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Report on the 1992 Survey of Georges Bank using Commercial Herring Seiners

by

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Abstract

In the fall of 1992, a sounder/sonar survey of the northeastern peak of Georges Bank was conducted with commercial seiners to investigate the distribution and abundance of reproductively active herring. Approximately 1300 km of line transects were covered by the two vessels during a 5 d period. Large concentrations of spawning herring were observed along the northern edge just west of the international boundary. Evidence for nearby spawning originated from ripe herring, cod with eggs in gut, and later larval surveys. This represents the first documented spawning on historical beds in Canadian waters since the stock's collapse in 1977. Seven hundred herring were also tagged to investigate movement.

Résumé

A l'automne 1992, avec le concours de senneurs commerciaux, on a réalisé un relevé au sonar et à l'échosondeur sur la pointe nord-est du banc Georges pour étudier la distribution et l'abondance du hareng en frai. Les deux harenguiers participants ont procédé à des virées transversales sur environ 1 300 km en cinq jours. De grandes concentrations de hareng en frai ont été observées le long de l'extrémité nord, juste à l'ouest de la frontière internationale. La présence de harengs gravides, la découverte d'oeufs dans l'appareil digestif des morues ainsi que les relevés larvaires subséquents étaient autant de preuves du frai voisin. Il s'agit du premier cas documenté de frai dans les frayères historiques des eaux canadiennes depuis l'effondrement du stock, en 1977. Sept-cent harengs ont été marqués pour qu'on puisse suivre leurs migrations.

Introduction

In the spring of 1991 the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC), in light of continued signs of a recovery of the Georges Bank herring stock, recommended that consideration be given to a small exploratory ("Scientific") fishery involving commercial vessels (Melvin et. al., 1991). The recommendation originated from the committee's need to obtain more information on the distribution of herring during the spawning season, especially on the Canadian portion of the Bank, and acknowledgement that annual research surveys provide only limited data. Although the stock continued to show strong signs of a recovery the Committee expressed concern about the apparent absence of fish on traditional northeastern spawning grounds.

The recommendation was presented to the Scotia Fundy Herring Advisory Committee (SFHAC) in October of 1991 as part of a status report on the stock. On the recommendation of the SFHAC a working group comprised of processors, fishermen and scientific representatives was established to develop a survey proposal and identify potential funding sources. Several meetings of the Working Group were held during the winter and a draft proposal presented to the SFHAC at the 1992 spring meeting. Upon general approval of the Committee the proposal was submitted to several agencies for funding. A copy of the proposal was also submitted to USA counterparts for review and to investigate the possibility of a cooperative program.

Although US federal and state counterparts expressed interest in a cooperative program, insufficient time was available to coordinate funds for procurement of labelled tags. The survey, which involved chartering one vessel from each of the two herring associations (Atlantic Herring Fishermens Marketing Cooperative Ltd. and Southwest Seiners Ltd.), was funded solely by the Nova Scotia/Federal Cooperation program. The Department of Fisheries and Oceans (DFO) contribution of manpower and expenses was funded from the standard operating budget.

Objectives

The survey was designed to incorporate the needs and interests of both the herring industry and DFO while concentrating on the request by the advisory committee for additional information concerning the distribution of fish. Specific objectives of the survey were as follows:

(1) To investigate the distribution of herring on the northeastern tip of Georges Bank during the spawning season. This was deemed critical to assessment of the stock status. The information collected during the survey will enhance available data on the geographical extent of spawning herring.

(2) To examine seasonal movement of Georges Bank herring. Over the years, many questions have arisen about the contribution of Georges Bank herring to other stocks (ie. the coastal juvenile fishery) and their general movement throughout the seasons. It was thus proposed that a tagging program be initiated during this survey to investigate movement. Tags were to be

labelled with a Canadian and US return address to facilitate returns in both countries and the recapture data would be coordinated by Canadian scientists.

(3) To evaluate the usefulness of sonar in a quantitative survey. One of the difficulties in assessing the stock status of Georges Bank herring is the large area of coverage. Current assessment methodologies (bottom trawl and acoustic surveys) have not been very useful in assessing pelagic species when there are large geographical areas to cover and the location of fish is unknown. By using commercial seiners, which have been searching for, and finding, schooling fish with the aid of sonar, the efficiency of locating and surveying fish may be enhanced.

Approach

The approach adopted for the survey was that between October 15 and November 15, 1992, the approximate spawning period for herring on Georges Bank, two commercial seiners would steam to the survey area on the northeastern portion of the Bank. Once there each vessel would commence running a series of defined line transects in search of herring with effort concentrated in areas where herring were observed historically. The parallel equidistant (2-4 naut mi) north/south lines were selected a priori by randomizing the starting point. Additional transects were to be established in areas where herring were observed. The vessels were to operate primarily at night when the herring are normally near the surface. This would optimize the use of sonar to locate schools, although some day time operations could be undertaken if conditions were suitable.

