

# SmartDots Summary of the autumn 2019 Western Baltic cod (*Gadus morhua*) age reading exchange – SD 22

---

## 1 Executive summary

Coordination and analysis: Stefanie Haase and Uwe Krumme (Thünen Institute of Baltic Sea Fisheries, Germany)

SmartDots event ID: 251

In spring 2019, a preliminary age reading exercise of Western Baltic cod (*Gadus morhua*) in ICES SD 22 took place (Smartdot event ID 201). One conclusion was to conduct regular otolith exchanges to continuously train age readers.

In autumn 2019 this second age reading comparison was conducted. It included a larger number of otoliths (n=360) covering two different quarters. A total of six age readers from three countries participated. The exchange included sliced otoliths, however, this method is currently only used in Germany. Denmark and Sweden use broken otoliths for aging. This had been already an issue in the previous spring exchange because readers reading broken otoliths are not used to read sliced otoliths.

Recently, McQueen et al. (2019) validated the zone formation of otoliths from juvenile Western Baltic cod (age 0 and age 1), and Krumme et al. (2020) validated the zone formation of both juvenile and young adult Western Baltic cod (age 0 to age 3). Both studies identified a change in the interpretation of the timing of the translucent zone (TZ) formation: the TZ is formed during summer, and not – as previously thought – during winter. Prior to this age reading comparison, McQueen et al. (2019), a manuscript version of Krumme et al. (2020) and a brief instruction for this otolith exchange via Smartdots using sliced otoliths was distributed.

The objectives of the present exchange were to:

- Evaluate the accuracy and precision in age reading of sliced Western Baltic cod otolith (SD 22)
- Train new age readers for this stock
- Identify common error sources in age reading
- Discuss and agree on the next steps to be taken as a form of an online workshop
- After the autumn otolith exchange, an online meeting was conducted on June 3<sup>rd</sup> 2020 to discuss the results from the exchange with all age readers. Frequent errors and uncertainties in the age readings were highlighted and discussed, the aim being, to support the learning process.

## 2 Overview of samples and advanced readers

Six age readers from three countries participated in the Western Baltic cod otolith exchange in autumn 2019 (Table 1). Two age readers were trained and read Western Baltic cod otoliths for the first time (“basic” expertise). The advanced readers provide the age readings for the stock assessment. All images were from sectioned otoliths; however, most age readers read broken cod otoliths in their routine work.

**Table 1:** Reader overview.

Country	Reader code	Expertise	standard method
Denmark	R02 DK	Advanced	Broken
Germany	R04 DE	Advanced	Sliced
Denmark	R06 DK	Advanced	Broken
Sweden	R08 SE	Advanced	Broken
Sweden	R10 SE	Basic	Broken
Sweden	R12 SE	Basic	Broken

In total, 360 otoliths covering fish lengths between 8 and 100 cm were included in this exchange. Samples covered quarter 1 and 4 and represented samples from the Baltic International Trawl Survey (BITS).

**Table 2:** Overview of samples used for the Western Baltic cod autumn 2019 exchange.

Year	ICES area	Quarter	Number of samples	Modal age range	Length range
2018	SD 22	4	155	0-8	80-1000 mm
2019	SD 22	1	205	1-7	120-880 mm

## 3 Results overview

### 3.1 Age readings

**Table 3:** Age reading table presents the number of readings made per expert reader for each modal age.

Modal age	R02 DK	R04 DE	R06 DK	R08 SE	total
0	34	34	34	34	136
1	33	33	33	33	132
2	68	68	68	68	272
3	152	153	148	153	606
4	29	29	28	29	115
5	28	28	28	28	112
6	10	10	10	10	40
7	4	4	4	4	16
8	1	1	1	1	4
<b>Total</b>	<b>359</b>	<b>360</b>	<b>354</b>	<b>360</b>	<b>1433</b>

### 3.2 CV table

The weighted average percentage agreement based on modal ages for all readers was 81 %, with the weighted average CV of 17 % and APE of 8 %.

**Table 4:** Coefficient of Variation (CV) table presents the CV per modal age and advanced reader, the CV of all advanced readers combined per modal age and a weighted mean of the CV per reader.

