

Not to be cited without
permission of the author¹

Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 89/ 60

Ne pas citer sans
autorisation de l'auteur¹

Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 89/ 60

Reappearance of Georges Bank herring: a biological update

by

R. L. Stephenson and M. J. Power
Marine Fish Division
Department of Fisheries and Oceans
Biological Station
St. Andrews, New Brunswick E0G 2X0

¹This series documents the scientific basis for fisheries management advice in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the Research Documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research Documents are produced in the official language in which they are provided to the Secretariat by the author.

¹Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée par les auteurs dans le manuscrit envoyé au secrétariat.

ABSTRACT

This paper reviews the history of the herring fishery on Georges Bank prior to its collapse in 1977, and provides a summary of evidence for reappearance of the stock in recent years.

Adult herring have been taken around the traditional spawning period by ground trawl in 1986, 1987 and 1988. In the first 2 yr, samples contained ripe and running fish, of the 1983 (both surveys) and 1984 (1987 survey) year-classes. The 1988 sample was dominated by the 1984 year-class but also contained a number of juveniles. Surveys in October/November 1987 and 1988 have documented substantial numbers of larvae.

RÉSUMÉ

Le présent document passe en revue la pêche au hareng dans le banc de Georges avant l'effondrement de cette pêche en 1977 et il résume les faits attestant d'une reprise du stock ces dernières années.

En 1986, 1987 et 1988, aux alentours de la période traditionnelle du frai, on a capturé au chalut à poissons de fond du hareng adulte. Les deux premières années, les échantillons contenaient du poisson gravide et du poisson migrateur de la classe annuelle de 1983 (les deux relevés) et de 1984 (relevé de 1987). Le relevé de 1988 était dominé par la classe annuelle de 1984, mais les échantillons contenaient aussi un certain nombre de juvéniles. Des relevés effectués en octobre et novembre 1987 et 1988 ont noté la présence d'une quantité substantielle de larves.

INTRODUCTION

A fishery for herring on Georges Bank began in 1961 and yielded approximately 2.7 million t before crashing in 1977. For several years, there was virtually no sign of either adults or larvae from what had once been estimated to be the largest herring population in the northwest Atlantic. In recent years (since 1984), there has been increasing indication of reappearance of herring on Georges Bank, including evidence of spawning and of substantial numbers of larvae.

Early evidence for reappearance (1984-86) was summarized in a previous Research Document (Stephenson et al. 1987). More recently, Stephenson and Kornfield (in press) have put forward the case that reappearance was the result of resurgence of a remnant of the original Georges Bank population, rather than recolonization from a neighbouring population.

Continued evidence for reappearance raises questions of stock size and attributes - particularly in relation to the historical Georges Bank population and the expectations of the present herring fishing industries.

In this paper we review the history of the Georges Bank herring fishery, update evidence for reappearance and summarize issues of relevance to research and management of this herring stock.

SUMMARY OF THE HISTORICAL FISHERY

A fishery for herring on Georges Bank began in 1961, and grew rapidly to become the largest herring fishery in the northwest Atlantic. Landings by a multinational fleet, using a variety of gear types, increased to 374,000 t in 1968 but subsequently declined. Catches in excess of 100,000 t were maintained until 1975 but the fishery then crashed. Only 2000 t were taken in 1977 and the fishery has been economically extinct since. The fishery followed a classic "boom and bust" pattern which yielded about 2.7 million t of herring between 1961 and 1976 (Table 1).

Anthony and Waring (1980) have summarized statistical information from the historical Georges Bank fishery, and their account follows. Table 1 lists landings from the Georges Bank historical fishery by country.

"In 1961 the USSR began the first intensive fishery for large herring on Georges Bank and landed 68,000 t of herring in the first year of operation [Table 1]. From 1961 to 1966 the USSR was the only nation harvesting the herring stock in significant quantities. Heavy fishing did not develop until 1967 when several other nations began intensive fishing operations. The Soviet Union diverted their effort from herring and began fishing for silver hake in 1963 and 1964 and for red hake and haddock in 1965. The catch of hake and haddock by the USSR in 1965 and 1966 totaled 422,000 and 371,000 t, respectively. The catch of herring by the Soviet Union in 1965 was only 36,300 t, although herring were very abundant.

Poland began intensive fishing for herring on Georges Bank in 1966, landing 14,000 t [Table 1], and by 1968 the catch had increased sharply to 75,000 t.

The Federal Republic of Germany (FRG) entered the fishery in 1967 with a small catch, but in 1968 their catch was nearly as great as that of Poland. The German Democratic Republic (GDR) also began fishing operations for herring on Georges Bank in 1967. Subsequently, herring on Georges Bank were harvested by the U.S., Canada, USSR, Poland, FRG, GDR, Romania, Iceland, Japan, Norway, Bulgaria and Cuba [Table 1].

