2020 North Sea and Skagerrak Plaice (*Pleuronectes platessa*) Age Reading Exchange (SmartDots ID 281)

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1 Summary

Workshop 2 on age reading of North Sea plaice (*Pleuronectes platessa*), (WKARP2) (ICES, 2022; full report https://ices-library.figshare.com/articles/report/Workshop_2_on_Age_Reading_of_North_Sea_plaice_Pleuronectes_platessa_WKARP2_outputs_from_2021_meeting_/20473083) was the first age reading workshop focusing specifically on age reading of the North Sea plaice stock (ple.27.420) in the North Sea and Skagerrak. The objectives of the workshop were: to evaluate the level of agreement between age readers for the stock by reviewing results of the 2020 North Sea Skagerrak plaice exchange in consideration of previous calibration and validation work; to standardize laboratory procedures and age reading methods applied; to provide guidelines for reliable age interpretation; to provide age error data to the stock assessment working group; to create an agreed age reference collection of otoliths.

This summary report outlines the results from 2020 North Sea and Skagerrak Plaice Age Reading Exchange (SmartDots ID 281) that took place in advance of the 2021 workshop, results are based only on the advanced age readers who provide age data for stock assessment purposes.

Two age reading exercises, one exchange before the workshop (SmartDots ID 281), and one workshop exercise (ID 402) were completed using SmartDots. Age readers' annotations of growth structures and ageing results from both exercises were examined using standardized quality analyses based on an R script, presented in this report. Age reading error data has been provided to the ICES WGNSSK (Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak) which can be tested in the ple.27.420 stock assessment model. Disagreement between readers is mostly attributable to differences in the identification of the first winter ring as this can vary in width across samples collected from different areas. Results showed that estimated ages in older fish can be unreliable due to a narrowing of the annuli close to the otolith edge. Further work is required to provide guidelines for age readers about which structures should be identified as annuli. Different preparation methods are applied in national laboratories. The group concluded that reading whole and sectioned otoliths viewed under reflected light is optimal; no obvious benefit was identified from sectioning plaice otoliths from fish under the age of 6. Using images of otoliths, the reliability of the age reading results is depending on image quality. To help standardize image format, lighting and calibration a workshop is recommended to establish a set of guidelines for image quality used in age determination.

2 Overview of samples and readers

In the 2020 North Sea plaice exchange, 90 samples of whole otoliths from Skagerrak Area 27.3.a.20 were provided, and 106 samples from the North Sea 27.4.b and c (Table 2.1). The North Sea otoliths were provided as both whole and sectioned, taken from the same fish but not the same otolith.

Table 2.1. Overview of the samples, number of readers and modal age range by strata used for the 2020 North Sea Plaice age reading exchange.

Strata	N samples	N readers	Modal age range	Comparison
Skagerrak, 27.3.a.20, whole otoliths	90	14 (7 advanced)	0–14	All readers (section 2.3.2)
				Advanced readers (section 2.4.5)
North Sea, 27.4.b and c, whole otoliths	106	14 (7 advanced)	0–11	All readers (section 2.3.3)
				Advanced readers (section 2.4.6)
North Sea, 27.4.b and c, sectioned otoliths	106	7 (6 advanced)	0–16	All readers (section 2.3.4)
				Advanced readers (section 2.4.7)

Table 2.2. Reader overview showing reader code, level of expertise (based on whether or not the reader delivers data for stock assessment purposes), rank, and strata applied in the analysis.