Modal age	R02 DK	R04 DE	R06 DK	R08 SE	all
0	-	-	-	-	-
1	33 %	42 %	32 %	17 %	<b>39 %</b>
2	6 %	6 %	29 %	17 %	<b>19 %</b>
3	10 %	7 %	23 %	13 %	<b>14 %</b>
4	9 %	5 %	12 %	10 %	<b>10 %</b>
5	5 %	5 %	14 %	10 %	<b>10 %</b>
6	0 %	0 %	8 %	11 %	<b>11 %</b>
7	0 %	7 %	10 %	7 %	<b>12 %</b>
8	-	-	-	-	<b>0 %</b>
<b>Weighted Mean</b>	<b>11 %</b>	<b>10 %</b>	<b>23 %</b>	<b>14 %</b>	<b>17 %</b>

### 3.3 PA table

**Table 5:** Percentage agreement (PA) table represents the PA per modal age and reader, advanced the PA of all advanced readers combined per modal age and a weighted mean of the PA per reader.

Modal age	R02 DK	R04 DE	R06 DK	R08 SE	all
0	21 %	100 %	0 %	97 %	<b>54 %</b>
1	82 %	85 %	42 %	97 %	<b>77 %</b>
2	99 %	99 %	56 %	85 %	<b>85 %</b>
3	96 %	96 %	60 %	92 %	<b>86 %</b>
4	86 %	97 %	79 %	79 %	<b>85 %</b>
5	93 %	93 %	64 %	71 %	<b>80 %</b>
6	100 %	100 %	20 %	50 %	<b>68 %</b>
7	100 %	75 %	0 %	75 %	<b>62 %</b>
8	100 %	100 %	100 %	100 %	<b>100 %</b>
<b>Weighted Mean</b>	<b>87 %</b>	<b>96 %</b>	<b>52 %</b>	<b>88 %</b>	<b>81 %</b>

### 3.4 Relative bias table

**Table 6:** 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.

Modal age	R02 DK	R04 DE	R06 DK	R08 SE	all
0	0.79	0.00	1.00	0.03	<b>0.46</b>
1	0.18	-0.09	0.58	0.03	<b>0.17</b>
2	0.01	0.01	0.25	0.15	<b>0.11</b>
3	0.03	0.01	-0.17	0.10	<b>-0.01</b>
4	0.07	-0.03	-0.14	0.21	<b>0.02</b>
5	0.07	-0.07	-0.04	0.32	<b>0.07</b>
6	0.00	0.00	-0.80	0.60	<b>-0.05</b>
7	0.00	-0.25	-1.50	0.25	<b>-0.38</b>
8	0.00	0.00	0.00	0.00	<b>0.00</b>
<b>Weighted Mean</b>	<b>0.12</b>	<b>-0.01</b>	<b>0.07</b>	<b>0.14</b>	<b>0.08</b>

### 3.5 Bias plot

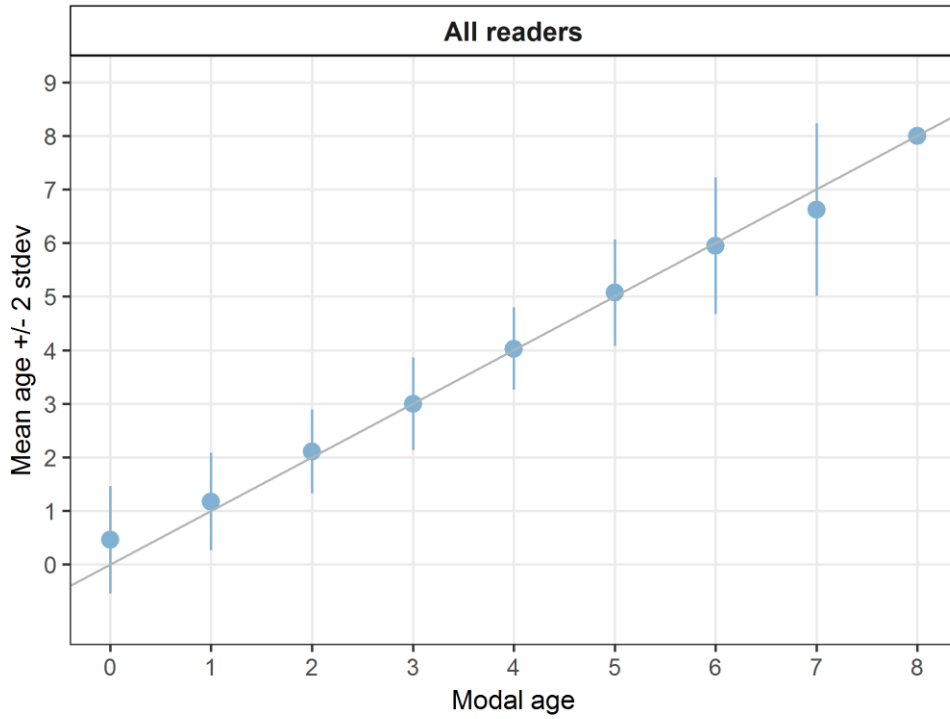


Figure 1: Age bias plot for advanced readers.