Gill nets were used extensively by the Soviet Union during the first three years of the fishery. In 1961, 216,386 gill nets were used and in 1962 and 1963, 1,105,566 and 106,079 nets were used, respectively. Although pair trawling was tried in 1964, the bottom-fished otter trawl was the major gear type used by the Soviet Union from 1964 to 1968. In 1968, the USSR introduced purse seines into the fishery. This gear caught an average of 18,000 t or 23% of the Soviet catch during 1968-76. Until the introduction of midwater trawling by the GDR in 1971, side and stern bottom-fishing trawlers were the dominant vessels in the fishery. The side trawlers were primarily smaller than 900 GRT and the larger stern trawlers fished with otter trawls on the bottom until about 1972 when a change to midwater gear occurred. The catch of purse seines increased steadily from 1970-75 and then sharply declined. The shift to midwater trawling may have resulted, in part, from reduced ICNAF quotas on demersal fish stocks.

The shift in effort in 1965 and 1966 between the side and stern trawlers resulted from a shift of effort by the Soviets onto the large haddock and hake stocks which were fished by the larger stern trawlers. The catch of herring may have been only a by-catch." (Anthony and Waring 1980, pp. 74-76).

REAPPEARANCE OF GEORGES BANK HERRING

The absence of Georges Bank herring after collapse of the fishery in 1977 was confirmed by larval surveys (e.g. Smith and Johnson 1986) and by-catch records from groundfish surveys (e.g. Azarowitz and Grosslein 1987).

The reappearance is chronicled in Table 2. Evidence has been compiled primarily from directed surveys for larvae (oblique bongo tows) and from the appearance of adult herring as by-catch in both Canadian and U.S. research groundfish surveys, with additional observations from juvenile gadid (IGYPT trawl) and larval lobster surveys (bongo) and the commercial fishery.

The first indication of reappearance was postlarval herring taken by IGYPT trawl in the spring of 1984 (1983 year-class). Research groundfish surveys began picking up prespawning adult herring in the spring of 1986 and the first spawning adults in the fall of 1986; these were almost exclusively of the 1983 year-class. A Canadian purse seiner made one trip to Georges Bank in May 1986 and made sets of 2 and 68 t.

Key information came in the fall of 1986 with the verification of ripe herring in both Canadian and U.S. ground trawl surveys of Georges Bank. A directed survey in the fall of 1987 recorded ripe and recently spent adults (Fig. 1), and the presence of significant numbers of larvae (Fig. 2), indicating that spawning had been successful.

A survey for both larval and adult herring on Georges Bank was undertaken again between Oct. 30 and Nov. 11, 1988 (Lady Hammond cruise 194). Adults were taken opportunistically in ground trawl sets (Fig. 3). Tows were made for larvae according to a stratified random design in the area of historical spawning on the Georges Bank (Fig. 4). At the same time, a collaborative U.S. cruise (Delaware II) surveyed herring larvae on the western portion of Georges Bank, Nantucket Shoals and north of Cape Cod. At one point, the two vessels met for a series of comparative tows. It is intended that data for the two cruises will be combined into a synopsis of larval distribution.

Both the 1987 and 1988 adult surveys caught predominantly herring of the 1983-86 year-classes (Fig. 5). The 1988 survey also caught a number of juveniles (age 1) of the 1987 year-class.

ISSUES OF RELEVANCE TO RESEARCH AND MANAGEMENT

The reappearance of Georges Bank herring raises questions of stock size and attributes - particularly in relation to the historical population and the expectation of the present herring fisheries. The following are major issues:

- 1) How should stock size be estimated? What new or different surveys/techniques are required (e.g. acoustics) and at what life history stage?
- 2) As a prelude to management, there is a need to define a) management objectives, b) transboundary issues and c) fishery objectives, expectations and concerns.
- 3) Has the reappearance been the result of resurgence or recolonization, and what impact does this have on assumptions re stock structure.

The Georges Bank fishery had been assessed by ICNAF prior to its collapse and three series of information may be of use in assessing the relative rate of recovery:

- 1) larval survey information;
- 2) herring bycatch from spring groundfish surveys;
- 3) early VPA's done during the decline of the fishery.

The historical use of these series is being reviewed and their potential use in quantifying the rate of recovery evaluated. In addition, consideration is being given to the potential for acoustic or trawl surveys in estimation of stock size for Georges Bank herring.

LITERATURE CITED

- Anthony, V. C., and G. Waring. 1980. The assessment and management of the Georges Bank herring fishery. *Rapp. P.-v. Réun. Cons. Int. Explor. Mer* 177: 72-111.
- Azarowitz, T. R., and M. D. Grosslein. 1987. Fishes and squids, pp. 315-346. In Backus, R. H. (ed.) *Georges Bank*. MIT Press, Cambridge.
- Smith, W. G. , and E. Johnson. 1986. Contrasts in distribution patterns of larval Atlantic herring in the Georges Bank area, early 1970's vs early 1980's. *NAFO SCR Doc.* 86/93.
- Stephenson, R. L., D. J. Gordon, and M. J. Power. 1987. Herring of the outer Scotian Shelf and Georges Bank: history of the fisheries, recent developments and management considerations. *Can. Atl. Fish. Sci. Adv. Comm. Res. Doc.* 87/76: 23 p.
- Stephenson, R. L., and I. Kornfield. Reappearance of spawning herring on Georges Bank: population resurgence not recolonization. *Can. J. Fish. Aquat. Sci.* (in press).

