

Distribution of Haddock in the Barents Sea
Depending on Abundance of the Population,
Thermal Conditions and Feeding Features in 1973

by

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Abstract. The paper deals with abundance, length-age and sexual composition, feeding, fatness, distribution of haddock and also with thermal conditions in the Barents Sea in 1973. It analyses factors on which the distribution of haddock in the Barents Sea depended.

Distribution of haddock in the Barents Sea and also stability and density of concentrations in a feeding period depend on abundance and length-age composition of the population, thermal conditions in feeding areas and on abundance and distribution of main food objects, capelin and euphausiids (Sonina 1967, 1969, 1970).

In 1973 catches taken in the Barents Sea mainly consisted of haddock of 31-50 cm in length, at the age of 4+ and of those at the age of 3+ of the rich 1969 and 1970 year classes respectively (Tables 1,2). In the southern Barents Sea haddock of the 1969 year class amounted to 68.0% and those of the 1970 year class made up 20.7%. In the Bear Island-Spitsbergen area fish of the year classes mentioned amounted to 47.3 and 28.4% respectively. Besides, a considerable by-catch of fish at the

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age of 5+ of the 1968 year class took place in both areas given above, they accounted for 8.3% and 11.8% respectively.

In the haddock population in the southern Barents Sea males made up 51.2%. A number of males was considerably larger than that of females among fish of 16-40 cm in length, at the age of 2+ and 3+ of the 1971 and 1970 year classes. Among fish at the age of 4+ of the 1969 year class males also predominated to some extent (50.9%) and females predominated among fish of the 1968-1966 year classes. It is known that males reach maturity and migrate from the southern Barents Sea earlier than females (Sonina 1972). Predominance of males in the 1969 year class evidences that the main quantity of fish were not yet mature and remained in the Barents Sea. Judging by decrease in a quantity of males, one can conclude that a great part of fish of the 1966-1968 year classes already entered a spawning stock.

Haddock abundance in the Barents Sea was at a rather high level. An average weighted catch per 1 hour trawling included 546 haddocks and this indicated the highest abundance observed during the all previous years, beginning from 1927 (Sonina 1969). The 1969 year class of haddock was more plentiful than that of 1950 which was considered to be the strongest one for the last 35 years. For instance, an average weighted catch per 1 hour trawling included 138 fishes at the age of 3 complete years of the 1950 year class and 194 individuals at the age of 4, whereas haddock of the 1969 year class were represented in a catch by 230 and 300 fishes at the age of 3 and 4 respectively. An average catch of haddock per 1 hour trawling was twice larger in 1972 and 1973 than that in 1953 and 1954, it amounted to 2.1 and 3.2 centners against 1.1 and 1.6 centners. It should be

noted that fish of the 1969 year class grow faster than those of the 1950 year class. For instance, haddock of the 1969 year class has an average length of 32.8 cm, at the age of 2 and approximately the same length (33.0 cm) was found in fish of the 1950 year class at the age of 3. An average length (39.8 cm) of 3 year-olds of the 1969 year class was similar to that (40.0 cm) of 4 year-olds of the 1950 year class and an average length (43.2 cm) of 4 year-olds of the 1969 year class was close to that (43.0 cm) of 5 year-olds of haddock of the 1950 year class. Great differences are also found in weight of haddock of the given year classes. An average weight of fish of the 1969 year class at the age of 3 complete years is 600 g and that of fish at the age of 4 is 740 g, whereas an average weight of fish of the 1950 year class at the former age is 330 g and that of haddock at the latter age is 620 g.

Observations made since the 10-th of May to the 10th of June 1973 on board the R/V "Tunets" showed that an average catch taken per 1 hour trawling in coastal areas and on the Rybachya Bank included 666 fishes and this indicates the highest abundance found during the all previous years (Tables 3, 4A). In addition, this year a remarkably large quantity of haddock migrated along the main stream of the Murmansk Current to the north-east. An average catch taken per 1 hour trawling in the areas along this stream consisted of 300 haddocks (Table 4B).

