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RECRUITMENT OF THE BARENTS SEA CAPELIN 1951-1961

By

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INTRODUCTION

The state of dependence between stock and recruitment is an important problem in fishery assessment. This applys for capelin to an especially high degree, since the main reason for regulations during the winter fishery for this species is to secure the possibility of normal recruitment.

It appears from the history of the fisheries that stock strength, spawning conditions and recruitment has fluctuated widely. This report gives some data on the dependance between recruitment and 1) stock size, 2) spawning area, 3) spawning time and 4) temperature in the years 1951 - 1961.

MATERIAL AND METHODS

Data, on catches of capelin and their distribution in space and time, was taken from Fiskets Gang, from 1951 - 1965. Data on age distribution in the spawning stock was found in PROKHOROV 1965,

OLSEN 1968 and LAHN-JOHANNESSEN, MØLLER and OLSEN 1966. Data on temperature was taken from PROKHOROV 1965 and MIDTTUN 1971.

Catch per ship, and week during the spawning season, was used as a measure for the strength of the spawning stock. The stock size in 1962 was interpolated between the years before and after, as there was no Norwegian capelin fishery that year.

The spawning stock in the period 1954-64 was composed of the year-classes 1951-1961. Hence the strength of these year-classes was calculated by dividing the spawning stock according to the age distribution, and, compensating for natural mortality which tentatively was taken as 20 per cent a year. Recruitment was calculated at an age of four years.

The coast of northern Norway is divided into fishery districts, and each of these districts were given numbers indicating their position. The numbers increase from west to east. Every number was multiplied by the catch taken in the area concerned, and a "central point" for the fishery, and thereby for the spawning inflow, was calculated. In the years concerned the capelin were only fished after they reached the coast, and therefore it is supposed that the majority had spawned where the fishing took place. The number of districts where an essential part of the fishing took place, was used as a measure for the size of the area covered by spawning. This method of calculation has the drawback that what was spawned on the Russian side of the border, is not included.

The time when the fishing occurred was used as a measure for the spawning time. The number of every week was multiplied by catch in the week concerned, and an "average week number" was found. The number of weeks in which an essential part of the fishing took place was used as a measure for the duration of the spawning period. Both these parameters may be of a somewhat dubious value, as too little is known about the connection between the time the capelin is near the shore and the time over which the spawning occurs.

RESULTS

Table 1 shows a slight negative correlation between 1) stock and recruitment, 2) between recruitment and extention of the spawning area and 3) between recruitment and duration of the spawning period.

There is a slight positive correlation between recruitment and "central point" of spawning in space and time. However, none of these correlations are significant. The material is sparse and relatively inaccurate and further statistical treatment is therefore not aplied, but some factors may be studied graphically.

Recruitment/parent stock

Fig. 1 seem to indicate that within the stock sizes concerned in the period 1951-1961 there is a certain positiv correlation between stock size and recruitment. The years 1957, 1960 and 1961 stands out clearly. This may be due to influence by especially good or bad natural conditions.

The dependence between stock size and recruitment is also indicated in Fig. 3 showing recruits per parent and parent stock size. Also in this figure the three years mentioned above fall outside the general trend.

Recruitment/spawning time- spawning place

The parameters, spawning time and spawning area shows a good correlation (Fig. 3) and can best be studied together. The years 1960 and 1961 show an early and westward spawning. These years stand out to have very poor recruitment. The years 1958 and 1959 had westward spawning, but it occurred relatively late. In 1958 the recruitment was average, and in 1959 good. This is the only example of a westward spawning giving good recruitment. In 1951 spawning was early and took place over a large area both in east and west Finnmark. This year gave average recruitment. The years 1952 to 1957 inclusive had a late spawning and an eastward distribution. Of these years 1957 gave an exeptionally strong year-class, and 1956 a strong year-class. The other year-classes were of average strength. It is impossible to show any connection between the recruitment and the size of the spawning area, or the length of the spawning period for the years considered.

