	395	-	16/06/2010 00:00:00	missing	8	-	8	100	-	0
5057	321	-	396	-	16/06/2010 00:00:00	missing	10	-	10	100	-	0
5058	321	-	372	-	16/06/2010 00:00:00	missing	8	8	8	100	0	0
5059	321	-	376	-	16/06/2010 00:00:00	missing	8	9	8	50	8	6
5060	321	-	380	-	16/10/2010 00:00:00	missing	8	9	8	50	8	6
5061	321	-	333	-	16/06/2010 00:00:00	missing	7	8	7	50	9	7
5062	321	-	355	-	16/10/2010 00:00:00	missing	7	8	7	50	9	7
5063	321	-	365	-	16/06/2010 00:00:00	missing	8	-	8	100	-	0
5064	321	-	326	-	16/06/2010 00:00:00	missing	7	10	7	50	25	18
5065	321	-	395	-	16/06/2010 00:00:00	missing	10	9	9	50	7	5
5066	321	-	317	-	16/06/2010 00:00:00	missing	6	8	6	50	20	14
5067	321	-	210	-	16/08/2008 00:00:00	missing	3	5	3	50	35	25
5068	321	-	198	-	16/08/2008 00:00:00	missing	2	5	2	50	61	43
5069	321	-	220	-	16/08/2008 00:00:00	missing	3	3	3	100	0	0
5070	321	-	205	-	16/08/2008 00:00:00	missing	2	3	2	50	28	20
5071	321	-	196	-	16/08/2008 00:00:00	missing	2	4	2	50	47	33
5072	321	-	215	-	16/08/2008 00:00:00	missing	2	1	1	50	47	33
5073	321	-	192	-	16/08/2008 00:00:00	missing	2	3	2	50	28	20
5074	321	-	230	-	16/08/2008 00:00:00	missing	3	4	3	50	20	14
5075	321	-	210	-	16/08/2008 00:00:00	missing	3	4	3	50	20	14
5076	321	-	225	-	16/08/2008 00:00:00	missing	3	4	3	50	20	14
5077	321	-	194	-	16/08/2008 00:00:00	missing	2	3	2	50	28	20
5078	321	-	218	-	16/08/2008 00:00:00	missing	3	3	3	100	0	0
5079	321	-	193	-	16/08/2008 00:00:00	missing	2	3	2	50	28	20
5080	321	-	205	-	16/08/2008 00:00:00	missing	2	2	2	100	0	0
5081	321	-	200	-	16/08/2008 00:00:00	missing	3	2	2	50	28	20
5082	321	-	248	-	16/08/2008 00:00:00	missing	3	3	3	100	0	0
5083	321	-	250	-	16/08/2008 00:00:00	missing	4	4	4	100	0	0
5084	321	-	237	-	16/08/2008 00:00:00	missing	3	3	3	100	0	0
5085	321	-	258	-	16/08/2008 00:00:00	missing	4	4	4	100	0	0
5086	321	-	250	-	16/08/2008 00:00:00	missing	3	3	3	100	0	0

Table 10.7.6: Number of age readings table gives an overview of number of readings per reader and modal age. The total numbers of readings per reader and per modal age are summarized at the end of the table.

Modal age	R01 GR	R02 PT	total
1	1	1	2
2	8	8	16
3	9	9	18
4	5	5	10
5	4	4	8
6	5	5	10
7	6	6	12
8	7	5	12
9	1	1	2
10	2	1	3
11	1	0	1
12	1	0	1
Total	50	45	95

Table 10.7.7: Age composition by reader gives a summary of number of readings per reader.

