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FLEET ACTIVITY IN THE 1997 4WX HERRING FISHERY

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ABSTRACT

The timing and location of fishing by commercial herring vessels is summarized for the three spawning stock components in the 1997 4WX herring fishery. For each week during the fishing season an outline describing fishing activity, as well as related information which may involve fish size, temperature and comments from fishers are provided. Observations and documentation of schools and spawning grounds by the commercial fleet are included, as well as quantitative hydroacoustic biomass estimates of spawning stock which were used to estimate the spawning stock biomass in the southwest (SW) Nova Scotia spawning component for 1997.

RÉSUMÉ

Les moments et lieux de pêche des harenguiers commerciaux sont résumés pour les trois composantes du stock de géniteurs de hareng de la pêche de 1997 en 4WX. Un sommaire des activités de pêche accompagné de renseignements portant notamment sur la taille des poissons, la température ou les remarques faites par les pêcheurs est donné pour chaque semaine de la saison de pêche. On trouve aussi les observations faites et les notes prises par la flottille commerciale relativement aux bancs et aux aires de frai de même que les estimations hydroacoustiques quantitatives de la biomasse qui ont servi à estimer la biomasse de la composante du stock de géniteurs du sud-ouest de la Nouvelle-Écosse.

INTRODUCTION

The following summary of the 1997 4WX herring fishery was compiled from industry records, vessel search records, and Dockside Monitoring Program logbooks to show the distribution of fishing activity on a weekly basis, and the changes and trends which occurred within each major fishing area during the season.

During 1996, some processing plants became involved in a sampling program that substantially increased the amount of biological information collected from the fishery. This sampling increased further during the 1997 season and has had a large impact on the amount and quality of information that is available. Processing plants submitted length frequency records of fish from all of the major fishing areas. In addition, plants prepared frozen samples of fish to be processed, at a later date, for fish size, age and maturity. It was primarily the length frequency records that were used in this report to summarize the size ranges of fish that were caught in particular areas during the fishing season.

An additional source of information was the notes taken during the year by fishing associations. Representatives of the purse seine and gillnet fleets have shared valuable notes on the daily and weekly activity of the fleets and fishers, the distribution of vessels, and comments or concerns expressed by captains or groups as the fishery progressed. These notes were coupled with observations and notes taken by staff of the St. Andrews Biological Station throughout the season to paint a more thorough picture of the 1997 fishery.

The Dockside Monitoring Program provided logbook records of all purse seine landings in each fishing area, and these records (1,241) were combined with the information gathered by fishing associations on fleet distribution. In addition, captains were at liberty to complete a section on biological information for each fishing trip when they felt there was relevant information to report. Many of the logs contained general, but useful, comments on set condition, fish condition and relative school size. However, very few logs contained records that were documented in a quantitative fashion (Figure 1). Quantitative comments (i.e. 2 miles by 1 mile of heavy fish, 15 fathoms thick), as opposed to more general comments (i.e. "big school" or "thick fish") are important because they can be related to the abundance of fish from that area. Comments from captains are included in the weekly summary of purse seine activity to better understand conditions during each period.

As in the past, a number of vessel captains submitted herring search records containing important observations made throughout the fishery on the size and distribution of herring schools and fish condition (Tables 1-3). These records were valuable in documenting the amount of fish seen during the fishing season.

In addition to submitting independent records, structured surveys of spawning grounds were performed by some vessels working together (Table 7). The purpose of these surveys was to attempt to document and quantify the biomass of spawning fish

present. Biomass was estimated by determining, from the sounder images, the length, width, depth and density of a school and attempting to affix a tonnage based on these parameters using the method of Stephenson et al. (1997) (Table 4).

During 1997 there was a reduction in the amount of documentation of schools and spawning grounds by the fleets. The amount of time invested in conducting structured surveys also decreased from 1996 (Figure 2), as did the number of vessel search records submitted. The decline in documentation, in spite of encouragement from fishing associations and DFO staff, was a result of the overall mood of the fleet. The general feeling of some captains was that they received very little reward, in the form of a quota increase, for their efforts in 1996. Although the quota increased by 7,000 tons in 1997, the overall allocation remained the same and because of a change in the distribution among sectors, the allocation of 4WX quota to the purse seine sector was smaller in 1997 than in 1996.

A new method to quantify the biomass of herring schools was introduced in 1997 (Melvin et al. 1998). Two hydroacoustic recording systems were set up on purse seine vessels and were operated throughout the entire fishing season. Vessel captains were at liberty to record schools at any time during a night of fishing. The systems recorded the sonar and sounder information and, by taking fish size into consideration, this information was then analyzed to give a quantitative estimate of abundance (Table 5). This method has proven to be very useful in the field in helping scientists quantify the amount of fish seen throughout the fishery.

Considerable effort by numerous parties went into documenting the fishery, and this provided valuable information on herring stocks and spawning groups within 4WX. The quality and amount of information that has been acquired is a product of the time and dedication of all those involved.

1) Offshore Scotian Shelf Banks

- Fished by the purse seine fleet
- The second year of reactivated fishing in this area
- The fishery started earlier in 1997 than in 1996, with some vessels steaming to Halifax in mid-April.
- Unlike 1996 when activity was concentrated in the vicinity of "The Patch", the fleet fished several banks in 1997 (Figure 3). Fish were seen on and between all of the banks and catches were widely distributed, spanning a distance of 20 - 140 miles (Table 6) on most nights.
- Fish size and condition differed between banks; fat content was very high, up to and over 20% at times.
- The majority of the fish stayed too deep in the water to be caught by purse seine. There were several nights when there were good sightings of fish, but few catches.

- Catches were higher in 1997 - 20,261 tons of herring were caught compared to 11,745 tons caught in 1996. Maps of distribution of purse seine landings by week are presented in Appendix I.

April 12 - May 5

A few vessels searched the outer banks. One vessel searched the The Patch on April 12, but found no fish. A vessel made a set on a large group on Roseway Bank on April 22, but released the fish because they were too small (18-20 cm, 7-8 inches). Four vessels searched The Teardrop, The Patch, and surrounding areas on April 23, but found no fish. On May 5, one vessel searched the banks and returned to Halifax the next day after seeing no fish.

May 18 - 24

The fishery began on May 19 with one landing from Emerald Bank. On May 20, one landing came from Browns Bank. Many more vessels were fishing by May 24 with most landings coming from Emerald Bank and Mackenzie Spot. Fish were caught during the day and staying on or near bottom most of the time. Water temperatures ranged from 38°F to 39°F (3-4°C).

May 25 - 31

Catches were reported primarily from Mackenzie Spot and Emerald Bank. Fish were also seen on The Teardrop, The Bullpen and near The Owl. Fish were reported to be moving fast.

June 1 - 7

Catches were widely distributed with vessels fishing on and between the small banks, such as Sambro Bank, The Patch, The Teardrop & Mackenzie Spot, in addition to Emerald Bank and Emerald Basin. During a Monitoring Working Group (MWG) conference call on June 2 it was reported that fish from different areas were of different size and condition. The fish from the banks had a very high fat content relative to past years. Water temperature ranged from 41°F to 44°F (5-7°C) between the banks, and 46°F (8°C) on The Bullpen. Fish were moving fast and staying deep. Captains report seeing "miles of fish" and "more fish seen now than during all last year". This is the first week that fishing occurred on The Patch; fish were feedy, with good fat content.

June 8 -14

Fish landings came from The Bullpen area for most of the week. Fish were seen everywhere, but stayed deep. One vessel reported searching French Bank all day on June 11, but saw no fish. Water temperature on The Bullpen was 45-46°F (7-8°C).

June 15 - 21

Fishing on the traditional banks continued while fishing started on Western Hole. One vessel searched north of Browns Bank and found no fish. Landings came primarily from The Patch. Observations from The Patch on June 17 include 5 miles of fish on bottom, 15 fathoms thick.

June 22 - 28

On June 23 a MWG conference call was held. Landings at this time were just under 6,700 tons, which was lower than last year at this time. Fish were staying close to bottom and fish from different areas differed in size and fat content. Water temperature on The Patch

was 52°F - 53°F (11-11.5°C). Another MWG conference call was held on June 27 due to the landings exceeding that of last year (~12,000 tons). Since only a portion of available fish on the banks were moving up in the water column high enough to be caught, the decision was made to proceed with the fishery with increased use of vessel search records. Processors commented that fat content was continuously climbing (up to and over 20% at times). Landings were mainly from The Bullpen and The Patch, however, fishing continued on Mackenzie Spot, The Cowpen and The Teardrop.

June 29 - July 5

Landings came from Emerald Basin, Mackenzie Spot, The Patch, The Teardrop, and northeast of Sambro Bank. Observations from NE of Sambro Bank on July 2 - 4 indicated that there were lots of fish, but that they were staying deep with only a portion coming up high enough to be set on. Water temperature was 58°F (14°C). A MWG Conference Call was held on July 4 to report that landings were just under 15,000 tons. As well, there had been size differences between fish caught from The Bullpen and Sambro Bank. Fish from The Bullpen were relatively small with a moderate fat content, and fish from Sambro Bank were larger and contained more fat.

July 6 - 12

Early in the week landings came primarily from Mackenzie Spot, however, by mid-week the majority of the landings came from Emerald Basin, with some from east of Sambro Bank. Fish were moving around and getting harder to catch. Fishing also occurred on LaHave Bank, LaHave Basin, Western Hole and Roseway Bank. Acoustic analysis of a small school of fish on Mackenzie Spot showed an estimated 40,600 tons of herring where vessels were fishing on July 7. A MWG conference call was held on July 11. Total landings thus far were just under 19,000 tons. One captain reported seeing 3 square miles of fish on the bottom between LaHave and Roseway banks. Overall, sizes of fish had been consistent with that of last year.