Reader code	Expertise	Expertise_rank	strata
R02 SE	Advanced	3	Whole_27.4
R02 SE	Advanced	3	Whole_27.3.a.20
R02 SE	Advanced	5	Sectioned_27.4
R04 NL	Advanced	1	Sectioned_27.4
R04 NL	Advanced	5	Whole_27.3.a.20
R04 NL	Advanced	5	Whole_27.4
R06 DK	Advanced	9	Whole_27.4
R06 DK	Advanced	9	Whole_27.3.a.20
R08 SE	Advanced	6	Whole_27.4
R10 NL	Advanced	2	Sectioned_27.4
R10 NL	Advanced	8	Whole_27.3.a.20
R12 BE	Advanced	2	Whole_27.3.a.20
R12 BE	Advanced	2	Whole_27.4
R14 BE	Advanced	4	Whole_27.4
R14 BE	Advanced	4	Whole_27.3.a.20
R14 BE	Advanced	5	Sectioned_27.4
R16 GB	Advanced	3	Sectioned_27.4
R18 DK	Advanced	1	Whole_27.3.a.20
R18 DK	Advanced	1	Whole_27.4

3 Results

Table 3.1 Overview of results from the 2020 North Sea and Skagerrak Plaice exchange (SmartDots ID 281).

Strata	N samples	N readers	Modal age range	Comparison	PA%	CV%
Skagerrak 27.3.a.20	90	14 (7 advanced)	0–14	All readers	66%	43%
				Advanced readers	69%	55%
North Sea 27.4.b and c	106	14 (7 advanced)	0–11	All readers	75%	50%
				Advanced readers	76%	46%
North Sea 27.4.b and c	106	7 (6 advanced)	0–16	All readers	75%	38%
				Advanced readers	75%	38%
Stock level ple.27.420	196	11 (9 advanced)	0–16	Advanced readers	72%	32%

3.1 Advanced readers: stock level (ple.27.420)

A stock-level (ple.27.420) analysis of age-reading agreements was carried out for the first time in 2020. Only age readings of those readers who provide age data for stock assessment purposes (advanced readers) based on images of otoliths prepared following their routine age reading methods were used in this analysis. The Guus Eltink Excel Workbook *Age Reading Comparisons* was used. Stock-level results for ple.27.420 show an overall PA of 73% (Table 3.1.2) and CV of 32% (Table 3.1.3). Reader bias is positive overall at 0.06, ranging from 0.08 to 0.28 at modal ages 0 to 7 (except for modal age 4 which is negative) indicating an overestimation of age compared with modal ages.

Individual reader bias ranges from −0.32 to 0.53 with the highest bias values being positive and again indicating an overestimation compared with modal age.

Table 3.1.1 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 (except age 0). Reader number, country, and method (S = sectioned and W = whole) is given for each advanced reader for ple.27.420.

Modal age	R04 NL S	R18 DK W	R10 NL S	R12 BEL W	R02 SE W	R16 GB S	R14 BE W	R04 NL W	R08 SE W	R10 NLD W	R06 DK W	All readers
0	0%	0%	316%	168%	178%	132%	0%	0%	129%	0%	447%	172.3%
1	0%	31%	0%	57%	43%	49%	44%	18%	34%	0%	18%	29.0%
2	17%	0%	29%	30%	35%	30%	33%	12%	35%	37%	22%	25.1%
3	11%	15%	27%	13%	13%	25%	15%	20%	14%	13%	22%	13.3%
4	0%	15%	0%	6%	6%	12%	8%	9%	0%	8%	22%	7.4%
5	12%	11%	11%	21%	8%	17%	16%	10%	14%	16%	28%	12.2%
6	14%	6%	14%	16%	10%	13%	8%	16%	8%	18%	17%	11.7%
7	20%	9%	10%	12%	5%	15%	23%	11%	6%	23%	18%	10.8%
8	6%	18%	10%	17%	6%	12%	15%	11%	10%	15%	36%	14.9%
9	16%	16%	10%	12%	13%	19%	20%	12%	6%	6%	14%	11.0%
10	5%	19%	6%	10%	14%	7%	16%	12%	19%	5%	12%	10.6%
11	–	0%	–	5%	5%	–	14%	5%	–	5%	9%	–
12	–	20%	–	6%	16%	–	12%	18%	–	–	28%	–
13	–	–	–	–	–	–	–	–	–	–	–	–
14	–	–	–	–	–	–	–	–	–	–	–	–
15	–	22%	–	4%	5%	–	4%	4%	–	4%	8%	–
0–15	7.8%	13.5%	39.1%	36.9%	38.2%	34.3%	19.1%	11.4%	29.0%	11.6%	65.0%	**32.0%**

