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**THE ABUNDANCE OF O-GROUP BALTIC HERRING OFF
THE COAST OF FINLAND IN 1979—82**

by

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Abstract

In September-October 1979-82 a total of 207 hauls were made along the coast of Finland with the Isaacs-Kidd mid-water trawl. In 1979, 1980 and 1982 the greatest abundance of 0-group Baltic herring was recorded in the Archipelago Sea and in 1981 in the Gulf of Finland. The mean daily instantaneous mortality rate, calculated from larval and IKMWT samples taken in 1979-82, was $Z_d = 0.0083$ in Sub-divisions 29N and 30 (east) and $Z_d = 0.0099$ in Sub-division 32. Of the larvae alive in June, approximately 18 % would survive to the end of the year.

Résumé

Un total de 207 halages furent effectués le long de la côte de Finlande avec un chalut Isaacs-Kidd d'eaux intermédiaires (IKMWT) en septembre et octobre des années 1979-1982. La plus grande abondance de harengs de la Baltique du groupe 0 a été enregistrée en 1979, 1980 et 1982 dans la mer de l'Archipel et en 1981 dans le golfe de Finlande. Le taux moyen quotidien de mortalité instantanée calculé à partir des échantillons de larves et IKMWT était de $Z_d = 0.0083$ en 1979-82 dans les sous-divisions 29N et 30 (est) et de $Z_d = 0.0099$ dans la sous-division 32. Environ 18 % des larves vivantes en Juin pourront survivre jusqu'à la fin de l'année.

Introduction

Information on the abundance of Baltic herring larvae off the coast of Finland has been presented earlier on several occasions (SJOBLÖM & PARMANNE 1975, 1976, 1977, 1978, 1979, PARMANNE & SJOBLÖM 1980, 1981a, 1982a, Anon. 1983). The survival, mortality and abundance of 0-group Baltic herring is of interest in estimating the year class strength for predictions of stock biomass and yield. This report gives the results of sampling 0-group Baltic herring with the Isaacs-Kidd mid-water trawl along the Finnish coast in the years 1979-82 and compares the results with those of larvae sampling.

Material and methods

In 1979-82 sampling of 0-group Baltic herring was performed along the Finnish coast in September-October during five to seven weeks as the research boat SILAKKA cruised from the eastern part of the Gulf of Finland (ICES Sub-division 32) through the Archipelago Sea (29N) to the northern part of the Bothnian Sea (30) and returned along the same route. There were mainly three sampling sites per ICES statistical rectangle (Fig. 1). In 1979 altogether 49, in 1980 40, in 1981 and 1982 59 hauls were made with the Isaacs-Kidd mid-water trawl (IKMWT) modified to operate in shallow waters. The mesh size of the cod end was 4 mm and the mouth opening about 8 m².

In 1979, three horizontal hauls were made at each sampling station, which together covered the depth layer between 0 to 15 m. The hauling time was about 15 minutes. In 1980, 1981 and 1982 a double oblique haul from the surface to near the bottom was performed at each sampling station. The hauling time varied from 15 to 45 minutes depending on the depth. The trawl was lowered and lifted at a rate of 2 metres per minute and the hauling speed was about 2.5 knots.

Results

In 1979, 1980 and 1982 the mean number of 0-group Baltic herring per trawling hour was highest in the Archipelago Sea and in 1981 it was highest in the Gulf of Finland (Table 1). In 1979 the mean abundance in Sub-division 29N was about eight-fold that in Sub-divisions 30 and 32. In that year the highest mean value for a statistical rectangle - 888 individuals

per hour - was recorded in the Archipelago Sea (29N); in the Bothnian Sea (30) the highest mean value was 136 and in the Gulf of Finland (32) 84 per hour. In 1980 the mean abundance was lower than in 1979 in the Archipelago Sea and the Bothnian Sea, but higher in the Gulf of Finland. In 1981 the mean abundance was the lowest recorded for the period 1979-81 in Sub-divisions 29N and 30 and at the same level in the Gulf of Finland as in 1979. In 1982 the mean abundance was lowest in the Gulf of Finland and highest in the Archipelago Sea. In the Gulf of Finland, however, the abundance was the highest recorded in the years 1979-82. The highest mean value for a statistical rectangle in 1982 was 418 individuals per hour in the Archipelago Sea (29N). In the Bothnian Sea (30) the highest mean value was 410 and in the Gulf of Finland (32) 211 per hour.

