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**DISTRIBUTION AND ACOUSTIC BACKSCATTER OF HERRING IN NAFO
DIVISIONS 4T AND 4Vn, FALL 1990 - 1992**

by

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ABSTRACT

The fall distribution and acoustic backscatter of herring in NAFO Divisions 4T and 4Vn obtained from fall acoustic surveys for the years 1990, 1991 and 1992 indicate that the Chaleur Bay area is the main area of concentration for herring in October and early November. Most herring schools were found in the East Miscou, Shigawake and Maisonnette strata of Chaleurs Bay in 1991 and 1992, while the 1990 backscatter was mostly recorded in the western part of the bay. The Cape Breton area accounted for 22% of the backscatter in 1992, and 10% or less in 1991 and 1990; the main area of concentration being Aspy Bay strata. Biomass estimates indicate that 1990 had the highest value of the three years, while the proportion of transects with backscatter present and the percentage of mileage covered with backscatter recorded both reveal a higher value for 1992, followed closely by 1991. Fall spawners represented 81.6% of the 1992 total backscatter, 74.7% in 1991 and 49.1% in 1990. The 1987 year class accounts for 36% of these fall spawners in 1991 and 29% in 1992. The 1990 survey had large amounts of juvenile herring in the trawl sets, which were mostly spring spawners; juveniles of ages 1 and 2 comprised 46% of the total backscatter. Temperatures in all areas ranged between 0 and 12°C for both the 1991 and 1992 surveys. In general, stronger haloclines and thermoclines were observed in the inshore strata.

RESUME

La distribution géographique et la diffusion acoustique des bancs de harengs détectés durant les relevés acoustiques de 1990, 1991 et 1992, dans les divisions 4T et 4Vn de l'OPANO, indiquent que la baie des Chaleurs est la principale région de concentration du hareng en octobre et début novembre. En 1991 et 1992, la plupart des bancs de hareng furent détectés dans les strates de Miscou Est, Shigawake et Maisonnette, tandis qu'en 1990, 78% de la diffusion acoustique fut détectée dans la partie ouest de la baie. Dans la région du Cap Breton, 22% de la diffusion acoustique y fut détectée en 1992, et seulement 10% ou moins en 1991 et 1990; la strate principale étant celle de Aspy Bay. L'estimation de la biomasse d'après l'intensité de la diffusion acoustique indique que l'année 1990 est la plus élevée. D'autres indices, tels que la proportion de transects avec de la diffusion acoustique détectée et le pourcentage de la distance totale couverte sur laquelle il y avait de la diffusion acoustique présente, indiquent que les valeurs les plus élevées étaient en 1992, suivi de près par 1991. Les géniteurs d'automne représentaient 81% de la diffusion acoustique totale en 1992, 74.7% en 1991 et 49.1% en 1990. De ceux-ci, la classe d'âge de 1987 comptait pour 36% du total en 1991 et 29% en 1992. En 1990, une bonne proportion des échantillons étaient composés de harengs juvéniles qui représentaient 46% de la diffusion acoustique totale; la plupart étant des géniteurs de printemps âgés de 1 et 2 ans. La température des masses d'eau variait entre 0 et 12°C pour les années 1991 et 1992. En général, les haloclines et thermoclines les plus prononcées se situaient dans les strates côtières.

INTRODUCTION

From 1984 to 1989, Gulf Region conducted acoustic surveys of late fall concentration of herring in the southern Gulf using the ECOLOG system (Shotton 1986, Shotton et al. 1987 a and b, Cairns et al. 1988 and 1989, Cairns and Wright 1990). Since 1990, a Simrad EY200 echo sounder with a single-beam 120 KHz transducer has been used.

This paper provides the fall distribution and acoustic backscatter of herring in NAFO Divisions 4T and 4Vn for the years 1990 to 1992. The 1990 acoustic survey was held mostly in November, while the 1991 and 1992 surveys were in October. Survey effort was concentrated in the Chaleurs Bay and Cape Breton areas, where NAFO division 4T herring congregate in the fall.

METHODS

SURVEY DESIGN, AREA AND SAMPLING

Acoustic surveys were conducted according to a stratified random design, using random parallel transects within strata. Transect lines were selected from a series of points spaced 200 meters apart on the seaward boundary of a stratum. Perpendicular lines were drawn from the selected points to approximately the 10 fathom depth line inshore or to the opposite boundary line in the case of offshore strata. Strata and their boundaries were those used in 1989 (Cairns and Wright 1990) plus added strata (Figure 1, Table 5).

Survey time among strata was allocated so that the density of coverage varied with the expected herring biomass. Each year, available survey time per stratum was thus directly proportional to the mean backscatter density recorded in past surveys plus the proportion of seiner set sites per stratum. To ensure that all areas were adequately covered, we adjusted the initial time allotments so that a minimum of 4 transects were selected in each stratum. However, the East Miscou stratum, being much larger than all others, is allotted a fixed time for coverage depending on the number of sea days available.

Whenever possible, coverage of inshore strata, where most herring schools are found, was done at night when fishing for species identification and biological samples was possible. In 1991 and 1992, a CTD (conductivity and temperature versus depth) probe was cast at preselected stations, to obtain temperature and salinity profiles of the area surveyed.

1992 Survey

Acoustic transects were run from October 1 to 22nd on the research vessel E.E. Prince. Transects were run 24 hours a day at an average speed of 8 knots. Available survey time per stratum was allocated so that the density of coverage was directly proportional to the mean backscatter density recorded for the years 1985 to 1989 and 1991, plus the 1989, 1990 and 1991 proportion of seiner set sites per stratum. The sequence of coverage was from east to west in the inner Chaleurs Bay, followed by the Gaspé area, East Miscou, eastern PEI, northwest and northeast Cape Breton, and Sydney Bight (Figures 2 and 3). Overall, more than 95% of planned transects were covered.

1991 Survey

Acoustic transects were run from October 10 to 24 on the research vessel Alfred Needler. Transects were run 24 hours a day. Available survey time per stratum was allocated so that the density of coverage was directly proportional to the mean backscatter density recorded for the years 1985 to 1989, plus the 1989 and 1990 proportion of seiner set sites per stratum. The sequence of coverage was East Miscou, followed by the Gaspé area, east to west in the inner Chaleurs Bay, northwest and northeast Cape Breton, and Sydney Bight (Figures 4 and 5).

On the third transect of the survey (Oct. 10), towed body and cable got snagged in submerged gear line and signal was lost. Damage was done to the new cable sheath and splicing was done. On Oct. 17, the transceiver's motherboard had to be replaced. Further cable problems occurred on Oct. 18 to 20 which forced us to reduce ship speed.

1990 Survey

Acoustic transects were run from October 26 to November 8 on the research vessel Alfred Needler. Transects were run 24 hours a day. Available survey time per stratum was allocated so that the density of coverage was directly proportional to the mean backscatter density recorded for the years 1985 to 1989. The sequence of coverage was East Miscou, followed by the Gaspé area, east to west in the inner Chaleurs Bay, northwest and northeast Cape Breton, and Sydney Bight (Figures 6 and 7). Cable problems also occurred early in the survey and splicing was done on October 26 and 29.

Biological Sampling

Fishing for species identification and biological samples were only possible at night using a midwater trawl. The Alfred Needler used an IYGPT trawl in 1990 and 1991, while on the E.E. Prince, an Engles 400 midwater trawl was used in 1992. Wherever large concentrations of acoustic backscatter were detected in a particular stratum, a set was cast. The total catch of herring and other species was estimated, and a sample of up to 350 herring were measured. Also, a subsample of 3 herring per 0.5 cm group was kept and frozen for detailed laboratory analysis.

Temperature and Salinity

A total of 83 CTD profiles were taken during the 1992 survey. In 1991, 68 casts were done. The instrument used was a Seabird SBE 9 Seacat Profiler. The CTD profiles were taken at least once per stratum, and in the majority of cases, at least once at both boundaries of the stratum. In order to summarize the data, the strata were divided into four areas: the Gaspé Peninsula, the eastern end of the Bay des Chaleurs, the western end of the Bay des Chaleurs and Cape Breton.

ACOUSTIC DATA ANALYSIS

Equipment

The acoustic equipment consisted of a Simrad 120-25-E single beam transducer. The echo sounder used was a Simrad EY200. The signal received by the echosounder was digitized using a Femto model J9001 dual channel digitizer.

The SIMRAD EY200 transceiver used on the acoustic survey does not have a constant ping rate, but the digitizer samples at a constant frequency. It was found that the sample size per ping (C.V. of up to 30 %). Area Scattering coefficient (Sa) are not calculated for each ping but averaged over a larger integration interval. The number of pings per unit of integration was found to have a much smaller C.V. (3 % or less). Further analysis has shown that there is no correlation ($r^2 < 0.1$) between the number of samples per integration interval and the ping rate. Hence, the variable ping rate does not bias the data.

Calibration

Two methods were used to calibrate the acoustic equipment. The first method consisted of using a dummy load on the transceiver. This calibration was unsuccessful due to loading of the EY200 on the calibration circuit. The second method of calibration was to use a Biosonics 120 kHz calibration ball. This method is combined to TVG calibrations for the various transceiver settings used during the survey. The calibration data obtained showed a combined fixed and TVG gain of 16.887 dB at Gain 4 and Attenuation 0.

The calibration parameters used were:

Source level and Receiver Sensitivity: 31.99 dB

TVG: 20 log R

Equivalent Ideal Beam Angle: -17.5 dB

Pulse Length: 1 m sec

Frequency: 120 kHz

Sampling Threshold: 0.25 mV

Calibrations constants for 1991 and 1990 were calculated from 1992 calibrations. During the 1991 cruise, and again after the cruise, the transceiver was repaired and the motherboard was changed. These repairs may have caused a variation in the transceiver fixed gain. An attempt to quantify the variation caused by the on cruise motherboard change, by checking the bottom signatures before and after the change, showed that the gain difference may be as high as 5.3 dB. However, unknown factors such as the time at which the original motherboard went out of alignment, towed body position and effects of the second motherboard change make it impossible to attribute these changes solely to the on cruise motherboard change. Therefore, we assumed that no internal gain changes in the EY200 occurred from 1990 to 1992. In 1990, a TVG of 40 log R was used on the EY200. The calibration was compensated for this by adjusting the source level accordingly.

Data Editing and Processing

All data acquisition, editing and processing were done using the Femto Model 9001 Hydroacoustic Data Processing System (HDPS). To select acoustic targets attributed to herring, verification was made by fishing whenever possible. Most of the major acoustic concentrations were identified in this manner. (Tables 5 to 7). The visual configuration and distribution of positively identified herring acoustic targets, confirmed by many trawl sets over the years surveyed, plus acoustic logbook observations, helped in the selection process when fishing was not possible. Calculation of mean and variance of acoustic backscatter and biomass estimates follow procedures outlined by O'Boyle and Atkinson (1989) (Appendix 1).

The proportion of transects with recorded backscatter was determined. Also, an estimate of the total mileage surveyed and the proportion thereof which had backscatter recorded was done, based on the charted maps of backscatter distribution.

Target Strength

Foote's (1987) formula was used to calculate target strength based on length and weight of sampled fish (Appendix 1). Mean length were derived from the length frequency samples, while the weight-length regression was obtained from the detail samples. One single target strength per year was calculated for the Cape Breton strata, as fish size distribution was fairly homogenous throughout the area. In Chaleurs Bay, strata with predominantly juvenile herring present were identified and assigned a different target strength than the strata with adult herring (Table 1).

Foote's (1987) formula was derived from nighttime measurements on in situ herring. Experimental evidence has shown that target strength is higher during the day than at night (MacLennan and Simmonds, 1992). Experiments with caged fish have shown that the diurnal change in target strength correlates well with the tilt angle of the body. This is probably caused by some change in fish behaviour associated with light level. Buerkle (1990) noted that fish orient at different tilt angles during the day than at night and suggests that applying nighttime target strengths to daytime fish orientations likely overestimates biomass.

Since the difference between nighttime and daytime target strengths could not be quantified, the data summary tables were divided into day and night time periods (night = 1900 to 0700 HR) and an estimate of the percentage of backscatter recorded during either time periods is included.

RESULTS

DISTRIBUTION AND BACKSCATTERING OF ACOUSTIC TARGETS

The distribution of herring encountered during surveys in the Chaleurs Bay and Cape Breton areas for the years 1992, 1991 and 1990 are mapped in Figures 2 to 7. Backscatter and biomass estimates per transect for each year and both areas are presented in Tables 2 to 4, subtables a, b, c and d. The total backscatter and biomass estimates per strata for these same areas are found in Tables 5 to 7.

1992 Survey (Oct. 1-22)

The 1992 acoustic survey backscatter per transect by area and time period is detailed in Tables 2a) Chaleur nighttime, 2b) Chaleur daytime, 2c) Cape Breton nighttime and 2d) Cape Breton daytime. The total per strata values (nighttime plus daytime) are summarized in Table 5, with the visual distribution in Figures 2 and 3.

Close to 45% of the total 1992 backscatter was recorded in the East Miscou stratum (number 23). Another 25% of the total was located in the Chaleur inshore strata, with the highest concentrations found in the northern strata of Grande-Riviere and Shigawake, followed by the southern stratum of Maissonnette, all of which were extensively covered and have comparatively low variance values.

The Cape Breton area accounted for 22% of total backscatter, almost entirely found inshore, with Aspy Bay and Neil Harbour strata to the northwest having the highest values.

1991 Survey (Oct. 10-24)

The 1991 acoustic survey backscatter per transect by area and time period is detailed in Tables 3a) Chaleur nighttime, 3b) Chaleur daytime, 3c) Cape Breton nighttime and 3d) Cape Breton daytime. The total per strata values (nighttime plus daytime) are summarized in Table 6, with the visual distribution in Figures 4 and 5.

A large proportion, 50% of the total backscatter, was recorded in the east Miscou stratum in 1991. The Chaleur inshore strata accounted for another 37% of the total, once again with the northern strata of Shigawake having a high value, followed by the southern strata of Maissonnette.

In Cape Breton, 10% of the total backscatter was recorded, concentrated mainly in the Aspy Bay stratum. No offshore strata were surveyed in 1991.

1990 Survey (Oct. 26 -Nov. 8)

The 1990 acoustic survey backscatter per transect by area and time period is detailed in Tables 4a) Chaleur nighttime, 4b) Chaleur daytime, 4c) Cape Breton nighttime and 4d) Cape Breton daytime. The total per strata values (nighttime plus daytime) are summarized in Table 7, with the visual distribution in Figures 6 and 7.

Most of the 1990 backscatter was recorded in the western part of Chaleur Bay, with 58% of the backscatter in the Carlisle offshore stratum. The three sets which were made there consisted mostly of juvenile herring. Together with the New Richmond and Richmond Offshore strata, also in the western part of the bay, these three strata accounted for 78% of the 1990 total backscatter.

The remaining 22% of backscatter recorded is dispersed. The Cape Breton strata of New Waterford and Aspy Bay accounted for 10% of the total backscatter.

Total Backscatter and Biomass Estimates

Total acoustic backscattering and biomass estimates, using Foote's (1987) formula for target strength, in the Southern Gulf from 1988 to 1992 are presented in Table 8. The current randomly selected parallel transects sampling design was initiated in 1988. Included in Table 8, for the years 1990 to 1992, are the proportions of transects surveyed during nighttime (1900 - 0700 HR) and the proportion of backscatter and biomass which was recorded at night.

The 1990 survey has the highest backscatter and biomass values, with 78% of the total backscatter from the western part of Chaleur Bay, consisting mostly of juvenile herring. If the proportion of smelt present in sets was subtracted from estimated biomass, the 1990 biomass estimate would decrease by 193990 tons.

In 1991 and 1992, the Chaleur Bay offshore strata had the highest proportion of total backscatter and biomass, due to the East Miscou stratum which accounted for most of this total. If the proportion of smelt present in sets was subtracted from estimated biomass, the 1992 biomass estimate would decrease by 6916 tons.

The proportion of backscatter and biomass detected at night was 75% in 1991 and 1992, and 80% in 1990. The highest number of transects surveyed was in 1992. This considerably reduced the coefficient of variation values, especially in the inshore strata of both Chaleur Bay and Cape Breton.

Proportion of Transects with Backscatter

The number of total transects per stratum and the proportion of transects with backscatter from the 1988 to 1992 herring acoustic cruises can be found in Table 9.

The 1992 survey had the highest proportion of transects with backscatter overall (0.67) as well as for each of the areas; Chaleur inshore (0.73), Chaleur offshore (0.64) and Cape Breton inshore (0.82). 1991 shows the second highest proportions with an overall value of 0.46, followed by the year 1988 (0.25). In contrast, 1990 showed the lowest values, with an overall proportion of 0.22, and for Chaleur inshore (0.13), offshore (0.16). The 1989 survey was only partially completed and is not considered here.

The area showing annually the highest proportion of transects with backscatter is Cape Breton inshore, although the number of transects surveyed in this area is lower than the Chaleur Bay inshore and offshore areas.

Percentage of Transect Length with Backscatter

Table 10 is a resume of total transect length covered per strata, together with the total transect length showing herring backscatter, and the percentage of transect length covered with backscatter, for the years 1988 to 1992.

The 1991 and 1992 surveys have the highest percentage length of transect with backscatter. Overall, 1991 had 16.8%, with the Chaleur area at 17.1% and the Cape Breton area at 16.7%. In 1992, the overall value was 13.6%, with Chaleur having 13.1% and Cape Breton 16.8%. In comparison, the 1990 survey had the lowest percentages of these three years, with an overall value of 8.8%, with Chaleur area at 6.1% and Cape Breton at 15.3%.

Annually, the area showing the highest percentage length of transect with backscatter is Cape Breton inshore.

TRAWL SETS, SAMPLE COMPOSITION AND CTD PROFILES

Lengths, weights and spawning affinity of herring acoustic cruise samples from 1990 to 1992 are summarized in Table 1.

1992 Survey (Oct 1 - 22)

The 1992 survey set locations can be found on Figures 2 and 3, plus per strata sets in Table 5. Length frequency distributions of herring samples are shown in Figures 8a and 8b.

Mostly adult herring were found in sets both in Chaleur Bay and the Cape Breton area. Juvenile herring were found in New Carlisle and Anse a Beaufils strata sets. Over 90% smelt were present in sets from New Richmond inshore and offshore strata at the western end of Chaleur Bay. The Cape Breton area samples had large herring which were on average 5 cm longer.

The Chaleur Bay samples were composed of 71% fall spawners while the Cape Breton area had 96% fall spawners.

1991 Survey (Oct. 10 - 24)

The 1991 set locations can be found on Figures 4 and 5, per strata location in Table 6. Length frequency distributions of herring samples are shown in Figure 9a for Chaleur Bay and 9b for Cape Breton.

All sets in both areas were composed of adult herring, except for a small proportion of juveniles in the West Miscou set. Larger herring were again found in the Cape Breton area samples. Chaleur Bay samples consisted of 68% fall spawners while Cape Breton had 99%.

1990 Survey (Oct. 26 - Nov. 8)

Set locations for the 1990 survey can be found on Figures 6 and 7, plus per strata distribution in Table 7. Length frequency distributions of herring samples are shown in Figure 10.

In Chaleur Bay, over 80% of herring backscatter was found in the western end, with samples composed primarily of juvenile herring. Adult herring were found in the eastern Chaleur Bay samples. Some smelt were present in sets from New Richmond (80%), Richmond offshore (8%) and Carlisle offshore (5%). Larger adult herring were found in the Cape Breton area samples.

Due mainly to the large number of juvenile herring samples which were mostly spring spawners, the total Chaleur Bay area samples consisted of 32% fall spawners while Cape Breton samples were composed of 92% fall spawners.

Catch-at-age

Catch-at-age for 4T-4Vn herring combined weighed by the total backscatter proportions for each area (Chaleur and Cape Breton) is presented in Table 11.

The fall spawners represented 81.6% of the 1992 total backscatter, and 74.7% in 1991. In 1990, this percentage was down to 49.1%, mainly because of the large proportion of juveniles which are mostly spring spawners. The strong 1987 fall year-class accounts for 36% of fall spawners in 1991 and 29% in 1992.

For the spring spawners, the strongest year-class was in 1988 which accounted for 29% of the 1990 biomass. The large amounts of juveniles found in 1990 were mostly spring spawners; ages 1 and 2 accounting for 46% of the total backscatter.

Temperature and Salinity

The TS (temperature-salinity) plots by area derived from the CTD profiles encompass all the temperature and salinity data points over all depth ranges. Figure 11 summarizes the 1992 acoustic cruise data while the 1991 temperature-salinity plots by area are shown in Figure 12. Temperatures in all areas ranged between 0 and 12 °C for both years. In 1992, the Cape Breton area had a narrower range of temperatures (from 2 to 4 °C) and a wider salinity range than in 1991. The east Chaleur and Gaspé areas have quite similar patterns for both years. Salinity gradients were stronger in the inshore strata of the western part of the Chaleur Bay in 1991. In general, stronger haloclines and thermoclines were observed in the inshore strata.