Table 1. Historical record of herring landings from Georges Bank (1961-77): (from Anthony and Waring 1980, p. 75).

Year	USA	Canada	FRG	GDR	USSR	Poland	Japan	Bulgaria	France	Iceland	Norway	Romania	Cuba	Others	Total
1961..	105	-	-	-	67 550	-	-	-	-	-	-	-	-	-	67 655
1962..	101	-	-	-	151 864	277	-	-	-	-	-	-	-	-	152 242
1963..	322	-	-	-	97 646	-	-	-	-	-	-	-	-	-	97 968
1964..	489	-	-	-	130 914	35	-	-	-	-	-	-	-	-	131 438
1965..	1 191	-	-	-	38 262	1 447	-	-	-	-	-	1 982	-	-	42 882
1966..	4 308	-	-	1 133	120 113	14 473	-	-	-	-	-	2 677	-	-	142 704
1967..	1 211	1 306	28 171	22 159	126 759	36 677	40	-	-	-	-	1 420	-	-	218 743
1968..	758	13 674	71 086	67 719	143 097	75 080	171	-	-	292	-	1 656	-	65	373 598
1969..	3 678	945	61 990	44 624	138 673	45 021	583	812	-	12 786	1 224	337	-	85	310 758
1970..	2 011	7	82 498	28 063	61 579	70 691	1 412	348	-	-	-	685	-	-	247 294
1971..	3 822	12 863	54 744	18 447	81 258	88 325	2 466	4 551	-	-	-	898	-	-	267 374
1972..	2 782	53	27 703	40 016	48 072	49 392	1 161	2 355	500	-	-	2 156	-	-	174 190
	(4 000)	(5 800)	(31 600)	-	(48 200)	(49 400)	(200)	-	-	-	-	(600)	-	(8 200)	(150 000)
1973..	4 627	5 083	31 501	53 326	52 340	49 275	1 722	1 380	2 784	-	-	297	-	-	202 335
	(5 250)	(5 050)	(31 600)	-	(48 200)	(49 400)	(1 200)	-	-	-	-	(1 300)	(8 000)	-	(150 000)
1974..	3 370	217	23 690	31 530	41 541	39 312	4 242	1 773	3 617	-	-	2 018	-	-	149 510
	(6 955)	(2 980)	(23 900)	(31 440)	(41 725)	(39 000)	-	-	-	-	-	-	(4 000)	-	(150 000)
1975..	4 582	0	22 957	30 901	40 945	38 392	1 878	421	3 304	-	-	1 544	10	1 162	146 096
	(8 400)	(3 000)	(23 750)	(31 150)	(41 100)	(38 400)	-	-	-	-	-	-	(4 200)	-	(150 000)
1976..	744	-	8 806	7 891	12 996	10 517	868	105	1 166	-	-	115	296	3	43 507
	(12 400)	(1 000)	(9 200)	(9 300)	(12 190)	(11 000)	(1 100)	(900)	(1 100)	-	-	(800)	(10)	(1 000)	(60 000)
1977..	361	2	-	-	1 492	119	-	1	-	-	-	-	152	-	2 127
	(12 000)	(1 000)	(4 725)	(4 825)	(3 400)	(5 100)	-	(100)	(1 000)	-	-	(100)	(50)	(700)	(33 000)

* National allocations in parentheses.

Table 2. Chronology of the reappearance of herring on Georges Bank.

Date	Observation	Vessel/Location
12 June 1984	Small juveniles (n>200) taken by mid-water (IYGPT) trawl on Canadian research survey. All from 1983 year-class; mean length = 60.5 mm.	R/V <u>Alfred Needler</u> cruise 29 One set at 42°02'N, 66°59'W.
24 Feb. 1986	Adult herring (n=213; non-reproductive) taken by ground trawl on U.S. groundfish survey. All from 1983 year-class.	R/V <u>Delaware</u> cruise 86-02 At four sets around 41°49'N, 66°50'W.
5-12 Mar. 1986	Adult herring (n=786; non-reproductive) taken by ground trawl on Canadian groundfish survey. Length range 15-26 cm (mean = 19.5 cm) indicates 1983 year-class.	R/V <u>Alfred Needler</u> cruise 59 19 sets.
19-20 May 1986	First successful commercial purse seiner catch.	M/V <u>Lady Melissa</u> . Sets of approx. 2 t (42°04'N, 66°30'W) and 68 t (42°05'N, 66°35'W) by purse seine.
14-24 Oct. 1986	Adult herring (n=43; reproductively active) taken by ground trawl on U.S. groundfish survey. All from 1983 year-class.	R/V <u>Albatross</u> cruise 86-05 (II).
29 Oct.- 5 Nov. 1986	Adult herring (n=111; reproductively active) taken by ground trawl on Canadian groundfish survey. Almost entirely 1983 year-class.	R/V <u>Alfred Needler</u> cruise 71 13 sets along 50 fath contour of northeast peak.
3-11 Nov. 1987	Adult herring (n=396; reproductively active) taken by ground trawl, and larvae (in 19 sets; in significant numbers (n>200) in four sets) taken by bongo net in Canadian research survey.	R/V <u>Lady Hammond</u> cruise 181
30 Oct.- 11 Nov. 1988	Collaborative larval survey by both Canada and U.S. Adult herring taken by ground trawl on western edge of Georges.	R/V <u>Lady Hammond</u> cruise 194 R/V <u>Delaware II</u> cruise

