SmartDots Summary Report for the 2022 exchange for the central Baltic herring stock *her.27.25-2932* (event ID 449)

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1 Summary

This summary gives the results presented to the BWKBALTPEL (ICES benchmark workshop on Baltic Pelagic stocks) 2023 data compilation meeting in November 2022. Age error matrices (AEM's) were provided following a request from the group. A single matrix per ICES SubDivision (SD) was provided as well as a combined AEM for all SD's.

The full report can be found https://smartdots.ices.dk/ViewEvent?key=449

The 2022 exchange for the central Baltic herring stock *her.27.25-2932* took place via the SmartDots platform between May and October 2022. The exchange was organised following a request from WGBFAS and in preparation for the 2023 benchmark of the stock. Fifteen readers from nine countries took part (Denmark, Poland, Sweden, Germany, Latvia, Lithuania, Estonia and Finland); twelve "advanced" readers (providing age data for assessment) and 3 "basic" readers (do not provide age data for assessment). 163 otoliths images, covering ICES SD25, 26, 29 and 32 were provided by Poland and Finland and uploaded to the SmartDots platform. The aim was to include samples from all SD's included in the stock assessment but the otoliths from SD27 were not included due to lack of resources within the lab photographing the otoliths. Images of whole otoliths from SD's 25 (n=27) and 26 (n=30) were provided by Poland. For SD 29, images of sectioned and stained and whole otoliths from the same fish (n = 24) plus additional images (n=18) of sectioned and stained otoliths were provided by Finland. For SD32, images of sectioned and stained otoliths (n=40) were provided by Finland. The aim was to cover all areas, quarters and age groups for each ICES SD's used in the stock assessment but this aim was not reached.

This summary report presents the results based on advanced readers only (those who provide age date for stock assessment purposes); for SD 25 overall PA was 93%, CV was 8% and relative bias -0.04; for SD 26, overall PA was 85%, CV was 9% and relative bias -0.01; for ICES SD 29 overall PA was 89%, CV was 12% and relative bias 0.06; for ICES SD 32, (based on the ATAQCS analysis) overall PA was 70%, CV was 7% and relative bias 0.38. The analysis was carried out by ICES SD as not all readers are experienced in reading otoliths from all areas and the growth patterns observed in the otoliths vary greatly from north to south, meaning a correct interpretation by readers not experienced with samples from another SD would introduce bias in the results.

2 Overview of samples and advanced readers

Table 2.1: Overview of samples for the 2022 exchange for the central Baltic herring stock. The modal age range is 0-10.

Year	ICES area	Quarter	Number of samples	Modal age range	Length range
2021	27.3.d.25	3	8	1-7	10-20 mm
2021	27.3.d.25	4	5	1-10	15-20 mm
2022	27.3.d.25	1	6	1-7	15-20 mm
2022	27.3.d.25	2	8	1-8	10-20 mm
2021	27.3.d.26	3	6	1-8	15-20 mm

2021	27.3.d.26	4	8	1-8	15-20 mm
2022	27.3.d.26	1	8	1-8	10-25 mm
2022	27.3.d.26	2	8	1-8	10-20 mm
2022	27.3.d.29	1	24	0-6	95-180 mm
2021	27.3.d.32	1	20	1-8	90-175 mm
2021	27.3.d.32	2	20	1-8	95-175 mm

Table 2.2: Overview of advanced readers.

Reader code	Expertise
R01 DK	Advanced
R02 SE	Advanced
R03 EE	Advanced
R04 LT	Advanced
R05 FI	Advanced
R06 FI	Advanced
R07 PL	Advanced
R09 LV	Advanced
R10 EE	Advanced
R11 DE	Advanced
R12 DE	Advanced

3 Results

This section shows overall results from the SmartDots output for ICES SD 25, 26 and 29. A full description of the methods applied are available in the full report. Only two advanced readers read the samples from ICES SD 32, thus the SmartDots output is not available, results from SD 32 are based on a separate analysis.

