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USA-USSR Cooperative Fishery Research in 1970

by

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Introduction

The 1970 cooperative research program was the fourth in the series begun in 1967. The primary objective was to continue development of groundfish survey techniques for monitoring groundfish abundance. A standard survey was conducted from Cape Hatteras to the Laurentian Channel, employing the two U.S. research stern trawlers Albatross IV and Delaware II from Woods Hole, and the Soviet scouting vessel KVANT from Kaliningrad.

In addition to the standard groundfish survey, the 1970 operations included an intensive series of trawl comparisons aboard the KVANT (see Res. Doc. 71/61). Also there was a joint cruise involving Canada as well as the US and USSR in a study of sea herring spawning on Georges Bank. A Canadian submersible was used to make first hand observations of herring egg patches while the Soviet vessel Alferas carried out concurrent studies of egg and larval abundance using bottom grabs and plankton gear; Albatross IV was utilized chiefly as a carrier vessel for the submarine. Results of this operation are reported in research document 71/85.

In this document we present a brief summary of the 1970 joint US-USSR groundfish survey operations. Included are further observations on relative fishing power of the standard survey trawls, as well as distribution and abundance of a few selected species.

Survey Methods and Operations

Station selection followed the standard stratified random sampling scheme as described for the 1969 survey (Grosslein and Sauskan, 1970). Sampling strata are shown in figures 1 and 2.

Standard 30 minute survey hauls were made at 3.5 knots with the Yankee #36 and USSR 27.1m trawls. Specifications of the trawls are as given by Grosslein (1968) with the following exceptions:

1) There were no ground cables on the Yankee #36.
2) Weight of trawl doors used with 27.1m trawl was 670 Kg (as opposed to 750 Kg reported for 1967 cruise).
3) Bobbins were used on the 27.1m trawl for part of the survey.

The Yankee #36 was used by Albatross IV and also by a second US research stern trawler the Delaware II (155 feet overall, 680 tons, 1000 horsepower). The 27.1m trawl was used by the KVANT, a standard SRTM side trawler comparable to the USSR vessels used on previous joint surveys. This was the same trawl used on the 1967 and 1968 joint surveys.

Methods of sampling and recording catches were the same as on previous joint surveys. Also there was partial exchange of personnel, and complete exchange of data at the end of the survey.

The Nova Scotian shelf was surveyed independently by the KVANT from 10 August - 3 September and a total of 98 stations were completed (figure 2). Random stations had been selected and charts prepared in Woods Hole, and mailed to Dr. Richter prior to KVANT's departure from Kaliningrad. For this segment of the survey, the 27.1m trawl was rigged with four large (40 cm diameter) bobbins on the center section of the footrope (figure 3).

The next segment of the survey covered the region from Cape Hatteras to Long Island, New York. Delaware II occupied 60 station from Cape Hatteras to Hudson Canyon (strata 61-76) from 3-11 September and during the period 7-16 September KVANT completed 69 stations from Cape Hatteras to Long Island (strata 61-76, 1-4), as shown in Figure 4. The two vessels operated independently on this part without exchange of personnel in order to save time. On this segment and for the remainder of the joint survey, KVANT used 7.5 cm Katuschka "rollers" in place of the large bobbins as shown in Figure 3.

KVANT made its first port call in Woods Hole on 20 September and then carried out a series of trawl comparisons from 23 September to 10 October, including measurements of vertical and horizontal spread of six trawls and fishing power comparisons between two Soviet trawls (Griswold, et. al., 1971). At the same time Albatross IV and another USSR vessel Alferas were engaged in the study of sea herring spawning on Georges Bank. In addition to the US, Canadian and Soviet scientists responsible for the herring work, two members of the KVANT scientific party were also aboard Albatross IV as observers.

After completion of the herring studies, KVANT and Albatross IV resumed the groundfish survey, covering the area from Long Island to Georges Bank during the period 14 October to 1 November. KVANT made 67 hauls and Albatross IV completed 125 hauls (figure 4). As usual tear-ups were a problem on Georges Bank with the 27.1m trawl rigged without rollers, and much time was spent searching for trawlable bottom near the random stations. In addition rough seas were encountered throughout most of this segment. These factors prevented the KVANT from completing the number of scheduled stations on Georges Bank (strata 13-25); only 31 out of 50 were completed.

Survey logs of both vessels were copied and exchanged, and the KVANT sailed from Woods Hole on 4 November. Albatross IV then completed the remainder of the survey region (Gulf of Maine and western Nova Scotia as far east as Division 4X - strata 31-49) during the period 5-20 November, occupying 121 stations. By mid-March, all the preliminary data processing was completed, and data listing of individual catches for both vessels were sent to Kaliningrad.

Fishing Power Comparisons

No catch comparison experiments (or paired tows) were conducted with the 27.1m and Yankee #36 trawls during the 1970 joint work. However a comparison of the relative fishing power of these trawls was obtained by analysis of catch frequencies and mean abundance indices, and their relative performance appeared to be roughly comparable to that observed for the same gear in 1967 and 1968.

Percentage frequency distributions of total catches in 1970 again showed both the 27.1m and #36 trawls with relatively few (<10 percent) catches exceeding 500 pounds, in contrast to the 24.6m trawl used in 1969 which showed a much higher frequency of very large catches (Table 1).

Fishing power factors for hake and yellowtail in southern New England (strata 1-12) for the 1970 survey did not differ markedly from those observed in 1967 and 1968 (Table 3). In the case of total catches (all species) in strata 1-12, the factor was unusually high in 1970, but this reflects a bias due to the distribution of spiny dogfish as described below. The stratified means from which these fishing power factors were calculated are shown in Table 2 and figure 5.

The Albatross IV made considerably greater catches of spiny dogfish in southern New England than did the KVANT particularly in strata 1 and 2; and this is reflected in the very large fishing power factor for dogfish shown in Table 3. Although the difference was a real one, it does not represent a valid comparison of fishing power. Rather it serves as a good example of the importance of synchronizing fishing operations in time and place when attempting to compare trawls, at least in the case of a highly migratory species such as spiny dogfish. The discrepancy occurred because the KVANT fished the Hudson Canyon area (strata 1-4) in September when the main concentration of dogfish appeared to be east of that area, whereas Albatross IV didn't fish strata 1-4 until mid-October at which time the dogfish had moved into the Hudson Canyon region. Quite clearly the type of movement exhibited by the dogfish will also be a problem in monitoring annual changes in relative abundance unless the survey is restricted to a shorter time span (or conducted at a different season).

