International Council for the
Exploration of the Sea

C.M. 1963
Herring Committee
No. 61 H

Spawning Efficiency of the Atlanto-Scandian Herring in 1962

by

I.G. Yudanov

Study of the spawning efficiency and gathering the Atlanto-Scandian herring larvae was carried out in 1962 on the spawning grounds located along the shelf of the West Scandinavia and in the shallow water area surrounding the Faroe archipelago. Besides, the Hebrido-Orkney Shoal was investigated superficially. Investigations of the spawning grounds were carried out on board the research vessels "Academician Berg", "Professor Mesyatsev" and "Balaklava".

Results of Gathering the Herring Larvae on the Spawning Grounds.

Western Coast of Norway (Areas II-VII).

In 1962 the runs of the pre-spawning herring concentrations the Norwegian shallows began with considerable delay compared with the usual terms observed during the last 2o years. A noticeable moving away of the older pre-spawning herring concentrations from the area of wintering eastward was traced only late in January and established only by the end of the first ten-day period of February. In 1962 the fishery for these concentrations carried out by the Soviet fleet on the slopes of the Norwegian shallows started on 26 February, and the Norwegian fishery for those herring conducted near the coast began on 28 February, i.e., a month later in comparison with 1961.

Despite the exceptionally great delay of arrivals chiefly in the central and western banks of the Norwegian shallows the mass herring spawning and its end occurred somewhat later in 1962 than usually. Thus, the spawning was intensive and occurred in the limited terms.

In 1962 investigations of the spawning grounds located along the western coast of Norway were carried out twice. The first, more detailed, investigation carried out from 2 - 7 April covered the area adjacent to the south-western and western coasts including the shallow part of the Viking Bank, from 60°30' up to 66°20'N. The second investigation was carried out exceptionally in the area where the commercial concentrations were fished before spawning and on spawning (see attached Figures 1 and 2).

Table 1 and the percentage curves in Figures 1 and 2 show the length composition, total amount of the herring larvae caught, and also the approximate terms of spawning and hatching of larvae in each area during the first and second surveys of the spawning grounds along the western coast of Norway.

Judging by the average number of larvae which one sample contains, the spawning efficiency of herring was considerably lower in 1962 than during the last 3 years. The average number of larvae in one sample especially decreased during the second survey of the spawning grounds and this is clearly seen if one compares the results of the gathering (Table 3) by areas during both periods of the investigation.

Somewhat more samples were collected in 1962 than in 196o. The total number of larvae was more than 2o times smaller than in 196o and with regard to the number of larvae in one sample it was about 27 times smaller than in 196o. This difference is still observed to a greater degree on the Griptarene Bank which is, with rare exceptions, the most popular mass spawning ground during all the years. According to both indices the spawning efficiency was 34-35 times lower in 1962 than in 196o. In comparison with the total results of the larvae gathering in 1961 and 1959 the spawning efficiency by these indices was 15-1o times lower in 1962 than in 1961 and 9-7 times lower than in 1959.

Considerable decrease in larvae abundance in the northern parts of the spawning ground during the second survey in 1962 testified that their great mortality rate is due to a lack of coincidence of the terms of the development of the newly born plankton with the beginning of the larvae actively feeding. Judging by that, the total abundance of the 1962 year-class in the area of the Norwegian shallows can be estimated as low and this year-class is considered as rather poor.

Spawning on the Shallows of the Faroe Archipelago

In comparison with the Norwegian shallows somewhat different results were obtained during the detailed investigation of the spawning grounds located in the shallow-water zone surrounding the Faroe Archipelago. In 1962 the larvae gathering in the shallow-water area was carried out twice. In both cases the gathering was carried out at the oceanological stations in the same points as far as possible (Figures 1 and 2).

The relatively great amount of larvae in the early stages of development, up to 10 mm long, observed during the spawning-ground survey carried out twice during 14 days convinces of the fact that several arrivals of the pre-spawning herring concentrations in the shallow-water area were observed both in the preceding years and in 1962. Judging by the amount of larvae taken in the different parts, the most intensive spawning took place in the area south-west and south of the Süderø Island.

Table 4 shows the length composition and total amount of the herring larvae caught, including the number of larvae by the single horizons of gathering and also the supposed terms of the mass spawning and hatching of the larvae during the first and second surveys of the shallow-water area surrounding the Faroe archipelago.

