

SCOTTISH INVESTIGATIONS ON THE PELAGIC 0-GROUP PHASE OF SOME
DEMERSAL GADOIDS IN 1970

by

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SUMMARY

Three midwater trawling surveys were made during the months of June and July 1970. The distribution of 0-group cod, haddock, Norway pout and saithe was found to be more widespread than during the same period in 1969, and larger concentrations of these species were found off the east coast of Scotland. Of these four species, only saithe showed a significant overall increase in the numbers taken per haul between the two years. 0-group whiting were scarce everywhere, but the largest numbers were caught off the north coast of Scotland. Mean lengths are given for each species. Whiting taken to the west of the Orkneys and Shetlands were on average smaller than those in the North Sea. Weight-length data and condition factors are presented for five gadoid species. There were no consistent diurnal changes in catch-rates, except in the case of Norway pout, which were caught in the largest numbers at night.

INTRODUCTION

The results of a midwater trawling survey designed to investigate the distribution and abundance of 0-group gadoids in the North Sea were presented in a previous paper (Hislop, 1970). It was reported that a 30 ft x 30 ft pelagic trawl, with an extension piece and codend made from $\frac{1}{2}$ " knotless netting, captured quite large numbers of 0-group fish and appeared to be an appropriate sampling instrument for use in such surveys.

This young fish trawl was used on three research vessel cruises in 1970. F.R.S. "Clupea" carried out a sprat survey between 23 June and 9 July and F.R.S. "Scotia" two midwater trawling surveys of pelagic 0-group gadoids during the periods 20 June-4 July and 16-30 July. The area covered included that surveyed in 1969, and in addition during the second "Scotia" cruise several hauls were made along the Scottish north coast, and to the west of the Orkneys and Shetlands. The towing speed and gear used were kept constant.

An attempt was made to fish at the depth of diffuse midwater echo-traces, thought from observations in the previous year (Hislop, 1970) to be caused, in part, by 0-group gadoids. In practice, the net was towed at depths of between 10 and 35 fathoms on all three surveys. Variation in catch-rates attributable to differences in trawling depth cannot be ruled out, but in view of the more or less random incidence of hauls at different depths and the fact that no prior knowledge of the depth distribution of 0-group gadoids was available, the mean catches of each species in 1969 and 1970 are used in this paper as measures of abundance. Diurnal variation in availability may cause a bias when mean catch-rates on different surveys are compared but since diurnal variation in catch-rates was apparent for Norway pout only, and since hauls were made by both night and day, in both years, this factor has been ignored.

The sampling period in 1970 (20 June-30 July) was nearly the same as that of the 1969 cruise (26 June-22 July), so a comparison can be made between the catches taken in the two years. The distribution of the hauls made on each cruise are shown in Figure 1.

Distribution and relative abundance of cod, whiting
haddock, Norway pout and saithe

The catch data from the three cruises have been combined and the mean catches per hour of cod, haddock, whiting, Norway pout and saithe in each statistical rectangle sampled are shown separately in Figures 2-6 together with the numbers of hauls in that rectangle.

Cod, Gadus morhua (Fig. 2) ranged from 2 to 9 cm in length and the largest individual catch/hour was 200 fish. None were taken west of the Orkneys and Shetlands and the largest catches were made off the east coast of Scotland south of 58°N.

Whiting, Merlangius merlangus (Fig. 3), ranging from 1 to 9 cm in length, were caught in very small numbers, the largest individual catch/hour being 47 fish. Numbers caught tended to be highest west of the Orkneys and Shetlands, although there the fish were small, ranging from 13 to 59 mm.

Haddock, Melanogrammus aeglefinus (Fig. 4), from 1 to 13 cm in length were scarce in the catches west of the Orkneys and Shetlands but were caught over a large area of the northern North Sea. The largest numbers were caught off the Scottish east coast and in the central part of the northern North Sea, the largest haul being 419 fish per hour.

Norway pout, Trisopterus esmarkii (Fig. 5), was, as in 1969, the species caught in the largest numbers per haul. They ranged in length from 1 to 7 cm and the largest individual catch/hour was ca 17,700 fish. Catches were widely distributed and were particularly high in the Fladen area. Much smaller numbers were caught west of the Orkneys and Shetlands, although large catches were made off Foula.