Fishing power factors for selected species were also calculated for Georges Bank (strata 13-25) and the expected greater USA-USSR differential for 1969 seems to be more in evidence on Georges Bank than in southern New England (Tables 2,3 and figures 5,6). However results for Georges Bank generally are much less consistent from year to year than for southern New England and this appears to be due to greater variability among the USSR indices. This is not surprising in view of the relatively few USSR stations on Georges Bank; only 37 and 31 stations were made in 1969 and 1970 respectively (Table 3). Also in 1970 the KVANT was unable to sample at all in strata 23-25 which contributed a negative bias to the USSR indices for cod and haddock (see figure 6).

About the only firm conclusion we can come to from these data is that the sampling intensity achieved by Soviet vessels on Georges Bank in the last two years is insufficient to permit even rough estimates of fishing power differentials. Consequently it is probably also inadequate for estimating abundance trends.

Data on statistical precision of abundance indices derived from the US and the joint US-USSR survey suggests that the average sampling intensity achieved by the US vessels on Georges Bank (about one station per 220 square miles in last three years) is the minimum which will probably be required to achieve a level of precision needed for assessment (Grosslein, 1971; see also Res. Doc. 71/32).

Hake Distribution Relative to Temperature and Depth

Previous joint surveys in the Mid-Atlantic Bight have taken place in October and they documented the occurrence of a cold cell of bottom water between 38°N and Nantucket Shoals. In 1970, the joint survey in this area took place in early September and the cold water mass was better defined than in previous years with water temperatures reaching as low as 5°C (figure 7). Spotted hake is a species whose distribution seems to be closely related to this cold bottom water. In 1967, this species was found in moderate abundance north of Delaware Bay in waters mostly above 10°C which occurred in both shoal and deep waters on either side of the cold water mass in that year (Grosslein, 1968). However in September 1970, the cold water appeared to cover a wider range of depth and few spotted hake were caught north of Delaware Bay or in water less than 10°C which was present at intermediate depths south of Delaware Bay to about 37°30'N.

Bottom temperatures in October and November from southern New England to western Nova Scotia were not greatly different from preceding years (figure 8). There were no noticeable shifts in red and silver hake distribution for the later partsof the survey with most catches in the 31-60 fathom zone from Hudson Canyon to Georges in temperatures from 10-14°C as in previous fall surveys. There has been insufficient time to examine distribution of fish in relation to temperature on the Nova Scotian shelf, but the general pattern of bottom temperatures in August 1970 is shown in figure 9.

Dogfish Distribution

The 1970 joint survey provided further indication of the timing of the well known southward seasonal migration of spiny dogfish in the Mid-Atlantic area. Past fall surveys have been conducted in October when dogfish are found in good concentrations south of Long Island and down as far as Delaware Bay (figure 10). However, as noted earlier, in 1970 the survey from Cape Hatteras to Long Island was conducted in early September and no dogfish were found. About one month later, Albatross IV made large catches of dogfish just south of Long Island indicating the southern movement probably began in late September.

Literature Cited

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Table 1.--Percentage frequency distributions of total catches (pounds) by USA and USSR trawls, in two strata sets, 1968-1970

Total Catch (lbs.)	STRATA 1-8, 61-76						STRATA 9-25					
	1968		1969		1970		1968		1969		1970	
	#36	27.1	#36	24.6	#36	27.1	#36	27.1	#36	24.6	#36	27.1
≤500	90	78	87	42	96	94	97	92	98	65	92	90
500-1000	9	14	6	11	3	1	3	6	2	20	7	4
1001-2000	1	5	3	22	1	4	-	-	-	10	1	4
2001-4000	-	2	3	14	-	-	-	2	-	4	-	2
>4000	-	-	1	10	-	1	-	-	-	-	-	0
Total Number Hauls	100	78	98	62	102	86	90	65	89	49	91	48

Table 2.--Stratified mean catch/tow ($\log_e$ pounds) for southern New England and Georges Bank for joint US-USSR groundfish surveys, 1967-1970

	STRATA SET 1-12						STRATA SET 13-25									
	Red Hake		Silver Hake		Yellowtail		Red Hake		Silver Hake		Haddock		Cod		Yellowtail	
Year	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR	US	USSR
1967	1.05	2.02	1.63	2.64	2.25	1.70	0.46	-	0.74	-	2.45	-	1.74	-	1.32	-
1968	0.79	1.88	1.80	3.62	2.03	1.78	0.64	0.84	1.27	1.65	1.15	1.07	1.04	1.19	1.40	1.01
1969	1.19	2.20	1.21	3.38	2.00	1.75	0.85	1.79	0.92	2.75	1.10	1.65	1.32	1.59	1.35	1.91
1970	1.35	1.93	1.35	2.34	2.12	1.50	0.44	1.03	0.83	1.02	1.35	0.57	1.35	0.87	0.96	1.80

Table 3.--Fishing power factors 1/ for selected species and all species combined in southern New England (strata 1-12) and on Georges Bank (strata 13-25)

Species	Strata 1-12				Strata 13-25		
	1967	1968	1969	1970	1968	1969	1970
Spiny dogfish	.41	.25	.19	3.75	1.20	.95	1.54
Silver hake	.36	.16	.11	.37	.70	.15	.83
Red hake	.38	.34	.36	.56	.84	.37	.56
Yellowtail	1.74	1.29	1.29	1.86	1.48	.55	.43
Cod	-	-	-	-	.86	.73	1.62
Haddock	-	-	-	-	1.12	.55	2.19
All Species	.53	.42	.17	1.25	.86	.26	1.06
Total No. hauls US,USSR	65,40	62,46	66,42	63,56	69,51	73,37	70,31

1/ Fishing power factors were calculated as the antilog of the difference between stratified mean catch per haul indices ($\log_e$ pounds) USA minus USSR indices.

