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USSR Research Report for 1990

by

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AtlantNIRO Research Activities in the NAFO Subarea 4 in 1990

by

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A. STATUS OF FISHERY

As in 1989 silver hake experimental fishery was made during the second half of May. Dense concentrations were found between 250 and 480 m. During the first and second decades of April situation was similar to that observed in previous year. Catch rates often amounted to 40 t per day fished and even more. Hake were caught at depths from 150 to 350 m.. However catch-per-unit-effort (CPUE) declined sharply during the third decade of April and reached its lowest value at the beginning of May. No dense stable hake concentrations were encountered in May-June to the south of SMGL (Small Mesh Gear Line). Predominantly small species were caught between 59°00'W and 63°00'W. They were met there till the middle of July. The catches increased greatly, but then a sharp decline was observed and at the beginning of February fishing fleet had gone off the Nova Scotian Shelf.

On the whole fishery situation was much more poor as compared to that observed in 1989. The USSR hake catches in 1990 accounted for 54700 t at quota of 57000 t. Catch-per-unit-effort estimates based on field data are shown in Table 1.

B. SPECIAL INVESTIGATIONS

Environmental studies

In 1990 environmental studies were made during two cruises conducted in accordance with the Bilateral Agreement between

the USSR and Canada. The studies mentioned should be considered as a part of the joint researches on silver hake. The first cruise was conducted on RTMA-7111 EVRIKA from May 1 to July 20. The objective of the cruise was to continue studying environmental conditions affecting silver hake distribution pattern on the Nova Scotian Shelf. During this cruise 9 ecological surveys were made and the following measurements were performed:

- 346 oceanographic stations;
- 509 salinity determinations using electrosalinometer;
- 1922 phosphate content determinations using photoelectrocalorimeter.

During exploratory tows feed plankton was collected using both Bongo-60 plankton sampler and ICS-80 plankton net. Both were were attached to the headline to sample plankton directly at the towing depth. Totally 182 zooplankton samples were collected. They are being analysed now to determine qualitative and quantitative composition of plankton species that are considered to be the main feeding objects for silver hake and to make comparative studies of zooplankton and silver hake distributional patterns. Environmental factors and their distribution will be estimated from this point of view as well. Ecological survey data analysis will be made to reveal environmental factors influencing silver hake concentrations formation and distribution. The final results will be presented in special reports. Provisional analysis data on silver hake and environmental factors distributional patterns confirm both a good positive correlation between hake distribution and hydrologic front position in the Shelf-Slope area and timing of silver hake concentrations to the near-bottom temperatures of 7.5-9.5°C, i.e. to the slope water masses. According to the results of six consecutive surveys made in the slope area between 60°30'W and 61°20'W silver hake catches and its distributional pattern are influenced by front dynamics, its acuity and meandering character. At the same time these factors should be considered as ones influencing zooplankton patches distribution. Comparison of zooplankton wet biomass and hake research catch values demonstrates their mutual discrepancy in many cases. It proves other materials concerning hake feeding should be in-

cluded into analysis as well.

Collection of hydrological data was also undertaken by SRTMK-8102 MALTSEVO from September 18, 1990 to January 14, 1991. The cruise was conducted in accordance with the Bilateral Canada--USSR Agreement and the main objective was to estimate juvenile silver hake abundance. During the surveys 108 hydrological stations were made and water temperature was measured using bathythermographs.

Data on water temperature obtained during two cruises were used for 1990 temperature conditions assessing in the Shelf area. The results received will be contained in a special report on year-to-year water temperature fluctuations in the Northwest Atlantic for the last 5-year period.To realize this objective the following data were analysed:

- 1986-1990 average monthly values for sea surface temperature and data on water boundary localization;
- 1978-1990 bathythermographic data obtained during autumn surveys on juvenile hake abundance;
- hydrological data collected by RTMA-7111 EVRIKA in May-July 1990.

Data analysis indicates the 1990 seasurface temperature decrease in Labrador area and on the Grand Bank and Scotian Shelf. The location of boundaries for cold shelf and slope water masses and the Gulf Stream between 59°00'W and 65°00'W shows their substantial south transition in spring, summer and autumn 1990. The situation was close to that observed in "cold" 1988. Hydrographic surveys conducted between May and July demonstrated water temperature decrease at 0-30 m in the greater part of the Scotian Shelf and at 0-200 m in its eastern area. Analysis of autumn water temperature anomalies revealed the difference between surface layer temperature trend and that of more lower layers. The trend of surface layer temperature decrease was firstly observed after 1982 and has continued up to now. Anomalies at 50 and 75 m and in near-bottom layer can be characterized by two periods of temperature increase and 3 periods of temperature decrease. The last period of temperature decrease began after 1986 and has continued till now.

BIOLOGICAL STUDIES

In October-November annual juvenile silver hake (0 age--group) trawl survey was conducted. The studies were based on cooperative USSR-Canada programme. Totally 108 stations were made. According to provisional estimate mean weighted catch per haul for all layers surveyed amounted to 121.2 specimens. Index of abundance for the main layers only (Canada method) was 196.5 specimens. This value is similar to that estimated for 1986 and 1988 year-classes. As far as abundance is concerned these year--classes are considered to be the mean ones. In December repetitive juvenily silver hake survey was begun. It was completed in January 1991.

Studies on adult silver hake distribution and biology were carried out by R/V EVRIKA in May-July 1990 as a part of Canada-USSR scientific research. Totally 216 trawling stations were made on the Scotian Shelf, area to the north of Small Mesh Gear Line (SMGL) including. Length values ranged from 12 to 51 cm; the number of the juvenile specimens in the catches decreased in the north-east direction. Juvenile silver hake constantly occurred in the layers with water temperature of 8-10.5°C. Adult silver hake were most available at 170-200 m within the temperature range of 8.6-9.8°C. Rates of maturation were rather slow as compared to those observed in 1989. Among the feeding objects euphasiids, shrimp, temisto, fish and squid were found.