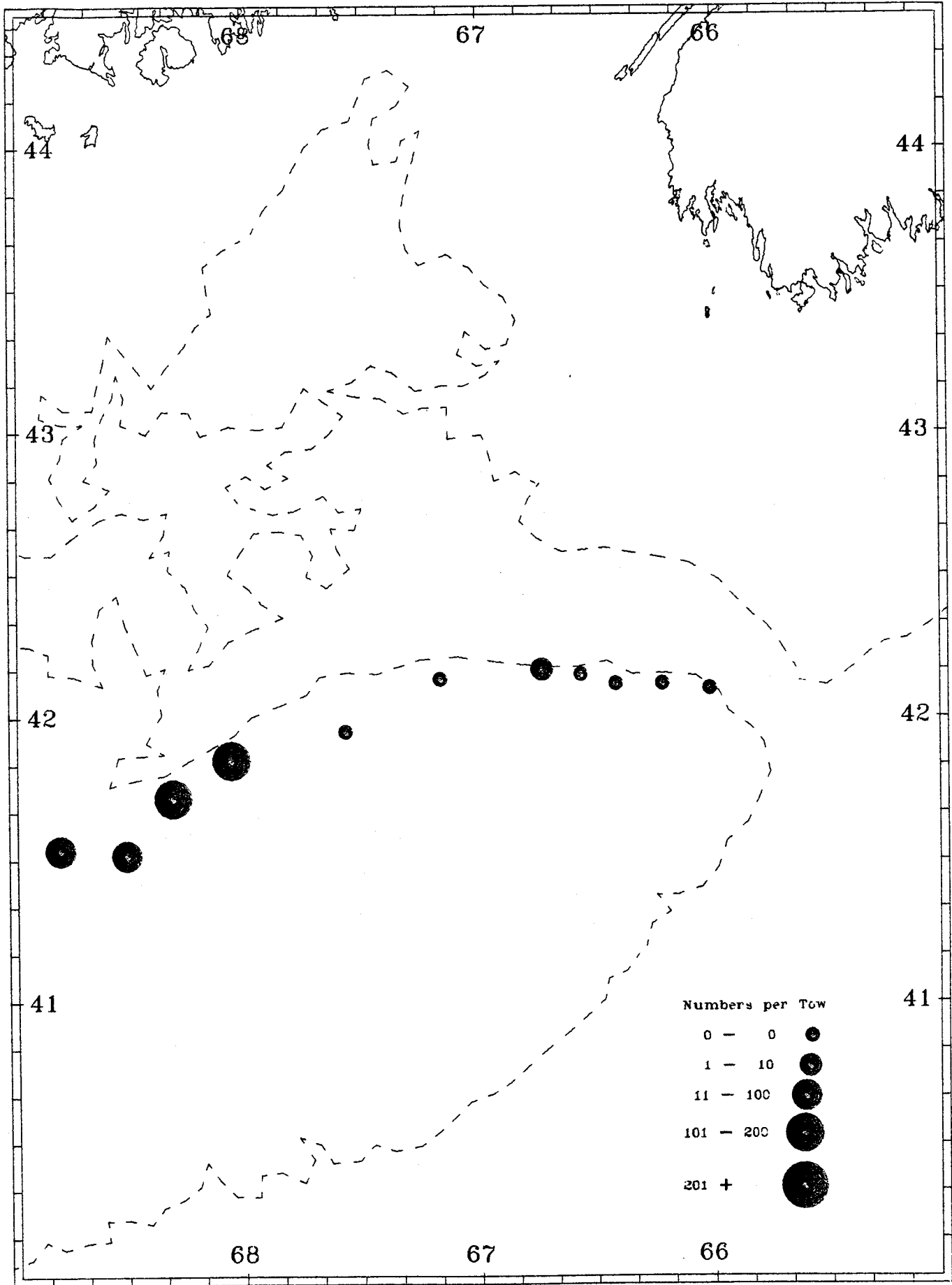


Fig. 1. Catches of adult herring (number/tow) in ground trawl sets of the 1987 survey (H181).