DISCUSSION

The 1992 acoustic survey held from Oct. 1 to Oct. 22 was the most extensive of Gulf Region acoustic surveys; furthermore, no major equipment failure or cable breaks occurred. This survey had the highest proportion of transects with backscatter recorded and was close to the 1991 value for highest mileage covered with backscatter recorded. This suggests a more widespread distribution of herring in both the Chaleur Bay area and northern Cape Breton. A ball calibration was done on our acoustic equipment on May 11th, 1993 in conjunction with the TVG calibration, to confirm the receiver fixed gain and digitizer gain. The calibration files were within 0.2 dB of the ball calibration results, and thus assumed to be correct. The biomass estimate derived from these TVG calibration files and our calculated target strengths for 1992 was 203797 tons. This value is lower than the VPA model using the ADAPT framework in the assessment for 4T fall spawners, 1992 (Chaput et al. 1993).

The 1991 acoustic survey held from Oct. 10 to Oct. 24 was marred with equipment failure and cable breaks. The splicing of the cable and motherboard change, plus the inability to quantify the variation in fixed gain resulting from that change, make our 1991 estimate questionable. Other indicators such as the highest mileage covered with reported backscatter and a high proportion of transects with backscatter would indicate that the 1991 distribution and abundance would be similar to 1992.

The 1990 survey held from Oct. 26 to Nov. 8 had a biomass estimate which was high compared to 1991 and 1992. No major equipment problem occurred, although there were some cable problems and splicing was done. The TVG set at 40 log R could affect quantification by increasing the estimate of low amplitude signals (Allen Clay, pers. comm.). The large proportion of the biomass estimate attributed to juvenile herring could reflect the large fall 87 and spring 88 year classes. However, this large biomass estimate does not coincide with other indicators. The 1990 survey had the lowest proportion of transects and the lowest mileage covered with reported backscatter, compared to 1991 and 1992. The equipment change in 1991 and poor logbook records of transceiver settings in 1990 could be possible sources of error.

The proportion of backscatter recorded during nighttime hours was fairly constant; between 75 and 80% for the years 1990 to 1992. Any daytime overestimate of biomass derived by applying nighttime target strengths to daytime backscatter would be relatively constant over this time period.

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Table 1. Lengths, weights, spawning affinities and calculated target strengths for 1990-92 herring acoustic surveys.

Area and Year	Samples	Mean Length (cm)	Number	Weight at Mean Length (g)	Weight Formula	Percent Fall Spawners by Weight	Target Strength (dB/kg)
CHALEUR							
1992	Adult	27.7	3454	159.0	$0.00467 \cdot \text{len}^{3.146}$	71**	-35.103
1992	Juvenile*	21.3	619	71.0	$0.00552 \cdot \text{len}^{3.091}$	71**	-33.82
1991	all	27.6	2581	160.5	$0.00588 \cdot \text{len}^{3.079}$	68	-35.137
1990	East	27.0	272	155.1	$0.00211 \cdot \text{len}^{3.40}$	32**	-35.179
1990	West***	23.2	1709	89.8	$0.00393 \cdot \text{len}^{3.192}$	32**	-34.125
CAPE BRETON							
1992	all	32.6	796	254.5	$0.00685 \cdot \text{len}^{3.02}$	96	-35.69
1991	all	33.5	631	275.3	$0.01053 \cdot \text{len}^{2.897}$	99	-35.80
1990	all	32.9	833	263.2	$0.00843 \cdot \text{len}^{2.963}$	92	-35.76

* Juvenile herring samples, New Carlilse & Anse a Beaufills strata

** Percentage represents all Chaleur samples combined

*** Mostly juvenile herring

TABLE 2a. 1992 CHALEUR (NIGHTTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
East_Miscou	396	27011	375.39	-35.1	0.000000	0	0.0000	0.000	18
	397	27353	380.14	-35.1	0.000000	0	0.0000	0.000	
	399	26518	368.53	-35.1	0.000049	17903	0.1573	57974.502	
	400	25760	358.00	-35.1	0.000011	4000	0.0362	12952.589	
Cap_Bon_Ami	359	4354	9.41	-35.1	0.000000	0	0.0000	0.000	
	360	8029	17.36	-35.1	0.000000	0	0.0000	0.000	
	361	8166	17.65	-35.1	0.000000	0	0.0000	0.827	
	362	8496	18.37	-35.1	0.000000	0	0.0000	0.102	
	363	8228	17.79	-35.1	0.000000	1	0.0001	1.673	
	364	9374	20.27	-35.1	0.000001	19	0.0031	62.654	
American_Bank	385	5895	14.70	-35.1	0.000000	0	0.0000	0.000	
Gaspe_Offshore	356	9446	12.95	-35.1	0.000000	0	0.0000	0.000	
	357	9459	12.97	-35.1	0.000000	0	0.0000	0.000	
	358	5508	7.55	-35.1	0.000000	0	0.0000	0.000	
Gaspe_Bay	388	8083	16.48	-35.1	0.000001	23	0.0045	73.805	17
	389	7253	14.78	-35.1	0.000000	0	0.0000	0.000	
	390	6925	14.12	-35.1	0.000001	7	0.0017	23.906	
	391	7137	14.55	-35.1	0.000000	0	0.0000	0.000	
	392	7137	14.55	-35.1	0.000000	0	0.0000	0.000	
	393	6445	13.14	-35.1	0.000001	8	0.0019	24.931	
	394	5777	11.78	-35.1	0.000001	6	0.0016	19.388	
	395	4336	8.84	-35.1	0.000003	27	0.0097	86.008	
	La_Malbaie	340	16035	56.46	-35.1	0.000000	2	0.0001	
341		10604	37.33	-35.1	0.000000	0	0.0000	0.000	
342		16975	59.76	-35.1	0.000002	91	0.0049	295.092	
Anse_A_Beaufils	331	10606	28.01	-33.8	0.000006	171	0.0147	412.136	14
	332	11296	29.83	-33.8	0.000008	229	0.0185	550.857	
	334	10550	27.86	-33.8	0.000000	0	0.0000	0.000	
	335	11847	31.28	-33.8	0.000000	0	0.0000	0.000	
	336	7756	20.48	-33.8	0.000000	0	0.0000	0.000	
	337	6635	17.52	-33.8	0.000000	0	0.0000	0.000	
	338	6746	17.81	-33.8	0.000000	0	0.0000	0.000	
	339	6800	17.96	-33.8	0.000000	0	0.0000	0.000	
	Grande_Riviere	298	8463	12.30	-35.1	0.000003	31	0.0081	
300		7359	10.70	-35.1	0.000003	27	0.0081	86.799	
301		7651	11.12	-35.1	0.000019	208	0.0604	671.934	
302		11790	17.14	-35.1	0.000021	361	0.0683	1170.227	
304		6543	9.51	-35.1	0.000071	674	0.2296	2183.695	
305		8486	12.34	-35.1	0.000090	1108	0.2908	3587.336	
306		8328	12.11	-35.1	0.000071	861	0.2304	2789.549	
307		7715	11.22	-35.1	0.000015	174	0.0502	562.760	
308		7516	10.93	-35.1	0.000002	27	0.0081	88.420	
309		8419	12.24	-35.1	0.000007	89	0.0236	288.346	
310		8151	11.85	-35.1	0.000007	84	0.0231	273.477	
311		6123	8.90	-35.1	0.000018	160	0.0581	516.824	
312		6281	9.13	-35.1	0.000023	206	0.0729	665.881	
Newport	87	6343	4.66	-35.1	0.000000	1	0.0006	2.731	
	88	7263	5.34	-35.1	0.000000	0	0.0000	0.000	
	89	7213	5.30	-35.1	0.000000	0	0.0000	0.000	
	90	7535	5.54	-35.1	0.000000	0	0.0000	0.000	
	91	7624	5.60	-35.1	0.000000	0	0.0000	0.000	
	92	7263	5.34	-35.1	0.000000	0	0.0000	0.000	
	93	7039	5.17	-35.1	0.000000	0	0.0000	0.000	
	94	7115	5.23	-35.1	0.000000	0	0.0000	0.000	
	95	8711	6.40	-35.1	0.000000	0	0.0000	0.000	
	96	8083	5.94	-35.1	0.000007	42	0.0227	135.115	
	118	10982	8.07	-35.1	0.000004	35	0.0140	113.133	
	120	8826	6.49	-35.1	0.000000	0	0.0000	0.000	
	121	10881	8.00	-35.1	0.000001	11	0.0047	37.191	
North_Miscou	25	14390	53.33	-35.1	0.000000	0	0.0000	0.000	1
	26	15154	56.16	-35.1	0.000000	0	0.0000	0.000	
	27	13402	49.67	-35.1	0.000000	0	0.0000	0.000	
	29	12816	47.49	-35.1	0.000002	74	0.0050	239.553	
	30	14616	54.17	-35.1	0.000000	0	0.0000	0.000	
	31	11937	44.24	-35.1	0.000002	79	0.0058	257.176	
	32	12148	45.02	-35.1	0.000000	0	0.0000	0.000	
	33	15041	55.74	-35.1	0.000000	8	0.0005	25.464	
	Newport_Offshore	122	14108	47.64	-35.1	0.000000	0	0.0000	
123		11702	39.51	-35.1	0.000000	0	0.0000	0.000	

TABLE 2a. 1992 CHALEUR (NIGHTTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Newport Offshore (con't.)	124	11093	37.46	-35.1	0.000000	0	0.0000	0.000	
	125	10516	35.51	-35.1	0.000000	0	0.0000	0.000	
	126	7707	26.02	-35.1	0.000000	0	0.0000	0.000	
	127	9853	33.27	-35.1	0.000000	0	0.0000	0.000	
	129	10476	35.37	-35.1	0.000000	0	0.0000	0.000	
	130	9570	32.31	-35.1	0.000000	0	0.0000	0.000	
East_Cent_Chaleur	185	9721	15.95	-35.1	0.000000	0	0.0000	0.000	
	186	9888	16.23	-35.1	0.000000	0	0.0000	0.000	
	187	10309	16.92	-35.1	0.000000	0	0.0000	0.000	
	188	10145	16.65	-35.1	0.000000	0	0.0000	0.000	
	189	10298	16.90	-35.1	0.000000	0	0.0000	0.000	
	190	10420	17.10	-35.1	0.000000	0	0.0000	0.000	
	191	10060	16.51	-35.1	0.000000	0	0.0000	0.000	
	192	11198	18.38	-35.1	0.000000	0	0.0000	0.000	
	193	11357	18.64	-35.1	0.000000	0	0.0000	0.000	
	194	11353	18.63	-35.1	0.000000	0	0.0000	0.000	
West_Miscou	49	9471	9.07	-35.1	0.000000	0	0.0000	0.000	
	51	8691	8.32	-35.1	0.000000	0	0.0000	0.000	
	52	9970	9.55	-35.1	0.000000	0	0.0081	0.533	
	53	10023	9.60	-35.1	0.000000	0	0.0000	0.000	
	54	9880	9.46	-35.1	0.000000	0	0.0000	0.000	
	56	9968	9.54	-35.1	0.000000	0	0.0000	0.000	
	57	9101	8.71	-35.1	0.000000	0	0.0000	0.000	
	58	7956	7.62	-35.1	0.000000	0	0.0000	0.000	
	59	8627	8.26	-35.1	0.000000	0	0.0000	0.000	
	60	8949	8.57	-35.1	0.000000	0	0.0000	0.000	
	61	8498	8.14	-35.1	0.000000	0	0.0000	0.000	
	62	8763	8.39	-35.1	0.000000	0	0.0000	0.000	
	63	8892	8.51	-35.1	0.000000	0	0.0000	0.000	
	65	8422	8.06	-35.1	0.000008	62	0.0251	202.318	2
	66	9630	9.22	-35.1	0.000007	65	0.0230	211.979	
	67	9502	9.10	-35.1	0.000006	54	0.0193	175.134	
	68	10033	9.61	-35.1	0.000020	193	0.0650	624.272	
	80	9567	9.16	-35.1	0.000000	0	0.0000	0.000	
81	9008	8.62	-35.1	0.000003	26	0.0099	85.072		
83	8889	8.51	-35.1	0.000003	24	0.0093	79.194		
84	7705	7.38	-35.1	0.000000	0	0.0000	0.000		
85	5874	5.62	-35.1	0.000000	0	0.0000	0.000		
86	6941	6.64	-35.1	0.000000	0	0.0000	0.000		
Shigawake	148	10839	12.48	-35.1	0.000023	293	0.0761	949.880	
	149	10275	11.84	-35.1	0.000007	84	0.0231	272.834	
	150	10075	11.60	-35.1	0.000003	35	0.0098	113.607	6
	152	9788	11.27	-35.1	0.000003	31	0.0090	101.068	
	153	8706	10.03	-35.1	0.000019	189	0.0611	612.857	
	154	8599	9.90	-35.1	0.000006	57	0.0186	184.307	
	155	8440	9.72	-35.1	0.000013	124	0.0412	401.007	
	156	8481	9.77	-35.1	0.000020	191	0.0632	617.782	
	157	9184	10.58	-35.1	0.000013	142	0.0434	459.185	
	158	7898	9.10	-35.1	0.000009	84	0.0300	273.329	
	159	7680	8.85	-35.1	0.000012	103	0.0378	334.164	
	160	7851	9.04	-35.1	0.000006	57	0.0204	184.880	
	161	6491	7.48	-35.1	0.000007	54	0.0234	174.992	7
	162	6516	7.51	-35.1	0.000007	53	0.0230	172.620	
163	6347	7.31	-35.1	0.000072	523	0.2315	1692.599		
Central_Chaleur	195	6827	9.45	-35.1	0.000000	0	0.0000	0.000	
	196	11249	15.56	-35.1	0.000000	0	0.0000	0.000	
	197	10523	14.56	-35.1	0.000000	0	0.0000	0.000	
	198	10904	15.09	-35.1	0.000000	0	0.0000	0.000	
Carlilse_Offshore	248	18483	75.35	-35.1	0.000003	220	0.0094	710.909	10
	249	19357	78.91	-35.1	0.000003	216	0.0088	698.099	
	250	2203	8.98	-35.1	0.000004	34	0.0121	108.915	
	252	15577	63.50	-35.1	0.000001	89	0.0045	288.384	
	253	14170	57.77	-35.1	0.000002	138	0.0077	445.976	
Maisonnette	264	4615	3.37	-35.1	0.000056	188	0.1809	609.250	12
	265	3852	2.81	-35.1	0.000010	28	0.0325	91.359	
	266	4059	2.96	-35.1	0.000061	182	0.1984	587.777	
	267	4353	3.18	-35.1	0.000032	103	0.1047	332.715	
	268	4489	3.28	-35.1	0.000081	266	0.2628	861.080	
	269	4421	3.23	-35.1	0.000022	70	0.0700	225.858	
	270	4382	3.20	-35.1	0.000023	74	0.0749	239.551	
	271	4017	2.93	-35.1	0.000009	26	0.0282	82.681	
	272	4085	2.98	-35.1	0.000011	33	0.0361	107.627	
	273	4290	3.13	-35.1	0.000005	15	0.0157	49.253	

TABLE 2a. 1992 CHALEUR (NIGHTTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Maisonnette (con't.)	274	4671	3.41	-35.1	0.000016	54	0.0510	173.765	
	275	4196	3.06	-35.1	0.000010	32	0.0340	104.007	
	276	3623	2.64	-35.1	0.000012	32	0.0392	103.589	
	277	4656	3.40	-35.1	0.000011	37	0.0352	119.786	
	278	4968	3.63	-35.1	0.000012	44	0.0392	142.243	
	279	5121	3.74	-35.1	0.000030	112	0.0973	363.751	
New_Carlilse	215	5229	17.33	-33.8	0.000004	62	0.0087	150.459	
	216	7421	24.60	-33.8	0.000011	265	0.0260	639.414	
	217	8664	28.72	-33.8	0.000004	103	0.0086	248.320	8
	219	4188	13.88	-33.8	0.000007	91	0.0157	218.424	
New_Richmond	220	6098	10.41	-35.1	0.000000	0	0.0000	0.000	
	221	5194	8.87	-35.1	0.000003	27	0.0097	86.293	
	223	6163	10.53	-35.1	0.000003	35	0.0109	114.465	
	224	6758	11.54	-35.1	0.000004	49	0.0137	158.189	
	225	5540	9.46	-35.1	0.000006	59	0.0203	192.189	
	226	4616	7.88	-35.1	0.000005	42	0.0173	136.731	
	227	4409	7.53	-35.1	0.000007	53	0.0230	172.997	
	228	4817	8.23	-35.1	0.000006	50	0.0196	161.473	
	229	5164	8.82	-35.1	0.000006	50	0.0185	163.087	
	230	5142	8.78	-35.1	0.000006	54	0.0198	174.018	
	231	4777	8.16	-35.1	0.000006	51	0.0202	165.046	9
Richmond_Offshore	254	4018	20.85	-35.1	0.000000	0	0.0000	0.000	
	255	14567	75.58	-35.1	0.000013	1006	0.0431	3258.943	
	256	14977	77.71	-35.1	0.000000	0	0.0000	0.000	11
Beaufils_Offshore	313	7278	16.86	-35.1	0.000000	0	0.0000	0.000	
Bon_Ami_Offshore	365	10004	26.16	-35.1	0.000000	0	0.0000	0.000	
	367	10692	27.96	-35.1	0.000000	0	0.0000	0.000	
	368	11737	30.69	-35.1	0.000000	0	0.0000	0.000	
	369	10218	26.72	-35.1	0.000000	0	0.0000	0.000	
	370	10004	26.16	-35.1	0.000000	0	0.0000	0.000	

TABLE 2b. 1992 CHALEUR (DAYTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
East_Miscou	401	26137	363.24	-35.1	0.000007	2568	0.0229	8316.240	
	402	14514	201.71	-35.1	0.000012	2355	0.0378	7626.736	
American_Bank	375	10455	26.07	-35.1	0.000005	138	0.0171	445.670	
	376	10469	26.10	-35.1	0.000013	333	0.0413	1076.976	
	377	9694	24.17	-35.1	0.000002	37	0.0050	120.826	
	378	9374	23.37	-35.1	0.000000	9	0.0013	30.529	
	379	9467	23.60	-35.1	0.000000	6	0.0009	20.372	
	380	9437	23.53	-35.1	0.000000	8	0.0010	24.656	
	381	8708	21.71	-35.1	0.000001	25	0.0038	81.492	
	382	7423	18.51	-35.1	0.000002	37	0.0065	120.361	
	383	6244	15.57	-35.1	0.000001	10	0.0021	32.784	
	384	5546	13.83	-35.1	0.000001	10	0.0022	30.852	
Gaspe_Offshore	345	8512	11.67	-35.1	0.000002	28	0.0078	91.122	
	346	8446	11.58	-35.1	0.000000	0	0.0000	0.000	
	347	9594	13.16	-35.1	0.000000	0	0.0000	0.000	
	348	9476	12.99	-35.1	0.000000	0	0.0000	0.000	
	350	12060	16.54	-35.1	0.000001	10	0.0020	32.674	
	351	10824	14.84	-35.1	0.000000	0	0.0000	0.000	
	352	10806	14.82	-35.1	0.000000	0	0.0000	0.000	
La_Malbaie	343	19456	68.50	-35.1	0.000000	13	0.0006	40.675	
Newport	97	6769	4.97	-35.1	0.000003	14	0.0088	43.788	
	98	7308	5.37	-35.1	0.000003	14	0.0086	46.037	
	99	8285	6.09	-35.1	0.000003	20	0.0104	63.476	
	101	4563	3.35	-35.1	0.000015	51	0.0494	165.721	
	102	7976	5.86	-35.1	0.000008	47	0.0260	152.467	
	103	8833	6.49	-35.1	0.000001	10	0.0048	31.249	
	104	10189	7.49	-35.1	0.000001	11	0.0046	34.511	
	106	8179	6.01	-35.1	0.000000	0	0.0000	0.000	
	107	8907	6.54	-35.1	0.000005	31	0.0152	99.617	
	109	8884	6.53	-35.1	0.000000	2	0.0012	7.984	
	110	9183	6.75	-35.1	0.000002	13	0.0064	43.065	
	112	8595	6.32	-35.1	0.000001	5	0.0024	14.880	
	113	8329	6.12	-35.1	0.000000	1	0.0008	4.665	
	114	8329	6.12	-35.1	0.000000	0	0.0000	0.000	
	115	9257	6.80	-35.1	0.000014	92	0.0439	298.691	
116	9169	6.74	-35.1	0.000034	232	0.1113	749.975		
North_Miscou	34	9691	35.91	-35.1	0.000031	1120	0.1010	3625.988	
Newport_Offshore	131	9628	32.51	-35.1	0.000000	12	0.0012	38.406	
East_Cent_Chaleur	181	9276	15.22	-35.1	0.000000	0	0.0000	0.000	
	182	10178	16.70	-35.1	0.000000	0	0.0000	0.000	
	183	9640	15.82	-35.1	0.000000	0	0.0000	0.000	
	184	9902	16.25	-35.1	0.000000	0	0.0000	0.000	
West_Miscou	41	8495	8.13	-35.1	0.000000	3	0.0012	9.916	
	43	8480	8.12	-35.1	0.000000	4	0.0015	12.183	
	45	9004	8.62	-35.1	0.000001	9	0.0034	28.916	
	48	9009	8.63	-35.1	0.000001	5	0.0020	17.192	
	69	8982	8.60	-35.1	0.000020	174	0.0655	562.986	
	70	11530	11.04	-35.1	0.000006	62	0.0183	201.721	
	71	11915	11.41	-35.1	0.000001	8	0.0023	25.792	
	72	12357	11.83	-35.1	0.000003	41	0.0113	133.559	
	74	12102	11.59	-35.1	0.000002	25	0.0070	80.826	
	76	11664	11.17	-35.1	0.000002	20	0.0058	65.244	
	77	11673	11.18	-35.1	0.000001	6	0.0018	20.436	
	78	12002	11.49	-35.1	0.000000	0	0.0000	0.000	
	79	12267	11.74	-35.1	0.000002	28	0.0076	89.279	
	Shigawake	133	7600	8.75	-35.1	0.000039	344	0.1274	1115.292
134		5732	6.60	-35.1	0.000009	62	0.0302	199.342	
135		8731	10.06	-35.1	0.000010	105	0.0338	340.355	
136		8408	9.69	-35.1	0.000007	64	0.0212	205.651	
137		6425	7.40	-35.1	0.000011	80	0.0349	257.979	
138		8039	9.26	-35.1	0.000004	38	0.0133	122.903	
139		8175	9.42	-35.1	0.000014	134	0.0462	435.123	
140		7190	8.28	-35.1	0.000004	34	0.0134	110.964	
141		7197	8.29	-35.1	0.000005	38	0.0149	123.721	
142		7115	8.19	-35.1	0.000015	123	0.0487	399.222	
143		7282	8.39	-35.1	0.000022	185	0.0714	599.217	
144		8803	10.14	-35.1	0.000005	50	0.0161	162.938	
145		9398	10.82	-35.1	0.000013	144	0.0430	465.426	
146		8997	10.36	-35.1	0.000009	98	0.0307	318.305	
147		8956	10.32	-35.1	0.000009	97	0.0305	315.117	