Table 3.1.2 Percentage agreement (PA) table represents the PA per modal age and reader, the PA of all readers combined per modal age, and a weighted mean of the PA per reader. Reader number, country, and method (S = sectioned and W = whole) is given for each advanced reader for ple.27.420.

Modal age	R04 NL S	R18 DK W	R10 NL S	R12 BE W	R02 SE W	R16 GB S	R14 BE W	R04 NL W	R08 SE W	R10 NLD W	R06 DK W	All readers
0	100%	100%	90%	70%	75%	44%	100%	100%	60%	100%	95%	87%
1	100%	86%	100%	63%	82%	82%	87%	97%	79%	100%	97%	87%
2	90%	100%	60%	53%	53%	67%	59%	94%	80%	57%	82%	73%
3	89%	80%	78%	80%	80%	44%	67%	87%	78%	83%	80%	77%
4	100%	81%	100%	94%	94%	67%	88%	88%	100%	90%	69%	87%
5	75%	86%	92%	71%	81%	42%	62%	90%	67%	78%	76%	75%
6	50%	88%	50%	50%	71%	25%	63%	50%	75%	75%	88%	64%
7	75%	73%	75%	80%	88%	50%	60%	73%	75%	43%	73%	70%
8	78%	63%	67%	53%	80%	44%	26%	63%	78%	70%	50%	58%
9	71%	42%	57%	50%	43%	86%	17%	50%	71%	60%	50%	51%
10	80%	64%	60%	58%	38%	60%	25%	64%	60%	71%	73%	58%
11	–	100%	–	33%	67%	–	67%	67%	–	67%	33%	–
12	100%	0%	100%	50%	0%	100%	0%	0%	0%	100%	0%	29%
13	–	0%	–	100%	0%	–	0%	100%	–	100%	–	–
14	–	0%	–	100%	100%	–	0%	0%	–	100%	0%	–
15	–	67%	–	33%	0%	–	67%	0%	–	67%	0%	–
0–15	85.7%	78.4%	80.2%	65.3%	71.4%	58.8%	61.7%	79.0%	73.6%	76.4%	74.1%	**72.7%**

Table 3.1.3 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. Reader number, country, and method (S = sectioned and W = whole) is given for each advanced reader for ple.27.420. Red or black values (column "All readers") indicate negative or positive overall bias, respectively.

