

HERRING

EXTRAIT

Herring

CONSEIL PERMANENT INTERNATIONAL POUR
L'EXPLORATION DE LA MER

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Herring

INTRODUCTION

The section on herring contains contributions by the following scientists:—

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In addition the "Report of the Joint Investigation on the Distribution of Herring in Relation to Hydrography and Plankton in the Norwegian Sea, May/June 1964", as drafted by O. J. ØSTVEDT and accepted by the participating scientists, is given as an appendix to *Annales biologiques*.

When reviewing the fisheries on herring in the northeastern Atlantic, 1964 must be regarded as quite a good year. With exception of the north-western and central North Sea and the Norwegian fishery for juvenile herring, the yield in most areas improved. This is mainly due to good recruitment. In Norwegian spring-spawners, the year-classes 1959 and 1960 are rich. The year-class 1960 is also strong in the North Sea, Minch and Kattegat herring. In some parts of the North Sea the year-class 1961 was also above average. The Dunmore fishery was based on the year-class 1961.

Three main changes in the distribution of fish and fisheries became evident, although they had been recorded in 1963 or even earlier. The Icelandic summer fishery is now confined to the northeast

and east coast of Iceland. Considerable parts of the Norwegian spawning stock are to be found in the Vestfjord; the main fishing for North Sea herring took place in the northeastern North Sea, where at least half a million tons of herring were caught (complete and detailed statistics not yet available).

In all areas, a shift from drift-netting to various kinds of trawling, especially with pelagic gear, and to an extensive use of purse-seine and ring-net has been observed. The only very big drift-net fleet still in operation is the Soviet fleet in the Norwegian Sea and neighbouring areas. With the increase in catch, especially in the fisheries on Atlanto-Scandian herring off Iceland and Norway and on North Sea herring (and some Kattegat herring) in the northeastern North Sea and the Skagerak, the portion of the total catch which was processed for fish meal and oil increased.

The main features for the various regions might be summarized as follows.

Norway and Iceland. The fishery for juvenile Norwegian herring and echo-surveys off the north and northwest coast of Norway indicate that the year-classes 1963 and 1964 are slightly more abundant than the very poor year-class 1962. As in 1963, two centres of spawning were observed along the Norwegian coast. One group of herring consisting of about half recruits and half older herring took the traditional route from the overwintering area east of Iceland to the Møre region, whereas a group of recruits and second-time spawners entered the Vestfjord from the Norwegian Sea. Both areas yielded almost equal catches. It is likely that the group spawning in the Vestfjord remained in the eastern Norwegian Sea during summer 1964. The tagging experiments on juvenile and adult herring and extensive echo-surveys were carried out as in previous years. The analysis of the recaptures of tagged herring with regard to the relative strength of the various spawning groups is given in the reports by Norway and Iceland.

The Norwegian summer fishery northeast and east of Iceland was reduced in effort because many Norwegian purse-seiners preferred fishing in the North Sea. The total catch of Norwegian boats in Icelandic waters remained rather stable, however, the decrease in effort being balanced by the increase in stock abundance.

The season of the Icelandic fishery in the same area lasted from the end of May until the end of the year, it yielded to the highest total catch on record, 425,000 tons. A considerable part of the catch was not taken in the traditional summer fishery on feeding herring, but from September to December/January on migrating and overwintering herring. — The Icelandic winter fishery was fairly successful, although it was hampered by the fact that the herring concentrations were far to the east of the southeast coast of Iceland, i.e. far from ports.

In Icelandic spring- and summer-spawners the previously strong year-class 1956 was not abundant any more but was substituted by the year-classes 1959 to 1961. The same was the case with the Norwegian herring where the famous year-class 1950 is now finally superseded by the year-classes 1959 and 1960. The percentage of Icelandic spring-spawners in the summer catches was only 11% and the Icelandic summer-spawners were almost missing, whereas in former years 50% of the herring were of Icelandic origin.

Western Shelf. English and Scottish research vessels explored the trawling grounds west of Scotland, on the outer part of the shelf. According to Scottish data of July 1964 good concentrations of rather old herring were found from St. Kilda to Stanton Bank. In this area, autumn spawners prevailed. — The fishery by drift-net and ring-net in the Minch was very successful. With 245,000 crans these fisheries produced far more herring than the British herring fishery in the North Sea (185,000 crans). The Minch fishery was mainly based on autumn-spawned herring of 1960 and 1961 year-classes, whereas in German catches in October west of the Hebrides considerable admixtures of the 1956 year-class were found. The Clyde fishery took advantage of the strong 1961 year-class which showed a fast individual growth. The Irish fishery at Dunmore yielded 20% less than in 1963/64. The 1960 year-class was still dominating.

North Sea. As mentioned earlier the main fishing took place in the northeastern part of the

North Sea, where the Norwegian catch by purse-seiners amounted to 200,000 tons. The Swedish fishery reported 245,000 tons mainly from the same area. The catches consisted of North Sea autumn-spawners of the 1960 and 1961 year-classes with some admixtures of older herring (1956 year-class) and of Kattegat autumn-spawners (1960 year-class) the latter being fairly abundant in the inner Skagerak in winter and in the Danish and Norwegian catches of August to October in the Egersund area. Spring spawners resembling those of the Viking Bank were found in Swedish catches in early August in the Gut area and later in the year in the Skagerak and the eastern North Sea.

The fishery in the western North Sea showed a decrease in effort of all drifter-fleets and of the German trawler fleet. The trawling of German drifters and cutters and also the Dutch trawling effort increased, however, to some extent. Effort figures for other nations fishing in that area are not yet available. The catch of the Scottish fleet north of 59°N fluctuated strongly during the season but was in general similar to 1963, whereas the catches between 59°N and 55°30'N were rather poor. The latter coincides with the poor results of the English and Dutch fishery in the central North Sea. The English drift-net fishery failed in the Shields area because of poor recruitment by the 1961 year-class. All fisheries in the southern North Sea were relatively successful, the British East-Anglian fishery yielded with a little more than half the effort of last year almost the same total catch. The catches on the traditional spawning grounds in the English Channel, however, were very poor, whereas good catches of spawning herring came from Hinder and Bullock bank. — There is no uniformity in the opinion about the strength of the 1962 year-class in North Sea herring. Some good concentrations of these young fish were found in the northeastern North Sea, in the Shields and in the East-Anglian Fishery, whereas they were very poor in other fisheries. In general the mean length for age of the three- and four-year old fish was very high. The percentage of "wide"-type herring in the southern North Sea seems to decrease continuously according to English analyses.

Baltic. The contribution from Poland on Baltic herring indicated good recruitment and excellent feeding conditions of herring in the central Baltic.

G. HEMPEL

The Icelandic Herring Fishery in 1964

(Figure 109; Tables 61–73)

Immature Herring

The special fishery for immature herring was as in previous years only carried out in Eyjafjörður on the north coast. Only one purse-seine was used and the catch was as follows in metric tons:—

Year	For reduction	For quick freezing	For canning	Total
1962		295	336	631
1963	301	223	296	828
1964	219	52	270	541

The great majority of this herring was of the I-group, the remaining minority was of the II-group but no 0-group herring has been found in the catches.

Apart from this special immature fishery, some immature herring are sometimes caught as by-catch in the mature herring fishery. This was especially pronounced in the January–May fishery off the south coast.

Adult Herring

Surveys

(a) Winter Surveys. Asdic echo-surveys were carried out during the period 12. — 25. Jan. on the "Ægir" to locate herring concentrations off the southwest coast of Iceland. At the beginning of the year dense concentrations were located in Skeiðarárdjup off the eastern south coast far from the main landing ports which for winter herring are situated around Faxaflói. Therefore a special attempt was made to locate herring in the area between Snæfellsnes and Vestmannaeyjar. In spite of a thorough search up to a hundred nautical miles from the coast, no positive results were obtained in the surveyed area. It should be noted that during January and February the trawler "Thorsteinn Thorskabítur" which was then used as a herring research vessel, kept more or less continuous asdic contact with the main concentrations off the eastern south coast.

(b) Summer surveys. As in previous years, the "Ægir" was engaged in asdic-echo and environmental surveys throughout the summer from 1. June to 15. October. Up to 23. June the work was part of the joint cruises of Icelandic, Norwegian and Soviet research ships that terminated at a meeting in Seyðisfjörður on 23. and 24. June the results of this work are described in a special report in this volume (p. 183). During July and August the summer feeding migrations of the Norwegian and the Icelandic spring-spawning herring were

studied in detail and distribution charts compiled at weekly or fortnightly intervals. In September and the first half of October de studies were carried out on the migrations of herring towards the overwintering areas of east coast of Iceland. The scientist in charge board the Ægir also had two other asdic-equipped ships of 100 and 120 ft at his disposal for his survey work throughout the summer.

As compared with last year the distribution of the herring concentrations followed the general trends although some differences were observed. Thus the main invading herring concentrations entering the northeast and eastern waters during June and the first half of July were much stronger in 1964 than in the previous year. During the second half of the conventional season, August, the herring concentrations were scattered over wide areas which reached up to 250 nautical miles east and northeast of Iceland. At the beginning of September the herring started to assemble in large shoals and before the end of September they were located only on the windward grounds some 55–90 nautical miles off the coast of Iceland where they remained more or less stationary until the end of the year.

(c) Autumn surveys. During the three months of the year one or two research vessels carried out herring surveys off the southwest coast. In October and the first twenty days of November the herring was only found 20–50 n.m. West of Snæfellsnes. During the period 20.–25. November concentrations started to move south and as they did so, the shoals disintegrated and the research ships lost contact with them until about 20. December when good concentrations were found in the eastern part of the south coast where, in previous years, the western migration had been with immature herring (2–3 ringers). The autumn and eastward winter migration thus started at least one month earlier than in previous years. During the years 1960 to 1963 the migration was in shoals were large and easy to follow as is shown in my report (JAKOBSSON, 1963).

Contrary to this behaviour pattern the herring seemed to disintegrate on their migration route in Dec./Jan. 1963/1964 and this change in behaviour has caused a great loss in catch because, prior to 1964, the best catches were usually taken during the south and eastward winter migration of the herring.

The fishery

The winter and spring fishery

During the period 1. January to 22. Feb

the herring fishery took place in a limited area off the eastern south coast, some 20 n.m. south of Ingolfshöfði. In spite of considerable effort as described in the previous section, no fishable herring concentrations were located off the south-west coast. The fishery was greatly hampered by bad weather conditions throughout the period, but whenever weather permitted, good catches were obtained. The fact that no fishing port was within 150 n.m. from the fishing grounds also reduced the efficiency of the fleet. The total catch of 64,139 metric tons in January and February landed by some 80 purse seiners must therefore be considered quite good.

During the last 10 days of February very strong invasions of capelin on the herring grounds forced the fishermen to give up the herring fishery and turn to purse-seining for capelin and cod. In late April the herring fishery was resumed by some 30–50 boats which during the period 20. April to 31. May landed 8,256 metric tons.

In the spring fishing took place in coastal waters, on either side of the Reykjanes peninsula. Thus the total catch of the winter and spring fishery in 1964 was 72,395 as compared with

97,127 metric tons in 1963 and 83,499 metric tons in 1962.

The north and east coast fishery

Yet another season has been successful with a record catch of 425,000 tons. The total yield of the north and east coast fishery as well as that per purse-seine during the last four years has been as follows:—

Year	Yield (1,000 tons)	Yield per purse-seine (1,000 tons)
1961	212	0.98
1962	324	1.44
1963	239	1.10
1964	425	1.83

With regard to fishing areas there was in 1964 further shift to the east as compared with the previous year. This was especially pronounced because 1964 is the first year of absolutely no herring catches neither off the western nor off the middle north coast as shown in Figure 109. Throughout the recent period of good catches from 1961 onwards Figure 109 shows that more than 50% of the catches have been taken off the east coast in

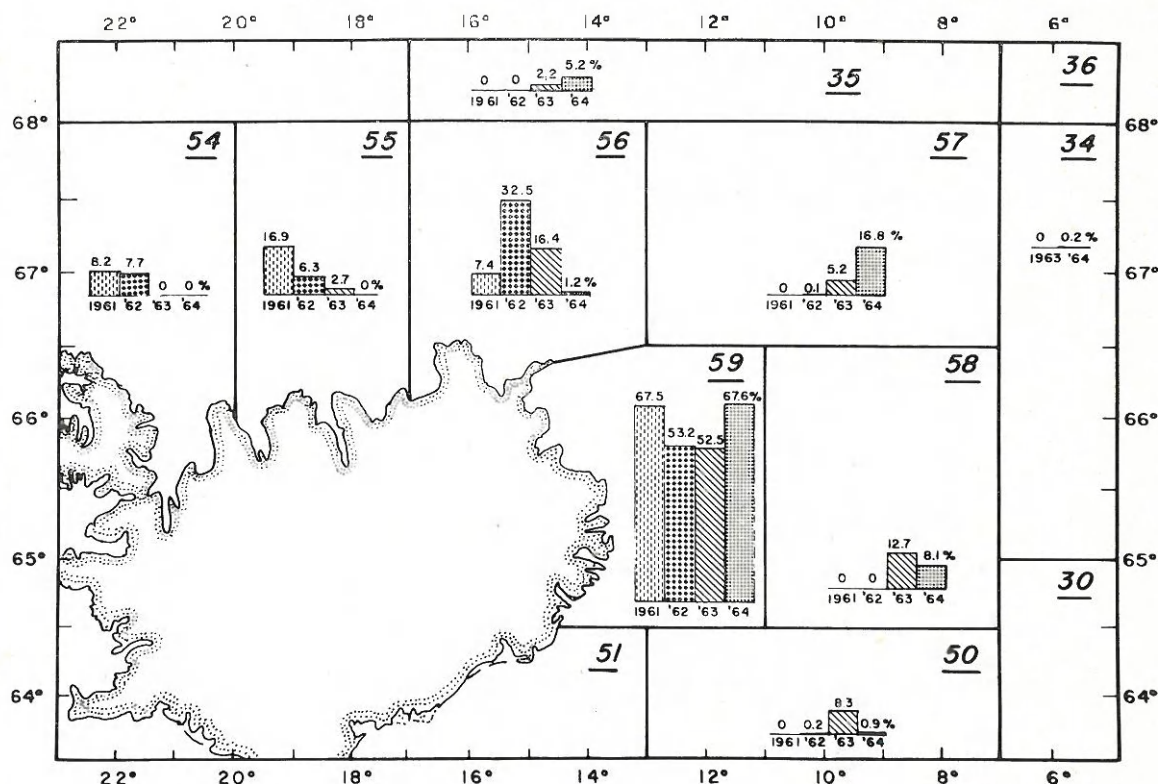


Figure 109. Chart showing the percentage distribution of the north and east coast catches 1964.

area 59. In 1961 and 1962 the remainders of the catches were distributed along the north and north-east coast (areas 54, 55, 56). During the two last years 1963 and 1964 the catches in these areas have practically vanished and instead fishing in oceanic areas (35, 57, 34, 58) has commenced as shown in Figure 109. The catch by month is shown in Table 61. The most striking feature of the 1964 season is that it lasted much longer than in previous years since the first catch was taken on 31. May and the last catch at the end of the year where as in previous years the season closed in September.

The north and east coast purse-seine fishery has in previous years been entirely dependent on feeding herring shoals but in 1964 there was a radical change because most of the catch from September and all from October–December came from overwintering shoals located in the overwintering area off the east coast of Iceland. It should also be noticed that never before has successful purse-seining been carried out in that area during the late autumn and winter. Table 61 shows that the number of boats fishing varied greatly between months. Thus e.g. the August catch of 58,000 tons is taken by more than 200 vessels where as the October catch which is almost as high (55,800 tons) is taken by 50–80 boats. The sharp decline in catches in August compared with the previous month was mainly due to two reasons, i.e. bad weather and disintegration of the feeding shoals due to unfavourable shoaling conditions. The recovery of the fishery in September in total catch and especially in catch per vessel was due to the formation of large overwintering shoals which were easily fished whenever weather permitted. The success of the October–December experimental fishery off the east coast as well as a very strong invasion of Norwegian herring on the east coast fishing grounds in June and early July must be considered the two main factors contributing to the record breaking catch in 1964.

The summer south coast fishery

This fishery started in 1963 and was continued in 1964 by some 25 boats fishing during the period

Table 61. The catch of the Icelandic north and east coast fishery in 1964 by months

Month	1,000 tons	%/nn	Approx. No of boats fishing
May	0.1	+	
June	87.8	207	1–200
July	103.7	243	233
August	58.0	136	233–200
September .	86.2	203	200–50
October ...	55.8	131	50–80
November .	5.8	14	80–10
December .	27.8	66	10–80
Total	421.2	1,000	

July–September. In addition 56 boats fished periodically off the south coast especially v passing by on their way to or from the n and east coast. None of these 50 boats made more than 9 landings where as the 25 boats landed 20–40 times per boat. The total catch amounted to 31,068 tons. The herring concentration remained more or less stationary in various localities around the Vestmannaeyjar and scouting or survey vessels were needed to help the fishing boats locate the shoals.

The southwest coast autumn fishery

The autumn season off the southwest coast started during the first week of October. During October and November the herring concentrations were more or less stationary some 20–60 km west of Snæfellsnes. Acoustic surveys (vertical and horizontal ranging) showed that these concentrations were much smaller than in previous years. The shoals stayed in relatively deep water and rarely entered the uppermost 50 meters. The small concentrations as well as the depth of the shoals greatly hampered the fishery. In addition the shoals dispersed before the end of November so that in December there was practically no herring fishing off the southwest coast. As a result of these negative factors one can say that the season was a failure with a total catch of only 18,900 metric tons compared with 39,000 in 1963 and 65,000 metric tons in 1962.

Biological data

The winter and spring fishery

The age and length distribution of the salmon taken during the winter and spring season (January–May) is shown in Tables 62 and 63. The age is arranged by number of winters and the length

Table 62. Winter and spring herring 1964, southwest coast

year-class	Age	NN	ISPR	ISUM	?
1962	2	—	—	—	18
1961	3	—	221	140	856
1960	4	667	321	280	99
1959	5	—	105	168	25
1958	6	333	111	122	2
1957	7	—	67	61	—
1956	8	—	100	112	—
1955	9	—	40	50	—
1954	10	—	13	18	—
1953	11	—	5	15	—
1952	12	—	3	17	—
1951	13	—	3	10	—
1950	14	—	3	7	—
1949	15	—	8	—	—
Total ...		1,000	1,000	1,000	1,000
No		3	371	721	556
Mean ...		4.7	5.2	5.7	3.1
Tribe ratio			34%	66%	

Table 63. Length distribution of the winter and spring herring 1964, south and southwest coast

Length, cm	NN	ISPR	ISUM	?	Total
19	—	—	—	3	1
20	—	—	—	3	1
21	—	—	—	5	2
22	—	—	—	15	5
23	—	—	—	15	5
24	—	8	—	53	21
25	—	30	1	126	52
26	—	65	11	169	79
27	—	70	42	299	140
28	333	132	114	161	135
29	333	191	161	67	134
30	334	108	137	35	95
31	—	97	137	5	81
32	—	75	111	10	67
33	—	78	94	18	63
34	—	86	124	8	74
35	—	38	54	3	32
36	—	5	10	3	6
37	—	11	4	2	5
38	—	3	—	—	1
39	—	3	—	—	1
Total	1,000	1,000	1,000	1,000	1,000
No	3	371	721	609	1,704
Mean	29.0	30.0	30.9	26.9	29.3

is measured to the centimetres above. Since this fishery started in 1961, the 1956 year-class has been the dominant one, but in 1964 this year-class declined and contributed only 100‰ to the spring spawning stock and 112‰ to the summer spawners. The dominant year-classes in 1964 are those from 1961 and 1960 in the ISPR stock and 1961, 1960 and 1959 in the ISUM stock. It should be stressed that a large number of immature herring (in maturity stage II) were present in the samples. Since these could not be identified they were entered under a "?" in Table 62. The majority of these immature herring were of the 1961 year-class. Including these, Table 62 shows the overall age distribution of the winter and spring herring in the last column where the 1961 year-class emerges as the dominant year-class in this fishery in 1964. Only three Norwegian herring were present in the samples. The average age of the two Icelandic stocks was 5.2 and 5.7 as compared with 6.6 and 6.3 in 1963. The overall average age of the samples was even less or 4.7 which is by far the lowest that has been recorded for this fishery.

This dominance of younger year-classes is clearly reflected in the length distribution. The modal length for the mature stocks is at 29 cm but was in 1963 at 33 cm. Similarly, the average length of the two stocks is 30.0 and 30.9 cm but was in 1963 31.9 and 31.7 respectively. The overall mean length of the 1964 winter and spring samples was still less or 29.3 cm as shown in Table 63.

Table 64. Age distribution of the north and east coast summer and autumn herring 1964

Year-class	Age	NN	NS	ISPR	ISUM	?	Total
1962	2	—	2	—	—	153	+
1961	3	14	66	21	179	462	36
1960	4	121	81	6	205	—	94
1959	5	505	430	13	77	231	416
1958	6	2	5	43	205	—	10
1957	7	—	1	77	77	—	10
1956	8	1	—	144	179	—	19
1955	9	1	10	56	—	—	11
1954	10	4	15	62	26	—	15
1953	11	16	26	126	26	—	32
1952	12	14	38	167	26	77	40
1951	13	40	64	173	—	77	64
1950	14	215	209	56	—	—	192
1949	15	18	15	34	—	—	19
1948	16	19	11	9	—	—	15
1947	17	14	15	2	—	—	13
1946	18	4	2	9	—	—	4
1945	19	6	7	2	—	—	6
1944	20	4	3	—	—	—	3
1943	21	1	—	—	—	—	1
1942	22	—	—	—	—	—	—
1941	23	1	—	—	—	—	+
Total		1,000	1,000	1,000	1,000	1,000	1,000
No		2,108	1,308	467	39	13	3,935
Mean		8.1	8.3	10.5	5.7	4.8	8.4

The north and east coast summer and autumn herring

The age distribution of the samples taken during the 1964 north and east coast season is shown in Table 64. Unlike previous years, the 1950 year-class, although still well represented, (over 200‰) is no longer dominant in the Norwegian herring. Its place in 1964 is taken by the 1959 year-class which contributed 505 and 430‰ to the northern Norwegian and southern Norwegian types respectively. It should be noted that the age distribution shown in Table 64 is based on the samples, but these have not been weighted according to areas and months. Since relatively more sampling took place during the first part of the season than during the later periods and, taking into account that the younger Norwegian year-classes entered the fishery mainly during the late summer, the older year-classes are probably over-represented in this Table. The age distribution of the Icelandic spring spawners is similar to that of previous years. The year-classes from 1951, 1952 and 1956 are most abundant although one can hardly speak of any strong dominant year-classes in this group. The 1956 year-class, which in 1960 to 1962 was promising, has during the two last years been disappointingly weak in this fishery. The presence of the 1961 year-class should be noted. Only 39 summer spawning herring appeared in the

Table 65. The length distribution of the north and east coast summer and autumn herring 1964

Length, cm	NN	NS	ISPR	ISUM	?	Total
20	—	—	—	—	4	1
21	1	—	—	—	—	+
22	—	—	—	—	—	—
23	4	—	—	—	—	2
24	6	2	—	—	4	4
25	11	4	—	—	14	8
26	20	5	2	—	14	13
27	27	8	2	—	18	17
28	52	14	—	57	21	32
29	87	27	11	103	25	54
30	117	47	4	103	33	74
31	180	147	9	51	12	132
32	116	205	24	128	27	123
33	21	104	43	154	43	51
34	5	22	81	154	67	27
35	37	42	180	205	159	69
36	132	132	310	51	198	158
37	127	134	240	—	214	150
38	47	86	73	—	108	68
39	9	19	19	—	37	16
40	1	2	2	—	2	1
Total	1,000	1,000	1,000	1,000	1,000	1,000
No	2,108	1,308	467	39	490	4,412
Mean	32.4	33.6	35.7	32.5	34.8	33.4

samples and their age distribution appears similar to that of this stock in the winter and spring south coast samples.

As in previous years the length distribution of the Norwegian tribes was bimodal in 1964. This is shown in Table 65. The distance between the two modal lengths is 6 cm but in 1963 it was 7 cm and in 1962 the difference of the two modal lengths was 10 cm. The mean length of the three spring spawning stocks shows that in 1964 the Icelandic stock had the highest mean of 35.7 cm whereas the mean length of the Norwegian tribes was 32.4 and 33.6 cm. As compared with 1963 this shows a decrease in the mean length of the Norwegian stocks of 1.9 cm and 1.0 cm for the NN and NS types respectively and an increase for the ISPR type of 1.3 cm.

The relative strength of tribes in 1964 is shown in Table 66. There was a further development of the trends in the two previous years. Thus the Norwegian tribes together contribute 871‰ in 1964 and the Icelandic spring spawners which during the period 1957–1962 contributed over 500‰ in 1964 were of little significance and contributed only 119‰ to the samples. As in a few previous years the summer spawners did not have

Table 66. The relative strength of tribes in 1964

Type	Number	‰
NN	2,108	537
NS	1,308	334
ISPR	467	119
ISUM	39	10
Total	3,922	1,000

Table 67. Stomach content of the north and east summer herring (10 herrings per sample)

June		July	
11.—20.	21.—30.	1.—10.	11.—20.
22.4 ml.	21.5 ml.	37.0 ml.	32.0 ml.
			9.0

any significant effect on the purse-seine fishery constituted only 10‰ of the samples. The portions of the different tribes in 1964 resemble those of the period prior to 1956, although it should be stressed that the age composition was then much different.

Table 67 shows the volume of the stomach content of the north and east coast herring. Compared with previous years, the food in the stomachs appeared in similar quantities as in 1963 but half of what it was in 1962. During the first two days of July the contents were considerably higher than in 1962 and were of the same order as in the good year 1962. During the last 10 days of the month the food decreased dramatically and (not shown in Table 67) remained low in most of the samples throughout the rest of the season.

With reference to earlier comments (FRIEDRIKS 1960; JAKOBSSON, 1961, 1962, 1963) it should be noticed that the quantity of food in the herring stomachs once again coincided with the catfish during the period when the fishing depends on feeding shoals. This relation is on the other hand not applicable in the autumn when the fish, as already pointed out, depended on over-winter shoals.

The south coast summer fishery

The age distribution of the samples taken during the south coast summer fishery are shown in Table 68. The dominant year-class in both spring and summer spawning stock is that of 1961 or 3 year-old herring.

Table 68. Age distribution of the south coast summer herring 1964

Year-class	Age	ISPR	ISUM	?
1	—	—	—	8
2	—	—	13	496
3	659	429	485	11
4	262	287	—	—
5	40	142	—	—
6	8	54	—	—
7	31	38	—	—
8	—	13	—	—
9	—	8	—	—
10	—	4	—	—
11	—	4	—	—
12	—	—	—	—
13	—	8	—	—
Total		1,000	1,000	1,000
No		126	240	363
Mean		3.5	4.1	2.5

Table 69. Length distribution of the south coast summer herring 1964

Length, cm	ISPR	ISUM	?	Total
17	—	—	3	1
18	—	—	8	4
19	—	—	3	1
20	—	—	3	1
21	—	—	10	5
22	—	—	50	26
23	—	—	137	70
24	8	—	168	87
25	—	8	124	66
26	24	25	166	97
27	206	104	174	157
28	278	150	90	141
29	206	187	45	118
30	167	246	3	109
31	63	146	10	63
32	24	71	3	28
33	24	46	—	19
34	—	13	—	5
35	—	—	3	1
36	—	4	—	1
Total	1,000	1,000	1,000	1,000
No	126	240	379	745
Mean	28.7	29.6	25.3	27.3

It should be noted that approximately 50% of the herring is not allocated to either of the stocks. These 363 herring were practically all immature two and three ringers in maturity stages I and II and were therefore not ascribed to spawning populations. The average age of 3.2 (overall) is considerably lower than in any other Icelandic fishery as is seen from other sections of this report. The length distribution is shown in Table 69. The mean lengths of 28.7, 29.6, 25.3 and 27.3 cm of the spring/summer spawning immature herring and overall respectively also show a significant difference from the mean lengths of other Icelandic

Table 70. Age distribution of the autumn southwest coast herring 1964

Year-class	Age	ISPR	ISUM	?	NN	Total
1963	1	—	—	17	—	3
1962	2	3	—	792	—	161
1961	3	146	119	165	—	132
1960	4	199	162	26	—	140
1959	5	73	136	—	500	101
1958	6	52	130	—	250	92
1957	7	156	60	—	—	63
1956	8	209	212	—	—	170
1955	9	42	68	—	—	50
1954	10	31	27	—	—	22
1953	11	10	30	—	—	21
1952	12	10	19	—	—	14
1951	13	31	22	—	—	19
1950	14	10	8	—	250	7
1949	15	3	—	—	—	3
1947	17	3	—	—	—	2
Total ...		1,000	1,000	1,000	1,000	1,000
Total ...		96	369	115	4	584
Mean ...		6.2	6.5	2.2	7.5	5.4

Table 71. Length distribution of the autumn southwest coast herring 1964

Length, cm	ISPR	ISUM	NN	?	Total
16	—	—	—	9	2
17	—	—	—	—	—
18	—	—	—	—	—
19	—	—	—	9	2
20	—	—	—	26	5
21	—	—	—	113	22
22	—	—	—	182	36
23	—	—	—	227	45
24	—	—	—	139	27
25	—	—	—	96	19
26	—	—	—	26	5
27	—	—	—	17	3
28	52	8	250	61	27
29	52	68	—	78	67
30	83	95	—	17	77
31	135	135	—	—	109
32	83	119	250	—	87
33	83	130	—	—	96
34	220	168	250	—	145
35	178	198	—	—	155
36	83	68	—	—	57
37	10	5	250	—	7
38	21	3	—	—	5
39	—	3	—	—	2
Total	1,000	1,000	1,000	1,000	1,000
Total	96	369	4	115	584
Mean	32.9	32.8	31.8	23.8	30.5

fisheries. The analyses of these samples and the fishery on which they are based clearly show that the area around the Vestmannaeyjar off the south coast is probably an important nursery ground for the Icelandic herring stocks in their 2nd and 3rd year of life. Considering also that the samples from the winter and spring herring that mainly came from catches in January and February, some 80-100 n.m. east of the Vestmannaeyjar, also contained substantial proportion (1/3) of immature herring (Table 62) it appears that the herring spend the first 9 months of the year in various localities off the middle and eastern south coast.