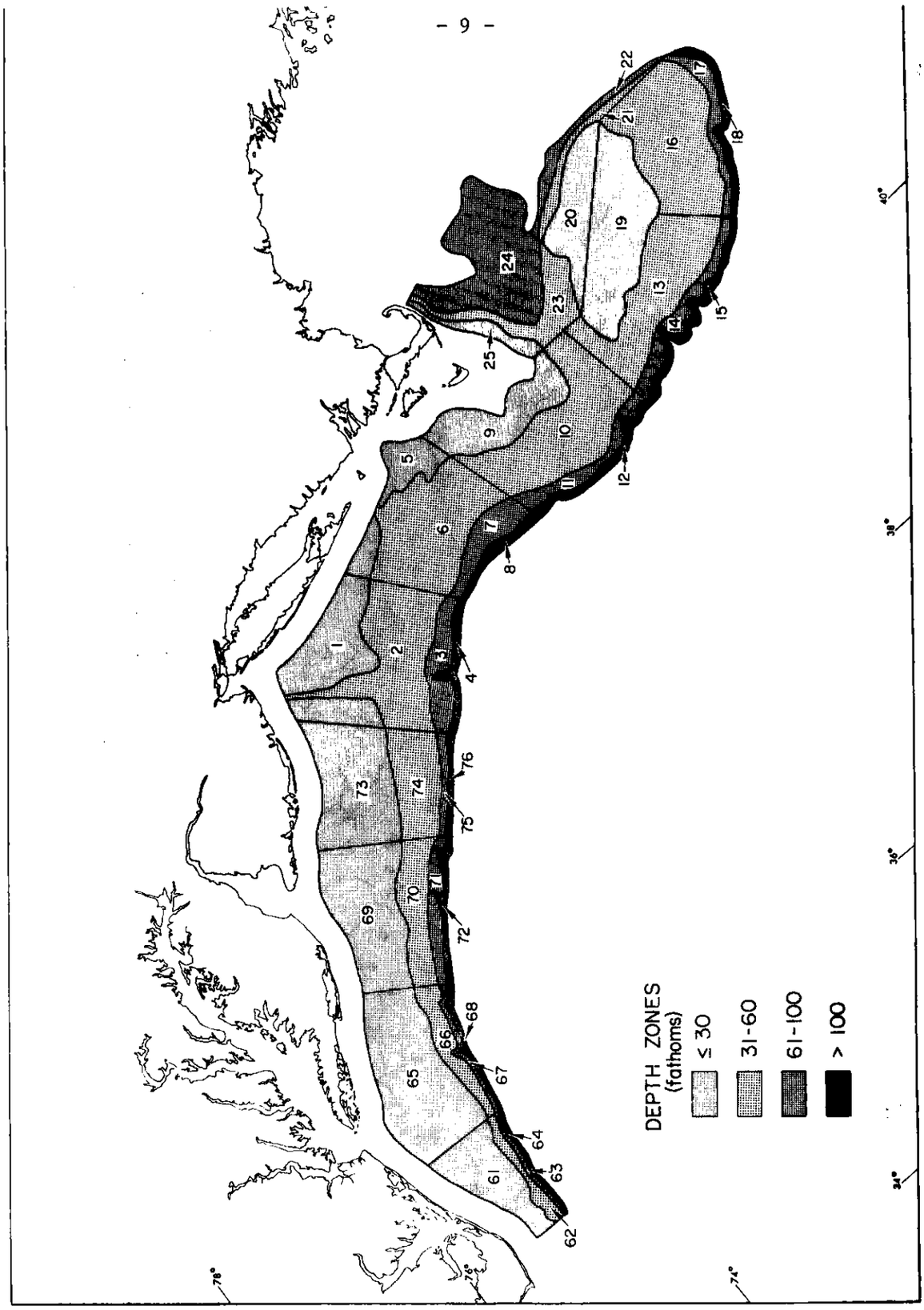

Figure 1.--Sampling strata occupied during September-October in the 1970 joint US-USSR groundfish survey.