In June in accordance with the cooperative programme mentioned above mackerel survey was conducted on the Nova Scotian Shelf. The main objective was to study mackerel distributional pattern and ambient conditions for the summer period. Totally 67 trawling stations were made. The data received provisionally show mackerel abundance in the area surveyed to be low in June. This can be explained by the fact that the species spawning movement via the Scotian Shelf to the Gulf of St. Lawrence takes place in April-May. From April to July inclusive collection of biological samples was made by observers on commercial trawlers. Totally about 80000 specimens were measured and 1400 pairs of silver hake otoliths were taken for age determination. Specimens

with length of 26-35 cm prevailed in the catches. Mean length and weight values were notably low as compared to those observed in previous years. (Table 2). As usual specimens of age 2, 3 and 4 predominated (Table 3). However portion of age 2 fish was notably higher than that reported for 1989. Age readings were made using specified technique discussed with Canadian scientists during the last bilateral meeting (March 1990). As it was expected mean age estimates decreased as compared to those observed in 1989.

Compararive analysis of biological state and catch-per-unit-effort estimates by 5-day period for 1989 and 1990 fishery seasons was made by using data on fishery statistics and those obtained by observers. Results received are presented in Tables 4 and 5.

Data collected allow to reveal notable differences in silver hake biological characteristics between 1989 and 1990. It can be suggested that sharp decrease of catch-per-unit-effort observed at the end of April - early May 1990 resulted from the escape of the bulk of the population (mainly large specimens) from the fishery areas. Abnormal environmental conditions mentioned above could be the reason of this escapement as well. So, it is evident that catch-per-unit-effort can't be always considered as reliable index of the Scotian Shelf stock status. Thus, the use of 1990 catch-per-unit-effort estimate for silver hake stock evaluation seems to be rather arguabe.

An attempt was made to estimate silver hake natural mortality (M) for age-group 4 and older fish. For this an assumption was made that fishery mortality rates become relatively constant for fully recruited age-groups. Natural mortality values (M) by age-group calculated according to Waldron (1989) and our estimates are as follows:

Age group	1	2	3	4	5	6
M	0.733	0.642	0.236	0.332	0.521	0.544

It can be expected that results obtained and supported by Waldron's estimates for younger age-groups will give us more realistic value of stock size as compared to those calculated

for many previous years using natural mortality constant coefficient.

In 1992 silver hake of 1987, 1988, 1989 and 1990 year-classes will form the bulk of the fishery stock. On the whole their sizes were similar to those estimated for year-classes which form fishery biomass in 1987-1990. Thus, it is highly probably that in 1992 silver hake stock size will be as large as in the years mentioned.

PINRO Research in the NAFO Area in 1990

by

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Subareas 0 and 1

A. Fisheries status

In October-November 1990, Greenland halibut was fished off Baffin Island by 7 to 9 PST-type trawlers. Hauls ranged from 0.4 to 1 t per 3 to 3.5 hours tow with daily catches varying from 1.2 to 5.4 t (up to 7.5 t on some occasions). The USSR total catch is given in Table 6 (preliminary data).

B. Special research

1. Environmental studies

a. Hydrographic observations

Hydrographic observations were conducted in the Davis Strait in October - early November south of 66°N (Divs. 1BCD and 0B) on RV "Kapitan Shaitanov". The observations involved temperature and salinity measurements in standard depths in 43 random and 24 standard casts on 34-A and II-A transects (Fyllas Bank - Cumberland) (Table 7).

Comparative analysis of water temperature distribution on Cumberland and 34-A transects and water temperature fields over Div.0B for 1990 and 1989 discovered the following:

- the temperature in the upper 50 m was, on average, 1.3°C colder than in 1989;

- mean water temperature in 50-200 m and 200-500 m on Cumberland transect was warmer than in 1989 by 0.6° and 1.0°C on the shelf, and by 1.6°C and 0.3°C on the continental slope, respectively;
- over most of the slope and in the Hudson Strait trough the near-bottom temperatures were colder than in 1989.

Appreciable warming in the intermediate depths on the Baffin Island shelf seems to be indicative of an increased advection of heat into that area with the Irminger component of the West Greenland Current.

2. Biological studies

Greenland halibut (0B+1). In 1990, a trawl survey for Greenland halibut covered Div. 0B and 1BCD. Tows were made, like in earlier years, using standard sampling trawl with a small-meshed insertion that was towed for 1 hour at a speed of 3 knots. Sites of tows were selected through the random point technique with subsequent corrections, if needed, for depth, bottom topography, etc. Off Baffin Island, the survey was conducted from 24 October to 9 November. There were 66 valid tows at depths of 200 to 1500 m. Greenland halibut occurred in hauls over the whole Div.0B. The results obtained on the shelf at depths of 200-500 m indicate that Greenland halibut gradually moved into greater depths of the slope. In 1989, mean catches by stratum within that depth range varied from 10 to 65 kg (average 21 kg), while in 1990, they were not above 20 kg (average 9 kg). These depths were dominated by small Greenland halibut of 18 to 30 cm in length with juveniles of 7 to 9 cm occurring in the shallowest areas. At depths of 500 m to 1000 m, Greenland halibut were scattered and did not gather in commercial amounts. Catches were mostly below 100 kg per valid tow.

The abundance of Greenland halibut in the trawl survey area in Div. 0B had remained at about the same level in three preceding years: 83.8 x 10^6 fish in 1988, 91.8 x 10^6 in 1989, and 88.5 x x.10^6 in 1990 with biomasses of 64,200 t, 83,700 t, and 78,900 t, respectively. A higher abundance and biomass in 1989 relative to 1988 and 1990 seems to be associated with the strong 1984-1985 year-class reported from a Canada shrimp survey in Div. 2J+3KL. Most of the Greenland halibut surveyed in 1990 were distributed at depths of 1100 to 1500 m (Table 8).

In Subarea 1 (West Greenland), trawl surveys have been conducted by the USSR, and Greenland jointly with Japan since 1987. The 1990 survey embraced the period from 8 to 23 October. There were 50 valid hauls from depths of 200 to 1500 m. Greenland halibut occurred in hauls from all the depths. On the shelf, at depths of 201 to 500 m (strata 29, 20, 28, 19, 27), the hauls consisted of a few fish. Mean catch per 1 valid tow varied from 0.6 to 14.8 kg. At depths greater than 500 m, the catches came up to peak (243.6 kg) at depths of 1001-1500 m. It is the depth range that had the more abundant concentrations on the continental

slope.