The southwest coast autumn fishery

The age distribution of the samples taken during the southwest coast autumn fishery is shown in Table 70. Comparison of Tables 62 and 70 show that the year-class from 1961 which dominated in the winter and spring catches was not present in any comparable proportion during the autumn. The 1956 year-class is - as in previous years - the most abundant in the autumn samples. Practically all the 115 herring which are entered under a " ? " were immature mainly of the II and III-group. The average age of the autumn samples of 6.2 and 6.4 years for the adult fish is practically the same as in 1963.

The continued dominance of the summer spawners should be noted. The ISUM/ISPR ratio of 369/96 is slightly lower than in 1964 when it

Table 72. Tags returned at the north and east coast plants 1964

Year of tagging	Tagged in Norway	Tagged at NE coast	Tagged at S coast	Total
1951	3	2	—	5
1952	3	6	—	9
1953	6	2	1	9
1954	4	6	—	10
1955	13	11	—	24
1956	6	10	1	17
1957	9	9	—	18
1958	12	25	—	37
1959	23	57	3	83
1960	24	75	3	102
1961	8	142	25	175
1962	16	204	12	232
1963	18	102	15	135
1964	6	96	3	105
	151	747	63	961

was approximately 6/1. Considering the age distribution of the south coast herring as a whole (Tables 62, 68 and 70) it is probable that in 1965 the catch will consist mainly of the younger year-classes (1960 and younger).

The age distribution in the autumn fishery is clearly reflected in the length distribution as shown in Table 71. Compared with the length of the winter and spring herring the corresponding tables show that the average length of the mature autumn herring was approximately 2 cm higher than that of the winter and spring herring. This is contrary to previous years when the mean length of herring in these two fisheries was approximately the same. Only 4 Norwegian herring were found in the samples.

Tagging returns

Table 72 shows the returns of tags during the summer and autumn north and east coast season 1964. During this season, 961 tags were returned as compared with 588 in 1963 and 1,290 in 1962. Considering that the quantity reduced in the reduction plants was 4.1 mill. hl. as compared with 1.9 and 3.0 mill. hl. reduced in 1963 and 1962 respectively it is clear that the 1964 returns are lower per million hl. than in the two previous years. This indicates a somewhat greater quantity of herring on the grounds, probably due to invasion of younger year-classes. As in previous years the table clearly shows the migrations of herring from the two spawning centres (west coast of Norway and the south coast of Iceland) to the north and east coast feeding grounds. Thus 151 Norwegian tags were returned and 63 from the south coast as compared with 90 and 74 respectively in 1963 and 137 and 355 respectively in 1962. The ratio of returns from the two spawning centres is thus in good general agreement with the relative strength of tribes during this season as discussed in a

Table 73. Tags returned at the south and southwest plants in 1964

Year of tagging	Tagged at N & E coast	Tagged at SW coast
1956	—	1
1957	1	1
1958	4	1
1959	6	18
1960	26	4
1961	2	56
1962	32	49
1963	77	176
1964	1	229
	149	535

previous section of this report. It should especially be noted that 6 tags were returned from the 1964 Norwegian tagging experiments caught during the late winter and early spring these tags came from two liberations from 13 14. April located at or just south of the Lo area.

Three of these tags were returned in August, one in September and two in December. All from the east coast fishing grounds.

Table 73 shows the returns of tags in 1964 from the south and southwest coast plants. The number of returns was 684 compared with 1,054 in 1963 and 1962 respectively. The decrease in returns is probably due to a small quantity of herring reduced in the plants as well as less efficiency of the magnets in some of the reduction plants. It should be noted that in 1964 not a single Norwegian tag was returned from the south and southwest coast plants.

J. JAKOBSSON

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Norwegian Small and Fat Herring Investigations in 1964

(Figure 110; Tables 74—78)

Survey

From 25. August to 5. October a cruise was undertaken with R.V. "G. O. Sars" to the off northern Norway and in the Barents Sea to investigate the distribution of immature herring. The route of the ship and the records of herring obtained by asdic and echo-sounder are shown in Figure

"G. O. Sars" was equipped with purse-seine and pelagic trawl which made it possible to identify the herring observed. According to the records obtained, 0-group herring were distributed over broad reaches both in the Barents Sea and west of Bear Island and Spitsbergen.

In the western part of the area investigated (90-150 nautical miles NW of Andenes) a mixture of fat herring and maturing herring were located.

When comparing the echo-traces of the 0-group with those obtained at the same time in the five previous years, it is likely that the size of the 1964 year-class is of about the same order of magnitude as the 1963 year-class, which was predicted to be slightly more abundant than the 1962 year-class. However, the size of both the 1963 and 1964 year-classes are considerably less than the 1959 and 1960 year-classes.

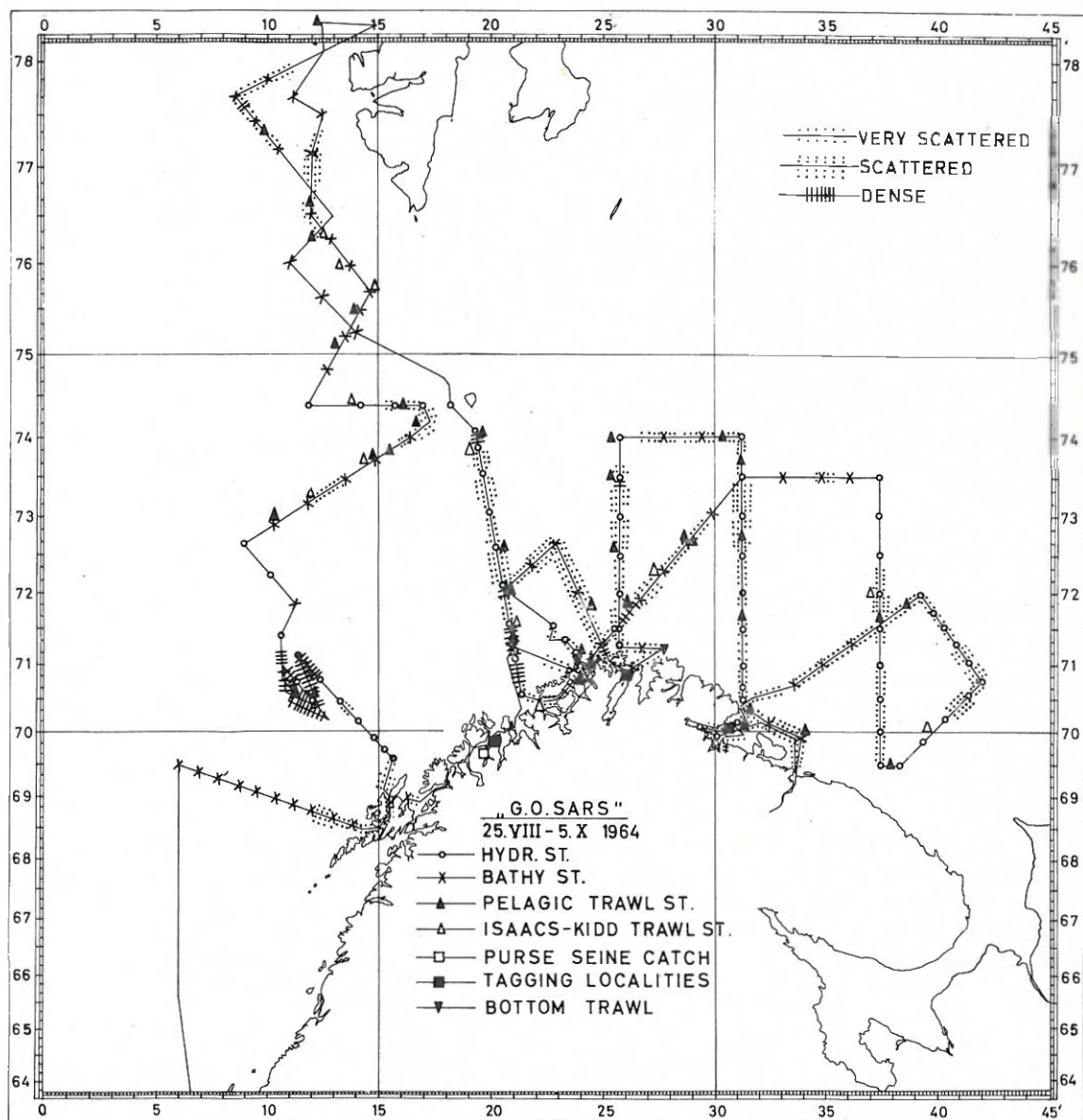


Figure 110. The routes of "G. O. Sars" and the grid of stations, 25. August-5. October 1964. The distribution of herring is also shown.

Table 74. The landings of immature herring (mill. hl) in different districts, 1964

Area	Small herring		Fat herring	
	Mill. hl	%	Mill. hl	%
Finnmark	0.109	9.5	0.001	0.2
Troms	0.176	15.3	0.017	2.7
Nordland/North				
Trøndelag	0.428	37.3	0.235	37.7
South Trøndelag/ Møre and Romsdal	0.251	21.9	0.349	55.9
Sogn and Fjordane/ Hordaland, Rogaland	0.184	16.0	0.022	3.5
Total	1.148	100.0	0.624	100.0

Table 75. The landings per month (mill. hl) of immature herring, 1964

Month	Small herring		Fat herring	
	Mill. hl	%	Mill. hl	%
January	0.108		0.005	
February	—		0.003	
March	—		0.003	
April	0.004		0.320	
May	0.209		0.039	
June	0.138		0.058	
July	0.059		0.056	
August	0.043		0.058	
September	0.070		0.024	
October	0.188		0.025	
November	0.222		0.025	
December	0.106		0.008	
Total	1.148		0.624	

Table 76. Length distribution of fat herring in the different districts (%), 1964

Length (cm)	Finnmark	Troms	Nordland/ N. Trøndelag	S. Trøndelag/ Møre and Romsdal	Sogn and Fjor- Hordaland, Ro
12.5	10	5	4	—	—
13.0	67	6	2	—	6
13.5	96	34	20	—	8
14.0	212	28	29	—	3
14.5	356	6	21	—	11
15.0	163	34	18	—	6
15.5	39	34	19	2	33
16.0	29	34	38	2	66
16.5	29	73	39	38	86
17.0	—	135	58	72	60
17.5	—	107	50	32	105
18.0	—	17	43	14	105
18.5	—	22	33	12	105
19.0	—	11	32	16	110
19.5	—	17	36	8	74
20.0	—	6	39	2	30
20.5	—	—	28	2	14
21.0	—	22	17	—	3
21.5	—	22	2	—	—
22.0	—	90	6	—	3
22.5	—	73	3	—	19
23.0	—	95	—	—	11
23.5	—	67	1	—	11
24.0	—	17	5	2	14
24.5	—	—	13	2	6
25.0	—	17	25	4	—
25.5	—	—	41	14	—
26.0	—	17	42	18	—
26.5	—	6	45	34	—
27.0	—	—	52	34	—
27.5	—	—	38	50	—
28.0	—	—	24	56	3
28.5	—	—	24	68	11
29.0	—	5	25	80	14
29.5	—	—	34	125	16
30.0	—	—	37	129	8
30.5	—	—	23	64	6
31.0	—	—	16	50	6
31.5	—	—	13	34	6
32.0	—	—	3	28	16
32.5	—	—	—	4	11
33.0	—	—	2	—	14
33.5	—	—	1	4	—
Total	1,000	1,000	1,000	1,000	1,000
Number	200	178	951	499	362
Mean	14.40	21.00	22.22	26.80	19.52

Table 77. Age composition of fat herring in the different districts (‰), 1964

Year-class	Finnmark	Troms	Nordland/ N. Trøndelag	S. Trøndelag/ Møre and Romsdal	Sogn and Fjordane/ Hordaland, Rogaland
1963	980	580	608	255	151
1962	15	—	12	11	144
1961	5	41	20	26	130
1960	—	314	61	181	172
1959	—	65	298	524	403
1958	—	—	1	3	—
Total	1,000	1,000	1,000	1,000	1,000
Number	199	169	939	353	139

The fishery

The total catch of immature herring landed in Norway in 1964 amounted to 1,772¹⁾ mill. hl, 1,148 mill. hl being taken as small herring and 0,625 mill. hl as fat herring and "forfangstsild", compared with 3,361 mill. hl in 1963 (1,821 mill. hl small herring and 1,540 mill. hl fat herring and "forfangstsild") and 3,317 mill. hl in 1962 (1,460 mill. hl small herring and 1,857 mill. hl fat herring and "forfangstsild"). The yields landed in the different districts are shown in Table 74. It will be seen that the most important fishing areas were Nordland, North Trøndelag, South Trøndelag and Møre and Romsdal, where 59.2% of the small herring and 93.6% of the fat herring were caught.

The fishery on small herring was mainly carried out in early summer and during late autumn. Contrary to 1963, when the main season for the fat herring fishery was in June to August, about half of the catch in 1964 was landed in April during the "forfangstsild"-season (Table 75).

Biological data

During the first half of the year, the 1963 year-class predominated in the catches of small herring, whereas the 1964 year-class dominated during the last three months of the year.

The length- and age compositions of the fat herring and "forfangstsild" are presented in Tables 76 and 77. Judging from the length composition of these herring (Table 76) it will be seen that the samples consisted of fish ranging in length from 12.5 cm to 33.5 cm. This wide spread in length distribution shows that the fat herring are mixed with small herring and the "forfangstsild", with some mature herring (mainly first-time spawners). Therefore neither the length distribution nor the mean lengths listed in Table 76 give the true picture of the composition of the fat herring landed in the different districts (Table 74). The fat herring are mainly listed in the fishery statistics according to weight (length). These herring comprise

fish ranging in weight from about 55 g to 150 g or in length from 18.0 cm to 28.0 cm.

The samples from the northernmost county (Finnmark) consisted mainly of the 1963 year-class, whereas in Troms and Nordland/North Trøndelag the 1960 year-class also appeared in the catches. Further to the south the 1959 year-class predominated followed by the 1960 and 1963 year-classes. It should, however, be emphasized that the samples in this area mainly consisted of "forfangstsild".

Table 78. 0-group herring taggings, 1964

Date, Sept.	Area	Number of liberations by type of tag
16.	Varangerfjord	1,000 internal
25.	Porsangerfjord	1,000 internal
29.	Ullsfjord	2,000 internal

0-group taggings

The tagging localities and the number of herring tagged are listed in Table 78. The "forfangstsild" taggings are listed in Table 74.

OLAV DRAGESUND

Norwegian Adult Herring Survey 1964

(Figure 111)

In December 1963 the wintering area of the adult Atlanto-Scandian herring was located east of Iceland in the same area as in December 1961 and 1962. It was likely, therefore, that the arrival of the herring to the spawning areas off the Norwegian coast would be about the middle of February 1964. An increase in the winter season catch was expected as the good 1959 year-class would be five years old during the season, and the prognosis was two million hl.

The spawning migration was followed by the R.V. "Johan Hjort" and is demonstrated on Figure 111, which also shows the temperature in the surface layer of the area. The herring schools penetrated the warm front between 10-11°W and kept to temperatures 6-8 °C during the migration.

¹⁾ The landing figures for 1964 are preliminary.

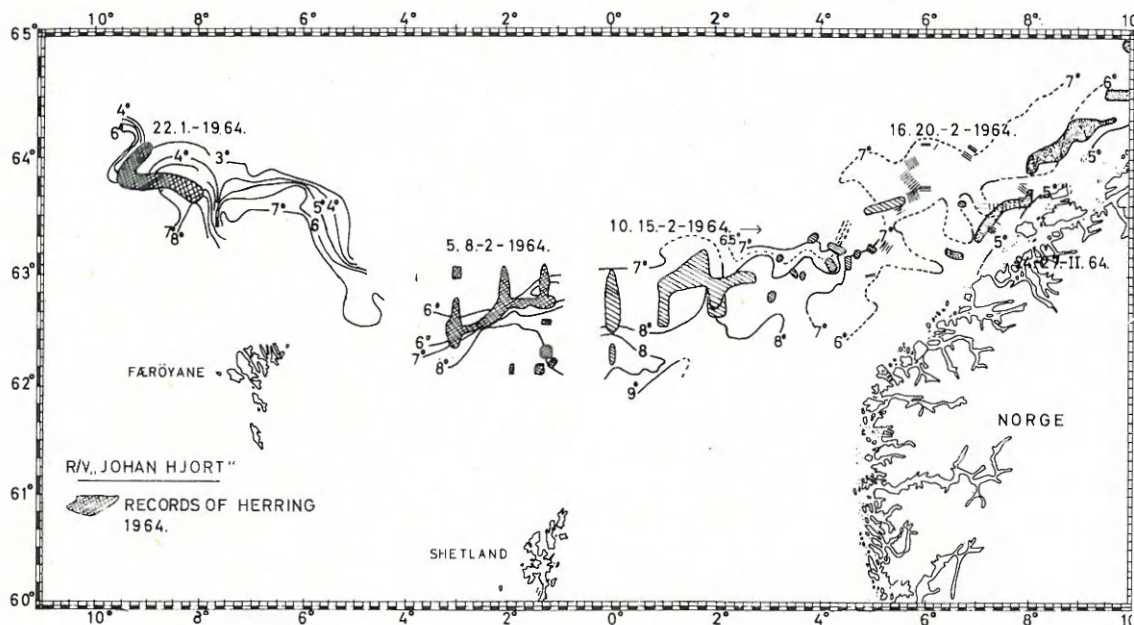


Figure 111. The migration route from the wintering area to the spawning grounds off Møre and Trøndelag compared with the surface temperature.

The first Norwegian catch was taken 13. February about 100 miles off the coast of Møre. The southern border of the spawning area was a little south of Kristiansund, and it continued north to the Sklinna Bank. Although many young herring had joined the mature stock, no shift of the spawning grounds towards the old more southern spawning grounds could be discovered.

After the herring season had got a good start, and the main part of the herring had arrived to their spawning grounds off Møre-Trøndelag, the R.V. "Johan Hjørt" went to northern Norway looking for the herring which had spent the winter in the deep water west of Ingøy (see: *Annls. biol.*, Copenh., 20: 160-62). Good herring schools were discovered about 27. February ten miles northwest of Røst, the concentrations extended about thirty miles in northeasterly direction. The herring schools moved southwards west of Røst and penetrated into the Vestfjord on both sides of the fjord. Information was given to the Norwegian herring fleet, and the main part of the purse-seiners left the southern fishing area for these more northerly schools. Due to extremely good weather conditions during the season, the total catch amounted to three million hl, and half of the catch was caught in the Vestfjord area.

The mature herring left the Norwegian coast water in late March/early April and the fishery lost contact with the northern part of the stock. A cruise of the R.V. "Johan Hjørt" in July off North Norway did not elucidate where this herring were feeding. It is, however, known that in late August and during September the Soviet herring fleet fishing about 150 miles west of Andenes based their fishing upon the herring. Three Norwegian purse-seiners tried to fish in the same area and caught about 2400 hl of herring was generally not available for the purse-seiners in that area, as the schools kept to the outside the reach of the purse-seine during the day. In the evening the schools migrated towards the surface where the schools dispersed. Only a few times in the evening, therefore, it was possible to attack the schools with purse-seine. The Norwegian R.V. "G. O. Sars" caught samples of this herring in late August, which show a mixture of mature and maturing herring.

From 23. October to 2. November the area was covered by R.V. "Johan Hjørt" and herring schools were located about 150 miles northwest of Trondheim. The herring were keeping to a depth below 200 m day and night, where the temperature was 3-4°C.

FINN DEVI

The Norwegian Herring Fishery 1964

(Tables 79-87)

The winter herring season

The season lasted from 13. February to 25. March, in all 29 fishing days. Catch and effort data for 1962/64 are given in Table 79.

The first catch was taken about 100 nautical miles off Møre. The herring shoals migrated further north-eastwards and the main fishing took place on the Halten and Sklinna bank.

As in 1963, spawning herring from northern waters migrated into the Lofoten area in early March. The fishery started on 2. March near Røst and was continued in the Vestfjord until 25. March.

The total catch of winter herring amounted to 3,078,000 hl (286,254 tons) of which 1,491,013 hl was taken in the Lofoten. About 81% of the total catch was taken by the purse-seiners, and the average catch per purse-seiner was 10,464 hl compared with 1,635 hl only in 1963. The catch

per boat in 1964 is thus the highest since the record in 1956.

The summer herring season north and east of Iceland

The fishery started in the first week of June northeast of Langanes and continued until early October. The fishery in early June took place between 12° to 14°W at about 67°30'N extending northwards to lat. 68°40'N. In the second half of June dense concentrations of herring were found off the east coast where the fishery then concentrated throughout the season. The total catch and number of boats over the years 1962/64 are given in Table 84. Since several Norwegian purse-seiners rather went fishing in the North Sea the number of purse-seiners fishing for industrial herring at Iceland was only 89 compared with 130 in 1963.

Biological data

Winter herring

During the season, 44 samples containing 4,510

Table 79. Catch and effort statistics for the Norwegian winter herring fisheries 1962-64

Gear Year	Purse-seine		Gill-net		Trawl		Total	
	1,000 hl	No. of vessels	1,000 hl	No. of vessels	1,000 hl	No. of vessels	1,000 hl	Tons
1962	455	197	449	395	—	—	904	84,072
1963	350	214	260	465	40	40	650	60,450
1964	2,501	239	441	450	130	138	3,078	286,254

Table 80. Length distribution of Norwegian winter herring (°/100)

Gear Maturity cm	Bergen-Møre			Off Møre				Lofoten		
	Purse-seine IV-VIII	Purse-seine I-VIII	Gill-net IV-VIII	Purse-seine IV-VIII	Purse-seine I-VIII	Gill-net IV-VIII	Gill-net I-VIII	Purse-seine IV-VIII	Purse-seine I-VIII	Gill-net IV-VIII
21.0	—	8	—	—	—	—	—	1	2	—
22.0	—	10	—	—	1	—	—	—	2	—
23.0	—	17	—	—	—	—	—	—	5	—
24.0	—	10	—	—	4	—	—	1	4	—
25.0	—	10	—	—	5	—	—	6	11	—
26.0	20	20	—	1	14	—	—	52	55	—
27.0	37	44	3	12	23	—	1	64	67	40
28.0	142	139	43	31	41	8	8	151	150	120
29.0	276	258	170	98	103	38	40	286	280	260
30.0	299	277	347	175	167	117	119	278	269	300
31.0	152	139	283	147	138	130	131	137	132	240
32.0	52	48	107	55	52	43	44	18	17	40
33.0	22	20	40	5	5	10	10	2	2	—
34.0	—	—	7	7	7	24	23	—	—	—
35.0	—	—	—	118	111	185	183	2	2	—
36.0	—	—	—	201	188	261	259	2	2	—
37.0	—	—	—	112	105	151	150	—	—	—
38.0	—	—	—	31	29	27	27	—	—	—
39.0	—	—	—	7	7	5	4	—	—	—
40.0	—	—	—	—	—	1	1	—	—	—
Total number	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
True mean length	30.07	29.67	30.88	33.49	33.13	34.61	34.56	29.67	29.55	30.20

Table 81. Age composition of Norwegian winter herring

		Maturity stages IV-VIII (‰/100)												
		Bergen-Møre		Off Møre						Lofoten				
Gear		Purse-seine	Gill-net	Purse-seine			Gill-net			Purse-seine			Gill-net	
Year-class	Age			N type	S type	Total	N type	S type	Total	N type	S type	Total	N type	S type
1961	3	689	423	—	—	—	—	—	—	—	15	6	—	—
1960	4	242	423	1	83	40	—	63	31	2	240	101	—	205
1959	5	61	113	428	613	515	218	512	363	992	732	884	1,000	795
1958	6	8	17	5	4	4	—	2	1	2	4	3	—	—
1957	7	—	14	1	2	2	—	2	1	—	—	—	—	—
1956	8	—	3	3	10	7	—	—	—	—	—	—	—	—
1955	9	—	—	—	28	13	—	27	13	—	—	—	—	—
1954	10	—	—	6	4	5	10	13	11	—	—	—	—	—
1953	11	—	7	56	28	42	78	56	67	2	—	1	—	—
1952	12	—	—	18	26	22	24	49	36	—	—	—	—	—
1951	13	—	—	25	38	32	60	43	51	—	—	—	—	—
1950	14	—	—	400	148	280	540	213	379	2	9	5	—	—
1949	15	—	—	10	4	7	17	7	12	—	—	—	—	—
1948	16	—	—	20	5	12	13	4	10	—	—	—	—	—
1947	17	—	—	24	7	16	28	7	18	—	—	—	—	—
1946	18	—	—	1	—	1	4	2	3	—	—	—	—	—
1945	19	—	—	1	—	1	4	—	2	—	—	—	—	—
1944	20	—	—	1	—	1	4	—	2	—	—	—	—	—
		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total number		264	291	630	568	1,198	459	447	906	635	454	1,089	43	44
Mean age		3.39	3.83	9.96	7.25	8.68	11.84	8.28	10.09	5.03	4.82	4.94	5.00	4.80

fish were examined for age, length, maturity and racial characters. The length (cm below) and age distribution of the samples from the various fishing districts are shown in Tables 80 and 81. The samples taken off Møre show a bimodal length distribution with a corresponding dominance of the 1950 and 1959 year-classes. The 1950 year-class which since 1954 has predominated in the winter herring catches, was this year replaced by the 1959 year-class. The samples from Lofoten consisted mainly of young herring of the 1959, 1960 and 1961 year-classes of which the 1959 year-class was most abundant. The distribution of spawning groups (Table 82) shows that the recruit spawners constituted 485‰ (purse-seine) off Møre, thus the recruitment to the spawning stock were relatively greater than any year since 1956. Recruit spawners dominated in the catches from Lofoten, but it should be noted that also second time spawners were present.

The samples secured from the herring catches south of Stadt, mainly near Bergen, consisted almost entirely of 3 and 4 year-olds (Table 81). The origin and migration of these herring are uncertain.

The maturity and racial characters of the herring caught during January-March are shown in Table 83. As in previous years most of the herring were already in maturity stage V when the winter herring season started on the 13. of February. Off

Table 82. Distribution of spawning groups of Norwegian winter herring (‰)

Spawning groups	Off Møre		Lofoten	
	Purse-seine	Gill-net	Purse-seine	Gill-net
I	485	357	931	—
II	105	68	62	—
III	4	—	2	—
IV	1	2	—	—
V	10	13	—	—
VI	43	53	1	—
VII	102	131	1	—
VIII	51	98	—	—
IX	41	70	—	—
X	85	106	1	—
XI	56	75	2	—
XII	6	16	—	—
XIII	7	5	—	—
XIV	3	4	—	—
XV	—	1	—	—
XVI	1	1	—	—
		1,000	1,000	1,000
Total number		972	823	982

Møre spawning (50% of the herring in the same maturity stage VI or above) occurred already on 27. February only 2 weeks after the first season started. Further north in Lofoten spawning started about one week later (4. March only 2 days after the first catch was taken at Røst. Compared with 1963 the spawning occurred off Møre at approximately the same time. In the Lofoten area it was about two weeks e

Table 83. Maturity and racial characters of Norwegian winter herring

A. Percentage maturity (all age-groups)

			Maturity stage								No.
			I	II	III	IV	V	VI	VII	VIII	
Bergen Møre	January	♀	13.2	10.5	13.2	60.5	2.6	—	—	—	38
		♂	9.1	7.3	5.4	21.8	56.4	—	—	—	55
	February	♀	—	—	—	6.1	49.0	44.9	—	—	49
		♂	—	—	—	—	64.7	35.3	—	—	51
	March	♀	—	—	—	—	13.5	78.8	7.7	—	170
Off Møre	February	♀	—	—	—	—	17.6	66.7	15.7	—	222
		♂	0.1	3.9	4.4	7.8	63.5	18.1	2.2	—	802
	March	♀	0.1	3.3	0.8	3.4	68.6	22.2	1.6	—	946
		♂	—	—	0.5	—	14.0	61.2	24.3	—	214
	March	♀	—	—	—	—	4.4	66.7	28.9	—	249
Lofoten	March	♀	—	0.2	2.6	—	6.0	91.2	—	—	497
		♂	0.1	—	0.6	0.3	15.2	83.5	0.3	—	697

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Number of vertebrae

		56	57	58	59	Mean
Bergen Møre	January	8	57	25	1	57.21
	February	5	57	34	1	57.32
	March	13	58	25	1	57.14
Off Møre	February	29	141	78	1	57.20

Table 84. Catch and effort from summer herring season north and east of Iceland 1962-64

Year	Industrial herring		Salted herring		Total		
	No. of vessels purse-seine	Catch 1,000 hl	No. of vessels drift-net + purse-seine	Catch barrels	No. of vessels during the season	1,000 hl	Tons
1962	120	1,537	111	99,190	206	1,663	154,659
1963	130	938	91	83,130	208	1,044	97,092
1964	89	932	65	44,520	—	988	91,884

Conversion factors: 1 barrel = 118.5 kg. 1 hl = 93 kg.