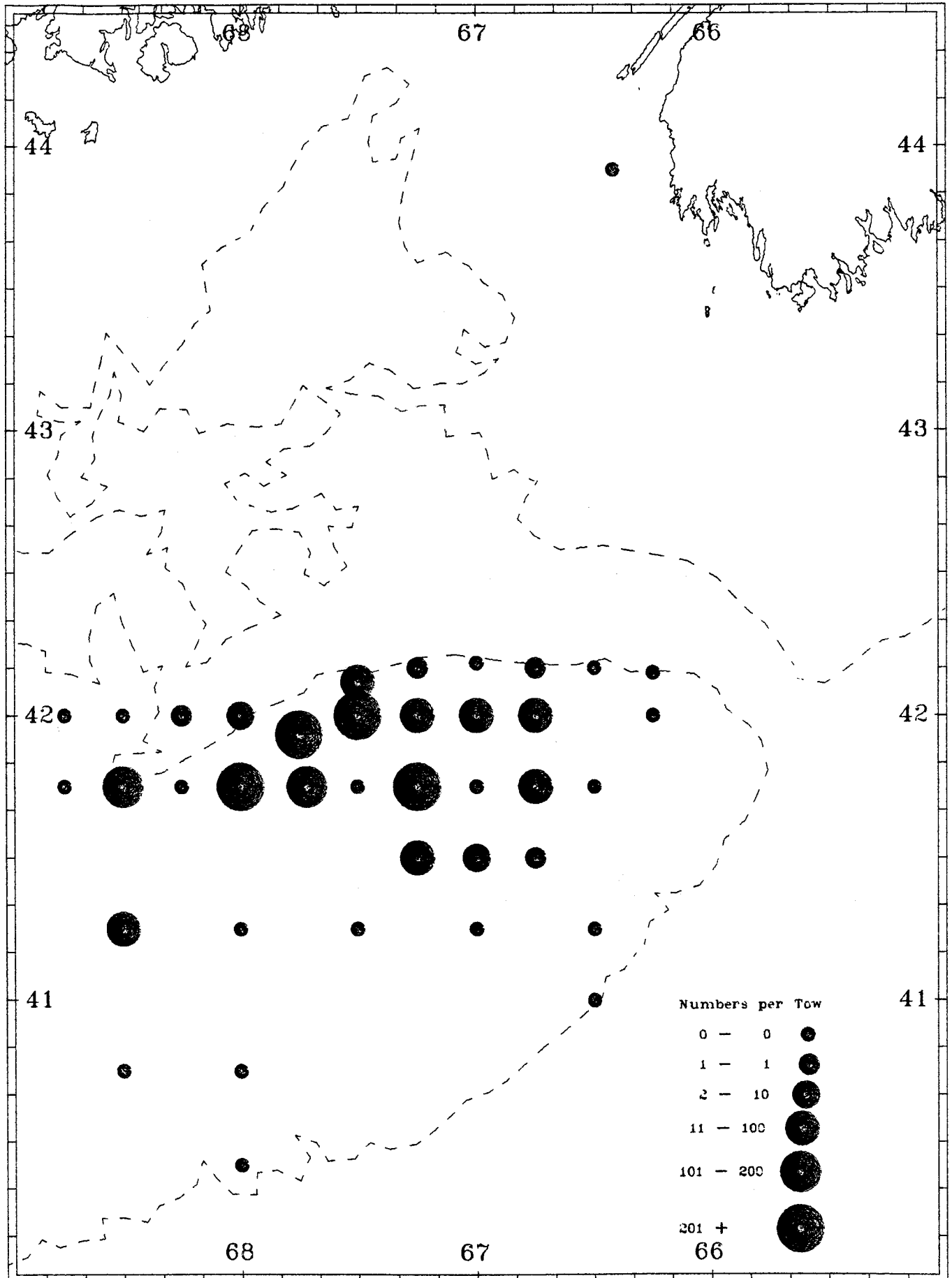


Fig. 2. Catches of larval herring (number/tow) in bongo sets of the 1987 survey (H181).