The length of Greenland halibut varied from 18 to 77 cm in males, and from 18 to 109 cm in females, with a modal group of 50-51 cm in both sexes. Greenland halibut fed poorly. Mean stomach fullness varied (on average by stratum) from 0.00 to 1.33. 75% of the stomachs examined were empty. Most preferred prey for Greenland halibut were squids, shrimps, and fishes (redfish). Total abundance of Greenland halibut, as estimated in the 1990 fall survey off West Greenland, amounted to 73.0 x 10^6 fish with a biomass of 83,000 tons (Table 9).

Roundnose grenadier. A trawl survey off West Greenland (Divs. 1BCD) was conducted from 8 to 23 October, 1990 by RV "Kapitan Shaitanov". Trawling covered the depths of 210 to 1490 m. At depths of 710 to 1000 m, catches of roundnose grenadier were low. The largest amount (990 kg, or 77% of total catch) was taken from 1140 m near Fyllas Bank. The survey showed absence of roundnose grenadier concentrations from the covered depth range. Mean length of roundnose grenadier grew with increasing depth of fishing from 25-35 cm in 700-900 m up to 50 cm in 1400 m. Mean length for all the catches was 43.3 cm.

In Div. 0B, the survey was carried out from 25 October to 9 November at depths of 230 down to 1330 m. No roundnose grenadier were found in hauls from depths less than 720 m. In hauls from greater depths, roundnose grenadier occurred as a small by-catch to Greenland halibut, and only in hauls from about 1300 m, its percentage came up to 42%. The same as in Subarea 1, mean length of roundnose grenadier in catches grew with increasing depth of fishing. For the whole area, it was 48.9 cm.

Subareas 2 and 3

A. Fisheries status

Greenland halibut. In January of 1990, Greenland halibut fishery in Div. 3K was prosecuted by two trawlers (BMRT and PST). They mainly trawled at depths of 460 to 480 m. On some occasions, the hauls amounted to 6 tons per 3 hour tow. From April to September, Greenland halibut occurred in catches as bycatch. In September, two SRTM vessels fished for Greenland halibut using bottom long-line off Labrador along the slope from 400 m down to 1100 m. With a long-line length of 6 km (2,500 to 5,000 hooks), the daily catch was not over 0.5 ton; with a length of 12 km, the catch was 1.3 tons/haul. Off Central Labrador, trawl fishery for Greenland halibut started in the third ten-day period of September. Daily catch ranged between 0.4 and 7.3 tons. Roundnose grenadier occurred as bycatch (about 20-30%).

Roundnose grenadier. Roundnose grenadier directed fishery in Div. 3K was prosecuted by BMRT trawlers only in July and August.

According to preliminary data, for 11 days in July, the catch averaged 12.2 t/day. In the same Division, two BMRTs fished for roundnose grenadier from 20 to 31 August. Daily catch for 51 vessel/days averaged 8.3 tons. Roundnose grenadier concentrations rested in great depths, which complicated the fishery.

Redfish. In 1990, the USSR fishing vessels fished for redfish mostly beyond the economic zone of Canada in the Flemish Cap area, off Southern and Southwestern Newfoundland, as well as within the Canada zone off Southern Newfoundland and in Notre Dame Bay.

Roughly, the USSR catch of redfish in 1990 in the NAFO Area was 36,219 tons. The increased catch, compared to 1989, comes from a higher quota alloted to the USSR on Flemish Cap.
From January to September, "Sevryba"'s and "Zapryba"'s vessels fished using midwater trawls over all slopes on Flemish Cap at depths of 300 to 900 m. Catches ranged from 3 to 8 tons/hr tow. During the first quarter, stormy weather interfered with the fishery. Fishing time loss caused by unfavourable conditions was 31.4-35%.

From January to September, the USSR vessels fished for redfish using bottom and midwater trawls over the southern slopes of the Grand Newfoundland Bank at depths of 150 to 650 m. Fishing efficiency was close to 1989. Fishing conditions were unstable. Basic concentrations of redfish were distributed over the slopes of Div. 3O. In 1991, there has been occasional fishery for redfish in Div. 3K.

Capelin. Prespawning capelin in the northern part of Div.3O was fished from 11 to 25 May, 1990. A small group of BMRTs (up to 6 vessels) had catches in the range of 5 to 20 tons per 1-3 hour tow. By-catches of sandeel, on some occasions, amounted to 30-40%, but normally were below 10%.

The total USSR catch of capelin within the 200-mile fishing zone of Canada was 3,500 tons. That year has had the highest fishing efficiency (48.6 t/vessel-day) since the fishery was resumed in that area in 1988.

The USSR vessels continued the capelin fishery from 18 June, when a part of the stock was beyond the 200-mile fishing zone of Canada about the spawning grounds on Southeastern Shoals (3N). In 1990, the fish left the 200-mile zone of Canada almost 20 days later than in 1989, which appears to be due to abnormally low heat content of waters in the Grand Bank area. In this area, a group of USSR vessels (about 15) operated up to 24 July. Mean daily yield was 54 tons.

The USSR quota for 1990 on the feeding grounds (2J3K) was 21,000 tons. In addition, by agreement with Canadian firms, some capelin

fishery was exercised on commercial basis. The USSR catch of capelin in that area totalled 52,000 tons.

Capelin fishery on the northern slopes of Hamilton Bank started early in September. Fishing conditions remained good in September and October. From the first half of November, as the fish started southward migration, the fishing conditions became unstable. The poorest fishing efficiency was reported in late November-first half of December, and the fishery was, therefore, ceased in mid-December. The fishing efficiency in that area averaged 49 t/vessel-day.

Other fishes. No directed fishery was conducted for the other fishes. Some negligible by-catch was seen in the redfish, Greenland halibut, roundnose grenadier, and capelin fisheries.

B. Special studies

1. Environmental studies

a. Hydrographic observations

Hydrographic works were performed in Subarea 2 on the Labrador shelf and continental slope in September-November by RVs "Kapitan Shaitanov" and "Vilnius". Temperatures and salinities were measured in standard depths from 15 random casts in Div. 2G and 2J, and 17 casts on standard transects 8-A and 38-A.

In 1990, mean water temperature in the cold component of the Labrador Current in 0-200 m was by 0.6°C below the long-term mean and the 1989 temperature. In the Irminger component, the temperature in the same depth was also by 0.6°C below normal and close to 1989. In 200-500 m and 500-1000 m, anomalies were -0.2 and -0.3°C, respectively.

b. Hydrographic observations in Subarea 3

Hydrographic works in Subarea 3 were performed from March to June by RV "Persey-III", in September and November-December, by RVs "Kapitan Shaitanov" and "Vilnius".