Norwegian Sea

Table 85. Norwegian herring samples from the Norwegian Sea 1964

Sample	Date	Locality	Gear
301*	9/6	67°53'N 15°10'W	Drift-net
302	19/6	65°36'N 11°07'W	Purse-seine
303	20/6	65°32'N 11°58'W	Purse-seine
304*	4/8	67°46'N 11°50'W	Drift-net
305*	5/8	68°28'N 07°10'W	Drift-net
306*	6/8	68°26'N 06°22'W	Drift-net
307*	7/8	68°44'N 07°33'W	Drift-net
308*	11/8	65°00'N 11°15'W	Drift-net
309*	12/8	64°50'N 11°04'W	Drift-net
310	2/9	150-200 n.m. off Anda fyr	Purse-seine
311*	31/8	70°33'N 12°05'E	Pelagic trawl
312*	1/9	70°35'N 11°17'E	Pelagic trawl
313*	1/9	70°35'N 11°20'E	Purse-seine
314*	2/9	70°40'N 11°30'E	Purse-seine
315*	9/12	65°01'N 10°15'W	Pelagic trawl

*) Research vessel sample.

Length, age and maturity for the herring samples during 1964 in the Norwegian Sea and Icelandic waters are given in Tables 86 and 87. The sampling localities are given in Table 85. Most of the samples are from research vessel catches and only few samples were secured from the catches taken by Norwegian vessels during the summer fishery east of Iceland. The Norwegian vessels were, however, mainly fishing in the same localities as the Icelandic fishing fleet and the biological data from this fishery are given in the Icelandic contribution in this volume.

The samples in June taken northeast and north of Langanes showed a large proportion of 1950 year-class. Later in the summer this year-class was replaced by the 1959 and 1960 year-classes.

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Table 86. Length distribution of samples from the Norwegian Sea ($^{\circ}/_{00}$)

Gear	Purse-seine	Drift-net	Drift-net	Drift-net	Purse-seine	Pelagic trawl	Pelagic trawl
Month	June	June	August	August	September	August-September	December
Samples No.	302 + 303	301	304 + 308 + 309	305 + 306 + 307	310 + 313 + 314	311 + 312	3
cm							
20.	—	—	—	—	—	—	
21.	—	—	—	—	—	—	
22.	—	—	—	—	—	—	
23.	—	—	—	—	7	—	
24.	—	—	—	—	7	9	
25.	—	—	—	—	20	38	
26.	—	—	—	—	27	78	
27.	—	—	—	—	47	173	
28.	9	—	3	17	147	154	
29.	—	—	10	100	182	212	2
30.	30	—	63	223	260	96	1
31.	91	—	153	330	207	106	2
32.	112	—	153	190	83	96	2
33.	27	10	40	20	13	29	
34.	24	—	30	—	—	—	
35.	91	20	100	37	—	—	
36.	267	220	207	43	—	9	
37.	192	350	170	23	—	—	
38.	118	260	57	7	—	—	
39.	39	110	7	10	—	—	
40.	—	20	7	—	—	—	
41.	—	10	—	—	—	—	
Total	1,000	1,000	1,000	1,000	1,000	1,000	1,0
Number . . .	330	100	300	300	300	104	1
True mean length . . .	35.67	37.78	34.70	31.88	30.00	29.34	31.

Table 87. Age composition of samples from the Norwegian Sea

Gear		Purse-seine	Drift-net	Drift-net	Drift-net	Purse-seine	Pelagic trawl	Pelagic trawl
Month		June	June	August	August	September	August-September	December
Year-class	Age	302 + 303	301	304 + 308 + 309	305 + 306 + 307	310 + 313 + 314	311 + 312	315
1961	3			12	10	72	99	
1960	4	17		8	108	183	297	2
1959	5	252	12	468	773	745	594	6
1958	6	23	—	4	8	—	—	
1957	7	13	—	8	—	—	—	
1956	8	23	12	28	—	—	—	
1955	9	10	—	21	—	—	—	
1954	10	23	61	4	—	—	—	
1953	11	84	159	61	8	—	—	
1952	12	57	61	44	10	—	—	
1951	13	60	49	44	—	—	—	
1950	14	371	329	250	80	—	10	
1949	15	10	61	12	—	—	—	
1948	16	20	37	—	—	—	—	
1947	17	27	134	28	3	—	—	
1946	18	—	24	—	—	—	—	
1945	19	7	24	—	—	—	—	
1944	20	—	37	8	—	—	—	
1943	21	3	—	—	—	—	—	
		1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total number		299	82	248	286	290	101	1,000
Mean age		10.8	13.9	9.0	5.8	4.7	4.6	
Norwegian tribe	%		%	%	%	%	%	
(N + S type)	87.6		78.1	85.4	89.2	96.2	100.0	9
Icelandic spring spawners		1.3	1.2	2.0	—	—	—	
Icelandic summer spawners		0.7	—	—	—	—	—	
Uncertain tribe		10.4	20.7	12.6	10.8	3.8	—	

Table 88. Tagging experiments, 1964

Category	Date	Area	Number of liberations by type of tag	
Skagerak herring	17. Feb.	30 m. SW off Lindesnes	1,000	internal
Spring spawners	14. March	Vinnesvågen	800	700 internal 100 external
Spring spawners	16. March	Vinnesvågen	700	internal
Spring spawners	17. March	Vinnesvågen	1,300	1,100 internal 200 external
Spring spawners	18. March	Vinnesvågen	1,100	internal
Spring spawners	19. March	Vinnesvågen	900	800 internal 100 external
Spring spawners	20. March	Vinnesvågen	1,100	internal
"Forfangstsild"	4. April	Ramsøyfjorden	1,000	internal
"Forfangstsild"	13. April	Kalsholmen	1,000	internal
"Forfangstsild"	14. April	Værøy	300	internal
"Forfangstsild"	24. April	Fillfjorden	500	internal
"Forfangstsild"	25. April	Fillfjorden	500	internal

Norwegian Herring Tagging Experiments

(Tables 88-91)

The tagging localities at the Norwegian coast and the number of fish tagged are listed in Table 88. All the herring tagged were caught by purse-seine and the tagging experiments were carried out outside the skerries.

The amount of winter herring reduced to oil and meal in 1964 were 2,497 mill. hl compared with 0,877 mill. hl caught by the Norwegian fishing fleet off Iceland in the summer 1964 for oil and meal processing (Table 89). A comparison of the recaptures from the latter fishery, with those from the Norwegian winter herring fishery during the last four years is shown in Table 90. In 1964 a total number of 366 internal tags were received from the different factories, 205 during the winter herring season and 161 during the summer season off Iceland. The within season recoveries and tags received from factories which do not possess magnets have not been taken into consideration. Out of 205 recovered tags during the winter herring season, 108 were released as spring and large herring, "forfangstsild" and fat herring; 97 were tagged at the north and east coast of Iceland.

The composition of the recaptures off Iceland in 1964 shows the same general pattern as the previous

Table 89. Landings (mill. hl) for oil and meal processing in Norway, 1961-1964

Season	Year			
	1961	1962	1963	1964
Norwegian winter herring season	0,093	0,054	0,079	2,497
Summer herring season north and east of Iceland	0,059	1,537	1,046	0,877

few years. Out of 161 recovered tags, 121 had been released off north and east Iceland, whereas only 40 had been tagged off the Norwegian coast.

Judging the per mille returns per million hl (Table 91) it will be seen that relatively more I-tags (herring tagged off Iceland) are recaptured during the herring seasons off Iceland than during the Norwegian winter herring seasons. The difference in per mille returns per million hl is by far not so distinct when regarding the N-tags (herring tagged off the Norwegian coast) recaptured during the same seasons. This indicates that relatively large number of Icelandic spring spawners mixed with some Icelandic summer spawners must have been present during the tagging experiments off Iceland.

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Table 91. Returns of Icelandic tags (I-tags) and Norwegian tags (N-tags) in Icelandic waters and during the Norwegian winter herring fishery

Year of tagging	Year of return	I-tags				N-tags			
		Returns		Returns per mill. hl in ‰		Returns		Returns per mill. hl in ‰	
		Iceland	Norway	Iceland	Norway	Iceland	Norway	Iceland	Norway
1958	1959	40	22	19.95	1.52	2	62	0.96	4.16
1959	1960	63	34	15.37	3.37	5	16	0.87	1.15
1963	1964	27	13	17.21	3.39	7	9	4.31	2.27

Table 90. Number of returns of internal tags in 1961, 1962, 1963 and 1964 from the different experiments. The w season recoveries and tags received from factories without magnets are excluded

Year of tagging	Category	Number tagged	Recaptures from:						
			The Norwegian winter herring season				The summer herring season north and east of Iceland		
			1961	1962	1963	1964	1961	1962	1963
1951	N H	3,064	—	—	—	1	1	—	1
1952	N H	17,308	—	—	—	—	—	1	—
1953	N H	10,181	—	—	—	—	4	2	1
1954	N H	8,783	—	—	—	3	7	6	4
1955	N H	9,241	1	—	—	—	8	6	1
1956	N H	8,443	—	—	—	1	10	6	4
1957	N H	7,550	1	1	—	2	14	11	2
1958	N H	9,594	4	—	—	2	27	22	9
1959	N H	9,946	1	1	—	12	41	38	15
1960	N H	6,847	—	3	—	5	30	63	18
1961	N H	9,450	—	5	—	28	—	126	26
1962	N H	10,668	—	—	—	30	—	—	42
1963	N H	2,900	—	—	—	13	—	—	—
Total			7	10	—	97	142	281	123
1950	S H	11,215	—	—	—	—	1	1	—
1952	L H	5,998	—	—	—	—	1	1	—
1951	S H	9,986	—	—	—	—	4	1	2
1952	L H	10,295	—	—	—	—	—	—	—
1952	S H	10,863	1	—	—	2	1	1	—
1952	F H	7,971	—	2	—	1	3	—	1
1953	L H	10,080	—	—	—	—	—	1	—
1953	S H	10,046	—	—	—	—	—	—	—
1953	F H	8,496	—	—	—	—	—	2	1
1954	L H	10,042	—	—	—	—	2	1	2
1954	S H	10,291	—	1	—	4	5	3	—
1954	F H	14,970	—	—	—	2	1	1	1
1955	L H	10,045	2	2	—	1	1	11	2
1955	S H	9,087	—	—	—	—	1	2	—
1955	F H	13,586	—	—	—	3	2	5	—
1956	L H	4,998	—	—	—	2	2	2	—
1956	F H	12,799	—	1	—	—	3	5	1
1957	L H	9,500	—	1	—	2	2	5	—
1957	S H	8,450	2	—	—	1	1	2	—
1957	F H	3,900	1	—	—	—	1	1	2
1958	S H	9,998	2	1	—	1	4	7	2
1958	F H	6,200	—	1	—	—	2	1	1
1959	S H	13,950	3	4	—	9	4	9	2
1959	F H	8,100	3	—	—	12	7	6	3
1960	L H	2,449	3	2	—	11	8	8	4
1960	S H	1,500	—	1	—	4	5	7	2
1961	L H	400	—	2	—	—	—	—	—
1961	F H	1,450	—	—	—	7	—	2	2
1962	L H	1,550	—	—	—	11	—	—	4
1962	F H	2,700	—	—	—	15	—	—	4
1963	S H	3,000	—	—	—	9	—	—	—
1963	F H	2,500	—	—	—	11	—	—	—
Total			17	18	—	108	61	85	36

N H = North and east coast herring. S H = Spring herring.
L H = Large herring. F H = Fat herring and "Forfangstild".

Trawling Survey for Adult Herring West of Scotland

(Tables 92-95)

The herring trawling survey off the west coast of Scotland, begun in 1962 (Vol. 19) was continued by a further survey made by F.R.S. "Explorer" in July 1964. The area surveyed was similar to that of the previous cruise, in August 1963 (Annls. biol., Copenh., 20). It extended from the north-west coast of Ireland to west of the Shetlands. Most of the trawlable grounds within the 100 fathom contour in this region were investigated.

Large shoals of herring were found in several localities. Catches of between 30 and 65 baskets of herring were taken in one hour hauls at positions, NW-SW. of Barra Head, south of St. Kilda and off Orkney.

Biological Data

Length, age, maturity and racial data of samples of the catches are given by statistical squares in Tables 92-95. In all localities the majority of hauls comprised a mixture of spring and autumn spawning herring with the autumn spawning component generally predominating. These fish were mainly in maturity stages III-V. Gonad development tended to be more advanced in the north than in the south of the area. Off Orkney (squares 18A, 17A) there was a small proportion of ripe male and female herring and also some spents in the catches. In other areas where small numbers of ripe fish occurred in the samples it was found that these were all male fish which tended to be at a more advanced stage of maturity than the females.

The age composition of the autumn spawning herring varied from locality to locality. In the

Table 92. Length distribution (0/m)

Statistical square	18A	17A	16WW	16YY	16ZZ	15VV	15WW	14UU
Length cm								
20	—	2.6	—	—	9.8	—	—	—
21	—	20.9	—	—	38.0	—	—	—
22	—	41.9	—	—	109.7	—	—	—
23	—	73.3	—	—	181.4	—	1.8	—
24	1.4	120.4	—	—	219.4	7.1	35.1	—
25	1.4	130.4	—	31.5	180.0	—	123.1	—
26	10.1	47.1	—	126.0	116.7	21.4	134.4	—
27	36.2	50.3	—	118.1	63.3	35.7	129.3	—
28	68.0	62.3	—	63.0	36.6	121.4	229.3	—
29	205.6	96.3	—	118.1	14.1	285.7	222.0	—
30	305.9	178.5	173.9	212.6	8.4	350.0	96.6	277.8
31	263.7	113.6	373.9	267.7	14.1	128.6	25.6	416.7
32	97.3	49.2	321.7	55.1	7.0	42.9	2.6	180.6
33	8.8	13.1	95.7	7.9	1.4	7.1	—	125.0
34	1.4	—	34.8	—	—	—	—	—
35	—	—	—	—	—	—	—	—
No. of fish	6,911	955	115	127	711	272	7,204	72
Mean length	29.98	27.25	31.44	29.14	24.48	30.85	27.59	31.15

Statistical square	14VV	13VV	12VV	11VV	11WW	10VV	10WW
Length cm							
20	—	—	—	—	—	—	—
21	—	—	—	—	2.7	—	—
22	—	—	—	—	16.8	—	—
23	—	0.1	—	—	120.5	—	7.9
24	—	—	0.2	0.1	205.6	6.9	52.9
25	5.8	2.2	0.8	0.9	157.4	57.9	174.6
26	23.1	2.7	1.8	7.7	160.6	116.8	240.7
27	27.0	14.0	1.8	20.8	117.7	194.4	169.3
28	159.8	117.8	7.9	62.8	85.7	212.8	119.0
29	314.8	221.0	53.6	123.5	45.6	180.1	105.8
30	294.5	319.4	182.2	259.5	37.4	149.7	63.5
31	135.2	222.5	303.9	321.7	29.3	52.1	45.0
32	30.7	69.2	343.6	144.6	15.2	19.7	13.2
33	7.1	26.9	88.3	42.4	6.0	9.0	7.9
34	2.1	4.0	14.0	15.6	—	0.5	—
35	—	0.1	1.8	0.3	—	—	—
No. of fish	6,767	10,694	5,049	6,866	1,030	3,647	378
Mean length	29.39	29.94	31.10	30.45	26.37	28.13	27.03

Table 93. Age composition (‰)

Year-class	Winter Rings	Statistical square						
		18A	17A	16WW	16YY	16ZZ	15VV	15WW
1962-63	1	—	13.6	—	—	22.5	—	—
1961-62	2	50.5	434.6	—	228.3	874.8	25.7	333.8
1960-61	3	523.4	373.8	8.7	204.7	73.1	113.9	268.6
1959-60	4	35.9	30.4	34.8	78.7	4.2	113.9	115.9
1958-59	5	80.9	12.6	69.6	—	2.8	51.5	24.6
1957-58	6	117.9	33.5	278.3	165.4	5.6	235.3	108.6
1956-57	7	109.7	69.1	121.7	157.5	11.3	205.9	97.6
1955-56	8	30.0	8.4	234.8	63.0	1.4	139.7	30.2
1954-55	9	34.6	10.5	200.0	55.1	1.4	66.2	14.7
1953-54 and older	>9	17.2	13.6	52.2	47.2	2.8	47.8	—
No. of fish in catch		6,911	955	115	127	950	272	7,204

Year-class	Winter Rings	Statistical square						
		14VV	13VV	12VV	11VV	11WW	10VV	10WW
1962-63	1	—	—	—	—	—	—	—
1961-62	2	53.8	28.6	8.1	43.0	650.5	352.9	582.0
1960-61	3	198.0	144.0	41.4	104.6	185.4	373.7	238.1
1959-60	4	148.1	199.1	42.4	105.4	29.1	44.1	58.2
1958-59	5	67.5	52.1	43.0	27.5	8.7	48.5	18.5
1957-58	6	228.9	188.6	204.4	226.0	29.1	79.2	29.1
1956-57	7	127.8	149.6	174.9	152.9	18.4	36.7	26.5
1955-56	8	61.6	132.1	230.1	151.2	19.4	20.0	10.6
1954-55	9	91.8	66.3	177.7	141.1	28.2	32.4	13.2
1953-54 and older	>9	22.5	39.6	78.0	48.2	31.1	12.3	23.8
No. of fish in catch		6,767	10,694	5,049	6,866	1,843	3,647	378

Table 94. Percentage age composition of spring and autumn spawning components

A. Spring spawners											
Year-class	1963	1962	1961	1960	1959	1958	1957	1956	1955	1954	% of s
Winter rings	1	2	3	4	5	6	7	8	9	>9	spaw
Stat. square											in ca
18A	—	—	79.4	3.3	5.5	11.4	0.4	—	—	—	33
17A	—	5.4	91.4	—	—	1.6	—	—	—	1.6	15
16WW	—	—	2.1	8.3	16.7	39.6	20.8	—	12.5	—	41
16YY	—	—	100.0	—	—	—	—	—	—	—	2
16ZZ	36.8	52.6	10.5	—	—	—	—	—	—	—	2
15VV	—	0.7	8.7	1.5	6.5	29.0	21.7	21.0	6.5	4.3	50
15WW	—	10.1	29.1	7.3	10.6	10.3	24.4	8.2	—	—	5
14UU	—	—	—	—	—	33.3	—	22.2	22.2	22.2	25
14VV	—	6.5	39.5	3.7	9.0	24.6	11.7	—	3.2	1.8	8
13VV	—	10.5	18.3	18.8	3.4	20.5	8.4	11.3	4.5	4.4	20
12VV	—	0.9	8.6	—	2.5	30.7	11.1	24.8	15.0	6.4	38
11VV	—	13.1	16.6	2.6	3.3	27.5	11.7	13.8	8.5	2.9	18
11WW	—	77.2	17.3	1.7	—	0.9	0.4	1.1	1.1	0.2	51
10VV	—	54.5	34.9	1.9	—	5.4	1.6	0.5	0.4	0.8	20
10WW	—	87.6	10.3	—	—	—	—	—	2.1	—	25

B. Autumn spawners											
Year-class	1962	1961	1960	1959	1958	1957	1956	1955	1954	1953	% of au
Winter rings	1	2	3	4	5	6	7	8	9	>9	spaw
Stat. square											in ca
18A	—	7.5	39.0	3.7	9.4	12.0	16.2	4.5	5.2	2.6	67
17A	1.7	52.7	24.3	3.8	1.6	3.8	8.6	1.0	1.3	1.3	80
16WW	—	—	—	—	—	19.4	6.0	40.3	25.4	9.0	58
16YY	—	23.4	18.6	8.1	—	16.9	16.1	6.5	5.7	4.8	97
16ZZ	1.3	88.4	7.2	0.4	0.3	0.6	1.2	0.1	0.1	0.3	97
15VV	—	4.5	14.2	21.6	3.7	17.9	19.4	6.7	6.7	5.2	45
15WW	—	35.9	26.6	12.1	1.6	10.9	8.2	3.1	1.6	—	90
14UU	—	—	—	—	—	7.4	14.8	3.7	35.2	38.9	75
14VV	—	5.3	17.9	15.9	6.5	22.7	12.9	6.8	9.8	2.3	91
13VV	—	1.0	13.4	20.2	5.7	18.5	16.6	13.7	7.2	3.8	80
12VV	—	0.8	1.4	6.8	5.4	14.1	21.4	21.9	19.5	8.6	63
11VV	—	2.3	9.1	12.3	2.6	21.5	16.1	15.4	15.4	5.3	81
11WW	—	52.1	19.8	4.2	1.8	5.0	3.4	2.8	4.6	6.2	48
10VV	—	30.3	38.0	5.1	6.1	8.6	4.2	2.4	4.0	1.4	79
10WW	—	48.0	28.5	7.8	2.5	3.9	3.6	1.4	1.1	3.2	74

Table 95. Maturity and racial characters

A. Percentage maturity (all age-groups)

Stat. square Maturity stage	18A	17A	16WW	16YY	16ZZ	15VV	15WW	14UU
I	—	10.6	—	—	25.5	—	0.3	—
II	3.7	8.1	—	2.4	14.8	1.8	3.9	—
III	12.0	21.5	47.0	10.2	36.3	22.1	43.7	13.9
IV	16.1	15.7	15.6	34.6	17.7	21.7	28.7	65.3
V	31.9	16.0	2.6	47.2	5.3	9.6	17.0	—
VI	10.3	2.8	—	3.1	0.4	1.1	1.5	—
VII	7.1	6.2	—	—	—	—	—	—
VIII	19.0	19.2	34.8	2.4	—	43.7	5.0	20.8
Stat. square Maturity stage	14VV	13VV	12VV	11VV	11WW	10VV	10WW	
I	—	0.1	—	0.3	15.4	0.7	8.2	
II	0.6	1.3	0.5	0.7	31.5	7.8	15.6	
III	18.9	49.3	47.6	52.4	39.8	57.2	55.3	
IV	41.8	24.5	20.8	19.2	6.4	23.1	13.0	
V	32.7	15.3	13.4	18.5	1.6	8.4	7.1	
VI	0.9	0.2	0.4	0.9	0.3	1.4	0.8	
VII	—	—	—	0.2	—	—	—	
VIII	5.2	9.3	17.3	7.8	5.0	1.5	—	

B. Vert. S (Actual numbers — all age-groups)

Number of vertebrae

Stat. square	54	55	56	57	58	59	Mean	No.
18A	—	4	38	31	6	—	56.49	79
17A	—	6	50	64	10	—	56.60	130
16WW	—	1	20	27	2	—	56.60	50
16YY	—	—	31	17	2	—	56.42	50
16ZZ	—	—	23	25	2	—	56.58	50
15VV	—	—	22	60	17	1	56.97	100
15WW	—	3	48	46	2	—	56.47	99
14VV	—	2	19	25	3	—	56.59	49
13VV	1	3	39	51	4	—	56.55	98
12VV	—	1	17	27	5	—	56.72	50
11VV	—	2	22	22	3	—	56.53	49
11WW	—	1	56	76	12	—	56.68	145
10VV	—	—	22	24	4	—	56.64	50
10WW	—	2	23	22	4	—	56.55	51

C. K₂ (Actual numbers — all age-groups)

Number of keeled scales

Stat. square	12	13	14	15	16	17	Mean	No.
18A	—	7	32	10	1	—	14.10	50
17A	—	16	47	14	1	—	14.00	78
16WW	—	7	31	11	1	—	14.12	50
16YY	—	13	26	10	1	—	13.98	50
16ZZ	—	6	24	19	1	—	14.30	50
15VV	1	18	22	5	—	—	13.67	46
15WW	—	12	57	25	3	1	14.22	98
14VV	1	9	31	8	1	—	13.98	50
13VV	—	14	54	25	4	1	14.22	98
12VV	1	13	27	7	1	—	13.88	49
11VV	—	10	25	10	5	—	14.20	50
11WW	—	10	17	22	1	—	14.28	50
10VV	—	6	23	18	2	—	14.33	49
10WW	—	4	19	23	3	—	14.51	49

D. Pectoral Fins (Actual numbers — all age-groups)

Number of fin rays

Stat. square	15	16	17	18	19	20	Mean	No.
16WW	1	15	22	10	1	—	16.90	49
16YY	—	5	22	19	3	1	17.46	50
16ZZ	2	6	25	16	—	—	17.12	49
15WW	1	21	47	23	5	—	17.10	97
14VV	—	5	15	23	5	—	17.58	48
13VV	—	20	50	22	4	—	17.10	96
12VV	—	5	20	23	1	—	17.41	49
11VV	—	12	24	12	2	—	17.08	50
11WW	6	28	65	39	6	—	17.08	144
10VV	1	5	25	18	—	1	17.28	50
10WW	—	12	21	15	1	—	17.10	49

region from St. Kilda to west of the Stanton Banks (squares 14UU, 14VV, 13VV, 12VV, 11VV), where most of the good catches were made, the majority of the herring were over six years old. South and east of the Stanton Banks (10VV, 10WW, 11WW), off the Flannan Isles (15WW), off the north coast of Scotland (16YY, 16ZZ), and off Orkney (18A, 17A) the autumn spawning fish were mainly 3 and 4 year-olds of the 1961 and 1960 year-classes.

Most of the spring spawners sampled were in maturity stages VIII, I, II, and early stage III. The age composition of these fish also varied from region to region. Off Orkney the most prominent group was 3 year-old fish of the 1961 year-class. South of St. Kilda 3 and 6 year-olds were prominent in many of the catches while south and east of the Stanton Banks 2 year-olds of the 1962 year-class were most abundant.

I. G. BAXTER

Scottish Fisheries on Adolescent Herring

(Tables 96-99)

North Sea

The catch and effort statistics for the halflin fisheries in the Moray Firth and Firth of Forth during the season 1963-64 are given in Table 96. In the Moray Firth the catch, effort and catch per unit effort fell sharply compared with the preceding year. In the Firth of Forth on the other

hand the fishery was more successful than in several years. The Moray Firth fishery was in the past, exclusively by drift-net. The greater part of the Firth of Forth landings were by net, but towards the end of the season pair-trawl was introduced to this fishery for the first

In the Firth of Forth samples almost 90% of the fish were 1-ringers of the 1961 year-class all of these were of autumn-spawned origin. The 1960 year-class made up all but 1% of the remainder. All of the fish sampled from the 1961 Firth catches were autumn-spawned members of the 1961 year-class. The length range, mean length and mean V.S. of these fish from the two areas are given in Table 97. For the Moray Firth are similar to those reported for this age-group in previous years. The 1961 year-class in the Firth of Forth, like the 1960 year-class in the previous season, were 2-3 cm larger than the normal length of 1-ringed fish in this area.

Clyde

The catch and effort statistics for the ring-net fishery for adolescent herring in the season are given in Table 98. Despite the fact that, for a considerable part of the season larvae were restricted by catch quotas, the total catch was almost double that of the previous year. The catch per arrival was the highest recorded in many years. The autumn-spawned component

Table 96. Statistics of halflin fisheries 1959-64

	1959-60	1960-61	1961-62	1962-63	1963-64
Upper Moray Firth					
Duration of season	31/10/59-12/3/60	22/10/60-28/1/61	30/9/61-10/2/62	6/10/62-12/1/63	23/11/63-21/1/64
Number of arrivals	1,186	169	458	524	60
Total catch (crans)	18,056	658	3,233	9,934	588
Catch/arrival (crans)	15.2	3.9	7.1	19.0	9.8
Upper Firth of Forth					
Duration of season	28/11/59-9/4/60	28/1/61-11/3/61	—	19/1/63-23/2/63	25/1/64-11/1/64
Greatest number of boats engaged	13	6	—	10	27
Estimated catch of halflins (crans)	6,417	195	—	2,014	7,162
Estimated catch of halflins per arrival (crans)	13.0	2.1	—	23.4	28.6

Table 97. Length and mean V.S. of 1-group (1961 year-class) and 2-group (1960 year-class) herring in inshore waters off the Scottish east coast in 1963-64

Locality	Date	Length range (cm)	Mean (cm)	M V
Autumn 1961 year-class				
Firth of Forth (ring-net) ...	Feb.-March 1964	19-25	22.43 (155)	56.3
Autumn 1960 year-class				
Firth of Forth (ring-net) ...	Feb.-March 1964	22-27	25.43 (16)	56.4
Autumn 1961 year-class				
Moray Firth (drift-net)	December 1963	17-23	20.43 (95)	56.5

Table 98. Statistics of Clyde adolescent fishery 1959-64

	Season					
	1959	1960	1961	1962	1963	1964
Number of arrivals	3,958	5,778	4,319	1,274	3,001	4,172
Total catch (crans)	60,289	72,943	49,015	10,143	38,782	67,413
Catch/arrival (crans)	15.2	12.6	11.3	8.0	12.9	16.16

Table 99. Mean length and meristic data of I, II and III-group herring in Clyde adolescent fishery in 1964

	Rings	Length	V.S.	K ₂	Pectoral fin
I Spring-spawned		20.55 (422)	56.74 (208)	14.11 (163)	16.72 (201)
Autumn-spawned		22.00 (10)	56.17 (6)	15.40 (5)	17.00 (6)
II Spring-spawned		23.75 (2,191)	57.08 (1,059)	14.06 (956)	16.91 (1016)
Autumn-spawned		25.17 (6)	56.50 (2)	14.00 (1)	18.00 (1)
III Spring-spawned		26.37 (238)	56.76 (131)	14.10 (133)	16.93 (126)
Autumn-spawned		26.75 (4)	56.25 (4)	14.50 (4)	17.25 (4)

of minor importance, never exceeding 2% of the landings in any month. Up to the end of July the 1962 year-class provided over 90% of the catches and the 1961 year-class virtually all of the remainder. The 1963 year-class first came into the fishery in August and from then until the end of the year made up about 27% of the catch, the 1962 year-class making up 64% and the remainder being of the 1961 year-class.

The mean lengths and meristic character data of the principal age-groups are given in Table 99.

A. SAVILLE

Scottish Herring Fisheries 1964

(Tables 100-122)

North Sea

The Fisheries

Drift-net. The drift-net fishery in the northern North Sea began in early April and continued until late September. The catch and effort statistics by months for 1964 and the annual totals for the previous three years are given in Table 100.