July 13 - 19

Fishing effort declined and only a few landings came from Mackenzie Spot early in the week. Vessels were spread out fishing from west of German Bank to east of Baccaro and LaHave banks. The last landing from the outer banks was on Monday, July 14.

2) Southwest Nova Scotia

- Fished primarily by the purse seine fleet except for parts of the coast, as in recent years Trinity Ledge and Spectacle Buoy, which are fished by the gillnet fleet. Figure 4 shows fishing locations and landmarks in Southwest and Coastal Nova Scotia for 1997.
- Large aggregations of feeding and spawning herring were recorded with hydroacoustic equipment in traditional areas (Table 5).
- As in recent years, structured surveys were performed on spawning grounds (Table 7a), with major aggregations documented on German Bank.
- Landings totaled 56,177 tons. Weekly purse seine catches are presented in Appendix I and monthly gillnet catches in Spectacle Buoy and Trinity Ledge are shown in Appendix II.

June 1 - 7

Fishing on the Long Island shore began.

June 8 - 14

A length frequency from Spectacle Buoy on June 4 shows fish 25.5 - 34.0 cm (10.0 - 13.5 in), with a mode of 29.0 cm (11.5 in). A survey of the area was conducted on June 12 with ten gillnet vessels. Three groups of fish were found within a two square mile area between Bald Tusket Island and the Spectacle Buoy. It was estimated that 15,000 tons of fish were present in the area. Fish were 25.5 - 35.5 cm (10 - 14 in) long (modal length=29.0 cm, 11.5 in). During a conference call on June 13 it was decided to permit up to 1,500 tons to be fished prior to the next survey.

June 15 - 21

A conference call was held on June 20 to discuss the status of the gillnet fishery in the Spectacle Buoy area. On June 19, three bunches of fish were present north of the buoy, in a different area from where the survey took place the previous week. The decision was made to allow the fishery to progress toward 3,000 tons. Another survey was to be conducted if a large aggregation appeared.

June 22 - 28

No fishing activity in SW Nova Scotia.

June 29 - July 5

No fishing activity in SW Nova Scotia.

July 6 - 12

An acoustic analysis of a large area of fish on the Long Island shore on July 11 shows an estimated 105,000 tons of herring present in the school. Vessels fished Northeast Bank and off White Head Island, Grand Manan.

July 13 - 19

Fishing effort shifted from the outer banks to SW Nova Scotia during this week. Fishing continued as usual on the Long Island shore, Digby Neck and Grand Manan. Vessels were catching small fish on the edge of German Bank and around Seal Island. Observations from the Trinity Ledge/Lurcher Shoal area on July 16 include fish of mixed sizes ranging from 15.0 - 28.0 cm (6 - 11 in). A MWG conference call was held on July 18.

July 20 - 26

The majority of fishing effort was concentrated off Cape St. Marys, 5 - 10 miles north of Trinity Ledge. Fish had no feed and good fat content. Observations from this area on July 21 showed fish ranging in size from 16.5 - 35.5 cm (6.5 - 14.0 in) with a mode at 28.5 cm (11.0 in). Water temperature was approximately 50°F (10°C). A quantitative acoustic analysis of a large group of fish off Grand Manan on July 21 showed approximately 101,800 tons present in the area. Observations from this week on Tongue Ground included very large aggregations of fish ranging from 23.0 - 25.5 cm (9 - 10 in). A MWG conference call was held on July 25. Large amounts of fish (23.0 - 28.0 cm, 9 - 11 in) were reported west of Dry Ledge Buoy.

July 27 - August 2

A survey of Scots Bay was conducted on July 29 with four captains participating. Two schools were encountered, one was estimated to contain 500 tons, and the second was described as being 5 miles long and consisting of strips, each 0.5 mi by 0.25 mi long. Overall, 15,000 tons was thought to be seen and the fishery was opened for 5,000 tons on

the view that many more fish were expected to show up in the area. The fishery began on July 30 with no prohibition on weekend fishing. Vessels were fishing Scots Bay and on a large aggregation of herring west of Seal Island for the remainder of the week.

August 3 - 9

Fishing in Scots Bay and west of Seal Island continued. Another survey was performed in Scots Bay on August 5 by four captains. Three major groups were found, estimated at a total of 10,000 tons. Captains agreed that they had not seen enough to warrant a further increase, but believed they had seen enough to continue fishing in the area with another survey to be scheduled in 7 - 10 days. One of the survey vessels recorded schools with hydroacoustic equipment. The acoustic estimate for Scots Bay on August 5 was estimated to be 44,400 tons. On August 6, a large amount of fish was seen north of Isle Haute. The fish from this area were slightly smaller, with up to 60 % hard roe. A group of fish from Scots Bay on the same day was estimated to contain 1,200 tons based on acoustic information. Two vessels were fishing in Advocate Bay on August 7 and saw 4 large bunches of fish, estimated by fishers to contain 10,000 - 20,000 tons. Fishing continued as normal on Grand Manan. One sample of fish from Grand Manan on August 6 was 19.0 - 25.5 cm (7.5 - 10.0 in), with modal length at 23.5 cm (9.0 in).

August 10 - 16

On August 11, one vessel performed a survey of Scots Bay from Margaretsville to Cape D'Or, then to the north of Isle Haute. Small groups totaling an estimated 1,700 tons were found. Another survey of Scots Bay was conducted on August 12 with one vessel. Two large schools were recorded and estimated to contain 35,000 tons of herring. This brought the minimum total seen thus far in Scots Bay to 55,000 tons and the target level was increased from 5,000 tons to 10,000 tons. Fishing continued in Scots Bay and around Grand Manan.

August 17 - 23

Fishing continued in Scots Bay with good schools caught off Margaretsville. Fishing also started on Jacquard's Ridge this week with good catches (a length frequency from the catch showed 29.0 - 30.5 cm, 11.5 - 12.0 in, fish). Large aggregations were seen NW of Seal Island on August 18 - 19. On August 18, two vessels recorded schools of fish in Scots Bay with hydroacoustic equipment. The acoustic estimate of the combined areas was 85,700 tons. Poor weather prevented fishing towards the end of the week.

August 24 - 30

Early in the week landings came from Dry Ledge Buoy and Jacquard's Ridge. Fishing effort in Scots Bay gradually decreased and the last landing from this area was on August 26. Large aggregations were observed on Tongue Ground. On August 27, a set was made on a small school on German Bank and most fish were ripe and running. The size range was 23.0 - 36.5 cm (9.0-14.5 in) with modes at 30.0 cm and 31.0 cm (12 in). Approximately 26 gillnet boats fished Trinity Ledge on August 26 and caught between 70 - 85 barrels.

August 31 - September 6

A survey of Trinity Ledge was performed by eleven gillnetters on September 1. One large and 2-3 small schools were located and estimated to contain 15,000 tons. The fishery was opened on September 2 for 1,500 tons. Purse seiners were allotted 500 tons, however, none participated in the fishery. The majority of the purse seine effort was

concentrated on German Bank. Poor weather prevented fishing for the latter part of the week. Some fishing occurred on the Long Island shore and Grand Manan banks.

September 7 - 13

The second survey of Trinity Ledge was conducted on September 9 by fourteen gillnetters and one purse seiner. A more extensive area was covered than previously, but only an estimated 1,000 tons was seen. The majority of the purse seine effort was still concentrated around German Bank.

September 14 - 20

Large aggregations were spotted on Crane Tow on September 16. An acoustic survey of German Bank was performed by DFO research vessel Teleost on September 16 - 23. On September 18, a joint survey involving the Teleost and industry vessels was conducted where the fleet had been fishing on German Bank. The Teleost surveyed an area around the purse seine vessels and documented 1,600 t. Among the purse seiners involved in the industry survey were the two vessels carrying hydroacoustic recording equipment. The analysis from the resulting data files shows that an estimated 17,600 tons were present in the area the fleet had been fishing. A third survey of Trinity Ledge was organized on September 16 with nineteen gillnetters. Three groups of fish were seen, totaling an estimated 7,000 tons.

September 21 - 27

On September 21, the Teleost recorded a group of fish from Lurcher to south of German Bank, which was estimated to contain 33,000 tons. A small group of mixed fish on German Bank was recorded by the Teleost on September 23. The acoustic estimate for this area is 8,000 tons. Gale force winds prevented fishing for the majority of the week. A couple of purse seine vessels fished early in the week and landed fish from German Bank. By mid-week, some fishing occurred after midnight and most of the boats landed fish.

September 28 - October 4

Gale winds prevented fishing for most of the week. A survey of German Bank was performed on October 3 by three purse seiners. Three dense groups of fish were encountered and recorded using acoustic equipment. The acoustic data were immediately downloaded and interpreted as 215,800 tons. At this point in the fishery, the remaining quota was less than the adopted 20% harvest rate, so no limit was put on fishing from the German Bank spawning bed. Fishing occurred on the weekend. Observations from October 4 include 4 miles of fish present on German Bank.

October 5 - 11

Landings came from German Bank and Grand Manan. On October 6, an acoustic analysis of a school on German Bank was estimated to contain 7,900 tons. An acoustic record of a group of fish on German Bank on October 8 showed an estimated 82,700 tons present in the area. A second acoustic survey of German Bank was independently organized by one purse seiner on October 9. Four hours were spent steaming through a large, dense group with the acoustic equipment turned on, recording the transects. The acoustic data was analyzed and 194,000 tons of herring was considered to have been present in the school.

October 12 - 18

The purse seine fleet was successful in catching their quota by October 15, the end of the quota year.

3) Coastal Nova Scotia

- Little Hope and Eastern Passage (Figure 4) - fished by the gillnet fleet.
- Three surveys were conducted (Table 7b).
- Landings totaled 6,543 tons. Monthly gillnet catches are presented in Appendix II.