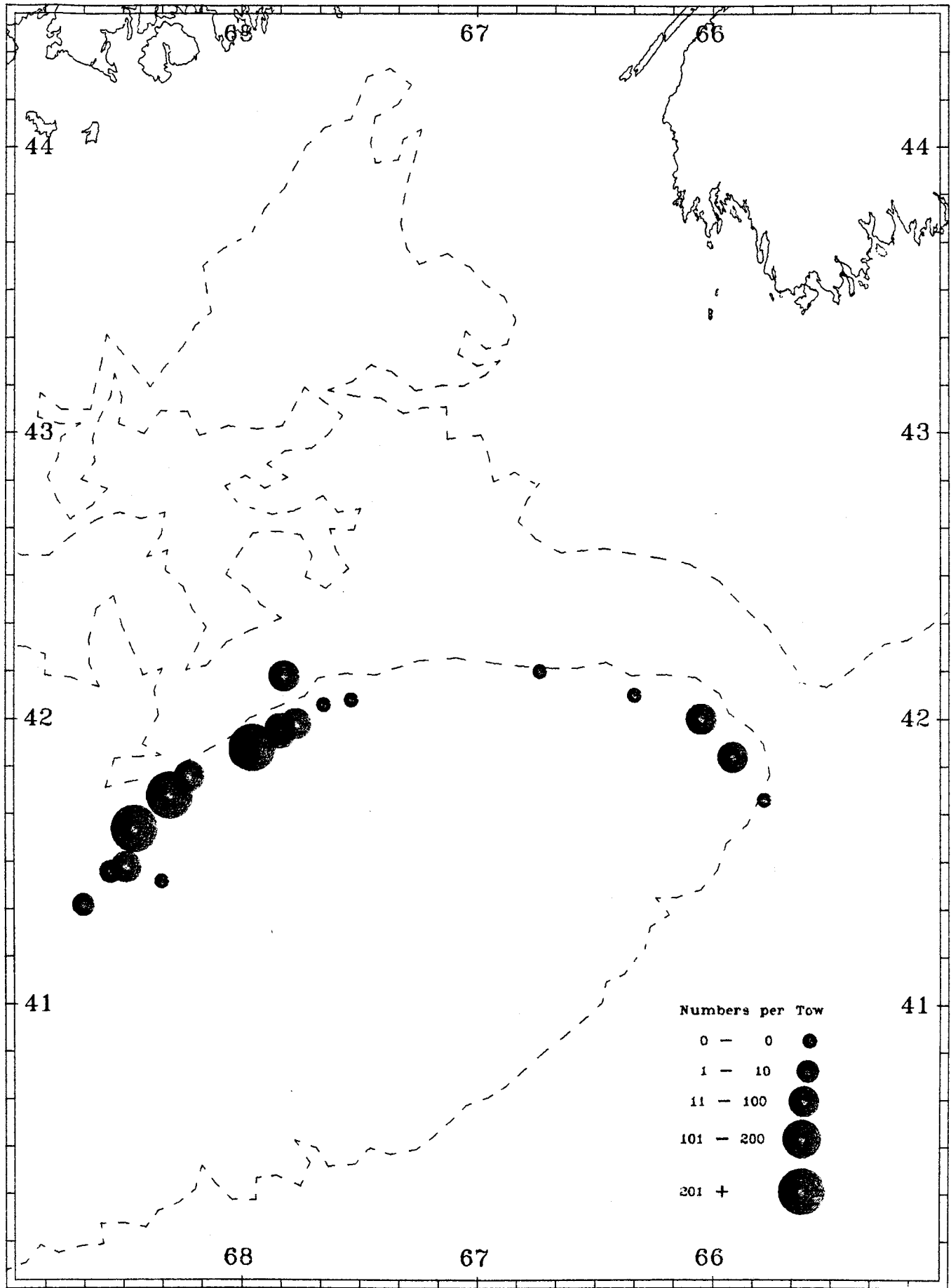


Fig. 3. Catches of adult herring (number/tow) in ground trawl sets of the 1988 survey (H195).

