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Review of Russian Bottom Trawl Surveys in the NAFO Subareas 0, 2 and 3 for 1961-1995

by

A. Yu. Bulatova, A. A. Vaskov, V. M. Kiseleva and P. I. Savvatimsky

Polar Research Institute of Marine Fisheries and Oceanography (PINRO)
6 Knipovich Street, Murmansk 183763, Russia

ABSTRACT

The paper provides data on trawl surveys carried out by Russia in the NAFO area during last 35 years.

All the years of investigations are conventionally divided into 4 periods, i.e 1954-1960, 1961-1970, 1971-1982, 1983-1995, during which changes in methods for trawl surveyes were done, as well as when collecting biological data and calculating stocks assessment.

A short description of the investigations is given in the paper and problems pertained to the difficulties of conducting the trawl surveys, mainly during the recent years, are considered.

INTRODUCTION

Retrospective review of Russian (USSR) trawl surveys in the NAFO area was done to maintain long-term series of observations and further using of data with allowance for the changes introduced into the methods of sampling and processing of biological data. The changes were done depending on the task preset when passing from quantitative assessment of young fish only to estimation of commercial fish total stock, as well as when changing a type of vessel, trawl, haul duration, methods for calculation of abundance and biomass indices. Depending on the methods applied, all the years of investigations were conventionally divided into 4 periods, i.e. 1954-1960, 1961-1970, 1971-1982, 1983-1995, a short description of which is given below, as well as contents of the investigations carried out.

MATERIAL AND METHODS

Contents of the investigations

The first investigations carried out by the Polar Institute in the NAFO (ICNAF) area refer to 1954. In 1954-1960 new fisheries areas were explored and most attention was given to obtaining and accumulating of biological data from fish-searching vessels. In December 1961 - January 1962 regular observations over stock status of commercial fishes were initiated during the first trawl survey. Despite the changes in programmes for research during different years, stock assessment of commercial fishes and prediction of their expected catch remained to be the main aim of all further syrveys.

Monitoring over a status of stocks was undertaken based on comprehensive studies on ecosystem. Environmental conditions of dwelling and formation of fish aggregations were studied, i.e. bottom topography, bottom composition, ice coverage and meteorological conditions. Direction and velocity of currents were studied and temperature, salinity and chemical composition of water from surface to bottom by standard depths were

determined in trawling points and along oceanographic sections crossing the shelf and slopes in all the areas from the North Labrador to St.Pierre Bank.

To characterize food supply and feeding migrations of fish a species composition of benthos from catches taken by a bottom trawl was analyzed; zooplankton samples were collected at trawling depth and in pelagial. Analysis for stomach content of different fish species from each catch allowed to reveal differences in feeding conditions depending on depth and water mass prevailed. To study daily rhythmicity of feeding, its intensity and vertical migrations of fish the daily observations over feeding concentrations were performed with hauls at the same position with specific time intervals.

Feeding, spawning and wintering migrations of fish were studied by results of tagging and recoveries from tagging. Location of spawning grounds was dependent on state of gonads in fish caught and on quantity of eggs and larvae in ichthyoplankton samples taken at different sections on the shelf. Data on quantity of eggs and larvae were used to estimate preliminary value for recruitment.

During a number of cruises studies were undertaken on populations based on parasitological and morphometric analyses, as well as on observations over distribution and direction of fish migrations.

To characterize stock status the data on quantity of fish in catches, their length-age, weight and sex composition, maturity, fatness and condition factor were gathered.

Besides, an extensive programme for research surveys included studying on bottom fishing trawl selectivity, technological investigations and searching of new methods for processing marine products. In 1985, an attempt was undertaken to assess stocks applying television and underwater camera. However, no special success was attained due to some technical problems.
Methods for trawl surveys

1961-1970 trawl surveys. Data on trawl surveys carried out during past 35 years are given in Table 1.