October 5 - 11

The roe fishery in Petpeswick Shoal and Eastern Passage officially opened on October 6. Fishing occurred all week. A survey was performed in this area on October 9 with ten vessels. An area of very dense fish (1 mi²) was present inside an area of medium density (4 mi²). Fish were 28.0 - 38.0 cm (11-15 in) with a mode at 30.0 cm (12 in). It was estimated that 15,000 tons were present in the area. Fishing occurred all week until October 13 when all the fish left the area. On October 9, six gillnet vessels landed hard fish from Little Hope. The fish were expected to be mature in a couple of days.

October 12 - 18

Ten gillnetters and one purse seiner participated in a joint survey of Little Hope on October 14. A moderate group of fish was encountered on Dogget Shoal and was estimated to contain approximately 4,000 tons of fish. No herring were found around Little Hope Island. During a conference call the next morning it was decided that a 400 ton fishery would be permitted, with access to the fishery being restricted to gillnetters only. Total landings from the Port Mouton/Little Hope area from October 16, 17 & 18 reached over one million pounds (454 tons). Gillnet boats were searching the Eastern Passage area on October 14-15 and found no herring.

October 19 - 25

A second survey of Little Hope was conducted on October 23 by ten gillnetters. Three small areas, and one moderate area, were found. A set was made on the moderate bunch and the catch was 100% mackerel.

October 26 - November 1

Boats were searching the Port Mouton/Little Hope area this week, but found no herring. The herring fishery in this area officially ended October 30. No spawning herring had been found in the Eastern Passage area, although some hard fish had been seen, and fishing activity ended this week.

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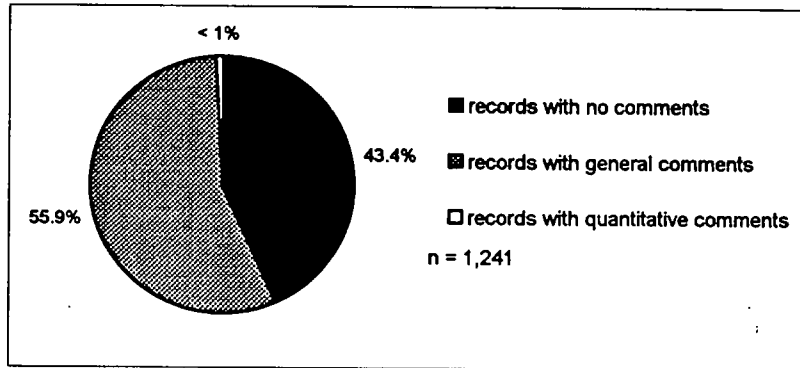


Figure 1. Comments from DMP log sheets by 4WX Herring Purse Seine Vessels 1997

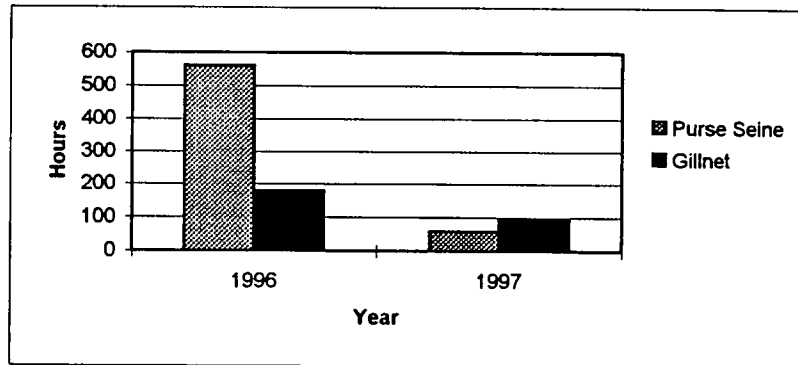


Figure 2. Time spent surveying spawning groups by 4WX herring fleets in 1996 & 1997.

