

# Age determination of Baltic sea Cod from east off Herrvik, Södra Midsjöbanken and off Skillinge 2018

Jon Kristjánsson  
 Fisheries Scientist  
 Reykjavik, Iceland  
 jonkr@mmedia.is  
[www.fiski.com](http://www.fiski.com)

January 2019

## Material, methods

Scales were collected from cod caught out of Herrvik Gotland. 8 cod, 20-28 cm long, were caught in April 2018 at 70-90 m depth. These samples are numbered 1-8.

Ten cod, 18-31 cm long, were caught in August 2018 at 10-20 m depth. These samples are numbered 9-18. Scale from fish no. 16 was missing.

The fish were caught at the approximate position N 57,44 and E19,14 (fig. 1).

Length, weight and sex were recorded.

Scales from commercial net catch from Södra Midsjöbanken and off Skillinge were analysed

Scales were pressed in a roller press into soft 0.7 mm thick celluloid plate to obtain a mold of the scale surface. The molds were placed in a micro film reader for age reading. The image from the screen was photographed and the distance from origo to each annulus measured in a photo program and length at age back calculated, assuming a linear relationship between scale size and fish length.



Fig 1. Approximate location of the Herrvik samples.

## Results

It was easy to read the age from the scales of these small fish. Mean back calculated lengths of each age group are shown in table 1 for the fish caught in April and in table 2 for the fish caught in August.

### Fish caught Out of Herrvik in April at 70-90 m depth

A plot of the mean growth of 2, 3 and 4 year old fish caught in April is shown in fig. 2. The mean growth of all age groups is shown in fig. 3. Length at age for all individual fish is shown in fig. 4. It seems that growth in the spring has just started, there is a very small addition in length since the formation of the winter annulus.

No	Length	Weight	K	Sex	Age	Yearcl	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>
1	23	111	0.89	0	2	2016	5.6	21.9		
2	21	74	0.86	1	2	2016	5.7	19.9		
3	29	251	1.00	1	3	2015	6.1	21.8	29.0	
4	26	147	0.89	1	3	2015	7.1	18.1	24.9	
5	23	97	0.80	1	3	2015	5.1	14.4	20.2	
6	24	123	0.89	1	3	2015	5.0	18.4	23.1	
7	26	171	0.97	1	4	2014	5.0	11.9	19.1	23.7
8	28	193	0.88	0	3	2015	4.9	15.7	26.8	

Table 1. Cod from catch in April 2018 at 70-90 m depth off Gotland. K=Fultons condition factor. I 1, I 2 etc, length at first, second, etc. winter in cm.

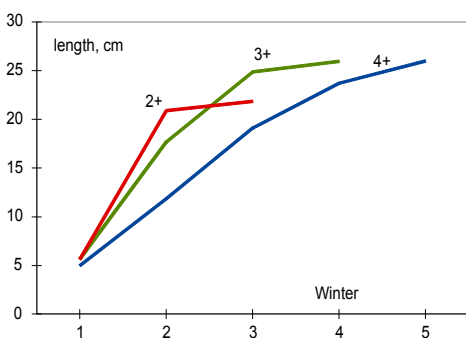


Fig 2. Plot of the mean growth of 2, 3 and 4 year old fish caught in April

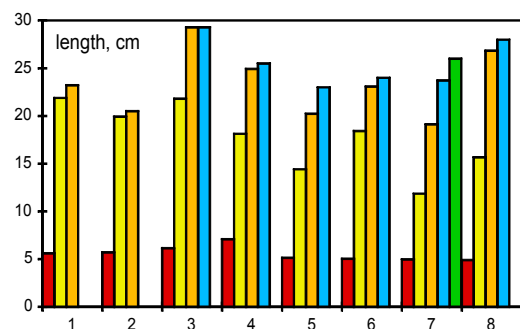


Fig 3. Length at first, second etc. winter and length at catch of all individual fish caught in April. Note how small the increment in length from last winter until the fish is caught in April.



Fig 4. Photo of the scale of fish no. 2. The fish is 2+ old, 23 cm long caught in April. Spring growth barely seen.



Fig 5. Photo of the scale of fish no. 7. The fish is 26 cm long, 4+ years old, caught in April

### Fish caught out of Herrvik in August at 10-20 m depth

All fish caught in August were age 2+. The length of the fish varied between 18 and 31 cm which is considerable variation within so young year class. A plot of the mean growth is shown in fig. 4. Length at age for all individual fish is shown in fig. 4.