On station, each vessel would proceeded along one of the defined transects (with sonar and sounder operating) recording the occurrence of fish schools. Information pertaining to size and location would be recorded for each encountered school. At selected sightings, the purse seine was to be deployed to capture the school and obtain information on species, length frequency and school size.

During the pursing operation, several hundred herring were to be dipnetted from the seine and placed in the holding tank for tagging. Tagging was to be undertaken by scientific staff (one aboard each vessel) while the remaining fish were being released from the seine and during the period when the gear was being stowed on deck. All tagged fish were to be released near the site of capture. The vessel was then to continue along the transect until it reached the outer limit of the grid, at which time it would commence the next line in the series.

Results

On October 14, 1992, the MV "SeaLife II" and "Mari Lynne Anita" departed Cape Sable Island and Yarmouth, respectively, for Georges Bank to conduct the 5-d survey. Arriving on station at midnight each vessel commenced to run their designated north/south transect. During the course of the survey approximately 700 naut. mi. of bottom were covered by the two vessels. All transects were surveyed during the night time hours, except when the line was nearly completed as day light approached. In this case, which occurred in areas of no observed herring,

the transect was completed before stopping for the day. Day time operations included a search by the ships captain for aggregations of herring and steaming to the next night's starting point. The survey tracks covered by both vessels are presented in Fig. 1. Detailed information on the location, length and time surveyed for each transect is presented in Table 1 for the "Sealife II" and Table 2 for the "Mari Lynne Anita".

Data collected during the survey for observed fish aggregations included location, time, water depth, position of fish in the water column and an estimate of school thickness from the ships sounder. The schools of fish were also broadly categorized into small, medium and large based on the amount of the sounder screen they occupied. In addition, when fish were observed to be continuous an estimate of distance was made from the first sighting to the end. The data are summarized in Table 3.

The school size and position of herring in the water column varied greatly. In general, however, the majority of fish were observed from mid-water depth to the bottom throughout the night survey period and during the day. This made it difficult to quantify the fish with sonar and to set the seine for species confirmation. The majority of sighting data were collected from the ship's colour sounder. Very large aggregations of fish, presumed to be herring were observed within the north western section of the survey area (Fig. 2). One school of fish approximately 50 m thick extended for 16 km along the bottom. Sightings for each vessel are displayed in Fig. 3 and 4.

During the survey only two seine sets were made. One set at 41°38'N 66°32'W, identified by the captain as not being herring, contained approximately 50 tonnes of very small (7-10 cm) silver hake (*Merluccius bilinearis*). The second set, made at 42°09'N 66°43'W captured an estimated 90 tonnes of Atlantic herring. This was an unusual occurrence in that the large school being tracked along the bottom suddenly broke with a small portion rising to the surface. The herring were held in the seine (loosely pursed) for approximately 2 h, without apparent duress, while fish were being tagged. In total 700 fish were marked with individually numbered Floy T-tags (Return address: DFO St. Andrews, N.B.) before the captain became concerned about the fish. At this point the seine was opened and all fish were released. The tagging study represents the first such effort in more than 15 yr.

A sample of 247 herring were measured for length. The length frequency distribution of fish is presented in Fig. 5. It was also observed that these fish were sexually mature and running ripe, thereby implying spawning activity in the vicinity.

Another observation critical to confirming spawning in the survey area originated from a secondary source. During the day a number of the ship's crew were jigging for groundfish. When the cod they caught were opened the stomachs were found to contain herring eggs, again confirming that herring spawning beds were nearby. This observation was also reported by commercial groundfish fishing vessels operating in the area.

Discussion

Prior to this survey, there was no direct evidence that herring were spawning on the historical (1960-1977) beds of the northeastern edge of Georges Bank. In fact, until the time of this survey spawning locations on the bank, identified from larval and groundfish research surveys, were concentrated in and around the Cultivator/Georges shoal area. Each year both Canadian and US larval surveys would document the absence of recently hatched larvae on the Canadian portion of the Bank. Larvae >10 mm have been collected in the area each year since 1987, however, because of the elapsed time between hatching and growth to the observed size the origin of spawning was uncertain (Melvin et. al., 1992; Melvin et. al., 1991; Smith and Morse, 1990; Stephenson et. al., 1990).