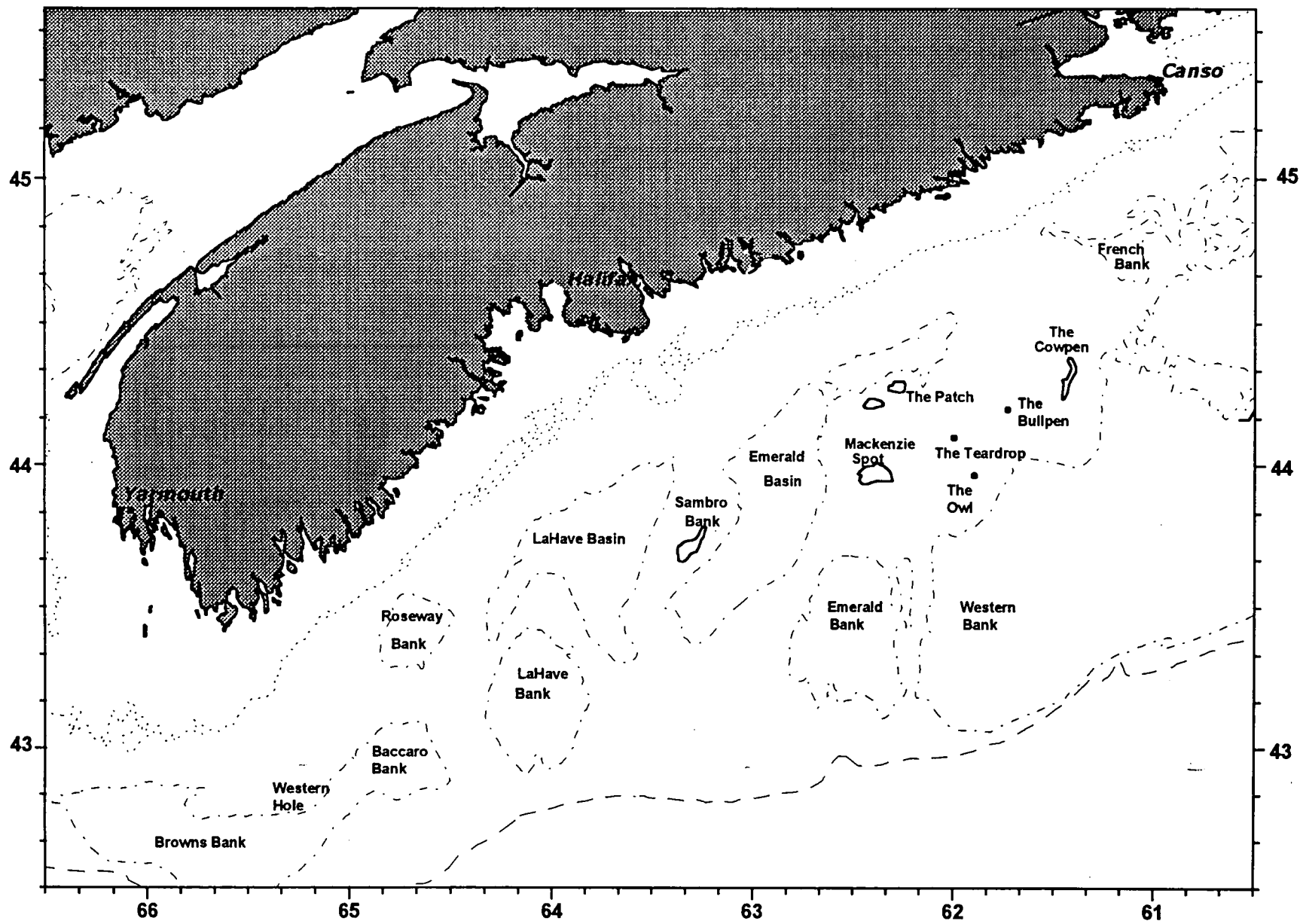


Figure 3. Fishing locations for herring on the Offshore Scotian Shelf banks 1997

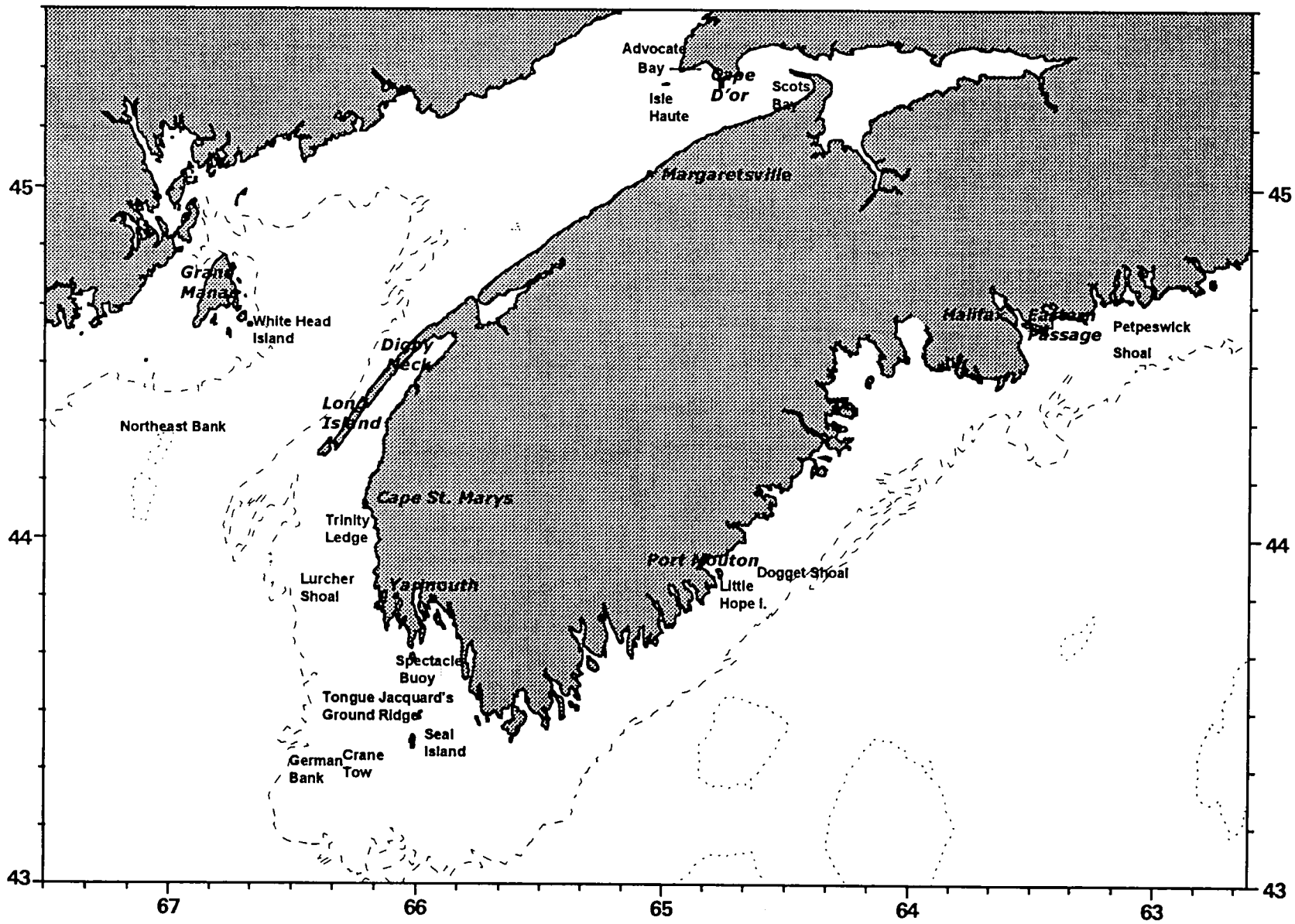


Figure 4. Fishing locations for herring in Southwest and Coastal Nova Scotia 1997

Table 1 a,b. Herring Purse Seine search records from a) offshore Scotian Shelf banks and b) SW Nova Scotia.

Table 1a)

Date	Vessel	Fishing Area
6-Jun	Ingalls Sands	The Patch
7-Jun	Seacord no. 1	The Patch
7-Jun	Island Pride	The Patch
9-Jun	Seacord no. 1	The Patch
11-Jun	Lady Melissa	Mackenzie Spot
15-Jun	Seacord no. 1	S of The Patch
15-Jun	Ingalls Sands	The Patch
16-Jun	Ingalls Sands	The Patch
18-Jun	Ingalls Sands	The Patch
20-Jun	Ingalls Sands	The Patch
20-Jun	Seacord no. 1	The Patch
23-Jun	Seacord no. 1	The Patch
23-Jun	Lady Melissa	The Patch
24-Jun	Lady Melissa	Cow Pen/Bull Pen
24-Jun	Seacord no. 1	The Patch
27-Jun	Seacord no. 1	W of Bull Pen
27-Jun	Island Pride	Emerald Basin
29-Jun	Eastern Fisher	Bull Pen
29-Jun	Island Pride	Bull Pen
30-Jun	Island Pride	Teardrop
30-Jun	Eastern Fisher	Bull Pen
30-Jun	Seacord no. 1	Mackenzie Spot
30-Jun	Ingalls Sands	Sambro Bank - The Patch
30-Jun	Lady Noreen	E of The Patch
30-Jun	Lady Melissa	Mackenzie Spot
1-Jul	Lady Melissa	Teardrop
1-Jul	Eastern Fisher	NW of The Owl
1-Jul	Ingalls Sands	Sambro Bank - The Patch
2-Jul	Ingalls Sands	Sambro Bank - The Patch
2-Jul	Seacord no. 1	Emerald Basin
2-Jul	Eastern Fisher	Emerald Basin
2-Jul	*Lady Melissa	E of Sambro Bank
2-Jul	*Island Pride	E of Sambro Bank
2-Jul	*Margaret Elizabeth	Sambro Bank - Emerald Bank
3-Jul	*Margaret Elizabeth	Emerald Basin
3-Jul	*Island Pride	E of Sambro Bank
3-Jul	Ingalls Sands	Sambro Bank - The Patch
6-Jul	Eastern Fisher	Mackenzie Spot
7-Jul	Ingalls Sands	Mackenzie Spot
10-Jul	Eastern Fisher	Mackenzie Spot
11-Jul	Eastern Fisher	Mackenzie Spot
13-Jul	Eastern Fisher	Mackenzie Spot
13-Jul	Seacord no. 1	The Patch
14-Jul	Eastern Fisher	Mackenzie Spot

Table 1b)

Date	Vessel	Fishing Area
15-Jul	Ingalls Sands	Tongue Ground
16-Jul	*Silver Harvester	N of Trinity/Lurcher area
21-Jul	*Leroy & Barry	N of Trinity Ledge
21-Jul	*Margaret Elizabeth	Grand Manan
22-Jul	*Morning Star	N of Trinity Ledge
22-Jul	Ingalls Sands	Tongue Ground
23-Jul	Ingalls Sands	Tongue Ground
24-Jul	Ingalls Sands	N of Tongue Ground
29-Jul	Lady Melissa	S of Seal Island
30-Jul	Lady Melissa	W of Seal Island
31-Jul	Eastern Fisher	Scots Bay
3-Aug	Eastern Fisher	Scots Bay
4-Aug	Eastern Fisher	Scots Bay
4-Aug	Lady Melissa	Scots Bay
18-Aug	Lady Melissa	NW of Seal Island
19-Aug	Lady Melissa	NW of Seal Island
24-Aug	Island Pride	German Bank
26-Aug	Lady Melissa	Tongue Ground
26-Aug	*Ingalls Sands	Scots Bay
27-Aug	Lady Melissa	Tongue Ground
27-Aug	*Morning Star	German Bank
2-Sep	Lady Melissa	Tongue Ground
2-Sep	*Ingalls Sands	SE of Lurcher Shoal
4-Sep	Lady Melissa	Tongue Ground
8-Sep	*Margaret Elizabeth	German Bank
16-Sep	Lady Melissa	Crane Tow
17-Sep	Lady Melissa	Crane Tow
18-Sep	Lady Melissa	Crane Tow
1-Oct	*Island Pride	German Bank
5-Oct	Lady Melissa	German Bank
14-Oct	*Morning Star	Port Mouton to Yarmouth

*Biological Station/Pelagics Research Council staff on board

Table 2. Quantitative Observations from Offshore Scotian Shelf Banks by 4WX Herring Purse Seine Fleet 1997

Date	Vessel	Location	Observations	Captain's Estimate (tons)	Calculated Estimate (tons)	Source of Information
Jun 07	Seacord no. 1	The Patch	3 bunches, .5mi each	1,400		Vessel search records
June 7-9	Island Pride	Emerald Basin - The Bull Pen	7 groups	600		Vessel search records
Jun 09	Seacord no.1	The Patch	2 groups	1200		Vessel search records
Jun 20	Seacord no.1	The Patch	bunches of fish	200		Vessel search records
Jun 23	Seacord no.1	The Patch	bunches	100		Vessel search records
Jun 24	Seacord no.1	The Patch	3 groups	1,100		Vessel search records
Jun 27	Island Pride	Emerald Basin-Halifax Hbr	5 groups	800		Vessel search records
Jun 27	Seacord	W of The Bullpen	.5 mi bunches	250		Vessel search records
Jun 29	Island Pride	The Bull Pen	1.25 mi; 2 smaller	700		Vessel search records
June 29-30	Lady Melissa	Sambro Bank & The Teardrop	9 groups	1,500		Vessel search records
Jun 30	Island Pride	The Teardrop	5 groups	400		Vessel search records
Jul 02	Margaret Elizabeth	Sambro - Emerald Bank	2 large schools	60,000		SABS staff records
	Seacord no.1	Emerald Basin	.25 mi long; blood red	2,000		Vessel search records
Jul 03	Island Pride	E of Sambro Bank	lg group - 800' wide	200		SABS staff records
Jul 14	Eastern Fisher	leaving Halifax Harbour	2 mi x 1 mi, heavy; "thousands"		28,000	Vessel search records

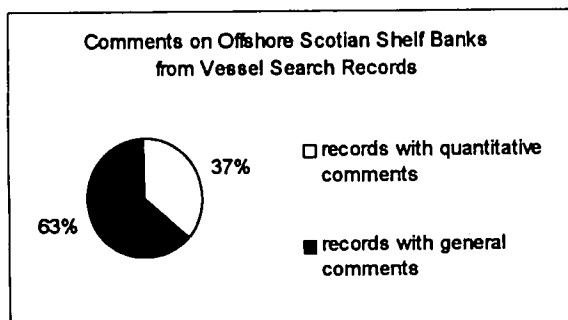


Table 3. Quantitative Observations from Southwest Nova Scotia by 4WX Herring Purse Seine Vessels 1997

