2025 North Sea Sprat (spr.27.3a4) age reading exchange
(Event ID:1910) SmartDots Summary Report

1 Summary

The 2025 North Sea sprat exchange took place via the SmartDots platform from January to March 2025. A total of 17 age readers took part, 9 of which provide age data for stock assessment of **spr.27.3a4** and 8 of which do not and are not included in this report. A larger report is available for all participating age readers and national age reading co-ordinators, including additional analyses on the ICES SmartDots webpage https://www.ices.dk/data/tools/Pages/smartdots.aspx

A total of 112 images were provided for annotation. The set comprised of 48 samples (fish) with 2 images per sample – 1 image taken with reflected light and 1 image taken with transmitted light. Readers routinely use different age reading methods with Sweden reading whole otoliths viewed on glass slides with transmitted light while all other countries read whole otoliths viewed on a black background under reflected light. For this reason, the same otoliths were photographed twice. Images taken under reflected light were provided by DTU Aqua while images taken using transmitted light were provided by SLU Aqua. In addition, 16 agreed age otolith images from the 2016 Workshop on age estimation of sprat (WKARSPRAT) were included, these are referred to as the Reference Collection (RC).

Based on only those readers providing data for stock assessment purposes (termed “advanced”), the overall percentage agreement (PA) was 77 % with a coefficient of variation (CV) of 28 % and an average percentage error (APE) of 18 % (Table 3). PA is lowest at modal age 0 and 2, at 73 % while CV and APE are highest at modal age 1 at 31% and 23% respectively. This shows there is disagreement and uncertainty between the readers as to how to interpret the growth structures laid down in the first years of the fishes life. There is an overall positive bias of 0.06, highest at modal age 0 at 0.38 indicating overestimation in comparison to modal age, also apparent at modal age 1, at 0.16. For modal ages 2-4 the bias is negative, indicating a tendency to underestimate in comparison to modal age (ranging from -0.24 to -0.11).

In comparison, the results from the age reading exercise carried out at WKARSPRAT are similar. Results in 2016 from ICES area 3a were PA = 67.8%; CV = 22.3% and APE = 16.9%. Results in 2016 from ICES area 4 were PA = 81%; CV = 21.7% and APE = 16.2%. A total of 16 agreed age fish (RC) from WKARSPRAT were read by all readers again in 2025 (not the exact same set of readers completed each exchange). For all but 1 fish the same modal age was reached in 2025. Figure 2 shows this otolith and the annotations of advanced readers in 2025, modal age = 2. In 2016, the modal age for the same otolith was 1 . The image shows the often banded appearance of the growth structures laid down in the first years of the fishes life and the disagreement between readers on how to interpret them.

In general, ageing uncertainty is due to; the “banded” appearance of first translucent zone, whether or not to count a narrow translucent zone present in the opaque inner zone of some otoliths, whether or not to include a narrow translucent zone which is sometimes apparent at the otolith edge for fish caught in June/July and underestimation of older ages due to difficulties in the identification of the narrow growth zones at the otolith edge.

2 Overview of samples and advanced readers

Table 1: Overview of samples used for the exchange (n=64) . The modal age range for all samples is 0-4.

Year	ICES area	Quarter	Number of samples	Modal age range	Length range
2013	27.3.a	1	3	3-4	130-140 mm
2014	27.3.a	2	1	1	80 mm
2014	27.3.a	3	1	0	80 mm
2015	27.3.a	3	1	1	100 mm
2015	27.3.a	4	3	0-1	80-110 mm
2015	27.4.b	2	4	1-2	90-110 mm
2015	27.4.b	3	2	1	125 mm
2016	27.4.b	1	1	2	115 mm
2023	27.3.a.20	3	2	2-3	100-115 mm
2023	27.4.b	2	9	1-3	95-140 mm
2023	27.4.b	3	3	0	80-85 mm
2023	27.4.b	4	14	0-3	85-130 mm
2024	27.3.a.21	3	6	1-3	85-150 mm
2024	27.4.b	1	8	1-3	80-140 mm

Table 2: Advanced reader overview showing expertise level, routine preparation method applied and expertise rank indicating the level of experience (1 being most experienced and 10 the least).

Reader code	Expertise	Routine age reading method	Expertise rank
R01 DK	Advanced	Whole/Reflected light	1
R02 NO	Advanced	Whole/Reflected light	2
R04 NO	Advanced	Whole/Reflected light	4
R05 SCT	Advanced	Whole/Reflected light	5
R06 SE	Advanced	Whole/Transmitted light	6
R07 DE	Advanced	Whole/Reflected light	7
R08 NO	Advanced	Whole/Reflected light	8
R09 NO	Advanced	Whole/Reflected light	9
R10 NL	Advanced	Whole/Reflected light	10

3 Results

3.1 PA, CV, APE and Relative Bias

Table 3: Presents the Coefficient of Variation (CV), Percentage Agreement (PA), Average Percentage Error (APE) and Relative Bias per modal age for all advanced readers combined. Total number of readings by modal age is also shown

Modal age	CV	PA	APE	Relative bias	Total no. of age readings
0	**-**	**73 %**	**-**	**0.38**	**93**
1	**31 %**	**84 %**	**23 %**	**0.16**	**187**
2	**28 %**	**73 %**	**15 %**	**-0.03**	**179**
3	**24 %**	**76 %**	**17 %**	**-0.24**	**99**
4	**9 %**	**89 %**	**5 %**	**-0.11**	**9**
Weighted Mean	**28 %**	**77 %**	**18 %**	**0.06**	**567**

