

ON THE MIGRATIONS OF THE COD IN THE SKAGERAK SHOWN BY TAGGING EXPERIMENTS IN THE PERIOD 1954—1965

By

DIDRIK S. DANIELSSEN

Statens Biologiske Stasjon, Flødevigen, Arendal

INTRODUCTION

Tagging experiments on cod carried out in the skerries and fjords on the Norwegian Skagerak coast have shown that the cod population or populations in the area undertake only short migrations and are more or less isolated from the cod in other areas of the Skagerak (DAHL 1906, RUUD 1939, LØVERSEN 1946). Two tagging experiments conducted from the Biological Station in Flødevigen in 1953 and 1954 showed, however, that cod from the Skagerak coast could undertake longer migrations along the Norwegian coast as well as into the Skagerak (unpublished data). These contradictory results, as compared with previous years tagging experiments, inspired the former director, Dr. A. DANNEVIG, to initiate tagging experiments also from the Danish side of the Skagerak. This paper describes the results of eleven tagging experiments carried out in the years 1954 to 1965.

MATERIAL AND METHODS

The tagging experiments were carried out in the years 1954, 1955, 1956, 1958, 1960, 1961 and 1965 during cruises with R/V G. M. Dannevig. The cod used for tagging were caught with hand line, and only fish in good condition were tagged. In all the years the fish were released at Robben (N 57°42', E 09°12') about 25 n.m. from the Danish Jylland coast. In 1954 and 1958 tagged fish were also released at Rubjerg (N 57°30', E 09°35'), and in 1956 near Hanstholm (N 57°15', E 08°00').

The Lea hydrostatic tag was used in all the experiments except in one experiment in 1954 when a tag consisting of impregnated paper printed

with necessary text, and rolled together to about the same size as the Lea tag was used.

All the tags were fixed in front of the first dorsal fin with a nylon thread.

The total length of the tagged fish ranged from 22 to 110 cm with a mean length of 56 cm, and the greatest frequencies were in the size groups 41 to 70 cm.

The number of tagged fish each year varied from 87 in 1956 to 309 in 1960, totalling 1,244 fish. The number of tagged fish and recaptures are given in Table 1.

RESULTS AND DISCUSSION

Of the 1,244 tagged fish a total of 367 or 29.5% had been recaptured within the end of May 1969. Tags (14) which have been reported found on the shore along the Danish, Norwegian and Swedish coast are not included in this figure. Of 44 fish tagged in 1954 with the impregnated paper tag, 11 fish have been recaptured compared to 12 recaptures of 45 fish tagged at the same locality and the same year with the Lea tag. The two tags are therefore treated in the present report as having the same tagging efficiency.

The recapture percentage from the different tagging years shows a variation from 24.9 to 35.6. The number of recaptures decreased rapidly after the first year in liberty (Table 1). The two experiments in 1954 gave no recaptures in the third year, and in general the number of recaptures in the third year was very small. The longest time in liberty was 83 months. In the total material the mean number of months before recapture is about the same in the different length groups.

The total material shows that the recapture percentage was higher in the larger length groups than in the smaller ones. Of 110 tagged fish in the group 41–45 cm 14.6% were recaptured compared to 43.2% recaptured from the group 66–70 cm with 111 fish (Fig. 1). This could either be due to availability, mortality, a higher shedding percentage among the smaller fish, or a combination of these factors. LEFRANC (1967) also got fewer recaptures from the smaller cod and assumes that the mortality could be higher among the smaller ones. The same decreasing recapture tendency with decreasing size at tagging was also shown on whiting by KNUDSEN (1964).

All the recaptures in the Skagerak have been taken on the Danish side of the Norwegian Channel. No fish from any of the three tagging localities was recaptured on the Norwegian Skagerak coast though the nearest tagging position, Robben, is only about 40 n.m. from the coast. Tagging experiments in the skerries on the Norwegian Skagerak coast in the years

Table 1. Number of cod tagged and recaptured in the years after tagging, and the percent returns from the different tagging years.