Date	Vessel	Location	Observations	Captain's Estimate (tons)	Calculated Estimate (tons)	Source of Information
Jul 16	Silver Harvester	Trinity Lurcher	3 mi x 1200 m, light density		110	Vessel search records
Jul 21	Margaret Elizabeth	Grand Manan	1) 1.5 mi x 1 mi, dense		21,000	Vessel search records
Jul 22	Morning Star	Cape St. Marys	1) dense school, 12 fathoms	200		Vessel search records
Jul 23	Ingalls Sands	Tongue Ground	many bunches 10 - 20 fathoms, heavy	(one bunch =) 1,000		Vessel search records
Jul 29-30	Lady Melissa	Seal Island	1) 4 schools	500		Vessel search records
Jul 31	Eastern Fisher	Scots Bay	1 mi x 0.5 mi, 10 fathoms, 100 tons/set		7,000	Vessel search records
Aug 03	Island Pride	Scots Bay	0.4 mi x 0.25 mi x 10-15 fathoms		1,400	DMP logbooks
Aug 03	Eastern Fisher	Scots Bay	0.5 square mi, 20 fathoms		7,000	Vessel search records
Aug 04	Pubnico Virgo	Scots Bay	1) 0.5 square mi x 15 fathoms, solid		7,000	DMP logbooks
			2) 0.25 square mi x 15 fathoms*, solid		3,500	DMP logbooks
Aug 06	Ocean Supreme	Scots Bay	4 schools, at least 10,000 t/school	40,000		DMP logbooks
Aug 07	Island Pride	Advocate Bay	4 large bunches	10,000-20,000		Fishing assoc notes
Aug 18	Lady Melissa	NW of Seal Island	1) 1 mi long	15,000		Vessel search records
Aug 19	Lady Melissa	NW of Seal Island	large bunch, red/heavy	20,000		Vessel search records
Aug 25	Island Pride	German Bank	1) 400 m x 400 m, 12-15 fathoms		650	Vessel search records
			2) 200m-1/4 mi x 3/4 mi, 10-15 fathoms	2,000		Vessel search records
Aug 27	Lady Melissa	Tongue Ground	1) lg group, roe fish	4,000-5,000		Vessel search records
			2) small fish	1,000-2,000		Vessel search records
Sep 16-18	Lady Melissa	Crane Tow	3/4 mi fish on bottom, heavy	20,000		Vessel search records
Sep 28	Pubnico Virgo	German Bank	0.75 mi x 0.25 mi x 5 fathoms		1,300	DMP logbooks
Oct 02	Island Pride	German Bank	1 square mi of fish		7,000	DMP logbooks
Oct 05	Lady Melissa	German Bank	1) 1 1/2 mi x 3/4 mi fish, 15-20 fathoms		15,000	Vessel search records
			2) 3 - 4 miles of fish, heavy	150,000		Vessel search records
Oct 05	Lady Melissa	German Bank	3 - 4 mi of fish x 1.5 mi; 20 fathoms		63,000	DMP logbooks
Oct 06	Pubnico Virgo	German Bank	1 mi x 0.25 mi x 4 fathoms		1,700	DMP logbooks
Oct 09	Pubnico Virgo	German Bank	0.5 mi x 0.5 mi x 10 fathoms		1,700	DMP logbooks

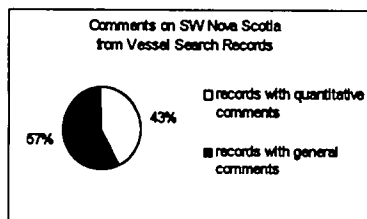


Table 4. Herring density estimates used to estimate spawning biomass from surveys in 1996

tons/set	designation	tons/km ²	tons/mi ²	Acoustic (t/km ²)
5	"light"	200	700	230 - 250
10		400	1,400	
25	"moderate"	1,000	3,600	600 - 1,300
50		2,000	7,000	
100	"heavy"	4,000	14,000	2,000 - 11,000
200		8,000	28,000	
250		10,000	36,000	
500		21,000	72,000	

Table 5. Summary of acoustic surveys 1997

Date	Vessel	Location	Estimate (tons)
7-Jul	ME	MacKenzie Spot	40,600
11-Jul	ME	Long Island Shore	105,000
21-Jul	ME	Grand Manan (North Head)	101,800
5-Aug	IP	Scots Bay	44,400
6-Aug	IP	Scots Bay	1,200
18-Aug	IP & ME	Scots Bay	85,700
18-Sep	Teleost	German Bank	1,600
18-Sep	IP & ME	German Bank	17,600
21-Sep	Teleost	German Bank	33,000
23-Sep	Teleost	German Bank	8,000
3-Oct	IP & ME	German Bank formal survey	215,800
6-Oct	IP	German Bank	7,900
8-Oct	IP	German Bank	82,700
9-Oct	IP	German Bank formal survey	194,000

ME = Margaret Elizabeth

IP = Island Pride

Table 6. Fleet Distribution on Offshore Scotian Shelf Banks 1997

Date*	Fishing Location	Distance (miles)**
24-May	Mackenzie Spot - Emerald Bank	40
26-May	Mackenzie Spot - The Teardrop	30
28-May	Emerald Basin - The Bullpen	40
29-May	Mackenzie Spot - The Teardrop	30
30-May	Emerald Basin - The Teardrop	30
31-May	Mackenzie Spot - The Teardrop	30
2-Jun	Mackenzie Spot - The Teardrop	30
3-Jun	Mackenzie Spot - The Teardrop	30
4-Jun	Emerald Basin - The Bullpen	90
5-Jun	Emerald Basin - The Patch	20
9-Jun	Mackenzie Spot - The Teardrop	40
12-Jun	The Patch - French Bank	90
16-Jun	The Patch	8
17-Jun	Eastern Hole - The Teardrop	140
19-Jun	The Patch - The Teardrop	20
20-Jun	The Patch - The Teardrop	25
21-Jun	The Patch - The Teardrop	25
24-Jun	The Patch	5
25-Jun	The Patch - The Cowpen	60
26-Jun	The Patch - The Cowpen	60
27-Jun	The Patch - The Cowpen	60
28-Jun	The Teardrop - The Bullpen	20
1-Jul	Emerald Basin - The Teardrop	60
2-Jul	Emerald Basin - The Teardrop	60
3-Jul	Emerald Basin	40
4-Jul	NE Sambro Bank - Emerald Basin	60
7-Jul	Emerald Basin - Mackenzie Spot	30
8-Jul	Emerald Basin - Mackenzie Spot	30
9-Jul	LaHave Bank - The Patch	120
11-Jul	Roseway Bank - Emerald Basin	120

* indicates the day the fish were landed

** indicates the approximate distance between the two most distant landings

Table 7 a,b. Details from surveys of spawning areas in 1997.

Table 7a. Southwest Nova Scotia

Spawning Area	Date	Survey type	Number of Vessels	Area of fish	Estimated Biomass (tons)	Length Frequency; mode (cm)	Roe Stage
Spectacle Buoy	Jun 12	A	10	3 groups within 2 sq. mi, 5-10 fa	15,000	26.0 - 35.5; 29.5	running
Scots Bay	Jul 29	A	4	5 mi of "strips"; each strip of fish ~0.5mi x 0.25 mi	15,000	23.5 - 32.0; 27.0	----
	Aug 05	A	4	0.5mi x 0.5 mi, + several good bunches	10,000	22.5 - 31.0; 27.5	----
		B	1	540 sq. km (209 sq. mi)	44,400*		----
	Aug 06	B	1	1.2 sq. km (0.46 sq mi)	1,200	23.0 - 33.0; 27.0	----
	Aug 11	A	1	4 groups; Margaretsville - Cape D'Or - N Isle Haute	1,700	----	----
	Aug 12	A	1	1) 1.25mi x 0.5 mi, 10 fathoms 2) 0.5 mi x 0.5 mi x 10 fathoms	35,000	set 1 14.0 - 30.5; 28.0 set 2 24.0 - 34.5; 28.0	ripe ripe & running
Trinity Ledge	Aug 18	B	2	17.3 sq. km (6.7 sq. mi)	85,700	24.0 - 31.5; 27.5	----
	Sep 01	A	11	1 sq. mi, heavy	15,000	26.5 - 32.0; 29.0	ripe
	Sep 09	A	13	2 medium bunches	1,000	----	----
	Sep 16	A	19	1) 1 sq. mi, heavy density 2) small area of low density	7,000	26.5 - 31.5; 28.5 & 29.5	running
German Bank	Sep 18	B	2	0.41 sq. km (0.16 sq. mi)	17,600	25.5 - 35.5; 29.0	----
	Oct 03	A	3	2 x 2.5 mi & smaller bunches, heavy density	100,000		
		B	2	10.3 sq. km (4.0 sq. mi)	215,800*	24.0 - 34.0; 27.0 & 27.5	running
	Oct 06	B	1	0.44 sq. km (0.17 sq. mi)	7,900	23.5 - 36.0; 28.0 & 30.0	----
	Oct 08	B	1	37.9 sq. km (14.6 sq. mi)	82,700	----	----
	Oct 09	B	1	14.95 sq. km (5.8 sq. mi)	194,100	24.0 - 34.5; 29.0	running