In the cruise by RV "Persey-III", standard temperature and salinity measurements were done from 354 random casts on the Newfoundland shelf and Flemish Cap. The data from this survey were used in estimation of near-bottom water temperatures in the nodal points of a regular half-degree grid and their anomalies from the long-term means derived for 1972-1986 (Borovkov and Tevs, 1988 MS).

The estimates showed that in March-May, 1990, the near-bottom water temperatures, practically all over the Newfoundland shelf, were below normal and the 1989. The largest negative anomalies, exceeding - 2°C, were recorded on the southwestern and southern slopes of the Grand Bank. Minor positive anomalies in the near-

bottom temperatures were only seen in some locations on the continental slope in Divs. 3K and 3L.

Relative to the long-term means, and considering the range of year-to-year variability, the most appreciable cooling in the near-bottom waters occurred on the Grand Bank with depths of less than 200 m and in limited areas on the continental slope in Divs. 3K and 3L.

Mean water temperature in Divs. 3NO was by 1.6°C, and in Divs.3KL by 0.7°C below normal estimated for the 1972-1986 period.

The area covered in Divs. 3NO by waters with "below normal" and "by far below normal" temperatures was over 90% of the total area of the Divisions. In Divs. 3KL this area increased from 45% in 1989 to 80% in 1990. Such a great cooling in the near-bottom waters on the Newfoundland shelf has not been reported since the observations started in 1971.

In the fall period, 97 random casts were made on the Newfoundland shelf. In September, the surface water temperatures on the eastern slope of the Funk Island Bank were 1.5°C, on the average, colder than in 1989. A relative increase in the vertical strength of the cold intermediate layer and colder temperatures in it were noted. In 250-800 m, water temperatures were 0.3-0.7°C, and near bottom 0.1-0.4°C warmer than in 1989, which seems to be indicative of an increased deep-water advection of heat.

2. Biological studies

In 1990, like in earlier years, the basic attention was paid to assessment of commercial fish stocks through trawl and acoustic surveys. The details on the scope and terms of the surveys are given in Table 10.

Roundnose grenadier (2+3K). Trawl survey in Div. 2G was conducted by RV "Kapitan Shaitanov" from 23 to 29 November in the depth range of 550 to 1380 m. No roundnose grenadier occurred in the hauls from the depths of less than 920 m. In the depth range of 920 m down to 1200 m roundnose grenadier had a small percentage in hauls. The largest haul (733 kg/hour tow) was taken from 1300 m. Roundnose grenadier dominated in hauls from depths greater than 1200 m. Mean length of fish increased with depth of fishing. Mean length of roundnose grenadier from all the hauls was 43.2 cm.

On 20 to 28 September, 1990; special tows by 100 m depth interval were done in Div. 3K by RV "Kapitan Shaitanov" to study the vertical distribution of bottom fishes. Bottom trawlings embraced the depth range of 550 to 1450 m. No roundnose grenadier occurred in hauls from depths of less than 700 m; the hauls from 1001 to 1200 m ranged from 40 to 100 kg per 1 hour tow to go up to 570 kg in depths greater than 1400 m, which was 80-90% of the total catch.

Mean length of roundnose grenadier in Div. 3K for all the hauls was 53.9 cm. Mean length and percentage of females increased with depth of fishing. Detailed information concerning distribution and biology of roundnose grenadier is given in a paper by P. Savvatimsky (SCR Doc. 91/).

Greenland halibut (2G,3K). Unfortunately, trawl survey for Greenland halibut in 1990 was done only off northern Labrador. 21 tows were done from 23 to 29 November in depths ranging from 501 to 1500 m. **Table 11** presents mean values for Greenland halibut catches reflecting the density of concentrations in the surveyed area. The largest hauls were associated with the depth range of 1251 to 1500 m.

Male length varied from 23 to 73 cm with modal group of 46-47 cm; female length ranged from 22 to 97 cm with modal group of 48-49 cm. Linear and weight size of both male and female Greenland halibut grew with depth of trawling: mean length of males from depths of 501 to 750 m was 36.2 cm, that of females - 38.9 cm, whereas mean length of males from 1251 to 1500 m was 48.9 cm, and that of females - 57.1 cm.

89.2% of males and 95.4% of females examined in this Division were immature.

The trawl survey in Div. 2G estimated the abundance of Greenland halibut to be 13.1 x 10^6 fish with a biomass of 14,700 t. These values are lowest for the 1984-1990 period (**Table 12**), however, it seems to be associated rather with shrinkage of the survey area than with a decrease in the Greenland halibut stock.

The 1990 trawl survey for Greenland halibut in Div. 3K was conducted from 1 to 18 June by RV "Persey-III". It showed that the years of 1990 and 1989 had similar distribution patterns of Greenland halibut. The densest concentrations of Greenland halibut were found in a deep-water trough (strata 627, 631, 626, 622). The hauls taken there from depths of 350 to 450 m numbered 300 to 1,800 fish per 30 min. tow. The concentrations comprised fish ranging in length from 10 to 73 cm, mostly from 32 to 42 cm at age 4 to 5 (**Table 13**). Greenland halibut fed poorly with preference for fishes and shrimp.

In 1990, the estimated abundance of Greenland halibut in Div. 3K was 131.2 x 10^6 fish with a biomass of 56,100 tons (**Table 14**).

Redfish (3M). In 1990, the commercial part of the Flemish Cap population was mainly represented by fish ranging in length from 24 to 30 cm at age 9 to 11 from the strong 1979-1981 yearclasses. In 1990, a good recruitment was seen that involved fish at age 4 to 5 (30%) from the strong 1985-1986 year-classes. The portion of fish at age 10 and older declined in 1990, compared to 1989, from 31% to 23%.

The trawl survey conducted in June, 1990 indicated that the estimated abundance and biomass of fish within reach of the bottom trawl had decreased from 1989 to stay below the long-term means (Tables 15, 16). The total abundance of redfish was estimated to 1406.1 x 10^6 fish with a biomass of 246,400 tons.