Thus, judging only by the abundance and length-age composition of the population one can expect a formation of dense haddock concentrations in the Barents Sea throughout the year and especially in August-October on the Kanin Bank and in the

Kanin-Kolguev shallow area where usually small and even-sized fish feed on benthos.

However, this year haddock formed dense concentrations only in the first half of the year.

In 1973 the Barents Sea was very warm. During the last 20 years only in 1954 a temperature of waters was somewhat higher. In spring and summer a temperature anomaly in the 0-200 m layer in the southern part of the sea was 0.5-0.7° higher than the long term mean. So, in July the near-bottom and surface temperatures on the Kanin Bank was 0.4° and 2° respectively higher than the normal.

Due to great heat content of waters and abundant population haddock widely spread over the Barents Sea. Usually the main quantity of haddock inhabit the southern Barents Sea but in the Bear Island-Spitsbergen area they occur in small quantities. However, in April and May of 1972 and 1973 haddock were caught in great quantities on the southern and western slopes of the Bear Island Bank. In June and July some schools moved to the north and remained up to October on the Spitsbergen Bank, in the South Cape Deep and the West Spitsbergen area.

In the southern Barents Sea haddock wintered in the neighbouring western and central areas as they do in warm years. From January to March dense concentrations occupied the North-Central area, northern slope of the Murmansk Shoaliness and those of the Murmansk Bank. In mid-March haddock concentrated on the Finnmark and Rybachya banks. Haddock started to migrate along the coastal stream of the Current to the east in April, about a month earlier than usually, and along the main stream they migrated in May that is also much earlier than in cold and

temperate years. In May and June haddock migrated in great quantities both along the coastal and main streams of the Current (Fig. 1). In the same period of the previous years haddock were not caught in such quantities on slopes of the Murmansk Bank and in central areas (Table 5). Such a great distribution of haddock was found only in the warm 1954.

Thus, high heat content of the Barents Sea waters resulted in expansion of an area, migration of a great quantity of fish in central areas and decrease in a quantity of haddock migrating to the south-eastern areas. However, the abundance of haddock migrating along the coastal stream of the Current was at a rather high level.

Early in July haddock reached the Kanin Bank where they are caught together with cod but stable concentrations were not found; haddock fed on euphausiids and quickly migrated to the north-east. In mid-July haddock dispersed over a great area and did not concentrate till the end of October. Thermal conditions on the Kanin Bank, in the Kanin-Kolguev shallow area and also in coastal areas were quite favourable for feeding of haddock on benthos.

It is known that in autumn haddock form stable concentrations in the south-eastern areas in the case when feeding of haddock on capelin and euphausiids before was low and their fatness in July-August is not higher than 4.0-4.5%. Besides, distribution and density of haddock concentrations in June - October depend on abundance of euphausiids which are more favourite food than benthos.

In January-June haddock fed mainly on benthos and kept to the bottom, their fatness was not great, 3.8-5.1%. Feeding of

haddock on capelin was low that year. In May fatness of haddock accounted on the average for 4.5%.

However, abundance of euphausiids was several times higher than the long term mean norm. According to data obtained by the laboratory of sea biology the greatest part of the stock was represented by cold water species, *Thysanoessa raschii*, (2/3 of the total stocks). The predominant quantity of these small crustaceans was found on the Kanin Bank, in the Kanin-Kolguev shallow area and in central areas. Due to this, as soon as haddock approached these areas, they started to feed on euphausiids and dispersed in water layers. In July and August fatness of haddock highly increased and accounted on the average for 6% and in some samples it amounted to 7.8%. Haddock feeding on euphausiids and having fatness over 5.5% never form concentrations (Scnina 1970).

Haddock started to school late in October; in November and December they were found in great quantities in central areas and on the Murmansk Bank. Haddock migrated to wintering areas mainly along the main stream of the Murmansk Current.