Table 100. Drift-net fishing Scotland, east coast 1961-64

	1961	1962	1963	1964					
				Total	April	May	June	July	Aug. Sept.
Northeastern North Sea (east of 2°E)									
Catch in crans	3,311	12,631	3,868	6,146	3,017	2,032	—	—	1,097 —
No. of hauls	144	484	190	212	90	85	—	—	37 —
Average catch per haul (crans)	23.0	26.1	20.4	29.0	33.5	23.9	—	—	29.7 —
Northwestern North Sea (west of 2°E and north of 59°N)									
Catch in crans	78,046	98,855	61,407	62,258	756	17,213	28,333	3,551	12,368 37
No. of hauls	2,803	4,174	2,528	2,581	15	614	1,297	375	276 4
Average catch per hauls (crans)	27.8	23.7	24.3	24.1	50.4	28.0	21.8	9.47	44.8 9.2
Northwestern North Sea (west of 2°E and between 55°30'-59°N)									
Catch in crans	39,613	5,785	111,603	38,607	45	161	5,794	20,422	10,755 1,430
No. of hauls	1,795	461	4,769	2,234	1	8	238	1,248	649 90
Average catch per haul (crans)	22.1	12.5	23.4	17.3	45.0	20.1	24.3	16.4	16.6 15.9

The striking feature of the season was the almost complete failure of the fishery in Shetland waters during July. The season started as usual with a small fleet fishing in the northeastern North Sea during April. An increased fleet fished successfully to the west of Shetland during May and to the east of Shetland in June. Towards the end of June catches declined sharply on the Shetland grounds and most of the boats moved to the Buchan grounds where a moderately successful fishery was carried on until August. The catches of the local fleet which continued fishing the Shetland grounds in July were very poor, the average catch per haul being less than 10 crans. Early in August, however, the catches at Shetland improved as suddenly as they had declined and a very successful fishery there lasted for 4 weeks.

As in 1962 and 1963 there was no major spawning fishery on the offshore Buchan grounds but a fairly successful fishery for spawning herring took place off Clythness, on the North coast of the Moray Firth, during August and September.

A few landings were also made from the north-eastern North Sea during August.

Table 101. Trawled herring — Scotland, East Coast 1961-64

	1961	1962	1963	Total	Jan.	March	May	1964	June	July	Aug.	Sept.	Oct.
					Northeastern North Sea (east of 2°E, north of 57°N)								
Catch in crans .	7,211	2,297	7,579	5,331	490	984	190	737	973	589	421	633	
Hours fishing . .	1,298	1,071	1,683	1,022	36	195	60	165	221	117	90	95	
Catch/100 hours (crans)	555.5	214.5	450.3	521.6	1,361.1	504.6	316.7	466.7	440.3	503.4	467.8	666.3	
					Shetland waters (stat. square 18D)								
Catch in crans .	585	1,031	611	2,116	—	—	187	117	1,239	573	—	—	
Hours fishing . .	188	626	205	554	—	—	40	40	357	117	—	—	
Catch/100 hours (crans)	311.2	164.7	298.0	381.9	—	—	467.5	292.5	347.1	489.7	—	—	
					Fladen (57°30'N-60°N, 0°-02°E)								
Catch in crans .	10,918	1,489	2,143	3,780	—	—	—	219	8,743	1,550	2,171	—	
Hours fishing . .	3,655	1,224	875	1,389	—	—	—	55	983	229	122	—	
Catch/100 hours (crans)	298.7	121.7	244.9	272.1	—	—	—	398.2	254.1	193.4	508.2	—	
					Gut and southwards (55°N-57°30'N, west of 2°E)								
Catch in crans .	2,017	644	2,108	7,250	—	—	—	—	—	105	2,134	5,010	
Hours fishing . .	738	557	438	898	—	—	—	—	—	30	229	639	
Catch/100 hours (crans)	273.3	115.6	481.3	807.3	—	—	—	—	—	350.0	931.9	784.0	

Trawl. Herring trawlers landed at Aberdeen from the northeastern North Sea, from Shetland waters (within 60 miles of Lerwick), from the Fladen grounds and from the Gut and southwards. The catch and effort statistics for these landings are given in Table 101.

Biological Data

Drift-net. Sampling of the drift-net fisheries was carried out as in previous years.

Northeastern North Sea (grounds east of 2°E). The length and age composition of the samples from the northeastern North Sea are given in Table 102 and the maturity and meristic date in Table 103. The age compositions of spring- and autumn-spawned herring (as determined from otolith characters) are given in Table 104.

Spring spawned herring made only a small tribution (8%) to the stocks sampled during May; of these 94% belonged to the 1961 (3-ring) year-class. During the same period the autumn spawned component was dominated by the (3-ringed) year-class (79%). The stock sampled in this area in August was different. Spring-spawned herring made up 23% of the catch with the year-class still the dominant one. Among autumn-spawned fish the 1961 year-class (as almost as abundant as the 1960 year (53%).

Northwestern North Sea (grounds west of 2° north of 55°30'N). The samples from this area divided into those taken north and south of lat 59°N.

Table 102. Length and age composition — northeastern North Sea — drift 1964

A. Per mille length composition (all age-groups)															
Length in cm															
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	Mean
April . . .		1.7	11.9	20.3	44.1	135.6	272.9	239.0	166.1	76.3	30.5	1.7			27.61
May . . .				20.0	44.0	156.0	312.0	256.0	140.0	52.0	20.0				27.52
August ..			10.0		30.0	180.0	130.0	220.0	240.0	80.0	60.0	20.0	30.0		28.18
B. Percentage age composition															
No. of winter rings															
	2	3	4	5	6	7	8	9	10	10+					
Year-class	1961-62	1960-61	1959-60	1958-59	1957-58	1956-57	1955-56	1954-55	1953-54	1952-53 and older					
April	5.6	79.4	2.9	3.8	1.0	5.8	0.3	0.2	0.3	0.7					
May	7.6	83.2	1.6	2.8	0.8	4.0									
August	38.0	54.0	2.0	6.0											

Table 103. Maturity and meristic characters — northeastern North Sea — drift 1964

A. Percentage maturity (all age-groups)

	Maturity stage								No.
	I	II	III	IV	V	VI	VII	VIII	
April	1.9	7.6	4.9	1.2	0.9	1.9	13.6	68.1	590
May	2.4	8.4	19.6	0.4		0.4	8.4	60.4	250
August		2.0	20.0	26.0	22.0	15.0		15.0	100

B: V:S. (Actual numbers — all age-groups)

	Number of vertebrae								No.
	53	54	55	56	57	58	59	Mean	
April	1		21	170	165	22	1	56.49	380
May			9	67	58	10		56.48	144
August			2	19	22	6	1	56.70	50

C. K₂ (Actual numbers — all age-groups)

	Number of keeled scales								No.
	12	13	14	15	16	17		Mean	
April	3	42	180	121	19	1		14.31	366
May	1	12	61	51	9			14.41	134
August		4	26	13	4			14.36	47

D. Pectoral fins (Actual numbers — all age-groups)

	Number of fin rays								No.
	14	15	16	17	18	19	20	Mean	
April	2	6	50	136	73	17	1	17.15	285
May	3	21	62	49	14			16.34	149
August	1	1	11	22	13	1	1	17.04	50

Samples from north of 59°N. The length and age composition of these samples are given in Table 105 and the maturity and meristic data in Table 106. The age compositions of the spring- and autumn-spawned fish (separated on otolith characters) are given in Table 107.

Spring-spawned herring were more abundant in these samples than in the samples from the northeastern North Sea during April–May. Their contribution to the stocks sampled was 16% from April to June, 27% during July when the fishing was poor, and 21% during August–September. Most of the spring fish (80%) belonged to the 1961 year-class.

The dominant year-class among the autumn spawned herring was that of 1960 (63%) but the contributions made by the 1956 year-class (16%) and the 1961 year-class (9%) increased as the season progressed.

It is interesting to note that the proportion of maturity stage VIII in June and July 1964 was much higher than has been recorded in previous years.

Samples from south of 59°N. The corresponding data for these samples are given in Tables 108, 109 and 110.

The composition of the samples from this area was very different from that from the other two areas. The contribution by spring-spawned herring

Table 104. Age composition of spring- and autumn-spawned herring in northeastern North Sea drift April, May and August 1964

Spring group				Autumn group				Total sample	
Year-class	Winter rings	Number		Year-class	Winter rings	Number		Number	
		April	May August			April	May August	Spring	Autumn
1962	2	1	1 5	1961	2	31	18 33	7	82
1961	3	56	9 13	1960	3	407	199 41	78	647
1960	4		1 2	1959	4	16	3	3	19
1959	5		3	1958	5	22	7 3	3	32
1958	6	1		1957	6	5	2	1	7
1957	7			1956	7	34	10		44
1956	8			1955	8	2			2
1955	9			1954	9	1			1
1954	10			1953	10	2			2
1953 and older ..	10+			1952 and older ..	10+	4			4
Total		58	11 23	Total		524	239 77	92	840

Table 105. Length and age composition — northwestern North Sea- north of 59°N — drift 1964

A. Per mille length composition (all age-groups)														
<i>Length in cm</i>														
	23	24	25	26	27	28	29	30	31	32	33	34	35	36 Mean
April	22.7	56.8	227.3	295.5	170.5	136.4	79.5	11.4						26.32
May	0.8	3.4	15.2	38.1	118.5	229.5	235.4	222.7	107.5	22.0	6.8			28.87
June	0.7	4.6	21.2	55.1	128.8	239.7	227.8	188.6	109.6	21.9	2.0			28.71
July		3.9	9.8	28.4	62.6	145.8	244.6	271.0	178.1	43.1	8.8	2.9	1.0	29.40
August			15.2	32.5	58.5	102.9	249.2	236.2	208.0	81.3	11.9	3.3	1.1	29.59
September		13.6	20.4	74.8	95.2	142.9	292.5	156.5	136.1	68.0				28.93

B. Percentage age composition											
<i>Number of winter rings</i>											
	1	2	3	4	5	6	7	8	9	10	10+
Year-class	1962-63	1961-62	1960-61	1959-60	1958-59	1957-58	1956-57	1955-56	1954-55	1953-54	1952-53 and older
April		13.6	70.5	1.1	2.3	2.3	8.0	1.1	1.1		
May	0.1	3.6	65.7	3.4	5.3	3.4	13.3	1.5	2.0	1.0	0.8
June		7.6	73.2	2.3	3.0	1.9	10.5	0.3	0.7	0.4	0.3
July		7.3	66.2	2.5	2.9	3.7	12.9	0.9	2.6	0.6	0.5
August ..		10.2	58.5	3.4	3.5	4.8	16.0	1.3	1.6	0.3	0.3
September		21.2	57.5	0.7	1.4	7.5	8.2	0.7	0.7	0.7	1.4

Table 106. Maturity and meristic characters — northwestern North Sea — north of 59°N — drift 1964

A. Percentage maturity (All age-groups)								
<i>Maturity stage</i>								
	I	II	III	IV	V	VI	VII	VIII
April	4.6	5.7	2.3	1.1			25.0	61.4
May	0.3	1.4	27.5	0.6	0.1		4.0	66.2
June	0.4	2.0	48.2	13.6	2.8		0.3	32.8
July	0.2	0.6	31.2	21.0	19.1	3.5	0.4	24.1
August	0.1	0.8	7.5	6.5	14.0	11.1	22.0	38.2
September			7.5	3.4	2.0	4.1	17.7	65.3

B. V. S. (Actual numbers — all age-groups)								
<i>Number of vertebrae</i>								
	53	54	55	56	57	58	59	Mean
April		I	3	48	33	2	I	56.40
May			22	328	358	70	I	56.61
June		I	42	456	453	53	3	56.52
July			15	208	209	47	I	56.61
August			16	194	186	25	3	56.54
September			8	52	79	5	I	56.58

C. K ₂ (Actual numbers — all age-groups)								
<i>Number of keeled scales</i>								
	12	13	14	15	16	17	18	Mean
April	I	19	25	21	5	2		14.22
May	I	58	364	242	28	2		14.35
June	2	102	491	309	46	2	I	14.32
July	2	80	242	128	13			14.15
August	2	70	177	134	23			14.26
September	6	44	62	25	4			13.84

D. Pectoral fins (Actual numbers — all age-groups)								
<i>Number of fin rays</i>								
	13	14	15	16	17	18	19	20 Mean
April			I	25	38	20	3	16.99
May		2	16	130	373	215	32	17.15
June	I		6	162	509	288	34	17.18
July			7	66	237	133	19	17.20
August			3	74	207	122	17	17.19
September			I	28	73	38	6	17.14

Table 107. Age composition of spring- and autumn-spawned herring in the northwestern North Sea — north of 59°N — drift April–September 1964

Year-class	Winter rings	Spring group						Year-class	Winter rings	Autumn group						Total sample	
		Apr.	May	June	July	Aug.	Sept.			Apr.	May	June	July	Aug.	Sept.	Spring	Aut.
1963 ...	1							1962 ...	1								1
1962 ...	2			4	5	4	2	1961 ...	2	12	38	108	70	91	31	15	350
1961 ...	3	2	157	192	227	167	15	1960 ...	3	60	611	899	447	367	69	760	2,453
1960 ...	4		18	13	13	14		1959 ...	4	1	22	21	12	17	1	58	74
1959 ...	5		36	17	20	20	1	1958 ...	5	2	26	28	10	12	1	94	79
1958 ...	6	1	4	2	3	5		1957 ...	6	1	36	26	35	39	11	15	148
1957 ...	7		2		3	1		1956 ...	7	7	154	157	128	145	12	6	603
1956 ...	8		1					1955 ...	8	1	17	4	9	12	1	1	44
1955 ...	9							1954 ...	9	1	24	11	26	15	1		78
1954 ...	10				1			1953 ...	10		12	6	5	3	1	1	27
1953 and older	10+							1952 and older	10+		9	4	5	3	2		23
Total ..		3	222	229	271	209	16	Total ..		85	950	1,264	747	704	130	950	3,880

was small (2%) and of these 45% belonged to the 1961 and 36% to the 1962 year-classes. Among the autumn-spawned herring, the 1961 year-class (53%) outnumbered the 1960 year-class (40%).

The mean lengths of the 2- to 5-ringed herring from the Fraserburgh and Peterhead samples during the period 1950–1961 and in samples from the northwestern North Sea south of 59°N in the years 1962–1964 are given in Table 111.

These data show that the mean lengths of the age-groups in 1964 were again high.

Herring Trawl. The length and age compositions for the trawled herring samples are given in Table 112 and the maturity and meristic data in Table 113.

The March sample from the northeastern North Sea consisted almost entirely of spring-spawned herring of the 1961 year-class. The October samples from both areas were dominated by the 1960 and 1961 autumn-spawned year-classes.

West Coast, Minch

The Fisheries

In 1964 drift- and ring-net vessels fished in the Minch from the ports of Stornoway, Ullapool and Gairloch in the North Minch and from Mallaig and Oban in the South Minch. Landing statistics from the North and South Minch ports in 1964 are given by month in Table 114. As in previous years, although fishing went on throughout the year the late autumn and winter period was the most productive. The summer fishery however was also a highly successful one – in the period June–September 1964, 48,000 crans of herring were landed from the Minch compared with only 17,000 crans in the same period of 1963. This increase in the productiveness of the summer fishery largely accounts for the increase of about 36,000 crans in total annual landings from these waters compared with 1963. As in 1963 marketing

Table 108. Length and age composition — northwestern North Sea— south of 59°N and north of 55°30'N — drift 1964

A. Per mille length composition (all age-groups)																	
Length in cm																	
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	Mean	No.
June				6.3	82.3	316.5	248.4	167.7	112.3	53.8	12.7					26.11	632
July			0.5	19.3	61.9	119.2	160.8	166.3	185.6	169.9	86.7	24.3	4.6	1.0		27.25	1972
August	0.6	0.6	1.3	13.8	49.1	107.5	179.2	191.8	169.2	150.3	92.5	35.2	8.2	0.6		27.32	1590
September				2.9	23.4	122.8	359.6	254.4	149.1	64.3	20.5	2.9				26.66	342
B. Percentage age composition																	
Number of winter rings																	
Year-class	1	2	3	4	5	6	7	8	9	10	10+	No.					
	1962–63	1961–62	1960–61	1959–60	1958–59	1957–58	1956–57	1955–56	1954–55	1953–54	1952–53 and older						
June		61.0	38.2	0.2	0.6							631					
July	0.8	44.0	49.0	1.2	1.6	1.0	2.2		0.1	0.1	0.1	1971					
August ..	1.0	53.2	37.1	1.1	0.8	1.3	4.7	0.4	0.4			1584					
September	0.3	82.1	11.4	4.1	0.6	0.6			0.6	0.3		341					

Table 109. Maturity and meristic characters — northwestern North Sea — south of 59°N and north of 55°30'N — drift

A. Percentage maturity (All age-groups)								
<i>Maturity stage</i>								
	I	II	III	IV	V	VI	VII	VIII
June	0.2	3.6	65.7	11.4	1.3		0.2	17.7
July	0.2	5.3	40.4	29.9	18.9	0.6		4.4
August	1.3	2.1	13.8	24.3	24.4	23.7	4.5	6.3
September	0.6	0.3	9.4	13.2	11.7	50.0	5.3	9.6

B. V. S (Actual numbers — all age-groups)								
<i>Number of vertebrae</i>								
	53	54	55	56	57	58	59	Mean
June			20	231	165	21		56.43
July			67	509	400	40	1	56.41
August	I		55	472	337	31	2	56.39
September			14	119	61	9		56.32

C. K ₂ (Actual numbers — all age-groups)								
<i>Number of keeled scales</i>								
	12	13	14	15	16	17		Mean
June	1	30	183	166	15	1		14.42
July	5	130	461	346	59	3		14.33
August	6	132	418	279	39	4		14.26
September	2	46	90	52	12			14.13

D. Pectoral fins (Actual numbers — all age-groups)								
<i>Number of fin rays</i>								
	14	15	16	17	18	19	20	Mean
June		3	63	203	148	14	1	17.25
July	2	28	206	490	266	26		17.05
August	1	15	157	422	268	32	4	17.17
September		3	32	99	65	7		17.20

Table 110. Age composition of spring- and autumn-spawned herring in northwestern North Sea — south of 59°N and of 55°30'N drift June–September 1964

Spring group						Autumn group						Total s:
Year-class	Winter	Number				Year-class	Winter	Number				Spring
	Rings	June	July	Aug.	Sept.		Rings	June	July	Aug.	Sept.	Num
1963	1					1962	1		16	16	1	
1962	2	8	10	10		1961	2	376	855	827	280	28
1961	3	3	29	3		1960	3	237	935	584	38	35
1960	4		4	1		1959	4	1	19	16	14	5
1959	5		4	1		1958	5	4	27	11	2	5
1958	6		1	4		1957	6		18	16	2	5
1957	7					1956	7		43	75		
1956	8					1955	8			6		
1955	9					1954	9		2	6	2	
1954	10					1953	10		2		1	
1953 and older	10+					1952 and older	10+		1			
Total		11	48	19		Total		618	1,918	1,557	340	78

Table 111. Mean lengths (cm) of 2–5 ringed herring, northwestern North Sea, south of 59°N and north of 55°

	2	3	4	5		2	3	4
1950	24.51	24.92	26.05	27.73	1958	24.51	26.76	28.09
1951	24.73	25.76	25.93	26.49	1959	24.88	26.28	28.25
1952	24.86	26.25	26.82	27.26	1960	24.57	26.14	27.75
1953	24.54	26.37	27.00	28.09	1961	24.96	26.84	28.22
1954	24.69	26.92	28.12	28.71	1962	25.67	27.10	28.35
1955	24.18	26.81	28.68	29.34	1963	25.81	27.46	28.47
1956	24.76	26.97	28.36	29.43	1964	25.86	28.28	28.29
1957	24.28	26.16	28.30	29.31				

Table 112. Length and age composition — trawled herring 1964

A. Per mille length composition

Length in cm

	24	25	26	27	28	29	30	31	32	Mean	No.
Northeastern North Sea											
March			20.0	40.0	80.0	280.0	380.0	160.0	40.0	29.60	50
October		100.0	80.0	220.0	100.0	300.0	120.0	40.0	40.0	28.14	50
Gut											
October	20.0	40.0	130.0	160.0	280.0	150.0	110.0	90.0	20.0	28.10	100

B. Percentage age composition

Number of winter rings

	1	2	3	4	5	6	7	8	9	10	10+	No.
Year-class	1962-63	1961-62	1960-61	1959-60	1958-59	1957-58	1956-57	1955-56	1954-55	1953-54	1952-5 and older	
Northeastern North Sea												
March ...			88.0	2.0	4.0	4.0	2.0					50
October .	41.7	45.8		2.1		2.1	4.2	2.1			2.1	48
Gut												
October .	38.0	48.0	1.0	1.0		3.0	8.0			1.0		100

Table 113. Maturity and meristic characters, trawled herring 1964

A. Percentage maturity (all age-groups)

Maturity stage

	I	II	III	IV	V	VI	VII	VIII	No.
Northeastern North Sea									
March			80.0	300.0	80.0	480.0	20.0	40.0	50
October	2.1	6.3	4.2		2.1	4.2	2.1	79.2	48
Gut									
October			3.0	5.0	1.0		5.0	86.0	100

B. V.S. (Actual numbers — all age-groups)

Number of vertebrae

	55	56	57	58	Mean	No.
Northeastern North Sea						
March		8	33	9	57.02	50
October	1	20	23	5	56.65	49
Gut						
October	5	54	39	2	56.38	100

C. K₂ (Actual numbers — all age-groups)

Number of keeled scales

	12	13	14	15	16	17	Mean	No.
Northeastern North Sea								
March	1	10	29	9			13.94	49
October		5	23	17	2		14.34	47
Gut								
October		12	40	36	9	1	14.46	98

D. Pectoral fins (actual numbers — all age-groups)

Number of fin rays

	15	16	17	18	19	Mean	No.
Northeastern North Sea							
March		5	26	18		17.27	49
October	1	8	22	18	1	17.20	50
Gut							
October		21	43	32	2	17.15	98

Table 114. West coast herring landings 1964

Net	Landings (crans)				No. of arrivals				Landings per arrival		
	North Minch		South Minch		North Minch		South Minch		North Minch		South
	Drift	Ring	Drift	Ring	Drift	Ring	Drift	Ring	Drift	Ring	Drift
January ...	9,665	3,664	175	21,270	432	103	6	605	22.4	35.6	29.2
February ...	12,657	1,585	1,423	11,946	437	54	35	301	29.0	29.4	40.7
March	13,375	460	—	792	614	25	—	14	21.8	18.4	—
April	4,587	1,764	65	1,193	353	103	4	44	13.0	17.1	16.3
May	91	1,091	—	34	18	53	—	4	5.1	20.6	—
June	63	488	—	117	15	60	—	4	4.2	8.1	—
July	5,258	1,664	—	3,549	273	118	—	132	19.3	14.1	—
August	3,434	1,804	2,271	4,540	196	81	71	125	17.5	22.3	32.0
September ..	7,219	1,812	4,889	11,543	493	90	198	286	14.6	20.1	24.7
October ...	1,741	829	4,724	5,512	164	38	274	185	10.6	21.8	17.2
November...	24,057	5,169	1,135	17,047	578	204	48	299	41.6	25.3	23.6
December...	14,282	792	—	35,599	492	23	—	550	29.0	34.4	—
Total	96,429	21,122	14,682	113,142	4,065	952	636	2,549	23.7	22.2	23.1

Table 115. Length and age composition — North Minch — drift-net 1964

A. Per mille length composition (all age-groups)

Month	Length in cm												Mean
	22	23	24	25	26	27	28	29	30	31	32	33	
January ...	10.3	10.3	10.3	51.5	123.7	309.3	185.6	195.9	82.5	20.6			27.56
February ...		10.2	30.5	50.8	182.7	182.7	162.4	192.9	111.7	71.1	5.1		27.78
March	4.3	4.3	13.0	39.0	64.9	129.9	212.1	233.8	168.8	90.9	30.3	8.7	28.53
April			20.2	10.1	242.4	292.9	252.5	90.9	80.8	10.1			27.39
July			33.3	120.0	306.7	353.3	106.7	60.0	6.7	6.7	6.7		26.60
August				23.8	71.4	95.2	95.2	285.7	238.1	166.7	23.8		29.05
September ..	4.3	17.2	81.9	133.6	224.1	228.4	159.5	99.1	51.7				26.69
October ...				54.1	189.2	135.1	162.2	189.2	81.1	162.2	27.0		28.27
November...			33.3	72.2	227.8	188.9	166.7	105.6	133.3	50.0	11.1	11.1	27.63
December...				27.2	97.8	119.6	195.7	233.7	201.1	119.6	5.4		28.62

B. Percentage age composition

	2	3	4	5	6	7	8	9	10	10+
	1961-62	1960-61	1959-60	1958-59	1957-58	1956-57	1955-56	1954-55	1953-54	1952-53
January ...	3.1	57.7	14.4	4.1	9.3	7.2	2.1	2.1		
February ...	5.3	55.1	10.7	2.7	13.4	9.6	0.5	2.1	0.5	
March	3.9	63.2	8.2	2.6	6.9	10.0	0.9	3.0	0.9	0.4
April	6.1	57.6	21.2	3.0	7.1	2.0	2.0	1.0		
July	69.6	26.4	0.7	0.7	0.7	1.4			0.7	
August	16.7	35.7	16.7		11.9	11.9	2.4	4.8		
September ..	70.7	19.4	3.4	0.9	3.4	1.3	0.9			
October ...	40.5	13.5	8.1	5.4	16.2		5.4	8.1		2.7
November...	59.2	29.1	2.8	1.1	3.9	1.7	0.6	1.7		
December...	26.1	34.8	5.4	2.7	12.0	12.0	2.7	2.7	0.5	1.1

Table 116. Length and age composition — South Minch — ring-net 1964

A. Per Mille length composition (all age-groups)

Month	Length in cm															
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	33 M
January			5.6	11.2	39.1	67.0	50.3	61.5	72.6	117.3	67.0	89.4	122.9	229.0	50.3	5.6 2
February	6.0		11.9	65.5	131.0	41.7	53.6	71.4	190.5	95.2	136.9	89.3	95.2	11.9		2
April ...		27.0	108.1	135.1	182.4	121.6	67.6	33.8	94.6	74.3	81.1	40.5	27.0	6.8		2
July ...				4.2		16.7	95.8	212.5	283.3	254.2	116.7	8.3	8.3			2
August .					8.2	4.1	57.6	168.7	255.1	296.3	115.2	53.5	32.9	8.2		2
October								40.0	100.0	160.0	400.0	160.0	60.0	60.0	20.0	2
November				18.4	13.2	15.8	28.9	92.1	100.0	115.8	128.9	218.4	173.7	63.2	21.1	10.5 2
December				10.4	34.7	48.6	34.7	76.4	90.3	93.7	156.2	201.4	166.7	69.4	13.9	3.5 2
	1		2		3		4		5		6		7		8	
	1962-63	1961-62	1960-61	1959-60	1958-59	1957-58	1956-57	1955-56	1954-55	1953-54	1952-53					
January		20.7	24.0	9.5	2.2	9.5	7.8	11.2	11.7	2.2	1.1					1.1
February		26.2	33.3	14.3	1.8	14.3	3.6	0.6	4.2	1.8						
April		62.0	21.3	4.0	0.7	3.3	2.7	2.7	0.7	2.0	0.4					0.4
July		75.8	21.7	1.7		0.4					0.8					
August	0.4	72.0	21.0	2.5	0.4	1.2	1.2	0.4								
October		26.0	44.0	12.0	4.0	8.0	2.0	2.0		2.0						
November	3.9	28.9	20.3	10.8	2.6	15.8	5.8	4.7	4.2	2.1	0.4					0.4
December	9.4	22.9	16.0	12.5	3.5	12.2	8.7	3.8	6.6	2.8	1.1					1.1

Table 117. Maturity and meristic characters — North Minch — drift 1964

A. Percentage maturity (all age-groups)									
Month	I	II	III	IV	V	VI	VII	VIII	No.
January	2.1	20.6	4.1	3.1	3.1			67.0	97
February	2.1	5.3	1.1	3.2	4.8	5.3		78.1	187
March	0.9	5.6	0.4	2.1	5.2	23.8	5.2	56.7	231
April	3.0	5.1					19.2	72.7	99
July	2.7	21.3	32.7	40.0		0.7	0.7	2.0	150
August		2.4		14.3	26.2	50.0		7.1	42
September	2.2	7.3	15.5	12.5	12.9	15.1	4.3	30.2	232
October	5.4		5.4	2.7			2.7	83.8	37
November		7.2	5.6	6.1	5.6	0.6	0.6	74.4	180
December		6.5	6.0	2.7	1.6	1.1		82.1	184
B. V. S. (Actual numbers — all age-groups)									
			55	56	57	58	59	Mean	No.
January			3	44	47	3		56.52	97
February			4	79	90	8	I	56.58	182
March			14	112	76	4		56.34	206
April			9	38	44	7		56.50	98
July			1	18	22	7		56.73	48
August			1	19	21	2		56.56	43
September			14	114	91	9		56.42	228
October			1	16	21			56.53	38
November			7	92	61	16		56.49	176
December			8	54	107	9	I	56.67	179
C. K ₂ (Actual numbers — All age-groups)									
Month	I ₂	I ₃	I ₄	I ₅	I ₆	I ₇	Mean	No.	
January		11	52	30	5		14.30	98	
February		26	99	50	9	I	14.02	185	
March		33	133	57	7		14.17	230	
April		17	52	25	2		14.13	96	
July		7	29	11	3		14.20	50	
August		6	22	14		I	14.26	43	
September	5	42	101	58	13	I	14.16	220	
October		2	24	10	2		14.32	38	
November	I	38	81	49	10		14.16	179	
December		15	100	58	8	I	14.34	182	
D. Pectoral fins (Actual numbers — all age-groups)									
Month	I ₄	I ₅	I ₆	I ₇	I ₈	I ₉	Mean	No.	
January			3	41	24	3	17.38	71	
February		I	32	96	50	8	17.17	187	
March			27	116	75	7	17.28	225	
April			13	53	25	5	17.23	96	
July		I	7	31	8	2	17.06	49	
August		I	3	18	16	2	17.38	40	
September	I	6	26	120	66	12	17.21	231	
October			6	18	11	4	17.33	39	
November	I	4	15	89	62	6	17.27	177	
December		3	34	77	38	8	17.09	160	

difficulties in the last three months of the year brought about the imposition of catch quotas, which reduced the catch at this time considerably below the level which would otherwise have been attained.