During 1961-1970 the surveys were carried out by side trawlers. Bottom trawl with a distance of trawl wings 10-12m and 1.6-1.8m opening height with 9-meter fine-meshed insertion (8-10mm mesh bar) in a codend surved as a fishing gear. Speed of trawling was 3.2 knots with a duration being 1 hour. The number of trawl stations was planned from cruise duration. During the first years, when the methods of trawl surveys was developing, hauls were done in Subareas 6-11 and their number in each of them was small. Position of trawl stations was taken on random, the points of the most successful hauls were annually tested.

In 1967, to cover the area more completely a grid of trawl stations was expanded and number of areas surveyed was limited by Subareas 3K, 3L, 3N, 3O, 3P, where about 300 hauls were performed during a cruise by the end of the period (1967-1970). Trawl station position became relatively constant and it was the same every year.

The 1961-1970 surveys aimed at estimating a size of recruitment by method of quantitative assessment of young cod and haddock to 35cm and S.marinus to 15cm length. Until 1967 surveys were carried out in autumn-winter period. Since 1968, when the season of observations was shifted to spring-summer, cod and haddock at length to 40cm and redfish to 20cm long have begun to refer to young fish. Fish larger than mentioned above were measured without determining their total number in catches. Age samples of young fish were taken from different catches in order to represent specimens from all size groups. Samples of adult fish were usually taken from concentrations, by size, 300 specimens from each area.

Strength of the next yearclasses was determined by indices of relative abundance/number of young fish from each yearclass in mean catch per trawling hour.

1971-1982 trawl surveys. Since 1970 in Subarea 3K and since 1971 in all Subareas the surveys have been carried out by stern trawlers, most frequently by MB-1202 "Persey-III". Since this time and during all subsequent surveys a trawl with a distance of trawl wings 14.3m and 4m opening height has been used. Length of small-meshed insertion in a codend was equal to 19m, with a mesh bar being 10-12mm. Speed of trawling was 3.5 knots with 1 hour duration. To maintain the long-term series of observations and to obtain comparable data 141 hauls were performed by BRT-96 "Rossia" and BMRT-1202 "Persey-III" in parallel courses at the same cod aggregations in 1970. Comparison of catches taken by different-type vessels and different trawls has shown the catches by BMRT "Persey-III" to be on the average by 1.4 times higher than those taken by BRT "Rossia".

Hauls, as in the previous period, were planned to be at the stations with the position preset, while a position of trawl stations somewhat varied during the surveys depending on the depth preset, bottom topography, bottom conditions and on other reasons.

Since 1971 the surveys have become total, i.e. all the caught fish of any species and of all length groups were quantitatively assessed. For quantitative estimation of specimens the same method was used as in the previous surveys, i.e. measurements, single specimen calculation or, in case of large catches, containers were used. Weight of fish in catches was determined for main commercial species. To this end, by the data on age samples the length-weight keys were developed which were supplemented and corrected during next surveys.

When assessing stocks mean quantity and mean weight of fish in catch per trawling hour were assumed to be the indeces of abundance and biomass. These indices were determined for each species and area by dividing the total number and weight of fish caught into the number of hauls including the empty ones.

Besides spring-summer surveys in Subarea 3, since December 1980 autumn-winter trawl surveys have been conducted both in Subarea 3 and Subareas 0, 1, 2 to assess stocks of halibut, to collect data on rock grenadier and to determine percent ratio of these fishes at different depth.

1983-1995 trawl surveys. Since 1983 trawl surveys and stock assessment have been carried out according to Canadian methods (Doubleday, 1981).It allowed Russia to obtain data comparable with results from the analogous surveys performed by other countries. As in the previous years, until 1990 BMRT-type vessels were used in the surveys; however, in 1985 the survey was carried out by PST-type vessel (smaller tonnage), which since 1991 have completely been replaced by large freezer trawlers. For sampling hauls the same trawl was used as in the previous years. Speed of trawling was constant - 3.5 knots. Duration of hauls was 1 hour in 1983, but since 1984, in order to increase their number, 30-minute haul duration has been used. During a cruise in Subareas 3K, L, M, N, O from 450 to 550 hauls were performed.Position of trawl stations was determined on random depending on the depth preset, rocky bad bottom, different sub- and underwater obstacles with allowance for a boundary of fishing zone. 3 and more hauls were planned for each stratum depending on its area.