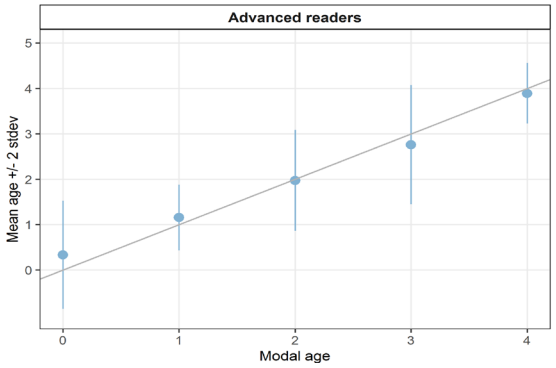

Figure 1: Age bias plot for advanced readers. Mean age recorded +/- 2 stdev of each reader and all readers combined are plotted against modal age. The estimated mean age corresponds to modal age, if the estimated mean age is on the 1:1 equilibrium line (solid line).

3.2 Age Error Matrix AEM

Table 4: Age error matrix (AEM) showing modal age in rows and the age classifications of advanced readers in columns. The matrix shows the proportion of each modal age mis-aged as other ages. The sum of each row is 1, which equals 100%.

modal_age	0	1	2	3	4	Total
0	**0.73**	0.20	0.06	-	-	1.00
1	-	**0.84**	0.16	-	-	1.00
2	-	0.16	**0.73**	0.11	0.01	1.01
3	-	0.08	0.12	**0.76**	0.04	1.00
4	-	-	-	0.11	**0.89**	1.00

3.3 Comparison to the WKARSPRAT Reference Collection

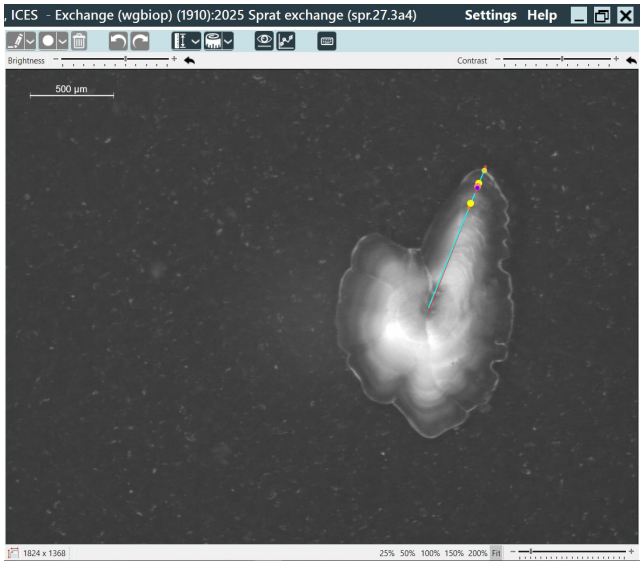

Figure 2: Image 1234576, catch date 23/06/2015, area 27.4.b, TL 105mm. Modal age in 2025 = 2. Modal age in 2016 = 1

Table 5: Presents the Coefficient of Variation (CV), Percentage Agreement (PA), Average Percentage Error (APE) and Relative Bias per modal age for all advanced readers combined. Total number of readings by modal age is also shown.

Modal age WKARSPRAT	CV	PA	APE	Relative bias	Total no. of age readings
0	**-**	**69 %**	**-**	**0.39**	16
1	**30 %**	**88 %**	**19 %**	**0.13**	80
2	**33 %**	**61 %**	**22 %**	**-0.06**	18
3	**0 %**	**100 %**	**0 %**	**0.00**	18
4	**9 %**	**89 %**	**5 %**	**-0.11**	9
Weighted Mean	**24 %**	**84 %**	**16 %**	**0.10**	**141**

4 Conclusion

It appears that what is causing most uncertainty between the readers is:

1) the first translucent zone can appear "banded" as opposed to distinct annual opaque and translucent zones. An example being fish ID 8710614 and to a lesser extent fish ID 8710613. This was an issue discussed at the WKARSPRAT 2016 where it was agreed that the *"first winter "band" can be split and fragmented into many different translucent rings which makes it wider and can also be wrongly interpreted as several winter rings."*

2) whether or not to count a narrow translucent zone which is present in the opaque inner zone seen in some otoliths. This can be related to the issue above, but in some cases a very narrow and faint translucent ring is visible which some readers count as the first translucent zone. See Fish ID 1234581 (Full report Figure 6) which in 2016 reached 100% PA at modal age = 0 but in 2025 reached just 67% PA at modal age = 0.

3) whether or not to include a narrow translucent zone which is sometimes apparent at the otolith edge for fish caught in June/July. This zone can vary from extremely narrow and only visible at the rostrum or post rostrum edge to a wider and clear zone which can be followed around the otolith edge. Here, the overall pattern of opaque and translucent zones seen in the otoliths should be considered so that an overall decrease in the width is followed.

4) Underestimation of older ages due to difficulties in the identification of the narrow opaque and translucent growth zones at the edge.

Individual reader PA, CV and APE are shown in the full report and a recently added feature to the SmartDots software shows modal age and PA per image. All readers annotations are now visible in the software for comparison purposes.

Preliminary results were provided to the stock assessor prior to HAWG 2025. The current SMS stock assessment model is not adapted to incorporate ageing error but ageing error data from this exchange is available. Results will be presented at the ICES Benchmark workshop on selected herring and sprat stocks (WKBHERSPR) 2025.