Table 7b. Coastal Nova Scotia

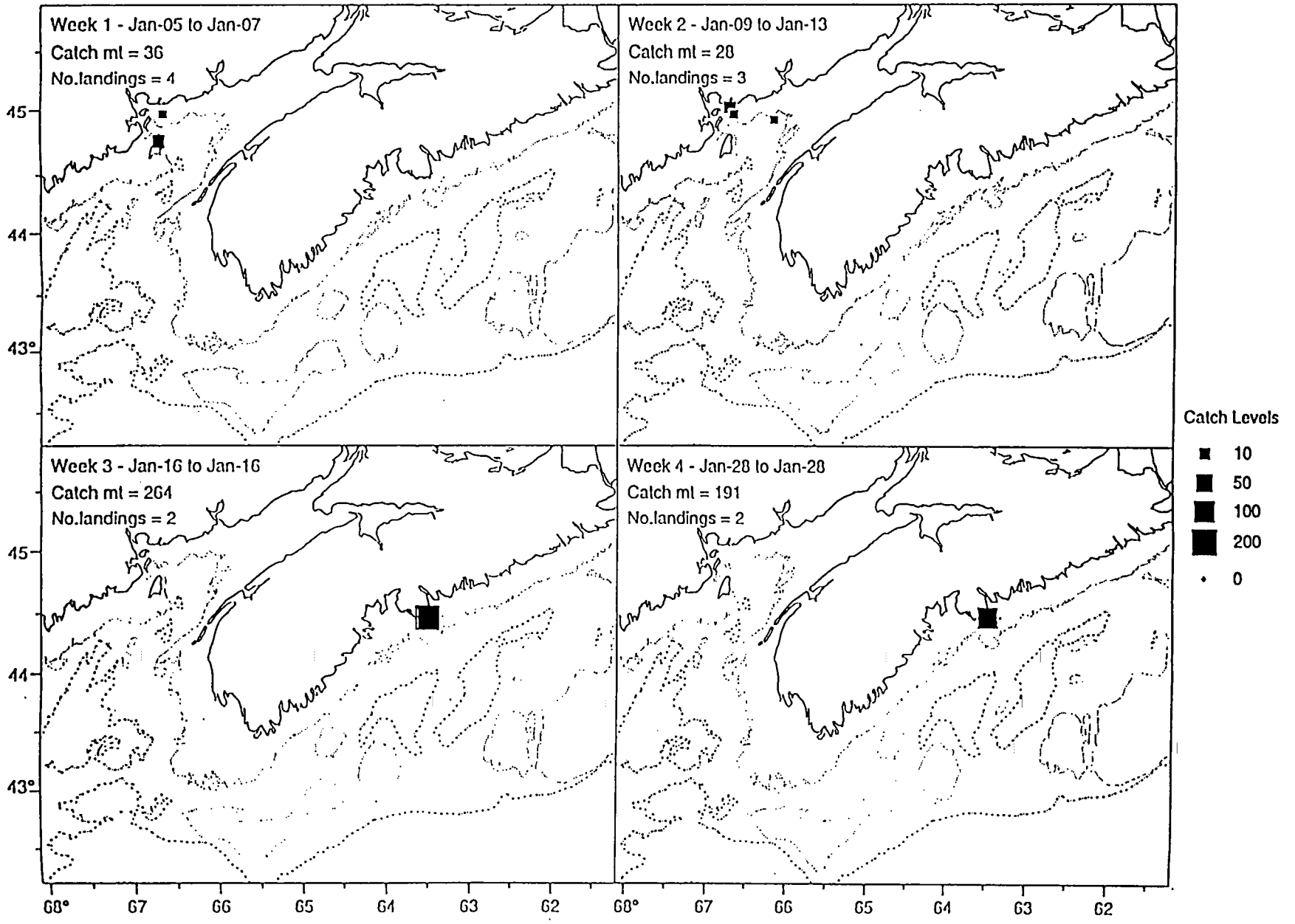
Spawning Area	Date	Survey type	Number of Vessels	Area of fish	Estimated Biomass (tons)	Length Frequency; mode (cm)	Roe stage
Eastern Passage	Oct 09	A	10	1 sq. mi of heavy fish within 3.8 sq. mi of moderate density	15,000	26.5 - 37.0; 30.0	running
Little Hope	Oct 14	A	11	1 sq. mi moderate density, 1-8 fathoms	4,000	----	----
	Oct 23	A	10	2,000 tons of mackerel	0	----	----

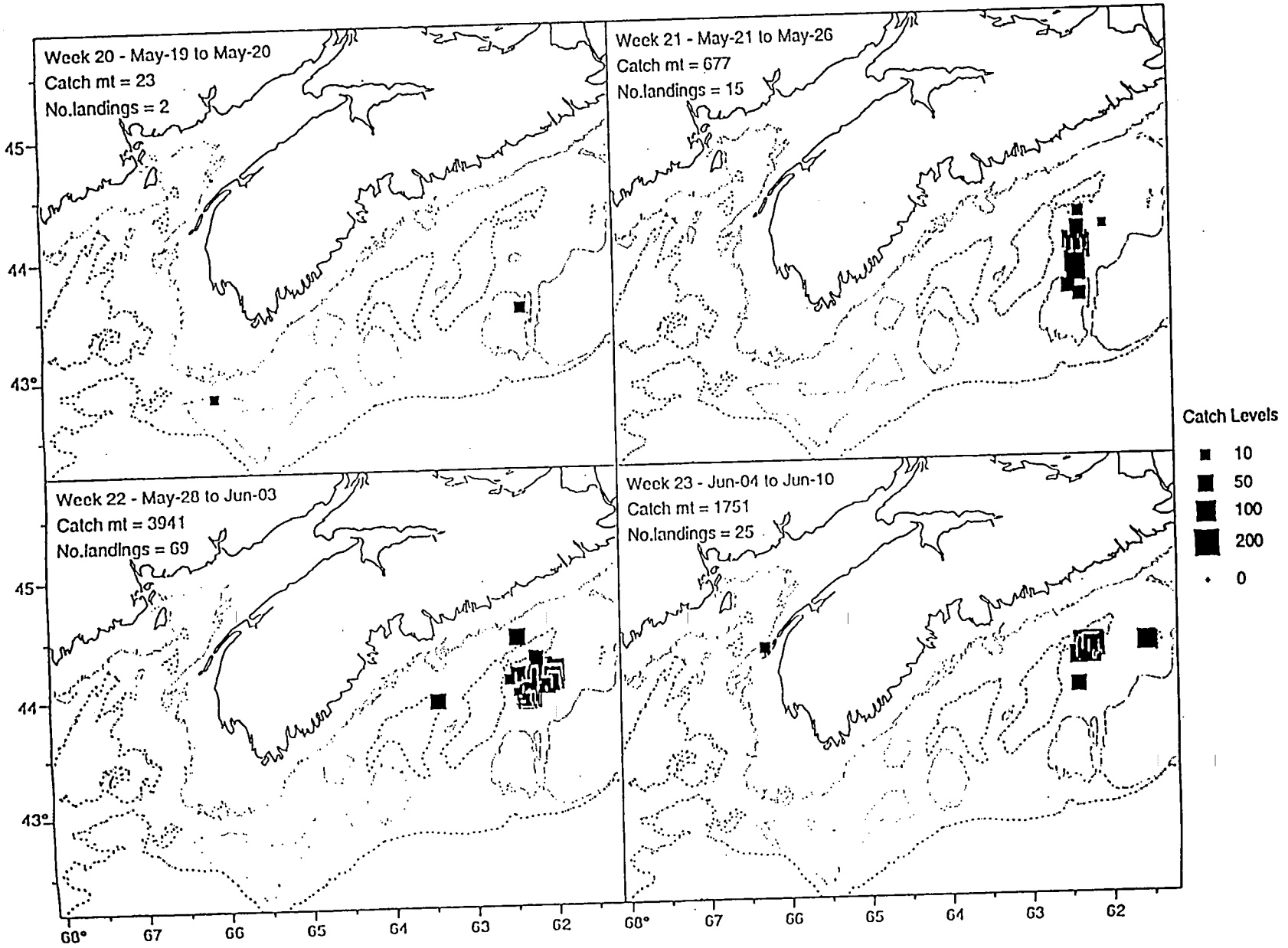
A=mapping survey

B=purse seine acoustic survey

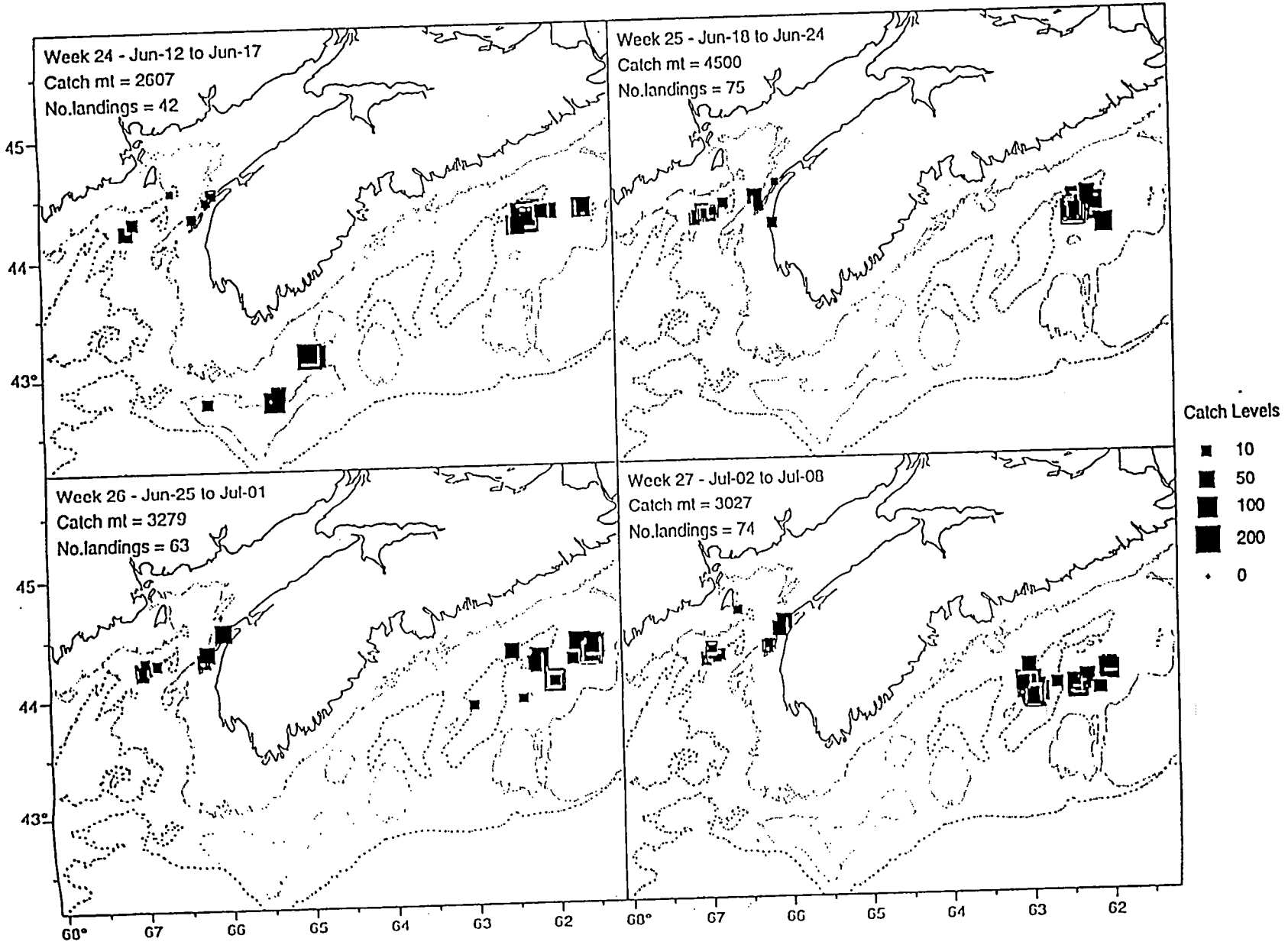
* quantitative hydroacoustic estimate (purse seine acoustic survey method) used to estimate biomass.