### 3.6 Age error matrices

Table 7: Age error matrix (AEM) for 27.3.d.

strata	Modal age	0	1	2	3	4	5	6	7	8
27.3.d	Age 0	0.5441	0.0303	-	-	-	-	-	-	-
27.3.d	Age 1	0.4559	0.7652	0.025735	0.00165	-	-	-	-	-
27.3.d	Age 2	-	0.2045	0.845588	0.07426	-	-	-	-	-
27.3.d	Age 3	-	-	0.125000	0.86139	0.06087	0.008929	-	-	-
27.3.d	Age 4	-	-	0.003676	0.05776	0.85217	0.053571	-	-	-
27.3.d	Age 5	-	-	-	0.00165	0.08696	0.803571	0.200	0.1250	-
27.3.d	Age 6	-	-	-	0.00165	-	0.125000	0.675	0.1875	-
27.3.d	Age 7	-	-	-	0.00165	-	0.008929	0.100	0.6250	-
27.3.d	Age 8	-	-	-	-	-	-	0.025	0.0625	1

## 4 Conclusion

Since the last age reading comparison in spring 2019 the uncertainties and national differences in age interpretation of Western Baltic cod in SD 22 continue. Modal age 0, 6 and 7 showed particularly low PAs but also other modal ages did not show PAs above 89 %. An average PA of 81 % and a CV of 17 % for advanced readers is not satisfactory for a stock for which otolith age reading is validated and considered relatively clear and easy. However, it has to be kept in mind that Sweden and Denmark do not read sliced otoliths on a routine basis, which were used for this and the previous exchange and readers might therefore have been less trained in reading sliced otoliths. Moreover, Swedish age readers usually do not read cod otoliths from SD22 because Sweden is not fishing in SD22 and also is not involved in surveys in SD22.

We can highlight that the basic age readers performed particularly well and participation in future exchanges is encouraged. This exchange is now closed in SmartDots and can be used for further training purposes because all readers' annotations are now visible for comparisons.

## Outlook

During the online meeting with age readers and national age reading coordinators several decisions were taken:

1. Regular otolith exchanges of sliced otoliths of Western Baltic cod will be continued.
2. The next exercise will take place in autumn 2020 and involve a selection of potentially incorrectly read otoliths from the BITS of the years between 2017 and 2019 (SD22 and 23) which may have led to discrepancies in the Western Baltic cod stock assessment in 2020. The results will be discussed in an online meeting in January 2021. Using SmartDots, DTU-Aqua will take the lead in this exercise.
3. It was highlighted that it is too late to thoroughly compare – and potentially correct - the national ageing results from the surveys (BITS) and the commercial samplings after the annual data upload in March to InterCatch (or in the future to the RDBES). Therefore, short- and mid-term steps were discussed to overcome this shortcoming of the present ICES procedure.
  - a. Commercial sampling: Ageing results from Q1 will be send around among countries during each summer to assess (dis-)similarities. The Thünen Institute will prepare and circulate a template using the age-length distribution of the Q1 2020 data from SD22. This will ensure that the format is consistent among countries.
  - b. Survey data: The Thünen Institute will continue to send around a short report of the age reading results shortly after each German Q1 and Q4 BITS.
4. The countries agreed that images of dubious otoliths should be send to other members of the group at any time.
5. In case it is considered helpful, the Thünen Institute offered to assist other labs by slicing up to 1000 Western Baltic cod otoliths per year.
6. Danish age readers had conducted an age reading comparison between broken and sliced otolith with the result of higher accuracy when reading sliced otolith (see uploaded report on the SmartDots webpage; event ID 269 and 270). After the online meeting, DTU-Aqua (Denmark) informed that they took the decision that Western Baltic cod otoliths will be sliced from 1. January 2020 onwards. This will hopefully increase the quality of the age readings and thus improve the input data for the stock assessment of Western Baltic cod.
7. The Thünen Institute compiled an age reading guide which can be found at the end of this document.