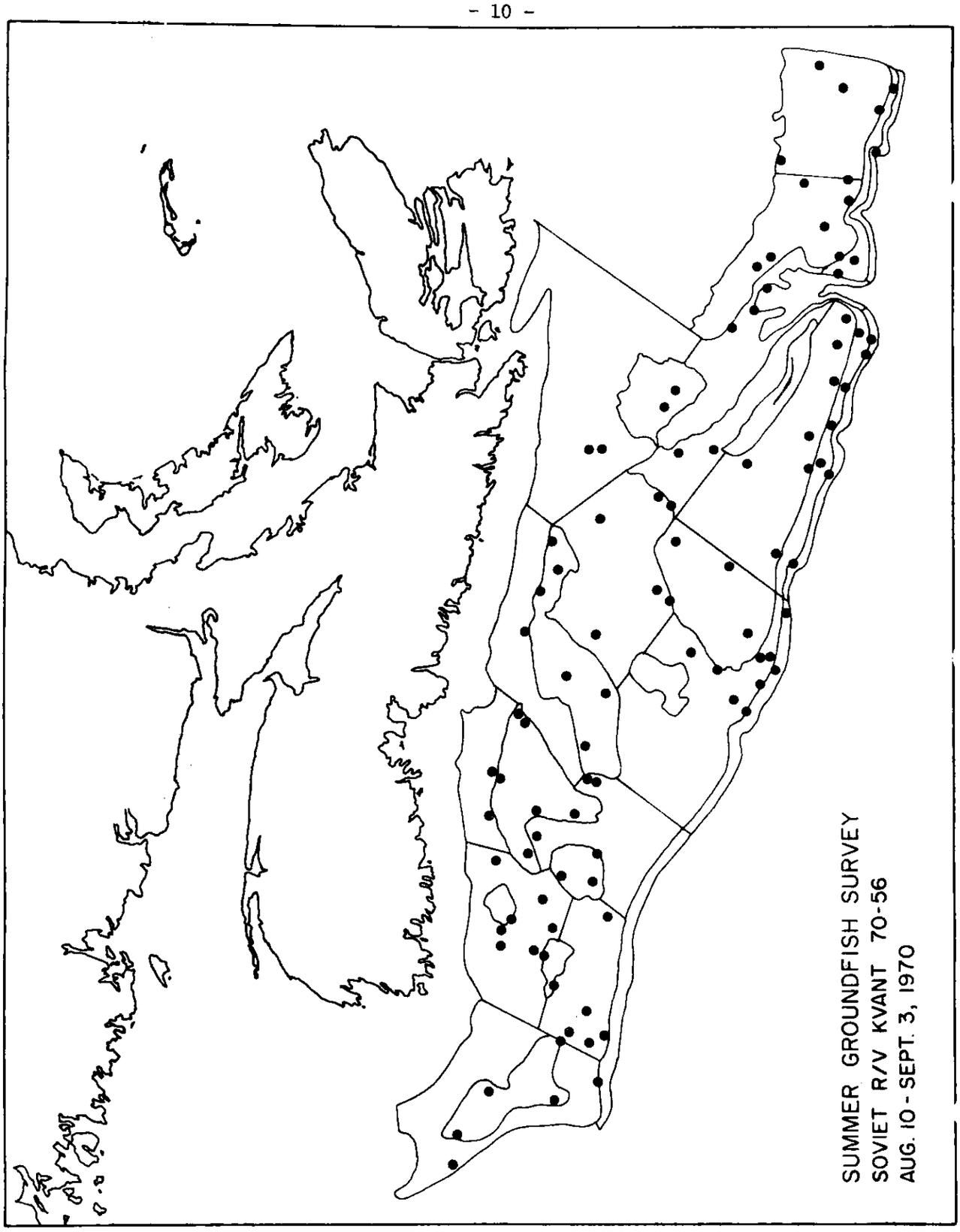

Figure 2.--Sampling strata and stations occupied by Soviet vessel on Nova Scotian shelf in 1970 groundfish survey.

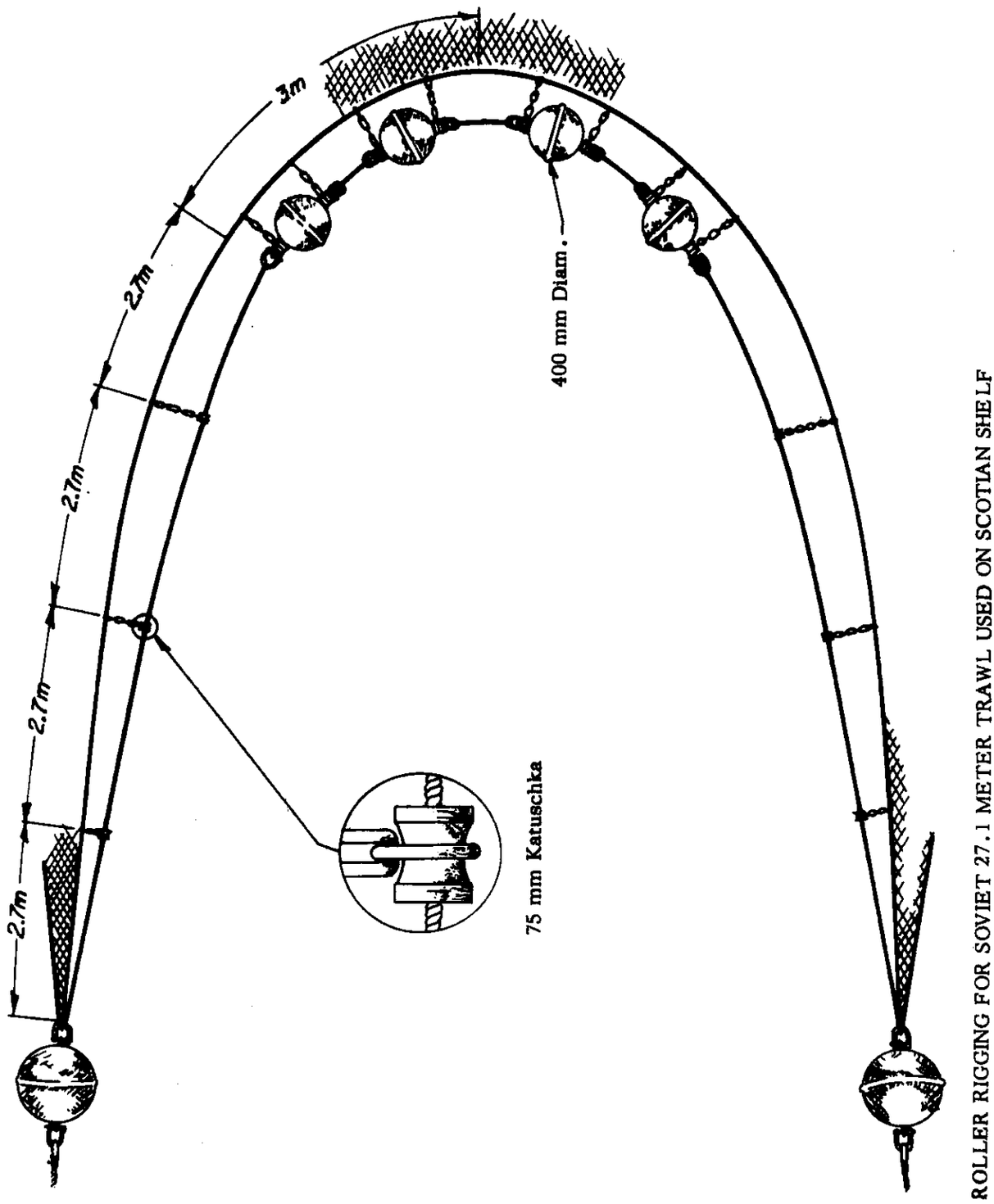

Figure 3.--Rigging of 27.1m trawl used by Soviet vessel KVANT on 1970 groundfish survey of Nova Scotian shelf.