Biological Data

Length and age composition data from the North and South Minch samples are given in Tables 115 and 116 and maturities, V.S., K₂ and pectoral fin ray data in Tables 117 and 118. North Minch data are derived from drift-net samples and South Minch data from ring-net samples. In the North Minch

the catches in the first four months of the year were dominated by the 1960-61 year-class which had been so prominent in this area in the previous year. Although this year-class continued to be of considerable importance in this area throughout the remainder of the year, from July onwards the greatest contribution was made by the 1961-62 year-class. In the South Minch the latter year-class was the dominant one during the summer period; during the rest of the year the 1960-61 and 1961-62 year-classes were of more or less equal importance. One-ringed fish were markedly scarce in the catches

Table 118. Maturity and meristic characters — South Minch — ring-net — 1964

A. Percentage maturity (all age-groups)								
Month	I	II	III	IV	V	VI	VII	VIII
January	14.5	11.7	0.5	2.8	1.7	2.8		65.9
February	19.0	12.5	1.8		1.2	1.8	0.6	63.1
April	22.7	32.7					6.7	38.0
July	7.1	25.4	25.8	22.5	6.3	2.9		10.0
August	2.9	14.4	23.9	24.7	18.9	7.8		7.4
October		2.0	34.0	10.0	2.0			52.0
November	3.4	8.7	6.8	6.8	5.8		1.1	67.4
December	5.6	10.8	3.8	1.7	1.4	1.0		75.7
B. V.S. (Actual numbers — all age-groups)								
Month			55	56	57	58	59	Mean
January			3	44	48	5		56.55
February			1	33	31	3		56.53
April				21	28	1		56.60
July			2	42	46	6	I	56.61
August			4	47	37	4		56.45
October				15	30	4		56.78
November			4	96	110	16		56.61
December			6	54	77	7		56.59
C. K ₂ (Actual numbers — all age-groups)								
Month		12	13	14	15	16	17	Mean
January	I	21	57	22	1			14.01
February		10	38	20	1			14.17
April		7	26	13	1		I	14.23
July		7	61	22	2			14.21
August		9	57	25	2			14.22
October		8	20	19	2			14.31
November		30	121	63	10			14.24
December		24	75	37	3			14.14
D. Pectoral fins (Actual numbers — all age-groups)								
Month			15	16	17	18	19	Mean
January				22	54	27		17.05
February				13	26	20	9	17.37
July				13	52	26	5	17.24
August		I	14	43	30	6		17.28
October		I	3	30	15	1		17.24
November		4	26	106	79	15		17.33
December		I	15	75	46	5		17.27

Table 119. Percentage of spring- and autumn-spawned herring — North Minch — drift 1964

Year-class	Rings	January-March			April-June			July-September			October-December	
		No.	Spr.	Aut.	No.	Spr.	Aut.	No.	Spr.	Aut.	No.	Spr.
1962-63	1											
1961-62	2	22	4	18	6	1	5	274	100	174	169	22
1960-61	3	305	112	193	57	9	48	99	8	91	121	31
1959-60	4	53	5	48	21	1	21	16		16	18	1
1958-59	5	15	5	10	3		3	3	1	2	9	5
1957-58	6	50	1	49	7		7	14	1	13	35	2
1956-57	7	48	3	45	2		2	10		10	25	
1955-56	8	5		5	2		2	3		3	8	1
1954-55 and older	8+	17	1	16	1		1	5		5	16	2

Table 120. Percentage of spring- and autumn-spawned herring — South Minch — ring-net — 1964

Year-class	Rings	January-March			April-June			July-September			October-December		
		No.	Spr.	Aut.	No.	Spr.	Aut.	No.	Spr.	Aut.	No.	Spr.	Aut.
1962-63	1							1		1	42	5	37
1961-62	2	81	10	71	93	6	87	357	119	238	189	48	141
1960-61	3	99	8	91	32	3	29	103	20	83	145	41	104
1959-60	4	41	1	40	6		6	5	1	4	83	6	77
1958-59	5	7	3	4	1		1	1		1	22	1	21
1957-58	6	41	3	38	5		5	4	1	3	99	20	79
1956-57	7	20		20	4		4	3	1	2	48	3	45
1955-56	8	21	3	18	4		5	1		1	30	2	28
1954-55 and older	8+	37		37	5		5	3		3	60	5	55

Table 121. Statistics of Clyde spawning fishery 1959-64

	1959	1960	1961	1962	1963	1964
Ring-net fishery						
Number of landings	180	562	1,094	532	378	900
Total catch (crans)	938	10,463	18,750	5,960	4,637	14,732
Catch/landing (crans)	5.2	18.6	17.1	11.2	12.3	16.4
Trammel-net fishery						
Number of landings	82	101	56	217	331	149
Total catch (crans)	420	704	494	1,642	854	2,029
Catch/landing (crans)	5.1	7.0	8.8	7.6	2.6	13.6

Table 122. Mean length and meristic data of 1958-1961 classes in 1964 Clyde spawning fishery

		Mean length	V.S.	K ₂	Pectoral fin
3 Ringers	Ballantrae	26.51 (553)	56.95 (266)	14.23 (249)	16.99 (264)
4 Ringers	Ballantrae	28.81 (5)	57.00 (5)	14.00 (4)	16.75 (4)
5 Ringers	Ballantrae	30.60 (5)	56.75 (4)	14.00 (5)	17.20 (5)
6 Ringers	Ballantrae	30.41 (17)	57.18 (11)	13.82 (11)	17.17 (12)
3 Ringers	S. Arran	25.23 (609)	56.89 (300)	14.17 (302)	17.08 (308)
4 Ringers	S. Arran	26.50 (8)	56.50 (2)	14.00 (1)	16.50 (2)
5 Ringers	S. Arran	27.50 (1)			
6 Ringers	S. Arran	30.60 (5)	57.17 (6)	14.33 (6)	16.50 (6)

from both areas in comparison with recent years. As in previous years the catches from both areas throughout the year were predominantly of autumn spawned fish (Tables 119 and 120). Spring-spawned fish were however of considerable importance, particularly in the North Minch in the first quarter, when the 1961 year-class was dominant, and in the North and South Minch in the second half of the year, when both the 1961 and 1962 year-classes of spring spawned fish were prominent.

Clyde

The Fishery

The catch and effort statistics of the ring-net and trammel-net fisheries for the spawning herring for the years 1959-64 are given in Table 121. In both branches of the fishery the total catch in 1964 was higher than in the preceding two years, and in the trammel-net fishery on Ballantrae Bank

the catch per unit effort was the highest for several years. The catches from both sections of the fishery were dominated by recruit spawners of the 1961 year-class. These provided over 80% of the catches of spawning fish, the 1958 year-class providing most of the remainder.

Biological Data

Length and meristic character data for the 1958 to 1961 year-classes are given in Table 122. The mean length of the 1961 year-class, although not as great as that of the 1960 year-class, as 3 years old, was still considerably higher than of other recent, recruit year-classes.

Tagging

No herring tagging experiments were carried out in 1964.

G. MCPHERSON, A. SAVILLE

The English Herring Fisheries in 1964

(Tables 123-132)

The Fisheries

The catch and effort statistics are summarized in Table 123 to show the catch in crans, effort in drifter shots and catch per effort in crans per shot. The catch per effort in 1963 is also given for comparison.

One of the main features of the 1964 fisheries was the much lower overall abundance of 3 year-old recruit herring (1961/62 year-class), than in the previous year when the 1960/61 year-class was so abundant. This had a very marked effect on the North Shields fishery, which is based to a large extent on the 3 year-old recruit herring. The effect was far less serious in the adult fisheries, where 4 year-old survivors of the 1960/61 year-class were present in considerable numbers.

The total catch in the North Shields fishery was some 4,000 crans down on the 1963 total for a somewhat higher effort, similarly the catch per effort showed a marked reduction, 11.7 compared with 17.3 crans per shot.

The Longstone fishery, after its quite exceptional yield in 1963, returned once again to the normal pattern, the fishing lasting for only a few weeks during August for a total catch of 2,322 crans. The catch per effort at the Longstone, however, of 18.0 crans per shot was quite reasonable, and was actually 4 crans per shot higher than in the Whitby fishery further to the south. Nevertheless, the total catch in the Whitby fishery in 1964 was 3,000 crans up on that of 1963 for very nearly the same effort. This improvement was mainly due to the very much better fishing during the month of September, than in the corresponding month of 1963.

Table 123. Catch and effort of the English herring fishery in 1964

Month	Crans	Shots	Crans per shot
North Shields Fishery			
May	1,523	132	11.5
June	2,196	281	7.8
July	5,320	370	14.4
August	664	49	13.6
Season	9,703	832	11.7
Haisborough Fishery			
September	5,325	186	28.6
October	2,307	174	13.3
Season	7,632	360	21.2
Hinder Fishery			
November	15,625	648	24.1
December	1,499	211	7.1
Season	17,124	859	19.9
Whitby Fishery			
August	12,308	755	16.3
September	13,979	1,119	12.5
Season	26,287	1,874	14.0
Longstone Fishery			
Season (Aug. only)	2,322	129	18.0
East Anglian Fishery			
October	10,048	433	23.2
November	5,628	318	17.7
Season	15,676	751	20.9

Although over 200 trawlers were again fishing on the main concentration of herrings at Whitby, smaller shoals were abundant along the coast from Skinningrove to Flamborough Head. These maintained a steady fishery throughout the season.

The Haisborough catch of 7,632 crans was less than half the 1963 total, but this was mostly due to a sharp reduction in effort, the catch per

Table 124. Age distribution
(as mean number per net per shot)

Age-group	Year-class	May	North Shields	Whitby	Longstone	Haisborough	East Anglian	Hinder
			June	July	August	fishery	fishery	fishery
II	1962/63	—	11.4	28.2	34.0	0.1	1.3	0.6
III	1961/62	165.6	111.8	155.8	108.9	181.5	73.6	106.6
IV	1960/61	95.6	30.6	42.5	31.5	122.6	57.3	164.3
V	1959/60	1.7	2.5	14.5	2.6	0.2	—	1.8
VI	1958/59	8.0	4.0	5.1	4.5	1.3	1.3	13.5
VII	1957/58	1.0	1.2	9.6	—	—	—	1.8
VIII	1956/57	0.1	0.4	1.5	—	4.8	0.2	6.4
IX	1955/56	—	—	0.2	—	0.3	—	—
X	1954/55	—	—	—	—	1.0	—	0.3
X +	—	—	—	—	—	0.3	—	—
?	—	4.0	2.4	5.0	—	4.7	2.9	10.3
Total	—	276.0	164.3	262.4	181.5	316.8	136.6	305.6

Note: The age distributions for the Whitby, Longstone, Haisborough and Hinder fisheries are for the spawning pawns only, i.e. fish in maturity stages V, V-VI, VI and VII at Whitby, Longstone and Haisborough, V-VI, VI and VII at the Hinder.

Table 125. Length distribution (as mean number per shot)

Length in cm	May	North Shields		August	Whitby fishery	Longstone fishery	Haisborough fishery	East Anglian fishery	Hinder fishery
		June	July						
19.0	—	2	—	—	—	—	—	—	—
19.5	—	19	—	—	—	—	—	—	—
20.0	—	75	9	—	—	—	—	—	—
20.5	30	223	82	—	—	—	—	4	—
21.0	93	408	227	54	—	—	7	8	—
21.5	154	586	468	27	—	—	10	25	1
22.0	572	679	803	190	8	—	3	53	11
22.5	806	727	895	380	1	—	23	136	31
23.0	1,832	959	1,321	596	1	—	60	312	66
23.5	2,631	1,171	1,283	867	28	82	153	767	310
24.0	2,967	1,165	1,219	1,464	83	29	153	1,669	811
24.5	2,694	1,380	1,405	1,681	129	328	534	2,867	1,302
25.0	2,340	1,278	1,655	2,196	597	465	818	4,221	2,733
25.5	1,795	1,024	1,650	1,139	1,140	744	1,490	4,808	3,019
26.0	1,555	699	1,614	1,301	1,927	1,306	1,961	5,007	2,330
26.5	1,086	541	1,177	1,220	1,607	891	1,978	4,186	2,289
27.0	1,114	295	919	1,410	1,567	920	2,600	3,681	1,813
27.5	494	230	496	895	1,103	742	2,740	3,032	1,789
28.0	356	119	470	624	1,360	960	2,783	2,187	978
28.5	309	104	347	271	1,164	850	2,629	1,224	592
29.0	139	39	249	461	932	459	2,112	676	210
29.5	59	11	119	190	662	260	1,126	320	83
30.0	32	—	59	163	311	132	427	128	25
30.5	8	—	28	27	93	51	180	77	8
31.0	—	—	14	27	67	15	82	23	2
31.5	—	—	—	—	26	—	36	12	3
32.0	—	—	—	—	12	—	—	13	2
32.5	—	—	—	—	6	—	—	4	—
33.0	—	—	—	—	6	—	—	—	—
Broken fish	314	175	320	—	199	182	744	988	525
Total	21,380	11,909	16,829	15,183	13,029	8,416	22,658	36,428	18,933

Note: The length distributions for the Whitby, Longstone, Haisborough and Hinder fisheries are for the spawning components only, i.e. fish in maturity stages V, V—VI, VI and VII at Whitby, Longstone and Haisborough, stages V—VI, VI and VII at the Hinder.

Table 126. Maturity distribution

Maturity stage	North Shields							
	May		June		July		August	
	f	%	f	%	f	%	f	%
I	61	1.5	789	15.3	576	13.5	47	8.4
II	875	22.3	1,353	26.2	775	18.2	123	22.0
VIII	1,142	29.1	729	14.1	318	7.5	2	0.4
III	526	13.4	1,011	19.6	975	22.9	64	11.4
III—IV	34	0.9	225	4.4	360	8.4	34	6.1
IV	18	0.5	311	6.0	422	9.9	45	8.0
IV—V	3	0.1	43	0.8	346	8.1	42	7.5
V	—	—	23	0.5	444	10.4	125	22.3
V—VI	—	—	—	—	—	—	58	10.4
VI	—	—	—	—	—	—	—	—
VII	1,260	32.2	675	13.1	46	1.1	20	3.5

Maturity stage	Whitby		Longstone		Haisborough		East Anglian		Hinder	
	f	%	f	%	f	%	f	%	f	%
I	2	0.1	64	5.4	121	2.2	610	2.4	68	0.3
II	30	0.9	72	6.1	46	0.8	1,498	5.7	165	0.6
VIII	8	0.3	10	0.9	—	—	81	0.3	19	0.1
III	12	0.4	55	4.6	1	0.0	47	0.2	—	—
III—IV	22	0.7	31	2.6	14	0.3	584	2.2	—	—
IV	58	1.8	132	11.1	63	1.2	1,151	4.4	34	0.1
IV—V	57	1.8	226	19.1	123	2.2	3,553	13.6	290	1.1
V	687	21.7	486	41.0	1,672	30.6	14,674	56.1	4,916	18.8
V—VI	770	24.3	7	0.6	1,467	26.8	1,236	4.7	7,126	27.3
VI	1,306	41.2	11	0.9	1,482	27.1	581	2.2	12,031	46.0
VII	217	6.8	92	7.7	481	8.8	2,154	8.2	1,491	5.7

Note: The maturity distributions are all raised distributions, i.e. sample maturity/length key $\times$ market measurements.

Table 127. Mean length for age

Age-groups	II	III	IV	V	VI	VII	
Year-class	1962/63	1961/62	1960/61	1959/60	1958/59	1957/58	
Whitby spawners (Fish in maturity stages V, V—VI, VI and VII)							
Mean length	—	26.50	28.56	—	29.62	—	
Number of fish	—	1,743	1,065	—	19	—	
σ^2	—	0.8263	0.8926	—	—	—	
Longstone spawners (Fish in maturity stages V, V—VI, VI and VII)							
Mean length	—	26.39	28.40	—	—	—	
Number of fish	—	323	249	—	—	—	
σ^2	—	0.7982	0.9746	—	—	—	
Haisborough spawners (Fish in maturity stages V, V—VI, VI and VII)							
Mean length	23.99	26.22	28.24	29.34	29.33	29.51	
Number of fish	25	2,326	2,129	23	254	21	
σ^2	—	0.9876	0.7896	—	0.6815	—	
East Anglian herring (Fish in all maturity stages)							
Mean length	24.50	25.95	27.77	28.08	29.35	29.88	
Number of fish	1,425	17,938	6,231	92	412	32	
σ^2	0.8785	1.0892	1.0776	1.4090	1.2784	0.6613	
Hinder spawners (Fish in maturity stages V—VI, VI and VII)							
Mean length	—	25.76	27.67	27.51	29.62	—	
Number of fish	—	14,284	5,511	54	94	—	
σ^2	—	0.9823	0.7638	3.0730	0.6031	—	

Note: The mean lengths are based on raised length distribution, i.e. sample age/length key $\times$ market measurement. 0.25 cm has been added to each mean length.

Table 128. Raised L_1 distributions of the spawning components of the 1961/62 year-class (the 3 year-olds) in the v fisheries

Fishery	Whitby		Longstone		Haisborough		Hinder
L_1 (cm)	f	%	f	%	f	%	f
7.0	—	—	—	—	—	—	—
7.5	—	—	—	—	—	—	—
8.0	—	—	4	1.2	16	1.1	99
8.5	3	0.2	—	—	12	0.8	142
9.0	7	0.4	4	1.2	16	1.1	265
9.5	4	0.2	—	—	4	0.3	434
10.0	15	0.9	—	—	23	1.6	387
10.5	83	4.8	2	0.6	40	2.7	1,178
11.0	152	8.7	13	4.0	94	6.5	1,774
11.5	170	9.8	25	7.7	162	11.1	1,655
12.0	237	13.6	23	7.1	252	17.3	1,929
12.5	263	15.1	51	15.8	237	16.3	1,531
13.0	218	12.5	65	20.1	138	9.5	884
13.5	171	9.8	33	10.2	191	13.1	989
14.0	156	9.0	27	8.4	81	5.6	675
14.5	72	4.1	15	4.6	61	4.2	505
15.0	61	3.5	18	5.6	54	3.7	635
15.5	55	3.2	11	3.4	44	3.0	459
16.0	28	1.6	4	1.2	4	0.3	305
16.5	15	0.9	13	4.0	10	0.7	232
17.0	13	0.7	7	2.2	10	0.7	128
17.5	11	0.6	8	2.5	7	0.5	78
18.0	3	0.2	—	—	—	—	—
18.5	6	0.3	—	—	—	—	—
19.0	—	—	—	—	—	—	—
19.5	—	—	—	—	—	—	—
20.0	—	—	—	—	—	—	—
Number of fish	1,743		323		1,456		14,284
Mean L_1	13.05		13.55		12.85		12.85
σ^2	2.3845		3.0117		2.3674		3.42

Note: 1. The sample L_1 /fish length keys were raised to the market measurements of the spawning components in fishery.

2. In Tables 128—132 the L_1 , V.S., K_2 and otolith types given for Haisborough spawners are based only on h above maturity stage V. This has been done in order to avoid including some East Anglian herring which present in the Haisborough fishery in this stage. Owing to the fact that nearly one third of the Haisborough fish were in stage V it has, however, been necessary to include these in the age and length calculations.

Table 129. Raised L_1 distributions of the spawning components of the 1960/61 year-class (the 4 year-olds) in the various fisheries

Fishery	Whitby		Longstone		Haisborough		Hinder	
L_1 (cm)	f	%	f	%	f	%	f	%
7.0	—	—	—	—	—	—	—	—
7.5	4	0.4	—	—	—	—	—	—
8.0	—	—	—	—	—	—	—	—
8.5	—	—	—	—	—	—	77	1.4
9.0	3	0.3	—	—	9	0.6	—	—
9.5	3	0.3	—	—	4	0.3	42	0.8
10.0	3	0.3	3	1.2	5	0.3	27	0.5
10.5	2	0.2	1	0.4	4	0.3	144	2.6
11.0	7	0.7	7	2.8	38	2.6	337	6.1
11.5	19	1.8	7	2.8	35	2.4	751	13.6
12.0	34	3.2	18	7.2	71	4.8	909	16.5
12.5	63	5.9	18	7.2	154	10.5	896	16.3
13.0	120	11.3	15	6.0	132	9.0	625	11.3
13.5	124	11.6	27	10.8	156	10.7	572	10.4
14.0	103	9.7	20	8.0	159	10.9	353	6.4
14.5	104	9.8	14	5.6	141	9.6	262	4.8
15.0	114	10.7	41	16.5	120	8.2	209	3.8
15.5	98	9.2	22	8.8	120	8.2	90	1.6
16.0	65	6.1	7	2.8	84	5.7	92	1.7
16.5	74	6.9	18	7.2	79	5.4	22	0.4
17.0	29	2.7	7	2.8	52	3.6	69	1.3
17.5	35	3.3	6	2.4	29	2.0	28	0.5
18.0	42	3.9	9	3.6	41	2.8	—	—
18.5	12	1.1	3	1.2	21	1.4	—	—
19.0	4	0.4	3	1.2	—	—	6	0.1
19.5	—	—	1	0.4	10	0.7	—	—
20.0	3	0.3	—	—	—	—	—	—
20.5	—	—	2	0.8	—	—	—	—
Number of fish	1,065		249		1,464		5,511	
Mean L_1	14.82		14.73		14.54		12.95	
σ^2	3.3205		4.0702		3.5103		2.2461	

Table 130. Mean V.S. by age-groups

Age-group	III	IV	V	VI	VII	VIII
Year-class	1961/62	1960/61	1959/60	1958/59	1957/58	1956/57
Whitby spawners (Mat. V, V—VI, VI and VII)	56.4180	56.4194	—	56.3750	—	56.3636
Number of fish	512	360	—	8	—	11
σ^2	0.4903	0.4503	—	—	—	—
Longstone spawners (Mat. V, V—VI, VI and VII)	56.3588	56.4087	—	—	—	—
Number of fish	131	115	—	—	—	—
σ^2	0.5087	0.4017	—	—	—	—
Haisborough spawners (Mat. V—VI, VI and VII)	56.4777	56.3994	—	56.3171	—	56.5600
Number of fish	247	358	—	41	—	25
σ^2	0.3806	0.4422	—	0.3220	—	0.4233
Hinder spawners (Mat. V—VI, VI and VII)	56.4847	56.4627	—	56.3684	—	—
Number of fish	619	402	—	19	—	—
σ^2	0.5155	0.3789	—	—	—	—

Note: Mean V.S. is based entirely on laboratory samples of commercially caught herring.

Table 131. Mean K_2 of the 3 and 4 year-old herring (1961/62 and 1960/61 year-classes) in the spawning fisheries

Age-group	III	IV
Year-class	1961/62	1960/61
Whitby spawners (Mat. V, V-VI, VI and VII)	14.2609	14.7407
Number of fish	69	54
σ^2	0.7839	0.4976
Haisborough spawners (Mat. V-VI, VI and VII)	14.7292	14.9155
Number of fish	48	71
σ^2	0.5421	0.6785
Hinder spawners (Mat. V-VI, VI and VII)	14.8539	15.1458
Number of fish	219	192
σ^2	0.5290	0.6069

of 21.2 crans per shot being only 3 crans lower than the figure for 1963.

In the south a most productive fishery took place on the traditional East Anglian grounds during October and November. The catch per effort of 20.9 crans per shot was 8.7 crans higher than the very poor 1963 figure of 12.2 crans per shot. Because of this, although the effort was almost half that of 1963, the total East Anglian catch was only just over 2,000 crans less.

As in 1963 a very good fishery developed in November in the region of the Hinder spawning grounds and although the yield dropped sharply in December the total catch of 17,124 crans for the season at 19.9 crans per shot was very satisfactory, and not very different from the results of the 1963 fishery.

Biological Data

The biological details for the herring sampled from the various fisheries in 1964 are summarized in Tables 124-132. They contain age, length and maturity distributions together with mean length and mean V.S. by age-groups. Mean K_2 and distributions of L_1 and otolith type have also been included for the 3 and 4 year-old spawning herring.

As already mentioned, the recruiting 1961/62 year-class was rather a poor one in the fisheries on both the Bank and Down stocks. Admittedly the catch per effort of 3 year-old herring in the East Anglian fishery was somewhat higher than in 1963 (mean of 275.2 as against 219.8 herring per net per shot) but this was most probably due to the fact that a succession of westerly winds, which

Table 132. Percentage distribution of otolith types 3 and 4 year-old spawning fish (1961/62 and 1960/61 classes)

Otolith type	Age group III 1961/62 year-class		
	Whitby	Haisborough	H
W	1.8	2.9	
N	95.2	93.2	
?	3.0	3.9	
Number of fish	498	207	
Otolith type	Age group IV 1960/61 year-class		
	Whitby	Haisborough	H
W	1.2	2.0	
N	96.1	95.3	
?	2.7	2.7	
Number of fish	337	298	

have been shown to be correlated with high catch per effort in the East Anglian drift-net fishery were recorded during the main part of the season. It is significant that 3 year-old herring were much less numerous amongst the Haisborough spawners, than in 1963.

The weakness of the 1961/62 year-class in the Bank stock can be judged by the fact that in the Whitby and Longstone fisheries there were nearly as many surviving 4 year-olds as recruiting 3 year-olds, while amongst the Haisborough spawners the 4 year-olds were even predominant.

Other features of importance during 1964 were:

1. The very much lower mean L_1 value for spawning of the 1961/62 year-class, compared with the preceding one, particularly in the Bank stock.

2. The very high mean length for age in both the 3 and 4 year-old herring. The 4 year-olds at Whitby, and both the 3 and 4 year-olds in East Anglia, had the highest mean length ever recorded for these age-groups.

3. A further reduction in the percentage "wide" type otoliths in the Downs stock. 12.8% "wides" amongst the 3 year-old herring spawning at the Hinder, was the lowest percentage recorded here.

In conclusion it may be noted that 2 year-old herring (1962/63 year-class) were much more numerous in both the North Shields and East Anglian fisheries than were the 2 year-olds (1961/62 year-class) in 1963.

R. J. W.

Survey of the German Commercial Herring Fisheries in 1964

(Figures 112-119; Table 133)

The Fisheries

The total landings of the German herring fishery amounted to 116,000 tons in 1964, which is 2.5% less than in 1963. 70.7% of the total catch (82,000 tons) were herring for human consumption and 29.3% (34,000 tons) industrial herring Table 133). The herring landings comprise at present 20.8% of the total landings of the German fishing fleet. In 1955 the herring constituted 44.6% (334,800 tons). This shows clearly the strong decline in the German herring fishery which is mainly due to the reduction of the trawler effort.

Herring trawlers

The total catch of the trawlers further decreased from 25,900 tons to 18,600 tons. This was mainly due to decreasing landings (by 34.4%) from the North Sea. Due to economical factors, the effort decreased from 241 to 122 trips (49.4%) and from 1,804 to 984 fishing days (45.5%). No catches were taken in the English Channel.

In the North Sea the total catch was 14,100 tons as against 21,500 tons in 1963. The catch per day increased from 14.0 to 19.6 tons (40%), while the effort decreased by 51.7%.

The fishery of the trawlers on the "Ostkante" (NE North Sea) in late winter and spring has completely ceased. The summer-autumn fishery in the Fladen Ground area started in the middle of July and was finished in the first decade of August. The total catch in this area decreased from 5,761 tons to 1,700 tons (70.5%) and the number of fishing days decreased from 286 to 119 (58.4), while the catch per day increased from 8.4 to 9.6 tons.

In the Bressay area the fishing intensity by trawlers was about 20% only of that in 1963. The catch per unit effort increased slightly.

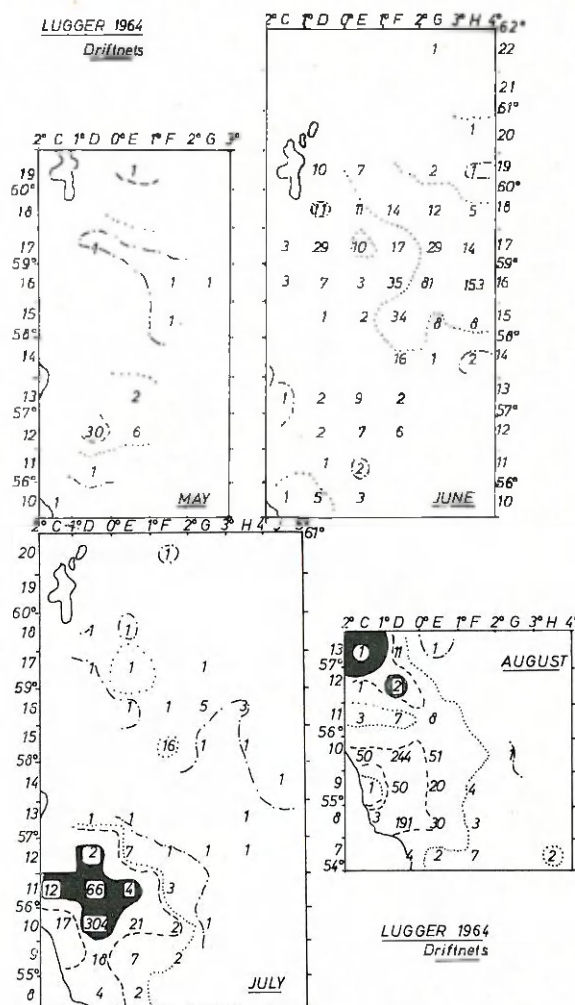


Figure 112. German lugger herring fishery. Drift-net. Mean catch per fishing day and number of hauls.

