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Status of groundfish stocks and fishery prospects in ICNAF Subareas 1, 2 and 3<sup>1</sup>

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1. Labrador-East Newfoundland Stocks

Mass spawning of the Labrador cod occurs on the continental shelf, mainly in its northern part, from where the developing eggs and larvae are carried southward by the current. Young cod at the age of three full years stay on the shelf of the northern Newfoundland Bank (Div. 3K) and at the age of four years migrate northward to the Labrador area.

Table 1 shows that the Labrador cod stock is characterized by relatively small fluctuations: 3-year-old fish of the strongest year-class are only five times as abundant as those of the poorest year-class (for the Grand Newfoundland Bank, West Greenland and Barents Sea cod stocks, this ratio may be as high as 50:1 or more). The relative stability of the strength of the Labrador cod year-classes is due to spawning under the ice cover, to low and practically constant runoff from the shores and to southward drift of eggs and larvae. Because of small fluctuations typical of the Labrador cod, intensive fishing has a perceptible effect on the size and age composition. Table 2 shows a gradual decrease in the mean age and weight of the Labrador cod in trawl catches as the older fish (over 10 years old) become scarce.

The strength of the annual recruitment to the stock has not become lower; it is seen from Table 1 that at the end of the period considered the spawning stock is capable of producing a year-class as abundant as those produced by earlier ones. Table 2 shows that the number of fish caught per hour trawling does not follow a downward trend. However, there is a gradual decline in the total biomass of the commercial stock due to a drop in the average weight of the fish.

Table 1. Average trawl catches of young cod (numbers) per 1-hour-haul from survey cruises.

Year-class	Number of 3-year-olds in Div. 3K	Number of 2-year-olds	
		Div. 3N	Div. 3O
1960	11	2	0
1961	20	4	3
1962	15	8	2
1963	36	5	1
1964	8	137	13
1965	15	14	12
1966	27	27	17
1967	32	3	4
1968	40	109	28
1969	13	11	6

It should be emphasized that the productivity of any fishery also depends on the distribution and behaviour patterns rather than on the biomass of the exploited stock alone. The productivity of the Labrador trawl fishery for cod increases when the main concentrations are found in deeper water (where they go under the effect of the abnormal cooling of water masses). Therefore, the forecasting of trawl

<sup>1</sup> Presented to the Special Commission Meeting, FAO, Rome, January 1973 as Sp.Mtg.Res.Doc. 73/13.

Table 2. Percentage age composition of cod in South Labrador area in the first half of the year.

Age	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
3	-	0.6	0.2	-	-	-	-	0.2	0.2	4.4	-	-
4	5.5	1.9	3.6	1.1	5.8	8.5	2.3	2.1	3.0	6.5	12.0	3.1
5	6.4	15.2	4.7	7.9	5.8	34.7	15.4	21.0	14.7	16.4	15.0	17.5
6	19.3	22.4	11.7	13.5	12.1	21.3	25.5	20.5	30.1	18.2	25.0	19.4
7	21.2	15.5	32.8	32.6	16.3	16.1	17.6	19.6	22.0	15.9	20.8	21.5
8	11.7	13.2	16.6	27.7	23.4	8.8	17.0	16.4	15.1	16.2	12.7	15.1
9	12.5	6.9	8.3	6.6	20.4	3.3	8.7	8.9	6.8	9.2	8.1	9.7
10	9.4	6.2	7.1	2.7	7.4	4.2	5.2	4.2	3.2	5.7	3.8	6.7
11	2.9	4.8	3.4	2.8	2.9	0.4	5.0	3.1	0.9	2.9	0.9	3.5
12	3.7	2.4	3.5	2.0	1.7	2.0	0.9	2.9	1.9	1.9	0.7	2.2
13	2.9	3.1	1.9	1.1	2.0	0.7	0.6	0.4	1.4	0.9	0.7	0.6
14	1.7	1.2	1.5	0.6	1.0	-	0.7	0.4	0.2	0.8	0.2	0.2
15	1.6	1.5	1.1	0.6	0.4	-	0.1	0.3	0.3	0.6	0.1	0.1
16	0.9	1.3	1.2	0.2	0.8	-	0.5	-	0.2	0.4	-	0.1
17	0.2	2.2	0.8	0.3	-	-	0.4	-	-	-	-	0.1
18	-	0.9	0.4	0.1	-	-	0.1	-	-	-	-	0.2
19	-	0.4	0.8	0.2	-	-	-	-	-	-	-	-
20	-	0.1	0.2	-	-	-	-	-	-	-	-	-
21	-	0.2	-	-	-	-	-	-	-	-	-	-
22	-	-	0.2	-	-	-	-	-	-	-	-	-
Mean age	8.0	8.1	8.2	7.6	8.0	6.3	7.3	7.1	7.0	7.0	6.6	7.3
Mean wt (g)	1534	1522	1394	1357	1346	1067	1036	1390	1422	1169	1086	1295
Av. No. per 1-hour-haul	1874	1984	2733	2793	2541	2867	2326	2756	2205	2335	2136	2115

catches requires the knowledge of both the biomass of the exploited stock and the environmental conditions.

Table 3 shows that the lower the Labrador Shelf water temperature in late autumn, the higher (as a rule) is the productivity of the trawl fishery at the beginning of the following calendar year. This regularity is briefly referred to in the 1970 Soviet Research Report (ICNAF Redbook 1970, Part II, p. 117-119).