The length distribution (in 15-mm length groups) of the samples is shown in Fig. 2. In 1979-81 the fish were biggest in the Archipelago Sea (29N) and smallest in the Bothnian Sea (30). In 1982 the fish were biggest in the Gulf of Finland (32) (Fig. 2).

The mean daily instantaneous mortality rate was calculated from the larval abundance (PARMANNE & SJÖBLOM 1980, 1981b, 1982b) and our IKMWT samples according to the formula of ROBSON & CHAPMAN (1961). The number of larvae was assumed to represent the situation in the middle of June, July and August. The number of 0-group fish was considered to represent the situation at the beginning of October. The mean daily instantaneous mortality rate in Sub-divisions 29N and 30 (assessment unit, Anon. 1983) in the years 1979-82 was $Z_d = 0.0083$ and in Sub-division 32 (assessment unit, Anon. 1983) $Z_d = 0.0099$ (Table 2). For larvae alive in the middle of June, the survival rate to the beginning of October is about 42 % in Sub-divisions 29N and 30 east and 36 % in Sub-division 32.

Discussion

The year class strength and the recruitment to the exploitable stock of Baltic herring is largely dependent on the survival of the different larval stages (PARMANNE & SJÖBLOM 1981b, 1982b, RAID 1982). The factors influencing survival can be biotic or abiotic. The year class strength seems to be determined by the production of big larvae off the coast of Finland (PARMANNE & SJÖBLOM 1981b).

PARMANNE & SJÖBLOM (1980, 1981b, 1982a,b) have reported that according to the abundance of larvae measuring 10-15 mm in June, the year classes 1979 and

1981 are above average and the year class 1980 about average. The numbers of 0-group fish agree with their predictions for the year classes 1979 and 1980 (Table 1). The large value in 1980 in Sub-division 32 (Table 1) is due to one very big catch of over 1000 fish per hour in one rectangle. The small number of 0-group fish in 1981 is partly due to the very bad weather conditions in the Archipelago Sea and the Bothnian Sea, which affected the behaviour of the fish. The 0-group herring shoals were probably in deeper waters in the open sea and/or very near the coast and islands seeking shelter from the rough sea. The number of 0-groups fish in 1982 indicates that the year class 1982 is above average in both assessment units. This disagrees with the prognosis based on the abundance of large larvae in June (Anon. 1983) according to which the year class strength is poorer than average. The difference may be explained by the unusual weather conditions. Summer 1982 was about two weeks delayed and the unusually warm weather in the later part of the summer probably improved production and survival later in the season.

The mean daily instantaneous mortality estimates calculated from larval and 0-group abundances are lower than those presented for larvae by BRIELMANN & BIESTER (1979), FOSSUM & JOHANNESSEN (1979) and PARMANNE & SJÖBLÖM (1980, 1981, 1982). If the daily mortality is assumed to be constant for the rest of the year, the proportion of larvae alive at the end of the year would be about 18 % of those alive in the middle of June.