Conclusions

1. In the southern Barents Sea haddock formed dense concentrations in January-June and also in November and December 1973. In July-October haddock were scarce in water layers.
2. Individuals of 31-50 cm in length, at the age of 4 and 3 of the rich 1969 and 1970 prevailed in the haddock population of the Barents Sea.
3. Haddock abundance was at a rather high level. An average weighted catch taken per 1 hour trawling in the southern Barents

Sea included 546 haddocks and this indicated the highest abundance observed during the all previous years, beginning from 1927.

4. In spring and summer a temperature anomaly in the 0 - 200 m layer in the southern Barents Sea was 0.5-0.7° higher than the long term mean norm. High heat content of waters resulted in expansion of the haddock inhabiting area and migration of a great quantity of fish in central areas along the main stream of the Murmansk Current.

5. Feeding of haddock on capelin was low. Fatness of fish in May was on the average 4.5%. However, an abundance of euphausiids was several times higher than the long term mean norm. Due to this, in July-October haddock fed on euphausiids, dispersed in water layers and did not form concentrations.

Length and sexual composition of haddock in 1973

Length groups, in cm	The southern Barents Sea						Bear Island- Spitsbergen area	
	Length compo- sition		Sex ratio				Length compo- sition	
	No. of fish	%	No. of fish		%		No. of fish	%
			♂♂	♀♀	♂♂	♀♀		
11-15	252	0,1	-	-	-	-	2	0,0
16-20	2909	1,6	1	-	100,0	-	23	0,4
21-25	6003	3,3	17	12	58,6	41,4	96	1,9
26-30	17840	9,7	211	130	61,9	38,1	169	3,3
31-35	34870	18,9	864	717	54,6	45,4	1012	19,8
36-40	41006	22,3	1625	1290	55,7	44,3	1096	21,4
41-45	48141	26,1	1992	1904	51,1	48,9	919	18,0
46-50	25439	13,8	1102	1295	46,0	54,0	844	16,5
51-55	6170	3,4	230	337	37,3	62,7	503	9,8
56-60	1002	0,5	34	65	34,3	65,7	209	4,1
61-65	360	0,2	19	16	54,3	45,7	88	1,7
66-70	110	0,1	9	12	42,8	57,2	49	1,0
71-75	53	0,0	4	2	66,6	33,4	44	0,9
76-80	40	0,0	2	5	28,5	71,5	47	0,9
81-85	13	0,0	1	1	50,0	50,0	16	0,3
86-90	4	0,0	-	-	-	-	3	0,0
Total	184212	100,0	6111	5336	51,2	48,8	5120	100,0

Age and sex composition of haddock in 1973

Age, year class	The southern Barents Sea				Bear Island-Spitsbergen area			
	Age compo- sition		Sex ratio		Age compo- sition		Sex ratio	
	No. of fish	%	♂♂	♀♀	No. of fish	%	♂♂	♀♀
<u>2</u> 1971	256	2,2	64,1	35,9	13	1,0	53,8	46,2
<u>3</u> 1970	2647	22,2	54,2	45,8	376	28,4	59,6	40,4
<u>4</u> 1969	8121	68,0	50,9	49,1	624	47,3	60,6	39,4
<u>5</u> 1968	819	6,9	41,1	58,9	156	11,8	67,9	32,1
<u>6</u> 1967	79	0,7	34,1	65,9	77	5,8	62,3	37,7
<u>7</u> 1966	7	0,0	14,2	85,8	13	1,0	61,5	38,5
<u>8</u> 1965	-	-	-	-	12	0,9	66,7	33,3
<u>9</u> 1964	6	0,0	50,0	50,0	22	1,6	72,7	27,3
<u>10</u> 1963	5	0,0	40,0	60,0	10	0,7	70,0	30,0
<u>11</u> 1962	2	0,0	50,0	50,0	9	0,7	44,4	55,6
<u>12</u> 1961	-	-	-	-	5	0,4	80,0	20,0
<u>13</u> 1960	3	0,0	100,0	0,0	2	0,2	100,0	0,0
<u>14</u> 1959	-	-	-	-	1	0,1	100,0	0,0
<u>15</u> 1958	-	-	-	-	1	0,1	0,0	100,0
Total	11945	100,0	51,2	48,8	1321	100,0	61,5	38,5