Date	Locality	Number of cod tagged	Years at sea							Sum recaptured	Total % returns tagged in the different years	
			1	2	3	4	5	6	7			
1954 Aug.	Robben	64	8	4							23	25.8
1954 Aug.	Rubjerg	25	10	1								
1955 April	Robben	129	22	7	6	5	2	1	1		44	34.1
1956 April	Robben	49	11	2	1				1			
1956 April	Hanstholm	38	7	6	2		1				31	35.6
1958 Aug. Sept.	Robben	110	20	2	2							
1958 Aug. Sept.	Rubjerg	104	26	10	2	2	2				101	34.1
1958 Nov.	Robben	82	22	10	3							
1960 May	Robben	188	33	16	9		2				83	26.9
1960 Aug.	Robben	121	16	4	1	1	1					
1961 Aug.	Robben	195	31	13		1			1			
1961 Nov.	Robben	34	6	3	1	1					57	24.9
1965 March	Robben	105	17	9	1		1				28	26.7
Total		1244	229	87	28	10	9	2	2		367	29.5

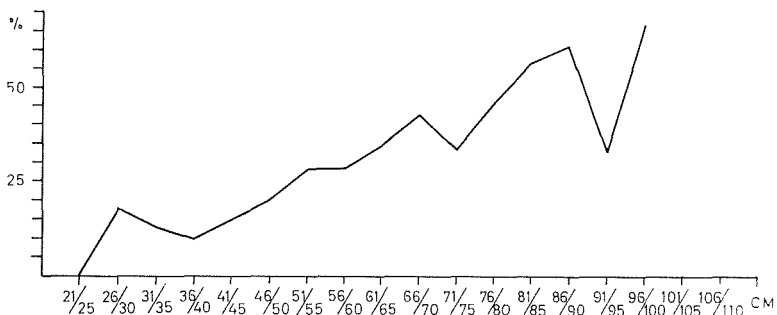


Fig. 1. Percent recaptured cod according to length when tagged. (Number of tagged fish in each of the 5-cm groups: 33, 47, 42, 110, 148, 140, 211, 225, 111, 62, 52, 30, 18, 3, 3.)

1953 and 1954 gave some returns from the Danish side of Skagerak (unpublished data). As the fish in these experiments had been kept in a spawning basin at Flødevigen for some weeks before tagging, the long migration may, however, have been an effect of the captivity. It seems reasonable to conclude therefore, that there usually is no connection between the cod populations on the Danish and the Norwegian Skagerak coast.

Most of the recaptures are taken near the tagging localities. From the Robben experiments 25.6% have been caught within 10 n.m. of the Danish coast, mostly from October to December (Fig. 2). No one was taken near the coast in July, only one in August and one in September. Farther off the coast most of the fish were taken from July to September. DANNEVIG (1966) mentions that the cod on the Norwegian Skagerak coast migrate to deeper water in the summer due to the warm surface water and return to shallow water in the autumn. A similar seasonal variation in recaptures is also shown in this material and could possibly be due to migration to deeper water in the last part of the summer and early autumn, and to shallow water in the late autumn.

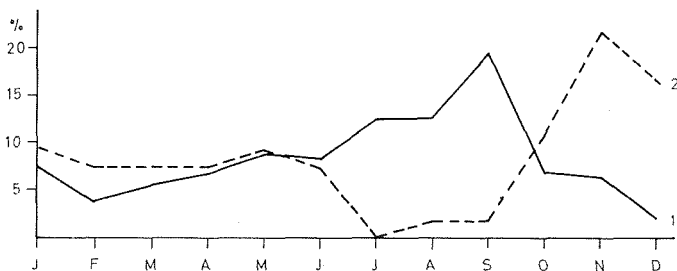


Fig. 2. Monthly variations in the recaptures in the Skagerak. 1) outside and 2) inside a limit of 10 n.m. off the Danish coast.

From the Hanstholm experiments one cod has been recaptured near Robben and four near Hanstholm on the Danish coast. Five have been caught in the eastern part of the North Sea and four near the tagging position.

Table 2. Total number of recaptures in Skagerak, the North Sea and Kattegat from each tagging year (Hanstholm experiment excluded).

Year	Skagerak	North Sea	Kattegat	Total
1954	18	2	2	22
1955	34	7	1	42
1956	10	5	0	15
1958	83	5	6	94
1960	58	10	3	71
1961	37	9	3	49
1965	19	5	0	24
Total	259 (81.4%)	43 (13.6%)	15 (4.7%)	317