Groundfish surveys during the spawning season (October-November) have also document the occurrence of adult herring on the Canadian side of the Bank in the vicinity of the major historical spawning locations (Melvin et. al.,1992). However, their numbers were relatively small (1-5 fish per tow) compared to Cultivator and Georges shoals. This led to the conclusion that herring had not reoccupied their traditional spawning beds on the Northeastern portion of the Bank which once formed the major component of the Georges Bank spawning stock.

The results of this survey provide the first direct evidence of herring spawning on the northeast portion of the Bank. While the distribution of fish does not appear to encompass as large an area as it did in pre-collapse years, the discovery of spawning in this area represents a major milestone in the stock's road to recovery. Evidence which supports the conclusion from the seiner survey includes, large aggregations of reproductively active adult herring and the discovery of eggs in cod stomachs. This was further substantiated by the observation of small larvae in the area during the November 1992 Canadian and US larval surveys.

The tagging of herring on Georges Bank, initiated during this survey, is hopefully the beginning of a much larger program for the years to come. With only 700 fish being tagged and no commercial herring fishery on the Bank it is unlikely that much information will be obtained concerning movement or seasonal distribution. The survey did, however, provide a mechanism to investigate the gear requirements and operational procedures for tagging from commercial seiners. In this regard a cooperative (DFO/Industry) tagging program could be undertaken from these vessels with minimal operational interference if a commercial fishery develops on the bank.

The usefulness of sonar gear as a quantitative assessment tool remains uncertain. Distribution of herring on or near the bottom not only limited the ability of the equipment to detect schools of fish, but also prevented the capture of fish to evaluate the sonar images. Further work in this area is required before its usefulness can be assessed.

Summary

In summary, the results of the above survey provided the first direct evidence of spawning at historical sites on the northeastern portion of Georges Bank. This is an excellent sign that the stock is beginning to return to its past levels and removes one of the main concerns of the advisory committee regarding this stock. Tagging will continue to investigate the temporal and spatial distribution of herring and further work will be conducted to evaluate usefulness of sonar in a quantitative survey. The survey also provided an opportunity for science and industry to jointly discuss, develop, and implement a valuable research program. It is hoped that this level of cooperation can continue in the future.

References

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Smith, W.G. and W.W. Morse. 1990. Larval distribution patterns: Evidence for the collapse/recolonization of Atlantic herring on Georges Bank. Int. Counc. Expl. Sea C.M. 1990/H:17: 16p.

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Table 1. Transect lines run by the herring seiner "Sealife II" on Georges Bank in October of 1992. Also included are start and stop times, start and stop positions, and the number of incidences of herring sightings for each transect line.

DATE LINE NO.	START TIME	STOP TIME	START LAT. LONGT.	STOP LAT. LONGT.	NAUT. MILES	OBS.
Oct 15 S-01	0130	0710	42°12' 66°35'	41°32' 66°35'	41.4	0
Oct 15 S-02	0730	1230	42°26' 66°30'	42°12' 66°30'	47.1	1
Oct 15 S-03	1900	2215	42°12' 66°44'	41°40' 66°44'	30.5	3
Oct 16 S-04	0215	0430	41°47' 66°50'	42°12' 66°50'	21.5	1
Oct 16 S-05	0500	0715	42°12' 66°55'	41°56' 66°55'	18.5	4
Oct 16 S-06	0730	0900	42°12' 67°00'	41°58' 67°00'	11.8	1
Oct 16 S-07	2130	0222	42°12' 66°20'	41°26' 66°20'	46.7	0
Oct 17 S-08	0310	0800	41°26' 66°10'	42°12' 66°10'	47.0	0
Oct 17 S-09	2230	0130	42°08' 67°08'	42°08' 66°30'	28.7	2
Oct 18 S-10	0230	0630	42°04' 66°30'	42°04' 67°02'	25.6	2
Oct 18 S-11	0655	1000	42°00' 67°00'	42°00' 66°30'	23.5	2

Table 2. Transect lines run by the herring seiner "Mari Lynne Anita" on Georges Bank in October of 1992. Also included are start and stop times, start and stop positions, and the number of incidences of herring sightings for each transect line.