VPA estimated the redfish stock on Flemish Cap as an average one, with abundance being 1550.6 x 10^6 fish and biomass - 386,400 tons

Redfish (3LNO). The hauls on the Grand Newfoundland Bank consisted mostly of 21 to 30 cm fish at age 8 to 11 coming from the 1979-1982 year-classes. The abundance and biomass estimates from the trawl survey indicate an appreciable drop in Div. 3LN commercial stock of redfish (Tables 15, 16). The total abundance was estimated to 139.3 x 10^6 fish, and the biomass - 39,600 tons.

However, an increase in Div. 30 redfish stock should be mentioned. According to the trawl-acoustic survey, the total abundance of redfish in this Division in 1990 came up from 1989 from 464.9 x x 10^6 to 1540.7 x 10^6 fish, and the biomass - from 75,100 tons to297,800 tons. We believe that this increase comes from a redistribution of redfish in the southern part of the Grand Bank.

VPA estimates of the commercial stock indicate a relatively stable redfish stock in Divs. 3LN in recent years (SCR Doc. 91/Vaskov et al.).

Redfish (3K). Fish of 15 to 50 cm in length occurred in sampling hauls in Notre Dame Bay Division. In 1990, the catches by fishing and research vessels consisted basically of 26 to 29 cm long redfish at age 12 to 14. Redfish occurred everywhere, except for the coastal waters.

As demonstrated by the trawl-acoustic survey, in 1990, the redfish stock in this Division was below the 1989 level (596.7 x 10^6 fish and 190,300 tons) amounting to 425.8 x 10^6 fish and 92,300 tons.

Cod (3M). The cod stock was assessed through a trawl-acoustic survey.

The trawl survey showed that in 1990, the Flemish Cap cod stock dropped to one-tenth of the long-term mean for the 1977-1990 period (Tables 15, 16). The trawl-acoustic survey also indicated a decrease in the stock in 1990 providing an abundance of 19.0 x x 10^6 fish, and a biomass of 15,200 tons (SCR Doc. 91/Kuzmin).

Cod (3NO). From the trawl-acoustic survey, the total abundance in the Newfoundland cod stock was 7.8 x 10^6 fish, and the biomass - 60,300 tons; the trawl survey indicated the values of 5.2 x 10^6 and 57,500 tons, respectively (Tables 15, 16).. Therefore, in 1990, there was continuation of the stock decrease that had been seen from 1986. The poor recruitment to the stock from the 1985-

1989 year-classes seems to be the basic reason of the decrease in Div. 3NO cod stock (SCR Doc. 91/Kuzmin).

Cod (3KL). Compared to 1989, in 1990, there were no considerable alterations in the Labrador cod stock values: abundance came from 353.2 x 10^6 to 375.9 x 10^6 fish, but biomass dropped from 547,700 to 459,400 tons (Tables 15, 16). From the trawl-acoustic survey, the estimated abundance and biomass were 646.8 x 10^6 fish and 774,200 tons, which is below the 1988-1989 values (SCR Doc. 91/ Kuzmin).

American plaice (3K, 3LNO, 3M). The 1990 trawl survey discovered a slight increase in the abundance and biomass of American plaice in Div. 3K that in 1990, came to 21.8 x 10^6 fish and 6,900 t (Tables 15, 16).

On the Grand Newfoundland Bank (3LNO), the abundance of American plaice went from 708.5 x 10^6 fish in 1989 down to 350.8 x 10^6 fish in 1990 (Table 15),, and the biomass from 244,600 t to 129,400 t, respectively (Table 16). In 1990, fish between 20 and 40 cm in length predominated in sampling trawl catches.

The estimated abundance on Flemish Cap (3M) was 2.6 x 10^6 fish with an estimated biomass of 1,200 t, which is less than the 1989 values by factors of 3.2 and 4.2, respectively (SCR Doc. 91/Morozova).

Yellowtail flounder (3NO). The 1990 trawl survey in Divs. 3NO estimated the abundance of yellowtail flounder to 60.1 x 10^6 fish and the biomass to 27,500 t, which is close to the 1987-1988 level and below 1989 (Tables 15, 16).. Fish between 35 and 43 cm long predominated in catches.

Capelin (3LNO and 2J+3K). In 1990, the USSR RVs continued acoustic assessment of capelin stocks and trawl survey assessment of 0-group fishes to provide the estimates of yearclass strength in the NAFO Area.

An acoustic survey for capelin in Divs. 3LNO was conducted by RV "Persey-III" from 15 to 29 May, 1990. The biomass of capelin over the surveyed area totalled 3,700,000 t. This indicates a 50% increase from the 1989 stock estimate (2,500,000 t). The increase seems to be associated with the fact that the strong 1987, and especially 1988 yearclasses have entered the stock (the percentage of the 1988 yrcl. came to 52%).

The fall acoustic survey on the feeding grounds (2J3K) was conducted by RV "Kokshaisk" from 6 to 21 November. The estimated biomass in this area was 631,000 t, which is about 6 fold less than the biomass estimate obtained in the spring survey that year in Divs. 3LNO.

In the fall period, in Div. 2J3K, an appreciable portion of the capelin stock was not, probably, surveyed, because due to abnormally low heat content of waters on the feeding grounds (2J3K), it lingered on the north of the Grand Newfoundland Bank (3L) where the survey is not, normally, conducted during this period.

Along with the acoustic survey for capelin, from 22 November to 11 December, 1990, RV "Kokshaisk" carried out a trawl survey for 0-group capelin in Div. 3LNO. The survey results show that the abundance index of the 1990 year-class of capelin in the 0-group stage is close to the strong 1983, 1988, and 1989 year-classes, which allows to expect a good recruitment to the capelin stock in the 2-3 coming years.

Table 1. Soviet silver hake catches per unit of effort by year (t).

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Catch per day fished	26.6	37.2	30.5	38.4	38.9	44.3	32.6	36.8	40.7	28.4
Catch per hour fished	2.00	3.74	2.30	3.18	2.63	3.54	2.98	2.97	3.07	1.84

Table 2. Silver hake length composition for Soviet commercial catches by year (%).