Table 3. Water temperatures and productivity of trawl fishery in the Labrador area.

Year	Water temperature (°C) in the 50-200-m depth zone on 1 November (Section 8-A)	Year	Average catch by commercial BMRT trawlers of the <i>Sevryba</i> class per day fished in February ('00 kg)	Cod catch by commercial BMRT trawlers of the <i>Sevryba</i> class as % of the total catch of all fish in February
1964	-0.18	1965	492	94.3
1965	1.06	1966	458	93.8
1966	1.44	1967	374	68.2
1967	0.89	1968	529	92.6
1968	-0.18	1969	577	95.4
1969	0.36	1970	444	75.1
1970	0.31	1971	337	79.9
1971	0.43	1972	364	89.9
1972	-0.39	1973	520 <sup>1</sup>	95.0 <sup>1</sup>

<sup>1</sup> Estimate

It can be said with confidence that the situation is now favourable to the success of the Labrador cod fishery in 1973. Table 1 shows that the 1966, 1967 and 1968 year-classes which will form the bulk of the exploitable stock belong to the category of good year-classes. The hydrographic conditions in the Labrador area contribute to an increase in the density of commercial concentrations. A higher productivity of the fishery was predicted in the 1972 Soviet Research Report (Redbook 1972, Part II, p. 81).

The specialized redfish fishery in the Labrador area started in 1958 and rapidly developed into a

fairly large-scale fishery. In the early sixties the productivity of the fishery and the total redfish catches declined, and now the fishing vessels off Labrador only turn to redfish when there is a decline in cod catches. From 1965 through 1970 each decline in the productivity of the cod fishery was accompanied by an increase of the redfish catch and vice versa. Table 3 shows that the proportion of cod in Soviet catches increased in the years characterized by the high productivity of the trawl fishery in the Labrador area.

## 2. Southern Newfoundland Stocks

The southern Grand Bank cod (Div. 3N, 30) is characterized by sharp fluctuations (Table 1). The juveniles of a strong year-class are about 50 times as abundant as those of a poor year-class. The sharp fluctuations in the year-class strength are caused by complicated and variable environmental conditions on the southern Grand Bank (close juxtaposition of cold and warm currents, vast shallow areas cooled down in winter and warmed up in summer). Sharp fluctuations sometimes balance the effect of the most intensive fishing: the appearance of a strong year-class would for a short time restore the abundance of the exploited stock. It is, therefore, difficult to determine the catch limit for each year. Between 1963 and 1966, for example, the annual catch of the southern Grand Bank cod averaged 80,000 tons and approximately this figure was recommended by ICNAF as a catch limit. But in 1967, due to an extremely large recruitment to the exploited stock, the annual catch amounted to 220,000 tons, i.e., was three times as high as the recommended catch limit.

It has been observed that stronger year-classes of the southern Grand Bank cod occur in the hydrographically cold years. The Grand Bank is the southern limit of the distribution range of cod on the Labrador-Newfoundland Shelf, and the cooling of water masses brings the environmental conditions closer to the optimum, i.e., to those typical of the central part of the distribution range of the species.

On the other hand, the Grand Bank haddock live at the northern limit of their distribution, and this stock finds itself in favourable conditions in hydrographically warm years. Thus, the Grand Bank cod and haddock stocks vary in opposite phases. The last decade is characterized by an increase in the abundance of cod and a decrease in that of haddock (ICNAF Res.Doc. 72/107).

The redfish catch in the Newfoundland area reached its peak in 1958-59 when the specialized trawl fishery started on the northern Newfoundland Bank (Div. 3K). Soon there was an appreciable decline in the abundance of redfish in this area, with redfish becoming only a minor objective of fishing. In recent years Soviet trawlers have been taking bigger redfish catches on the southern slopes of the Grand Bank and St. Pierre Bank (Table 4). There has been no decline in the abundance of redfish in this area so far, which is probably due to a more rapid growth and an earlier recruitment to the commercial stock of these fish as compared to northern populations. Since the southern Newfoundland redfish reach sexual maturity and commercial sizes at an earlier age, they possess better recovery characteristics and are able to compensate for the removal by fishing within a shorter time. The ages at which the deep-water redfish from different areas reach sexual maturity are given in the 1970 Soviet Research Report (Redbook 1970, Part II, p. 126).

Table 4. Redfish catch (tons) by Soviet commercial fleet in the southern Newfoundland area.

Year	Southeast slope of Grand Bank (3N)	Southwest slope of Grand Bank (30)	St. Pierre Bank (3P)	Total (3N-0-P)
1962	679	5,901	-	6,580
1963	-	3,568	-	3,568
1964	35	12,786	45	12,866
1965	68	19,300	-	19,368
1966	5,851	14,667	759	21,277
1967	12,793	17,707	1,216	31,716
1968	14,686	6,364	3,939	24,989
1969	22,068	15,344	22,009	59,421
1970	12,926	12,795	24,153	49,874
1971	23,456	18,433	18,206	60,095

A very interesting feature of redfish belonging to any population is the absence of changes in the size and age composition even when there is a very severe decline in abundance due to heavy fishing. The possible causes are discussed by V.A. Chekhova (Redbook 1970, Part III, p. 153-158).

