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THE NORWEGIAN FISHERIES FOR SANDEEL

By

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INTRODUCTION

The Norwegian trawl fishery in the North Sea originally started to exploit the North Sea herring, and later also sandeel, but it soon developed into a multi-species industrial trawl fishery (Lahn-Johannessen et.al. 1964). A particular sandeel fishery commenced during the summer 1957 when some of the herring trawlers operated small-meshed gears in the Dogger Bank area. The subsequent years this fishery gained importance and from 1960 to 1964 yielded on an average 12,5 per cent of the total Norwegian industrial trawl landings. During the latter half of the decade however, the quantities of sandeel landed from the North Sea and Skagerak decreased considerably, and the fishery is now negligible.

Several nations have been engaged in the sandeel fishery, Denmark being the pioneer and major exploiter since 1953. Comparative international landing figures available from 1960 to 1968 show that Denmark,

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West-Germany and Norway on an average landed 92, 4 and 4 per cent of the total quantity respectively. Danish vessels alone landed 193 000 tons in 1968.

In recent years a fishery for sandeel seems to have developed in some of the Norwegian fjords. It is based on local stocks which are heavily exploited during short periods, and has to some extent compensated for the decline observed in the landings from the North Sea and Skagerak.

MATERIAL AND METHODS

Data on commercial landings of sandeel were introduced in the official fishery statistics in 1956. From these sources three different tables (1 to 3) have been compiled. Table 1 summarises the total annual landings from the North Sea (area IV), Skagerak (area IIIa) and the Norwegian fjords for the period 1956 - 1969. Table 2 presents the monthly landings of sandeel from the North Sea and Skagerak from 1957 to 1959, and Table 3 the corresponding figures from the Norwegian fjords for 1962 and 1965 - 1969.

Sampling of commercial sandeel catches initially was carried out as ad Hoc investigations during the summer months, May to July in 1958/1959 from a factory trawler fishing for industrial purposes on Dogger Bank. From 1962 to 1966 a regular sampling programme was established at Egersund, the major port for such landings in Norway. The samples (each of about 100 Kg) were divided according to species and length measurements and weight of sandeel recorded from sub-samples. The total number of samples and number of sandeel measured from Dogger Bank, the Danish Skagerak coast and the Norwegian fjords respectively were 34, 6, 2 and 5633, 514 and 193. Fig. 1 presents the seasonal length distribution of sandeel samples from the North Sea (1958 - 1966) and from the Norwegian fjords (1966).

Effort statements have been derived partly from the official fishery statistics, but mainly from records of one factory at Egersund and additional sampling data (Table 4 and 5).

Records on fat content in sandeel have been obtained from the above mentioned factory at Egersund.

THE FISHERIES

General

Fishing for sandeel is carried out in the North Sea, Skagerak and in the Norwegian fjords. The fishery in the North Sea and Skagerak is generally carried out from relatively small vessels between 60 and 90 feet in length and fishing done mainly by small-meshed bottom trawls, the mesh size at the cod-end being approximately 12 mm, where as in the Norwegian fjords different kinds of small meshed purse seines are employed. The best years recorded (more than 10 000 tons) were 1960, 1962 - 1964 and 1966 (Table 1). Working out the average total landing figures it is seen that the nettings from the North Sea, the Norwegian fjords and Skagerak were 73.9, 23.5 and 2.7 per cent respectively. Generally sandeel constituted more than 90 weight per cent of the samples analysed.

The North Sea and Skagerak

The annual landings of sandeel reached the maximum of about 12 000 tons in 1960 and except for the following year, yielded more than 10 000 tons upto 1964. Since then, the catches decreased considerably and is now negligible. Compared to the landings of sandeel in the North Sea it is seen that the Skagerak fishery contributes only to a very little extend to the total sandeel landings (Table 1).

The fishery is of a rather short duration commencing from April-May and ending in July with a peak in June. During the Years 1957, 1961 and 1963 stray catches of sandeel continued to occur in the commercial catches even up to September-October (Table 2).

The main area of exploitation for this species is found to be the south-west part of Dogger Bank and the Danish Skagerak

coast. The fishery commences along the former area in April-May and the latter in June. From the official records it is found that 70.5 per cent of the landings came from the Dogger Bank area during 1961 - 1965 as against 29.5 per cent from the Danish Skagerak coast.