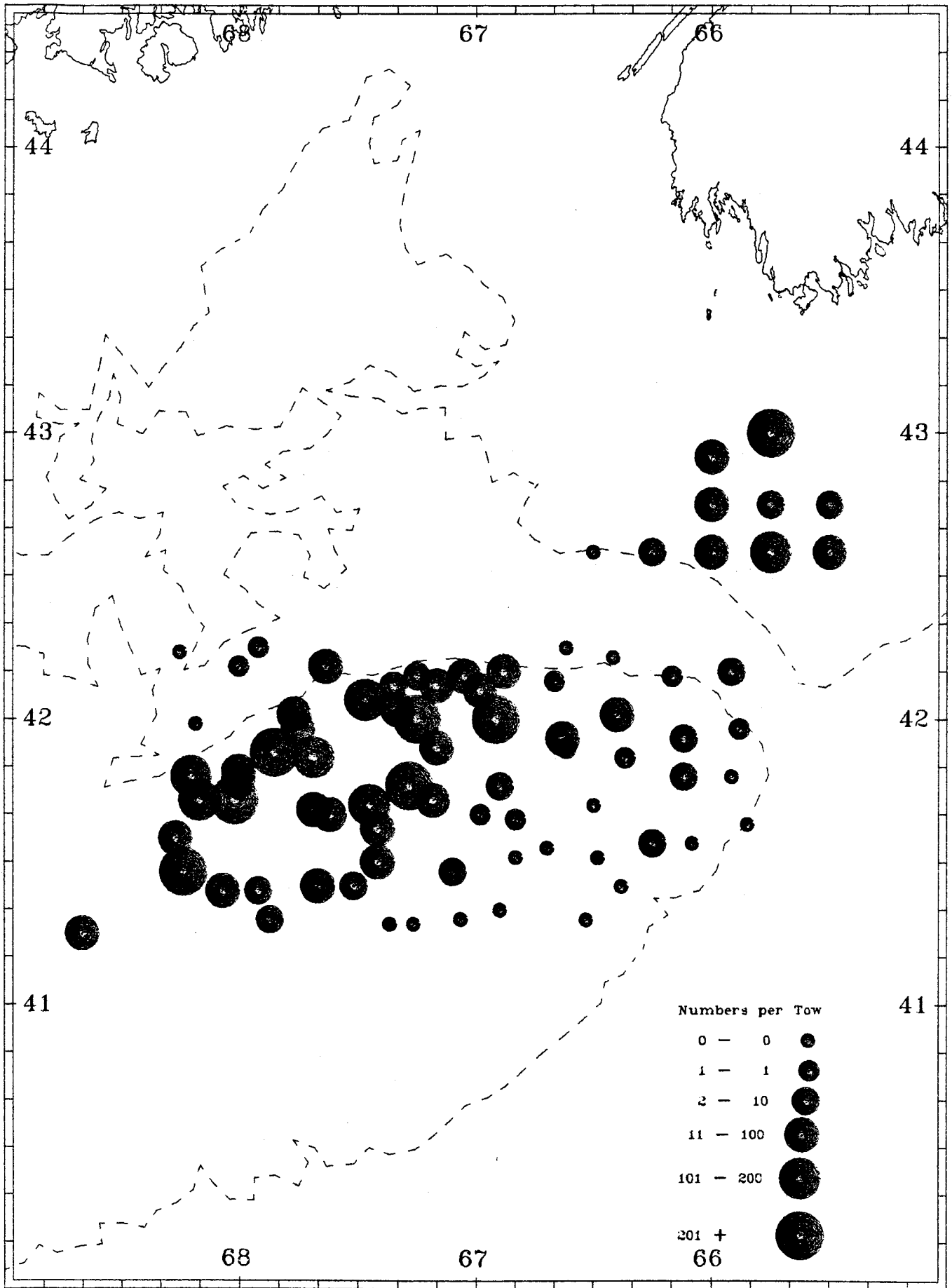


Fig. 4. Catches of larval herring (number/tow) in bongo sets of the 1988 survey (H195).