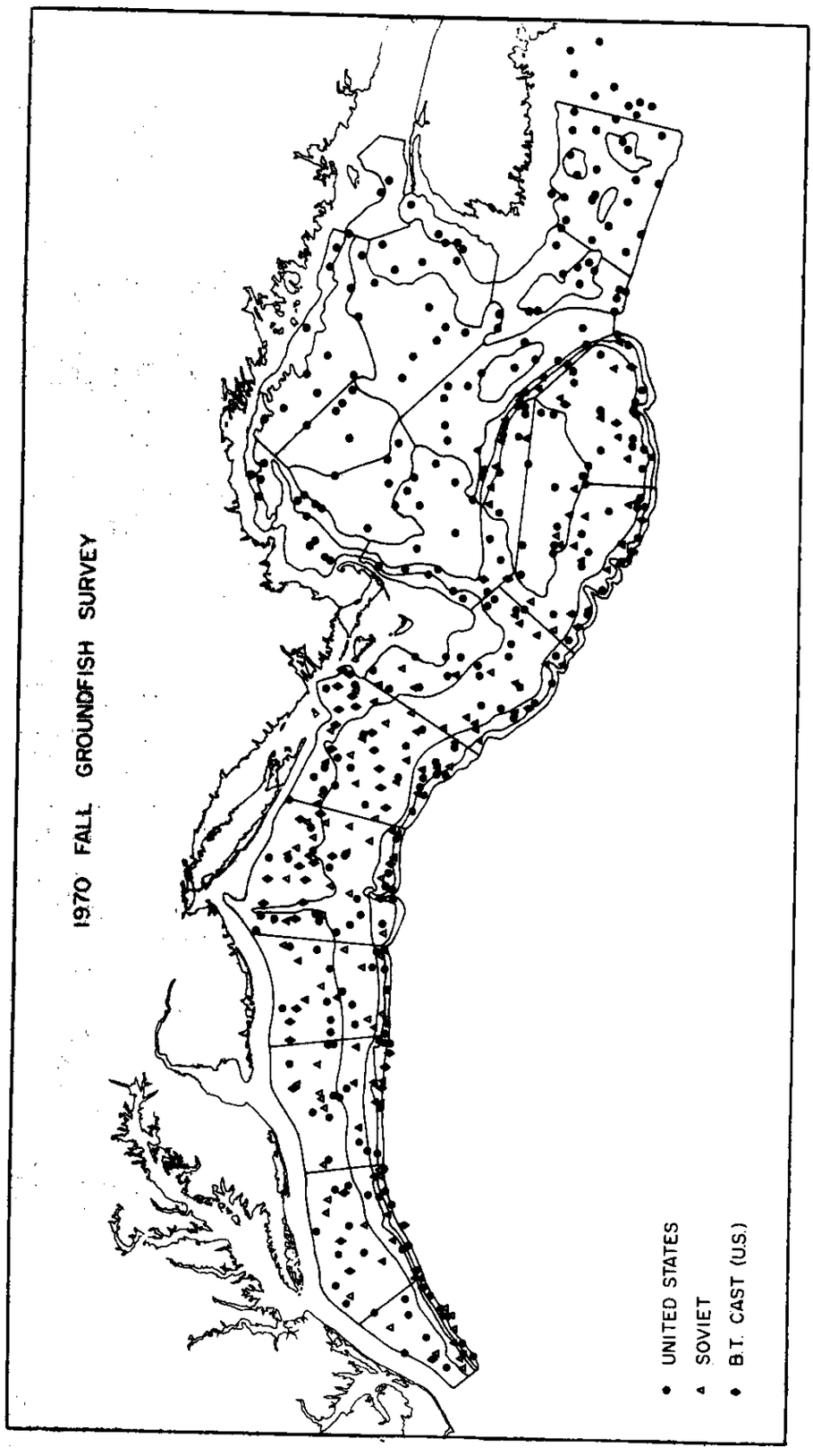

Figure 4.--Stations occupied during September-November in 1970 joint US-USSR groundfish survey operations.

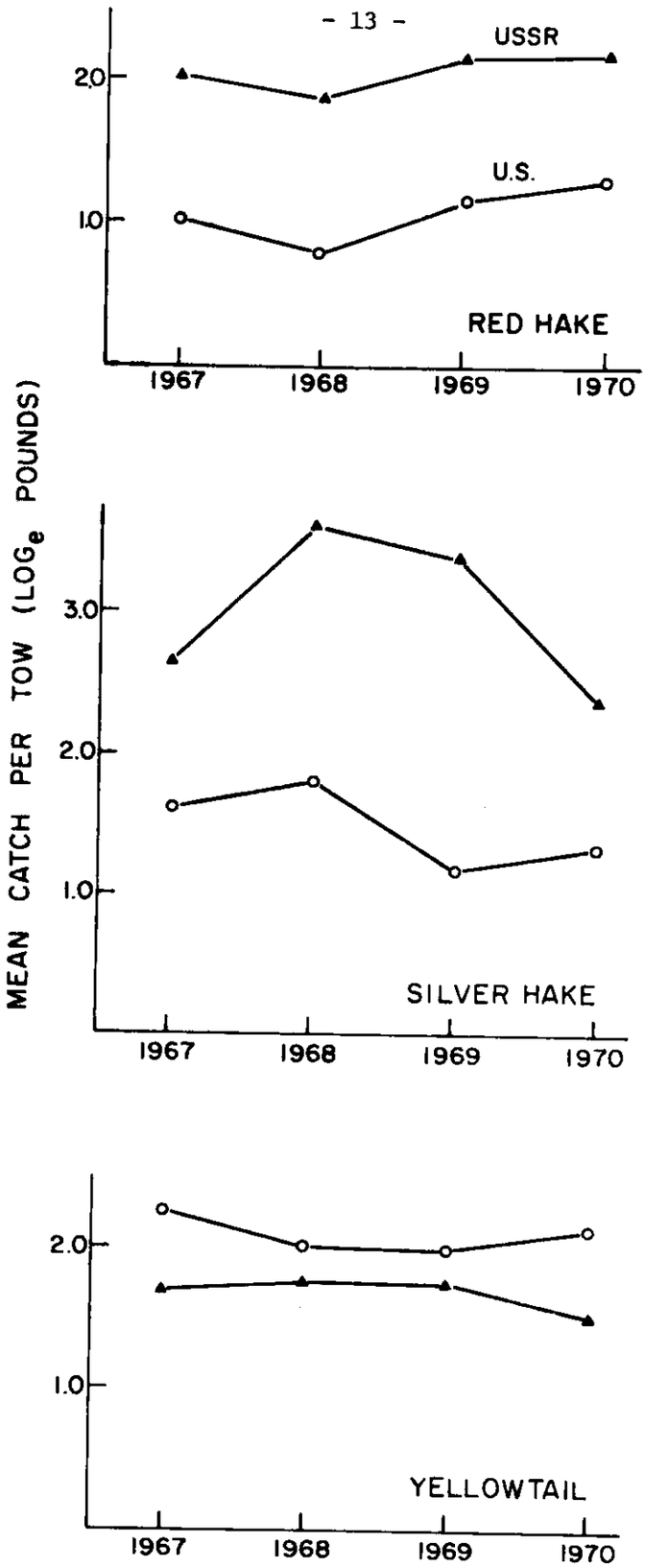

Figure 5.--Stratified mean catch/tow ($\log_e$ pounds) of selected species in strata 1-12 during joint fall surveys.