No	Length	Weight	K	Sex	Age	Yearcl	l <sub>1w</sub>	l <sub>2w</sub>	+ gr
9	24	134	0.97	1	2	2016	4.1	18.6	24
10	24	163	1.18	0	2	2016	4.5	17.5	24
11	21	86	0.93	0	2	2016	5.2	13.7	21
12	18	54	0.93	0	2	2016	5.4	11.7	18
13	27	178	0.90	0	2	2016	4.4	20.5	27
14	28	193	0.88	0	2	2016	4.9	20.3	28
15	26	160	0.91	0	2	2016	5.8	18.9	26
17	26	163	0.93	0	2	2016	3.9	18.2	26
18	31	263	0.88	0	2	2016	5.7	22.6	31

Table 2. Cod from catch in August 2018 at 10-20 m depth off Gotland. K= Fultons condition factor. l<sub>1</sub>, l<sub>2</sub> = length at first, second winter. +gr is the length at catch in cm.

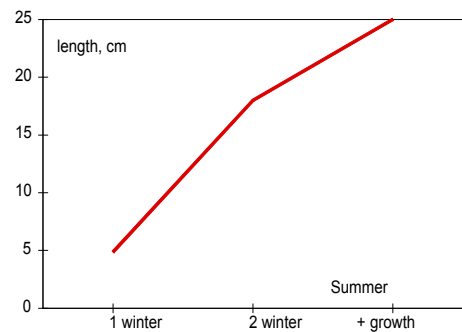


Fig 6. Plot of the mean growth of the fish caught in April. All 2+ old

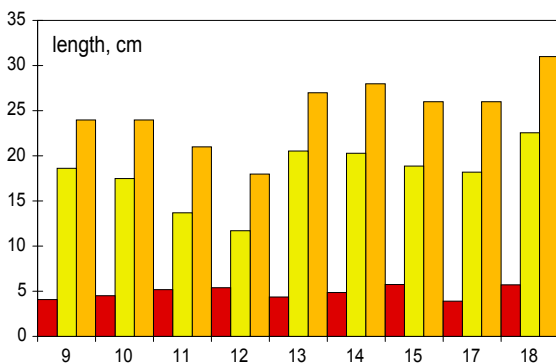


Fig. 7. Length at first, second etc. winter and length at catch of all individual fish caught in April. Note how small the increment in length from last winter until the fish is caught in April.

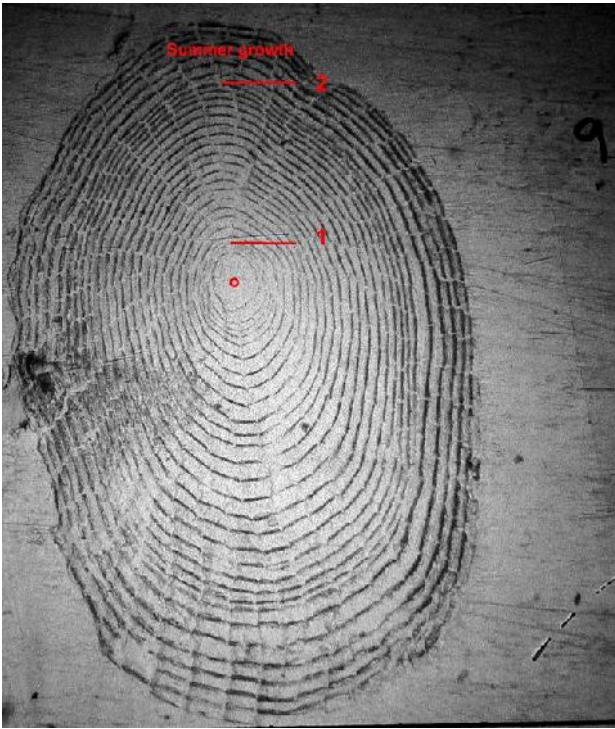


Fig. 8. Scale of fish no. 9.

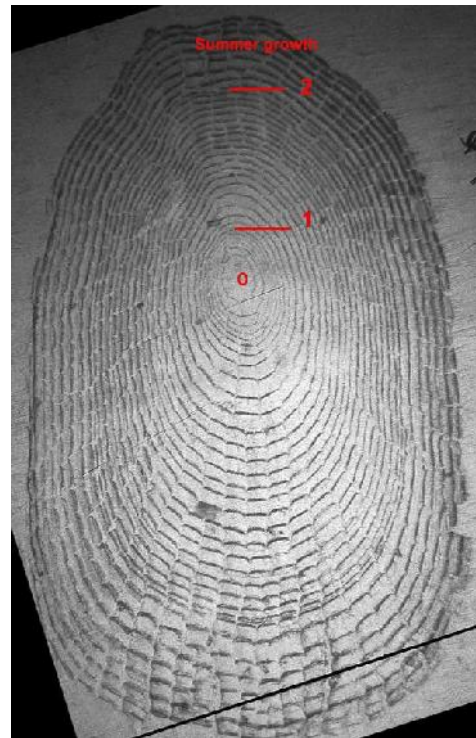


Fig. 9. Scale of fish no. 14.