In contradiction to the spawning grounds of the other areas the greatest amount of larvae in the area of the Faroe shallows was observed at a depth of 100 and especially 150 m throughout all the years. Judging from the larvae distribution during the first and second surveys the first spawning migrations occurred chiefly in the south-western part of the shallow-water area west of the Süderø Island, whereas the next arrivals were mainly observed in the eastern part of the shallow-water area opposite the Nolsö Island (Figures 1 and 2).

The mass development of spawning and the hatching of larvae in some parts of the Faroe shallows were observed during the same terms as in the area of the Norwegian shallows. In particular, the spawning occurred from 7 to 15 March and the hatching of larvae from 25 March to 2 April. Considering the fact that the amount of larvae during the second investigation was 4 times greater in 1962 than in 1960, the most numerous arrivals and mass spawning occurred chiefly in the eastern part of the shallow-water area by the middle of March.

For comparison of the total results of the two-times investigations of the spawning grounds in the whole area of the Faroe shallows during the last 4 years we adduce the data which are analogous to the data represented in Table 3 for the Norwegian shallows during the same years (Table 4).

In comparison with the results of the three-times surveys of the spawning grounds in 1961 with the two-times investigations in 1962, it should be considered that the spawning efficiency was much higher in 1962 than in 1961. The amount of larvae in one sample was also greater in 1962 (43/121) than in 1961 and 1959 and only when compared with 1960 it was considerably smaller.

Judging from the fact that in the area of the Faroe shallows there is no great difference in the amount of larvae in one sample during the single years, we can conclude that the spawning efficiency in this area appears to be almost stable. Proceeding from this fact, the single year-classes and in particular the 1962 year-class being born in the area of the Faroe shallows may be estimated as rather rich. However, as these spawning grounds make up a relatively small part of the area of all the spawning grounds, the single year-classes being rather dominant cannot greatly increase the total abundance of them, when the abundance of the year-classes on the main spawning grounds is rather low.

Spawning on the Slopes of the Hebrido-Orkney-Shetland Shallows

In 1962 the study of the spawning grounds located on the slopes of the shallows west of the Hebrides, Orkney Islands was carried out superficially when the R/V "Balaklava" was returning to the port. From 19 to 22 March 16 oceanological stations were worked and 48 samples of ichthyoplankton were collected at 3 levels at each station in the extensive area of the shallows. The survey of the spawning grounds in this area was carried out almost at the same terms as during the last years; however, the total amount of the larvae was very small (Figure 1).

The herring larvae were met in 18 samples on 10 stations. The total amount of the larvae caught was 118, the average length of the larvae being 8.85 mm; the length frequencies ranged from 5 to 17 mm. Of this amount the larvae from 5 up to 10 mm in length constituted 81.3%; from 11 up to 15 mm - 17.0% and the largest larvae, 16 and 17 mm long, - 1.7%.

It should be considered that the rather low amount of larvae was due to the low abundance of the males and females on their arrival to spawn and evidently to the extremely high mortality rate of larvae at the early stages of development. This convinces us of the fact that in 1962 the herring spawning in these areas was less effective and the abundance of the year-class being born as a result of this spawning was exceptionally low.

Conclusions

1. On the basis of the detailed survey of the spawning grounds located on the banks of the Norwegian shallows and within the limits of the slopes of the Faroe shallows, it was revealed that the degree of the abundance of herring of the year-class being born in 1962 was different in both areas. In the areas of the Norwegian shallows it is estimated as very poor, in the shallow zone of the Faroe archipelago as medium and in the shallow-water zone west of the Hebrides, Orkney and Shetland Islands as exceptionally poor.

2. However, the high constant degree of the abundance of herring in the area of the Faroe shallows with small commercial importance of the spawning grounds cannot increase the total abundance of the single year-classes being born on the main spawning grounds.

3. Total abundance of the Atlanto-Scandian herring of the 1962 year-class is estimated as very low over the whole area of the Norwegian Sea.