Recruitment/temperature

It was not possible to find a simple connection between recruitment and temperature at the Kola section in the fourth quarter of the

previous year, or on the Kola section and at Vardø in the first quarter of the same year.

DISCUSSION

The method applied to the years 1951-1961 cannot be used for the later years. This is mainly due to extensive changes in the fishery. But some data, mostly based on subjective valuation, is gathered in Table 2. The table shows that good year-classes, with the exeption of 1959 year-class, have only appeared in years with eastward spawning, and weak year-classes only in years with westward spawning. Year-classes of average strength have occurred with both types of influxes. In the latter years there have been both types of influxes in the same year, and hence it has been impossible to decide what spawning has contributed to the year-classes.

Small spawning stocks appear to be able to give both good and poor recruitment. The same applies to large spawning stocks. On an average, small spawning stocks seem to give more recruits per parent than larger spawning stocks.

The size of the capelin spawning stock during the period 1951-1971 has not been small enough to hinder satisfactory recruitment.

For herring, the extent of the spawning area, and the duration of the spawning season are important for the year-class strength (DRAGESUND 1970). Table 1 appears to indicate that these factors were of insignificant importance for capelin recruitment in the period 1951-1961. It should however be noted, that in the later years when capelin have been very reproductive, they have spawned over wide areas in eastern and western Finmark.

A connection between eastern spawning and strong year-classes of capelin has earlier been sugested by OLSEN (1968). BOCHKOV (1969) maintains that year-class strength is determined by water temperature and spawning place.

Literature

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Table 1. Capelin recruitment 1951 - 1961

Year	Recruitment at 4 year age (hundred hl per ship per week	Parent stock	$R/_P$	Spawning place (fishery area number) Sentral point	Distribution	Spawning time (weak number) Mean	duration
1951	7.23	2.76	2.62	12.1	9	12.2	8
1952	4.33	1.24	3.49	13.2	9	15.7	11
1953	5.30	3.13	1.69	14.6	6	16.3	6
1954	5.05	6.34	0.80	15.0	4	14.9	7
1955	6.98	4.75	1.47	14.8	7	14.0	6
1956	9.01	9.74	0.93	14.9	3	16.2	6
1957	18.33	7.08	2.59	14.0	6	14.8	7
1958	7.02	5.96	1.18	11.2	6	14.5	13
1959	8.86	8.48	1.05	10.8	9	14.4	6
1960	1.93	6.64	0.29	10.3	9	11.6	10
1961	1.11	13.17	0.08	10.7	8	11.7	10
Regression coefficient with regard to recruitment		- 0.03	0.43	0.35	- 0.30	0.38	- 0.39

Table 2. Stock and recruitment 1951-1971

Year	Parent stock	Recruitment	Spawning area E eastern W western
1951	small	medium	E/W
-52	"	"	E
-53	"	"	E
-54	medium	"	E
-55	"	"	E
-56	strong	strong	E
-57	medium	very strong	E
-58	"	medium	W
-59	strong	strong	W
-60	medium	small	W
-61	strong	small	W
-62	small	strong	E
-63	"	strong	E
-64	"	medium	W
-65	strong	"	W + E
-66	"	strong	E
-67	"	very strong	E
-68	"	strong	E (+W)
-69	"	strong	E + W
-70	"	medium	W + E
-71	very strong (> 20 mill hl)	strong	W + E