### Comments

The growth is very slow, 4+ fish in the deeper area was only 26 cm and 171 g. The growth seems to be asymptotic towards 28-30 cm. The condition factor is normal which is the case when slow growing fish has adapted the body shape to the slow growth, contrary to fish which suddenly experience food shortage.

### Fish caught off Skillinge 14. Mai 2018

No	Length	Weight	K	Sex	Yearcl	Age	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>	l <sub>6</sub>
1	52	960	0.68	1	2013	5	8	29	36	44	48	
2	53	660	0.44	0	2013	4	8	35	39	46		
10	51	1120	0.84	0	2014	4	7	34	45	48		
11	52	1340	0.95	0	2014	4	6	23	37	48		
12	48	800	0.72	0	2013	5	7	20	37	39	41	
13	47	840	0.80	1	2012	6	7	26	35	38	41	44
15	50	960	0.76	0	2012	6	9	29	39	40	43	47
16	45	820	0.90	0	2012	6	7	18	25	36	40	42

Table 3. Cod from commercial catch off Skillinge in May 2018. K= Fultons condition factor. l<sub>1</sub>, l<sub>2</sub> etc. = length at first, second winter, etc.

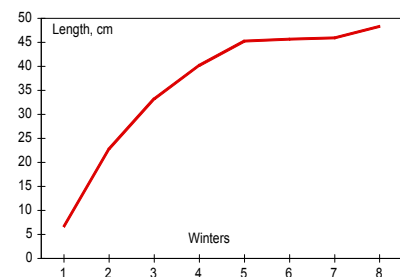


Fig 10. Plot of the mean growth of the fish caught off Skillinge in May 2018.

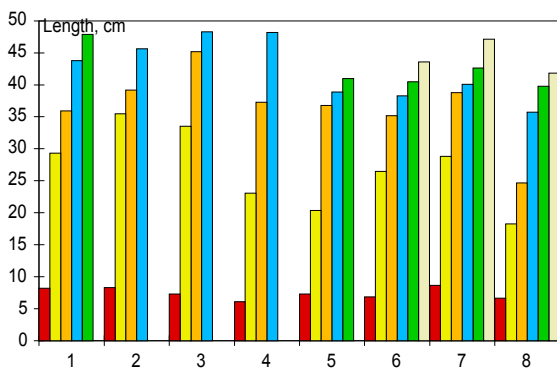


Fig. 11. Length at first, second etc. winter of all individual fish caught off Skillinge in May 2018.

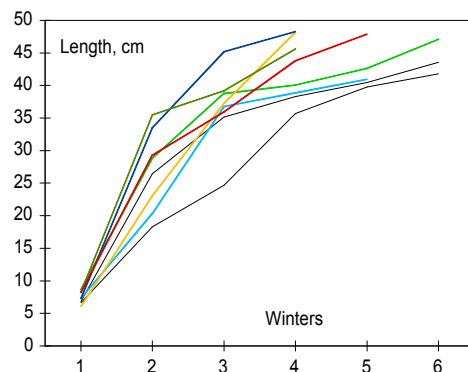


Fig. 12. Plot of the growth of all fish caught off Skillinge. Growth rate decreases with age.