Table 3

Number of haddocks of different length in a catch taken per 1 hour trawling in coastal areas and on the Rybachya Bank in May 1961-1969, in May-June 1973 x)

Year	Length in cm												Total
	20	25	30	35	40	45	50	55	60	65	70	85	
1961	5,7	21,7	31,7	45,5	117,0	155,0	80,0	27,3	6,1	0,9	0,3	0,8	492,0
1962	-	0,7	1,7	5,4	10,0	14,5	25,0	23,8	13,9	2,4	0,9	0,6	98,0
1963	-	1,6	13,0	52,4	52,2	40,8	14,0	4,2	1,7	0,6	0,1	0,1	180,7
1964	0,9	9,9	102,0	223,5	175,6	37,4	10,4	1,7	0,2	0,4	-	-	562,0
1965	0,2	0,8	4,5	43,2	164,5	132,0	53,0	10,6	1,9	0,3	-	-	411,0
1966	-	0,7	1,9	2,0	1,2	0,6	0,2	-	-	-	-	-	6,6
1968	0,1	0,1	0,4	3,4	44,4	115,0	73,8	26,1	6,1	1,3	0,3	-	271,0
1969	-	1,9	4,5	1,4	0,1	1,9	3,6	2,4	1,1	0,1	0,1	-	17,1
1973	13,8	19,0	73,9	180,4	177,6	150,7	44,8	5,2	0,6	0,2	0,1	-	666,3

x)

No investigations were carried out in 1970-1972.

Table 4

Number of haddocks in an average catch taken per 1 hour trawling in areas along the coastal stream (A) and main stream (B) of the Murmansk Current in May-June 1973

Area	Length in cm												Total
	15	20	25	30	35	40	45	50	55	60	65	80	
Rybachya Bank	0,3	7,0	10,4	18,8	42,6	31,3	34,0	14,0	2,9	0,4	0,2	0,1	162,0
Kildin Bank	1,3	21,3	36,0	113,5	150,1	81,2	46,0	10,7	1,3	0,2	0,3	0,2	462,0
West-coastal area	1,0	22,5	27,6	102,7	177,0	209,7	199,2	62,1	11,1	1,3	0,2	0,3	815,0
East-coastal area	-	1,6	2,0	60,7	351,8	388,2	323,5	92,4	5,7	0,4	0,3	-	1226,6
Total	0,7	13,1	19,0	73,9	180,4	177,6	150,7	44,8	5,2	0,6	0,2	0,1	666,3
%	0,1	2,0	2,9	11,0	27,0	26,8	22,6	6,7	0,8	0,1	0,0	0,0	100,0
North-western slope of the Murmansk Bank	0,2	2,8	10,2	32,4	54,7	61,9	46,2	16,4	2,1	0,8	0,5	-	228,2
North-eastern slope of the Murmansk Bank	-	0,4	6,9	29,9	56,3	53,9	54,8	26,2	3,3	0,6	0,4	0,2	232,9
Northern slope of the Murmansk Shoaliness	-	-	1,4	11,5	47,8	102,6	125,4	62,6	8,8	1,8	0,6	0,2	362,7
South-western slope of the Murmansk Bank	-	3,3	20,0	65,9	67,1	71,3	71,3	29,8	4,8	0,4	-	-	333,9
Murmansk Shoaliness	-	0,9	4,0	28,8	69,2	81,3	102,2	48,2	7,6	1,2	0,9	0,2	344,5
Total	-	1,5	8,5	33,7	59,0	74,2	80,0	36,6	5,3	1,0	0,5	0,1	300,4
%	-	0,5	2,8	11,2	19,7	24,8	26,6	12,2	1,8	0,3	0,1	0,0	100,0