DATE LINE NO.	START TIME	STOP TIME	START LAT. LONGT.	STOP LAT. LONGT.	NAUT. MILES	OBS.
Oct 15 M-01	0108	0201	42°12' 67°03'	42°12' 67°03'	9.0	0
Oct 15 M-02	0350	0650	42°09' 66°40'	41°36' 66°40'	21.7	0
Oct 15 M-03	0825	1305	41°21' 66°26'	42°09' 66°26'	49.4	0
Oct 15 M-04	1932	2127	42°12' 66°52'	41°52' 66°52'	21.5	1
Oct 15 M-05	2215	2415	41°46' 66°47'	42°11' 66°47'	27.3	0
Oct 16 M-06	1258	0430	42°11' 66°42'	41°39' 66°39'	31.6	0
Oct 16 M-07	0510	0940	42°11' 66°37'	42°33' 66°37'	37.8	1
Oct 16 M-08	2155	0257	42°09' 66°15'	41°26' 66°15'	43.7	0
Oct 17 M-09	0348	0800	41°26' 66°05'	42°08' 66°05'	42.0	0
Oct 17 M-10	2205	0130	42°10' 67°09'	42°10' 66°30'	24.3	3
Oct 18 M-11	0205	0535	42°06' 66°30'	42°06' 67°05'	27.1	0
Oct 18 M-12	0624	0735	42°02' 67°02'	42°02' 66°47'	10.0	0

Table 3. Herring sightings by "Sealife II" and "Marie Lynne Anita" between October 15 and 18 of 1992. Also included are time of sighting, transect line number, position, water depth, quantity of herring, and fish location.

DATE	TIME	LINE NUMBER	LAT. LONGT.	(m) DEPTH	QUANTITY	(m) FISH LOCATION
Oct 15	0515	radio report	42°06' 66°38'	192	N/A	20-40
Oct 15	1137	S-02	42°03' 66°30'	80	small school	80
Oct 15	2048	M-04	41°56' 66°52'	55	small school	55
Oct 15	2248	S-03	42°05' 66°45'	68	medium school	55-65
Oct 15	2252	S-03	42°05' 66°45'	68	medium school	35-65
Oct 16	0315	S-04	42°01' 66°50'	70	3 km line	0-18
Oct 16	0530	S-05	42°08' 66°55'	80	10 km line	10-64
Oct 16	0555	S-05	42°03' 66°55'	60	large school	25-35
Oct 16	0605	S-05	42°01' 66°55'	57	medium school	50-55
Oct 16	0610	S-05	42°01' 66°55'	57	small school	57
Oct 16	0800	S-06	42°07' 67°00'	68	medium school	20-68
Oct 16	0818	M-07	42°01' 66°38'	77	small school	75
Oct 17	1955	M09-10	42°09' 66°46'	146	large school	110-128
Oct 17	2300	S-09	42°08' 66°54'	75	4 km line	10-20

DATE	TIME	LINE NUMBER	LAT. LONGT.	(m) DEPTH	QUANTITY	(m) FISH LOCATION
Oct 17	2306	M-10	42°10' 66°54'	128	small school	120
Oct 17	2320	M-10	42°10' 66°51'	137	small school	70
Oct 17	2356	M-10	42°10' 66°44'	132	small school	132
Oct 18	0016	S-09	42°08' 66°43'	90	1 km line	10-20
Oct 18	0500	S-10	42°04' 66°50'	65	16 km line	20-75
Oct 18	0604	M-11	42°03' 66°58'	55	medium school	45-55
Oct 18	0619	S-10	42°04' 67°00'	58	4 km line	20-75
Oct 18	0655	S-11	42°00' 67°00'	57	4 km line	7-46
Oct 18	0915	S-11	42°00' 66°57'	57	8 km line	20-30