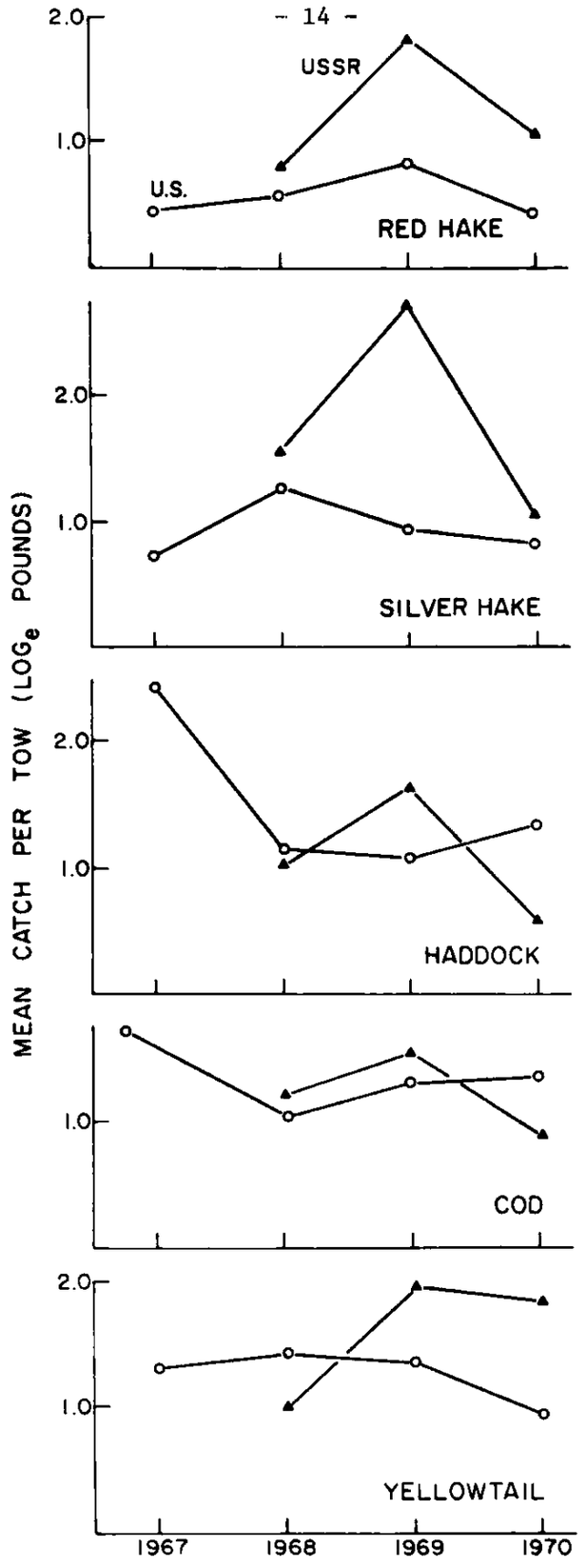

Figure 6.--Stratified mean catch/tow (log$_e$ pounds) of selected species in strata 13-25 during joint fall surveys.

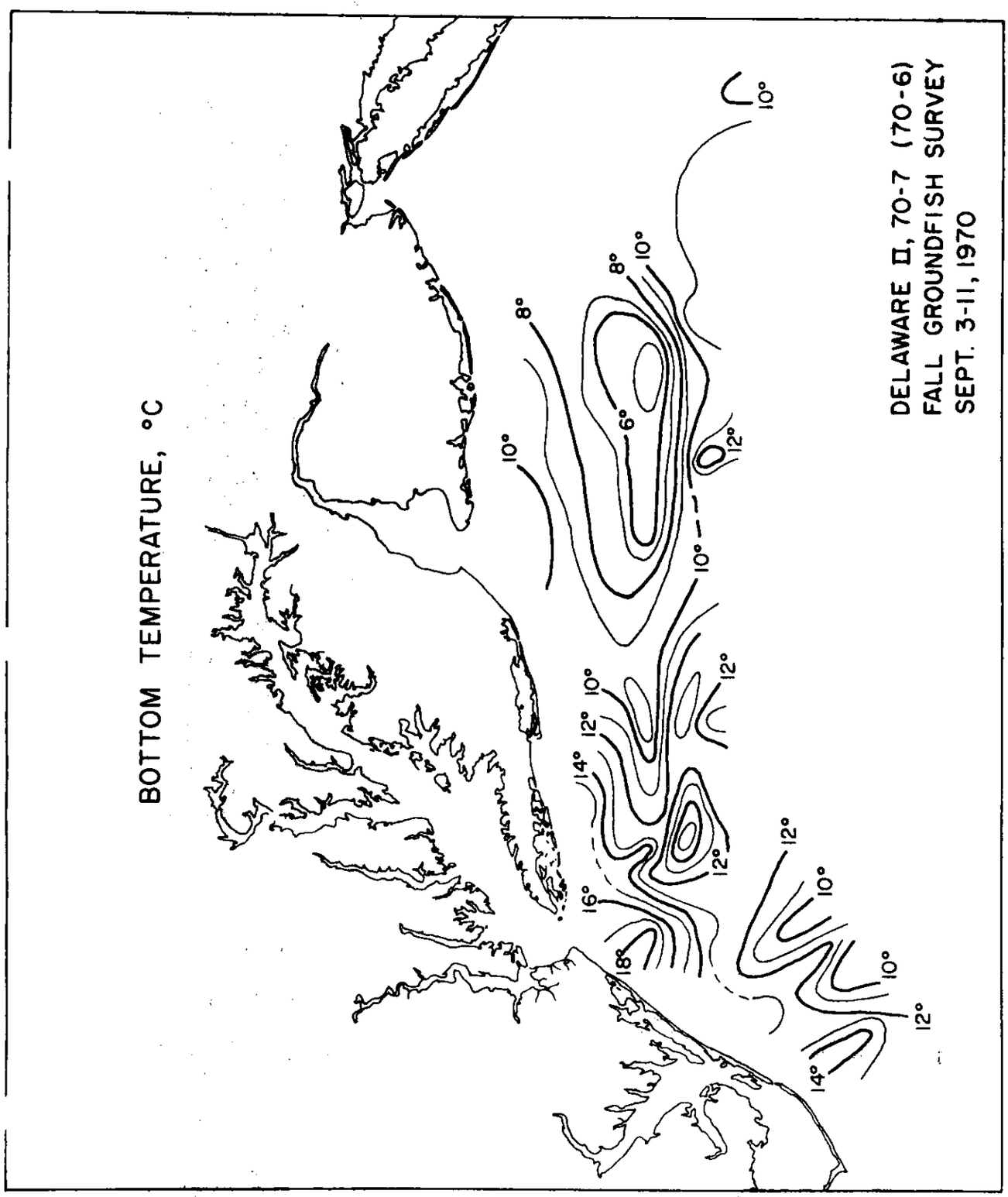

Figure 7.--Bottom temperatures observed by Delaware II in mid-Atlantic area in September 1970, joint US-USSR survey.