TABLE 2b. 1992 CHALEUR (DAYTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Shigawake (con't.)	174	6877	7.92	-35.1	0.000002	16	0.0065	51.669	
	175	6916	7.97	-35.1	0.000002	12	0.0050	39.521	
	176	6788	7.82	-35.1	0.000002	17	0.0070	54.919	
	177	6788	7.82	-35.1	0.000006	45	0.0185	144.804	
	178	7011	8.08	-35.1	0.000003	22	0.0089	72.275	
	179	6809	7.84	-35.1	0.000015	118	0.0487	381.973	
	180	7144	8.23	-35.1	0.000000	3	0.0013	10.502	
Central_Chaleur	199	6181	8.55	-35.1	0.000000	0	0.0000	0.000	
	200	9317	12.89	-35.1	0.000000	0	0.0000	0.000	
	201	3539	4.90	-35.1	0.000000	0	0.0000	0.000	
	202	4506	6.23	-35.1	0.000000	0	0.0000	0.000	
	203	3539	4.90	-35.1	0.000000	0	0.0000	0.000	
	204	9001	12.45	-35.1	0.000000	0	0.0000	0.000	
	205	9316	12.89	-35.1	0.000000	0	0.0000	0.000	
	206	9157	12.67	-35.1	0.000000	0	0.0000	0.000	
	207	9409	13.02	-35.1	0.000000	0	0.0000	0.000	
	208	8756	12.11	-35.1	0.000000	0	0.0000	0.000	
	209	10127	14.01	-35.1	0.000000	0	0.0000	0.000	
Carlilse_Offshore	246	17810	72.61	-35.1	0.000002	150	0.0067	485.830	
	247	18440	75.17	-35.1	0.000003	221	0.0095	717.221	
Maisonnette	280	4812	3.51	-35.1	0.000049	172	0.1587	557.637	
	281	4525	3.30	-35.1	0.000061	202	0.1981	654.425	
	282	5525	4.03	-35.1	0.000018	72	0.0582	234.703	
	283	4316	3.15	-35.1	0.000037	116	0.1191	375.099	
	284	4823	3.52	-35.1	0.000045	157	0.1444	508.379	
	285	5135	3.75	-35.1	0.000021	80	0.0690	258.763	
	286	5493	4.01	-35.1	0.000024	98	0.0788	316.029	
	287	5219	3.81	-35.1	0.000010	40	0.0338	128.779	
	288	5230	3.82	-35.1	0.000028	106	0.0895	341.823	
	289	5734	4.19	-35.1	0.000011	46	0.0355	148.757	
	290	5881	4.29	-35.1	0.000004	18	0.0136	58.246	
	291	5988	4.37	-35.1	0.000010	42	0.0309	134.931	
	292	6360	4.64	-35.1	0.000007	33	0.0229	106.259	
	293	6395	4.67	-35.1	0.000006	26	0.0179	83.485	
	294	6681	4.88	-35.1	0.000016	79	0.0526	256.577	
295	6784	4.95	-35.1	0.000004	20	0.0132	65.374		
296	7276	5.31	-35.1	0.000002	11	0.0066	34.840		
New_Carlilse	210	6015	19.94	-33.8	0.000008	150	0.0181	361.546	
	211	5002	16.58	-33.8	0.000001	20	0.0028	47.022	
	212	5333	17.68	-33.8	0.000004	79	0.0108	190.797	
	213	5052	16.74	-33.8	0.000007	114	0.0164	275.197	
	214	5170	17.14	-33.8	0.000027	456	0.0641	1098.306	
New_Richmond	233	6098	10.41	-35.1	0.000000	0	0.0000	0.000	
	234	6317	10.79	-35.1	0.000000	0	0.0000	0.000	
	235	6797	11.61	-35.1	0.000000	0	0.0000	0.000	
	236	6549	11.19	-35.1	0.000000	0	0.0000	0.000	
	237	7812	13.34	-35.1	0.000000	0	0.0000	0.000	
	239	8045	13.74	-35.1	0.000000	0	0.0000	0.000	
	240	7850	13.41	-35.1	0.000000	0	0.0000	0.000	
	241	7674	13.11	-35.1	0.000000	2	0.0004	5.373	
	242	5411	9.24	-35.1	0.000000	3	0.0010	8.827	
	243	5753	9.83	-35.1	0.000002	19	0.0061	59.945	
	244	4018	6.86	-35.1	0.000000	0	0.0000	0.000	
	245	2938	5.02	-35.1	0.000000	0	0.0000	0.137	
	Richmond_Offshore	258	8718	45.23	-35.1	0.000000	0	0.0000	0.000
259		9748	50.58	-35.1	0.000000	11	0.0007	34.919	
260		10640	55.21	-35.1	0.000010	546	0.0320	1766.863	
261		12133	62.95	-35.1	0.000004	276	0.0142	894.718	
Beaufils_Offshore	314	7366	17.06	-35.1	0.000000	0	0.0000	0.000	
	315	6852	15.87	-35.1	0.000000	0	0.0000	0.000	
	316	8233	19.07	-35.1	0.000000	0	0.0000	0.001	
	317	7370	17.07	-35.1	0.000000	6	0.0011	18.524	
	318	7444	17.24	-35.1	0.000000	0	0.0000	0.000	
	319	7376	17.08	-35.1	0.000000	1	0.0001	1.945	
	320	8430	19.53	-35.1	0.000000	0	0.0000	0.000	

TABLE 2b. 1992 CHALEUR (DAYTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ³)	Total Biomass (t/trans)	Set Number
Bonaventure_Off	321	5504	13.70	-35.1	0.000000	0	0.0000	0.000	
	322	6048	15.05	-35.1	0.000000	0	0.0000	0.000	
	325	11161	27.77	-35.1	0.000000	11	0.0013	36.796	
	326	9961	24.79	-35.1	0.000000	8	0.0011	27.235	
	327	9596	23.88	-35.1	0.000001	12	0.0016	39.288	
	329	11337	28.21	-35.1	0.000000	0	0.0000	0.000	
	330	8769	21.82	-35.1	0.000000	0	0.0000	0.000	
Bon_Ami_Offshore	371	9627	25.17	-35.1	0.000000	0	0.0000	0.000	
	372	10042	26.26	-35.1	0.000002	49	0.0061	159.297	
	373	9999	26.15	-35.1	0.000001	30	0.0037	97.124	
	374	6504	17.01	-35.1	0.000001	10	0.0018	31.364	

TABLE 2c. 1992 CAPE BRETON (NIGHTTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Milne	405	6894	40.24	-35.7	0.000000	0	0.0000	0.000	
	406	7852	45.83	-35.7	0.000002	80	0.0065	297.118	
	407	6786	39.61	-35.7	0.000000	0	0.0000	0.000	
	408	7814	45.61	-35.7	0.000000	0	0.0000	0.000	
Milne_Offshore	409	8745	51.05	-35.7	0.000004	193	0.0140	714.422	
St_Ann_Bay	470	8087	41.58	-35.7	0.000000	0	0.0000	0.000	
	471	8213	42.23	-35.7	0.000000	0	0.0000	0.000	
	472	8862	45.57	-35.7	0.000000	0	0.0000	0.000	
	473	7832	40.27	-35.7	0.000000	5	0.0004	18.117	
Wreck_Cove	464	7099	12.99	-35.7	0.000000	0	0.0001	1.492	
	465	7209	13.19	-35.7	0.000000	1	0.0002	2.178	
	466	7927	14.51	-35.7	0.000011	164	0.0419	607.408	
	467	8012	14.66	-35.7	0.000003	49	0.0123	180.648	
	468	8427	15.42	-35.7	0.000000	0	0.0000	0.000	
	469	8430	15.43	-35.7	0.000001	8	0.0019	28.950	
Neil_Harbour	483	11370	16.98	-35.7	0.000001	19	0.0042	71.115	
	484	11819	17.65	-35.7	0.000002	43	0.0090	159.197	
	486	9110	13.60	-35.7	0.000002	34	0.0091	124.332	
	488	12167	18.17	-35.7	0.000002	35	0.0072	131.219	
	489	11823	17.66	-35.7	0.000002	29	0.0061	107.281	
	490	11851	17.70	-35.7	0.000002	34	0.0071	125.574	
	491	14049	20.98	-35.7	0.000001	28	0.0050	105.045	
	492	14689	21.94	-35.7	0.000003	58	0.0097	213.626	
	Aspy_Bay	444	10465	33.52	-35.7	0.000072	2403	0.2657	8907.305
443		9150	29.31	-35.7	0.000047	1373	0.1736	5087.989	
445		10695	34.26	-35.7	0.000054	1842	0.1993	6828.438	
446		10339	33.12	-35.7	0.000089	2959	0.3312	10968.673	
447		10213	32.71	-35.7	0.000010	340	0.0386	1261.220	
448		9031	28.93	-35.7	0.000015	444	0.0569	1646.395	
449		5042	16.15	-35.7	0.000007	112	0.0257	414.975	
Pleasant_Bay	422	5411	30.24	-35.7	0.000011	328	0.0402	1215.512	
	423	8398	46.95	-35.7	0.000005	231	0.0183	858.040	
	424	8794	49.16	-35.7	0.000004	184	0.0139	681.573	
	426	5450	30.47	-35.7	0.000000	0	0.0000	0.000	
	427	5491	30.69	-35.7	0.000000	0	0.0000	0.000	
	428	5983	33.44	-35.7	0.000000	0	0.0000	0.000	
Haddock_Bank	493	12517	45.81	-35.7	0.000001	35	0.0029	130.559	
New_Waterford	510	7408	11.67	-35.7	0.000000	0	0.0000	0.000	
Donkin	511	8113	11.69	-35.7	0.000000	1	0.0003	3.668	
	512	10352	14.92	-35.7	0.000001	21	0.0053	79.084	
	513	9669	13.93	-35.7	0.000004	59	0.0156	217.629	
	514	8880	12.80	-35.7	0.000002	28	0.0080	102.720	
	515	8722	12.57	-35.7	0.000003	32	0.0095	119.118	
	516	7911	11.40	-35.7	0.000002	18	0.0060	67.980	
	517	7733	11.15	-35.7	0.000002	19	0.0063	70.218	
	518	7767	11.19	-35.7	0.000002	24	0.0081	90.588	
	519	8216	11.84	-35.7	0.000001	15	0.0048	57.213	
White_Capes	417	8495	51.16	-35.7	0.000001	66	0.0048	244.461	
	419	7243	43.62	-35.7	0.000007	311	0.0264	1152.627	
	420	6284	37.85	-35.7	0.000000	3	0.0003	9.703	
	421	6392	38.49	-35.7	0.000000	0	0.0000	0.000	
Lawrence_Offshore	450	5227	30.27	-35.7	0.000000	0	0.0000	0.000	
Aspy_Offshore	451	7952	81.05	-35.7	0.000000	0	0.0000	0.000	
	452	10352	105.51	-35.7	0.000000	0	0.0000	0.000	

TABLE 2d. 1992 CAPE BRETON (DAYTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Milne_Offshore	410	8801	51.37	-35.7	0.000000	0	0.0000	0.000	
	411	8896	51.93	-35.7	0.000000	0	0.0000	0.000	
	412	9217	53.80	-35.7	0.000000	0	0.0000	0.000	
Wreck_Cove	462	5207	9.53	-35.7	0.000010	99	0.0383	365.386	
	463	6722	12.30	-35.7	0.000003	34	0.0102	125.317	
Neil_Harbour	474	4878	7.28	-35.7	0.000018	133	0.0678	494.011	
	475	5225	7.80	-35.7	0.000000	0	0.0000	0.000	
	476	932	1.39	-35.7	0.000000	0	0.0000	0.000	
	477	5493	8.20	-35.7	0.000000	0	0.0000	0.000	
	478	5673	8.47	-35.7	0.000028	236	0.1031	873.697	
	479	9911	14.80	-35.7	0.000020	300	0.0751	1112.178	
	480	10074	15.04	-35.7	0.000035	532	0.1310	1971.171	
	481	10042	15.00	-35.7	0.000006	87	0.0216	323.614	
	482	10506	15.69	-35.7	0.000011	169	0.0399	625.636	22
Bay_St_Lawrence	436	6734	26.95	-35.7	0.000003	73	0.0101	272.284	
	437	8239	32.98	-35.7	0.000001	45	0.0050	165.453	
	438	3964	15.86	-35.7	0.000000	7	0.0015	24.371	
	439	5893	23.59	-35.7	0.000000	11	0.0018	42.400	
	440	6069	24.29	-35.7	0.000000	0	0.0000	0.000	
Haddock_Bank	494	11071	40.52	-35.7	0.000001	21	0.0019	77.395	
	495	9642	35.29	-35.7	0.000001	22	0.0023	80.796	
	496	4221	15.45	-35.7	0.000000	0	0.0000	0.000	
Sydney	497	6614	24.82	-35.7	0.000004	106	0.0159	393.364	
	498	6685	25.08	-35.7	0.000001	37	0.0055	137.053	
	499	6910	25.93	-35.7	0.000001	36	0.0052	135.018	
	500	14300	53.66	-35.7	0.000000	2	0.0001	7.464	
New_Waterford	501	8755	13.79	-35.7	0.000001	9	0.0024	33.380	
	502	8535	13.44	-35.7	0.000001	13	0.0036	47.955	
	503	8628	13.59	-35.7	0.000001	8	0.0022	29.870	
	504	8116	12.78	-35.7	0.000000	5	0.0015	19.258	
	505	7867	12.39	-35.7	0.000000	2	0.0005	6.040	
	506	7946	12.52	-35.7	0.000000	1	0.0002	3.043	
	507	8006	12.61	-35.7	0.000001	14	0.0040	51.005	
	508	9313	14.67	-35.7	0.000000	6	0.0015	21.487	
	509	9119	14.36	-35.7	0.000002	28	0.0071	102.476	
White_Capes_Offshore	413	10217	61.05	-35.7	0.000000	0	0.0000	0.000	
	414	10174	60.80	-35.7	0.000000	0	0.0000	0.000	
	415	10403	62.17	-35.7	0.000000	0	0.0000	0.000	
	416	10459	62.50	-35.7	0.000000	0	0.0000	0.000	
Pleasant_Bay_Offshore	429	7722	82.27	-35.7	0.000000	6	0.0003	23.354	
	430	10621	113.17	-35.7	0.000000	0	0.0000	0.000	
	431	10820	115.28	-35.7	0.000000	0	0.0000	0.000	
	432	10937	116.53	-35.7	0.000000	0	0.0000	0.000	
Lawrence_Offshore	433	10692	61.91	-35.7	0.000000	0	0.0000	0.000	
	434	10046	58.17	-35.7	0.000000	0	0.0000	0.000	
	435	10229	59.23	-35.7	0.000000	14	0.0009	53.223	
Aspy_Offshore	453	9920	101.10	-35.7	0.000000	0	0.0000	0.000	
	455	9917	101.07	-35.7	0.000000	0	0.0000	0.000	
Neil_Hrb_Offshore	456	8996	37.23	-35.7	0.000000	0	0.0000	0.000	
	457	8756	36.23	-35.7	0.000000	0	0.0000	0.000	
	458	8730	36.13	-35.7	0.000000	0	0.0000	0.011	
	459	8795	36.40	-35.7	0.000000	0	0.0000	0.000	
	460	8817	36.49	-35.7	0.000000	0	0.0000	0.000	
	461	8624	35.69	-35.7	0.000000	0	0.0000	0.000	

TABLE 3a. 1991 CHALEUR (NIGHTTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
East_Miscou	10	26819	372.72	-35.1	0.000001	375	0.0033	1222.551	1
	11	26510	368.43	-35.1	0.000012	4385	0.0388	14309.600	
Cap_Bon_Ami	12	10206	33.09	-35.1	0.000001	18	0.0018	59.678	2
	13	9887	32.06	-35.1	0.000000	0	0.0000	0.000	
	14	6912	22.41	-35.1	0.000000	0	0.0000	0.000	3
Gaspe_Bay	31	4642	7.74	-35.1	0.000000	0	0.0000	0.000	4
	32	5964	9.95	-35.1	0.000001	7	0.0023	22.538	
	33	1599	2.67	-35.1	0.000000	1	0.0010	2.541	
	35	4335	7.23	-35.1	0.000000	2	0.0011	7.889	
	36	4344	7.24	-35.1	0.000000	0	0.0000	0.000	
Anse_A_Beaufile	47	5696	19.35	-35.1	0.000000	0	0.0000	0.000	
Grande_Riviere	48	4826	4.97	-35.1	0.000000	0	0.0000	0.000	
	49	5599	5.76	-35.1	0.000000	0	0.0000	0.000	
	50	6579	6.77	-35.1	0.000000	0	0.0000	0.000	
	51	6697	6.89	-35.1	0.000000	0	0.0000	0.000	
	52	6697	6.89	-35.1	0.000000	0	0.0000	0.000	
	53	6401	6.59	-35.1	0.000000	0	0.0000	0.000	
	54	6957	7.16	-35.1	0.000000	0	0.0000	0.000	
	55	7905	8.14	-35.1	0.000000	0	0.0000	0.000	
	56	7477	7.70	-35.1	0.000000	0	0.0000	0.000	
	57	4361	4.49	-35.1	0.000000	0	0.0000	0.000	
	58	6419	6.61	-35.1	0.000000	0	0.0000	0.000	
	59	6474	6.67	-35.1	0.000000	0	0.0000	0.000	
	60	5735	5.90	-35.1	0.000000	0	0.0000	0.000	
	61	6066	6.25	-35.1	0.000000	0	0.0000	0.000	
	62	5937	6.11	-35.1	0.000000	0	0.0000	0.000	
	63	6754	6.95	-35.1	0.000000	0	0.0000	0.000	
	64	5882	6.06	-35.1	0.000000	0	0.0000	0.000	
65	5363	5.52	-35.1	0.000000	0	0.0000	0.000		
Newport	66	3813	4.24	-35.1	0.000000	0	0.0000	0.000	
	68	7104	7.90	-35.1	0.000000	3	0.0014	10.994	
	69	7645	8.50	-35.1	0.000000	3	0.0010	8.913	
	70	5691	6.33	-35.1	0.000000	0	0.0000	0.000	
North_Miscou	90	7601	21.13	-35.1	0.000000	0	0.0000	0.000	
	91	9297	25.84	-35.1	0.000000	0	0.0000	0.000	
	92	10553	29.33	-35.1	0.000000	0	0.0000	0.000	
	93	9722	27.02	-35.1	0.000000	0	0.0000	0.000	
	94	13133	36.50	-35.1	0.000000	0	0.0000	0.000	
	95	10453	29.05	-35.1	0.000000	0	0.0000	0.000	
	96	10680	29.69	-35.1	0.000000	0	0.0000	0.000	
	97	10609	29.49	-35.1	0.000000	0	0.0000	0.000	
	98	9388	26.09	-35.1	0.000000	0	0.0000	0.000	
	99	12484	34.70	-35.1	0.000001	40	0.0038	131.550	
	100	6178	17.17	-35.1	0.000000	0	0.0000	0.000	
West_Miscou	101	8390	9.53	-35.1	0.000000	0	0.0000	0.000	
	102	8887	10.09	-35.1	0.000000	0	0.0000	0.000	
	103	9718	11.04	-35.1	0.000000	0	0.0000	0.000	
	104	10294	11.69	-35.1	0.000000	0	0.0000	0.000	
	119	9207	10.46	-35.1	0.000000	0	0.0000	0.000	
	120	10012	11.37	-35.1	0.000000	0	0.0000	0.000	
	121	10375	11.78	-35.1	0.000001	9	0.0024	28.341	
	122	10465	11.88	-35.1	0.000000	5	0.0014	17.086	
	123	9192	10.44	-35.1	0.000002	26	0.0081	84.577	
	124	8756	9.94	-35.1	0.000003	27	0.0089	88.428	
	125	9076	10.31	-35.1	0.000002	18	0.0059	60.339	
	126	8986	10.21	-35.1	0.000002	16	0.0051	52.393	
	127	8529	9.69	-35.1	0.000001	10	0.0032	31.446	
	128	8792	9.99	-35.1	0.000001	6	0.0019	19.421	
129	9663	10.97	-35.1	0.000001	8	0.0024	26.641		
130	10184	11.57	-35.1	0.000001	13	0.0037	42.242		
Shigawake	150	7292	9.14	-35.1	0.000001	5	0.0017	15.596	
	151	7396	9.27	-35.1	0.000000	1	0.0002	1.830	
	152	8862	11.11	-35.1	0.000004	46	0.0136	150.602	
	153	6554	8.22	-35.1	0.000005	43	0.0171	140.203	
	154	6609	8.28	-35.1	0.000008	70	0.0277	229.824	
	155	6040	7.57	-35.1	0.000013	95	0.0411	311.025	
	156	6083	7.62	-35.1	0.000014	106	0.0456	347.548	
	157	6365	7.98	-35.1	0.000007	56	0.0228	182.266	
	158	5635	7.06	-35.1	0.000010	74	0.0342	241.827	
	159	5884	7.38	-35.1	0.000010	71	0.0315	232.151	
	160	5715	7.16	-35.1	0.000165	1182	0.5386	3858.729	