Since 1984 quantitative assessment has been done only for main commercial fish species - haddock, cod, redfish and four flatfish species.

In 1985 age samples were collected using Canadian methods. To analyze fish for age, 15-20 specimens per length group were taken from different catches. If the fish were measured by sex, then 20 males and 20 females per length group were taken for age analysis. The indices for relative abundance and biomass were calculated as following. Mean number and weight of fish in catch from the area fished off by trawl per time unit (1hr or 30 min) were determined by a number of hauls in each stratum.

Further caculation was done using the formula:

$N = S : s * n,$

where: N is abundance (or biomass) of fish in the stratum preset;

S is stratum area;
s is fished off area;
n is mean number (or weight) of fish in catch per time unit.

The fished off area was determined as a product of distance covered by vessel with a trawl per 1hr (or 30 min) and distance between trawl wings. With the speed of 3.5 knots vessel with a trawl covered 3.5 miles per 1hr and 1.75 miles per 30 min. In this case, distance between trawl wings was 14.3m. The area fished off by trawl during 1-hour trawling was equal to 0.027 miles^2 and to 0.0135 miles^2 during 30-minute haul. Trawl efficiency coefficient was conventionally assumed to be 1.

The indices of relative abundance and biomass of fish calculated for each stratum were summarized by area on the whole.

Since 1985, on the Flemish Cap Bank, and during subsequent years, in all areas of Subarea 3 the trawl survey has been followed by hydroacoustic survey, that allowed to assess abundance and biomass of fish in layers inaccessible to fishing off by a bottom trawl. The abundance and biomass indices obtained based on the bottom trawl survey and acoustic survey were summarized, that allowed to produce more accurate estimate for stocks and approximate their values to absolute.

CONCLUSION

It should be noted that, as time passes, the expanded programme for research performed by PINRO in the NAFO area, for some reasons independent of us, has grown shorter and become more specific. During recent years a general economic crisis in Russia has influenced the possibilities of the Polar Institute to carry out regular observations, i.e. different type of vessels, derangement of timing of vessel operations and of the surveys themselves; sometimes a survey was limited only by one area - the Flemish Cap Bank. Thus, biological information was incomplete and closure of fisheries areas resulted in unreliable fisheries statistics, analitical methods for stock assessment and TAC could not be applied.

REFERENCES

DOUBLEDAY, W.G. Editor. 1981. Manual on groundfish survey in the Northwest Atlantic. NAFO Scientific Council Studies. No.2. Dartmouth, Canada, 55 pp.

Table 1.

Information regarding trawl surveys conducted in 1961 - 1995

Year	Period	Area	Vessel	Cruise No.	Number of valid hauls	Principle objective
1	2	3	4	5	6	7
1961-1962	Dec -Mar	2J,3KLMNOP, 4VWX,5Z	BRT-95 "Pobeda"	1	181	Quantitative assesment of young cod and haddock
1962-1963	Dec -Jan	2GHJ,3KLMNOP	BRT-95 "Pobeda"	4	180	(to 35 cm) and redfish (to 15 cm)
1964	Jan -Mar	2J,3KLMNOP	BRT-95 "Pobeda"	1	148	- " -
1964-1965	Dec -Feb	3KLMNOP	BRT-97 "Sevastopol"	22	153	- " -
1965-1966	Dec -Feb	2GHJ,3KLMNOP	BRT-97 "Sevastopol"	24	118	- " -
1967	Jan -May	2J,3KLMNOP	BRT-99 "Novorissijsk"	21	182	- " -
			BRT -97 "Sevastopol"	26		
1968	Apr -June	3KLMNOP	BRT-96 "Rossiya"	10	222	Quantitative assesment
1969	Apr -Jul	2J,3LMNOP	BRT-96 "Rossiya"	11	276	of young cod and haddock
1970	Mar ,	3K	BMRT-1202 "Persey-Ш"	4		(to 20 cm)
	May-Aug	3LMNOP	BRT-96 "Rossiya"	13	299	- " -

Table 1. (continued)