21

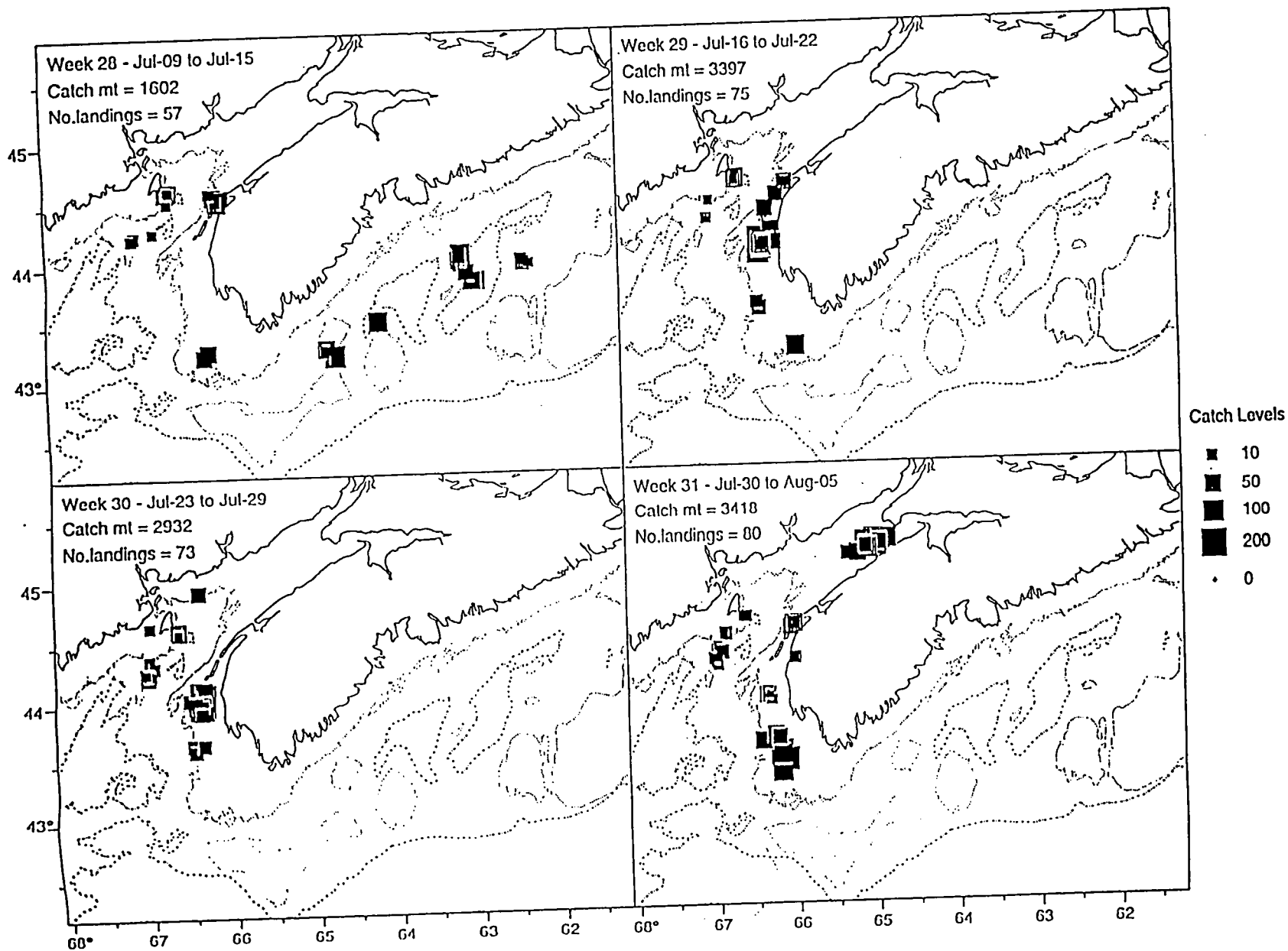




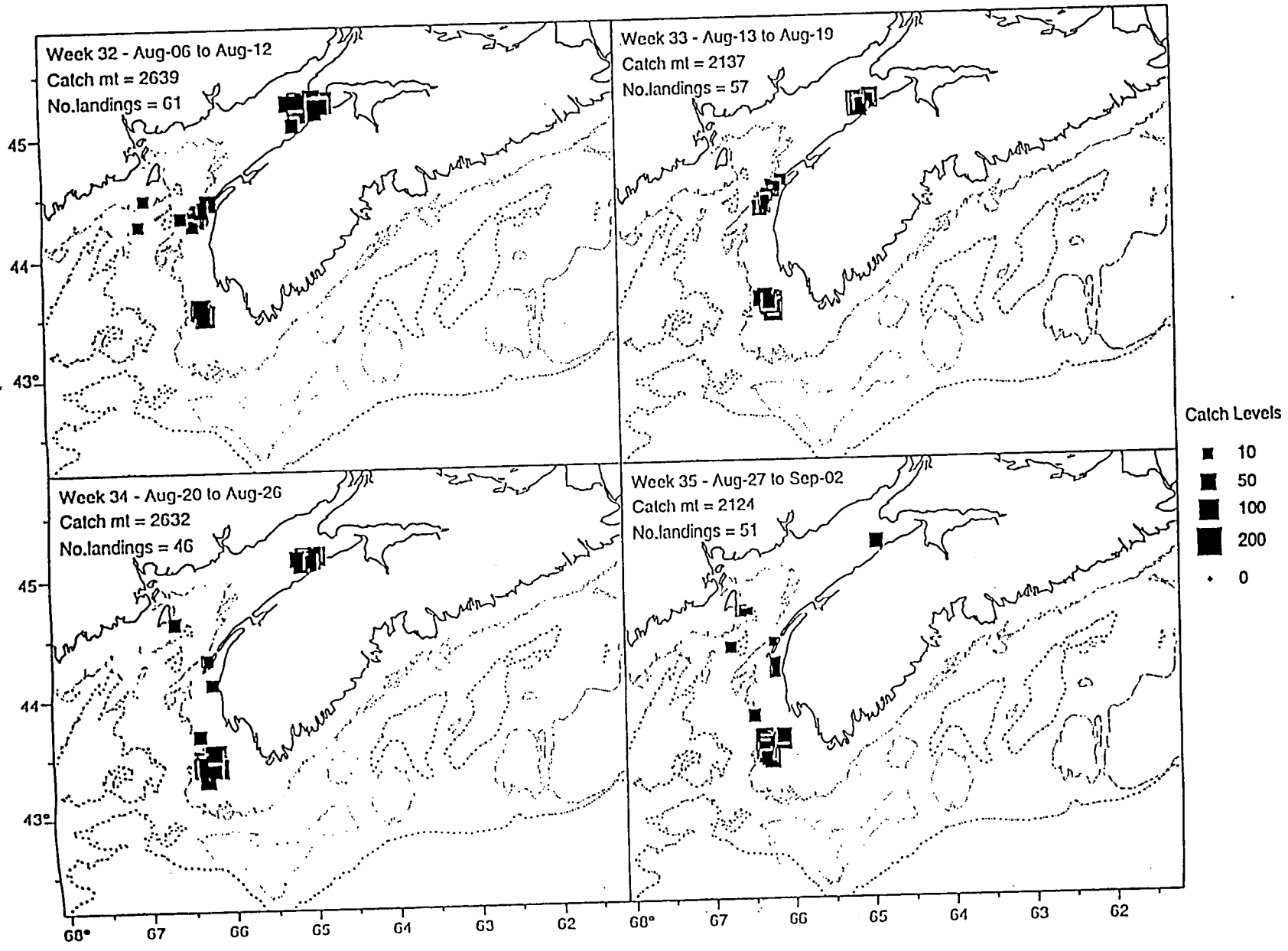
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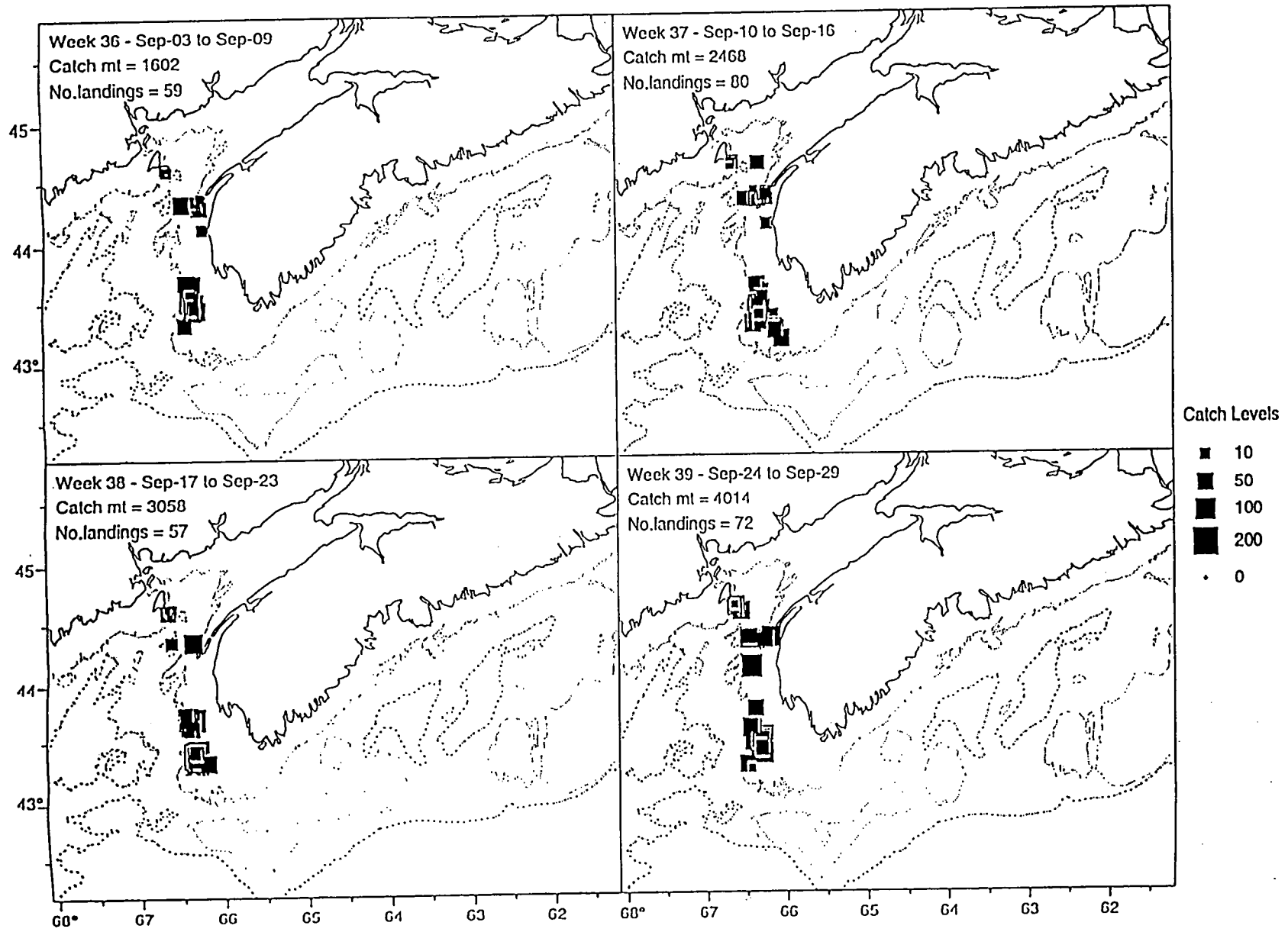