3.1 Age error matrix (AEM) for SD25

Table 3.1: Age error matrix (AEM) for ICES SD 25. The AEM shows the proportional distribution of age readings for each modal age. Only advanced readers are used for calculating the AEM.

Read age	1	2	3	4	5	6	7	8	10	Total
Modal age										
Age 1	**0,89**	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 2	0,07	**0,93**	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 3	0,00	0,00	**1,00**	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 4	0,00	0,00	0,00	**1,00**	0,00	0,00	0,00	0,00	0,00	1,00
Age 5	0,00	0,00	0,00	0,11	**0,89**	0,00	0,00	0,00	0,00	1,00
Age 6	0,00	0,00	0,00	0,00	0,00	**0,89**	0,11	0,00	0,00	1,00
Age 7	0,00	0,00	0,00	0,00	0,00	0,00	**1,00**	0,00	0,00	1,00
Age 8	0,00	0,00	0,00	0,00	0,00	0,00	0,17	**0,83**	0,00	1,00
Age 10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,33	**0,67**	1,00
Total	0,96	1,04	1,00	1,11	0,89	0,89	1,28	1,17	0,67	

3.2 Age error matrix (AEM) for SD26

Table 3.2: Age error matrix (AEM) for ICES SD 26. The AEM shows the proportional distribution of age readings for each modal age. Only advanced readers are used for calculating the AEM.

Read age	1	2	3	4	5	6	7	8	9	Total
Modal age										

Age 1	**0,95**	0,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 2	0,00	**0,90**	0,10	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 3	0,00	0,04	**0,96**	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 4	0,00	0,00	0,00	**1,00**	0,00	0,00	0,00	0,00	0,00	1,00
Age 5	0,00	0,00	0,00	0,00	**0,93**	0,07	0,00	0,00	0,00	1,00
Age 6	0,00	0,00	0,00	0,00	0,16	**0,68**	0,16	0,00	0,00	1,00
Age 7	0,00	0,00	0,00	0,00	0,00	0,20	**0,65**	0,15	0,00	1,00
Age 8	0,00	0,00	0,00	0,00	0,00	0,05	0,05	**0,85**	0,05	1,00
Age 9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**	0,00
Total	0,95	0,99	1,06	1,00	1,09	1,00	0,86	1,00	0,05	

3.3 Age error matrix (AEM) for SD29

Table 3.3: Age error matrix (AEM) for ICES SD 29. The AEM shows the proportional distribution of age readings for each modal age. Only advanced readers are used for calculating the AEM.

Read age	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**No age**	**Total**
Modal age									
Age 0	**0,95**	0,05	0,00	0,00	0,00	0,00	0,00	0,00	1,00
Age 1	0,05	**0,90**	0,00	0,00	0,00	0,00	0,00	0,05	1,00
Age 2	0,00	0,00	**0,85**	0,15	0,00	0,00	0,00	0,00	1,00
Age 3	0,00	0,00	0,00	**0,81**	0,19	0,00	0,00	0,00	1,00
Age 4	0,00	0,00	0,00	0,13	**0,63**	0,19	0,06	0,00	1,00
Age 5	0,00	0,00	0,00	0,00	0,00	**0,00**	0,00	0,00	0,00
Age 6	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**	0,00	0,00
Age 7	0,95	0,05	0,00	0,00	0,00	0,00	0,00	**0,00**	1,00
Total	1,00	0,95	0,85	1,09	0,81	0,19	0,06	0,05	

3.4 Age error matrix (AEM) for SD25, 26 and 29 combined

Table 3.4: Age error matrix (AEM) for ICES SD 25, 26 and 29. The AEM shows the proportional distribution of age readings for each modal age. Only advanced readers are used for calculating the AEM.