TABLE 3a. 1991 CHALEUR (NIGHTTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Shigawake (con't.)	161	5629	7.06	-35.1	0.000005	33	0.0152	107.502	10
	162	5401	6.77	-35.1	0.000017	114	0.0548	370.678	
	163	5842	7.32	-35.1	0.000009	67	0.0301	220.080	
	164	5935	7.44	-35.1	0.000014	108	0.0472	350.986	
	165	6009	7.53	-35.1	0.000011	81	0.0353	265.887	
	166	5071	6.36	-35.1	0.000009	56	0.0289	183.991	
	167	5808	7.28	-35.1	0.000013	95	0.0426	310.124	
	168	5178	6.49	-35.1	0.000006	36	0.0181	117.795	
	169	5294	6.64	-35.1	0.000015	100	0.0493	327.062	
	170	5331	6.68	-35.1	0.000006	42	0.0206	137.765	
173	4894	6.14	-35.1	0.000003	18	0.0097	59.220		
Carlilse_Offshore	193	16179	112.42	-35.1	0.000000	0	0.0000	0.000	11
Maisonnette	194	6293	21.66	-35.1	0.000002	33	0.0050	107.208	12
	195	4951	17.04	-35.1	0.000003	45	0.0087	147.862	
	196	4053	13.95	-35.1	0.000012	165	0.0385	537.396	
	197	3404	11.71	-35.1	0.000006	74	0.0206	241.777	
	198	3586	12.34	-35.1	0.000010	120	0.0317	391.176	
	199	3795	13.06	-35.1	0.000012	152	0.0381	496.963	
	200	3791	13.05	-35.1	0.000013	165	0.0412	537.791	
New_Carlilse	201	5791	17.17	-35.1	0.000001	23	0.0044	74.991	15
	203	5141	15.24	-35.1	0.000000	2	0.0005	7.240	
	204	6748	20.01	-35.1	0.000001	28	0.0046	91.861	
	205	4018	11.91	-35.1	0.000000	5	0.0015	17.509	
	206	4127	12.23	-35.1	0.000004	44	0.0118	143.757	
	207	6146	18.22	-35.1	0.000000	6	0.0011	19.994	
	208	5235	15.52	-35.1	0.000001	20	0.0041	64.361	
	209	5784	17.15	-35.1	0.000000	0	0.0000	0.000	
	210	5807	17.22	-35.1	0.000000	0	0.0000	0.000	
	New_Richmond	211	3937	15.32	-35.1	0.000000	0	0.0000	
212		3114	12.12	-35.1	0.000000	0	0.0000	0.000	
213		4574	17.80	-35.1	0.000000	0	0.0000	0.000	
214		5269	20.50	-35.1	0.000000	0	0.0000	0.000	
215		5417	21.08	-35.1	0.000000	0	0.0000	0.000	
216		5180	20.16	-35.1	0.000000	0	0.0000	0.000	
217		3625	14.11	-35.1	0.000000	0	0.0000	0.000	
219		3275	12.75	-35.1	0.000000	0	0.0000	0.000	
Richmond_Offshore	225	12046	111.60	-35.1	0.000000	0	0.0000	0.000	
	226	11554	107.04	-35.1	0.000000	4	0.0001	11.828	

TABLE 3b. 1991 CHALEUR (DAYTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
East_Miscou	3	26231	364.55	-35.1	0.000002	676	0.0060	2205.176	
	5	25835	359.04	-35.1	0.000004	1339	0.0122	4368.412	
	8	26460	367.73	-35.1	0.000001	325	0.0029	1061.868	
	9	25616	355.99	-35.1	0.000001	250	0.0023	815.849	
Cap_Bon_Ami	15	4756	15.42	-35.1	0.000000	0	0.0000	0.000	
American_Bank	16	9155	63.62	-35.1	0.000000	0	0.0000	0.000	
	17	7820	54.34	-35.1	0.000000	0	0.0000	0.000	
	18	6528	45.36	-35.1	0.000000	1	0.0001	4.737	
	19	2677	18.60	-35.1	0.000000	0	0.0000	0.000	
Gaspe_Offshore	21	9208	29.86	-35.1	0.000000	0	0.0000	0.000	
	22	9460	30.68	-35.1	0.000000	0	0.0000	0.000	
	23	9585	31.08	-35.1	0.000000	0	0.0000	0.280	
	25	10484	34.00	-35.1	0.000000	0	0.0000	0.000	
Gaspe_Bay	26	7210	12.02	-35.1	0.000000	0	0.0000	0.000	
	27	8990	14.99	-35.1	0.000000	0	0.0001	0.930	
	28	6776	11.30	-35.1	0.000000	1	0.0004	4.445	
	29	6376	10.63	-35.1	0.000000	0	0.0000	0.000	
	30	5750	9.59	-35.1	0.000001	7	0.0023	22.514	
Malbaie	37	15577	50.51	-35.1	0.000000	0	0.0000	0.000	5
	38	1184	3.84	-35.1	0.000000	0	0.0000	0.005	
	40	14267	46.26	-35.1	0.000000	0	0.0000	0.000	
	41	13417	43.51	-35.1	0.000000	14	0.0011	46.152	
Anse_A_Beaufils	42	6221	21.14	-35.1	0.000000	0	0.0000	0.000	
	43	6749	22.93	-35.1	0.000000	0	0.0000	0.000	
	44	7364	25.02	-35.1	0.000000	0	0.0000	0.000	
	45	8763	29.77	-35.1	0.000000	9	0.0010	28.614	
	46	5932	20.15	-35.1	0.000000	0	0.0000	0.000	
Newport	71	5934	6.60	-35.1	0.000000	0	0.0000	0.000	
	72	6256	6.96	-35.1	0.000000	0	0.0000	0.000	
	74	7650	8.50	-35.1	0.000000	0	0.0000	0.000	
	75	8052	8.95	-35.1	0.000002	16	0.0059	52.774	
	76	7432	8.26	-35.1	0.000002	15	0.0058	47.910	
	77	7381	8.21	-35.1	0.000005	39	0.0155	127.231	
	78	7564	8.41	-35.1	0.000006	47	0.0184	154.451	
	79	7967	8.86	-35.1	0.000007	64	0.0235	207.905	
	80	8597	9.56	-35.1	0.000008	79	0.0271	258.712	
	81	5678	6.31	-35.1	0.000002	13	0.0065	41.063	
	82	6777	7.53	-35.1	0.000003	19	0.0083	62.759	
	84	6202	6.90	-35.1	0.000000	0	0.0000	0.000	
	85	3847	4.28	-35.1	0.000000	0	0.0000	0.000	
	86	4547	5.06	-35.1	0.000000	0	0.0000	0.000	
	87	3919	4.36	-35.1	0.000000	0	0.0000	0.000	
88	3213	3.57	-35.1	0.000000	0	0.0000	0.000		
North_Miscou	89	7714	21.44	-35.1	0.000000	0	0.0000	0.000	
Newport_Offshore	105	14514	107.58	-35.1	0.000000	0	0.0000	0.000	
	106	11614	86.08	-35.1	0.000000	1	0.0000	3.753	
	107	10396	77.06	-35.1	0.000000	4	0.0002	13.770	
	108	7634	56.58	-35.1	0.000000	0	0.0000	0.000	
East_Cent_Chaleur	109	9366	23.14	-35.1	0.000000	0	0.0000	0.000	
	110	9347	23.09	-35.1	0.000000	0	0.0000	0.000	
	111	7712	19.05	-35.1	0.000000	0	0.0000	0.000	
	112	10069	24.88	-35.1	0.000000	0	0.0000	0.000	
	113	10689	26.41	-35.1	0.000000	0	0.0000	0.000	
	114	10312	25.48	-35.1	0.000000	0	0.0000	0.000	
	115	11684	28.87	-35.1	0.000000	0	0.0000	0.000	
	117	12338	30.48	-35.1	0.000000	0	0.0000	0.000	
	118	10554	26.08	-35.1	0.000000	0	0.0000	0.000	
	West_Miscou	131	11252	12.78	-35.1	0.000001	7	0.0018	22.489
132		10354	11.76	-35.1	0.000000	5	0.0013	15.502	
133		15765	17.91	-35.1	0.000000	2	0.0004	7.064	
134		11284	12.82	-35.1	0.000000	0	0.0000	0.000	
135		11746	13.34	-35.1	0.000000	0	0.0000	0.000	
136		188709	214.32	-35.1	0.000000	4	0.0001	14.201	
137		12930	14.68	-35.1	0.000000	0	0.0000	0.000	
138		6253	7.10	-35.1	0.000000	0	0.0000	0.000	
139		7422	8.43	-35.1	0.000002	14	0.0055	46.051	
140		6958	7.90	-35.1	0.000002	12	0.0051	39.995	
141		6937	7.88	-35.1	0.000006	48	0.0197	155.566	

TABLE 3b. 1991 CHALEUR (DAYTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
West_Miscou (con't.)	142	6922	7.86	-35.1	0.000002	12	0.0050	39.580	
	143	6723	7.64	-35.1	0.000001	9	0.0040	30.883	
	144	6461	7.34	-35.1	0.000000	2	0.0009	6.816	
	145	6797	7.72	-35.1	0.000000	3	0.0014	10.485	
Shigawake	146	5223	6.55	-35.1	0.000000	0	0.0000	0.000	
	147	5506	6.90	-35.1	0.000000	0	0.0000	0.000	
	148	7325	9.18	-35.1	0.000000	2	0.0007	6.174	
	149	6134	7.69	-35.1	0.000000	0	0.0000	0.000	
	174	5316	6.66	-35.1	0.000001	5	0.0022	14.818	
	175	5797	7.27	-35.1	0.000000	0	0.0000	0.000	
	176	8092	10.14	-35.1	0.000000	0	0.0000	0.000	
	177	4940	6.19	-35.1	0.000001	5	0.0026	16.318	
	178	4825	6.05	-35.1	0.000000	0	0.0000	0.000	
	179	4526	5.67	-35.1	0.000001	3	0.0017	9.721	
	180	4681	5.87	-35.1	0.000000	0	0.0000	0.000	
181	4999	6.27	-35.1	0.000002	10	0.0051	31.834		
Central_Chaleur	182	9462	27.55	-35.1	0.000000	0	0.0000	0.000	
	183	7587	22.09	-35.1	0.000000	0	0.0000	0.323	
	184	9133	26.60	-35.1	0.000000	0	0.0000	0.000	
	185	8952	26.07	-35.1	0.000000	1	0.0001	2.283	
	186	9114	26.54	-35.1	0.000000	0	0.0000	0.558	
	187	9934	28.93	-35.1	0.000000	0	0.0000	0.000	
	188	10995	32.02	-35.1	0.000000	0	0.0000	0.000	
Carlilse_Offshore	189	14085	97.87	-35.1	0.000000	0	0.0000	0.000	
	190	15095	104.89	-35.1	0.000000	0	0.0000	0.000	
	191	16112	111.96	-35.1	0.000000	21	0.0006	67.384	
New_Carlilse	202	5348	15.86	-35.1	0.000005	73	0.0150	237.528	
New_Richmond	220	4366	16.99	-35.1	0.000000	4	0.0007	11.831	
	221	2423	9.43	-35.1	0.000000	3	0.0012	11.234	
Richmond_Offshore	222	4189	38.81	-35.1	0.000000	0	0.0000	0.000	
	224	9481	87.85	-35.1	0.000000	0	0.0000	0.048	

TABLE 3c. 1991 CAPE BRETON (NIGHTTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
St_Ann_Bay	227	5004	25.50	-35.8	0.000000	0	0.0000	1.156	
	228	5469	27.87	-35.8	0.000000	0	0.0000	0.099	
	229	5800	29.56	-35.8	0.000000	0	0.0000	0.088	
	230	7519	38.32	-35.8	0.000000	8	0.0008	31.721	
Wreck_Cove	231	7214	17.82	-35.8	0.000000	0	0.0000	0.074	
	232	6886	17.01	-35.8	0.000000	2	0.0004	7.519	
	233	6173	15.25	-35.8	0.000000	1	0.0001	2.261	
	234	6858	16.94	-35.8	0.000001	9	0.0019	32.413	
Aspy_Bay	249	2634	14.64	-35.8	0.000000	0	0.0000	0.000	
	250	8298	46.13	-35.8	0.000003	161	0.0133	612.698	16
	251	9479	52.69	-35.8	0.000007	378	0.0273	1437.182	
	252	9183	51.05	-35.8	0.000006	300	0.0224	1142.168	17
Bay_St_Lawrence	253	6128	41.64	-35.8	0.000000	0	0.0000	0.000	
	254	8472	57.56	-35.8	0.000000	8	0.0005	29.053	
	255	8069	54.82	-35.8	0.000000	0	0.0000	0.000	18
Pleasant_Bay	256	5856	48.83	-35.8	0.000000	0	0.0000	0.000	19
	257	5490	45.78	-35.8	0.000000	0	0.0000	0.000	
	258	9755	81.34	-35.8	0.000000	0	0.0000	0.000	
Sydney	265	9288	45.89	-35.8	0.000000	1	0.0001	4.097	
	266	9370	46.30	-35.8	0.000003	146	0.0120	557.452	20
New_Waterford	267	8599	23.90	-35.8	0.000000	0	0.0000	0.000	
	268	8317	23.12	-35.8	0.000000	0	0.0000	0.000	
	269	7944	22.08	-35.8	0.000000	0	0.0000	0.003	
	270	7831	21.77	-35.8	0.000001	19	0.0032	70.737	
	271	6770	18.82	-35.8	0.000000	0	0.0000	0.000	
	272	7971	22.16	-35.8	0.000001	12	0.0020	44.810	
Donkin	273	6895	22.36	-35.8	0.000000	2	0.0003	6.592	
	274	10768	34.92	-35.8	0.000000	10	0.0011	38.670	21
	275	7590	24.61	-35.8	0.000000	0	0.0000	0.000	
	276	7075	22.94	-35.8	0.000000	0	0.0000	0.000	

TABLE 3d. 1991 CAPE BRETON (DAYTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Wreck_Cove	235	5901	14.58	-35.8	0.000000	3	0.0009	13.137	
	236	6011	14.85	-35.8	0.000000	0	0.0000	0.000	
Neil_Harbour	237	5644	12.20	-35.8	0.000000	0	0.0000	0.000	
	238	11643	25.17	-35.8	0.000000	0	0.0001	1.669	
	239	14190	30.68	-35.8	0.000000	2	0.0002	6.386	
	240	11236	24.29	-35.8	0.000000	0	0.0000	0.732	
	241	9538	20.62	-35.8	0.000000	0	0.0000	0.000	
	242	10627	22.97	-35.8	0.000000	0	0.0000	0.000	
	243	9147	19.78	-35.8	0.000001	12	0.0024	46.811	
	244	9373	20.26	-35.8	0.000000	0	0.0000	0.000	
	245	8743	18.90	-35.8	0.000000	0	0.0000	0.000	
	246	5510	11.91	-35.8	0.000000	0	0.0000	0.000	
	247	5146	11.13	-35.8	0.000000	0	0.0000	0.000	
248	4912	10.62	-35.8	0.000000	0	0.0000	0.000		
Pleasant_Bay	259	8483	70.74	-35.8	0.000000	0	0.0000	0.000	
Haddock_Bank	260	10627	52.51	-35.8	0.000000	0	0.0000	0.000	
	261	8619	42.59	-35.8	0.000000	1	0.0001	5.652	
	262	7411	36.62	-35.8	0.000000	1	0.0001	2.620	
Sydney	264	6987	34.53	-35.8	0.000001	2	0.0009	2.462	

TABLE 4a. 1990 CHALEUR (NIGHTTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
East_Miscou	3	22285	265.47	-35.2	0.000000	0	0.0000	0.000	
	4	25217	300.39	-35.2	0.000000	0	0.0000	0.000	
	5	24339	289.93	-35.2	0.000000	0	0.0000	0.000	
Grande_Riviere	14	4623	9.71	-35.2	0.000057	549	0.1865	1810.237	
	15	7100	14.91	-35.2	0.000017	251	0.0554	826.781	
	16	6067	12.74	-35.2	0.000000	0	0.0000	0.000	
	17	4674	9.82	-35.2	0.000026	253	0.0850	833.964	
	18	4825	10.13	-35.2	0.000000	0	0.0000	0.000	
	19	5270	11.07	-35.2	0.000000	0	0.0000	0.000	
	20	5380	11.30	-35.2	0.000000	0	0.0000	0.000	
	21	4061	8.53	-35.2	0.000000	0	0.0000	0.000	
Newport	22	5425	23.12	-35.2	0.000000	0	0.0000	0.000	
	24	7808	33.28	-35.2	0.000000	0	0.0000	0.000	
	25	6687	28.50	-35.2	0.000000	0	0.0000	0.000	
	26	6649	28.34	-35.2	0.000000	0	0.0000	0.000	
	27	7448	31.74	-35.2	0.000000	0	0.0000	0.000	
Newport_Offshore	41	7692	25.97	-35.2	0.000000	0	0.0000	0.000	
Anse_A_Beaufils	42	5622	19.79	-35.2	0.000000	0	0.0000	0.000	
	43	10364	36.49	-35.2	0.000000	0	0.0000	0.000	
	44	10364	36.49	-35.2	0.000000	0	0.0000	0.000	
	45	5495	19.34	-35.2	0.000000	0	0.0000	0.000	
	46	6509	22.92	-35.2	0.000000	0	0.0000	0.000	
	47	5813	20.47	-35.2	0.000000	0	0.0000	0.000	
	La_Malbaie	48	9910	34.89	-35.2	0.000000	0	0.0000	0.000
49		9702	34.16	-35.2	0.000000	0	0.0000	0.000	
50		14063	49.51	-35.2	0.000000	0	0.0000	0.000	
51		14496	51.04	-35.2	0.000000	0	0.0000	0.000	
American_Bank	52	4964	19.45	-35.2	0.000000	0	0.0000	0.000	
	53	9086	35.60	-35.2	0.000005	189	0.0175	622.711	
Cap_Bon_Ami	70	6970	22.60	-35.2	0.000000	0	0.0000	0.000	
Gaspe_Offshore	71	8348	22.89	-35.2	0.000000	0	0.0000	0.000	
	77	9862	27.05	-35.2	0.000000	0	0.0000	0.000	
	78	9241	25.34	-35.2	0.000000	0	0.0000	0.000	
	79	9122	25.02	-35.2	0.000000	0	0.0000	0.000	
	80	10688	29.31	-35.2	0.000000	0	0.0000	0.000	
Gaspe_Bay	72	6570	21.43	-35.2	0.000000	0	0.0000	0.000	
	73	6232	20.33	-35.2	0.000000	0	0.0000	0.000	
	74	6878	22.43	-35.2	0.000000	0	0.0000	0.000	
	75	6308	20.57	-35.2	0.000000	0	0.0000	0.000	
	76	5836	19.03	-35.2	0.000000	0	0.0000	0.000	
West_Miscou	95	10219	17.61	-35.2	0.000000	0	0.0000	0.000	
	96	13825	23.82	-35.2	0.000000	0	0.0000	0.000	
	97	10532	18.15	-35.2	0.000000	0	0.0000	0.000	
	98	7992	13.77	-35.2	0.000000	0	0.0000	0.000	
	99	11476	19.78	-35.2	0.000000	0	0.0000	0.000	
	100	12516	21.57	-35.2	0.000000	0	0.0000	0.000	
	101	12339	21.26	-35.2	0.000000	0	0.0000	0.000	
	102	12175	20.98	-35.2	0.000000	0	0.0000	0.000	
	103	7521	12.96	-35.2	0.000000	0	0.0000	0.000	
	104	8620	14.85	-35.2	0.000000	0	0.0000	0.000	
	105	7630	13.15	-35.2	0.000000	0	0.0000	0.000	
	106	6704	11.55	-35.2	0.000000	0	0.0000	0.000	
	107	6965	12.00	-35.2	0.000000	0	0.0000	0.000	
	108	7335	12.64	-35.2	0.000000	0	0.0000	0.000	
109	7163	12.34	-35.2	0.000000	0	0.0000	0.000		
110	7173	12.36	-35.2	0.000000	0	0.0000	0.000		
Maisonnette	111	4795	8.89	-35.2	0.000000	0	0.0000	0.000	
	112	7350	13.62	-35.2	0.000000	0	0.0000	0.000	
	113	6026	11.17	-35.2	0.000000	0	0.0000	0.000	
	114	5865	10.87	-35.2	0.000000	0	0.0000	0.000	
	115	5609	10.39	-35.2	0.000000	0	0.0000	0.000	