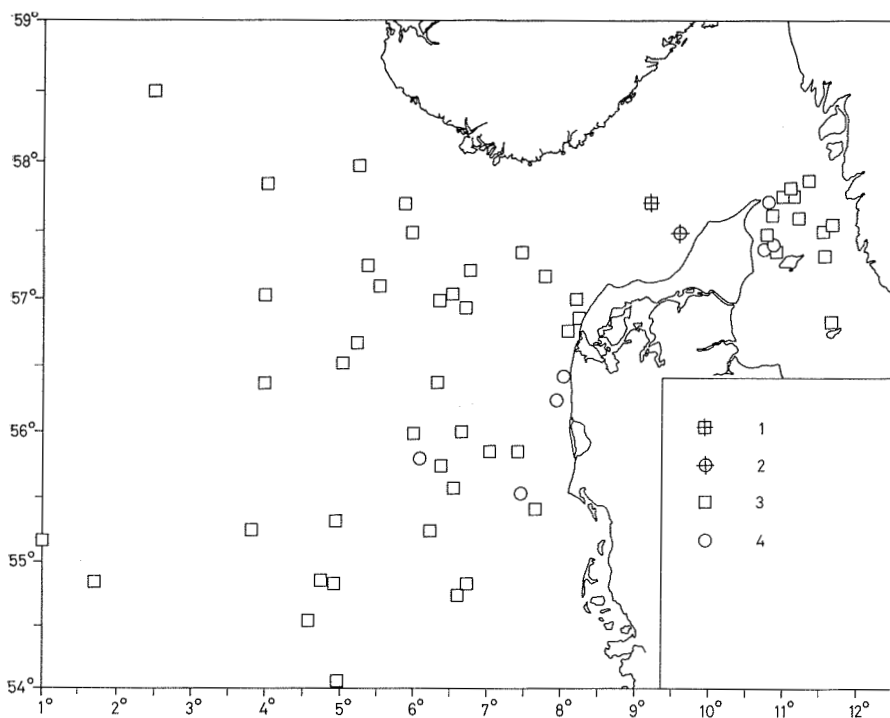


Fig. 3. Recaptures from the North Sea and Kattegat. Tagging positions. 1) Robben and 2) Rubjerg. Recaptures from 3) Robben and 4) Rubjerg.

As shown in Table 2 only 4.7% of the recaptures are from Kattegat (the border between Skagerak and Kattegat defined by a straight line from Skagen to Paternoster Lighthouse), and they have all, except one recaptured near Anholt, been taken in the area between Læsø and the border to Skagerak (Fig. 3). With two exceptions they have all been caught in the period from November to February.

From the Robben and Rubjerg experiments 13.6% of the recaptures have been caught in the North Sea, which should indicate a connection between the cod in the Skagerak and the eastern part of the North Sea. As Fig. 3 shows, all the cod except three are taken east of E 03°50' and between N 54°00' and N 58°00' with a random distribution in the area. Most of them have been taken in the first months of the year. In the southern and middle part of the area, south of N 57°00', most of the cod were caught during the first six months of the year, mainly from February to April (Table 3). Only three individuals have been taken from July to December. According to BEDFORD (1966) the central North Sea cod have in the summer (May to September) a northerly movement. Although the number of recaptures from the North Sea in the present material are few, the numbers are higher from the northern part (north of N 57°00') than from the southern part in this period.

Two fish from these tagging experiments made very long migrations. One cod, 72 cm long, was tagged on Robben in March 1965 and recaptured 49 months later on the Norwegian Helgeland coast. It is interesting to note that HYLEN (1964) reported a similar migration, but in opposite direction of a cod tagged on the Trøndelag coast and recaptured west of Skagen. The longest migration was made by a fish tagged on Robben in May 1960 and recaptured 34 months later on the Fyllas Bank on West Greenland. The shortest possible distance between the two places is 2,300 nautical miles. The total length of the fish was 65 cm at tagging and 93 cm when recaptured. A similar long journey, from the North Sea to the Grand Banks, has earlier been reported by GULLAND and WILLIAMSON (1962). Long migrations of cod have also been observed in other areas, as for example between Iceland and Greenland, from Iceland to the Faeroes and from the Faeroes to the North Sea (TÅNING 1934).

Table 3. Number of cod recaptured in the North Sea in the different months.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
North of 57°N	1	1		1	1		1	5	1	2		
South of 57°N	3	7	7	5	3	2	2					1

SUMMARY

1. A total of 1,244 cod was tagged from 1954 to 1965. The recapture percentage from the different tagging years varied between 24.9 and 35.6 with a mean of 29.5 for the whole period.
2. No cod has been recaptured on the Norwegian Skagerak coast, indicating that there is no connection between the cod populations on the Danish and Norwegian side of the Skagerak.
3. The recaptures in the Kattegat have been very small (15 individuals). The migration into the eastern part of the North Sea somewhat greater (43 individuals), and they were mainly caught in the first part of the year.
4. One cod has been recaptured on the Fyllas Bank on the West Greenland 34 months after the tagging, and one on the Norwegian Helgeland coast after 49 months at sea.

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