Modal age	R01 GR	R02 PT
1	0	1
2	8	2
3	10	9
4	2	9
5	5	4
6	6	0
7	5	7
8	7	6
9	1	5
10	4	1
11	1	1
12	1	0
Total	50	45

Table 10.7.8: Mean 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	R01 GR	R02 PT
1	-	215 mm
2	200 mm	202 mm
3	225 mm	217 mm
4	254 mm	259 mm
5	289 mm	246 mm
6	331 mm	-
7	336 mm	345 mm
8	377 mm	351 mm
9	395 mm	362 mm
10	402 mm	326 mm
11	402 mm	407 mm
12	413 mm	-
Weighted Mean	299 mm	288 mm

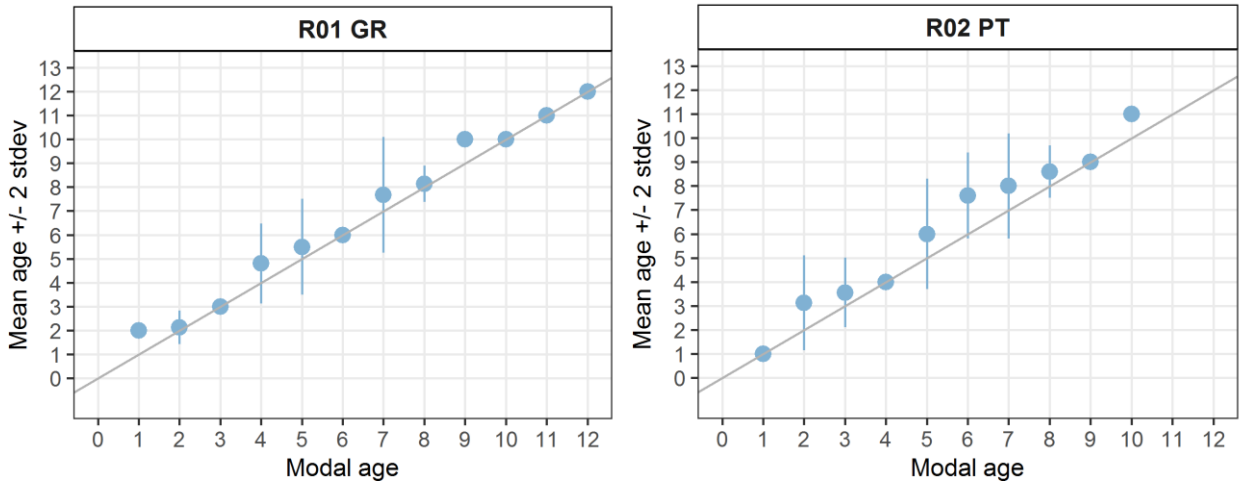


Figure 10.7.6: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader are plotted against modal age. The estimated mean age corresponds to modal age if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between estimated mean age and modal age.