TABLE 4a. 1990 CHALEUR (NIGHTTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
Shigawake	135	5556	9.47	-35.2	0.000000	0	0.0000	0.000	2
	136	6729	11.47	-35.2	0.000000	0	0.0000	0.000	
	137	6051	10.32	-35.2	0.000016	168	0.0537	553.490	
	138	7127	12.15	-35.2	0.000050	603	0.1635	1986.359	
	139	7968	13.58	-35.2	0.000000	0	0.0000	0.000	
	140	6428	10.96	-35.2	0.000000	0	0.0000	0.000	
	141	6948	11.85	-35.2	0.000000	0	0.0000	0.000	
	142	6819	11.62	-35.2	0.000000	0	0.0000	0.000	
	143	8117	13.84	-35.2	0.000004	51	0.0121	167.778	
	144	7473	12.74	-35.2	0.000000	0	0.0000	0.000	
	145	6900	11.76	-35.2	0.000000	0	0.0000	0.000	
	146	6584	11.22	-35.2	0.000070	785	0.2306	2588.270	
	147	6593	11.24	-35.2	0.000000	0	0.0000	0.000	
	148	5313	9.06	-35.2	0.000000	0	0.0000	0.000	
	149	5092	8.68	-35.2	0.000000	0	0.0000	0.000	
	150	7107	12.11	-35.2	0.000000	0	0.0000	0.000	
	151	5648	9.63	-35.2	0.000000	0	0.0000	0.000	
152	3848	6.56	-35.2	0.000000	0	0.0000	0.000		
153	7572	12.91	-35.2	0.000000	0	0.0000	0.000		
154	3942	6.72	-35.2	0.000000	0	0.0000	0.000		
155	4812	8.20	-35.2	0.000000	0	0.0000	0.000		
156	4513	7.69	-35.2	0.000000	0	0.0000	0.000		
New_Carlilse	175	4525	15.00	-34.1	0.000000	0	0.0000	0.000	
	176	4239	14.05	-34.1	0.000000	0	0.0000	0.000	
	177	3797	12.59	-34.1	0.000000	0	0.0000	0.000	
	178	5449	18.06	-34.1	0.000002	41	0.0059	107.271	
New_Richmond	179	6224	24.45	-34.1	0.000000	0	0.0000	0.000	
	180	5142	20.20	-34.1	0.000000	0	0.0000	0.000	
	182	5674	22.29	-34.1	0.001138	25365	2.9423	65579.810	
	183	4399	17.28	-34.1	0.001175	20311	3.0388	52512.019	
	184	4627	18.18	-34.1	0.000201	3654	0.5198	9448.215	
185	5350	21.02	-34.1	0.000086	1818	0.2236	4700.138		
Carlilse_Offshore	196	14869	84.86	-34.1	0.000126	10711	0.3263	27692.497	10
	197	12379	70.65	-34.1	0.000654	46232	1.6918	119528.100	
	198	17088	97.53	-34.1	0.000825	80426	2.1321	207934.364	
	200	14609	83.38	-34.1	0.001417	118159	3.6639	305489.590	
North_Miscou	207	14805	54.87	-35.2	0.000015	847	0.0509	2792.608	
	208	12461	46.18	-35.2	0.000000	0	0.0000	0.000	
	209	9515	35.26	-35.2	0.000000	0	0.0000	0.000	
	211	6661	24.69	-35.2	0.000000	0	0.0000	0.000	

TABLE 4b. 1990 CHALEUR (DAYTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
East_Miscou	6	25063	298.55	-35.2	0.000000	0	0.0000	0.000	
	7	22569	268.84	-35.2	0.000000	0	0.0000	0.000	
	8	24469	291.48	-35.2	0.000000	0	0.0000	0.000	
	9	19312	230.05	-35.2	0.000041	9524	0.1364	31386.164	1
Grande_Riviere	11	3879	8.15	-35.2	0.000323	2629	1.0636	8662.922	
Newport_Offshore	28	11493	38.81	-35.2	0.000000	0	0.0000	0.000	
	29	14243	48.09	-35.2	0.000000	0	0.0000	0.000	
	30	11373	38.40	-35.2	0.000000	0	0.0000	0.000	
	31	11010	37.18	-35.2	0.000000	0	0.0000	0.000	
	32	10374	35.03	-35.2	0.000000	0	0.0000	0.000	
	33	8100	27.35	-35.2	0.000000	0	0.0000	0.000	
	34	10174	34.35	-35.2	0.000000	0	0.0000	0.000	
	40	8000	27.01	-35.2	0.000000	0	0.0000	0.000	
	East_Cent_Chaleur	35	9333	16.50	-35.2	0.000000	0	0.0000	0.000
36		9476	16.75	-35.2	0.000000	0	0.0000	0.000	
37		9666	17.08	-35.2	0.000000	0	0.0000	0.000	
38		9792	17.31	-35.2	0.000000	0	0.0000	0.000	
39		9993	17.66	-35.2	0.000000	0	0.0000	0.000	
124		11580	20.47	-35.2	0.000000	0	0.0000	0.000	
125		11432	20.21	-35.2	0.000000	0	0.0000	0.000	
126		11667	20.62	-35.2	0.000000	0	0.0000	0.000	
127		10775	19.04	-35.2	0.000000	0	0.0000	0.000	
128		10828	19.14	-35.2	0.000000	0	0.0000	0.000	
129		9423	16.65	-35.2	0.000000	0	0.0000	0.000	
130		8846	15.63	-35.2	0.000000	0	0.0000	0.000	
131		8064	14.25	-35.2	0.000000	0	0.0000	0.000	
American_Bank	54	7593	29.75	-35.2	0.000000	0	0.0000	0.000	
	55	9837	38.54	-35.2	0.000003	108	0.0093	356.599	
	57	9051	35.46	-35.2	0.000000	0	0.0000	0.000	
	58	8274	32.42	-35.2	0.000000	0	0.0000	0.000	
	59	4441	17.40	-35.2	0.000000	0	0.0000	0.000	
Cap_Bon_Ami_Offshore	60	9568	37.53	-35.2	0.000000	0	0.0000	0.000	
	61	9550	37.46	-35.2	0.000000	0	0.0000	0.000	
	62	9640	37.81	-35.2	0.000000	0	0.0000	0.000	
	63	9591	37.62	-35.2	0.000000	0	0.0000	0.000	
	65	11135	43.67	-35.2	0.000000	0	0.0000	0.000	
	66	11986	47.01	-35.2	0.000000	0	0.0000	0.000	
	Cap_Bon_Ami	67	6923	22.45	-35.2	0.000000	0	0.0000	0.000
68		7657	24.83	-35.2	0.000000	0	0.0000	0.000	
69		9114	29.56	-35.2	0.000436	12887	1.4369	42467.965	
West_Miscou	91	9288	16.01	-35.2	0.000000	0	0.0000	0.000	
	92	10143	17.48	-35.2	0.000000	0	0.0000	0.000	
	93	11034	19.02	-35.2	0.000000	0	0.0000	0.000	
	94	9552	16.46	-35.2	0.000000	0	0.0000	0.000	
Maisonnette	116	5266	9.76	-35.2	0.000000	0	0.0000	0.000	
	117	4565	8.46	-35.2	0.000000	0	0.0000	0.000	
	118	5123	9.49	-35.2	0.000000	0	0.0000	0.000	
	119	4850	8.99	-35.2	0.000000	0	0.0000	0.000	
	120	4692	8.69	-35.2	0.000000	0	0.0000	0.000	
	121	4139	7.67	-35.2	0.000000	0	0.0000	0.000	
	122	4216	7.81	-35.2	0.000000	0	0.0000	0.000	
	123	3888	7.20	-35.2	0.000000	0	0.0000	0.000	
	Shigawake	132	4770	8.13	-35.2	0.000000	0	0.0000	0.000
133		5127	8.74	-35.2	0.000000	0	0.0000	0.000	
134		5500	9.38	-35.2	0.000000	0	0.0000	0.000	
Central_Chaleur	157	6344	10.97	-35.2	0.000000	0	0.0000	0.000	
	158	9208	15.92	-35.2	0.000000	0	0.0000	0.000	
	159	10315	17.84	-35.2	0.000000	0	0.0000	0.000	
	160	10367	17.93	-35.2	0.000000	0	0.0000	0.000	
	161	8634	14.93	-35.2	0.000000	0	0.0000	0.000	
	163	9121	15.78	-35.2	0.000000	0	0.0000	0.000	
	164	9802	16.95	-35.2	0.000000	0	0.0000	0.000	
	165	10657	18.43	-35.2	0.000000	0	0.0000	0.000	
	166	10923	18.89	-35.2	0.000000	1	0.0002	4.390	
	167	11689	20.22	-35.2	0.000000	0	0.0000	0.000	
	168	10594	18.32	-35.2	0.000000	0	0.0000	0.000	
	169	10838	18.74	-35.2	0.000000	0	0.0000	0.000	

TABLE 4b. 1990 CHALEUR (DAYTIME) con't.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
New_Carlilse	170	3313	10.98	-34.1	0.000000	0	0.0000	0.000	
	171	4195	13.91	-34.1	0.000000	0	0.0000	0.000	
	172	6096	20.21	-34.1	0.000000	0	0.0000	0.000	
	173	5777	19.15	-34.1	0.000000	0	0.0000	0.000	
	174	5847	19.38	-34.1	0.000000	0	0.0000	0.000	
New_Richmond	187	2856	11.22	-34.1	0.000001	16	0.0037	40.983	
	188	1936	7.61	-34.1	0.000000	0	0.0000	0.000	
	189	2114	8.31	-34.1	0.000000	0	0.0000	0.000	
	190	4507	17.71	-34.1	0.000000	0	0.0000	0.000	
New_Richmond_Offshore	186	3394	24.65	-34.1	0.000000	0	0.0000	0.000	5
	191	7978	57.95	-34.1	0.000000	0	0.0000	0.000	6
	192	7170	52.08	-34.1	0.000002	126	0.0062	325.465	7
	194	9972	72.44	-34.1	0.000000	0	0.0000	0.106	8
	195	11297	82.06	-34.1	0.000083	6791	0.2140	17556.626	9
Carlilse_Offshore	201	14902	85.05	-34.1	0.000055	4650	0.1413	12021.576	
North_Miscou	202	5378	19.93	-35.2	0.000000	0	0.0000	0.000	
	203	3710	13.75	-35.2	0.000000	0	0.0000	0.000	
	204	9325	34.56	-35.2	0.000000	0	0.0000	0.000	
	205	13694	50.75	-35.2	0.000012	597	0.0388	1966.906	
	206	14370	53.25	-35.2	0.000004	212	0.0131	697.318	

TABLE 4c. 1990 CAPE BRETON (NIGHTTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
White_Capes	219	7122	34.31	-35.8	0.000000	0	0.0000	0.000	
	220	6370	30.69	-35.8	0.000000	0	0.0000	0.000	
	221	6439	31.02	-35.8	0.000000	0	0.0000	0.000	
Pleasant_Bay	222	4762	22.82	-35.8	0.000000	0	0.0000	0.000	
	223	7525	36.05	-35.8	0.000000	0	0.0000	0.000	
	224	7597	36.40	-35.8	0.000000	0	0.0000	0.000	
	225	9274	44.43	-35.8	0.000000	0	0.0000	0.000	
Aspy_Bay	226	7169	32.15	-35.8	0.000040	1279	0.1498	4816.402	11
	228	9806	43.97	-35.8	0.000140	6165	0.5282	23224.930	
	230	3732	16.74	-35.8	0.000000	0	0.0000	0.000	12
Neil_Harbour	231	14924	17.22	-35.8	0.000000	0	0.0000	0.000	
	232	14799	17.08	-35.8	0.000000	0	0.0000	0.000	
	233	14746	17.02	-35.8	0.000000	0	0.0000	0.000	
	263	11103	12.81	-35.8	0.000000	0	0.0000	0.000	
	264	11148	12.86	-35.8	0.000000	0	0.0000	0.000	
	265	10754	12.41	-35.8	0.000000	0	0.0000	0.000	
	266	10924	12.61	-35.8	0.000000	0	0.0000	0.000	
	267	10162	11.73	-35.8	0.000000	0	0.0000	0.000	
	268	9814	11.32	-35.8	0.000000	0	0.0000	0.000	
	269	9538	11.01	-35.8	0.000000	0	0.0000	0.000	
	270	7827	9.03	-35.8	0.000000	0	0.0000	0.000	
Wreck_Cove	256	6247	13.06	-35.8	0.000000	0	0.0000	0.000	
	257	6346	13.27	-35.8	0.000000	0	0.0000	0.000	
	258	6724	14.06	-35.8	0.000000	0	0.0000	0.000	
	259	6457	13.50	-35.8	0.000000	0	0.0000	0.000	
	260	6351	13.28	-35.8	0.000000	0	0.0000	0.000	
	261	5986	12.52	-35.8	0.000000	0	0.0000	0.000	
	262	6984	14.60	-35.8	0.000000	0	0.0000	0.000	13
Donkin	286	7068	22.92	-35.8	0.000017	390	0.0640	1467.908	
	289	7466	24.21	-35.8	0.000041	1001	0.1557	3769.316	
	290	8268	26.81	-35.8	0.000001	24	0.0034	89.979	
	291	8334	27.03	-35.8	0.000000	0	0.0000	0.752	
New_Waterford	293	5563	10.95	-35.8	0.000041	453	0.1558	1706.830	14
Sydney	313	12311	30.80	-35.8	0.000000	0	0.0000	0.000	

TABLE 4d. 1990 CAPE BRETON (DAYTIME) backscatter and biomass for transects.

Stratum	Transect Number	Transect Length (m)	Transect Area (km ²)	Target Strength (dB/kg)	Sa - Area Scattering (/sr)	Total Scattering (m ² /sr)	Biomass Density (Kg/m ²)	Total Biomass (t/trans)	Set Number
White_Capes_Offshore	212	10428	62.32	-35.8	0.000000	1	0.0001	4.432	
	213	6990	41.77	-35.8	0.000000	0	0.0000	0.000	
	215	6990	41.77	-35.8	0.000000	0	0.0000	0.000	
	216	9853	58.88	-35.8	0.000000	0	0.0000	0.000	
White_Capes	217	8037	38.72	-35.8	0.000000	4	0.0004	16.878	
	218	8311	40.04	-35.8	0.000000	0	0.0000	0.000	
Pleasant_Bay	282	6663	31.92	-35.8	0.000000	0	0.0000	0.000	
	283	5767	27.63	-35.8	0.000000	0	0.0000	0.000	
	284	5857	28.06	-35.8	0.000000	0	0.0000	0.000	
Aspy_Bay	273	9686	43.44	-35.8	0.000087	3772	0.3271	14209.395	
	275	4116	18.46	-35.8	0.000006	119	0.0243	448.300	
Neil_Harbour	234	4400	5.08	-35.8	0.000125	634	0.4700	2386.570	
	235	4235	4.89	-35.8	0.000065	316	0.2438	1191.238	
	236	4520	5.22	-35.8	0.000055	285	0.2059	1073.557	
	237	4987	5.75	-35.8	0.000013	74	0.0482	277.548	
	238	9663	11.15	-35.8	0.000002	22	0.0074	83.004	
	239	9782	11.29	-35.8	0.000000	0	0.0000	0.000	
	240	9448	10.90	-35.8	0.000000	0	0.0000	0.000	
	241	9286	10.72	-35.8	0.000003	33	0.0117	125.884	
	242	9770	11.27	-35.8	0.000008	88	0.0293	330.188	
	243	10413	12.02	-35.8	0.000009	111	0.0349	419.756	
	244	10496	12.11	-35.8	0.000009	110	0.0342	413.793	
St_Anns_Bay	245	4620	10.56	-35.8	0.000000	0	0.0000	0.000	
	247	5065	11.57	-35.8	0.000000	0	0.0000	0.000	
	248	4400	10.06	-35.8	0.000000	0	0.0000	0.000	
	250	4319	9.87	-35.8	0.000000	0	0.0000	0.000	
	251	7509	17.16	-35.8	0.000000	0	0.0000	0.000	
	252	7100	16.23	-35.8	0.000000	0	0.0000	0.000	
	253	7298	16.68	-35.8	0.000000	0	0.0000	0.048	
	254	6863	15.69	-35.8	0.000000	0	0.0000	0.000	
	255	7101	16.23	-35.8	0.000000	0	0.0000	0.000	
	Bay_St_Lawrence	277	5453	21.83	-35.8	0.000000	0	0.0000	0.000
278		5570	22.29	-35.8	0.000000	0	0.0000	0.000	
279		5749	23.01	-35.8	0.000000	0	0.0000	0.000	
280		5602	22.42	-35.8	0.000000	0	0.0000	0.000	
281		5347	21.40	-35.8	0.000000	0	0.0000	0.000	
New_Waterford	295	6853	13.49	-35.8	0.000383	5171	1.4438	19480.065	
	296	7604	14.97	-35.8	0.000320	4789	1.2050	18038.580	
	297	6713	13.22	-35.8	0.000102	1349	0.3844	5080.648	
	298	7413	14.59	-35.8	0.000049	711	0.1836	2679.031	
	299	7837	15.43	-35.8	0.000068	1050	0.2564	3956.487	
	300	7826	15.41	-35.8	0.000000	0	0.0000	0.000	
	302	9255	18.22	-35.8	0.000169	3083	0.6374	11614.563	15
Sydney	303	12118	30.31	-35.8	0.000001	41	0.0051	154.450	
	309	9359	23.41	-35.8	0.000000	0	0.0000	0.384	
	310	8120	20.31	-35.8	0.000000	0	0.0000	0.000	
	311	9156	22.90	-35.8	0.000000	0	0.0000	0.000	
	312	11965	29.93	-35.8	0.000000	0	0.0000	0.000	
Haddock_Bank	305	7927	29.01	-35.8	0.000000	0	0.0000	0.000	
	306	7690	28.14	-35.8	0.000001	28	0.0038	106.399	
	307	7701	28.18	-35.8	0.000001	28	0.0037	105.488	
	308	7360	26.94	-35.8	0.000000	0	0.0000	0.011	

Table 5. 1992 Backscatter and estimated biomass per stratum.