In regard to the input of effort it is found that 16 trawlers including one factory trawler, participated in the fishery during 1958. The next two years the annual participation of trawlers increased to 50-60, but later a decline was noticed during the years 1961-64, with only 40-50 trawlers operating. During 1965 only 20-25 trawlers were operating, which was a sudden drop as compared to the previous figure. The reason for such a decline may probably be due to trawlers going as helpers in the purse-seine fishery. A great purse-seine fishery for herring in the North Sea and Skagerak took place in 1965 - 1967.

Landing/trip (in H1) of sandeel from the North Sea and Skagerak during 1964 and 1965 delivered to one factory in Egersund, receiving more than 90% of such landings, are presented in Table 4 for comparison. For both years the fishery in the Dogger Bank area commenced during May and lasted till June. The maximum average catch/trip recorded was in May and it then decreased approximately to 70% in June. At the Danish Skagerak coast June appears to be the best month for this fishery. Based on the sampling material an attempt has been made to estimate the catch/day/trip of sandeel (in H1) for the Dogger Bank area (May and June) and the Danish Skagerak coast (June) during 1962-65 (Table 5). The salient features noticed are as follows:

- 1) The catch/day/trip (c/d/t) reached a maximum in 1965 with 155.6 in May and 111.2 in June for the Dogger Bank area and 208.6 in June for the Danish Skagerak coast.
- 2) In the Dogger Bank area May generally showed higher c/d/t figures than June. The exception observed in 1963 was due to exploitation of new fishing grounds in June off the south-eastern coast of England.

- 3) The fishery appeared to be better at the Danish Skagerak coast than in the Dogger Bank area according to the c/d/t figures.
- 4) More fishing days per trip were spent in the Dogger Bank area than at the Danish Skagerak coast. In the former area the annual average number of days/trip varied from 6 to 13/14 days where as in the latter area the corresponding figures were 3 to 4 days.

The Norwegian fjords

Landings of sandeel from the Norwegian fjords were officially recorded in 1956, 1962 and 1965 to 1969. The maximum landings were netted in 1966, yielding about 98 per cent of the total annual landings. The landings have been irregular and marked fluctuations noticed from year to year (Table 1). It has been found that a regular annual sandeel fishery takes place in some of the fjords of south western Norway. Occasionally landings have been reported from Oslo fjord (1956), Trondheimsfjord (1966 and 1967) and even further north (1967). The peak period of the fishery in the fjords of south western Norway and the Trondheimsfjord respectively were August and September (Table 3). The duration of this fishery normally lasts for 2-3 weeks, the number of fishing days/-trip being 1-2 days. Further records on effort are not available.

Comparisons between the main areas of exploitation

As indicated earlier in this paper the fishing season for sandeel is of rather short duration, generally lasting for 3-4 months in the North Sea and Skagerak (Table 2) and for a few weeks only in the Norwegian fjords. Popp Madsen (1963) points out that sandeel occur in abundance on some limited localities in the North Sea and Skagerak and that tagging experiments indicate that the species is very stationary. Considering these observations and the intense exploitation of fishable resources taking place in the North Sea, Skagerak and the Norwegian fjords, it seems reasonable to believe that the short fishing seasons for sandeel are mainly due to over-exploitation of the available stocks.

The stocks of sandeel in the North Sea and Skagerak, however, appear to rebuild successfully from year to year, as indicated by increased annual landings in Denmark from 1964 (104.7 tons) to 1968 (193.6 tons) and the figures given in table 4 and 5. The great fluctuations in annual landings of sandeel from the Norwegian fjords (Table 1) may probably be due to larval drift from spawning grounds in the North Sea (Soleim 1945), which by irregular intervals give sudden rises in the abundance of fishable local stocks in the fjords during the subsequent years.

The commencement of fishing as well as the peak fishing season have varied between the different fishing grounds, but seems to follow a certain pattern. Sandeel fishery starts in the Dogger Bank area in April-May (peak season May-June), then at the Danish Skagerak coast in June (peak season June) and lastly in the south western fjords of Norway in August (peak season August). Some years fishing extended further north along the coast where it started in August with peak season in September (Trondheimsfjord 1966 and 1967).

NOTES ON BIOLOGY

A. marinus occurs in the North Sea and North-east Atlantic in greater numbers than any of the three known species. (Raitt 1934). Popp Madsen (1963) has indicated that sandeel is most abundant in the south east parts of the North Sea up to Horns reef, on Jutland reef and along the Danish Skagerak coast and western parts of Kattegat.