Table 5

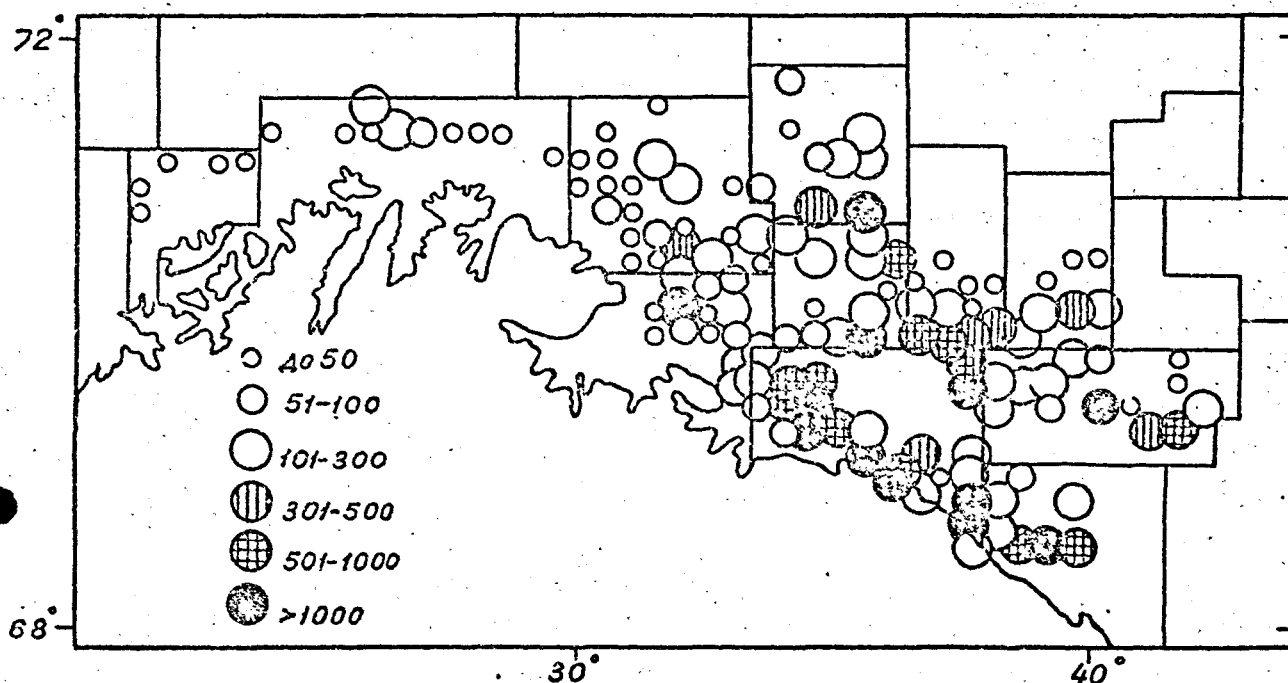
Number of haddocks (in spec.) in an average catch per 1 hour
trawling in May 1961-1969 and in May-June 1973

Area	Year								
	1961	1962	1963	1964	1965	1966	1968	1969	1973
Soro Bank	-	-	-	-	-	-	-	24	2
Nordkin Bank	-	-	-	114	102	13	-	6	-
Norwegian Deep	33	42	15	142	48	6	7	23	60
Finnmarken Bank	28	24	61	8	6	18	14	12	64
Rybachya Bank	79	191	92	360	475	11	282	20	162
Kildin Bank	229	71	62	1525	84	1	186	27	462
West-coastal area	735	77	349	214	1097	-	345	5	815
East-coastal area	509	150	4	27	-	-	-	-	1227
North-western slope of the Murmansk Bank	-	16	-	-	-	-	37	-	228
South-western slope of the Murmansk Bank	-	-	-	411	-	-	23	12	334
North-eastern slope of the Murmansk Bank	-	-	-	-	-	-	-	-	233
Murmansk Shoaliness	-	59	2	-	-	-	-	-	345
Northern slope of the Murmansk Shoaliness	-	-	-	-	-	-	-	-	363

Heading for Figure

in the paper by M.A.Sonina "Distribution of Haddock in the Barents Sea Depending on Abundance of the Population, Thermal Conditions and Feeding Features in 1973"

Fig. 1. Distribution of haddock in May-June 1973 according to data collected by the R/V "Tunets" (a number of specimens in an average catch per 1 hour trawling).



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