Area and Stratum Number (see Fig. 1)	Stratum	Target Strength (dB/kg)	Stratum Area (km ²)	Area Scattering (sr)	Total Scattering (m ² /sr)		Biomass Density (kg/m ²)	Total Biomass (t/stratum)		Set Number
					Total	S.E.		Total	S.E.	
CHALEUR INSHORE										
1	CAP.BON.AMI	-35.1	109.8	0.000000	22	19	0.0006	71	62	
2	GASPE.OFFSHORE	-35.1	150.0	0.000000	44	29	0.0010	144	93	15**
3	GASPE	-35.1	117.6	0.000001	76	29	0.0021	248	95	17
4	MALBAIE	-35.1	191.2	0.000000	91	87	0.0015	294	282	
5	ANSE.BEAUFILS	-33.8	191.9	0.000002	402	265	0.0050	969	639	14
6	GRANDE.RIVIERE	-35.1	173.8	0.000027	4662	1265	0.0869	15097	4095	13
7	NEWPORT	-35.1	187.0	0.000004	676	246	0.0117	2189	797	4
8	SHIGAWAKE	-35.1	323.3	0.000011	3683	625	0.0369	11925	2024	6.7
9	NEW.CARLISLE	-33.8	167.0	0.000008	1296	402	0.0187	3124	968	8
10	NEW.RICHMOND	-35.1	253.6	0.000002	548	116	0.0070	1773	374	9*
11	MAISONNETTE	-35.1	137.5	0.000022	2965	369	0.0698	9599	1195	12
12	WEST.MISCOU	-35.1	354.0	0.000002	872	267	0.0080	2825	863	2
CHALEUR OFFSHORE										
+	13 BON.AMI.OFFSHORE	-35.1	229.5	0.000000	88	53	0.0012	285	173	
	14 AMERICAN.BANK	-35.1	187.4	0.000003	497	330	0.0086	1609	1070	
+	15 BONAVENTURE.OFFSHORE	-35.1	190.9	0.000000	39	15	0.0007	127	50	
+	16 BEAUFILS.OFFSHORE	-35.1	132.6	0.000000	6	6	0.0001	19	18	
+	17 NEWPORT.OFFSHORE	-35.1	332.6	0.000000	12	12	0.0001	40	38	
	18 EAST.CENTRAL.CHALEUR	-35.1	239.4	0.000000	0	0	0.0000	0	0	
	19 CENTRAL.CHALEUR	-35.1	208.0	0.000000	0	0	0.0000	0	0	
+	20 CARLISLE.OFFSHORE	-35.1	410.4	0.000002	1013	192	0.0080	3280	622	10
+	21 RICHMOND.OFFSHORE	-35.1	350.1	0.000005	1659	1027	0.0153	5372	3325	11*
	22 NORTH.MISCOU	-35.1	417.8	0.000003	1212	1104	0.0094	3923	3575	1
	23 EAST.MISCOU	-35.1	2093.5	0.000013	27436	16567	0.0424	88843	53648	18
@ MILNE, PEI										
+	24 MILNE	-35.7	187.7	0.000000	88	80	0.0017	325	297	
+	25 MILNE.OFFSHORE	-35.7	203.4	0.000001	189	193	0.0034	698	714	
CAPE BRETON INSHORE										
+	26 WHITE.CAPE	-35.7	214.0	0.000002	475	294	0.0082	1760	1092	
+	27 PLEASANT.BAY	-35.7	281.3	0.000003	946	351	0.0125	3507	1302	20
+	28 BAY.ST.LAWRENCE	-35.7	126.9	0.000001	140	69	0.0041	518	257	
	29 ASPY.BAY	-35.7	168.3	0.000046	7665	2921	0.1688	28414	10828	21
	30 NEILHARBOUR	-35.7	259.5	0.000007	1891	579	0.0270	7009	2146	22
	31 WRECK.COVE	-35.7	109.7	0.000003	360	167	0.0121	1331	620	
	32 ST.ANNS.BAY	-35.7	159.0	0.000000	5	5	0.0001	17	18	
	33 HADDOCK.BANK	-35.7	94.9	0.000001	54	29	0.0021	200	108	
	34 SYDNEY	-35.7	168.6	0.000001	237	87	0.0052	876	324	
	35 NEW.WATERFORD	-35.7	141.3	0.000001	91	26	0.0024	338	97	
	36 DONKIN	-35.7	109.2	0.000002	214	47	0.0072	791	174	
CAPE BRETON OFFSHORE										
+	37 WHITE.CAPE.OFFSHORE	-35.7	267.7	0.000000	0	0	0.0000	0	0	
+	38 PLEASANT.BAY.OFFSHORE	-35.7	456.6	0.000000	6	6	0.0001	25	23	
+	39 LAWRENCE.OFFSHORE	-35.7	232.7	0.000000	16	14	0.0003	59	53	
+	40 ASPY.OFFSHORE	-35.7	302.2	0.000000	0	0	0.0000	0	0	
+	41 NEILHARBOUR.OFFSHORE	-35.7	196.9	0.000000	0	0	0.0000	0	0	

* Set with smelt mixed with herring

**Set with capelin and shrimp

+ Additional strata since 1990

@ Milne strata covered in 1992 only and included in Cape Breton transect Tables 2c and 2d

Table 6. 1991 Backscatter and estimated biomass per stratum.

Area and Stratum Number (see Fig. 1)	Stratum	Target Strength (dB/kg)	Stratum Area (km ²)	Area Scattering (/sr)	Total Scattering (m ² /sr)		Biomass Density (kg/m ²)	Total Biomass (/stratum)		Set Number
					Total	S.E.		Total	S.E.	
CHALEUR INSHORE										
1	CAP.BON.AMI	-35.1	109.8	0.000000	19	18	0.0006	64	60	3
2	GASPE.OFFSHORE	-35.1	150.0	0.000000	0	0	0.0000	0	0	
3	GASPE	-35.1	117.6	0.000000	24	9	0.0007	77	29	
4	MALBAIE	-35.1	191.2	0.000000	14	14	0.0003	47	46	
5	ANSE.BEAUFILS	-35.1	191.9	0.000000	12	9	0.0002	40	29	
6	GRANDE.RIVIERE	-35.1	173.8	0.000000	0	0	0.0000	0	0	
7	NEWPORT	-35.1	187.0	0.000002	400	106	0.0070	1306	346	8,9,10
8	SHIGAWAKE	-35.1	323.3	0.000010	3253	1164	0.0328	10619	3800	
9	NEW.CARLISLE	-35.1	167.0	0.000001	209	74	0.0041	683	242	
10	NEW.RICHMOND	-35.1	253.6	0.000000	11	5	0.0001	36	15	14,15
11	MAISONNETTE	-35.1	137.5	0.000007	1009	150	0.0239	3290	489	
12	WEST.MISCOU	-35.1	354.0	0.000000	172	58	0.0016	561	191	
CHALEUR OFFSHORE										
+	13 BON.AMI.OFFSHORE	--	229.5	--	--	--	--	--	--	
	14 AMERICAN.BANK	-35.1	187.4	0.000000	1	1	0.0000	5	5	
+	15 BONAVENTURE.OFFSHORE	--	190.9	--	--	--	--	--	--	
+	16 BEAUFILS.OFFSHORE	--	132.6	--	--	--	--	--	--	
+	17 NEWPORT.OFFSHORE	-35.1	332.6	0.000000	5	4	0.0001	18	13	
	18 EAST.CENTRAL.CHALEUR	-35.1	239.4	0.000000	0	0	0.0000	0	0	
	19 CENTRAL.CHALEUR	-35.1	208.0	0.000000	1	1	0.0000	3	2	11
+	20 CARLISLE.OFFSHORE	-35.1	410.4	0.000000	20	21	0.0002	64	67	
+	21 RICHMOND.OFFSHORE	-35.1	350.1	0.000000	4	4	0.0000	12	12	
	22 NORTH.MISCOU	-35.1	417.8	0.000000	51	40	0.0004	168	132	1
	23 EAST.MISCOU	-35.1	2093.5	0.000003	7030	3916	0.0110	22942	12781	
CAPE BRETON INSHORE										
+	26 WHITE.CAPE	--	214.0	--	--	--	--	--	--	18,19
+	27 PLEASANT.BAY	-35.8	281.3	0.000000	0	0	0.0000	0	0	
+	28 BAY.ST.LAWRENCE	-35.8	126.9	0.000000	7	8	0.0002	24	29	
	29 ASPY.BAY	-35.8	168.3	0.000005	858	332	0.0194	3266	1264	16,17
	30 NEIL.HARBOUR	-35.8	259.5	0.000000	17	12	0.0002	64	46	
	31 WRECK.COVE	-35.8	109.7	0.000000	17	8	0.0006	63	30	
	32 ST.ANNS.BAY	-35.8	159.0	0.000000	12	8	0.0003	43	31	20
	33 HADDOCK.BANK	-35.8	94.9	0.000000	1	1	0.0001	6	5	
	34 SYDNEY	-35.8	168.6	0.000002	206	120	0.0042	782	548	
	35 NEW.WATERFORD	-35.8	141.3	0.000000	32	20	0.0009	124	76	21
	36 DONKIN	-35.8	109.2	0.000000	13	10	0.0004	47	37	

+ Additional strata since 1990

Table 7. 1990 Backscatter and estimated biomass per stratum.

Area and Stratum Number (see Fig. 1)	Stratum	Target Strength (dB/kg)	Stratum Area (km ²)	Area Scattering (/sr)	Total Scattering (m ² /sr)		Biomass Density (kg/m ²)	Total Biomass (t/stratum)		Set Number
					Total	S.E.		Total	S.E.	
CHALEUR INSHORE										
1	CAP.BON.AMI	-35.2	109.8	0.000130	14230	12887	0.4271	46892	42468	
2	GASPE.OFFSHORE	-35.2	150.0	0.000000	0	0	0.0000	0	0	
3	GASPE	-35.2	117.6	0.000000	0	0	0.0000	0	0	
4	MALBAIE	-35.2	191.2	0.000000	0	0	0.0000	0	0	
5	ANSE.BEAUFILS	-35.2	191.9	0.000000	0	0	0.0000	0	0	
6	GRANDE.RIVIERE	-35.2	173.8	0.000038	6642	2562	0.1259	21888	8442	
7	NEWPORT	-35.2	187.0	0.000000	0	0	0.0000	0	0	
8	SHIGAWAKE	-35.2	323.3	0.000006	1998	972	0.0204	6584	3204	2
9	NEW.CARLISLE	-34.1	167.0	0.000000	48	41	0.0007	125	107	
10	NEW.RICHMOND	-34.1	253.6	0.000304	77119	30015	0.7862	199385	77601	4@
11	MAISONNETTE	-35.2	137.5	0.000000	0	0	0.0000	0	0	
12	WEST.MISCOU	-35.2	354.0	0.000000	0	0	0.0000	0	0	
CHALEUR OFFSHORE										
+	13 BON.AMI.OFFSHORE	-35.2	229.5	0.000000	0	0	0.0000	0	0	
	14 AMERICAN.BANK	-35.2	187.4	0.000001	267	202	0.0047	880	664	
+	15 BONAVENTURE.OFFSHORE	-	190.9	-	-	-	-	-	-	
+	16 BEAUFILS.OFFSHORE	-	132.6	-	-	-	-	-	-	
+	17 NEWPORT.OFFSHORE	-35.2	332.6	0.000000	0	0	0.0000	0	0	
	18 EAST.CENTRAL.CHALEUR	-35.2	239.4	0.000000	0	0	0.0000	0	0	
	19 CENTRAL.CHALEUR	-35.2	208.0	0.000000	1	1	0.0000	4	4	
+	20 CARLISLE.OFFSHORE	-34.1	410.4	0.000617	253343	107035	1.5960	654998	276729	8*,9*,10
+	21 RICHMOND.OFFSHORE	-34.1	350.1	0.000024	8374	6760	0.0618	21649	17478	5,6,7*
	22 NORTH.MISCOU	-35.2	417.8	0.000005	2076	957	0.0164	6842	3154	
	23 EAST.MISCOU	-35.2	2093.5	0.000005	10253	9524	0.0161	33787	31386	1
CAPE BRETON INSHORE										
+	26 WHITE.CAPE	-35.8	214.0	0.000000	5	4	0.0001	21	17	
+	27 PLEASANT.BAY	-35.8	281.3	0.000000	0	0	0.0000	0	0	
+	28 BAY.ST.LAWRENCE	-35.8	126.9	0.000000	0	0	0.0000	0	0	
	29 ASPY.BAY	-35.8	168.3	0.000073	12327	5936	0.2759	46438	22362	11,12
	30 NEIL.HARBOUR	-35.8	259.5	0.000007	1769	720	0.0257	6662	2712	
	31 WRECK.COVE	-35.8	109.7	0.000000	0	0	0.0000	0	0	13**
	32 ST.ANNS.BAY	-35.8	159.0	0.000000	0	0	0.0000	0	0	
	33 HADDOCK.BANK	-35.8	94.9	0.000001	47	32	0.0019	179	122	
	34 SYDNEY	-35.8	168.6	0.000000	44	41	0.0010	166	154	
	35 NEW.WATERFORD	-35.8	141.3	0.000143	20179	5691	0.5380	76016	21439	14,15,16
	36 DONKIN	-35.8	109.2	0.000014	1529	933	0.0528	5762	3516	
CAPE BRETON OFFSHORE										
+	37 WHITE.CAPE.OFFSHORE	-35.8	267.7	0.000000	1	1	0.0000	5	4	

* Set with some smelt mixed with herring

**Set with mackerel and juvenile cod

+ Additional strata since 1990

@ Set with 80% smelt

Table 8. Total acoustic backscattering and biomass estimates in the Southern Gulf of St. Lawrence, 1988-1992.

Year	Area	Number of Transects	* Proportion covered at night	Total Scattering (m ² /sr) Total	C.V.	Estimated Biomass (t/stratum)	* Proportion recorded at night
**1992	CHALEUR INSHORE	216	0.57	15337.4	0.103	50434.5	0.65
	CHALEUR OFFSHORE	102	0.48	31962.3	0.521	108600.8	0.75
	CAPE BRETON INSHORE	78	0.58	12076.9	0.250	44762.1	0.85
	CAPE BRETON OFFSHORE	22	0.14	22.0	0.694	83.4	0
1992 TOTAL		418	0.53	59376.6	0.286	203797.4	0.75
1991	CHALEUR INSHORE	158	0.59	5123.0	0.456	16724.0	0.87
	CHALEUR OFFSHORE	50	0.32	7133.0	0.550	23214.0	0.65
	CAPE BRETON INSHORE	49	0.61	1163.0	0.316	4417.8	0.98
	CAPE BRETON OFFSHORE	0	0	0	0	0	0
1991 TOTAL		257	0.54	13419.0	0.330	44355.8	0.75
1990	CHALEUR INSHORE	115	0.76	100035.6	0.328	274873.9	0.73
	CHALEUR OFFSHORE	73	0.27	274314.3	0.393	718160.0	0.91
	CAPE BRETON INSHORE	82	0.41	35900.5	0.231	135243.9	0.30
	CAPE BRETON OFFSHORE	4	0	1.3	0.765	5.2	0
1990 TOTAL		274	0.51	410251.7	0.275	1128283.1	0.81
1989	CHALEUR	186	--	3029.0	0.308	11249.0	--
1988	CHALEUR	154	--	64706.0	0.202	240294.0	--
	CAPE BRETON INSHORE	86	--	50051.0	0.288	172886.0	--
1988 TOTAL		240	--	114757.0	0.240	413180.0	--

* Proportion of transect covered and biomass detected during nighttime hours, 19:00 to 07:00 HR.

** 1992 Milne strata not included

Table 9. Total number of transects per stratum and proportion of transects with herring backscatter for the years 1988 to 1992.

Strata number	Strata	1992 OCTOBER		1991 OCTOBER		1990 NOVEMBER		1989 NOVEMBER		1988 NOVEMBER	
		Number of transects	Proportion with herring	Number of transects	Proportion with herring	Number of transects	Proportion with herring	Number of transects	Proportion with herring	Number of transects	Proportion with herring
CHALEUR INSHORE											
1	CAP.BON/LAMI	6	0.50	4	0.25	4	0.25	5	0.00	3	0.00
2	GASPE/OFFSHORE	10	0.20	4	0.00	5	0.00	5	0.00	4	0.00
3	GASPE	8	0.63	10	0.50	5	0.00	6	0.00	3	0.00
4	MALBAIE	4	0.75	4	0.50	4	0.00	5	0.00	4	0.00
5	ANSE/BEAUFILS	8	0.25	6	0.17	6	0.00	5	0.00	6	0.00
6	GRANDE/RIVIERE	13	1.00	18	0.00	9	0.44	12	0.00	12	0.58
7	NEWFORT	29	0.62	20	0.50	5	0.00	8	0.50	13	0.00
8	SHIGAWAKE	37	1.00	34	0.78	25	0.16	28	0.00	23	0.47
9	NEW/CARLISLE	9	1.00	10	0.80	9	0.11	7	0.00	5	0.20
10	NEW/RICHMOND	23	0.61	10	0.20	10	0.50	8	0.00	14	0.21
11	MAISONNETTE	33	1.00	7	1.00	13	0.00	16	0.08	12	0.67
12	WEST/MISCOU	38	0.53	31	0.65	20	0.00	48	0.08	20	0.15
	INSHORE PROPORTION	218	0.73	158	0.53	115	0.13	151	0.08	119	0.28
CHALEUR OFFSHORE											
14	AMERICAN/BANK	11	0.91	4	0.25	7	0.43	6	0.00	4	0.00
17	NEWFORT/OFFSHORE	9	0.11	4	0.50	9	0.00	-	-	-	-
18	EAST/CENTRAL/CHALEUR	14	0.00	8	0.00	13	0.00	6	0.00	-	-
19	CENTRAL/CHALEUR	15	0.00	7	0.00	12	0.00	6	0.00	12	0.17
20	CARLISLE/OFFSHORE	7	1.00	4	0.25	5	1.00	-	-	-	-
21	RICHMOND/OFFSHORE	7	0.57	10	0.20	5	0.40	-	-	-	-
22	NORTH/MISCOU	9	0.56	12	0.08	9	0.33	7	0.43	4	0.00
23	EAST/MISCOU	6	0.67	6	1.00	7	0.14	10	0.00	15	0.07
	OFFSHORE PROPORTION	78	0.40	56	0.23	67	0.21	35	0.09	35	0.09
	CHALEUR TOTAL	294	0.64	214	0.45	182	0.16	188	0.08	154	0.23
CAPE BRETON INSHORE											
27	PLESANT	6	0.50	4	0.25	7	0.00	-	-	-	-
28	ASPY/BAY	6	1.00	4	0.75	5	0.80	-	-	5	0.00
30	NEIL/HARBOUR	17	0.82	12	0.25	22	0.41	-	-	23	0.38
31	WRECK/COVE	8	0.88	6	1.00	7	0.00	-	-	14	0.98
32	ST.ANNS/BAY	4	0.25	4	0.50	9	0.00	-	-	14	0.14
33	HADDOCK/BANK	4	0.75	3	0.67	4	0.75	-	-	2	0.00
34	SYDNEY	4	1.00	3	1.00	6	0.17	-	-	9	0.11
35	NEW/WATERFORD	10	0.90	6	0.50	8	0.88	-	-	15	0.00
36	DONKIN	9	1.00	4	0.50	4	0.75	-	-	4	0.00
	INSHORE PROPORTION	68	0.82	46	0.54	72	0.38	-	-	86	0.28
CAPE BRETON OFFSHORE											
38	LAWRENCE/OFFSHORE	4	0.25	3	0.33	5	0.00	-	-	-	-
	CAPE BRETON TOTAL	72	0.78	49	0.53	77	0.35	-	-	86	0.28
	4T+4Vn TOTAL	368	0.67	263	0.46	259	0.22	-	-	240	0.25
Additional Transects											
	CHALEUR OFFSHORE	24	0.33	-	-	6	0.00	-	-	-	-
	MILNE (EAST FEI)	8	0.25	-	-	-	-	-	-	-	-
	CAPE BRETON INSHORE	9	0.78	-	-	5	0.20	-	-	-	-
	CAPE BRETON OFFSHORE	18	0.06	4	0.00	4	0.00	-	-	-	-
	Additional Transects Total	59	-	4	-	15	-	-	-	-	-

Table 10. Total transect lengths (nm) per stratum, length (nm) having herring, and percentage thereof, for the years 1988 to 1992. (Mline strata not included)