— — — — — = 1-10 kantjes
 = 11-30 kantjes
 - - - - - = 31-50 kantjes
 ————— = > 50 kantjes

Table 133. Total herring landings (in 1,000 tons) of the German fishing fleet in 1964

(Yield of 1963 in brackets)

	North Sea	Channel	Skagerak	N of Hebrides	N of Ireland	Other areas	Total
Trawlers	14.1 (21.5)	— (—)	0.1 (—)	3.8 (3.6)	0.6 (0.6)	— (0.2) ¹⁾	18.6 (25.9)
Drifters	43.2 (56.4)	0.4 (0.8)	5.9 (0.6)	0.5 (0.2)	0.3 (+)	— (0.2)	50.3 (58.2)
Drift-net	13.6 (35.1)	0.1 (0.7)	— (+)	— (—)	— (—)	— (+)	13.7 (35.8)
Trawl	29.6 (21.3)	0.3 (0.1)	5.9 (0.6)	0.5 (0.2)	0.3 (+)	— (0.2)	36.6 (22.4)
Deep-sea cutters	29.9 (18.3)	— (—)	0.2 (—)	— (—)	— (—)	17.0 ²⁾ (16.8) ²⁾	47.1 (35.1)
for consumption	0.8 (6.4)	— (—)	0.1 (+)	— (—)	— (—)	12.2 ²⁾ (14.2) ²⁾	13.1 (20.6)
for factories	29.1 (11.9)	— (—)	0.1 (+)	— (—)	— (—)	4.8 ²⁾ (2.6) ²⁾	34.0 (14.5)
Total	87.2 (96.2)	0.4 (0.8)	6.2 (0.6)	4.3 (3.8)	0.9 (0.6)	17.0 ²⁾ (17.2) ²⁾	116.0 (119.2)

¹⁾ Norwegian Coast.

²⁾ Baltic.

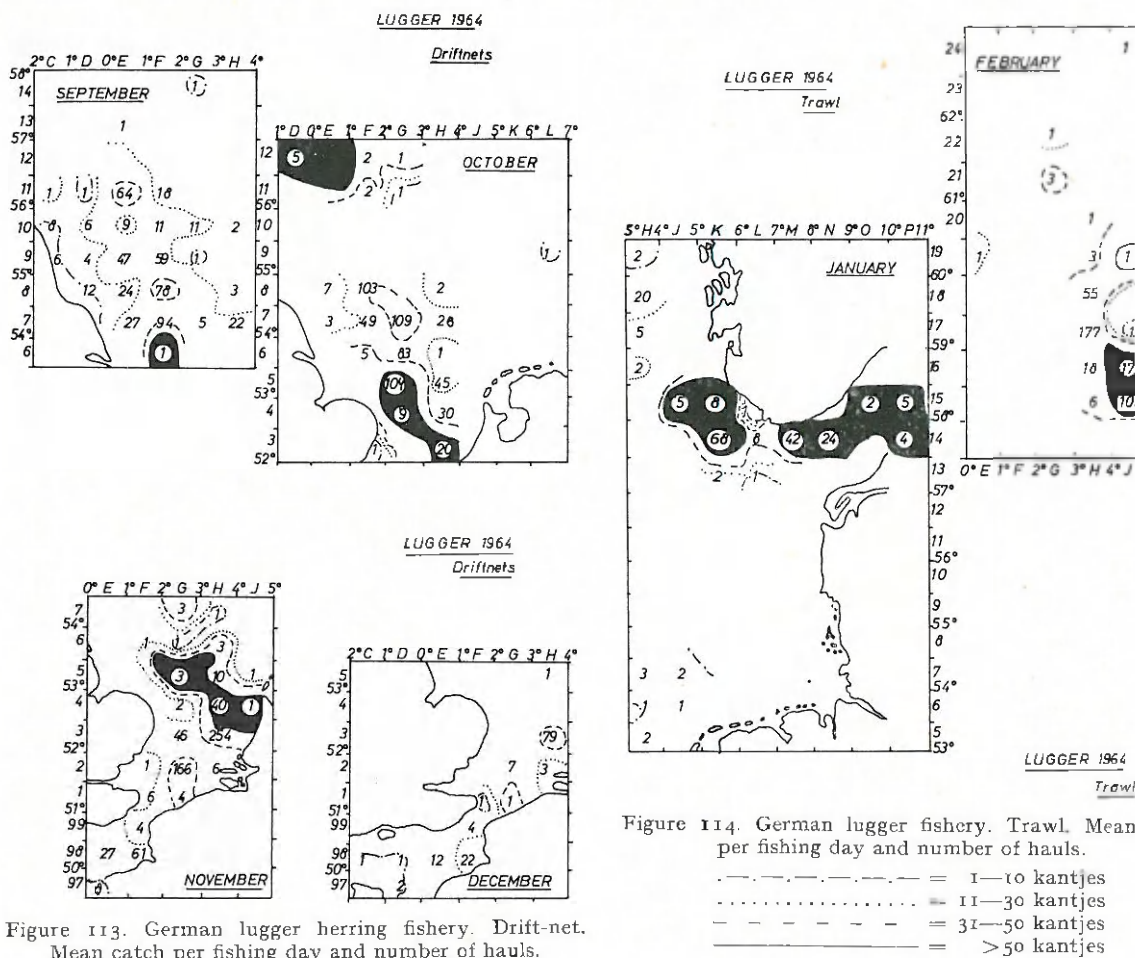


Figure 113. German lugger herring fishery. Drift-net.
Mean catch per fishing day and number of hauls.

Figure 114. German lugger fishery. Trawl. Mean per fishing day and number of hauls.

 = 1—10 kantjes
 = 11—30 kantjes
 = 31—50 kantjes
 = > 50 kantjes

Some fishing was carried out in the Gut area in mid-August, on the spawning places on the Aberdeen and Berwick Banks mainly. In mid-September fishing took place for some days on the Berwick Bank and once again in the third decade of October in the Gut proper. The total catch of 3,354 tons was taken in less than half of the fishing days in 1963, the average catch per day increased from 17.8 to 26.0 tons.

On the Dogger Bank grounds fishing was carried on from the third decade in August until the end of September, mainly on the spawning grounds off the English east coast (Whitby Ground, Flamborough Head, NE Bank). There was but a little fishing in the spawning area of the Dogger Bank from the second decade of September to the

beginning of October (SW Pit, S-Riff, E-Bruceys Garden). The total yield decreased 10,417 to 8,413 tons, the number of fishing from 526 to 389. The catch per day increased 19.8 to 22.3 tons.

The fishing off the west coast of Great Britain north of the Hebrides, took place in three periods: July, the beginning of August, late September, October and early November. The total catch yielded 3,786 tons against 3,143 tons by slashers for reduced effort. The catch per day's work increased from 15.2 tons to 17.9 tons.

In October and November some fishing place in the area North of Ireland with results as in 1963. The catch per day was 18.6

Luggers

The total catch and the number of fishing of the luggers decreased by about 13%. The drift fishing shifted to trawling (see Table 133).

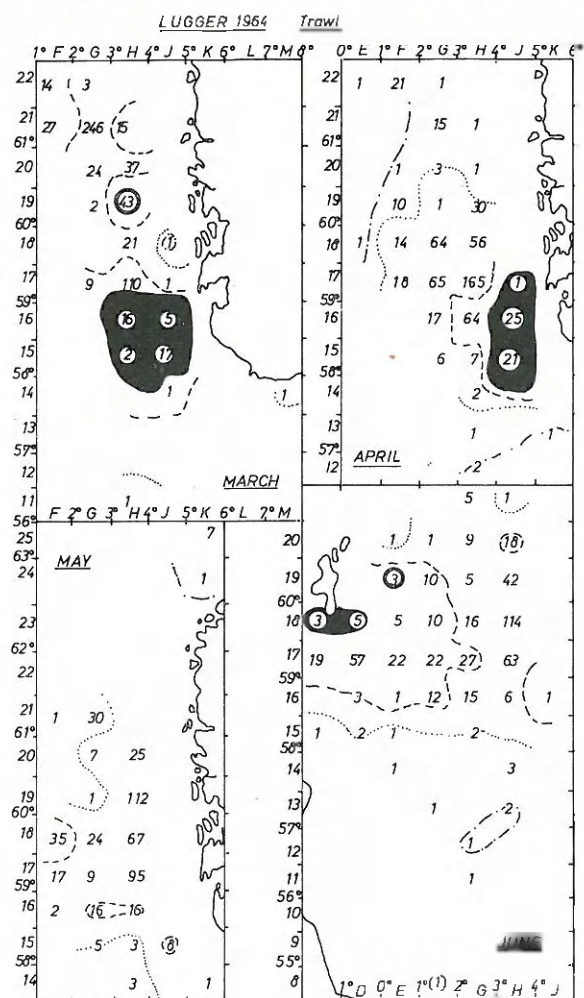


Figure 115. German lugger fishery. Trawl. Mean catch per fishing day and number of hauls.

per fishing day and number of hauls:

.....	= 1-10 kantjes
.....	= 11-30 kantjes
.....	= 31-50 kantjes
.....	= > 50 kantjes

drift-net, effort decreased from 6,758 to 4,017 fishing days, whereas for trawling an increase in effort was recorded (6,410 days compared with 5,184 days in 1963). The catch per day's fishing for drift-net dropped from 5.3 tons to 3.4 tons and increased for the trawl from 4.3 tons to 5.7 tons.

The main catch was taken in the North Sea (43,200 tons; 56,400 tons in 1963). 13,600 tons were caught by drift-net and 29,600 tons by trawl.

Figures 112-113 show the monthly distribution of the mean catch and the number of hauls for the drift-net fishery and Figures 114-119 show the mean catch and number of hauls for the trawl fishery of luggers in 1964.

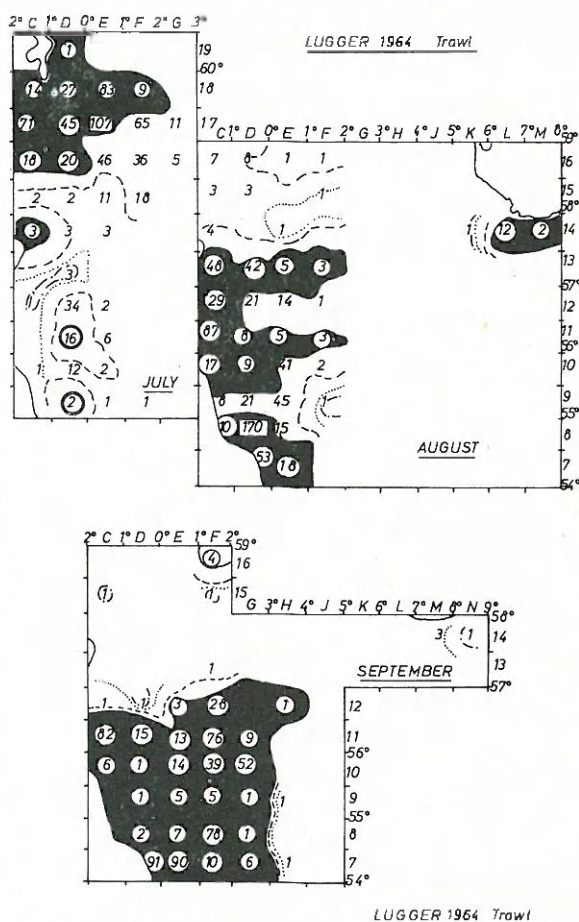


Figure 116. German lugger fishery. Trawl. Mean catch per fishing day and number of hauls.

.....	=	1—10 kantjes
.....	=	11—30 kantjes
.....	=	31—50 kantjes
.....	=	> 50 kantjes

The main catch from the North Sea was taken in late winter and spring on the "Ostkante" and in summer and autumn at the Gut and Dogger areas.

The fishing showed an improvement in the "Binnensee". The total catch increased from 1,774 tons to 4,409 tons, and the catch per day from 2.0 to 4.0 tons for the drift-net. In the English Channel area fishing was poor. In the Skagerak the fishery recovered in 1964 and 5,871 tons herring were caught by trawl in January and in October-December in 623 fishing days. The catch per day amounted to 9.4 tons.

Some fishing was done in different months in the areas of the Hebrides and north of Ireland.

Cutters

The total yield of deep sea cutters increased from

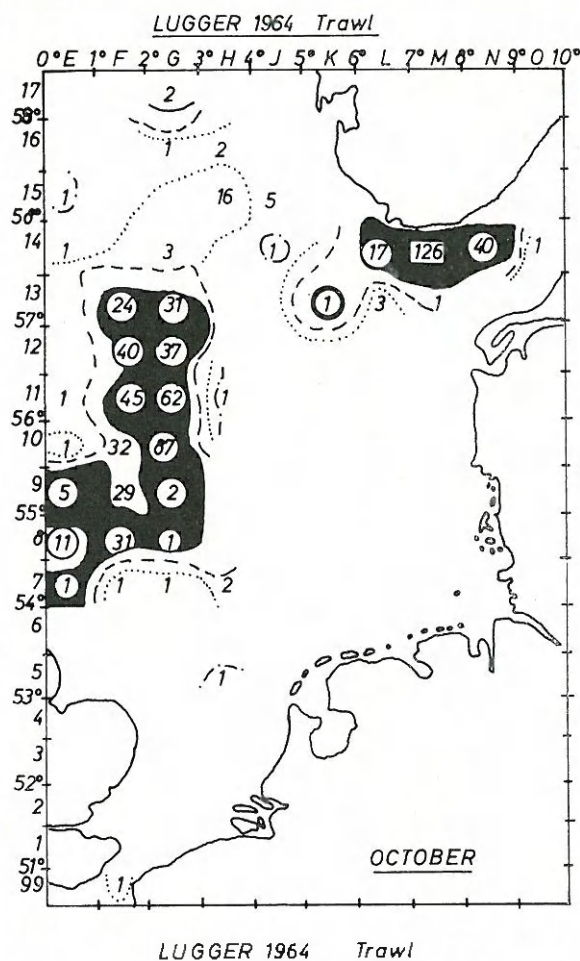


Figure 117. German lugger fishery. Trawl. Mean catch per fishing day and number of hauls.

..... = 1-10 kantjes
 - - - - - = 11-30 kantjes
 ————— = 31-50 kantjes
 ————— = >50 kantjes

35,100 tons to 47,100 tons. 63.5% came from the North Sea. The increase was due to high catches of industrial herring.

The total catch in the North Sea increased from 18,300 tons to 29,900 tons. 29,100 tons were herring for factories. The main catch originated from the "oil" herring fishery in July to October.

The landings from the Baltic for human consumption and industrial purposes were about the same as in 1963.

Biological Data

(The relevant detailed tables are found in "Statistical News Letters", No. 27, Tables 7-9, 17, 18 and 22-25).

The biological data are given in a monthly split by areas in Table 7 for total length, in Table 25 for maturity stages, Table 8 shows the age

composition, and Table 9 the mean length age. Mean L_1 , VS Rf are represented in a by year-classes and area (Tables 22, 17 and 2 respectively) and the mean number of VS and relation to stages of maturity (Tables 18 and 2

"Ostkante": (Viking Bank/Utsira)

From March to June and in August 2,461 herrings were collected in 6 samples from this area. The average length in March was 30.81 cm. In the months it varied between 27.78 cm and 29.1 cm. The average length was in all months larger in 1963.

In March spawning and newly spent herring formed the bulk of the catch. In April stage (660‰) and VII prevailed (170‰). In May June stages VIII, II and III predominate. August stages III to V and VII to VIII (Table 8).

Throughout the season the 1960 year class (4 year-olds) predominated in the catch. In April, the 1956 year-class (175‰), in May and August, the 1961 year-class (222‰, 122‰, 122‰) also contributed to some extent (Table 8).

The meristic characters show that the catch in March was composed to 90% of late winter spawners. In April to June and August a mixture of winter and autumn spawners was found. Pregnant in April and May were the autumn spawners, while in the other months the part of the winter spawners were larger.

Bressay shoal

In June and August 1,763 herrings from 8 samples were examined. The average length varied between 26.52 to 28.23 cm (Table 7). In June maturity stages VIII (540‰) and III (300‰) prevailed and in August stages VIII (374‰) and V (180‰) (Table 25). Predominant in both months were the 1960 year-class (4 year-olds) and the 1961 year-class (3 year-olds) (Table 8). According to the meristic characters, these were autumn spawners only among the immature fish late winter spawners were found.

Fladen Ground

From June to August 4,622 herrings from 17 samples were investigated. The average length fluctuated from 26.95 to 28.23 cm (Table 7). In July maturity stages III (560‰), IV (180‰), V (160‰) were predominant, while in August stages VII (333‰), V (198‰), VI (151‰), VIII (145‰) were seen (Table 25).

The 1961 and 1960 year-classes (3 and 4 year-olds) were the most abundant age-groups. In August the 1956 year-class (8 year-olds) was of some importance. (Table 8).

Gut area

In January, July and August 3,435 herrings from 14 samples were examined. The average length in January was 27.76 cm, in July and August 25.94 and 29.19 cm respectively (Table 7). Maturity stages V to VIII formed the bulk of the catches (Table 25), which consisted of the 1960 and 1961 year-classes mainly.

Dogger Bank area

From July to September 7,219 herrings from 20 samples were investigated. The average length fluctuated from 25.98 cm to 27.81 cm (Table 7). The maturity stages III (470⁰/₀₀) and IV (350⁰/₀₀) were predominant in July. In August stages VI (713⁰/₀₀) and V (100⁰/₀₀), and in September stages VI (317⁰/₀₀), V (203⁰/₀₀), IV (128⁰/₀₀) and VIII (103⁰/₀₀) were the most abundant ones (Table 25).

In July and September the 1961 year-class (3 year-olds) was the most abundant one (799⁰/₀₀ and 452⁰/₀₀ respectively), followed by the 1960 year-class (4 year-olds) (171⁰/₀₀ and 362⁰/₀₀ respectively). In addition the 1962 year-class (2 year-olds) had in September some importance (106⁰/₀₀). In August the 1960 year-class (610⁰/₀₀) and the 1961 (303⁰/₀₀) were predominant (Table 8).

All herring sampled on Fladen, Gut and Dogger areas were autumn spawners.

Egersund area

In January, February, August, October and December 10 samples with 3,401 herrings were examined. The average length varied between 26.86 cm to 29.75 cm (Table 7). The catches consisted of a mixture of spring and autumn spawners, accordingly the composition with regard to maturity stages was not homogenous (Table 25).

The 1960 year-class (4 year-olds) was prevailing (609⁰/₀₀) in January. In February the abundant age-groups were the year-classes 1956 (277⁰/₀₀), 1960 (200⁰/₀₀), 1959 (139⁰/₀₀), 1957 (123⁰/₀₀) and older than the 1955 year-class (185⁰/₀₀). In August the 1960 (531⁰/₀₀) and 1961 (305⁰/₀₀) year-classes dominated, in October the 1956 (232⁰/₀₀) and 1957 (119⁰/₀₀) year-classes also had some importance. December showed a predominance of the year-classes 1960 to 1963 (Table 8).

Skagerak

In January, February, November and December 7,638 herrings in 26 samples were investigated. The average length in January was 26.98 cm. In November/December adult and young herring populated the area. The average length fluctuated between 22.74 cm to 23.29 cm in the bottom trawl and between 28.07 cm to 29.19 cm in the pelagic trawl (Table 7). Additional samples for

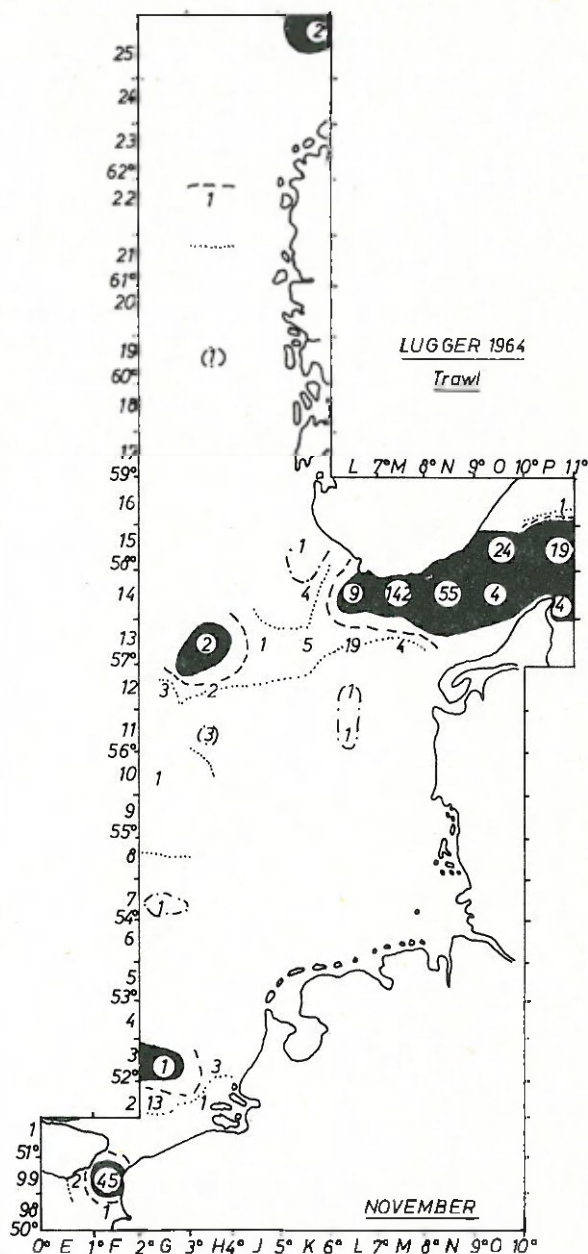


Figure 118. German lugger fishery. Trawl. Mean catch per fishing day and number of hauls.

..... = 1—10 kantjes
 = 11—30 kantjes
 - - - - - = 31—50 kantjes
 ————— = >50 kantjes

length measurements only were taken in July and August during the fishery for immature herring. In January, November and December maturity stages VIII and I were predominant, while in February stages II and IV also had some importance (Table 25).

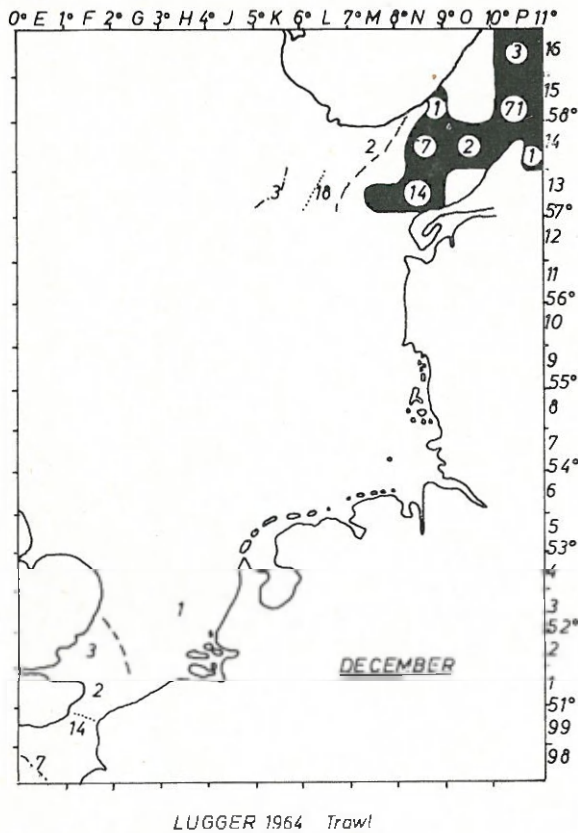


Figure 119. German lugger fishery. Trawl. Mean catch per fishing day and number of bauls.

..... = 1—10 kantjes
 = 11—30 kantjes
 - · - · - = 31—50 kantjes
 ————— = > 50 kantjes

As in other areas the 1960 and 1961 year-classes were the most abundant age-groups in January and February. In November and December the year-classes 1960, 1961, 1962 and 1963 prevailed (Table 8). In all months the catches were a mixture of late winter and autumn spawners. The stages I and VIII in November and December were pure autumn spawners.

Jutland Bank

From this area 4 samples with 1,567 herrings were examined in August and December. The average length was 18.36 cm and 21.35 cm respectively (Table 7). Young herring in maturity stage I predominated in both months. In December some adult fishes in stage VII were also present (Table 25). The age composition showed the prevailing of the 1962 year-class. In December the 1961 year-class had also some importance (Table 8). The catches consisted of autumn spawners.

Ling Bank

In August 1 sample with 229 herrings was in this area. The average length was 28.2 (Table 7). Stages IV and V were dominant (Table 25). The catch consisted of autumn spawners mainly, of the 1960 and 1961 classes.

East of Dogger

In August 2 samples with 346 herrings examined. The average length was 18.5 (Table 7). These herring were almost all immature autumn spawners of the 1962 year-

German Bight

439 herrings in one sample in August came from this area. The average length was 16.59 cm (Table 7). The catch consisted of immature autumn spawners.

Hebrides

The 3 samples taken in October consisted of 1,049 herrings with an average length of 29. (Table 7). The maturity stages VII and VIII were prevailing (Table 8). The catches constituted by the 1956 and 1960 year-classes (Table 8) and were a mixture of autumn and late winter spawners.

Donegal area

From this area 3 samples with 1,276 herrings from a research vessel were examined in August. The average length was 28.41 cm (Table 7). The most abundant maturity stages were V and VI (Table 25). The 1961, 1960 and 1957 year-classes were predominant (Table 8). The catch consisted of a mixture of autumn and late winter spawners.

Remarks

The bulk of the catches of adult autumn spawners in the North Sea consisted of the strong 1961 year-classes.

Young herring of the 1962 year-class were found in August in small numbers on the Fladen Ground and Gut areas, and in larger numbers on the Jutland Bank, East of Dogger, and German Bight. In September they were found in great quantities in the samples on the Dogger and in November and December in the Egersund, Skagerak, and Jutland Bank areas.

The 1963 year-class was found in moderate strength in August in the German Bight and in December in the Egersund and Jutland Bank areas. More abundant was this year-class in November/December in the Skagerak. Both year-classes seem to be poor. In 1965 the bulk of the catches of adult herring in the North Sea therefore consisted of 4 and 5 year-old herring with 3 year-olds.

K. SCHULZ

The German Oil Herring Fishery in 1964

(Table 134)

In 1964, the catches of the German oil herring fishery amounted to 27,889 tons = 3,736,000 German Marks and were thus 2.3 times higher as in 1963, when the lowest catch since 1952 was obtained. Fishing grounds were as usual: Weisse Bank, Lower Scruff, Upper Scruff, the Dogger Bank and Mittel Riff.

The length composition of 10 herring samples taken in July (2.), August (6.), September (1.) and October (1 sample) was as shown in Table 134.

Table 134. Length distribution (‰) of herring

cm	14.5	15.0	15.5	16.0	16.5	17.0	17.5
‰	2	10	37	73	104	120	118
cm	18.0	18.5	19.0	19.5	20.0	20.5	21.0
‰	111	95	74	53	33	19	9
cm	21.5	22.0	22.5	23.0	23.5	24.0	24.5
‰	4	3	2	3	3	3	5
cm	25.0	25.5	26.0	26.5	27.0	27.5	28.0
‰	8	10	12	15	16	15	11
cm	28.5	29.0	29.5	30.0	30.5	31.0	31.5
‰	10	9	6	4	2	1	0

n = 1,806.

For the catch composition compare "By-catch in the German oil-herring fishery in 1964".

P. F. MEYER-WAARDEN

By-Catch in the German Oil Herring Fishery in 1964

(Tables 135-136)

Twelve random samples of German oil herring catch comprising 5,931 fish (= 354 kg) were analysed at the Cuxhaven Laboratory of the Institut für Küsten- und Binnenfischerei as to their species and length composition. They were composed on average of 56.7% herring, 26.0% sprat, 7.7% whiting, 5.4% haddock, 1.5% dab, 1.2% mackerel, 0.7% gurnard, 0.7% bastard mackerel and 0.1% cod. 1.4% of the catches consisted of undersized protected fish: 0.9% whiting, 0.4% dab and 0.1% cod.

The length composition of whiting and haddock is given in table 135 and 136.

Table 135. Length distribution (‰) of whiting

cm	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0
‰	1	2	1	1	—	—	—	2
cm	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0
‰	3	2	1	2	2	—	—	—
cm	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0
‰	1	3	3	5	7	7	8	6
cm	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0
‰	6	10	16	21	34	52	58	64
cm	24.5	25.0	25.5	26.0	26.5	27.0	27.5	28.0
‰	79	98	99	87	76	65	54	40
cm	28.5	29.0	29.5	30.0	30.5	31.0	31.5	32.0
‰	22	11	11	11	7	5	4	3
cm	32.5	33.0	33.5	34.0	34.5	—	—	—
‰	3	3	1	1	2	—	—	—

n = 879.

Table 136. Length distribution (‰) of haddock

cm	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0
‰	1	3	7	15	22	24	28	36
cm	23.5	24.0	24.5	25.0	25.5	26.0	26.5	27.0
‰	50	66	68	64	69	67	49	27
cm	27.5	28.0	28.5	29.0	29.5	30.0	30.5	31.0
‰	29	41	37	28	23	18	19	22
cm	31.5	32.0	32.5	33.0	33.5	34.0	34.5	35.0
‰	23	23	25	32	25	13	9	7
cm	35.5	36.0	36.5	37.0	37.5	38.0	—	—
‰	4	5	10	8	3	0	—	—

n = 185.

P. F. MEYER-WAARDEN

The Norwegian Herring Fisheries in the North Sea and Skagerak in 1964

(Tables 137-141)

The Fisheries

The total landings of herring from the North Sea and Skagerak amounted to 2,030,720 hl in 1964. This is more than five times the yield in 1963. This great increase of the catch is largely due to the purse-seiners, participating in the fishery in this area for the first time. The total catch and number of vessels over the years 1960/64 are given in Table 137.