Table 1 Length composition and amount of the herring larvae by areas in 1962.

length of larvae (mm)	Amount of larvae									
	IV. Gripta-rene		V. Freya		VI. Halten		VII. Sklinna		Total	
	4.IV	22.IV	5.IV	23.IV	6-7.IV	23-24.IV	7.IV	24-25.IV	4-7.IV	22-25.IV
I	2	3	4	5	6	7	8	9	10	11
6	-	-	-	-	-	-	2	-	2	-
7	39	-	5	-	9	-	69	-	122	-
8	252	-	48	-	99	1	266	2	665	3
9	460	-	171	-	232	20	442	1	1305	21
10	536	1	204	1	230	46	390	7	1360	55
6-10	1287	1	428	1	570	67	1169	10	3454	79
11	177	-	128	-	48	31	73	17	460	48
12	29	1	28	-	-	27	14	28	71	56
13	1	2	4	-	-	14	5	27	10	43
14	-	-	1	-	-	19	1	19	2	28
15	-	-	-	-	-	12	-	17	-	31
16	-	-	-	-	-	8	-	13	-	21
17	-	-	-	-	-	7	-	6	-	13
18	-	-	-	-	-	2	-	2	-	4
11-18	207	5	161	-	48	110	93	129	543	244
Total	1494	6	589	1	618	177	1262	139	3963	323
Average length	9.48	13.0	9.91	10.40	9.39	11.82	9 20	13.23	9.66	12.46
Spawning	7-9. III	9.III	8-9. III	8.III	10-11. III	16-18. III	10-11. III	18-23. III	7-11. III	8-23.III
Hatching of larv.	22-23. III	23. III	22-23. III	22. III	24-25. III	30-31. III	24-25. III	1-5. IV	21-25. III	23.III-5.IV

Table 2 Results of gathering the herring larvae on the banks of the Norwegian Shallows in 1962.

Banks	Date	Samples collected / Amount of larvae				Average length in (mm)
		Total	Samples with larvae	Total	Average no. in one sample x)	
Griptarene	4.IV	28	19	1494	53/79	9.48
	22.IV	9	4	6	1/1	13/00
F r e y a	5.IV	15	15	589	39/39	9.91
	23.IV	10	1	1	+/+	10.40
H a l t e n	6-7.IV	43	15	618	14/31	9.39
	23-24.IV	43	19	177	4/9	11.82
Sklinna	7.IV	20	9	1262	63/140	9.20
	24-25.IV	27	15	139	5/9	13.23
Total	4-7.IV	153	58	3963	26/69	9.66
	22-25.IV	89	39	323	4/8	12.46
Total 1962	2-25.IV	242	97	4286	18/44	11.06
1961	27.III-27.IV	335	193	90566	270/469	11.39
1960	19.III-24.IV	237	103	121419	312/1179	9.81
1959	20.III-23.IV	105	50	14396	137/288	9.79

x) In this column the numerator indicates all the samples collected in the area of the single spawning grounds; the denominator - only the samples containing the herring larvae.

Table 3 Length composition and amount of the herring larvae on the Faroe shallows in 1962.

Length of larvae in mm	Amount of larvae		
	7-10.IV	19-21.IV	Total from 7 up to 21.IV
6	18	-	18
7	296	210	506
8	568	1077	1645
9	709	2634	3343
10	636	3719	4355
6-10	2227	7640	9867
11	118	2136	2254
12	-	307	307
13	-	19	19
14	-	1	1
11-14	118	2463	2581
Total	2345	10103	12448
	Including the horizons of gathering		
5 m	203	1457	1660
50	252	2731	2983
100	481	3293	3774
150	1409	2622	4031
Average length in mm	8.90	9.79	9.57
Date of spawning	7.III	15.III	7-15.III
Larvae gathering	25.III	2.IV	25.III-2.IV

Table 4 Results of gathering the herring larvae during the investigation of the Faroe shallows in 1962-1959

Year	Date	Samples collected		Amount of larvae		Average size of larvae in mm
		Total	Samples with larvae	Total	Average no. in one sample	
1962	7-10.IV	123	20	2345	19/117	8.90
	19-21.IV	120	66	10103	84/153	9.79
	7-21.IV	243	86	12448	51/145	9.57
1961	27-31.III	79	13	1417	22/132	8.34
	5-11.IV	136	47	7898	58/168	9.48
	16-20.IV	79	48	2393	30/50	10.43
	27.III-20.IV	294	108	12005	41 III	9.40
1960	7-13.IV	80	15	4545	57/305	9.08
	24-27.IV	100	42	4272	43/102	9.89
	7-27.IV	180	57	8817	49/154	9.48
1959	7-11.IV	56	29	2002	36/70	9.81
	17-19.IV	68	39	4067	60/104	11.50
	7-19.IV	124	68	6069	39/89	10.68

PS. Unfortunately it has not been possible for the Secretariat to reproduce the figures belonging to the present contribution on stencil.