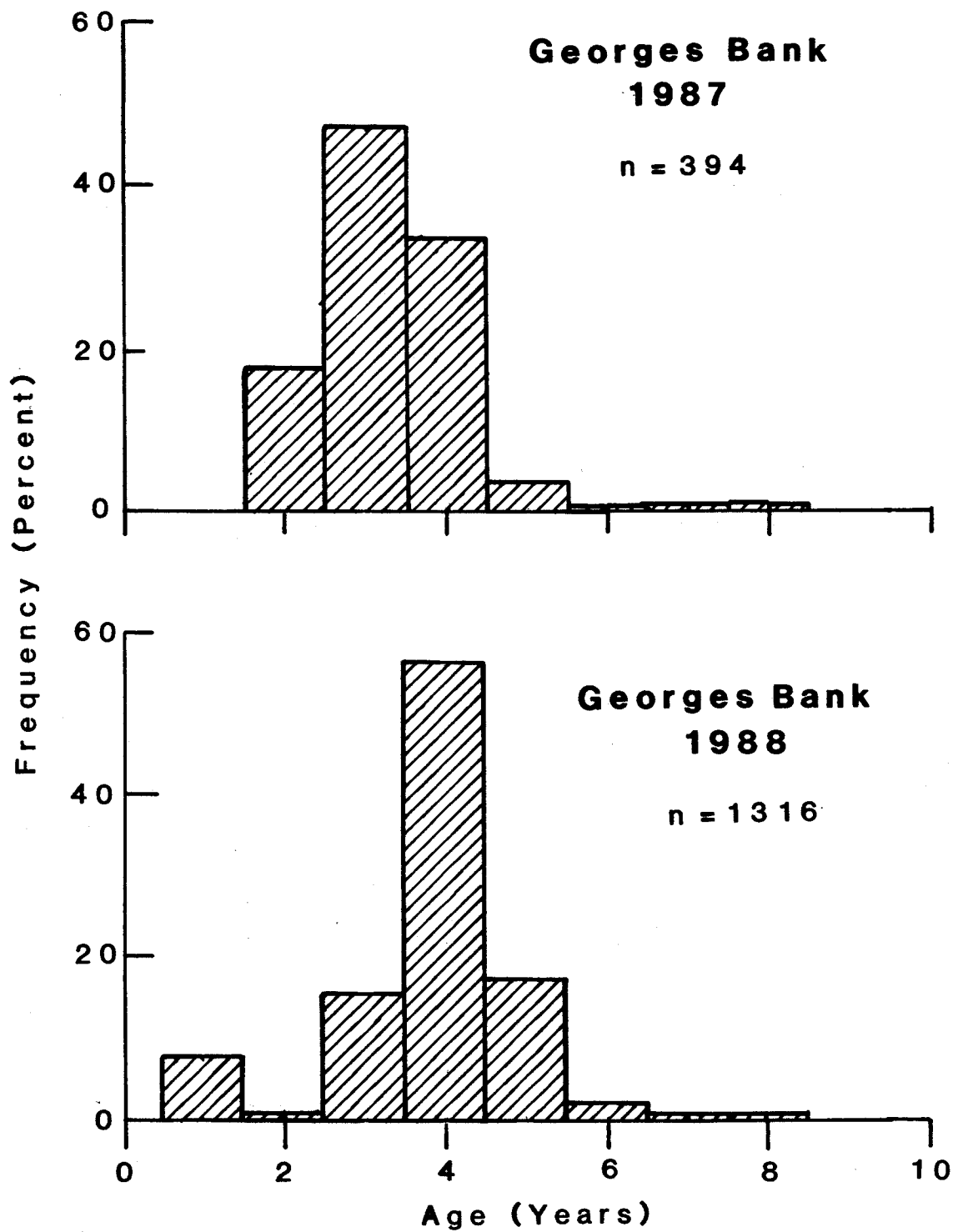


Fig. 5a. Adult age frequency from Hammond cruises - 1987, 1988.

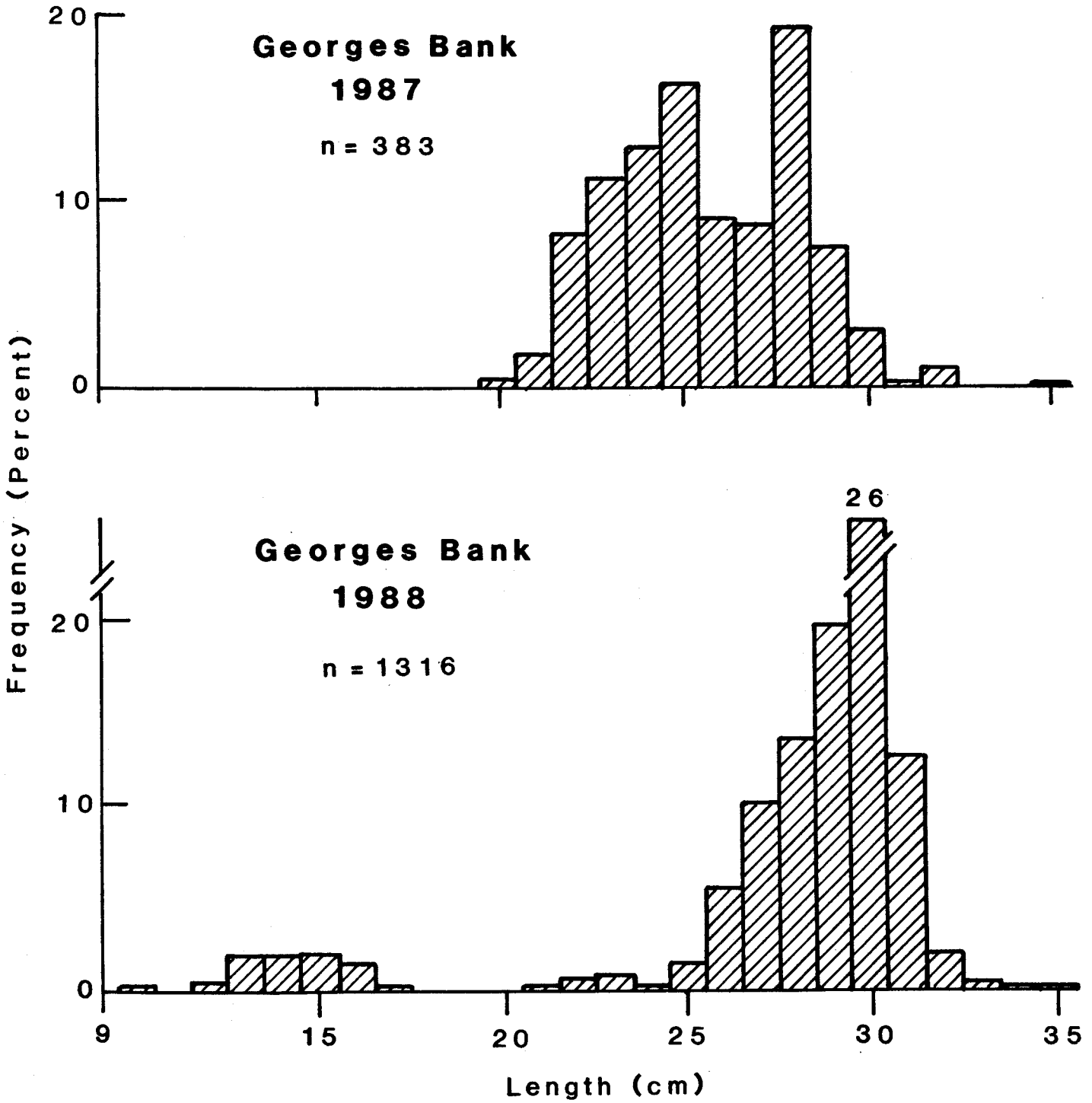


Fig. 5b. Adult size frequency from Hammond cruises - 1987, 1988.