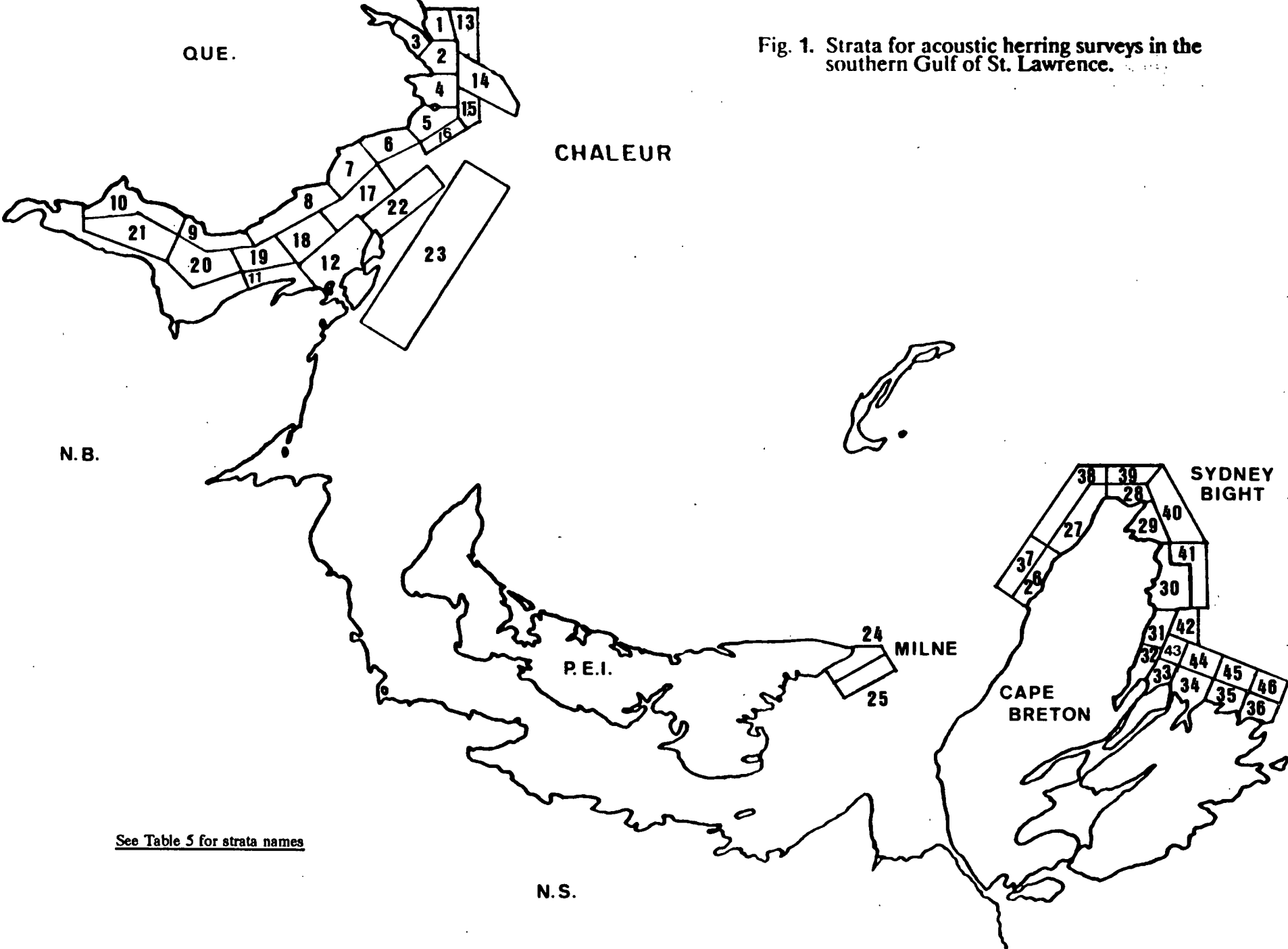
	1988			1989			1990			1991			1992		
	nm	Herr. nm	%	nm	Herr. nm	%	nm	Herr. nm	%	nm	Herr. nm	%	nm	Herr. nm	%
Chaleur Inshore															
1 Cap Bon Ami	13.3	0.0	0.0	21.3	0.0	0.0	33.2	1.3	3.8	17.1	0.0	0.0	25.1	0.8	3.3
2 Gaspé Offshore	22.9	2.2	9.6	23.5	0.5	2.1	25.5	0.0	0.0	20.9	0.0	0.0	50.8	2.1	4.1
3 Gaspé Bay	8.6	0.0	0.0	17.8	0.0	0.0	20.0	0.0	0.0	30.2	3.3	10.9	27.8	3.8	13.5
4 La Malbaie	29.0	0.0	0.0	37.8	0.0	0.0	26.0	0.0	0.0	23.4	4.4	18.8	34.0	1.7	4.9
5 Arse a Beauvais	28.3	0.0	0.0	27.2	0.0	0.0	34.4	0.0	0.0	18.6	1.5	8.1	38.9	2.5	6.4
6 Grande Rivière	37.2	6.5	17.5	40.8	0.0	0.0	24.8	4.2	16.8	60.5	0.0	0.0	55.5	12.1	21.8
7 Newport	46.3	15.0	32.4	35.1	2.7	7.7	18.3	0.0	0.0	67.6	12.9	19.1	128.2	13.0	10.1
8 Shigawake	71.1	6.8	9.6	60.5	21.5	35.5	122.5	10.0	8.2	105.3	31.9	30.3	158.4	46.0	29.0
9 New Carlisle	14.8	0.4	2.7	11.7	0.0	0.0	23.4	1.0	4.3	29.2	9.0	30.8	25.8	3.0	11.6
10 New Richmond	38.9	6.4	16.5	18.2	3.1	17.0	23.2	3.0	12.9	22.2	1.4	6.3	72.3	0.0	0.0
11 Malsorette	27.4	2.9	10.6	36.4	0.0	0.0	35.8	0.0	0.0	16.1	6.2	38.5	89.5	23.0	25.7
12 West Misco	85.4	2.1	2.2	227.4	6.2	2.7	98.8	0.0	0.0	25.2	23.8	94.4	17.0	14.5	85.3
SUB TOTAL	433.3	42.3	9.8	569.8	34.0	6.1	485.9	19.4	4.0	496.3	94.4	21.8	723.3	122.4	16.9
Chaleur Offshore															
14 American Bank	16.4	0.7	4.3	18.1	0.0	0.0	28.8	2.9	10.1	14.1	0.0	0.0	14.1	5.0	35.5
19 Central Chaleur	63.2	0.0	0.0	27.8	1.9	6.8	63.7	2.0	3.1	35.2	7.6	21.6	66.0	0.0	0.0
22 North Misco	19.3	0.0	0.0	35.0	4.6	13.1	48.1	8.5	17.7	25.2	0.0	0.0	64.3	3.5	5.4
23 East Misco	183.4	0.0	0.0	151.4	0.0	0.0	88.1	2.8	3.2	84.7	5.6	6.6	85.7	25.8	27.0
SUB TOTAL	262.4	0.7	0.2	232.4	6.5	2.8	228.7	16.2	7.1	169.2	13.2	6.3	240.1	34.3	14.3
Chaleur Offshore (Partial)															
13 Bon Ami Offshore	-	-	-	-	-	-	33.2	0.0	0.0	-	-	-	47.5	1.3	2.6
15 Bonaventure Offshore	-	-	-	-	-	-	-	-	-	-	-	-	33.5	4.2	12.4
18 Beauvais Offshore	-	-	-	-	-	-	-	-	-	-	-	-	32.6	1.3	3.8
17 Newport Offshore	-	-	-	-	-	-	49.9	0.0	0.0	23.7	2.9	12.2	50.7	0.0	0.0
18 E. Central Chaleur	-	-	-	30.4	0.0	0.0	70.6	0.0	0.0	49.7	13.3	26.8	80.9	0.0	0.0
20 Carlise Offshore	-	-	-	-	-	-	39.4	16.0	40.8	36.5	0.0	0.0	57.0	3.0	5.3
21 Richmond Offshore	-	-	-	-	-	-	21.5	5.0	23.3	20.1	0.0	0.0	40.4	5.0	12.4
SUB TOTAL	-	-	-	30.4	0.0	0.0	214.6	21.0	8.6	130.0	16.2	12.5	342.8	14.7	4.3
CHALEUR TOTAL	715.7	43.0	6.0	822.7	40.5	4.9	929.2	56.8	6.1	725.5	123.8	17.1	1308.0	171.4	13.1
Cape Breton Inshore															
27 Pleasant Bay	-	-	-	-	-	-	25.6	0.0	0.0	18.5	0.0	0.0	21.3	2.9	13.6
28 Bay St. Lawrence	-	-	-	-	-	-	14.9	0.0	0.0	15.4	0.8	3.9	16.7	0.7	4.2
29 Aspy Bay	30.1	10.3	34.2	-	-	-	20.2	5.9	29.2	8.6	4.8	55.8	35.0	17.7	50.6
30 Nell Harbour	70.0	4.3	6.1	-	-	-	114.4	25.6	22.4	8.5	3.2	37.6	28.4	9.7	34.2
31 Wreck Cove	-	-	-	-	-	-	24.3	0.0	0.0	31.2	6.1	19.6	31.8	7.4	23.3
32 St. Ann's Bay	-	-	-	-	-	-	28.1	0.0	0.0	12.8	0.7	5.5	17.8	0.0	0.0
33 Haddock Bank	-	-	-	-	-	-	16.6	1.9	10.8	14.4	1.7	11.8	20.2	7.2	35.6
34 Sydney	-	-	-	-	-	-	43.1	5.0	11.6	17.8	6.7	37.4	18.6	3.8	20.4
35 New Waterford	-	-	-	-	-	-	31.9	5.0	15.7	25.5	4.8	18.0	52.9	5.1	9.6
36 Donkin	-	-	-	-	-	-	18.8	4.1	24.4	25.6	1.5	5.9	41.7	9.1	21.8
SUB TOTAL	100.1	14.6	14.6	-	-	-	134.6	31.5	23.4	17.1	8.0	46.8	63.4	27.4	43.2
Cape Breton Inshore (Partial)															
28 White Capes	-	-	-	-	-	-	19.6	0.0	0.0	-	-	-	15.3	2.1	13.7
SUB TOTAL	-	-	-	-	-	-	19.6	0.0	0.0	-	-	-	15.3	2.1	13.7
Cape Breton Offshore															
37 White Cape Offshore	-	-	-	-	-	-	22.8	10.7	46.9	-	-	-	22.3	0.0	0.0
38 Pleasant Offshore	-	-	-	-	-	-	-	-	-	-	-	-	21.6	0.0	0.0
39 Lawrence Offshore	-	-	-	-	-	-	-	-	-	-	-	-	18.7	0.0	0.0
40 Aspy Offshore	-	-	-	-	-	-	-	-	-	18.6	0.0	0.0	20.6	3.2	15.5
41 Nell Offshore	-	-	-	-	-	-	-	-	-	-	-	-	28.4	0.0	0.0
42 Wreck Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43 Haddock Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44 Sydney Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45 Waterford Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46 Donkin Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUB TOTAL	-	-	-	-	-	-	22.8	10.7	46.9	-	-	-	109.6	3.2	2.9
CAPE BRETON TOTAL	100.1	14.6	14.6	-	-	-	379.3	58.1	15.3	822.5	153.7	16.7	1715.3	240.3	16.8
GRAND TOTAL	815.8	57.6	7.1	822.7	40.5	4.9	1308.5	114.7	8.8	1648.0	277.5	16.8	3021.3	411.7	13.6

Table 11. Catch-at-age matrices for Southern Gulf herring from acoustic cruise samples, 1990 - 1992.

Numbers are proportions of total backscatter by weight, 4T and 4Vn combined.

Fall spawners	AGE	1990	1991	1992
	0	0.00	0.00	0.00
	1	1.49	0.05	0.00
	2	11.41	0.98	0.98
	3	8.66	13.09	1.44
	4	6.25	26.65	12.33
	5	3.06	7.50	23.58
	6	4.22	4.65	7.22
	7	3.85	3.47	3.52
	8	1.96	7.33	6.89
	9	1.20	3.49	5.01
	10	2.14	1.53	5.16
	11+	4.86	6.05	15.54
Proportion of total backscatter		49.10	74.78	81.67
Spring spawners	AGE	1990	1991	1992
	0	0.06	0.00	0.00
	1	16.47	2.57	2.40
	2	29.25	10.05	2.34
	3	2.30	6.02	2.50
	4	1.04	2.74	6.70
	5	0.41	0.85	1.66
	6	0.41	0.57	1.05
	7	0.58	0.80	0.32
	8	0.00	0.73	0.59
	9	0.35	0.93	0.56
	10	0.15	0.28	0.35
	11+	0.00	0.79	0.00
Proportion of total backscatter		51.02	26.34	18.48

Fig. 1. Strata for acoustic herring surveys in the southern Gulf of St. Lawrence.



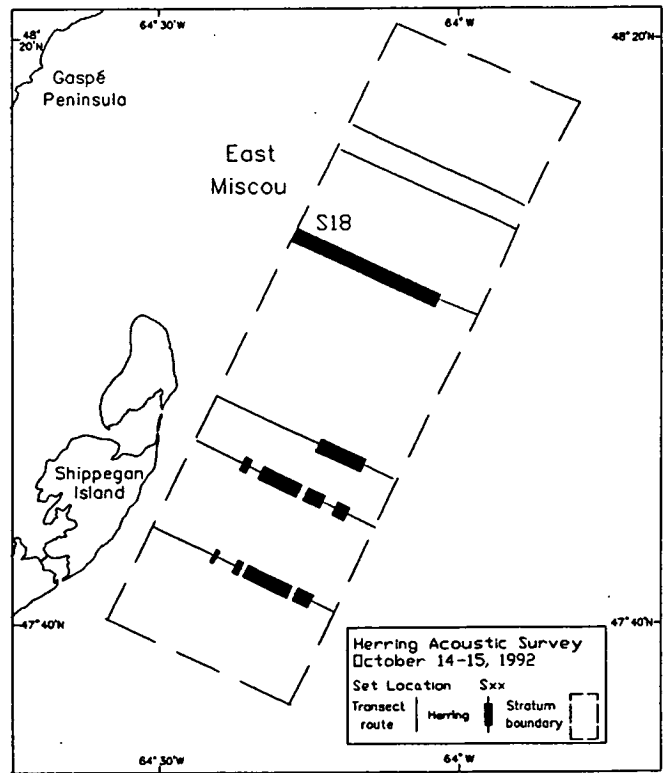
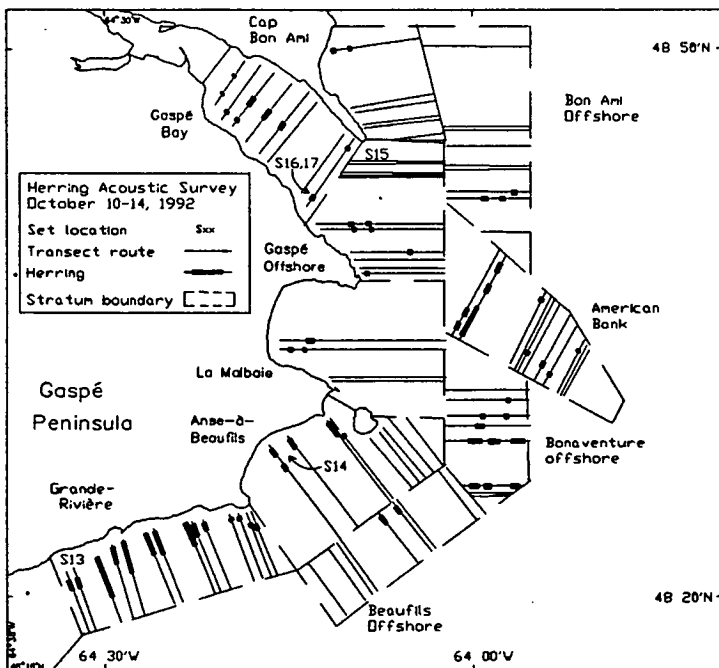
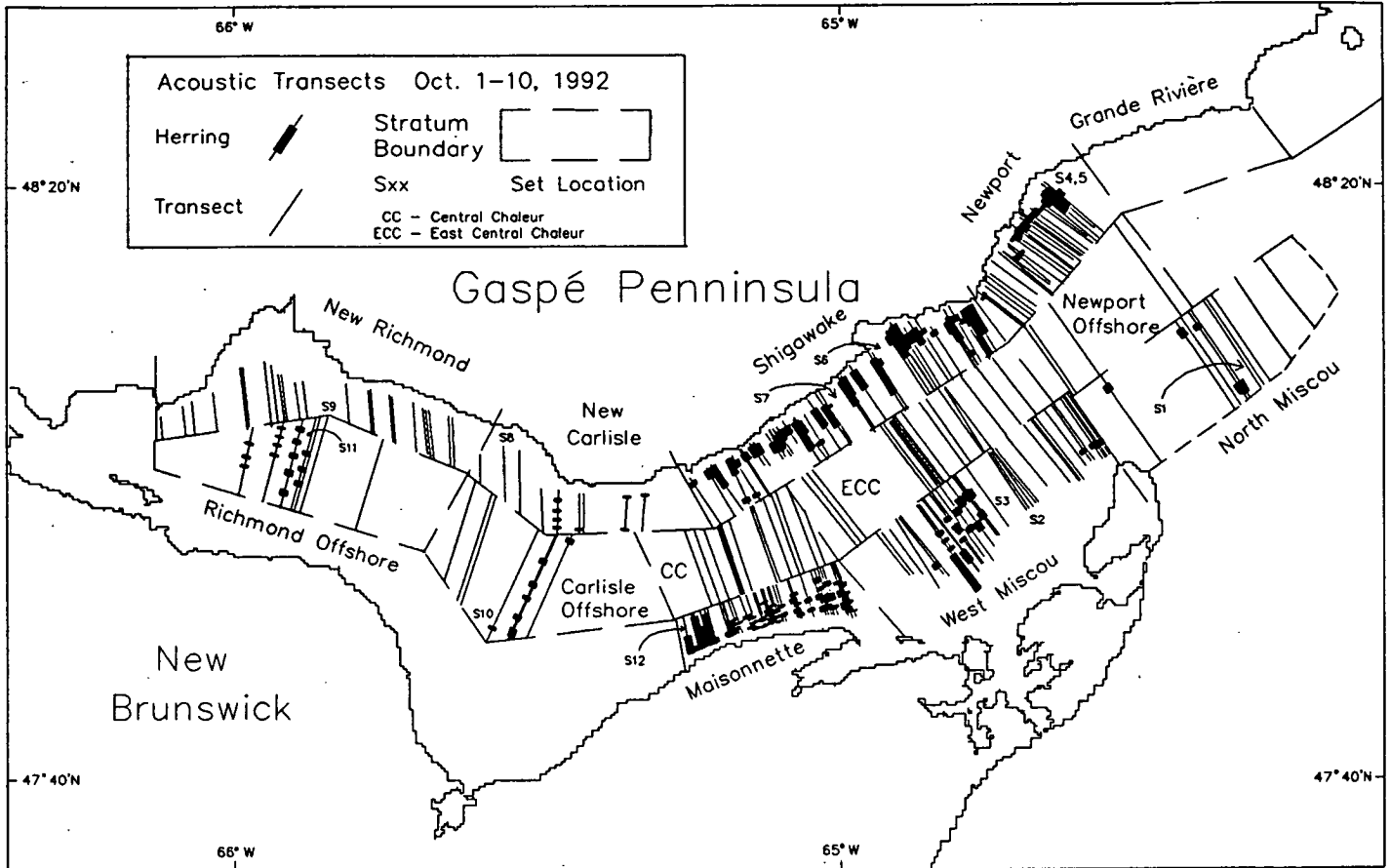


Fig. 2. Acoustic transects, herring distribution, and set locations - Chaleur Bay, Gaspé and East Miscou, 1992.