1	2	3	4	5	6	7
1971-	May -Aug	3 KLMNOP	BMRT-1202 "Persey-III"	6	240	Total survey
1972	Apr - Jul	3 KLMNOP	- " -	8	241	- " -
1973	June-Aug	3 KLMNOP	- " -	11	291	- " -
1974	June-Aug	3 KLMNOP	- " -	12	266	- " -
1975	June-Sept	3 KLMNOP	- " -	14	295	- " -
1976	Mar-Jun	3 KLMNOP	- " -	15	294	- " -
1977	Apr-Jul	3 KLMNO	- " -	18	227	- " -
1978	May-Jyl	2J,3 KLMNO	- " -	20	262	- " -
1979	Mar-Jun	3KLMNO	BMRT-2645 "Suloy"	2	309	- " -
1980	Apr-Jul	2J,3 KLMNO	BMRT -0422 "Kononov"	2	334	- " -
1980-	Dec-Jan	0B,3K	- " -	3	69	Survey halibut
1981						
1981	Jun-Jul	2J,3 KLMNO	- " -	4	232	Total survey
	Dec	0B	BMRT-1202"Persey"	26	11	Survey halibut
1982	Apr-Jul	2J,3KLMNO	BMRT-2645 "Syloy"	2	324	Total survey
	Jul	3K	- " -	2	53	Survey halibut
1982-	Nov-Jan	0B,3K	- " -	26	51	- " -
1983			- " -		67	- " -

Table 1.(continued)

1	2	3	4	5	6	7
1983	May-Jul	3KLMNO	BMRT-2645 "Suloy"	27	464	Total survey
	Jul	3K	- " -	-"-	94	Survey halibut
	Nov-Dec	OB,2GH	- " -	29	126	- " -
1984	Mar-Jul	3KLMNO	- " -	30	514	Total survey
	Jul	3K	- " -	-"-	113	Survey halibut
	Sept,	OB	- " -	31	105	- " -
	Nov-Dec	2GH	BMRT-0023 "Kuropatkin"	6		- " -
1985	Mar-Jun	3KLMNO	PST-1363 "Genichesk"	2	447	Total survey
	Jun	3K	- " -		53	Survey halibut
	Nov-Dec	OB,2GH	BMRT-422 "Kononov"	33	83	- " -
1986	Apr-Jul	3KLMNO	- " -	34	540	Total survey
	Oct	OB,2GHJ,3K	PST-1330 "Klenzi"	23	125	Survey halibut
1987	Mar-Jul	3KLMNO	BMRT-1202 "Persey-III"	37	530	Total survey
	Sept-Nov	OB,1BCD,2GH	PST-1366 "Shajtanov"	8	195	Survey halibut
1988	Mar-Jul	3KLMNO	BMRT-1202 "Persey-III"	40	524	Total survey
	Aug-Dec	1BCD,OB,2GH,3K	PST-1366 "Shajtanov"	12	260	Survey halibut
1989	Mar-Aug	3KLMNO	BMRT-1202 "Persey-III"	43	589	Total survey
	Aug-Dec	1BCD,OB,2G,3K	PST-1366 "Shajtanov"	17	161	Survey halibut
1990	Mar-Aug	3KLMNO	BMRT-1201 "Persey-III"	48	512	Total survey
	Aug-Dec	1BCD,OB,2G,3K	PST-1366 "Shajtanov"	23	184	Survey halibut

Table 1.(continued)

1	2	3	4	5	6	7
1991	Mar-Jul	3LMNO	PST-1362 "Vilnus"	35	368	Total survey
1991-	Aug-Jan	0B,2GHJ,3KLM	PST-1362 "Vilnus"	25	285	Survey halibut
1992	Apr	3M	PST-1366 "Shajtanov"	27	53	Total survey
	Oct-Dec	0B,2GHJ,3KLM	PST-1366 "Shajtanov"	28	147	Survey halibut
1993	Apr-Jul	3LMNO	PST-1362 "Vilnus"	43	300	Total survey
1994	Jun-Jul	3L	PST-1362 "Vilnus"	48	85	Survey halibut
1995	May	3M	STM-0708 "Oleniza"	6	58	Total survey