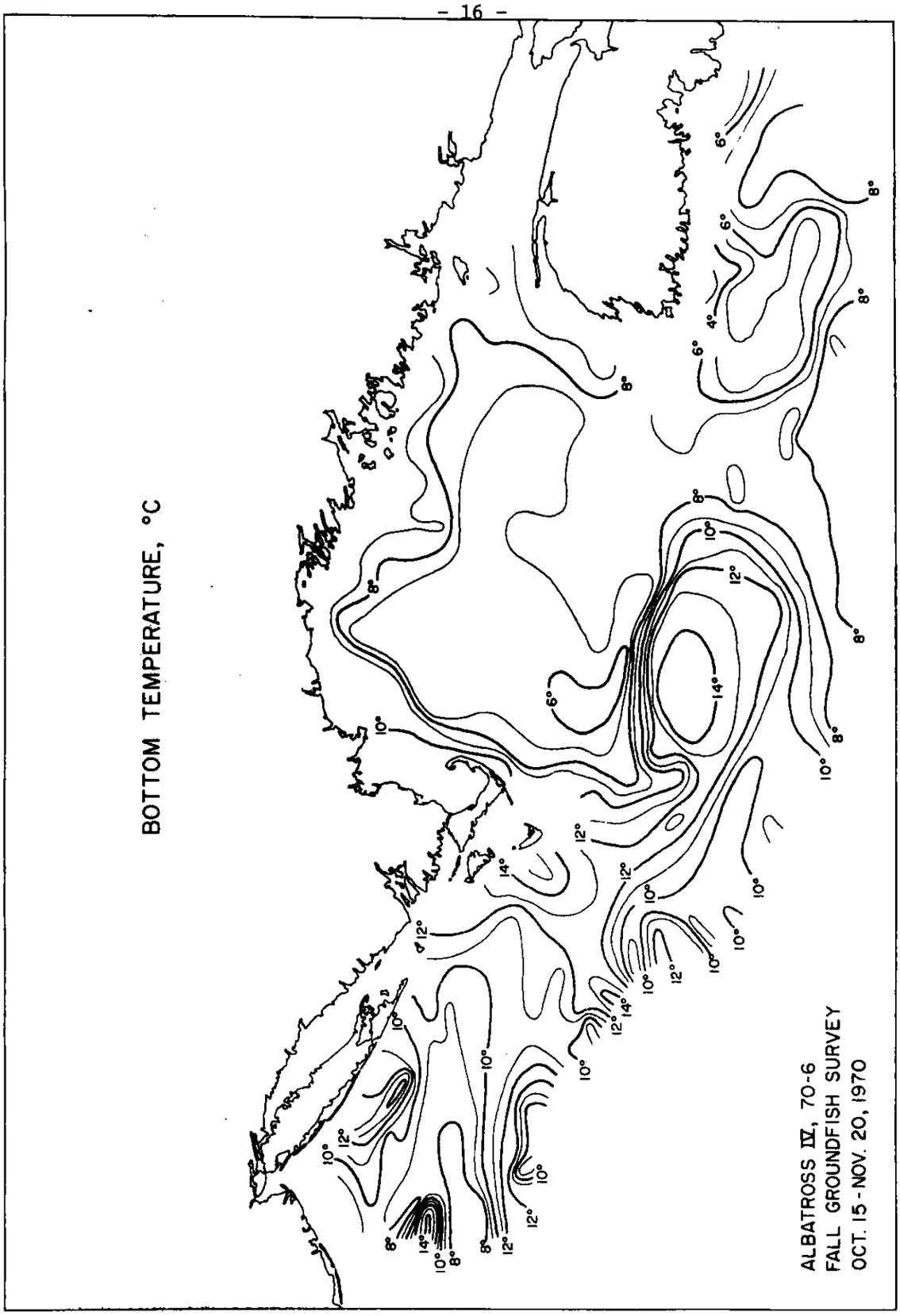

Figure 8.--Bottom temperatures observed in October-November during 1970 joint US-USSR groundfish survey.