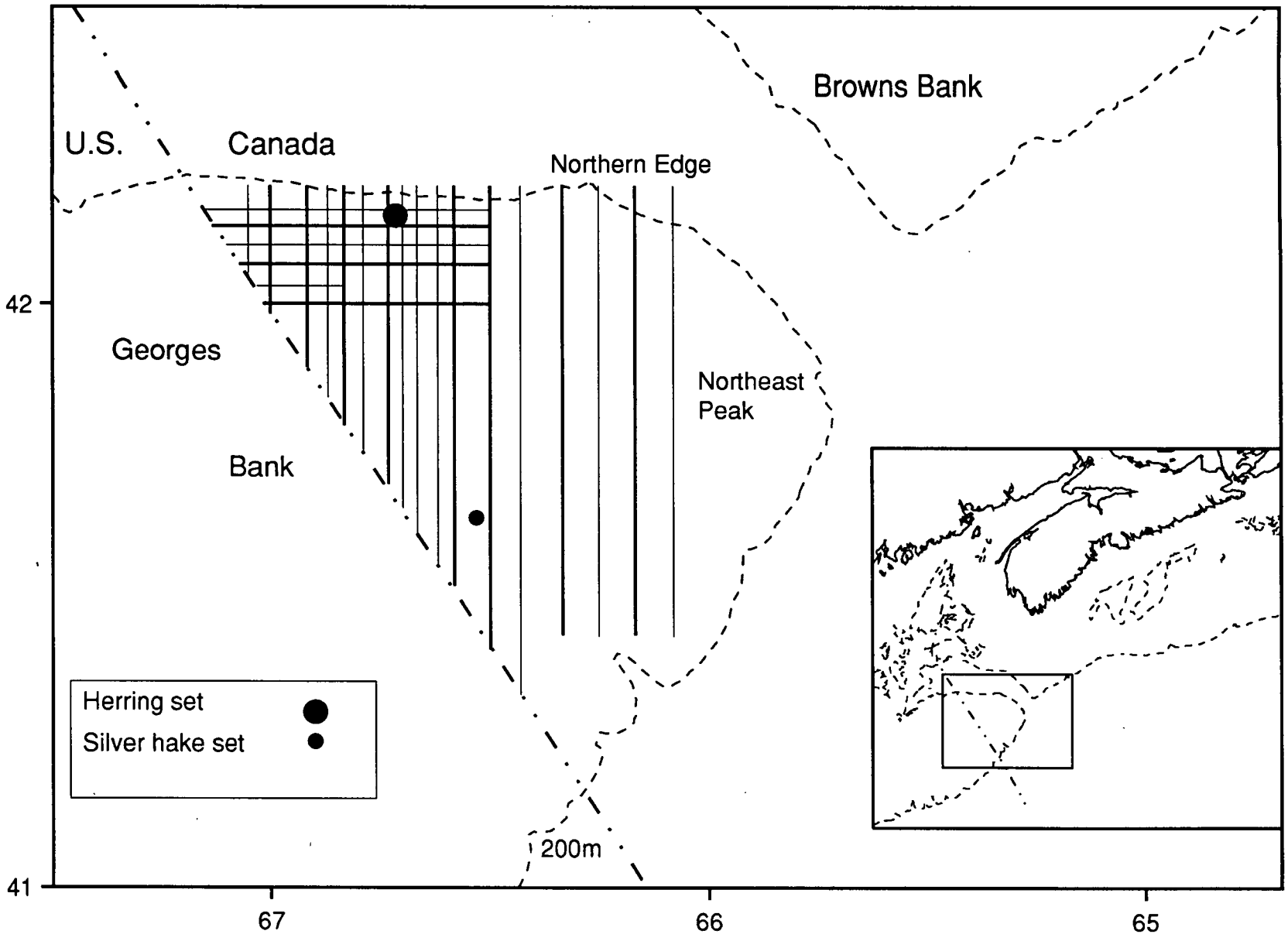

Figure 1. Georges Bank 1992 - Commercial Seiner Survey.
Vessels: 'Sealife II' (thick line) and 'Mari Lynne Anita' (thin line) October 15 - 19.