The landings from different areas are shown in Table 138. Fishing in Skagerak was carried out in January and from October to December. In May and June the fishery was centred from Patch Bank to Viking Bank, and from July to October in the Egersund Bank area. From February to May there was a reduced yield from the North Sea and Skagerak, a result of diminished effort due to the Norwegian winter herring fishery.

Table 137. Total catch (hl) and number of vessels over the years 1960/1964 in the North Sea and Skagerak

Year	hl		Number of vessels	
	Trawl	Purse-seine	Trawlers ¹⁾	Purse-seiners
1960	177,108	—	224	—
1961	152,312	—	219	—
1962	133,705	—	221	—
1963	344,600	3,389	437	16 from Dec.
1964	434,382	1,596,338	519	195

¹⁾ Including a few drifters.

Table 138. The landings of herring from the North Sea and Skagerak in 1964

Area	hl	%
Skagerak	923,834	45.5
Egersund Bank, West Bank, Coral Bank	830,322	40.9
Patch Bank, Viking Bank	170,279	8.5
Fladen Ground, Bressay Ground, Northwest coast of Denmark ...	103,285	5.1
Total	2,030,720	100.0

Table 139. Length composition of herring from northeastern North Sea and Skagerak, 1964 (^{6/00})

Gear Area	Purse-seine Skagerak	Trawl purse-seine Patch Bank		Purse-seine Egersund Bank			Purse Skag	
Month	Jan.	Feb.	June	July	Aug.	Oct.	Nov.	D
Length cm.								
18.0	—	—	—	—	—	7	—	
.5	—	—	—	—	8	33	—	
19.0	—	—	—	—	3	80	—	
.5	5	—	—	—	8	120	—	
20.0	5	—	—	—	19	133	—	
.5	20	15	—	—	25	120	—	
21.0	20	30	—	—	86	147	10	
.5	30	20	—	—	72	100	10	
22.0	15	15	—	—	61	100	20	
.5	35	25	—	—	17	73	10	
23.0	50	35	20	4	31	53	10	
.5	45	35	30	12	22	20	—	
24.0	45	30	50	36	14	—	10	
.5	60	30	20	44	14	—	20	
25.0	70	65	60	56	17	—	80	
.5	65	45	20	72	6	—	40	
26.0	110	90	70	88	6	—	100	
.5	85	60	130	116	20	—	120	
27.0	90	60	90	84	39	13	90	
.5	60	95	170	92	39	—	60	
28.0	25	50	110	100	47	—	111	
.5	50	55	130	96	45	—	80	
29.0	20	60	30	52	36	—	70	
.5	30	90	50	48	56	—	50	
30.0	30	40	—	48	78	—	40	
.5	20	15	—	12	78	—	30	
31.0	10	30	10	16	45	—	30	
.5	5	10	10	4	56	—	10	
32.0	—	—	—	20	31	—	—	
.5	—	—	—	—	6	—	—	
33.0	—	—	—	—	12	—	—	
.5	—	—	—	—	—	—	—	
34.0	—	—	—	—	—	—	—	
.5	—	—	—	—	3	—	—	
Total	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of fish	200	200	100	250	358	150	100	200
True mean	25.97	26.79	27.24	27.49	26.74	21.09	27.43	28.00

Biological data

During the year, 12 samples, totalling 1,458 herring were examined. The length compositions (measured to $\frac{1}{2}$ cm below) of the samples are shown in Table 139. The age compositions of the spring- and autumn-spawners (separated on otolith characters) are given in Table 140. The 1960 year-class was dominant among the autumn spawners during most of the year. In August and October 1-ringed fish of the 1962 year-class were prominent in the Egersund Bank area. The spring spawners made up 22% of the samples in February and 37% in August. The rest of the year, spring spawners formed a small proportion of the samples.

Maturity and racial characters are given in

Table 141. These data indicate that the main of the herring consisted of autumn spawner admixture of spring spawners being great February and August. It should be noted that autumn spawners in the Egersund Bank area July, August and October had a low number of vertebrae, 56.30 ($n = 171$), 56.38 (178) and 56.39 ($n = 145$) in these three months respectively. The average number of vertebrae in autumn spawners in the other samples was ($n = 419$). This might indicate that the autumn spawners visit the Egersund Bank during late summer and autumn (October immature herring).

S. HARALDSEN

Table 140. Age composition of autumn and spring spawners, northeastern North Sea and Skagerak, 1964

Area Year- class	Winter rings	Patch Bank		Egersund Bank area				Skagerak	Total sample
		Feb.	June	July	Aug.	Oct.	Nov.	Dec.	
1962	1	—	—	—	412	986	154	93	270
1961	2	340	313	453	136	—	393	224	255
1960	3	507	638	491	333	14	417	611	400
1959	4	26	25	19	28	—	—	12	17
1958	5	7	—	25	11	—	—	12	9
1957	6	13	12	—	34	—	12	24	14
1956	7	107	12	12	40	—	24	24	34
1955 and older	7+	—	—	—	6	—	—	—	1
Total		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Number of fish		150	80	161	177	147	84	85	884

Otoliths not fit for age determination = 55.

Area Year- class	Winter rings	Patch Bank		Egersund Bank area				Skagerak	Total sample	
		Feb.	June	July	Aug.	Oct.	Nov.	Dec.	No.	%
1963	1	—	—	—	—	1	—	—	1	6
1962	2	3	—	—	3	—	1	—	7	45
1961	3	32	1	5	66	—	7	4	115	73.2
1960	4	7	—	—	8	—	1	—	16	102
1959	5	1	3	2	7	—	—	1	14	90
1958	6	—	—	—	4	—	—	—	4	25
1957 and older	6+	—	—	—	—	—	—	—	—	—
Number of fish		43	4	7	88	1	9	5	157	

Otoliths not fit for age determination = 16.

Table 141. Maturity and racial characters, northeastern North Sea and Skagerak, 1964

Area	Month	A. Percentage Maturity (All age-groups)								No.
		I	II	III	IV	V	VI	VII	VIII	
Skagerak	Jan.	30.8	10.6	2.5	5.6	—	—	3.5	47.0	198
Patch Bank	Feb.	15.0	17.5	3.5	8.5	12.0	—	—	43.5	200
	June	3.1	4.1	66.0	20.6	3.1	—	—	31.0	97
Egersund Bank	July	—	4.1	38.8	32.7	23.0	—	—	1.5	196
	Aug.	22.9	4.7	29.6	24.6	9.4	—	—	8.8	297
	Oct.	94.0	4.6	—	0.7	0.7	—	—	—	149
	Nov.	4.0	11.0	3.0	7.0	—	—	—	75.0	100
Skagerak	Dec.	2.0	13.0	3.0	3.0	2.0	—	—	77.0	100
Area	Month	B. V. S. (Actual numbers — All age-groups)								No.
		53	54	55	56	57	58	59	Mean	
Skagerak	Jan.	—	3	4	95	88	8	1	56.49	199
Patch Bank	Feb.	—	—	10	82	95	11	—	56.54	198
	June	—	—	2	45	49	1	—	56.51	97
Egersund Bank	July	—	—	17	100	68	8	—	56.36	193
	Aug.	1	1	6	132	115	35	—	56.60	290
	Oct.	—	1	5	77	62	1	1	56.41	147
	Nov.	—	—	5	40	47	6	1	56.58	99
Skagerak	Dec.	—	—	2	45	40	6	1	56.56	94

The Swedish Herring Fisheries in the North Sea, Skagerak and Kattegat in 1964

(Figures 120-122)

The landings of herring for human consumption were 143,000 tons according to preliminary figures, which means a decrease of about 9% since 1963. The catches of industrial herring, on the other hand, increased by over 100%, so the total landings came up to approximately 240,000 tons, i.e. a total increase of nearly 19%.

Swedish statistics do not permit computation on catch per effort and are not even detailed enough to give exact information about the quantitative distribution of the catches on the various fishing grounds. Instead of improving, conditions for the collecting of catch statistics have grown worse in recent years, since still more catches — in 1964 over 80% — have been landed in foreign harbours, above all in the Danish ones. Due to this fact, the collecting of samples for scientific purpose has been hampered too; although attempts have been made to procure samples from areas where fishing was most concentrated at different seasons, the analyses cannot possibly give any complete picture of the herring stocks, as their composition as to age and race vary considerably from shoal to shoal within the same time interval on one and the same fishing ground.

During the first six weeks of 1964, the fishery was carried out with pelagic trawls in the same two areas as immediately before the end of the previous year, namely the inner and the outer Skagerak and adjacent parts of the North Sea. In the first area, NE, N and NW of the Skaw, catches were very uneven in quality, with almost pure North Sea bank herring or Kattegat autumn spawners or with both tribes mixed, mostly however, with a few percent of maturing Skagerak spring spawners. (Samples 1-5 Figure 120, see also Table 27 in Statistical News Letters No 27 p. 70). Young bank herring, one year old, frequently predominated. In the western area the most uniform catches were taken and the larger boats were fishing here, SE, S and SW of Ryvingen.

In the last two weeks of February the adult herring disappeared from the Skagerak and the herring fleet spread westward first, then northwestward over Egersund Bank and E of Patch up to Old Viking Bank, Samples 1 and 2 in Figure 121 (see also Table 26 in Statistical News Letters No. 27) show how catch composition differs on one single ground.

During early spring the majority of the boats kept to the pelagic pair trawl, but some boats changed to

Inner Skagerak & Northern Kattegat

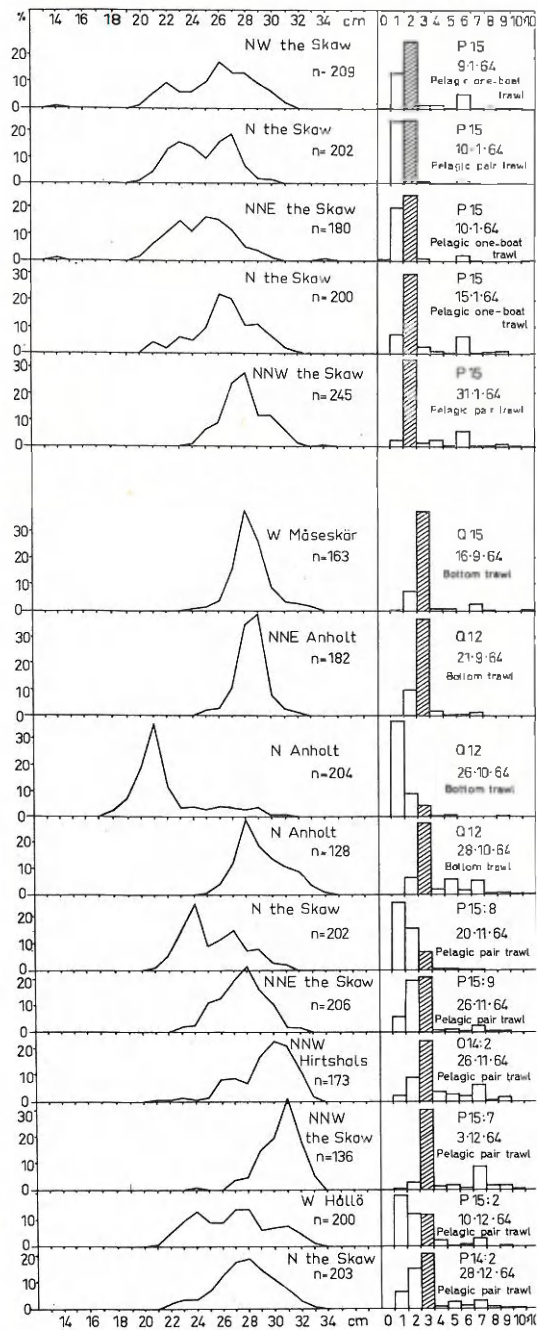


Figure 120.

the bottom-trawl and, in March, on the Old Viking Bank, a few of them came across spawning her of a remarkably big size. (Samples 3 and 4, Figure 121, see also Table 26 in Statistical News Letters No. 27).

In April and May several boats changed to bottom trawling and, especially on the Egersund Bank but also on Patch, Klondyke, West Bank and Coral Bank, the catches were often made up of small-sized herring mixed with mackerel, which at times played the principal role. Large quantities of haddock, just above 27 cm in length, were frequently caught as by-catch.

The summer fishing with bottom trawls in the northwestern part of the North Sea, from Bressay Ground in the north to the Gut in the south, started modestly in June, but became more productive from July onwards. At first the 1960 year-class of the North Sea Bank herring clearly predominated (Samples 5—7, Figure 121, see also Table 26 in Statistical News Letters No. 27); some samples taken from the Gut in September indicated that the new recruit class of 1961 had not become a complete failure (Samples 11 and 12, Figure 121 and Table 26 in Statistical News Letters No. 27).

Quite a remarkable catch was taken in early August on the Gut area (Sample 8, Figure 121 and Table 26 in Statistical News Letters No. 27) in which the bank herring (two- and three-ringers) constituted only 22% and the majority of the rest consisted of spring spawners of the same age- and size composition as the Viking Bank herring in the March samples (3 and 4, Figure 121 and Table 26 in Statistical News Letters No. 27) and it possibly belonged to this tribe too.

In the second half of August part of the Swedish herring fleet concentrated in the border area between the North Sea and Skagerak, mainly fishing with pelagic trawl at the same time as the bottom-trawl fishery was carried on in the central North Sea, inter alia the Gut area and around Middle and Outer Rough.

In and outside the mouth of Skagerak, fishing was continued until late October, when the herring in dense concentrations moved further eastward to inner Skagerak (in the middle of November), where they stayed for the rest of the year. With the statistical square P 15 as the centre, enormous herring concentrations attracted thousands of fisherboats from ten different countries. Never before had Skagerak been so crowded with vessels. Contrary to 1963 no fishing occurred in outer Skagerak at the same time.

The large number of dense shoals consisted of spents and recovering spents of the North Sea Bank herring in very good condition and of a high fat content. The 1960 year-class predominated as four year-olds, but three, two and even one year-olds were also present. Eight year-olds of

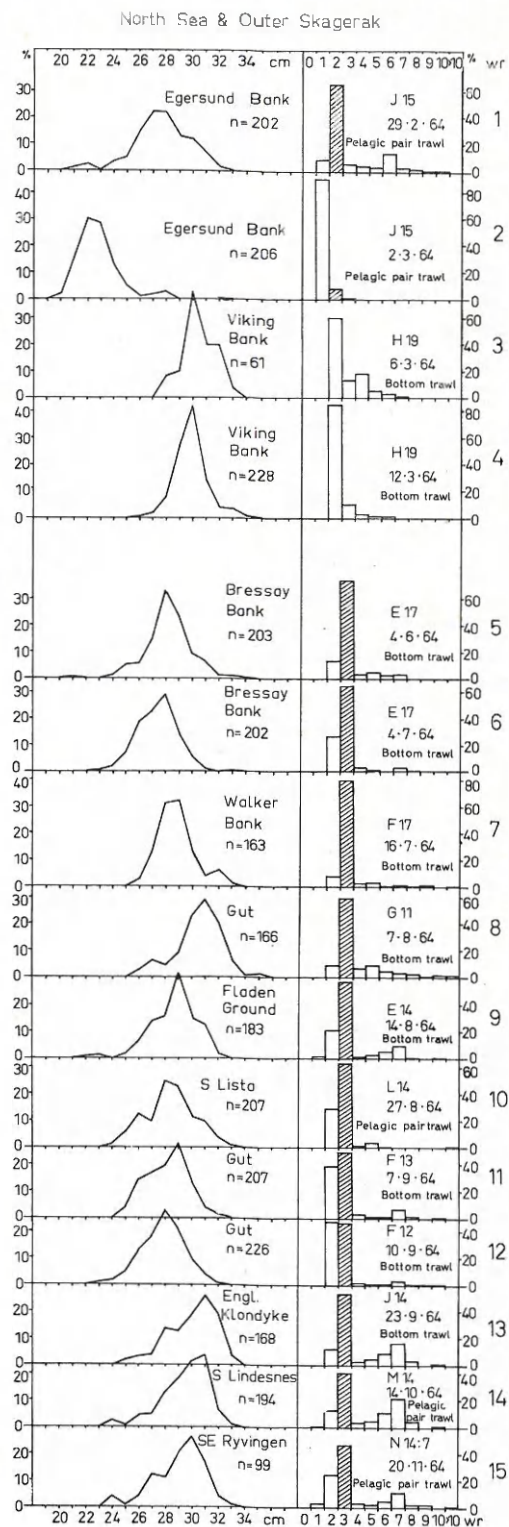
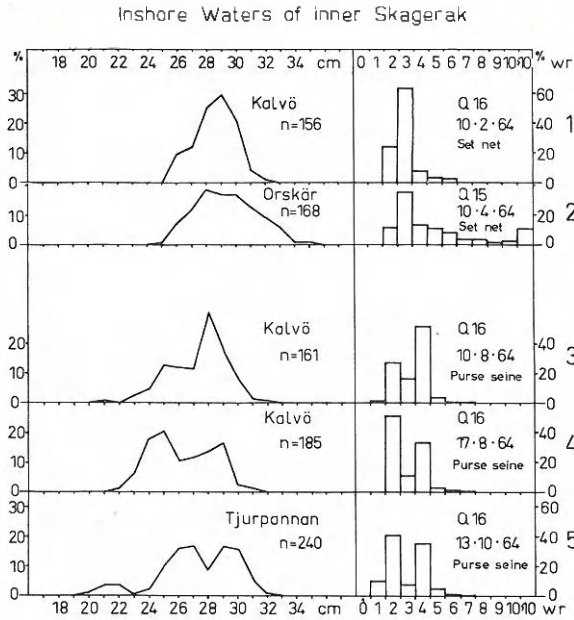


Figure 121.



the 1956 year-class were included by up to 17%. (Figure 120, Samples 10—15 and Table 26 in Statistical News Letters No. 27).

Also the Kattegat autumn spawners were relatively abundant, with the 1960 year-class strongly predominating. They were fished with pelagic and bottom trawls on the spawning grounds in the Kattegat, from Anholt northwards during September and in the first half of October (Samples 7 and 9, Figure 120 and Table 26 in Statistical News Letters No. 27), but specimens of this tribe were caught already in August in the Skagerak on their migration from the North Sea to Kattegat (Sample 6, Figure 120 and Table 27 in Statistical

News Letters No. 27).

Spring spawners in Stages III—V frequently occurred mixed with the spent herring in the Skagerak and eastern North Sea during autumn as well as in the inner Skagerak in November and December (Samples 13—15, Figure 121 and Table 26 in Statistical News Letters No. 27, and Samples 12—15, Figure 120 Table 27 in Statistical News Letters No. 27). Judging from the V.S., the length-for-age the age distribution and the scale type presumably belonged to the Viking Bank s

The fishery for Skagerak spring spawners carried on within the archipelago along the north coast of Bohuslän with set nets, shore seines, small purse-seines quite independent of the sea fishery. (Figure 122 and Table 28 in Statistical News Letters No. 27). The yield of the in fishery amounted to a few hundreds tons only

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Polish Investigations on Baltic Herring in

(Tables 142—143)

The length and age composition of the spawning sea herring taken from commercial catches during the summer-autumn feeding season are presented in Tables 142 and 143. The numerous year-classes in both areas were the 1959 and 1957. In the Gulf of Gdańsk the year-class was good too. The quality of the herring was excellent. The length/weight coefficient (Stages II—VIII—III) in the spring spawning herring increased in the Gulf of Gdańsk from 0.589 in 1963 to 0.705 in 1964 and in the Bornholm Basin from 0.581 in 1963 to 0.695 in 1964.

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Table 142. Length distribution in ‰

cm	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	23	23.5
Gulf of Gdańsk	13	16	30	67	61	85	95	98	103	105	77	66	51	34	17
Bornholm Basin ..	1	1	7	16	23	74	98	145	128	167	64	79	39	25	25
cm	24.5	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30	30.5	31	31.5
Gulf of Gdańsk	13	13	7	9	5	5	3	2	1	2	1	1	—	—	1
Bornholm Basin ..	20	22	10	14	4	3	1	1	1	—	1	—	—	—	—

Table 143. Age distribution in ‰

Age	2	3	4	5	6	7	8	9	10	11	12+
Year-class	1963	1962	1961	1960	1959	1958	1957	1956	1955	1954	1953
Gulf of Gdańsk	105	99	96	39	256	104	107	69	55	37	33
Bornholm Basin ..	11	23	51	35	556	86	118	32	54	22	12

Herring Investigations in the Northeastern Baltic in 1961-1964

(Figures 123-125; Tables 144-145)

The average number of larvae caught with a Hensen net at regular intervals at 9 stations on the spring spawning grounds and at 5 stations on the autumn spawning grounds in the northeastern part of the Gulf of Riga are given in Table 144.

Table 144. Average numbers of herring larvae per 10 min. haul with the Hensen net in the northeastern part of the Gulf of Riga

Year	1961	1962	1963	1964
Spring herring . . .	8.3	58.1	37.7	114.7
Autumn herring . .	9.9	30.8	3.0	3.2

The investigations on larval abundance of the spring herring carried out since 1947 show that there is a connection between the average number of larvae and the strength of the year-class in commercial catches (the correlation coefficient is $+0.62$). However, there seems to be a much more

general and closer connection between the surface water temperature in the central part of the Gulf of Riga in April and the strength of the spring herring year-class (the correlation coefficient is $+0.80$). The quantity of autumn herring larvae gives no indication as to the strength of the year-class in commercial catches. The abundance of a year-class of this race depends principally on the severity of the winter following the hatching.

Routine samples were taken from commercial trawl catches as well as from coastal catches during both the spring and the autumn spawning period. The fact that individual herring from various parts of the Baltic can be differentiated by means of their otoliths gave us an opportunity to determine age, race and probable origin of each herring by otoliths. By this method it was revealed that on the spring spawning grounds of the Gulf of Riga and the Gulf of Finland the gulf herring dominates, whereas off the islands. Saaremaa and Hiiumaa the sea herring predominates (Figure 123). The relation between the sea and the gulf herring on the spring

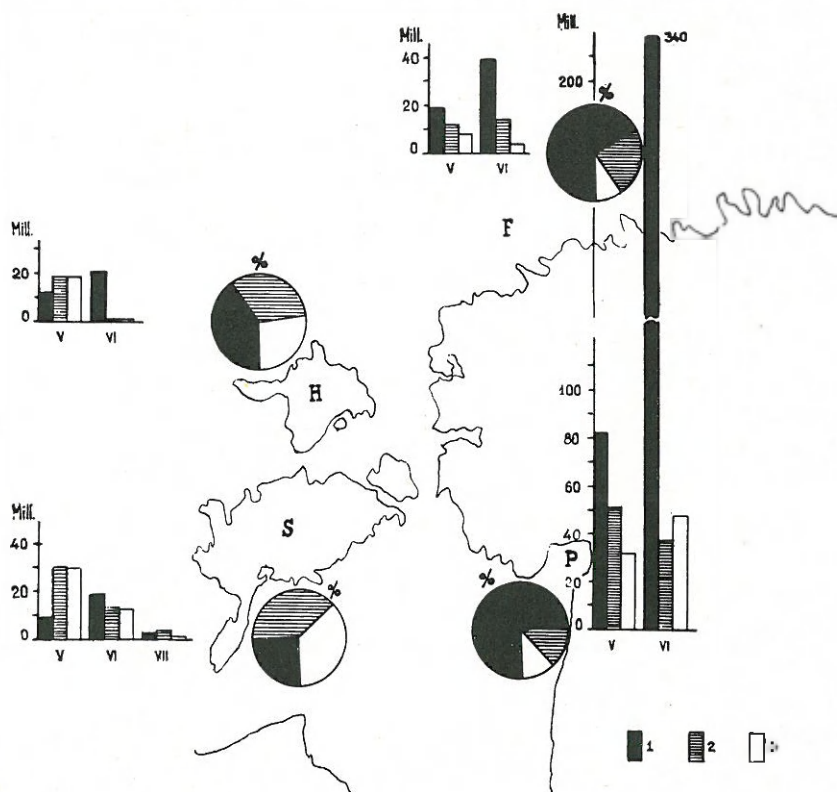


Figure 123. Distribution of various otolith types on the spring spawning grounds in the Estonian waters in 1964. 1 = Gulf herring; 2 = "northern" sea type; 3 = "southern" sea type; Mill. = Number of fish (mill.); F = Gulf of Finland; P = Pärnu Bay; S = Isle of Saaremaa; H = Isle of Hiiumaa.

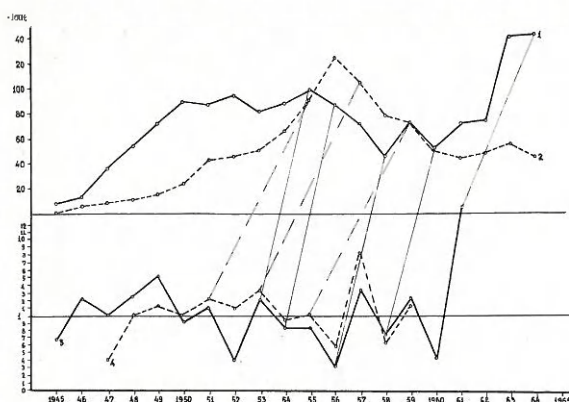


Figure 124. Abundance of the Gulf and open sea herring in "relative units" in Saaremaa and Pärnu catches. 1 = Pärnu catches; 2 = Saaremaa catches; 3 = Relative abundance of the Gulf herring year-classes; 4 = Relative abundance of the sea herring year-classes

spawning grounds off the island Saaremaa was 75 : 25 in 1964, whereas in the Pärnu Bay the corresponding values were 26 : 74. However, in the eastern part of the middle Baltic the Pärnu Bay region is the central spring spawning area not only for the Gulf of Riga herring but for the sea herring as well, because the number of sea herring spawning in this region is considerably greater than the number spawning off the islands.

The sea autumn herring and the older Gulf of Riga autumn herring spawn mainly in the deeper spawning grounds in the central part of the Gulf of Riga (and part of them on the banks in the open sea), whereas the principal spawning grounds of the Gulf of Riga autumn herring are situated in more shallow water nearer to the shore.

Determination of the relative strength of year-classes of the Gulf of Riga and the sea spring and autumn herring, as well as observations on catch fluctuations on various spawning grounds, showed that while the strength of the year-classes of the Gulf of Riga herring and the sea herring of the same year-class fluctuates in the same direction, the fluctuations almost never have the same amplitude. Generally, the fluctuations of year-classes of the sea herring are more similar to the southern herring groups than to those of the Gulf of Riga herring.

From Figure 124 it can be seen that the relative abundance of the Gulf of Riga spring herring obviously differed from that of the sea spring herring in 1952 and 1961. On the sea spring herring

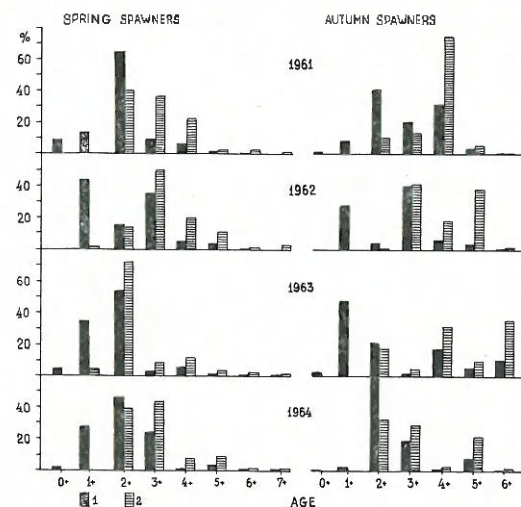


Figure 125. Age composition of the spring and autumn herring in coastal (pound net and net catches) and catches in the Gulf of Riga.

1 = trawl catches; 2 = pound net and net catches

spawning grounds the maximum catches were in 1955–1957. During this period the good condition of the sea spring herring stock was mainly responsible for the high level of the total herring yields in the Estonian S.S.R. During the 1958–1962 the spring herring landings were considerably lower level because from 1954 to only two numerous year-classes (in 1957 and 1958) developed in both spring herring stocks. The abundance of the 1954 and 1955 year-classes was moderate or somewhat below, and the 1956, 1957, and 1960 year-classes were poor (Figures 12 and 125). In 1961 a very numerous year-class hatched in the Gulf of Riga. Owing to this year-class the pound net catches of the Pärnu region in 1963–1964 were higher than ever. In other areas of the middle Baltic this year-class was less abundant. In view of this the increase of the Pärnu catches considerably raised the total yield of herring in the Estonian S.S.R. (Table 145).

In the autumn spawning race the relative strength of the Gulf of Riga and the sea herring differed markedly in the 1954 and 1955 year-classes. In the sea herring the 1954 year-class was particularly strong.

Table 145. Herring catches in the Estonian S.S.R. 1961–1964

	Coastal catches (1,000 t)	Trawl catches (1,000 t)	Spring herring (1,000 t)
1961	14.3	1.4	4.8
1962	15.8	1.6	3.4
1963	24.8	1.3	4.2
1964	24.2	1.6	6.2

relatively the strongest. Good catches of the sea herring on the spawning grounds in the central part of the Gulf of Riga was responsible for the maximum yield of the autumn herring in 1957–1958. After 1959 the catches of the sea herring as well as the total yield decreased considerably. The catches of the Gulf of Riga autumn herring were much more stable and were during a rather long period (1959–1963) maintained by the rich 1956 year-class (Figure 125).

In the Gulf of Finland, too, this year-class was relatively abundant. The 1957 and 1959 broods were poor, while the 1958 and 1960 ones were moderate. The abundance of the 1961 year-class is somewhat above moderate. Since 1956 there has been no prominent autumn herring year-classes in the northeastern Baltic. Therefore, the importance of this race has decreased in this area. In 1964 the percentage of the autumn herring on the feeding grounds in various parts of the north-eastern and middle Baltic was as follows:—

in the Gulf of Finland	2—3%
in the open Baltic	10—15%
in the Irben Sound	40—50%
in the northern part of the Gulf of Riga	20—25%
in the southern and eastern parts of the Gulf of Riga	10—15%

As can be seen from the age composition of the trawl catches (Figure 125) in the northeastern Baltic, the recruitment of both herring races will be considerably lower in 1965 than in 1963 and 1964.