In 1969 saithe, Pollachius virens (Fig. 6), were caught only in very small numbers in an area to the east of the Greenwich meridian and to the north of 58°30'N. In 1970 greater numbers were taken over a much more extensive area, the largest individual catch/hour being 169 fish (cf. 27 fish/hour in 1969). They ranged in length from 1 to 11 cm. The largest numbers were taken in and near the Moray Firth, and none was taken west of the Orkneys and Shetlands.

To summarise, in 1970 catches of all 0-group gadoids were very small to the west of the Orkneys and Shetlands. In the North Sea, haddock, Norway pout and saithe were fairly widely distributed over the entire survey area, whereas catches of cod tended to be larger south of 58°N. Whiting were apparently scarce in all areas surveyed. These patterns of distribution are in marked contrast to those found in 1969, when haddock and Norway pout were caught in largest numbers in the eastern parts of the survey area, north of 58°30'N. Thus, in 1970, the abundance of both these species and of cod and saithe appeared to be higher in the southern and western part of the area surveyed than they were in 1969.

Relative abundance in 1969 and 1970 is difficult to assess owing to the patchiness of the distributions. In an attempt to overcome this difficulty, a comparison has been made of catch-rates, including negative hauls, using the transformation $\log_{10}(x + 1)$, where x is the number of fish caught per hour in a single haul. Since no sampling was carried out west of the Orkneys and Shetlands in 1969, the 1970 hauls in this area have been excluded from the analysis, as have those made by F.R.S. "Clupea" which worked mainly in an area poorly sampled in 1969 (see Fig. 1). The results of this analysis, converted to geometric means, are shown in Table 1. Although the distribution of cod, haddock and Norway pout was wider in 1970, the geometric means of all catches over the entire survey area in the two years are not significantly different, and only in the case of saithe was there a significant

increase in the numbers caught per haul. Thus, there is no evidence that the total abundance of 0-group cod, haddock or Norway pout in the north-western North Sea differed between the two years.

Size composition of catches

During the second cruise by F.R.S. "Scotia" (16-30 July), samples of gadoids were measured to the millimetre below and the mean lengths (mm), for all samples combined, are shown in Table 2. Means are given separately for fish caught in the North Sea and west of the Orkneys and Shetlands.

Of the species well represented in both areas, whiting caught west of the Orkneys and Shetlands were, on average, smaller than those caught in the northern North Sea but in the case of Norway pout the difference was not significant.

Weight-length relationships

During the two "Scotia" cruises samples of fish were collected to determine weight-length relationships. The fish were blotted dry, sorted into 5 mm length-groups, heat-sealed into small bags and then deep frozen at sea. Weights were determined ashore. Table 3 shows, for each species, the mean weight and condition factor (K) at each length sampled.

For each species the condition factor is more or less constant over the range of lengths investigated, but there are clear interspecific differences, particularly marked when haddock and Norway pout are compared.

Diurnal variation in catch-rate

Table 4 shows the diurnal variation in geometric mean catch-rates of 0-group gadoids on the two "Scotia" surveys in the North Sea. Catches have been grouped into four time periods, of which only the period 2200-0400 hours was in darkness at the time of the surveys.

The significance of the diurnal variation in catch rates was tested by an analysis of variance using a logarithmic transformation. The results of this analysis indicate that there was no evidence for diurnal variation in the case of 0-group cod, whiting, saithe and haddock. Since observations in 1969 indicated a nocturnal increase in catches of haddock (Hislop, 1970), further investigation is clearly required.

Catch-rates of Norway pout were significantly higher at night, in both surveys. A similar diurnal change in availability in midwater was recorded for this species in 1969 (Hislop, 1970). The possibility that this was due to vertical migration will be discussed in a later paper.

Reference

HISLOP, J. R. G., 1970. Preliminary investigations on the pelagic 0-group phase of some demersal gadoids. ICES, C.M.1970/F:12 (mimeo).

Table 1. Geometric means of numbers caught per hour in the northern North Sea by F.R.S. "Scotia".