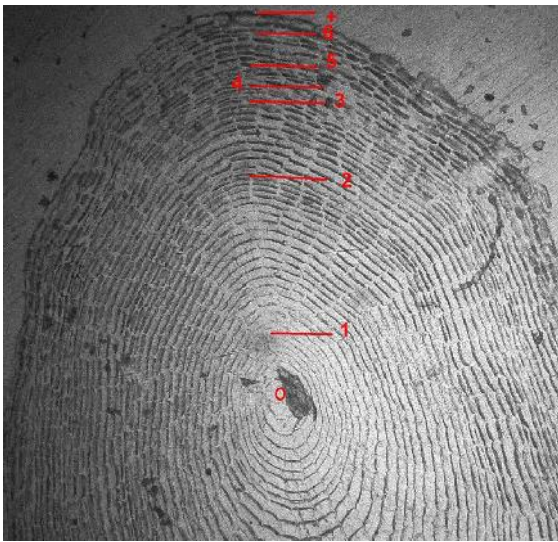


Fig 13. Scale of fish no.15 at Skillinge

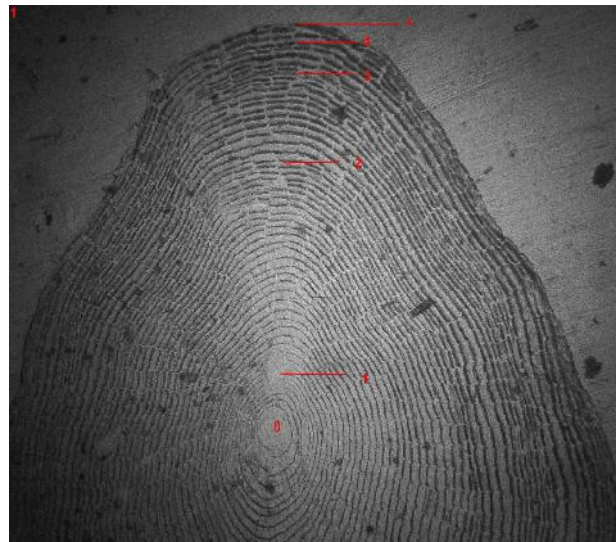


Fig 14. Scale of fish no. 10 at Skillinge

### Comments

Age reading in the first years fairly easy. Narrow rings at the edges as the growth ceases, fish can be older than the scale readings indicate. Young fish grow faster than old fish, condition factor ranges from very low to normal.

### Fish caught at Södra Midsjöbanken 12. Mai 2018

No	Length	Weight	K	Sex	Yearcl	Age	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>	l <sub>6</sub>	l <sub>7</sub>	l <sub>8</sub>
3	64	1800	0.69	0	2013	5	11	37	46	54	61			
4	48	1120	1.01	0	2011	7	6	19	30	35	39	43	46	
5	48	1050	0.95	0	2010	8	6	19	26	32	37	42	45	47
6	49	1050	0.89	0	2012	6	7	21	32	39	44	46		
7	53	1200	0.81	0	2012	6	7	28	32	40	45	49		
8	54	1200	0.76	0	2012	6	8	23	32	40	50	54		
9	52	1000	0.71	0	2013	5	4	26	41	49	51			
14	52	1200	0.85	0	2010	8	5	14	28	36	42	47	48	50

Table 4. Cod from commercial catch at Södra Midsjöbanken in May 2018. K= Fultons condition factor. l<sub>1</sub>, l<sub>2</sub>, l<sub>3</sub> etc. = length at first, second, third winter, etc.

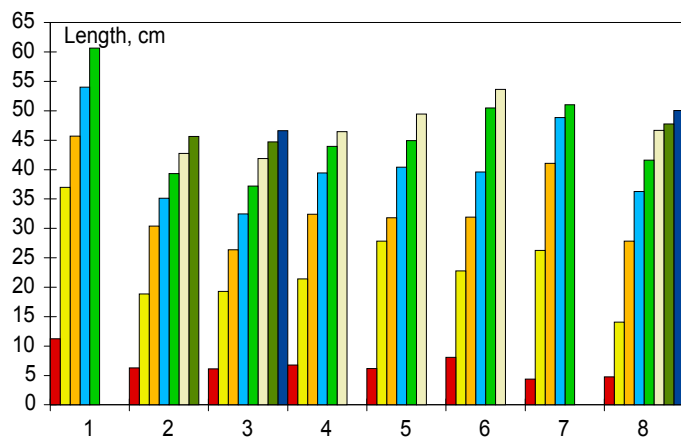


Fig. 16. Length at first, second etc. winter of all individual fish caught at Södra Midsjöbanken in May 2018.

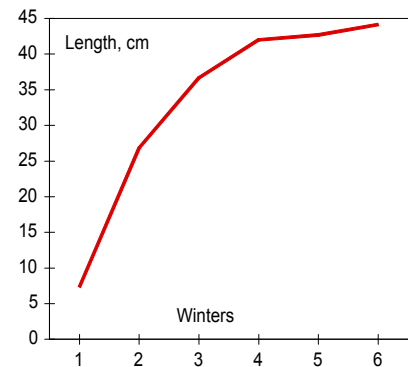


Fig 15. Plot of the mean growth of the fish caught at Södra Midsjöbanken in May 2018.