Length, cm	Year				
	1986	1987	1988	1989	1990
15	+	+	-	0.2	+
16	0.3	0.1	-	0.4	0.1
17	0.6	0.3	+	0.5	0.2
18	1.1	0.3	+	0.5	0.4
19	1.2	0.3	+	0.4	0.4
20	1.6	0.2	+	0.5	0.3
21	1.4	0.1	+	1.3	0.2
22	1.0	0.2	+	1.7	0.3
23	0.8	1.2	0.1	1.7	1.4
24	0.6	5.5	0.5	1.6	4.7
25	0.8	12.2	1.8	3.0	10.8
26	2.0	15.2	4.9	4.8	14.8
27	4.5	13.2	10.9	5.2	15.0
28	8.2	9.0	17.5	7.3	12.6
29	13.1	7.2	19.8	11.6	11.4
30	16.9	7.3	16.2	15.2	9.8
31	14.8	6.9	11.8	15.0	7.6
32	12.8	6.7	7.0	12.2	4.9
33	8.7	4.9	4.0	7.5	2.5
34	4.5	3.4	2.7	4.0	1.2
35	2.4	2.2	1.3	2.2	0.6
36	1.4	1.3	0.7	1.2	0.4
37	0.6	0.8	0.3	0.8	0.2
38	0.4	0.5	0.1	0.4	0.1
39	0.2	0.3	0.1	0.3	0.1
40	0.1	0.2	+	0.2	+
41	+	0.1	+	0.1	+
42	+	0.1	+	0.1	+
43	+	+	+	0.1	+
44	+	+	+	+	+
45	+	+	-	+	+
46	+	+	-	+	+
47	+	-	-	+	+
48	+	-	-	+	+
49	+	-	-	+	-
50	+	-	-	+	-
51	+	-	-	+	-
Mean length, cm	29.8	28.4	29.4	29.6	27.7
Mean weight, kg	0.189	0.161	0.190	0.188	0.141

Table 3. Silver hake age composition for Soviet commercial catches (%).

Age	Year				
	1986	1987	1988	1989	1990
1	7.4	1.6	+	5.0	2.3
2	12.9	59.3	42.4	31.7	51.4
3	45.1	21.0	41.3	38.1	32.4
4	28.8	14.5	13.8	20.2	11.6
5	5.3	2.8	2.4	4.1	1.8
6	0.4	0.6	0.1	0.8	0.5
7	0.1	0.2	+	0.1	+
8	+	-	+	+	+
9	+	-	-	+	-
10	+	-	-	-	-
Mean age	3.1	2.6	2.8	2.9	2.6

Table 4. Silver hake catches per unit of effort and some other biological characteristics for 1989 by month and five-day period.

Month and five-day period	Average catch per day fished, t	Average length, cm		Average maturity stage		Average stomack index
		Males	Females	Males	Females	Males and females total
April						
5	52.9	29.2	31.7	4.0	3.0	0.6
6	38.4	29.2	31.2	3.9	3.0	0.1
May						
1	46.9	29.6	31.9	3.9	3.0	0.8
2	48.9	29.6	31.8	4.3	3.0	1.0
3	42.0	29.4	30.8	4.0	3.0	1.0
4	32.4	28.2	29.8	4.3	3.0	1.0
5	36.6	27.8	29.2	3.8	3.2	0.6
6	37.8	28.8	31.0	4.6	3.8	1.4
June						
1	30.0	28.3	29.7	4.5	3.9	1.4
2	36.6	28.5	30.7	4.6	4.2	1.4
3	35.5	27.9	30.7	4.7	3.9	0.8
4	44.5	27.4	29.6	4.8	4.1	0.2
5	25.3	28.5	31.5	4.8	4.1	0.4
6	35.7	28.2	30.6	4.7	4.3	0.3
July						
1	47.0	27.9	30.8	4.6	4.2	0.1
2	38.6	29.0	32.5	4.8	4.7	0.0

Table 5. Silver hake catches per unit of effort and some other biological characteristics for 1990 by month and five-day period.

Month and five-day period	Average catch per day fished, t	Average length, cm		Average maturity stage		Average stomack index	
		Males	Females	Males	Females	Males	Females
April							
1	28.6	27.3	28.7	3.0	3.0	0.8	0.6
2	33.1	27.7	29.2	3.1	3.0	0.4	0.3
3	42.4	28.5	30.4	3.0	3.0	0.1	0.4
4	44.6	28.0	30.0	3.0	3.0	0.8	0.6
5	32.9	27.7	29.0	3.0	3.0	0.3	0.5
6	26.9	26.5	27.9	3.1	3.2	0.7	0.8
May							
1	23.4	26.1	26.8	3.1	3.1	1.0	0.7
2	21.9	27.6	28.3	3.3	3.3	0.8	0.7
3	27.5	27.0	28.5	3.3	3.5	0.3	0.4
4	27.3	27.2	28.7	3.7	3.5	0.8	0.9
5	24.3	27.5	28.9	3.7	3.5	0.6	0.6
6	19.7	26.6	28.8	3.9	3.6	1.0	1.1
June							
1	20.0	26.6	27.9	3.9	3.4	1.5	0.8
2	22.1	27.0	28.9	4.0	3.6	0.6	1.0
3	28.9	27.0	28.9	3.9	3.6	1.6	1.0
4	31.9	26.6	28.2	4.0	3.6	1.2	1.1
5	24.4	26.9	28.4	4.2	3.7	1.2	1.1
6	28.3	27.1	29.0	4.0	3.7	1.4	1.4
July							
1	34.0	26.6	28.5	4.4	4.4	0.1	0.1
2	27.8	27.4	28.7	4.2	4.1	0.6	1.0
3	38.3	26.5	28.1	4.2	4.5	1.4	1.4

Table 6. USSR catch in Subareas 0, 2, 3, 4 in 1988-90, tons.

Fish species	NAFO Divs.	1988	1989	1990+
Cod	2GH	-	-	-
	2J+3KL	11	25	8I
	3NO	2590	5	I8
	3M	34	-	22
	4VWX	106	182	I63
Haddock	4VWX	385	470	272
	3NO	-	-	-
Redfish	2+3K	821	483	I34
(Sebastes mentella)	3LN	11723	10879	7362
	30	5207	4517	38II
	3M	13501	13892	3458I
	4VWX	68	195	243
Roundnose grenadier	0+1	120	1	I0I
	2+3	1890	2552	538
American plaice	2+3K	14	1	8
	3M	228	105	-
	3LNO	64	-	I7
	4VWX	-	-	45
Witch flounder	2J+3KL	4	-	-
	3NO	1005	3	9
	4W	-	-	-
Greenland halibut	0+1	53	32	I528
	2+3KL	1053	915	II6I
Capelin	2J+3K	16825	22512	57073
	3NO	4736	3384	I4076
Silver hake	4VWX	64685	72696	55429
	3NO	-	-	-
Pollack	4VWX	1054	1782	I040
Yellowtail flounder	3LNO	-	-	-
Herring	4VW	920	1212	2236
Mackerel	3+4	654	311	2233
Argentine	4VWX	315	105	I98
Squid Illex	3+4	352	1656	2043
Others		128	37	I2677
Total		128546	137952	I97099

+ Preliminary data

Table 7. Inventory of Oceanographic Stations in the Northwest Atlantic.