Modal age	R04 NL S	R18 DK W	R10 NL S	R12 BE W	R02 SE W	R16 GB S	R14 BE W	R04 NL W	R08 SE W	R10 NLD W	R06 DK W	All readers
0	0.00	0.00	0.10	0.35	0.25	1.00	0.00	0.00	0.40	0.00	0.05	0.16
1	0.00	0.14	0.00	0.63	0.23	0.14	0.10	0.03	0.21	0.00	0.03	0.15
2	−0.10	0.00	0.20	0.65	0.27	0.44	0.41	−0.06	0.10	−0.14	−0.18	0.16
3	0.11	0.07	−0.33	0.20	0.20	0.11	0.33	−0.20	0.22	0.17	0.00	0.08
4	0.00	−0.25	0.00	−0.06	0.06	0.33	0.13	−0.13	0.00	−0.10	−0.19	−0.05
5	0.33	−0.19	0.17	0.24	−0.19	1.00	0.43	−0.14	0.25	−0.11	0.24	0.16
6	0.00	0.13	0.00	0.88	0.00	1.25	0.38	0.13	0.25	−0.50	0.38	0.28
7	0.38	−0.33	0.38	0.40	−0.13	1.00	0.73	−0.40	0.25	−0.14	−0.33	0.12
8	0.00	−0.79	−0.44	0.74	0.00	0.56	1.32	−0.42	0.11	0.20	−1.44	−0.04
9	0.14	−0.83	0.29	0.42	−0.57	0.71	1.00	−0.75	0.00	0.40	−0.92	−0.07
10	−0.20	−1.09	−0.40	0.08	−0.38	0.00	1.17	−0.45	−1.00	0.29	−0.64	−0.20
11	–	0.00	–	0.67	−0.33	–	1.00	−0.33	–	−0.33	0.00	–
12	0.00	−5.00	0.00	−0.50	−3.00	0.00	0.00	−4.00	−1.00	0.00	−4.50	−2.06
13	–	−2.00	–	0.00	−1.00	–	3.00	0.00	–	0.00	–	–
14	–	1.00	–	0.00	0.00	–	5.00	−1.00	–	0.00	−1.00	–
15	–	−1.67	–	−0.67	−2.33	–	0.33	−1.33	–	−0.33	−2.00	–
0–15	0.07	−0.31	0.01	0.39	−0.05	0.53	0.53	−0.25	0.12	−0.01	−0.32	**0.06**

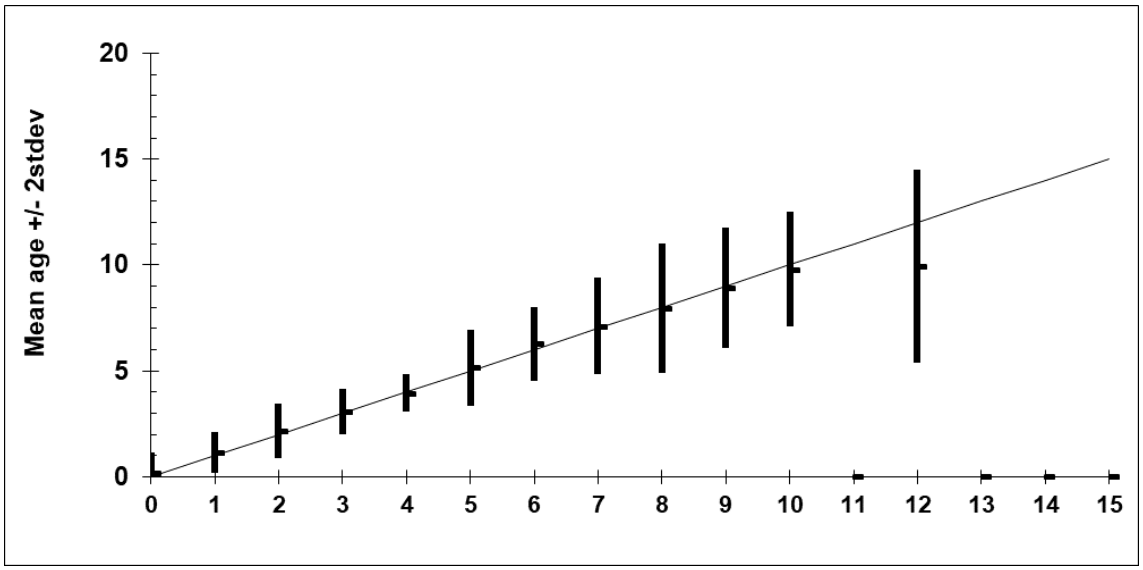

Figure 3.1.1 Age bias plot for all advanced readers for ple.27.420. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line). Relative bias is the age difference between the estimated mean age and modal age.

References

ICES. 2022. Workshop 2 on Age Reading of North Sea plaice (*Pleuronectes platessa*) (WKARP2; outputs from 2021 meeting). ICES Scientific Reports. 4:64. 189 pp. http://doi.org/10.17895/ices.pub.20473083.