	1969	1970	Significance level of difference
Cod	1.29	1.68	n.s.
Whiting	0.68	0.58	n.s.
Haddock	3.21	5.38	n.s.
Norway pout	15.86	5.79	n.s.
Saithe	0.43	2.24	p<0.001

Table 2. Mean lengths (mm) of 0-group gadoids captured between 16 and 30 July 1970 (number of samples and total number of fish measured in parantheses).

	Cod	Whiting	Haddock	Norway pout	Saithe
North Sea	58.9(7:65)	49.6(12:130)	83.1(14:830)	54.9(6:727)	92.4(5:12)
West of Orkney & Shetland	-	30.9(9:92)	36.5(4:4)	53.8(4:462)	-

Table 3. Weight/length relationship and condition factor for ungutted 0-group cod, whiting, haddock, Norway pout and saithe

L(cm)	Cod			Whiting			Haddock			Norway Pout			Saithe		
	W(g)	K	n	W(g)	K	n	W(g)	K	n	W(g)	K	n	W(g)	K	n
2.25										0.06	.53	21			
2.75							0.19	.91	14	0.11	.53	16			
3.35							0.32	.93	20	0.20	.58	117			
3.75	0.41	.78	10				0.49	.93	29	0.31	.59	159			
4.25	0.56	.73	14				0.68	.89	35	0.46	.60	112			
4.75	0.79	.74	27				0.98	.91	43	0.65	.61	96	0.85	.79	15
5.25	1.08	.75	43	1.31	.91	1	1.27	.88	72	0.89	.61	94	1.20	.83	15
5.75	1.37	.72	40	1.65	.87	2	1.65	.87	69	1.12	.59	68	1.55	.82	22
6.25	1.83	.75	26	1.85	.76	5	2.11	.86	65	1.41	.58	60	1.92	.79	28
6.75	2.43	.79	8	2.53	.82	9	2.76	.90	84	1.89	.61	32	2.38	.77	19
7.25	2.98	.78	2	2.73	.72	5	3.35	.88	81	2.34	.61	26	2.91	.76	19
7.75	3.99	.86	4	3.01	.65	4	4.11	.88	82	2.78	.60	3	3.75	.81	14
8.25	4.15	.74	2	4.47	.80	6	4.88	.87	81				4.51	.80	12
8.75				5.96	.89	5	5.87	.88	61				5.86	.87	6
9.25	7.36	.93	1	6.50	.82	2	6.91	.87	54				6.64	.84	7
9.75				7.42	.80	1	8.26	.89	45				7.66	.83	5
10.25							9.49	.88	32						
10.75							11.31	.91	6						
11.25							12.25	.86	9						
11.75							13.47	.83	2						
12.25							15.55	.85	3						
12.75							18.63	.90	2						

Notes: $K = \frac{\text{weight}(g)}{\text{length}^3(\text{cm})} \times 100$; n = no. of fish in sample

Table 4. Diurnal variation in catch-rates of 0-group gadoids in the North Sea (geometric mean of numbers caught per hour).

		Time Period (B.S.T.)				Significance of level of variation
		2200-0400	0400-1000	1000-1600	1600-2200	
No. of hauls	1st survey	11	6	12	16	
	2nd survey	7	2	5	5	
	Total	18	8	17	21	
Cod	1st survey	1.6	0.7	1.7	3.9	n.s.
	2nd survey	2.2	0	0.1	0.7	n.s.
	Total	1.8	0.5	1.1	2.8	n.s.
Whiting	1st survey	0.1	0	0.3	0.1	n.s.
	2nd survey	2.0	2.0	2.7	3.4	n.s.
	Total	0.6	0.3	0.8	0.5	n.s.
Haddock	1st survey	1.8	12.1	5.2	4.6	n.s.
	2nd survey	5.9	2.9	10.0	15.9	n.s.
	Total	3.0	8.6	6.3	6.3	n.s.
Norway pout	1st survey	48.7	0.9	1.5	9.6	$p < 0.05$
	2nd survey	43.4	0	0.1	0	$p < 0.05$
	Total	46.6	0.6	1.0	5.0	$p < 0.01$
Saithe	1st survey	3.7	2.5	3.1	5.2	n.s.
	2nd survey	0	0.7	0.4	0.6	n.s.
	Total	1.6	2.0	2.0	3.4	n.s.