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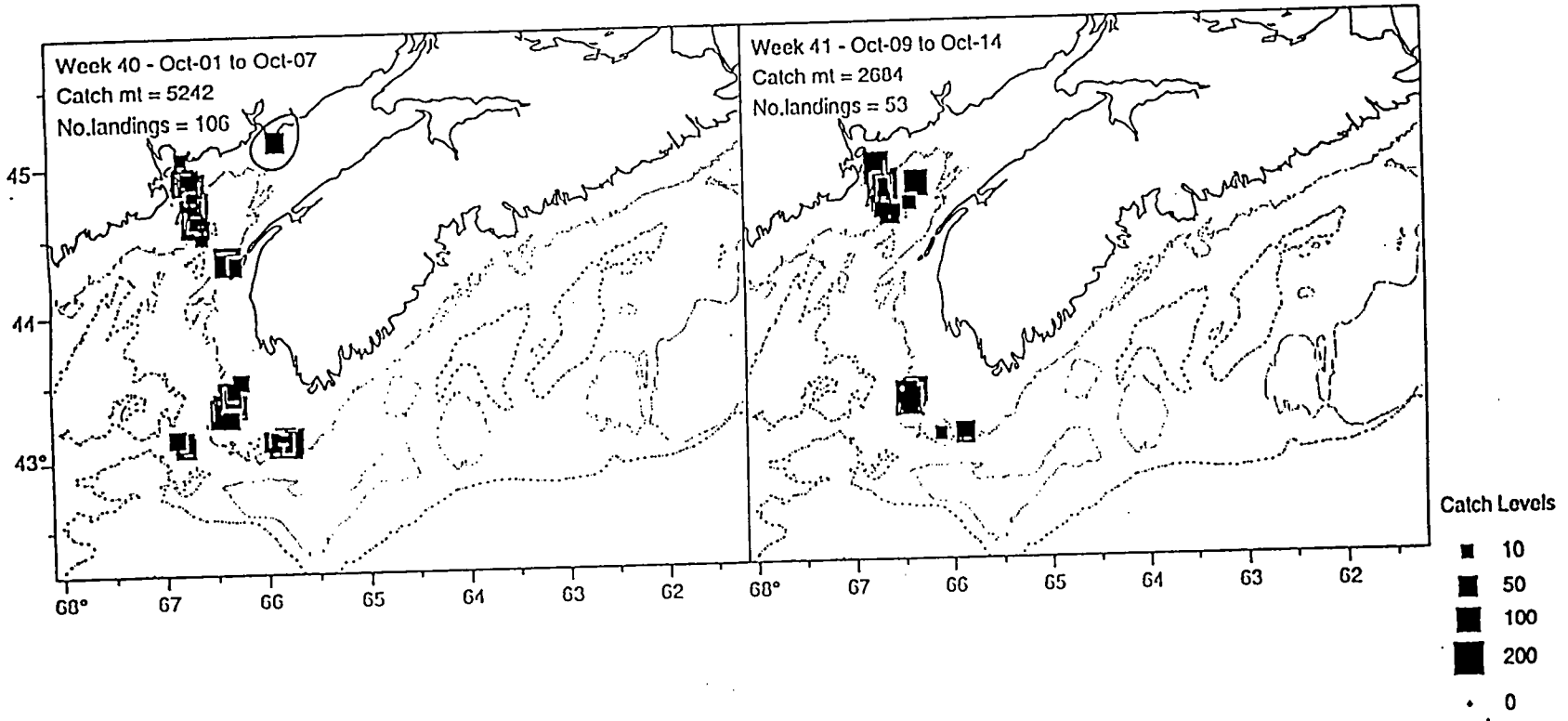


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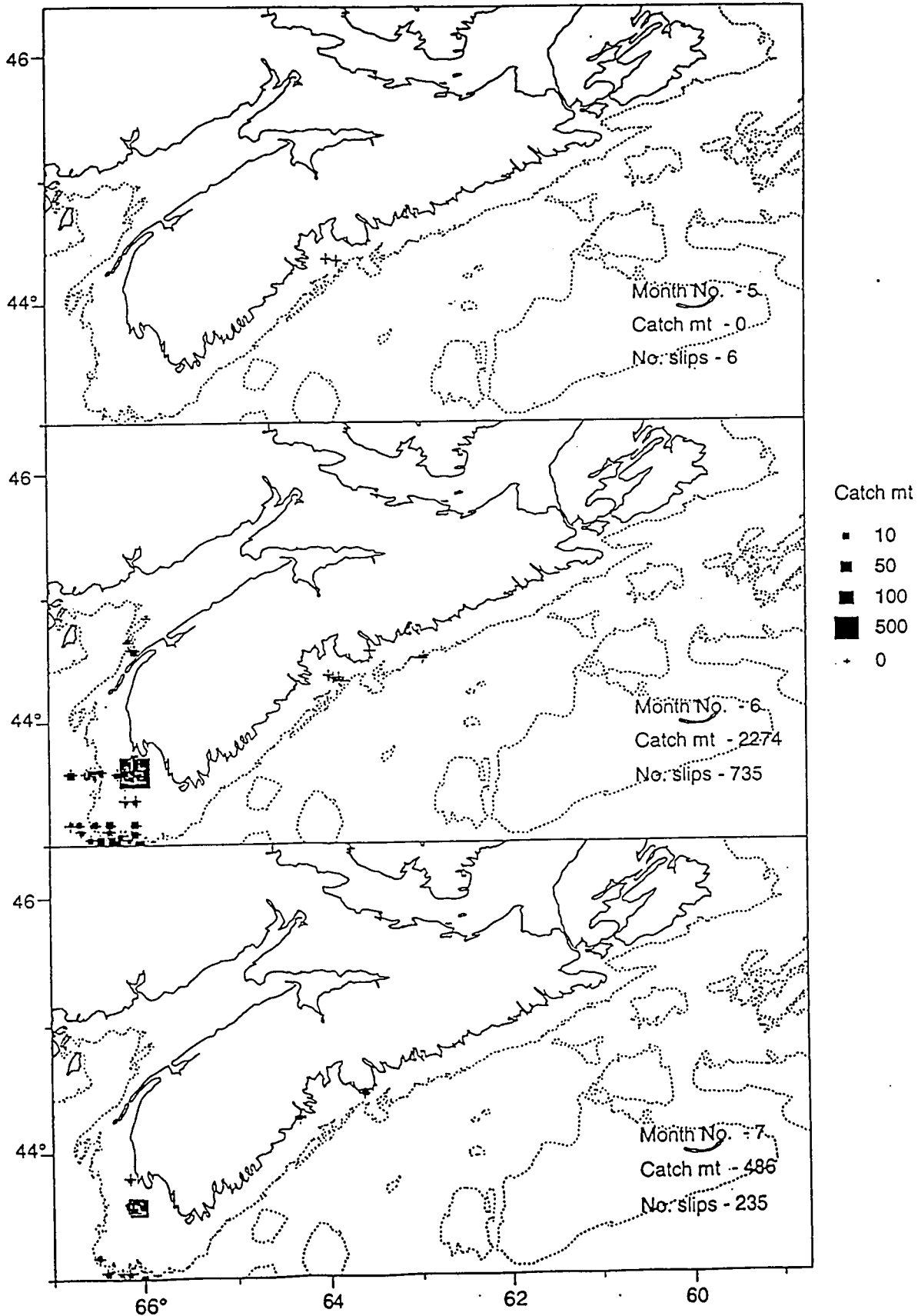




27



Appendix II - 1997 4WX herring gillnet catches by month.



Appendix II - 1997 4WX herring gillnet catches by month.