COUNTRY: USSR (PINRO) YEAR: 1990

SHIP NAME	NAFO SUB-AREA	NAFO STANDARD SECTION				OTHER STATIONS						TYPE
		Date Span	Name	Parameters (T,S,O_2,etc.)	Tot. Stns.	Seasons JFM	AMJ	JAS	OND	Parameters (T,S,O_2,etc.)	Tot. Stns.	STD or Bottle
Persey III	3						330	24		T, S	354	Bottle
Kapitan	2	04-05.10	38-A	T, S	6							Bottle
Shaitanov	1	23-24.10	Fylla Bank	T, S	9							Bottle
	0	24-25.10	Cumber-land	T, S	8							Bottle
	0	08-09.11	34-A	T, S	7							Bottle
	3							20		T, S	20	Bottle
	1								35	T, S	35	Bottle
	0								24	T, S	24	Bottle
	2								8	T, S	8	Bottle
Kokshaisk	2	02-05.11	8-A	T, S	11							Bottle
	2								29	T, S	7	Bottle
	3								55	T, S	77	Bottle

Table 8. Results from the trawl survey for Greenland halibut in Div. 0B in November, 1990.

Stratum	Depth, m	Nos of tows	Mean catch/hr tow		Abundance, '000 fish	Biomass, tons
			fish	kg		
I	20I-300	3	0.3	0.3	33.8	25.9
8	-"-	3	I2.7	0.8	I955.6	I2I.3
22	-"-	3	0.3	I.I	3I.9	I03.I
2	30I-400	3	47.0	I4.3	3768.2	II48.I
9	-"-	5	I0.8	2.5	I886.7	43I.7
23	-"-	3	64.0	I3.5	260I.7	547.I
3	40I-500	3	29.3	20.3	3336.0	2306.6
I0	-"-	5	4I.8	I2.5	2846.0	849.I
24	-"-	5	44.0	II.9	2772.0	746.6
4	50I-750	3	89.3	92.6	I8I4I.8	I880I.8
II	-"-	6	63.3	4I.9	6363.3	4208.9
25	-"-	4	63.8	36.3	5903.8	3364.I
5	75I-I000	5	II5.2	II5.6	I0368.0	I0404.8
I2	-"-	4	85.3	78.8	3495.3	3229.8
6	I00I-I250	5	207.0	253.8	I7775.0	2I795.4
I3	-"-	3	236.3	248.3	3524.4	3702.2
7	I25I-I500	3	5I.7	I00.2	3686.5	7I50.0
Total	20I-I500	66			88490.0	78936.5

Table 9. Results from the trawl survey for Greenland halibut in Div. 1BCD in October, 1990.

Stratum	Depth, m	Nos of tows	Mean catch/hr tow		Abundance, '000 fish	Biomass, tons
			fish	kg		
29	20I-300	3	I0.0	2.8	74.3	20.8
20	30I-400	3	I.3	0.6	23.0	I0.6
28	-"-	3	27.7	8.2	3II.9	92.3
I9	40I-500	3	2.7	I.4	I6.0	8.3
27	-"-	3	36.7	I4.8	432.4	I74.4
II	50I-750	4	76.8	72.4	6658.2	6276.8
I8	-"-	3	55.3	48.8	I567.6	I383.4
26	-"-	6	76.7	6I.5	II828.5	9484.4
I2	75I-I000	4	75.0	80.I	5I65.2	55I6.5
I7	-"-	5	I75.4	I96.I	I29I8.6	I4443.2
I3	I00I-I250	3	230.3	243.6	I20I5.7	I2709.6
I6	-"-	4	I33.3	I99.9	I2228.8	I8338.7
I4	I25I-I500	3	I69.3	243.6	6654.2	9574.5
I5	-"-	3	92.3	I48.5	3II0.I	5003.8
Total	20I-I500	50			73004.5	83037.3

Table 10. Inventory of biological surveys, 1990.

Sub-area	Division(s)	Month(s)[1]	Type of survey[2]	Nature of survey	No. of sets
3	3KLNO	4-6	S	Groundfish, temperature, salinity	393
	3LNO	5	O	Capelin, temperature, salinity	22
	3M	6-7	O	Eggs, larvae, temperature, salinity	43
	3M	6-7	S	Groundfish, temperature, salinity	119
0	0B	10-11	S	Greenland halibut, grenadier, temperature, salinity	66
2	2G	11	S	Greenland halibut, grenadier, temperature, salinity	21
	2J3K	11	O	Capelin, temperature, salinity	14
1	1BCD	10	S	Greenland halibut, grenadier, temperature, salinity	50
3	3K	9	O	Grenadier, greenland halibut, temperature, salinity	47
	3LNO	11-2	O	Larvae of capelin, temperature, salinity	55

[1] Use number from 1 to 12 for months.

[2] Insert S for stratified-random and O for other surveys.

Table 11. Results from the trawl survey for Greenland halibut in Div. 2G in November, 1990.

Stratum	Depth, m	Nos of tows	Mean size, cm	Mean weight g	Mean catch/1 valid tow: fish	Mean catch/1 valid tow: kg	Abundance '000	Biomass, tons
921	501-750	1	38.03	529	10.0	10.1	-	-
929	-"-	3	41.76	826	50.0	41.3	2741.3	2264.3
915	751-1000	3	45.82	863	94.7	81.8	395.3	341.4
920	-"-	3	44.55	829	184.0	152.6	1376.0	1141.2
916	1001-1250	4	48.24	988	76.0	75.1	482.4	476.7
919	-"-	3	48.51	1042	234.0	243.8	3214.9	3349.6
918	1251-1500	3	52.84	1467	216.7	317.8	4852.2	7116.0
917	-"-	1	47.00	920	1.0	0.92	-	-
Total	501-1500	21					13062.1	14689.2

Table 12. Abundance (× 10^6 fish) and biomass (× 10^3 tons) of Greenland halibut in Div. 2GH as estimated in trawl surveys in 1984-90.