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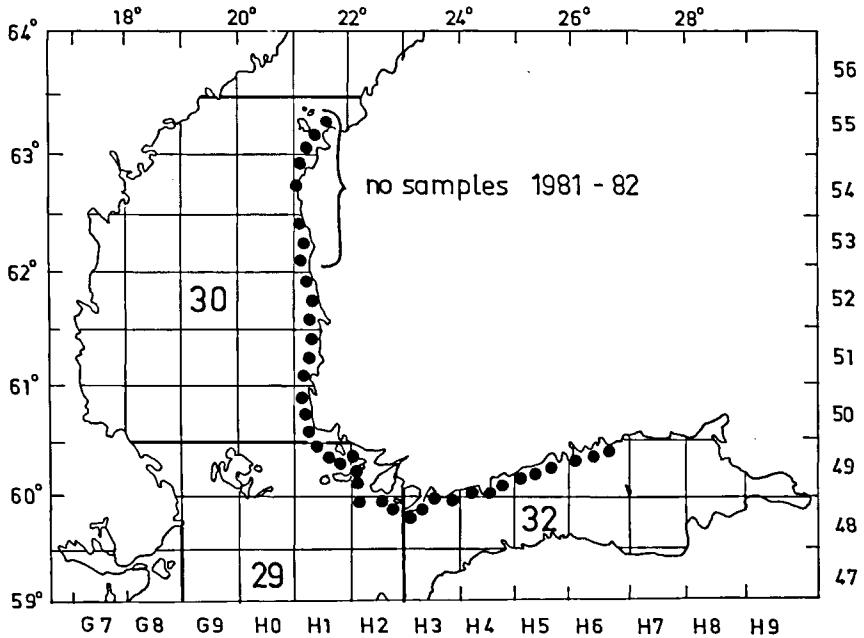


Figure 1. The sites at which 0-group Baltic herring were sampled off the coast of Finland in ICES Sub-divisions 29N, 30 and 32 in 1979-82.