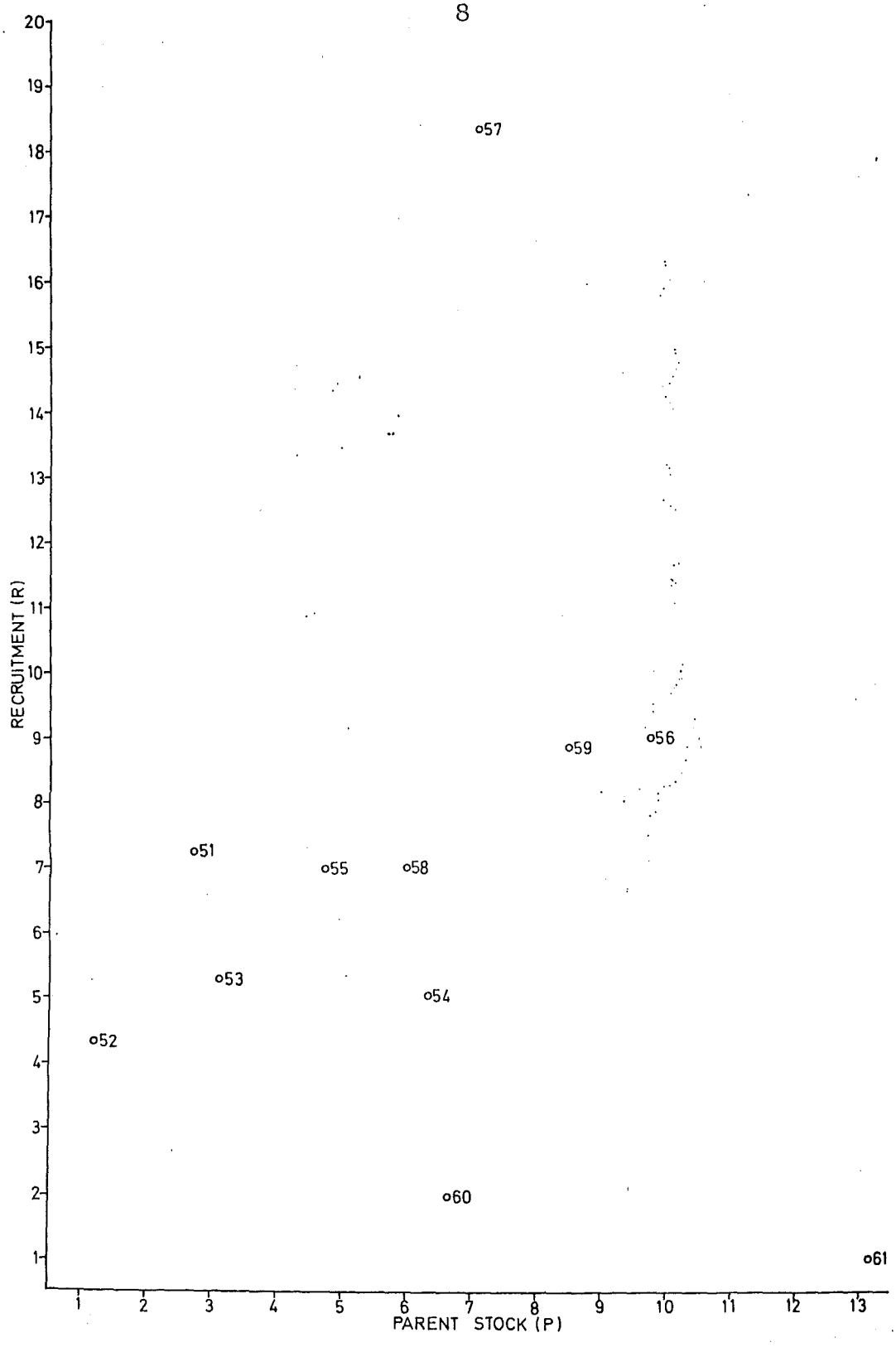

Fig. 1. Relationship between parent stock size and subsequent year-class strength. Both in 100 hl per ship per week.