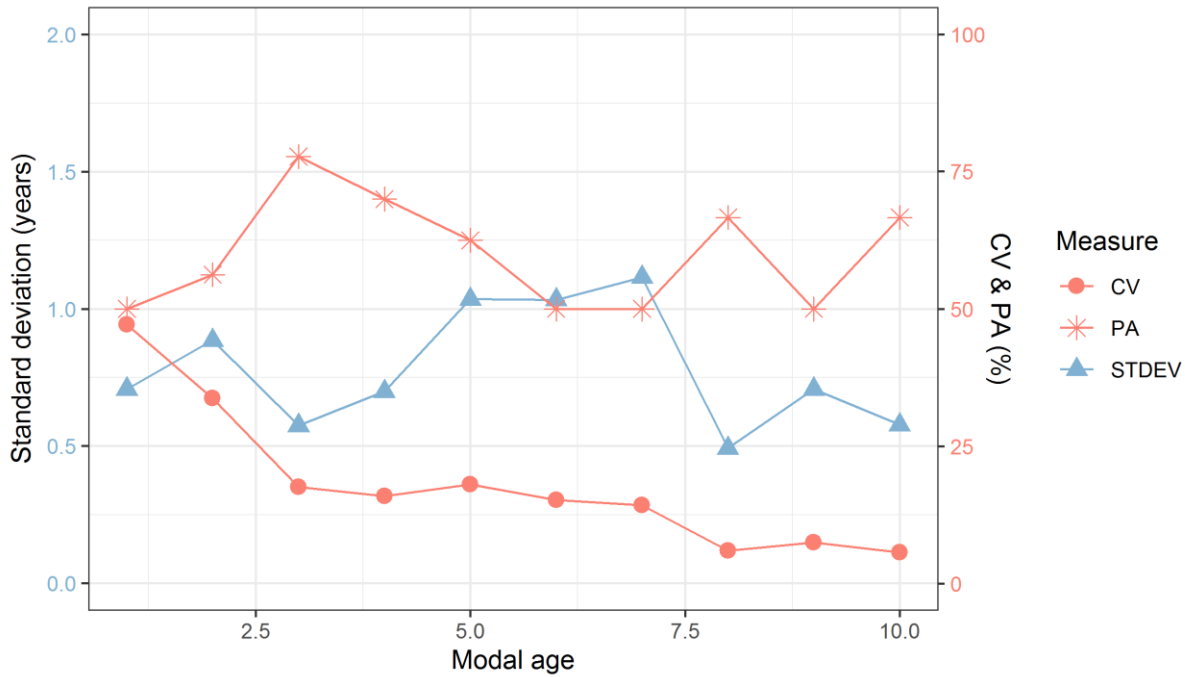


Figure 10.7.7: CV, PA and (STDEV (standard deviation) are plotted against modal age.

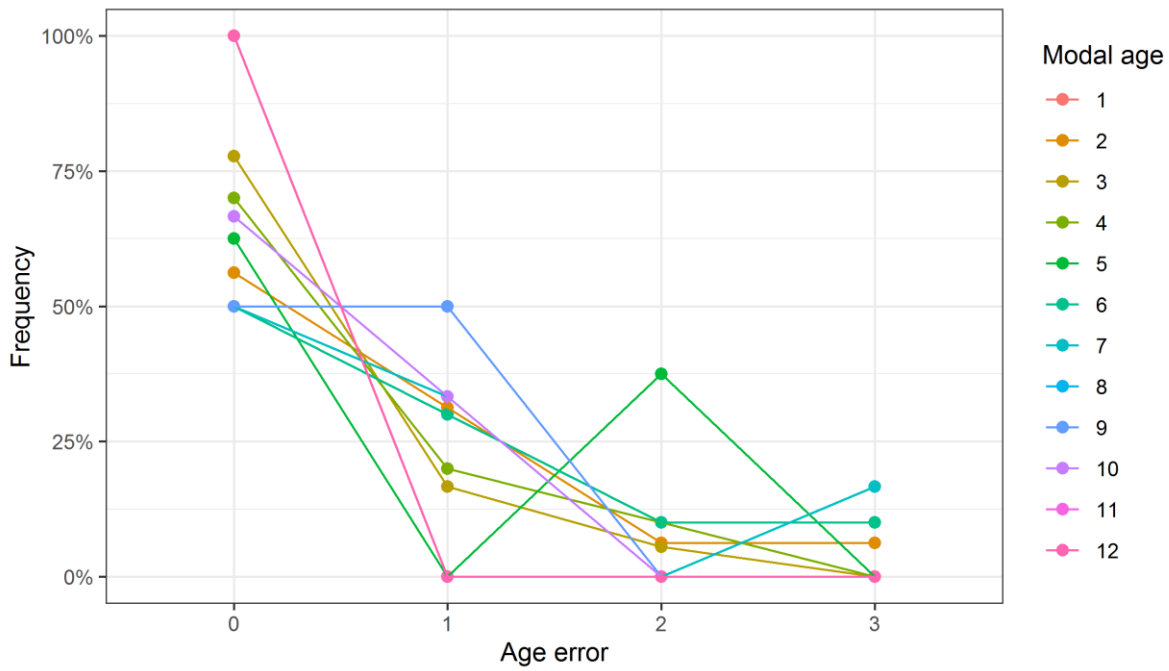


Figure 10.7.8: The distribution of the age reading errors in percentage by modal age as observed from the whole group of age readers in an age reading comparison to modal age. The achieved precision in age reading by MODAL age group is shown by the spread of the age readings errors. There appears to be no relative bias if the age reading errors are normally distributed. The distributions are skewed if relative bias occurs.