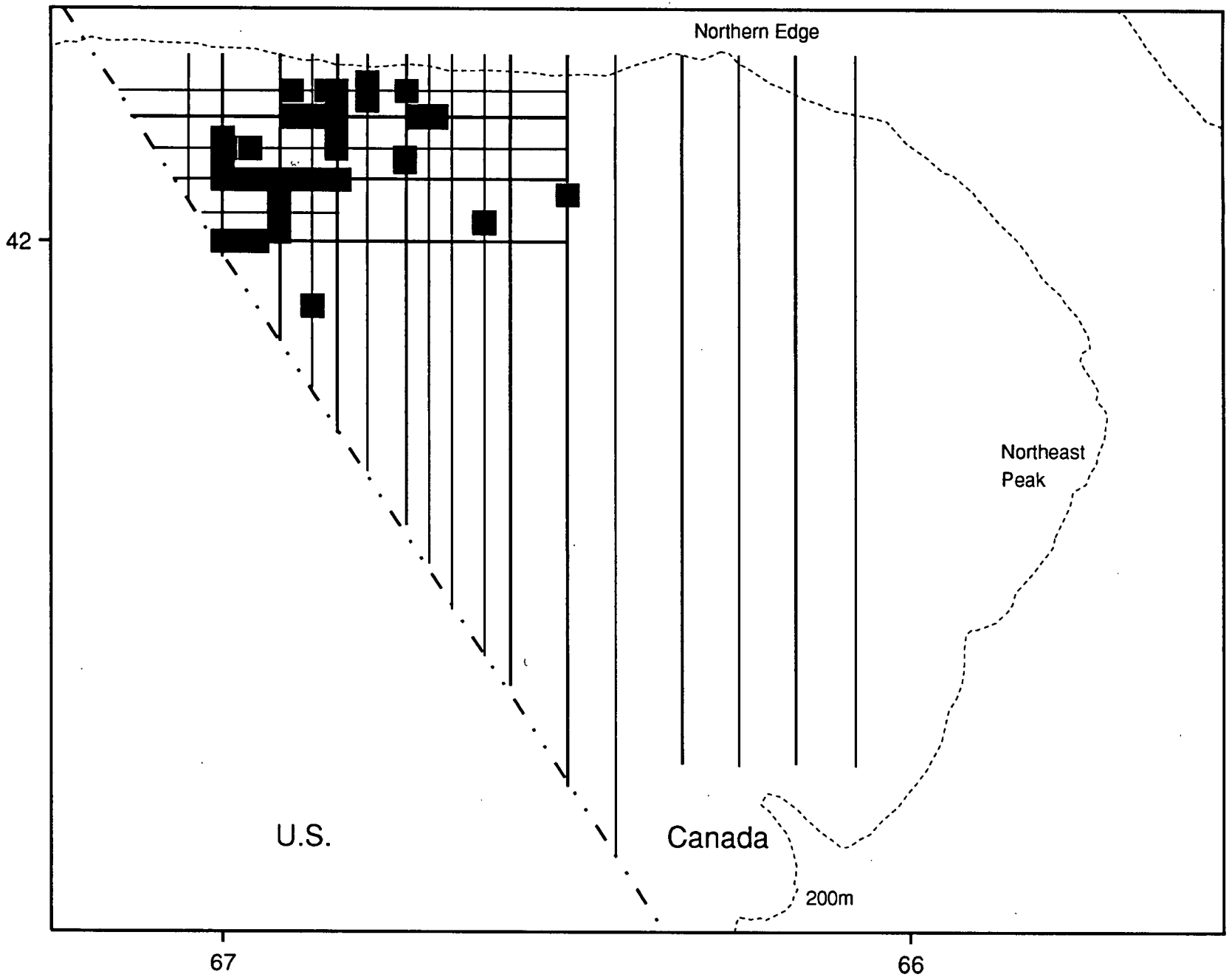

Figure 2. Herring shoals observed between Oct. 15 and 19 of 1992 on Georges Bank by 'Sealife II' and 'Mari Lynne Anita'.