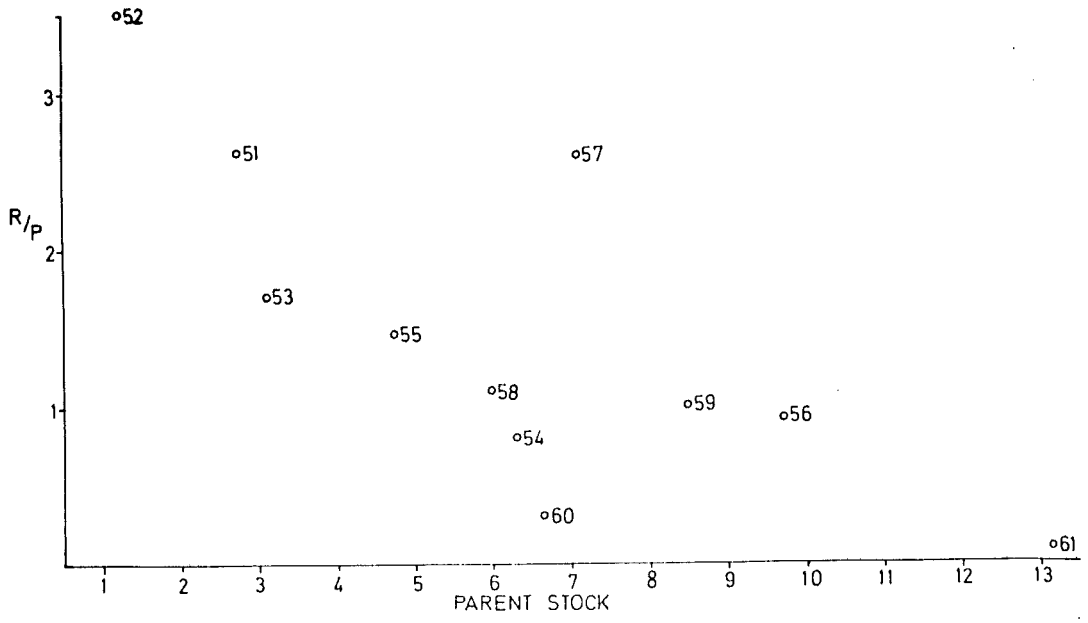

Fig. 2. Relationship between recruits per parent and parent stock. Units as in Fig. 1.

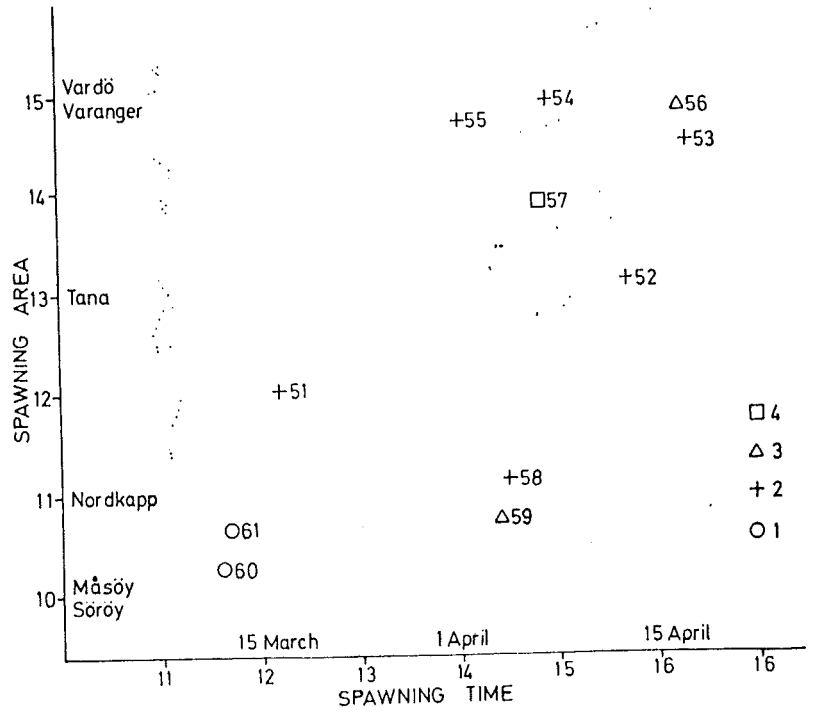

Fig. 3. Relationship between spawning time, spawning area and year-class strength. 1) very poor, 2) average, 3) strong, 4) very strong. Units along the axes indicates week number and fishing area number respectively.