The seasonal length distribution on samples from commercial landings of sandeel are presented in Fig. 1. Data for Dogger Bank are available for the years 1958, 1959, 1962 - 1965, the Danish coast for 1962, 1963 and 1966 and the Norwegian fjords for 1966:

The mean length of sandeel recorded in the Dogger Bank area varied from 16.1 to 20.0 cm and at the Danish Skagerak coast from 14.7 to 21.4 cm. The mean length recorded from the Norwegian fjords was 10.5 cm. Fig. 1 thus indicates that in general, the bigger size ranges of sandeel are available on Dogger bank,

medium size along the Danish coast and the smallest size range from the Norwegian fjords.

Fat analysis of samples collected during 1962 - 1966 have shown that sandeel grow fatter during the fishing season. The average figure increases from about 5 to 7.5 per cent during May and reaches 9.5 to 10 per cent in June. The highest values were found in 1963 when a maximum of 12.9 per cent was recorded in late June.

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Table 1. Annual landings of sandeel (in tons) from the North Sea (area IV), Skagerak (area IIIa) and the Norwegian fjords 1956 - 1969.

<u>Year</u>	<u>Area IV</u>	<u>Area IIIa</u>	<u>The fjords</u>	<u>Total</u>
1956	-	-	1.435	1.435
1957	3.220	-	-	3.220
1958	4.817	-	-	4.817
1959	7.955	24	-	7.979
1960	12.053	1.635	-	13.688
1961	5.136	264	-	5.400
1962	10.517	403	682	11.602
1963	11.511	55	-	11.566
1964	10.401	-	-	10.401
1965	4.888	-	38	4.926
1966	223	218	19.057	19.498
1967	987	-	889	1.876
1968 ⁺)	60	1	552	613
1969 ⁺)	-	2	152	154
<u>Sum</u>	<u>71.768</u>	<u>2.602</u>	<u>22.805</u>	<u>97.175</u>
<u>Percentage</u>	<u>73,85</u>	<u>2,68</u>	<u>23,47</u>	<u>100,00</u>

+) Preliminary figures

Table 2. Monthly landings of sandeel (in tons) from the North Sea and Skagerak 1957 - 1969.

Year	April	May	June	July	August	Sept.	Oct.	Correc- tion	Total
1957	-	1.166	954	484	99	-	518	-1	3.220
1958	83	1.732	2.719	254	-	-	-	29	4.817
1959	-	3.867	2.837	588	-	-	-	627	7.979
1960	-	3.847	8.249	1.264	-	-	-	328	13.688
1961	62	2.441	2.234	643	9	11	-	-	5.400
1962	-	1.490	5.053	4.376	-	-	-	1	10.920
1963	-	3.415	6.520	1.535	96	-	-	-	11.566
1964	-	4.310	5.701	390	-	-	-	-	10.401
1965	5	2.139	2.744	-	-	-	-	-	4.888
1966	-	223	185	33	-	-	-	-	441
1967	-	-	378	598	-	-	-	11	987
1968 ⁺)	-	30	28	-	-	3	-	-	61
1969 ⁺)	-	-	-	-	-	-	-	-	2
Sum	150	24.662	37.602	10.165	204	14	518	1.055	74.370

+) Preliminary figures

Table 3. Monthly landings of sandeel (in tons) from the Norwegian fjords 1962 - 1969.

<u>Year</u>	<u>July</u>	<u>August</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Total</u>
1962	4	676	2	-	682
1963	-	-	-	-	-
1964	-	-	-	-	-
1965	-	38	-	-	38
1966	-	18.295	748	14	19.057
1967 ⁺)	-	463	426	-	889
1968 ⁺)	-	492	-	60	552
1969 ⁺)	80	72	-	-	152
<u>Sum</u>	<u>84</u>	<u>20.036</u>	<u>1.176</u>	<u>74</u>	<u>21.370</u>

+) Preliminary figures

Table 4. Landing/trip of sandeel (in Hl) from the North Sea May-July 1964 - 1965, delivered to one factory at Egersund (No. of landings in brackets).

<u>Year</u>	<u>Locality</u>	<u>May</u>	<u>June</u>	<u>July</u>
1964	Dogger Bank	907.5 (46)	653.6 (75)	
1965	" "	933.5 (22)	666.9 (34)	
1964	Danish coast		645.5 (6)	290.5 (11)
1965	" "		764.7 (3)	

Table 5. Catch/day/trip (c/d/t) of sandeel (in H1) from the North Sea, May-June 1962 - 1965, estimated from samples of commercial landings. (Average No. of fishing days in brackets).