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The Herring Fisheries in the Netherlands in 1964

(Tables 146–151)

The fisheries

Herring trawl

The catch-effort statistics of the herring trawl fisheries are presented in Table 146, separated by months and by areas. The areas used are defined in *Annales Biologiques*, 16.

The total landings of herring from these trawl fisheries were somewhat higher than in 1963 and rose from 71,281 tons to 75,137 tons. The catch per unit of effort remained constant, at a level of 22.4 tons per 100 hours fishing. The effort increased slightly, by about 6%.

In the NE North Sea the spring fishery was more profitable than in 1963, but the autumn season gave poorer results. In areas NW and Central the fishery gave about the same yields as in 1963, but in area South the fishery improved: the total catch in this area was twice as large as in 1963, but the catch-per-effort increased only slightly. The fishery to the SE of Ireland gave poorer results than in 1963.

Pair trawl

Pair trawl fisheries were carried out in areas Central and South. Only the total landings of this type of fishery are available and are shown in Table 147. The total quantity of herring landed by the fisheries increased again from 20,730 tons in 1963 to 21,497 tons in 1964. The fishery in the central North Sea gave poorer results than in the preceding year (1963: 6,626 tons, 1964: 4,380 tons), but that in area South gave a better yield (1963: 14,104 tons, 1964: 17,117 tons).

Table 146. Catch and effort data of the herring trawl fisheries in 1964

Top figures: Total catch in tons.

Middle figures: Effort in $\frac{\text{fishing hours}}{100}$ of a motor trawler of 500 B.H.P.

Bottom figures: Catch per 100 hours fishing in tons.

Area	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
NE	156.4 53.5 2.9	1,122.2 96.3 11.7	3,361.5 232.8 14.4	1,749.6 291.0 6.0	597.4 106.2 5.6	189.7 25.0 7.6	104.3 21.0 5.0	18.0 16.9 1.1	595.7 40.1 14.9	107.7 54.6 2.0	217.1 48.9 4.4	3.4 8.7 0.4	8,223.0 995.0 8.3
NW	—	—	225.6 20.4 11.1	102.6 18.3 5.6	482.9 91.0 5.3	2,832.5 196.0 14.5	6,539.3 237.4 27.6	2,845.3 92.7 30.7	373.5 8.7 42.8	517.9 26.4 19.6	252.1 9.6 26.3	—	14,171.7 700.5 20.2
Central	—	—	2.6 1.0 2.6	20.5 17.5 1.2	136.8 97.6 1.4	1,274.4 138.4 9.3	1,838.5 150.0 12.3	12,641.0 321.2 39.4	15,514.5 347.7 44.6	7,051.3 230.6 30.6	1,735.9 82.9 20.9	58.1 2.8 20.9	40,273.6 1,389.7 29.0
South	—	—	—	—	—	—	—	—	132.5 0.6 220.8	—	5,736.8 97.5 58.8	1,362.4 27.8 49.0	7,231.7 125.9 57.4
SE Ireland .	1,679.5 7.4 226.0	—	—	—	—	—	—	—	—	741.0 35.9 20.6	1,107.7 57.8 19.2	1,709.4 46.9 36.4	5,237.6 148.0 35.4

Table 147. Catch of pair trawl fisheries in 1964

Area	Total catch in tons											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Central	13.5	—	—	—	—	11.5	28.8	297.1	2,689.4	1,330.8	16.3	—
South	3,782.7	902.9	113.5	—	—	—	—	43.3	314.4	1,076.0	5,926.0	4,968.3

Table 148. Catch and effort of drift-net fisheries 1964

Area	Top figures:					Total catch in tons.						
	Middle figures:					Effort in number of shots.						
	Bottom figures:					Catch per shot in tons.						
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
NE	—	—	27.7	2.3	—	37.7	—	—	—	—	—	—
	—	—	14	4	—	27	—	—	—	—	—	—
	—	—	2.0	0.6	—	1.4	—	—	—	—	—	—
NW	—	—	—	—	291.3	281.5	553.8	81.2	101.9	—	—	—
	—	—	—	—	208	390	167	48	74	—	—	—
	—	—	—	—	1.4	0.7	3.3	1.7	1.4	—	—	—
Central	—	—	—	—	0.2	176.9	1,377.7	1,126.5	1,151.2	610.8	—	—
	—	—	—	—	3	190	449	564	458	255	—	—
	—	—	—	—	0.1	0.9	3.1	2.0	2.5	2.4	—	—
South	—	—	—	—	—	—	—	—	—	1,626.9	2,380.8	201.5
	—	—	—	—	—	—	—	—	—	412	684	93
	—	—	—	—	—	—	—	—	—	3.9	3.5	2.2

Table 149. Age composition, given as numbers (thousands) caught per unit of effort

Units of effort, used for the various areas, were:

Area NW: 100 hours fishing of a trawler of 500 B.H.P.
 Central: 10 days fishing of a trawler of 500 B.H.P.
 Dogger: 10 days fishing of a trawler of 500 B.H.P.
 Sandettié: 10 days fishing of a trawler of 500 B.H.P.
 Engelse Wal: 10 drifter shots.

Area	Age in years										Maturity
	2	3	4	5	6	7	8	9	10	>10	
NW	0.5	38.6	60.0	2.1	3.7	1.5	18.2	0.5	0.6	1.9	All maturity
Central	7.2	81.9	117.2	1.5	7.8	0.4	10.5	0.1	0.6	0.8	All maturity
Dogger	0.8	51.4	82.4	1.6	11.0	2.3	7.9	0.4	0.3	0.6	Stage VI
Sandettié	0.3	90.4	92.3	0.9	3.2	0.6	0.9	—	—	—	Stage VI
Engelse Wal	7.3	160.3	64.2	0.1	4.4	0.2	0.2	—	—	—	All maturity

Table 150. Mean length per age-group, for various areas

Area	Age in years.										Maturity
	2	3	4	5	6	7	8	9	10	>10	
NW	22.1	25.6	28.2	28.8	29.2	29.9	30.2	30.0	30.6	30.9	All maturity
Central	21.9	26.2	28.5	28.4	29.5	30.5	30.2	30.8	30.3	32.1	All maturity
Dogger	23.6	26.2	28.4	29.4	29.6	30.2	30.4	30.6	31.2	31.0	Stage VI
Sandettié	22.4	25.9	27.8	28.7	29.5	28.7	29.3	—	—	—	Stage VI
Engelse Wal	24.8	25.9	27.9	30.0	28.8	30.3	30.4	—	—	—	All maturity

Drift-net

Catch and effort statistics of the drift-net fisheries are shown in Table 148. The total landings of these fisheries were the lowest on record (10,000 tons). This was partly caused by a further reduction of the effort. The catch-per-effort, however, declined too, from 4.11 tons per shot in 1963 to 2.49 tons in 1964. The reduction in the catch-per-effort was experienced in all areas, with

the exception of area South, where fishing slightly better than in 1963.

Biological data

Length and age data are summarized in 149-151, for the following fisheries —

I. NW (Fladen). Period: July-medio A
 Area: North of 57°30' N.L., west of 1
 Gear: Herring trawl.

Table 151. Length composition (%) for various areas

Area	Length (nearest cm)															Maturity
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	
NW	—	—	0.1	0.3	1.5	4.0	9.0	11.8	13.2	18.8	20.1	12.6	6.9	1.6	0.1	All maturity stages
Central	0.1	0.4	0.6	0.7	1.2	2.0	6.5	14.6	17.8	20.7	20.8	9.2	4.4	0.9	—	All maturity stages
Dogger	—	—	—	0.2	0.4	1.0	5.7	12.5	18.1	23.0	23.4	11.0	3.8	0.8	0.1	Stage VI
Sandettié ..	—	—	—	0.2	0.4	3.6	13.2	21.9	23.8	22.9	11.9	1.8	0.3	—	—	Stage VI
Engelse Wal	—	—	—	0.2	2.1	8.2	17.9	24.9	22.4	15.5	7.1	1.6	0.1	—	—	All maturity stages

II. Central. Period: August—medio September.

Area: between 54°–56° N.L. Gear: Herring trawl.

III. Dogger. Period: September—medio October.

Area: 53°45' N.L. to 55° N.L. and between 1°–3° E.L. Gear: herring trawl.

IV. Sandettié. Period: November. Area: Sandettié Bank, Galloper, North Hinder. Gear: Herring trawl.

V. Engelse Wal. Period: medio October—medio December. Area: between 52°–53°30' N.L. in the North Sea. Gear: drift-net.

From Table 149 it appears, that recruitment was only moderate on most grounds, except possibly in the southern North Sea (Engelse Wal). Dominant in the age compositions, at least in the northern and central North Sea, were the four year-old herring, belonging to the rich 1960 year-class. Two year-old fish were encountered on most grounds, mainly in small numbers, except in the areas Central and Engelse Wal.

The length for age of the three year-old fish (Table 150) remained at about the same high level as in 1963.

K. H. POSTUMA, J. J. ZIJLSTRA

The Belgian Herring Campaign 1964–1965

(Figure 126; Tables 152–163)

Fishery

As in previous years, the herring fishery was carried out mainly in the southern area of the North Sea, although some fishery went on in the central and northern areas. Only the results relating to the southern North Sea are mentioned.

Table 152. Number of trawlers, number of trips and fishing effort

Months	Number of trawlers	Number of trips	Fishing effort (h.a. × h.p.)
November	24	87	850,570
December	22	37	189,424
January	18	38	183,714
February	16	19	98,164
Total 1964–65 ..	38	181	1,321,872
Total 1963–64 ..	18	84	1,038,480

The fishing grounds extended from Schouwen Bank to the vicinity of Colbard L.V. With the exception of 13 catches made with drift-nets (6,591 kg herring), the herring fishery was exclusively carried out with the pelagic trawl. Only the results of the pelagic trawl are mentioned.

The first catches were landed on 2. November 1964 and the last on 27. February 1965.

Tables 152 and 153 give records of the fishing effort and the yield of the fishery. 38 trawlers made 181 trips and totalized 1,321,872 h.a. × h.p. (h.a. × h.p. = the number of hours at sea multiplied by the number of h.p. developed). In 1963–64, 18 trawlers, 84 trips and 1,038,480 h.a. × h.p. (Table 152).

A total weight of 1,057.2 tons were landed of which 904.2 tons were herring and 153.0 tons incidental catches. The average catch per trip reached 5 tons and per 100 h.a. × h.p. 68 kg (Table 153).

For the previous season, the figures were 756.7 tons of herring, the average catch per trip being 9 tons and per 100 h.a. × h.p. 73 kg.

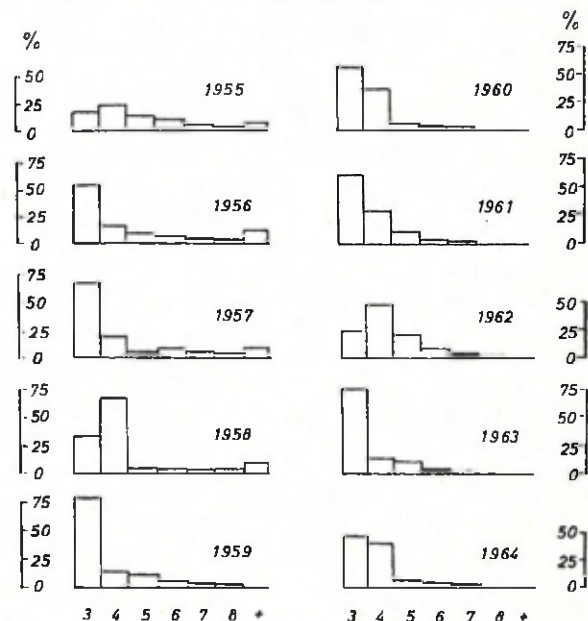


Figure 126. Age compositions during the period 1955–1964.

Biological data

A total of 355 herrings were analysed — 272 in November and 83 in December 1964.

Table 154 shows the length distribution for each month. The average weight and the percentage number of males are also recorded as is the average length of the fish.

Table 155 gives the stages of maturity for two months. The quantity of intestinal fat is also estimated according to months and to stages of maturity (Table 156 and 157).

The age composition of the catches is described in Table 158. The 3 year-old fish is predominant during each of the two months.

Table 153. Yields and average catches

Months	Yields of herring (tons)	Incidental catches (tons)	Total (tons)	Average catch per trip (tons)	Av. c. per h.a. × (1
November	528.8	103.7	632.5	6.1	62
December	122.2	19.4	141.6	3.3	62
January	178.0	6.9	184.9	4.7	97
February	75.2	23.0	98.2	4.0	77
Total 1964-65	904.2	153.0	1,057.2	5.0	68
Total 1963-64	756.7	28.7	785.4	9.0	75

Table 154. Length, weight and sex (numbers and $\frac{0}{100}$)

Length (cm)	November		December		Total 1964-1965		Total 1963-
	N	$\frac{0}{100}$	N	$\frac{0}{100}$	N	$\frac{0}{100}$	N
31.5	1	4	—	—	1	3	—
31.0	2	7	1	12	3	8	—
30.0	5	18	3	36	8	23	—
29.5	10	37	3	36	13	37	6
29.0	17	62	2	24	19	53	8
28.5	15	55	3	36	18	51	11
28.0	22	81	9	109	31	87	16
27.5	26	95	9	109	35	98	25
27.0	31	114	8	96	39	110	18
26.5	32	118	10	120	42	118	25
26.0	29	107	9	109	38	107	53
25.5	33	121	11	133	44	124	68
25.0	25	92	8	96	33	93	95
24.5	10	37	3	36	13	37	60
24.0	4	15	3	36	7	20	38
23.5	5	18	—	—	5	14	18
23.0	4	15	1	12	5	14	3
22.5	1	4	—	—	1	3	2
22.0	—	—	—	—	—	—	1
Total	272	1,000	83	1,000	355	1,000	447
Average length, mm (true mean)	269.7		269.5		269.7		258.3
Mode, cm	25.5		25.5		25.5		25.0
Standard error	3.8117		3.7475		3.7903		2.8926
Weight, g	168		141		162		147
Males, $\frac{0}{100}$	120	441	42	506	162	456	230

Table 155. Stages of maturity (numbers and $\frac{0}{100}$)

Stages	November		December		Total 1964-1965		Total 1963-
	N	$\frac{0}{100}$	N	$\frac{0}{100}$	N	$\frac{0}{100}$	N
I	—	—	1	12	1	3	—
II	8	29	—	—	8	23	5
III	—	—	—	—	—	—	2
IV	—	—	—	—	—	—	—
V	176	647	2	24	178	501	309
VI	29	107	—	—	29	82	44
VII	6	22	14	169	20	56	29
VIII	53	195	66	795	119	335	58
Total	272	1,000	83	1,000	355	1,000	447

Table 156. Quantity of intestinal fat (numbers and ‰)

Quantity	November		December		Total 1964—1965		Total 1963—1964	
	N	‰	N	‰	N	‰	N	‰
0	66	242	6	72	72	203	135	302
I	174	640	57	687	231	651	273	611
+	22	81	19	229	41	115	31	69
M	10	37	1	12	11	31	8	18
Total	272	1,000	83	1,000	355	1,000	447	1,000
Index	1.91		2.18		1.97		1.80	

Table 157. Quantity of intestinal fat according to the stages of maturity (numbers and ‰)

Quantity	Stages of maturity							
	I		II		III		IV	
	N	‰	N	‰	N	‰	N	‰
0	—	—	—	—	—	—	49	275
I	—	—	1	125	—	—	111	624
+	—	—	—	—	—	—	17	95
M	1	1,000	7	875	—	—	1	6
Total	1	1,000	8	1,000	—	—	178	1,000
Index 1964—65	4.00		3.75		—		1.82	
Index 1963—64	—		4.00		3.00		1.79	

Table 158. Age (numbers and ‰)

Age	Year-class	November		December		Total 1964—1965		Total 1963—1964	
		N	‰	N	‰	N	‰	N	‰
2	1962	—	—	2	39	2	9	3	11
3	1961	82	477	20	392	102	457	197	714
4	1960	72	419	18	353	90	404	39	141
5	1959	11	64	4	79	15	67	26	94
6	1958	3	17	5	98	8	36	7	25
7	1957	4	23	2	39	6	27	4	15
Total		172	1,000	51	1,000	223	1,000	276	1,000
Average age (years-months)		3.8		3.11		3.9		3.5	

Table 159. Average lengths by age and value of L_1 (mm) (numbers)

Average length by age mm				Average value of L_1 mm			
Year-class	Season 1964—1965		Season 1963—1964	L_1	Season 1964—1965		Season 1963—1964
	N	mm			N	mm	
1962	2	237	—	1962	2	162	—
1961	102	258	3	239	102	135	3
1960	90	277	197	251	90	141	197
1959	15	290	39	268	15	124	39
1958	8	298	26	282	8	132	26
1957	6	305	7	289	6	136	7
1956	—	—	4	294	—	—	4
Total	221		276		221		276

was the case during the previous season, although the percentage has dropped from 714‰ to 457‰.

The average length by age and the growth rate during the first year (L_1) are given in Table 159. Table 160 gives the range of lengths from L_1 to L_6 .

The number of vertebrae for months and year-classes are given in Tables 162 and 163.

Finally, Table 163 gives the number of keeled scales (K_2) for both months.

No stomachs were found to contain food.

Table 160. Range of lengths from L_1 to L_6

L	Number	Length in mm		
		Minimum	Maximum	Mean
1	223	75	180	137
2	221	140	255	213
3	119	210	280	251
4	29	245	280	269
5	14	265	290	285
6	6	280	300	295

Table 161. Vertebrae (VS) (numbers and ‰)

VS	November		December		Total 1964—1965		Total 1963—1964
	N	‰	N	‰	N	‰	
60	—	—	—	—	—	—	1
59	1	4	—	—	1	3	—
58	10	39	4	49	14	41	14
57	121	467	38	470	159	468	197
56	119	459	35	432	154	453	194
55	7	27	3	37	10	29	16
54	1	4	1	12	2	6	2
Total	259	1,000	81	1,000	340	1,000	424
Average	56.521		56.506		56.518		56.49
Standard error	0.6554		0.7113		0.6680		0.67

Table 162. Average number of vertebrae according to year-classes

Year-class	Season 1964-65		Season 1963-64	
	N	Average	N	Average
1962	2	56.000	—	—
1961	99	56.556	3	56.333
1960	89	56.551	187	56.481
1959	13	56.539	38	56.632
1958	8	56.375	24	56.583
1957	4	56.500	7	56.714
1956	—	—	3	56.667
Total	215		262	

Conclusions

The average length increased from 258.3 mm to 269.7 mm. The difference in maturity between 1963/1964 and 1964/65 is due to the lack of study material in 1963 which prevented observations beyond November, whereas in 1964 observations were continued during December, the month during which reproduction reaches its maximum.

During the previous season, the proportion of three year-old herrings was 714‰, this year only 457‰. This would tend to show that the 1961 generation was less abundant.

In the southern area of the North Sea catches of the herring season 1965-66 were composed mainly of four and five year-old herring (1961 and 1960 year-classes) as well as of herring which as three year-olds will appear for the first time on the spawning grounds. Older fish will play a very modest rôle.

Under these conditions, the prospects for the forthcoming herring season are not encouraging unless the new generation (the 1962 year-class) appears very numerous in the concentrations.

Ch. G

La campagne harenguière 1964-1965 dans la zone du Pas-de-Calais

(Figure 127)

La campagne 1964-65 de pêche au haricot de chaluier boulonnais s'est déroulée essentiellement pendant les mois de novembre et de décembre. Elle a débuté sur les concentrations de harengs pleins du sud de la Mer du Nord, mais cette zone, encore, aucune pêche n'a eu lieu au Sande de même, en Manche orientale, la région de la Hague a été complètement désertée. Les apports les plus importants ont été réalisés à proximité du

Table 163. Keel scales (K₂) (number and ‰)

K ₂	November		December		Total 1964—1965		Total 1963—1964
	N	‰	N	‰	N	‰	
18	—	—	—	—	—	—	1
17	3	11	1	12	4	11	9
16	47	175	8	96	55	156	85
15	113	420	43	518	156	443	210
14	95	353	26	314	121	344	109
13	10	37	5	60	15	43	18
12	1	4	—	—	1	3	—
Total	269	1,000	83	1,000	352	1,000	432
Average	14.758		14.687		14.741		14.9
Standard error	0.8360		0.7806		0.8225		0.8

de Bullock où le hareng n'avait pas été jusqu'à présent recherché et où il a pu être capturé grâce à l'emploi du chalut semi-pélagique.

Lieux, Epoque de pêche et Rendements

Pêche industrielle

Cette pêche est pratiquée par 20 à 25 chalutiers, de 300 à 500 t de jauge brute et d'une puissance comprise entre 700 et 1.400 CV.

Les lieux exploités, l'effort de pêche et les rendements obtenus sont indiqués sur la Figure 127 résumant l'activité de ces navires bouloonnais dans le sud de la Mer du Nord et en Manche orientale.

a) *Bancs du sud de la Mer du Nord*. Comme l'an passé le Sandettié a été complètement déserté et la campagne harenguière a débuté le 9. novembre dans une zone située entre les bancs du North Hinder et du Galloper. Elle s'est poursuivie jusqu'au 14. novembre environ produisant au total 711 tonnes de harengs pleins contre 1.067 t en 1963, année où la pêche dans cette région n'avait pris fin que le 25. novembre.

Quant au rendement par unité d'effort, c'est-à-dire par jour de pêche effective et par bateau, il est tombé de 11,1 tonnes à 9,0 tonnes.

L'amélioration des captures qui s'était manifestée l'an dernier dans cette région ne s'est donc pas maintenue confirmant ainsi l'importance décroissante des prises de hareng faites sur les bancs de Flandre par les chalutiers industriels.

b) *Pêche en Manche orientale*. Contrairement aux deux campagnes précédentes, les apports les plus importants ont été réalisés dans cette région et la mise à terre au port de Boulogne s'est élevée à 3,637 t contre 379 t en 1963-64 et 782 en 1962-63.

La pêche a débuté relativement tôt à proximité du banc du Colbart du 16. au 19. novembre et elle s'est poursuivie dans la région du Vergoyer du 20. au 22. novembre environ. Ces deux lieux de pêche ont produit respectivement 299 et 312 tonnes.

A. MAUCORPS

Herring Investigations at Dunmore East 1964-1965

(Tables 164-166)

The main herring season commenced on the 20. November 1964 and concluded on the 10. February, 1965. Twenty-four Irish based boats took part in the fishery and landings were made on 57

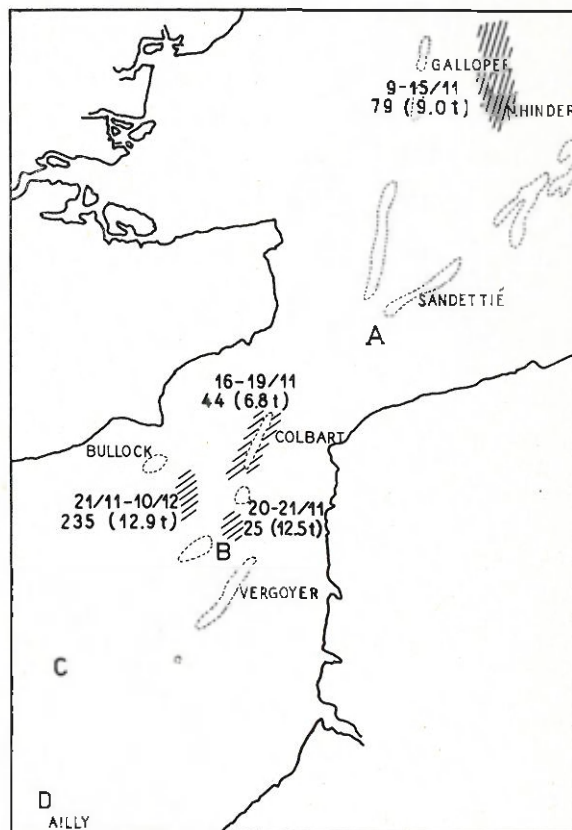


Figure 127.

days out of a possible 68. A total of 17,434 crans of trawl-caught fish were landed, a decrease of 4,578 crans or 20.8% on the figure for the 1963/64 season. Prior to the opening of the season approximately 70 crans of herring were taken in Waterford Harbour by the sprat-weirs and drift-nets. Three types of gear were used throughout the season:—single mid-water trawls, paired mid-water trawls and bottom trawls. No boats used ring-nets or purse-seines during the 1964/65 season. The major portion of the catch before Christmas was taken by mid-water trawls and after the 1st of January landings by bottom trawls increased and predominated by the end of the season.

Table 164. Monthly age-distribution

Age in years	2	3	4	5	6	7	8	9	10	10+	Total
November	35	168	230	22	26	37	13	4	4	7	546
December	328	327	410	38	50	142	27	16	30	25	1,393
January	242	506	563	142	62	278	39	18	28	49	1,927
February	101	177	221	83	17	119	21	5	13	10	767
Totals	706	1,178	1,424	285	155	576	100	43	75	91	4,633

The shoals were first located south of the Hook in 18 to 20 fathoms. Landings during November were poor and the major effort was concentrated around Tramore Bay. During this time small herring were also located in Waterford Harbour. By early January the shoals had moved into Baginbun Bay and towards the end of the month heavy landings were taken off the Keraghs. Early in February the fish had moved close inshore in Baginbun Bay and due to the very rough nature of the ground, the trawlers could not work effectively. From the 8. February until the end of the season shoals were again located south of the Hook in 31–32 fathoms.

Samples of herring were obtained during the season and examined in the usual way for length, sex, maturity, vertebral count, age (otolith-readings) and racial type. Due to the absence of ring-net

caught fish no scales were examined. Fish number 4,633 were thus examined and the monthly distribution is shown in Table 164. The dominant age-groups were found to be 4, 3, 2, and 7 old fish. The 1960 year-brood which predominated as 3 year-olds during 1963/64 again dominated samples as 4 year-olds. The 1957 year-class was well represented as 7 year-olds.

The monthly maturity distribution was similar to those of the previous seasons. fish, numbering 100 and not included in Table 166, found in November and early December samples had a typical autumn-spawning vertebral count of 56.49. The vast majority of fish examined in November and December were stage V fish) becoming stage VI (running) in January/February. The presence of some stage V fish in February suggested that fishing could

Table 165. Mean length, mean-vertebral count per maturity stage per age-class

Mat.	Age in years									
	2	3	4	5	6	7	8	9	10	10+
Nos.	209	5	2							
II Mean length ...	23.21	24.68	27.00							
Mean V.C.	56.85	56.40	56.50							
IV	6	6								
	23.60	26.45								
	56.83	57.00								
V	186	514	662	100	68	208	46	20	33	37
	23.44	25.79	27.53	28.91	29.46	29.54	29.85	30.20	30.22	30.57
	56.92	56.95	56.78	57.02	56.75	56.79	56.80	56.55	57.00	56.84
VI	278	608	698	174	74	344	49	22	36	51
	23.45	25.33	27.79	29.20	29.49	29.80	30.10	30.41	30.61	30.76
	56.91	56.95	56.76	57.10	56.78	56.80	56.78	56.82	57.03	56.88
VII	27	45	62	11	13	24	5	1	6	3
	23.83	25.30	27.58	28.72	29.54	29.71	30.02	30.90	30.82	30.63
	56.55	56.93	56.68	57.63	56.69	56.75	56.80	57.00	56.83	57.00
Totals	706	1,178	1,424	285	155	576	100	43	75	91
	23.39	25.53	27.66	29.08	29.48	29.70	29.98	30.32	30.46	30.68
	56.88	56.95	56.77	57.08	56.76	56.78	56.79	56.70	57.00	56.87

Table 166. Percentage distribution of otolith types per month per age-class for the 1964/65 season

(N = "narrow" type; W = "wide" type; U = unclassified)

Age	2			3			4			5			6			10+
Type	N	W	U	N	W	U	N	W	U	N	W	U	N	W	U	
Months																
November ...	80	3	17	62	38	2	78	21	1	50	41	9	77	15	8	
December ...	63	11	26	48	50	2	72	26	2	55	45	—	60	38	2	
January	75	7	18	53	46	1	71	28	1	71	28	1	68	29	3	
February	79	1	20	61	38	1	79	20	1	72	27	1	76	24	—	
Totals	70	8	22	54	45	1	74	25	1	68	30	2	68	29	3	
Age	7			8			9			10			10+			N
Type	N	W	U	N	W	U	N	W	U	N	W	U	N	W	U	
Months																
November ...	41	51	8	77	23	—	25	75	—	50	50	—	14	86	—	68
December ...	51	40	9	85	11	4	75	25	—	84	13	3	76	20	4	62
January	62	32	6	69	31	—	66	28	6	89	7	4	59	35	6	65
February	65	26	9	76	10	14	100	—	—	85	15	—	90	10	—	72
Totals	59	34	7	76	20	4	70	28	2	84	13	3	64	32	4	66

extended beyond the closing date. The monthly distribution of maturity stages was as follows:—

Month	II	IV	V	VI	VII	Total
November	3.3	0.4	95.9	0.4	—	100.0
December	13.3	0.7	69.4	10.8	5.8	100.0
January	0.4	—	17.8	79.3	2.5	100.0
February	0.7	—	5.3	85.0	9.0	100.0

Mean lengths and mean-vertebral counts per maturity stage per age-class are given in Table 165.

During 1964/65, 4,633 otoliths were collected, 546 in November, 1,393 in December, 1,927 in

January and 767 in February. These were divided into three categories following an examination of their first winter-ring, viz.: narrow 1st winter-ring (N), wide 1st winter-ring (W), and unclassified (U), the last-named category comprising those which could not be definitely classified under (N) or (W). The overall distribution of types was (N) 66%, (W) 29% and (U) 5%. In all year-classes the "narrows" dominated. The percentage distribution of otolith types per month per age-class may be seen in Table 166.

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