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Recruitment and a preliminary stock size calculation of the pelagic sprat stock of the Gotland Sea

by

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Fishery

GDR investigations on pelagic sprat stock of the Gotland Sea relate to the offshore parts of statistical areas 26. 27. 28. 29. The sprat concentrates in cold winters in December/January for overwintering in areas 27, 28 and 29 in deep water layers. From the and of February to begin of March the sprat forms dense prespawning concentrations in these areas and in area 26, too.

Since 1967 our sprat fishery has been lasting from December/January to April/May. In the years before it lasted from March/April to July. The basis of the sprat fishery are pelagic overwintering or prespawning shoals at the start of fishery and spawning shoals at the end of the season. The dependence of the beginning of the fishery on the winter conditions is clearly shown in the mild winters 1972/73, 1973/74 and 1974/75. In these winters a stable succesful fishery started only from the second half of February on prespawning shoals whereas the start of fishery on overwintering sprat shoals was in December/January in the colder winters before.

Age composition

The sprat stock on which this pelagic fishery is based consists mainly of the age groups 3 to 5. Younger sprats dominated only in a few years in which extremely strong year classes took part in the recruitment. This has been observed in the year classes 1967 and 1972. The following table gives an impression of the age composition of the pelagic sprat catches in the Gotland Sea area.

Table 1: Age composition of pelagic sprat catches (areas 26, 27, 28, 29)

years	overwintering and prespawning stock		spawning stock	
	sprats older than 2 years (%)	mean age of stock (years)	sprats older than 2 years (%)	mean age of stock (years)
1964	-	-	97	4.4
1965	-	-	90	4.8
1966	-	-	90	4.8
1967	98	5.0	96	4.6
1968	61	3.0	64	3.5
1969	44	3.5	44	3.5
1970	95	3.6	99	3.9
1971	90	3.9	96	4.3
1972	97	5.4	91	4.6
1973	-	-	51	3.3
1974	71	3.7		

Method

Calculations of the total mortality rate and stock size of the pelagic sprat were made on the basis of age composition in the catches of GDR. Z was estimated by the unit effort method. Stock size calculations were made by V.P.A. and by the method of Allen (1966).

Input data for V.P.A. were:

1. Catches

Total annual catch of the USSR and the catch of the GDR from areas 26 - 29

year	catch(1000 tons)
1968	78.4
1969	114.3
1970	139.9
1971	167.6
1972	185.7
1973	183.0
1974	180.0

2. Mean weight per age group

age group	1	2	3	4	5	6	7	8	9	10	11	12
g	5	7	10	12	13	15	16	17	11	19	20	20

3. Age composition

Only GDR samples

4. Natural mortality

M : 0.5 determinated from k according to Beverton (1963)

5. Fishing mortality

From catch per unit effort in 1973 F was determinated as 1.04 for the adult stock. This value resulted in F = 0.6 for 1974.

Results

The determination of Z by the unit effort method showed negative values for the mean Z (1964-1970) for the age groups 1 to 5 and for age group 6 only 0.36. From age group 7 to 14 Z increased remarkably. The recruitment pattern up to age group 6 is very likely caused by immigration to the pelagic stock. We termed this recruitment "permanent recruitment".

The calculation of stock size by V.P.A. resulted in the following:

Table 2: Fishing mortality rate and stock size

year	F age group 2 and older	F age group 6 and older	stock size millions	stock size 1000 metric tons
1968	0.06	0.34	320 504	2092
1969	0.05	0.41	326 057	2288
1970	0.07	0.25	268 159	2126
1971	0.09	0.35	228 578	1902
1972	0.11	0.57	213 354	1714
1973	0.06	1.01	445 912	2788
1974	0.08	0.60	313 224	2349

A calculation of stock size by the method of Allen (1966) resulted in the following:

Table 3: Stock size calculated by the Allenmethod

years	1964	1965	1966	1967	1968	1969	1970	1971	1972
1000 t	132	133	102	114	135	149	171	174	216

The calculation by Allen's method refers only to the stock available by the pelagic fishery on Gotland Basin in the corresponding years. It gives an impression of the sprat stock concentrating from wintering to spawning in the offshore parts of this area yearly.

The calculation by V. P. A. represents the whole stock, recruits for fishery for some years including.

In our pelagic fishery the catch has been basing by number in the average of about 73 percent of sprat older than two years. The calculation by V. P. A. showed an average portion of 26 percent of sprat older than two years in the calculated stock. By weight sprat up to two years old in average have had a portion of 12 percent in the pelagic fishery whereas in the V.P.A. calculation of stock size one and two year old sprat has been calculating with a portion of the stock of about 52 percent.

These relations show that only a relatively small part of the sprat stock calculated by V. P. A. is available for fishery in offshore areas and in this connection the observed "permanent recruitment" is of great importance. Nevertheless the results of both calculations show differences caused by different mathematical methods, too.
For the years 1970 to 1972 the calculations considering the "permanent recruitment" resulted in the following (V. P. A.-calculation without the age groups 1-3)

stock size in 1000 tons	1970	1971	1972
by Allens's method	171	174	216
by V. P. A.	412	679	675

These two calculations of the Gotland-Sea -sprat stock are preliminary ones. But it seems to be necessary for those calculations to take into consideration the observed phenomenon that the Gotland Sea is a meeting place of the older sprat age groups.

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