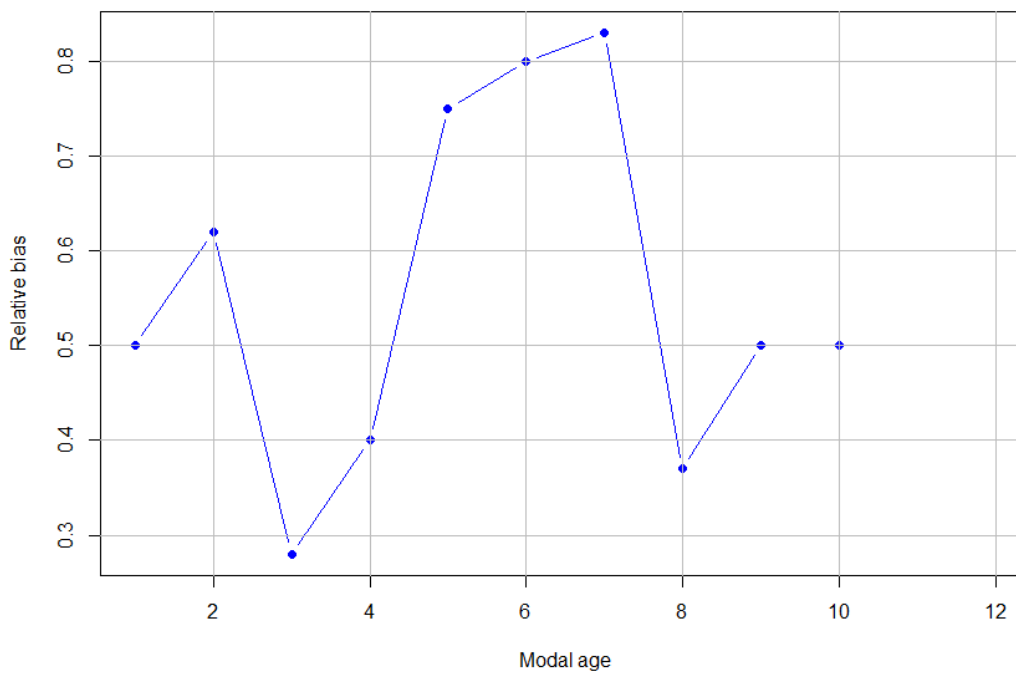


Figure 10.7.9: The relative bias by modal age as estimated by all age readers combined.

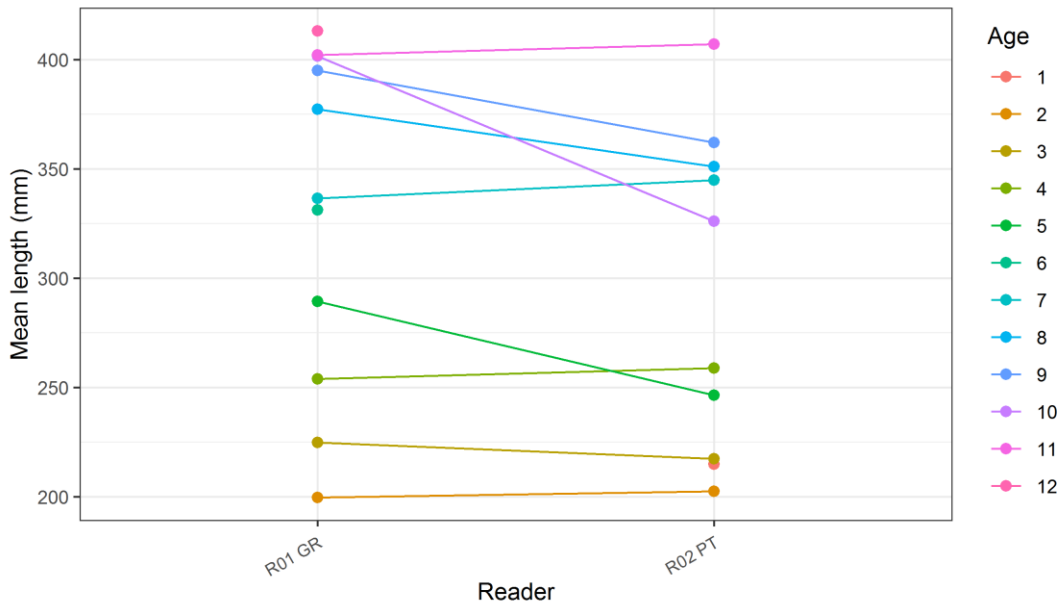


Figure 10.7.10: The mean length at age as estimated by each age reader.