Locality	Dogger Bank		Danish coast
Month	May	June	June
Year	c/d/t	c/d/t	c/d/t
1962	97.8 (8)	80.3 (13½)	123.3
1963	81.4 (11)	148.1 (7)	323.5 (3 2/3)+)
1964	90.8 (10)	65.4 (10)	176.0
1965	155.6 (6)	111.2 (6)	208.6
Average	106.40	101.25	207.85

+) Average figure for the period 1962 - 1965.

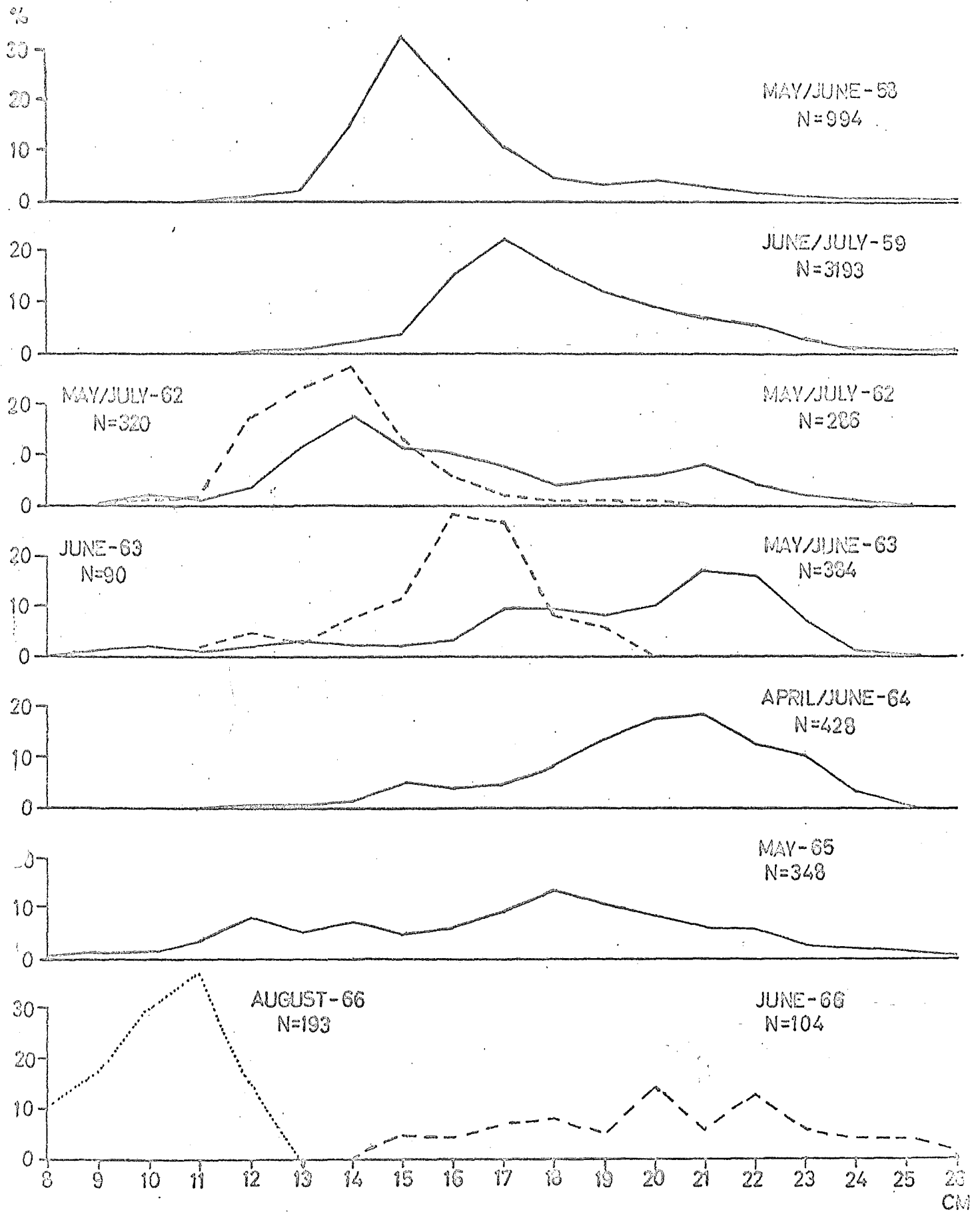


Fig. 1. Seasonal length-frequency distribution of sandeel from industrial trawl landings, 1958-1966. (Dogger Bank, ~~fish~~ line: Danish Skagerrak coast, broken line: Norwegian fjords, dotted line).