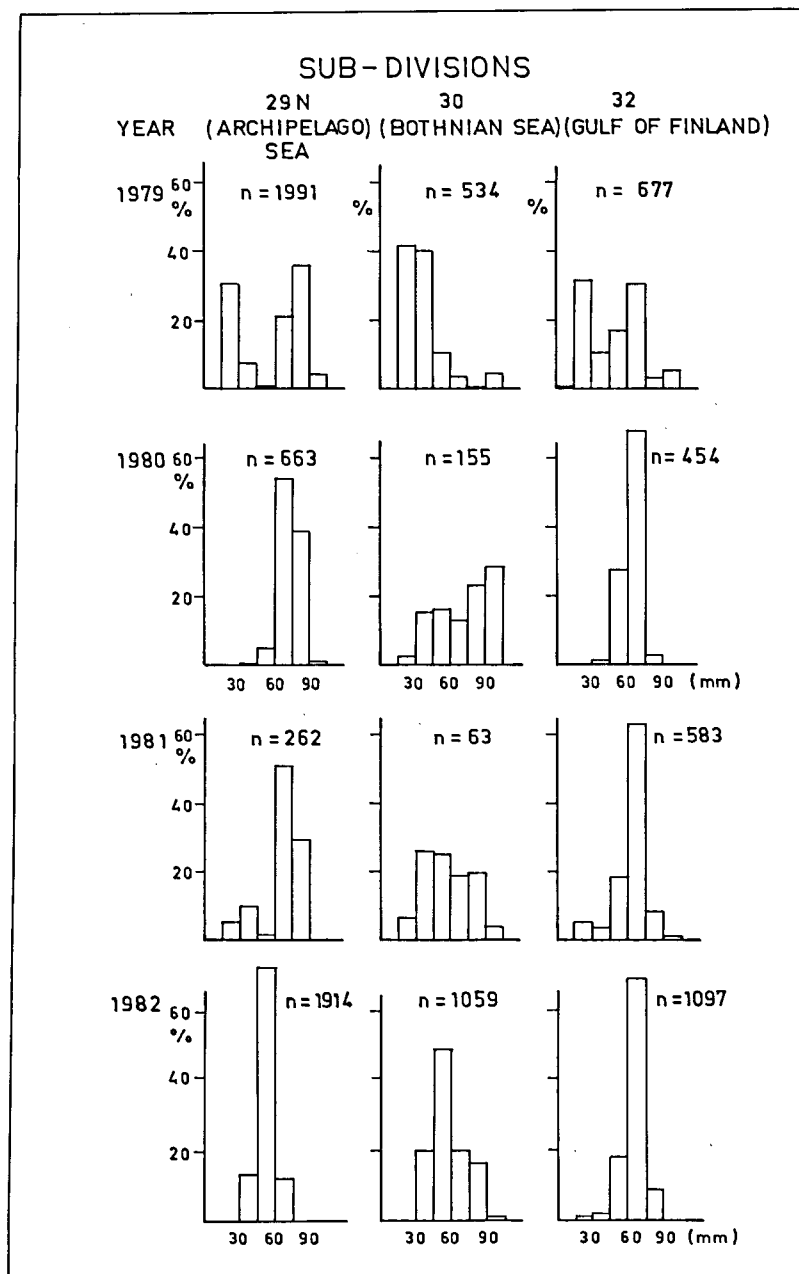


Figure 2. The length distribution (%) of 0-group Baltic herring off the coast of Finland in 1979-82 (Sub-divisions 29N, 30 and 32).

Table 1. The mean numbers of 0-group Baltic herring per trawling hour for the statistical rectangles and Sub-divisions in 1979-82 off the coast of Finland (numbers of hauls in brackets).

Sub-div.	Statistical rectangle	1979	1980	1981	1982
29N	49 H1	729 (2)	129 (3)	34 (6)	37 (6)
	49 H2	181 (3)	209 (3)	47 (6)	418 (6)
	48 H2	888 (3)	85 (3)	16 (6)	206 (6)
	Mean	583 (8)	141 (9)	32 (18)	220 (18)
30	55 H1	41 (3)	19 (3)	-	-
	54 H1	42 (2)	24 (3)	-	-
	53 H1	101 (3)	6 (3)	-	-
	52 H1	136 (4)	4 (3)	4 (4)	410 (4)
	51 H1	84 (3)	37 (3)	16 (6)	89 (6)
	50 H1	28 (4)	32 (3)	14 (6)	101 (6)
	Mean	71 (19)	20 (18)	13 (16)	174 (16)
32	49 H4	84 (4)	30 (3)	49 (7)	160 (8)
	49 H5	84 (7)	50 (3)	165 (6)	211 (6)
	49 H6	80 (5)	66 (3)	37 (3)	88 (3)
	48 H3	29 (6)	169 (4)	23 (8)	64 (8)
	Mean	68 (22)	86 (13)	68 (24)	133 (25)

Table 2. The abundance of larval and 0-group Baltic herring per 1 km² of sea surface off the coast of Finland in 1979-82 and estimates of survival and mortality rates (\hat{S}_{VI-X} , \hat{Z}_{VI-X} , \hat{Z}_d).

Year		1979		1980		1981		1982		1979	1980	1981	1982
Sub-div.		29N	30	29N	30	29N	30	29N	30	32	32	32	32
Larvae (10 ⁻³)	June	4600	2500	2900	1900	7000	2500	4400	1800	3400	3700	2500	6100
	July	2500	1400	4700	1600	6600	3100	6100	2400	2300	1600	2400	3400
	Aug	1400	1000	1200	800	1000	700	1000	1500	700	200	900	1500
0-group (10 ⁻³)	Oct	68	8	16	2	4	2	24	18	8	10	8	14
\hat{S}_{VI-X}		0.39	0.41	0.45	0.43	0.37	0.42	0.41	0.49	0.37	0.27	0.42	0.37
\hat{Z}_{VI-X}		0.94	0.89	0.80	0.85	0.99	0.87	0.88	0.72	1.00	1.31	0.86	1.00
\hat{Z}_d		0.0089	0.0085	0.0076	0.0081	0.0094	0.0083	0.0084	0.0069	0.0095	0.0125	0.0082	0.0095