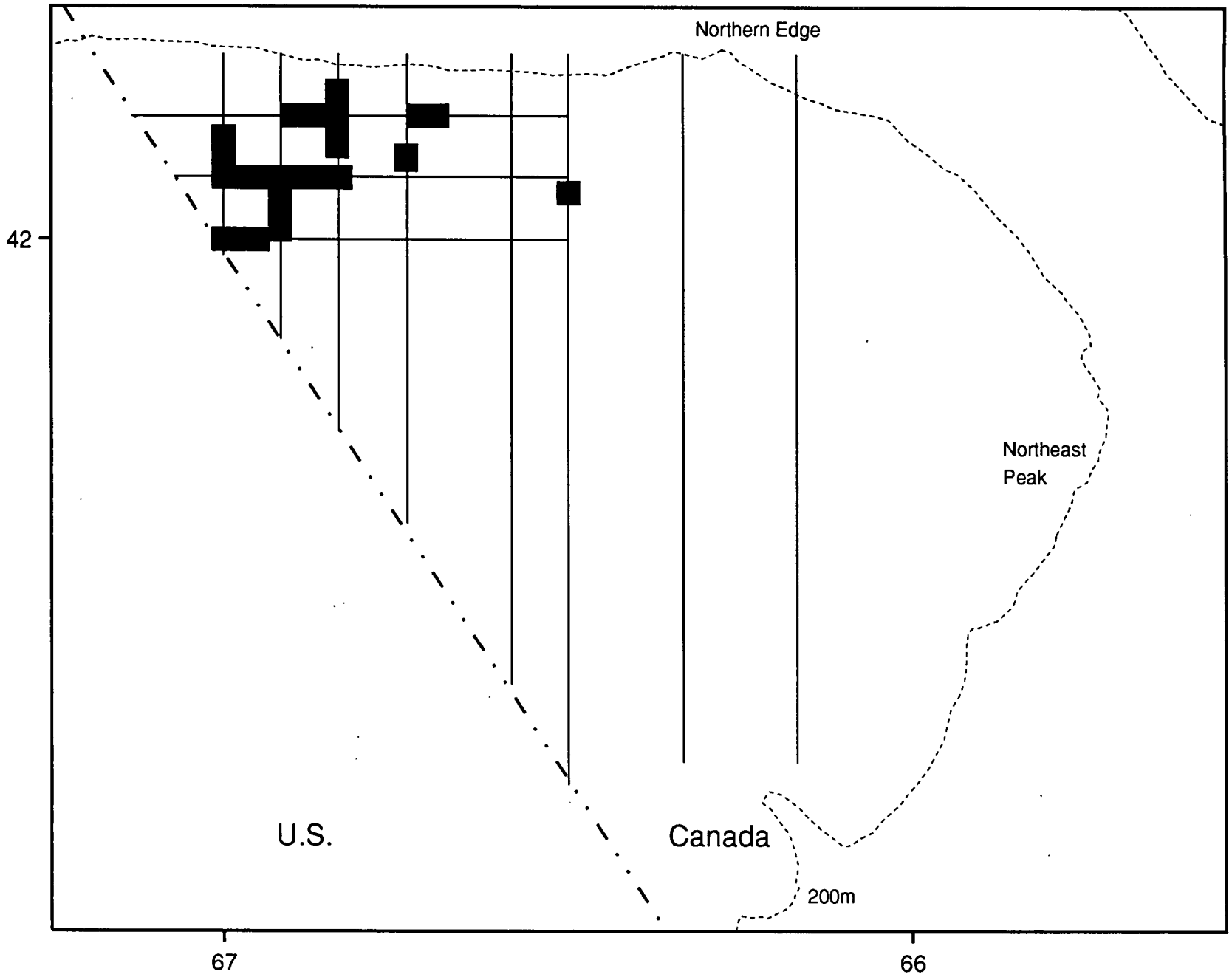

Figure 3. Herring shoals observed between Oct. 15 and 19 of 1992 on Georges Bank by 'Sealife II'.