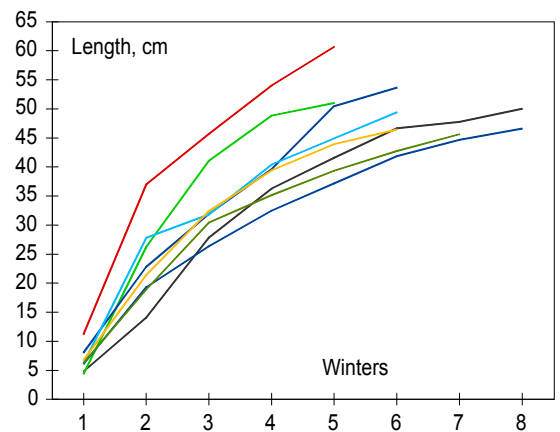


Fig. 17. Plot of the growth of all fish caught at Södra Midsjöbanken. Growth rate decreases with age.

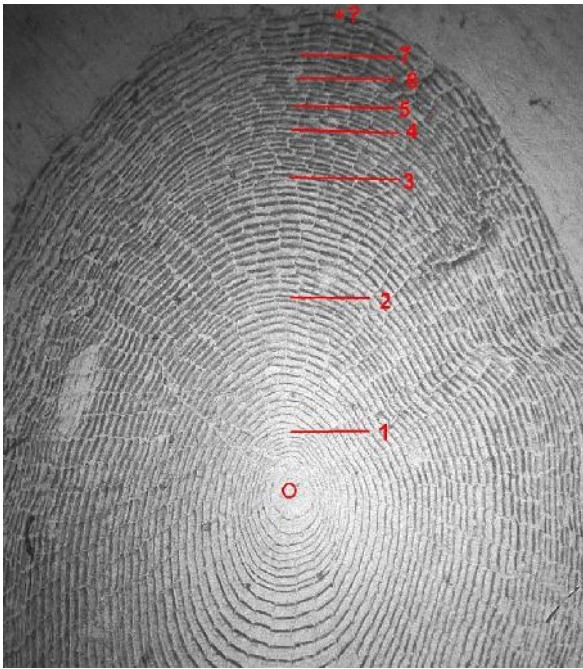


Fig 18. Scale of fish fish no. 4 at Södra Midsjöbanken.



Fig. 19. Scale of fish no. 9 at Södra Midsjöbanken..

### Discussion

Samples of large cod (45-50 cm) from three areas in 2018 show that the growth is similar at all sites (fig. 20). The small cod from Herrvika grow considerably slower, the growth will probably level out at 30 cm length. Probably these small fish will never be caught as the fishing rules prohibit small fish to be caught. Slow growth is caused by shortage of food caused by overpopulation of fish.

The general belief of the scientists responsible for the management is that the cod stock is over fished and they recommend reduced fishing pressure and selective fishing in order to protect small fish.

**Continuing this manage strategy might even reduce the growth further. The stock is obviously over populated and the only remedy is a thin out fishery with small meshes. The growth rate cheeses with length. This is a result of selective fishing combined with reduced fishing pressure.**

**Management that depends on growth should be used instead of the obligatory age-structured modelling. (Kolding and van Zwieten 2011).**

### References

Jón Kristjánsson 2018. Age determination of Baltic Cod 2018 .

<http://jonkr.mmedia.is/english/BalticCodAge18.pdf>

Jeppe Kolding & Paul A.M. van Zwieten 2011. The tragedy of our legacy: how do global management discourses affect small-scale fisheries in the South?

<http://jonkr.mmedia.is/english/tragedy.pdf>

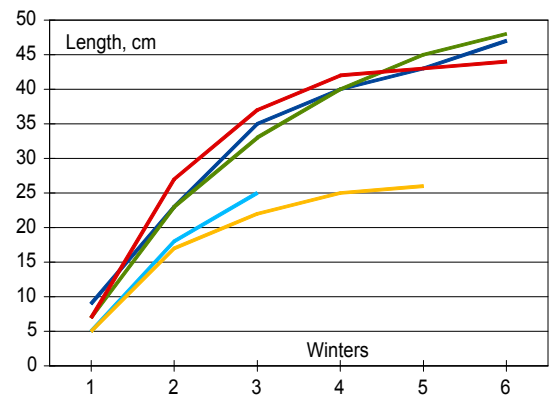


Fig 20. Comparison of growth at Skillinge 2018, red, Södra Midsjöbanken, green, and area 24 2018, blue (Kristjánsson 2018). Two lowest lines are from Herrvik, blue is from the shallow area, yellow is from the deeper area.