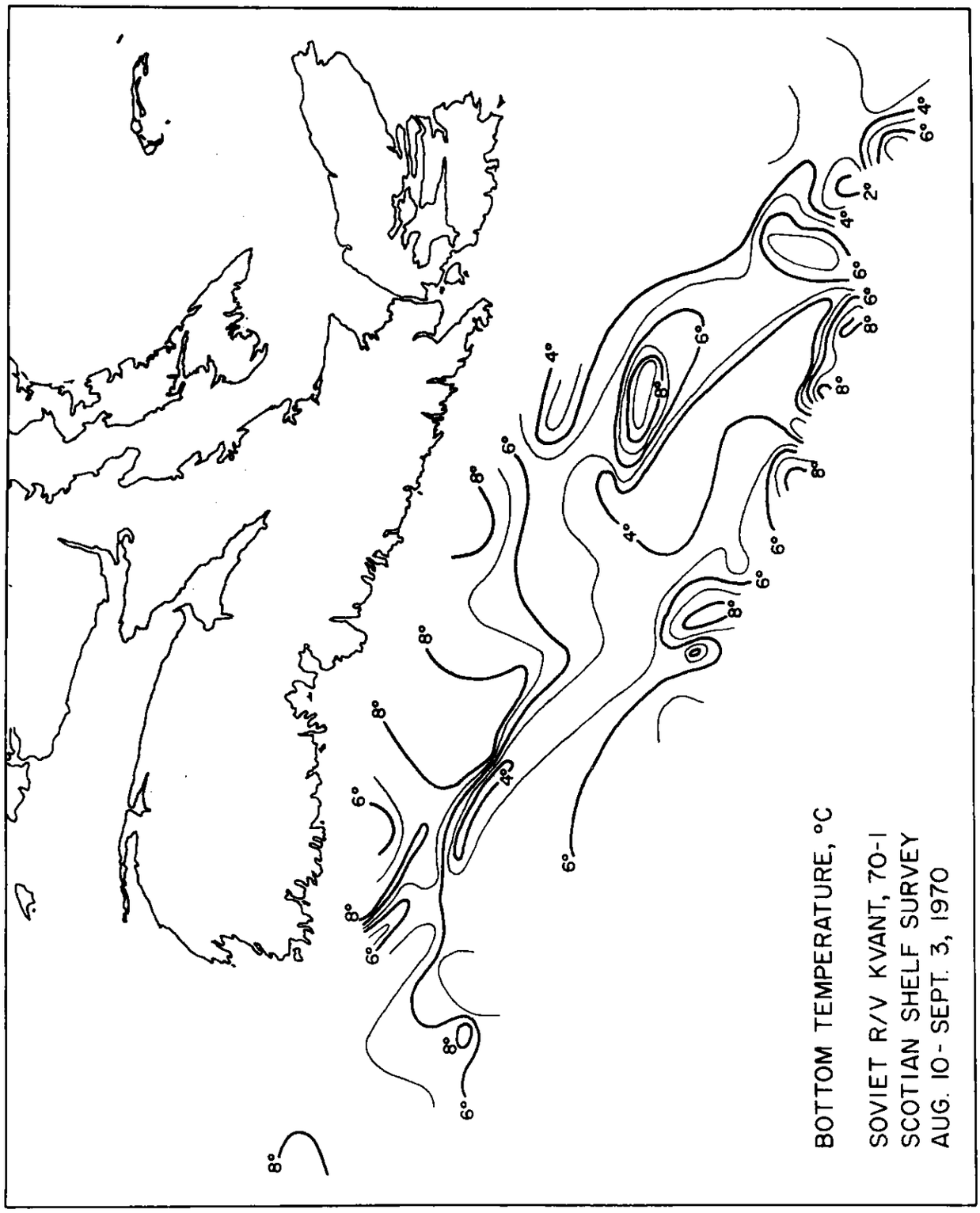

Figure 9.--Bottom temperatures on Nova Scotian shelf during 1970 groundfish survey by Soviet vessel.

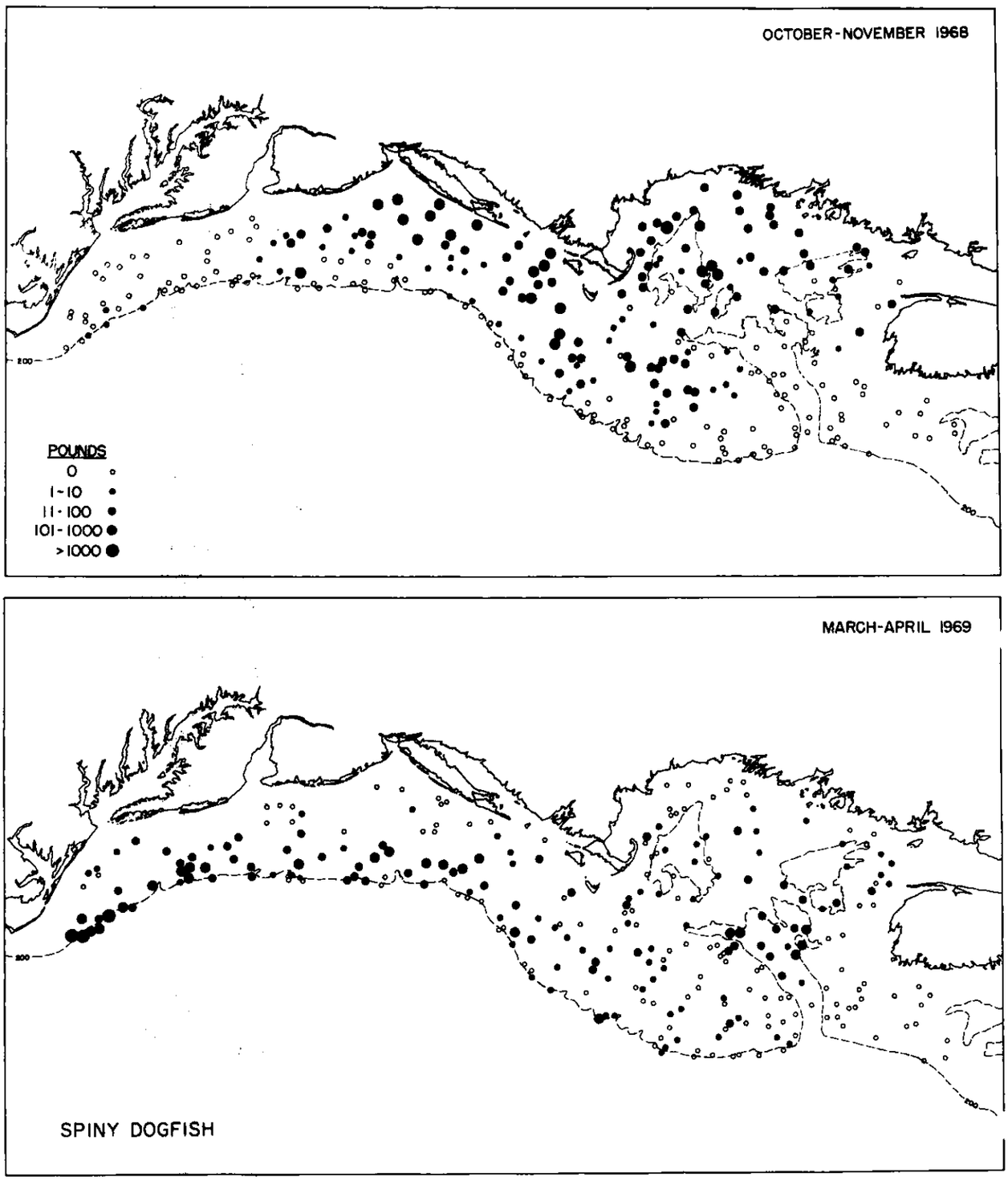

Figure 10.--Typical spring and fall distribution of spiny dogfish as shown by groundfish survey catches.