Read age	1	**2**	**3**	4	**5**	**6**	**7**	**8**	**9**	**10**	**No age**	**Total**
Modal age												
Age 1	**0,94**	0,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1
Age 2	0,04	**0,91**	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,02	1
Age 3	0,00	0,02	**0,93**	0,06	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1
Age 4	0,00	0,00	0,00	**0,93**	0,08	0,00	0,00	0,00	0,00	0,00	0,00	1
Age 5	0,00	0,00	0,00	0,08	**0,80**	0,10	0,03	0,00	0,00	0,00	0,00	1
Age 6	0,00	0,00	0,00	0,00	0,12	**0,74**	0,15	0,00	0,00	0,00	0,00	1
Age 7	0,00	0,00	0,00	0,00	0,00	0,13	**0,78**	0,09	0,00	0,00	0,00	1
Age 8	0,00	0,00	0,00	0,00	0,00	0,04	0,08	**0,85**	0,04	0,00	0,00	1
Age 9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**	0,00	0,00	0
Age 10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,33	0,00	**0,67**	0,00	1
Total	0,98	0,99	0,95	1,06	0,99	1,00	1,03	1,27	0,04	0,67	0,02	

3.5 Coefficient of Variation by ICES SD

Table 3.5: Coefficient of Variation (CV) per ICES SD shows the CV of all advanced readers combined per modal age and a weighted mean of the CV per SD.

Modal age	27.3.d.25	27.3.d.26	27.3.d.29
0	-	-	-
1	30 %	21 %	25 %
2	13 %	15 %	0 %
3	0 %	7 %	10 %
4	0 %	0 %	14 %
5	7 %	5 %	8 %
6	5 %	10 %	8 %
7	0 %	9 %	-
8	5 %	7 %	-
9	-	-	-
10	12 %	-	-
11		-	-
Weighted Mean	**8 %**	**9 %**	12%

3.6 Percentage Agreement by ICES SD

Table 3.6: Percentage Agreement (PA) per ICES SD shows the PA of all advanced readers combined per modal age and a weighted mean of the PA per SD.

Modal age	27.3.d.25	27.3.d.26	27.3.d.29
0	-	-	100 %
1	89 %	95 %	93 %
2	93 %	90 %	100 %
3	100 %	96 %	91 %
4	100 %	100 %	75 %
5	89 %	93 %	87 %
6	89 %	68 %	75 %
7	100 %	65 %	-
8	83 %	85 %	-
9	-	-	-
10	67 %	-	-
11	-	-	-
Weighted Mean	**93 %**	**85 %**	**89 %**

3.7 Relative Bias by ICES SD

Table 3.7: Relative Bias by per ICES SD shows the relative bias of all advanced readers combined per modal age and a weighted mean of the relative bias per SD.

Modal age	27.3.d.25	27.3.d.26	27.3.d.29
0	-	-	-
1	0.11	0.05	0.07
2	-0.07	0.10	0.00
3	0.00	-0.04	0.06
4	0.00	0.00	0.14
5	-0.11	0.07	0.00
6	0.11	0.00	-
7	0.00	-0.05	-

8	-0.17	-0.10	-
9	-	-	-
10	-0.67	-	-
11	-	-	-
Weighted Mean	**-0.04**	**-0.01**	**0.06**

3.8 Results from SD32

Table 3.8.1: Overview of results from the ATAQCS workbook showing per modal age; number of age readings per age reader, number of agreed ages, PA (percentage agreement), coefficient of variation (CV) and bias.

Age	R06	R05	No. Agreed	PA %	CV	Bias
0	-	-	-	-	-	-
1	5	5	5	100,0	0,000	0,00
2	12	8	8	66,7	0,106	0,33
3	5	8	4	80,0	0,070	0,20
4	8	5	4	50,0	0,093	0,75
5	3	5	3	100,0	0,000	0,00
6	3	3	1	33,3	0,043	0,67
7	2	3	1	50,0	0,088	1,00
8	2	2	2	100,0	0,000	0,00
9	0	1	0			
Totals	**0**	**40**	**40**	**70,00**	**0.067**	**0.38**

Table 3.8.2: Reader comparison matrix. Green area is agreement, red area is overestimation by R05 FI.

R06 FI Age	R05 FI Age									
	0	1	2	3	4	5	6	7	8	9
0										
1		5								
2			8	4						
3				4	1					
4					4	2	2			
5						3				
6							1	2		
7								1		1
8									2	
9										