Year	Abundance	Biomass	Survey area, '000 sq. miles
I984	65.7	85.8	5.9
I985	I7.3	I6.3	4.7
I986	-	-	-
I987	23.8	22.4	I5.3
I988	I6.4	I3.7	I7.2
I989	28.I	36.9	6.6
I990	I3.I	I4.7	2.6
Mean for 1984-1990	27.4	3I.6	
1990 as % to 1989	46.6	39.8	

Table 13. Age composition of Greenland halibut in Div. 3K in 1986-90 from trawl survey data, %.

Age	Males					Females				
	I986:	I987:	I988:	I989:	I990:	I986:	I987:	I988:	I989:	I990
I	2	4	2I	2	-	3	-	32	I0	I
2	38	85	I24	9I	63	6I	I02	I23	I27	98
3	97	I77	325	I76	I90	II4	I58	263	I72	I7I
4	I50	I09	I47	262	27I	I38	II6	I56	250	245
5	236	I47	I9I	I76	235	2I3	I2I	I83	I96	245
6	258	245	I22	202	I75	237	I99	I44	I65	I40
7	I56	I86	4I	77	59	I4I	202	59	56	92
8	45	26	2I	7	6	50	47	27	I0	7
9	I5	I7	5	6	I	2I	25	8	6	2
I0	3	3	2	I	-	I0	9	3	3	I
II	-	2	-	+	-	3	8	I	I	-
I2	-	+	-	-	-	3	5	I	2	+
I3	-	-	-	-	-	3	4	I	I	-
I4	-	-	-	-	-	I	I	-	-	-
I5	-	-	-	-	-	I	-	-	I	-
I6	-	-	-	-	-	I	I	-	-	-
I7	-	-	-	-	-	+	2	-	-	-
I8	-	-	-	-	-	+	-	-	-	-
I9	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-
Nos of fish	7006	33II	4424	2558	3585	8I65	4030	4983	2897	35I9
Mean age	5.32	5.05	4.04	4.52	4.47	5.34	5.3I	4.23	4.37	4.47

Table 14. Abundance and biomass of Greenland halibut in Div. 3K in 1981-90 (from trawl surveys).

Year, month	Surveyed area, mile^2	Nos of tows	Abundance, 10^6 fish	Biomass, 10^3 tons
1981, January	9479	34	57.1	62.3
1981, July	20755	48	110.2	62.5
1982, July	23030	53	154.9	98.4
1983, January	19954	67	120.2	96.7
1983, July	27926	94	587.8	122.6
1984, July	31185	113	288.6	216.7
1985, July	19012	53	127.1	72.9
1986, June	31185	122	266.4	174.8
1987, May-June	28470	108	129.7	66.9
1988, April-May	28470	107	303.1	112.3
1989, June	27886	108	182.6	80.8
1990, June	25761	104	131.2	56.1

Table 15. Abundance of bottom fishes in SA 3 from trawl surveys in 1983-90, $\times 10^6$ fish.

Species	Div.	1983	1984	1985	1986	1987	1988	1989	1990
Cod	3K	35.2	295.9	286.0	270.4	132.9	306.2	229.9	276.3
	3L	121.5	311.9	180.7	297.0	73.4	89.4	123.2	99.6
	3NO	137.3	259.3	520.7	269.8	54.2	55.4	13.4	5.2
	3M	65.5	60.7	37.1	37.2	36.8	26.7	70.4	4.3
Redfish	3K	964.3	749.1	810.3	816.1	154.6	44.1	68.5	44.6
	3LN	428.9	720.3	245.1	133.4	182.1	167.3	44.7	23.1
	3O	1187.8	763.8	1232.4	750.7	99.4	348.8	170.4	537.8
	3M	644.0	376.7	177.3	1200.2	463.2	183.1	283.8	74.7
American plaice	3K	144.7	93.3	48.8	48.3	44.4	56.9	17.6	21.8
	3LNO	1440.2	1295.6	693.8	826.8	604.3	458.6	708.5	350.8
	3M	20.4	26.5	15.8	33.4	16.5	10.0	8.3	2.6
Yellowtail flounder	3NO	257.4	261.0	194.0	89.6	64.8	45.4	128.2	60.1
Witch flounder	3K	8.5	16.2	28.4	22.1	8.3	5.5	4.9	3.5
	3LN	2.4	12.6	15.3	7.5	6.3	3.0	4.6	1.9
	3O	2.8	4.3	6.6	11.8	6.0	10.3	5.1	4.3

Table 16. Biomass of bottom fishes in SA 3 from trawl surveys in 1983-90, $\times 10^3$ *tons*.

Species	Div.	1983	1984	1985	1986	1987	1988	1989	1990
Cod	3K	56.0	355.3	243.6	271.3	130.5	331.2	352.2	335.7
	3L	202.3	383.3	177.1	437.2	132.9	159.4	195.5	123.7
	3NO	182.8	266.8	457.7	425.4	289.8	110.2	81.5	57.5
	3M	23.1	31.2	28.1	26.1	10.2	7.7	36.5	3.9
Redfish	3K	376.6	319.8	356.9	372.8	69.5	13.8	34.5	21.7
	3LN	125.0	199.4	85.9	46.8	60.8	40.0	10.9	7.1
	3O	127.4	108.7	129.0	109.4	19.2	34.5	27.9	98.6
	3M	154.9	132.3	51.9	309.5	106.4	47.0	83.3	17.7
American plaice	3K	64.5	52.7	17.9	18.9	18.4	13.9	5.9	6.9
	3LNO	533.8	642.1	325.6	348.6	225.8	160.4	244.6	129.4
	3M	8.9	7.5	7.8	20.2	9.3	6.5	5.0	1.2
Yellowtail flounder	3NO	113.3	96.9	84.5	39.5	26.5	20.8	43.8	27.5
Witch flounder	3K	6.2	13.0	19.8	14.5	5.0	3.1	3.2	2.1
	3LN	2.0	9.3	12.2	6.2	4.7	1.9	3.1	1.2
	3O	1.3	2.5	3.4	5.9	3.9	6.8	2.9	2.7