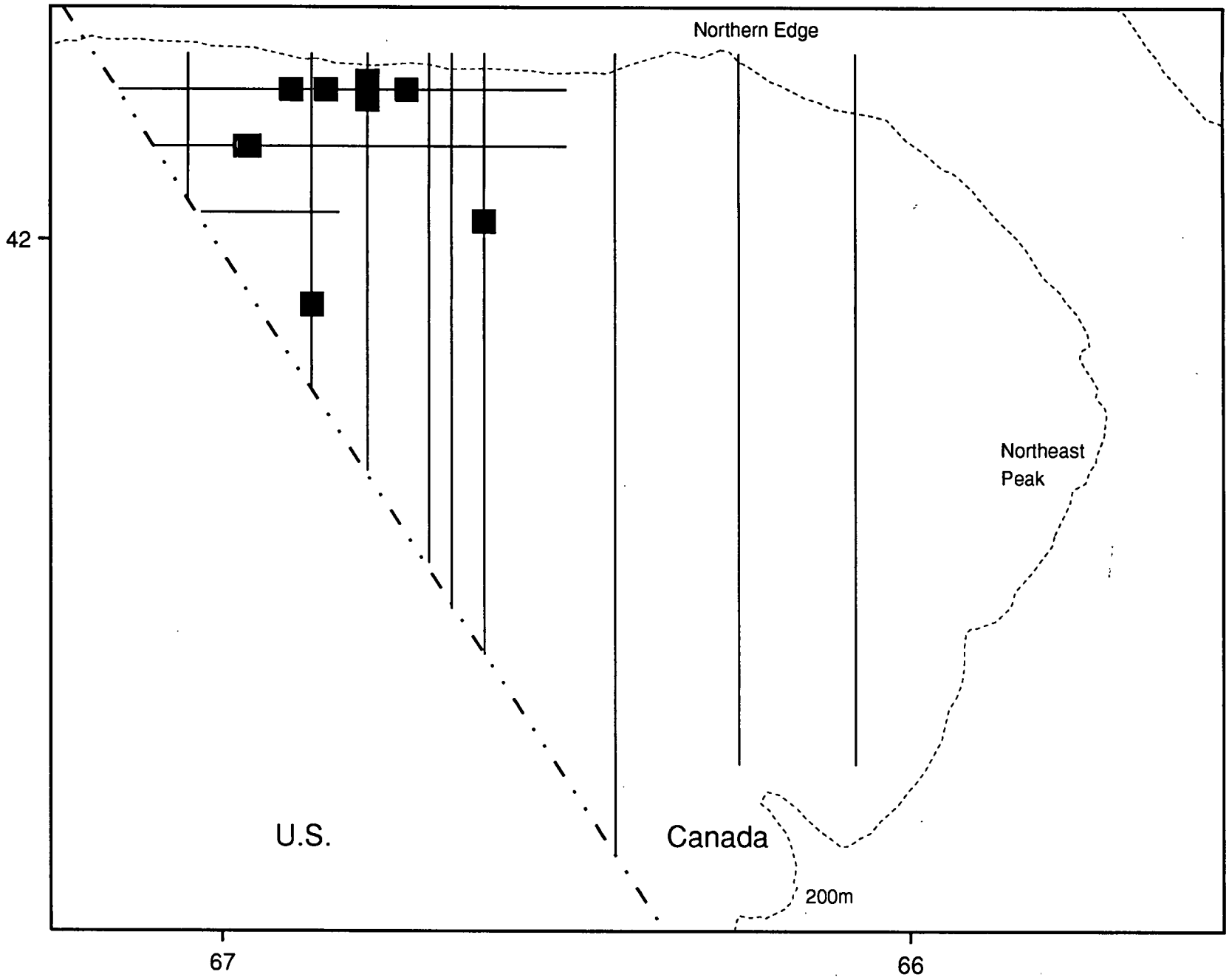

Figure 4. Herring shoals observed between Oct. 15 and 19 of 1992 on Georges Bank by 'Mari Lynne Anita'.

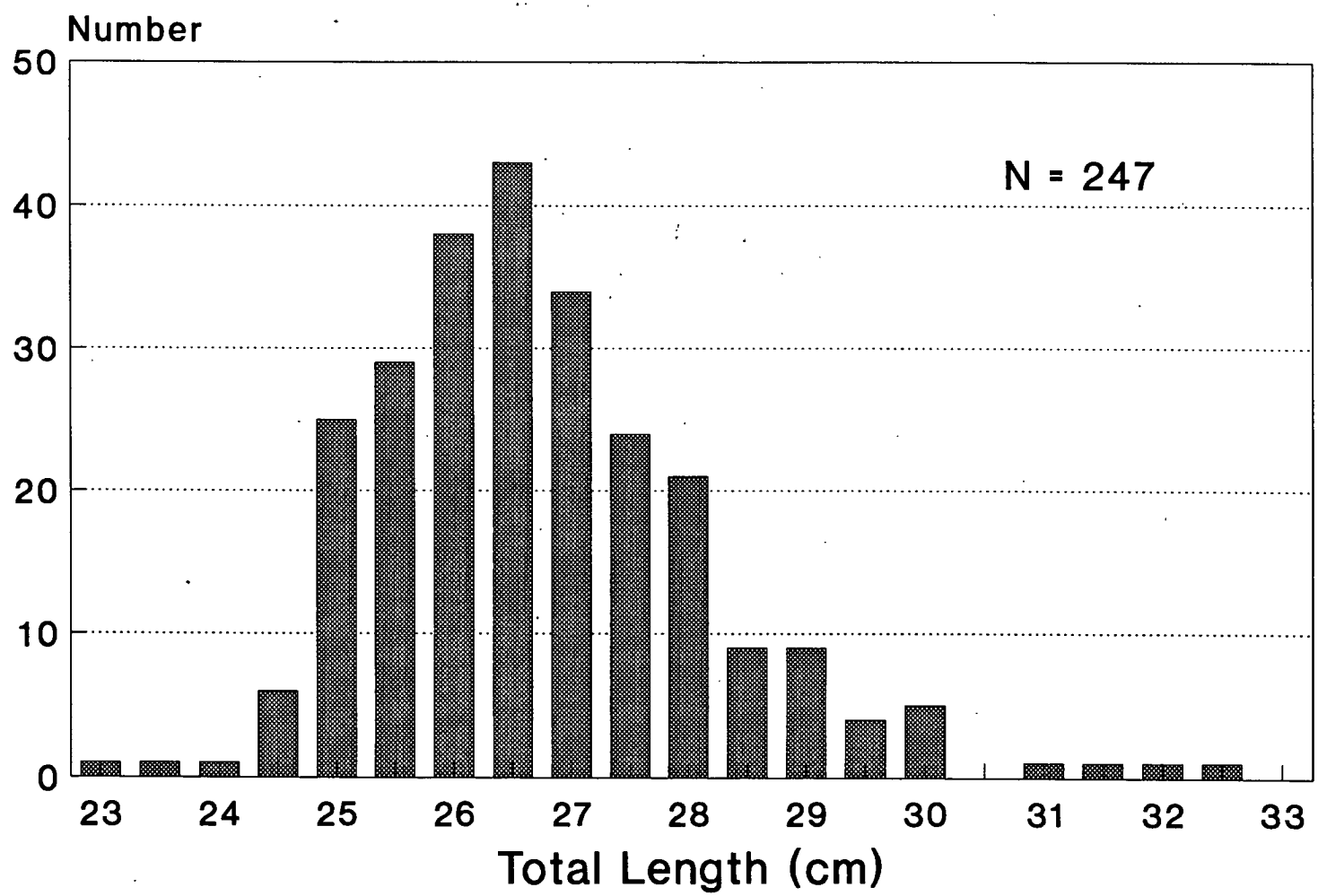

Figure 5. Length frequency of Atlantic herring.