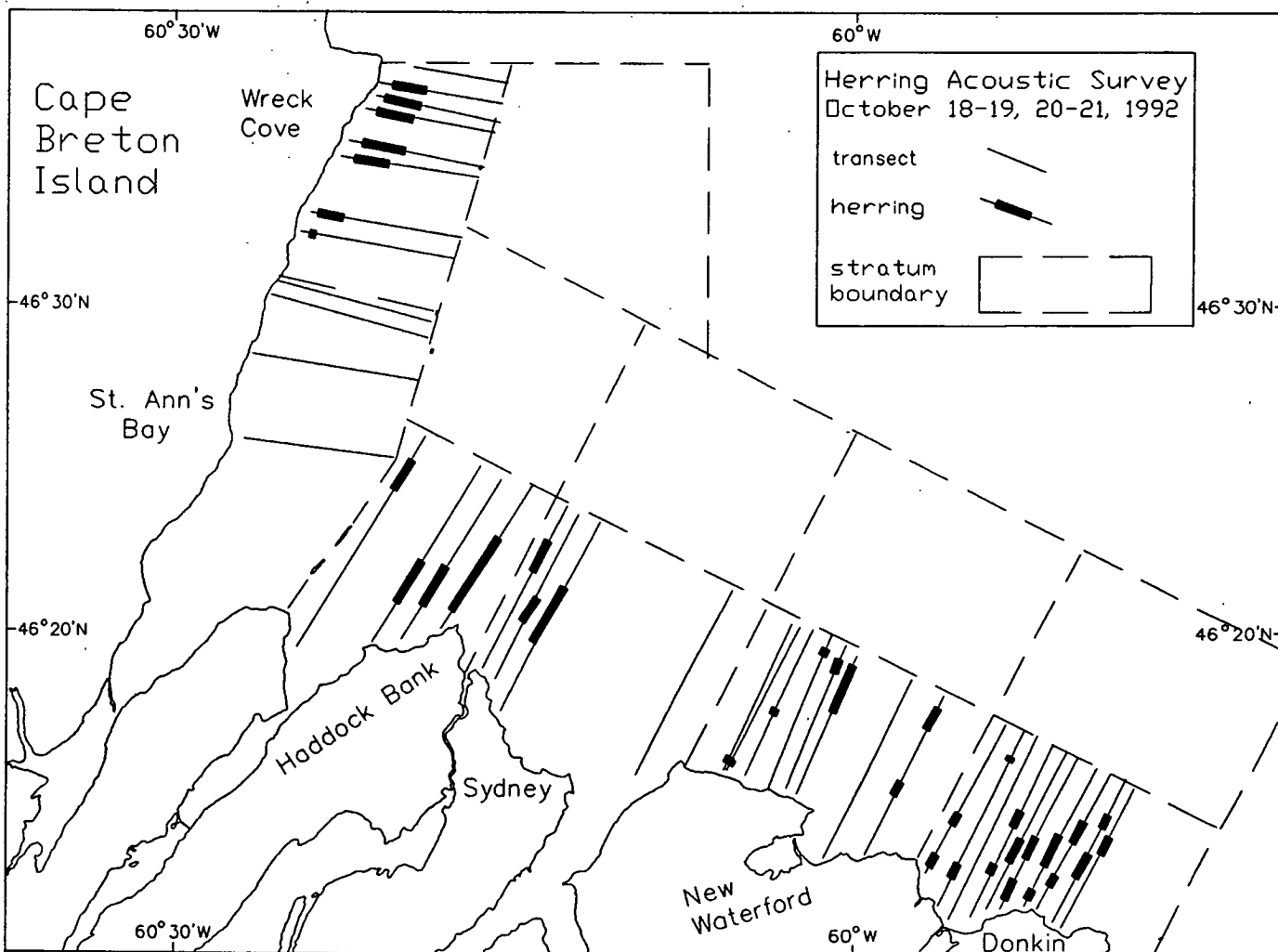
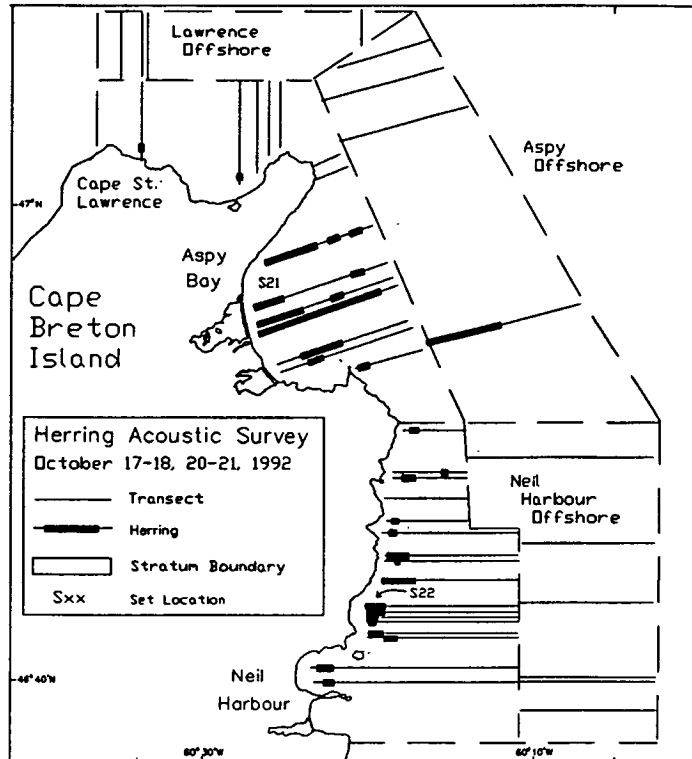
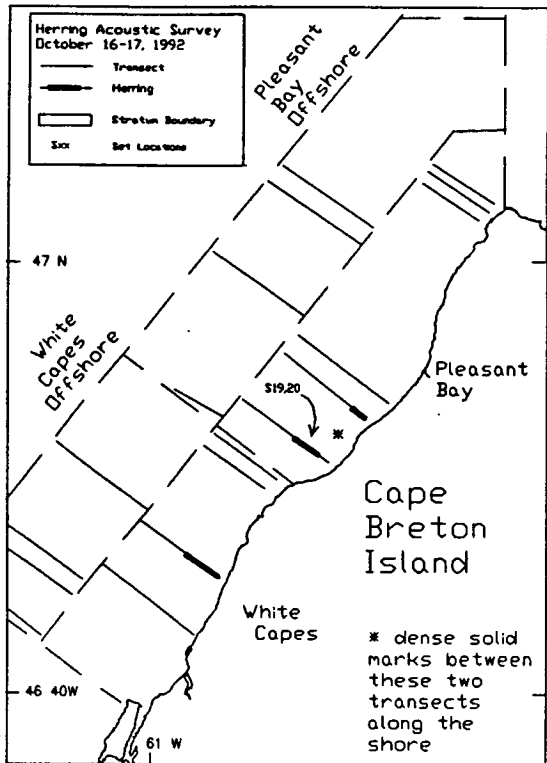


Fig. 3. Acoustic transects, herring distribution and set locations - Cape Breton, 1992.

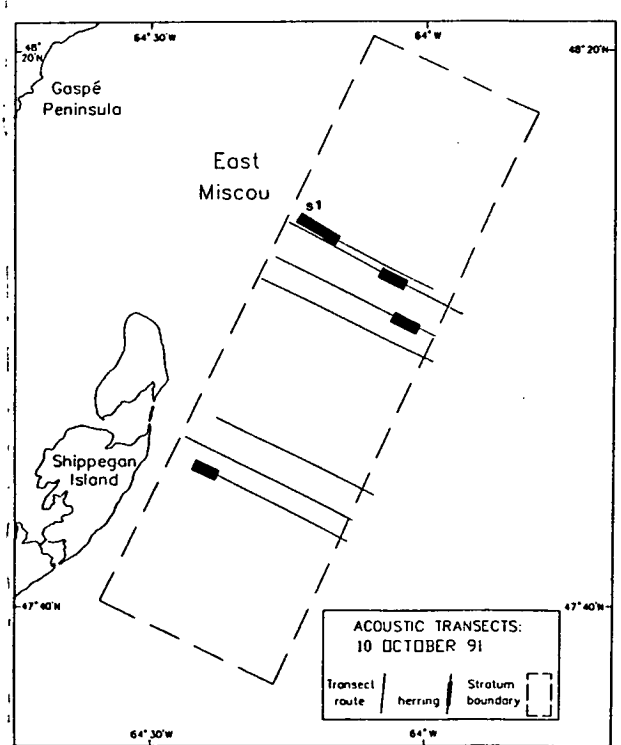
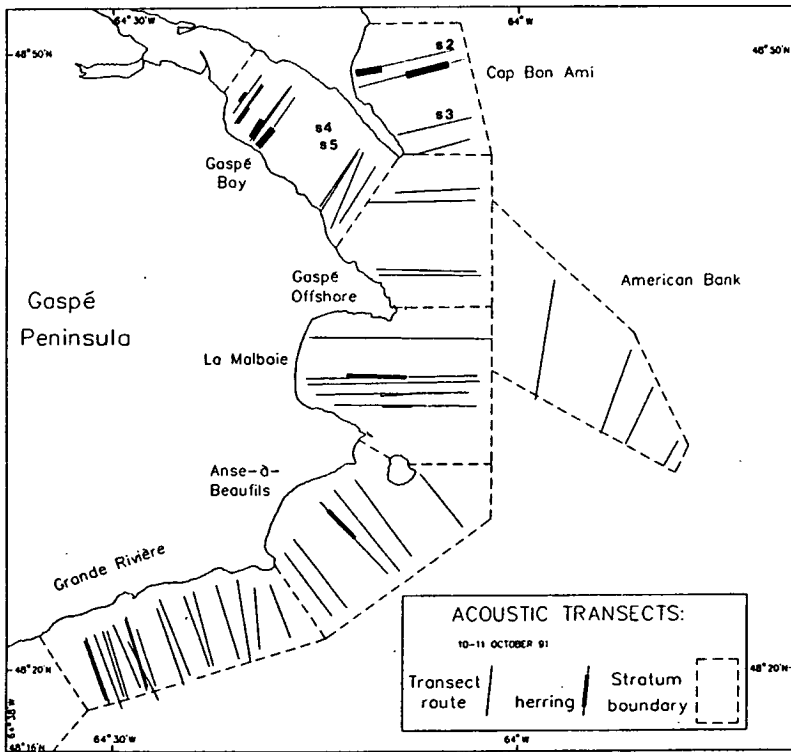
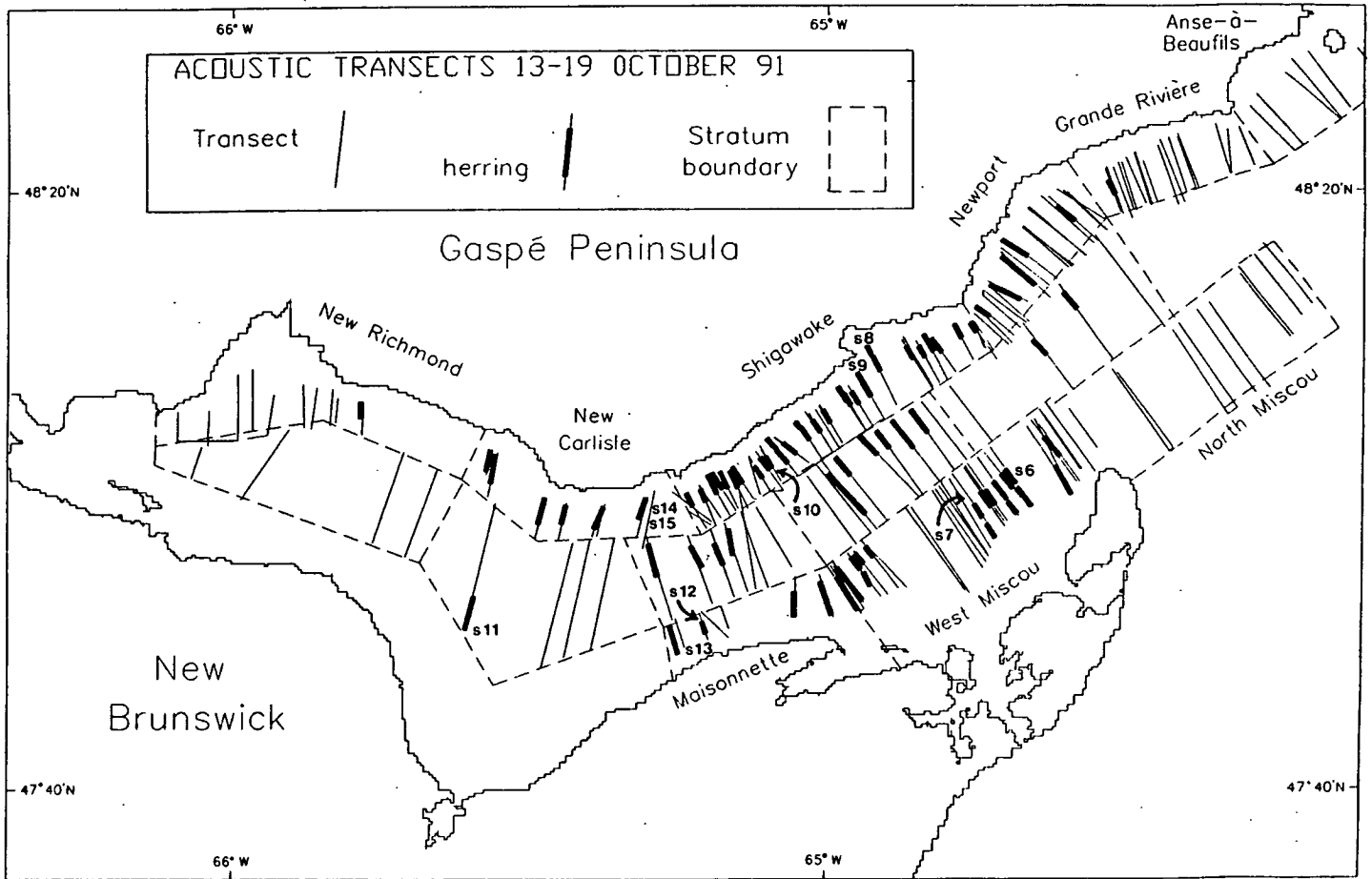


Fig. 4. Acoustic transects, herring distribution and set locations - Chaleur Bay, Gaspé and East Miscou, 1991.

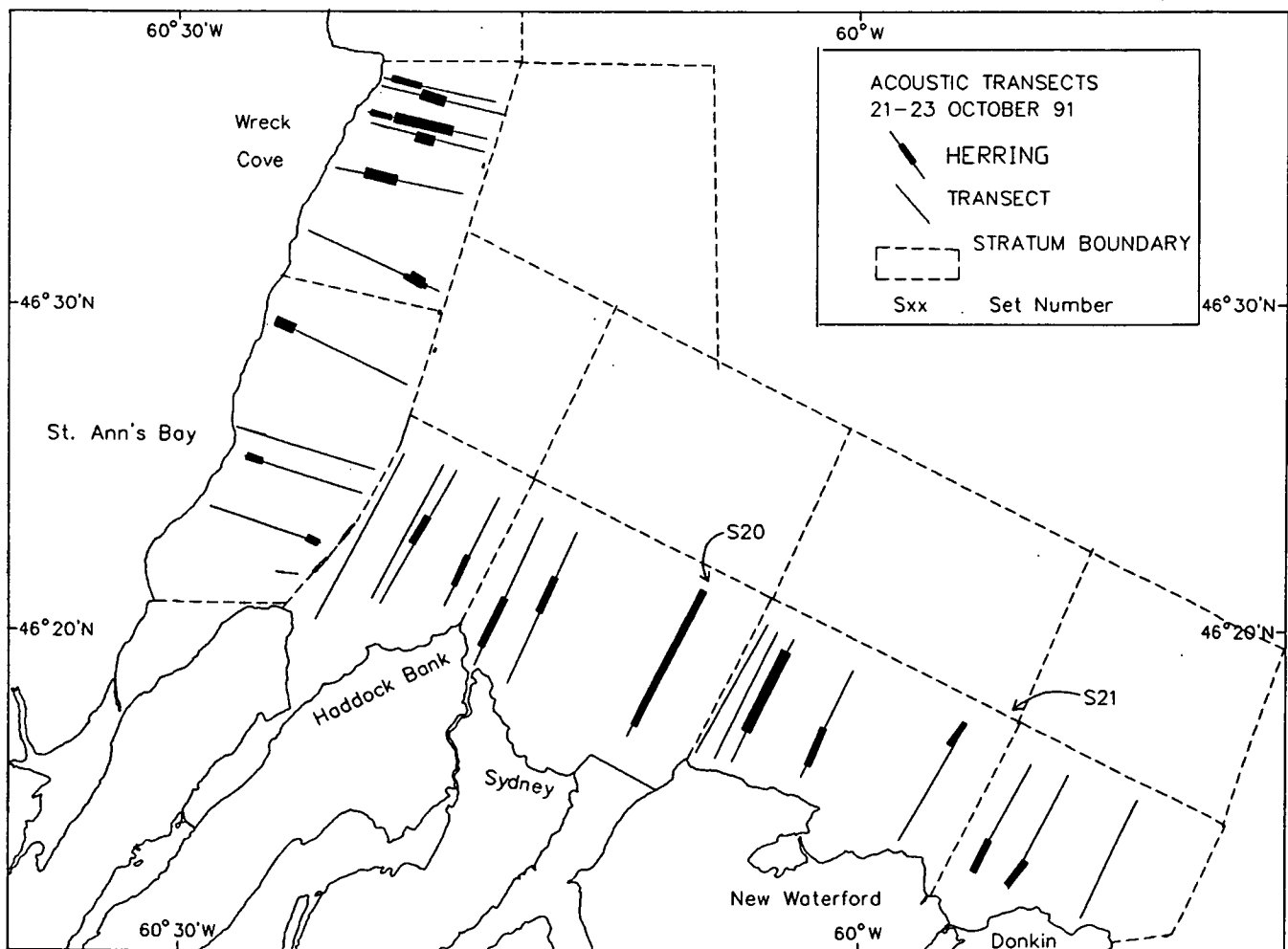
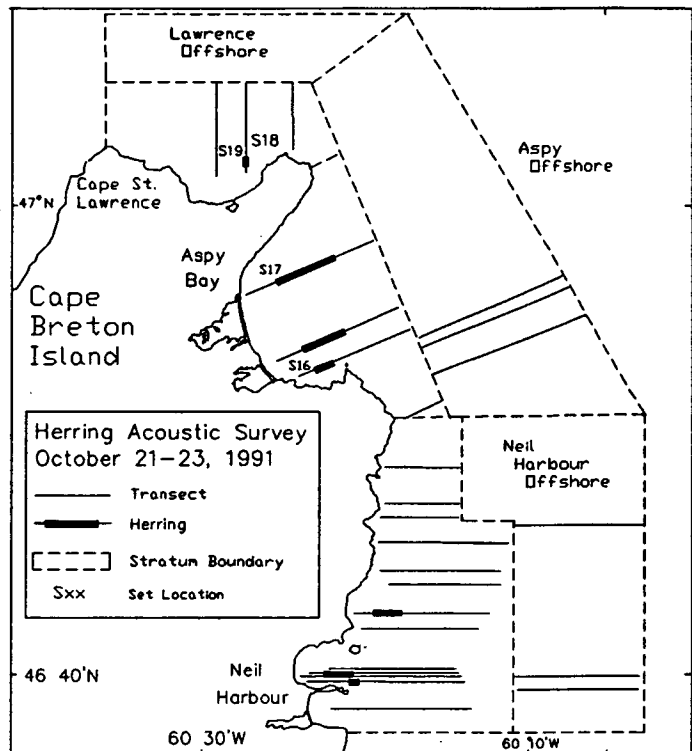
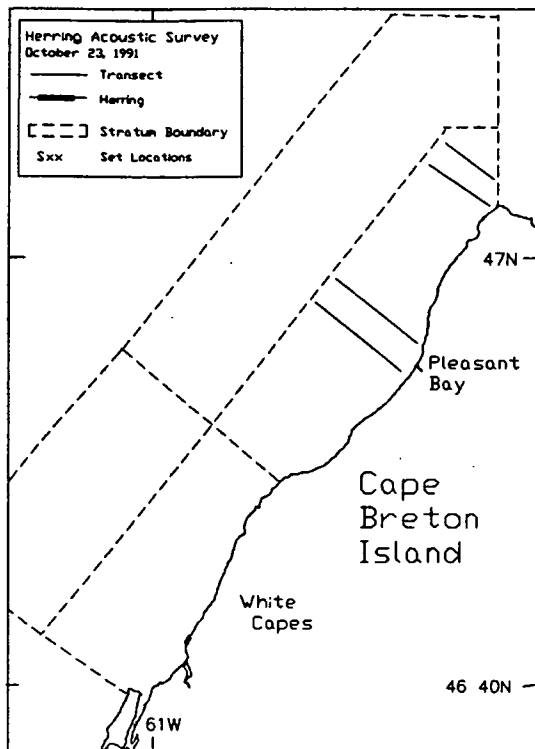


Fig. 5. Acoustic transects, herring distribution, and set locations - Cape Breton, 1991.

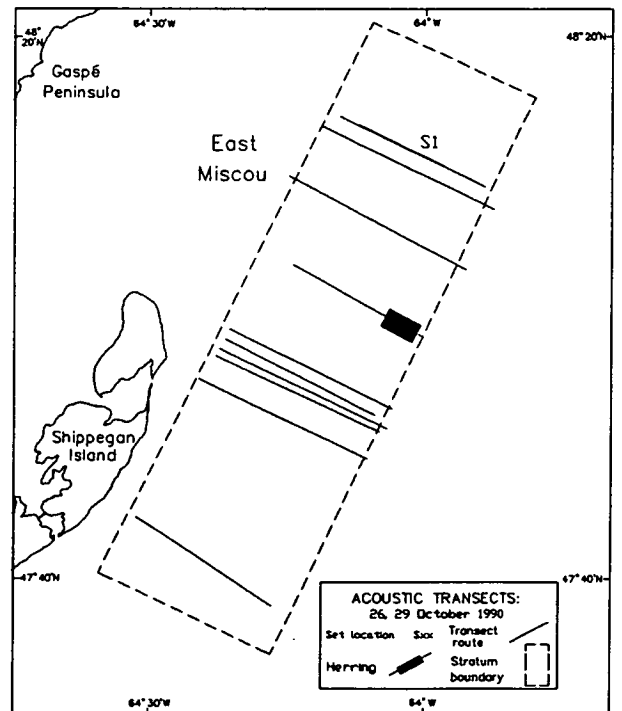
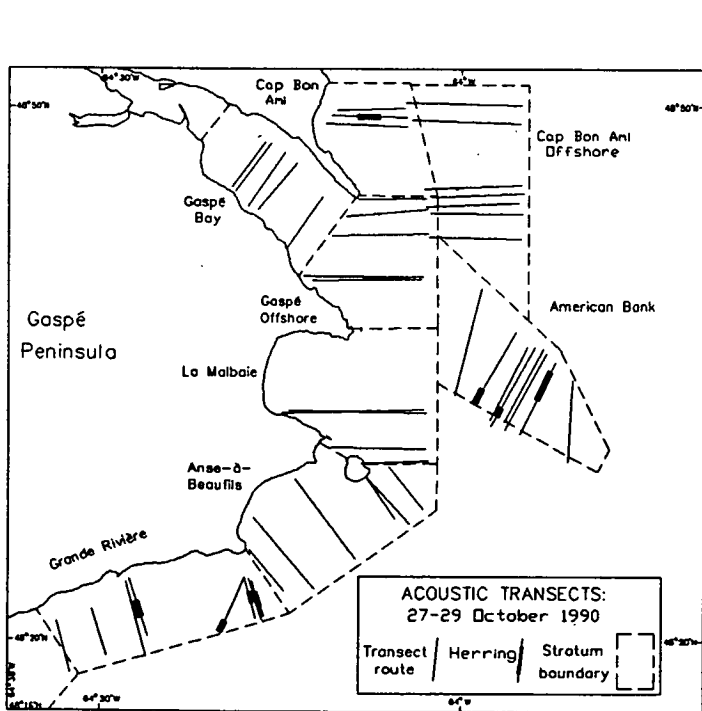
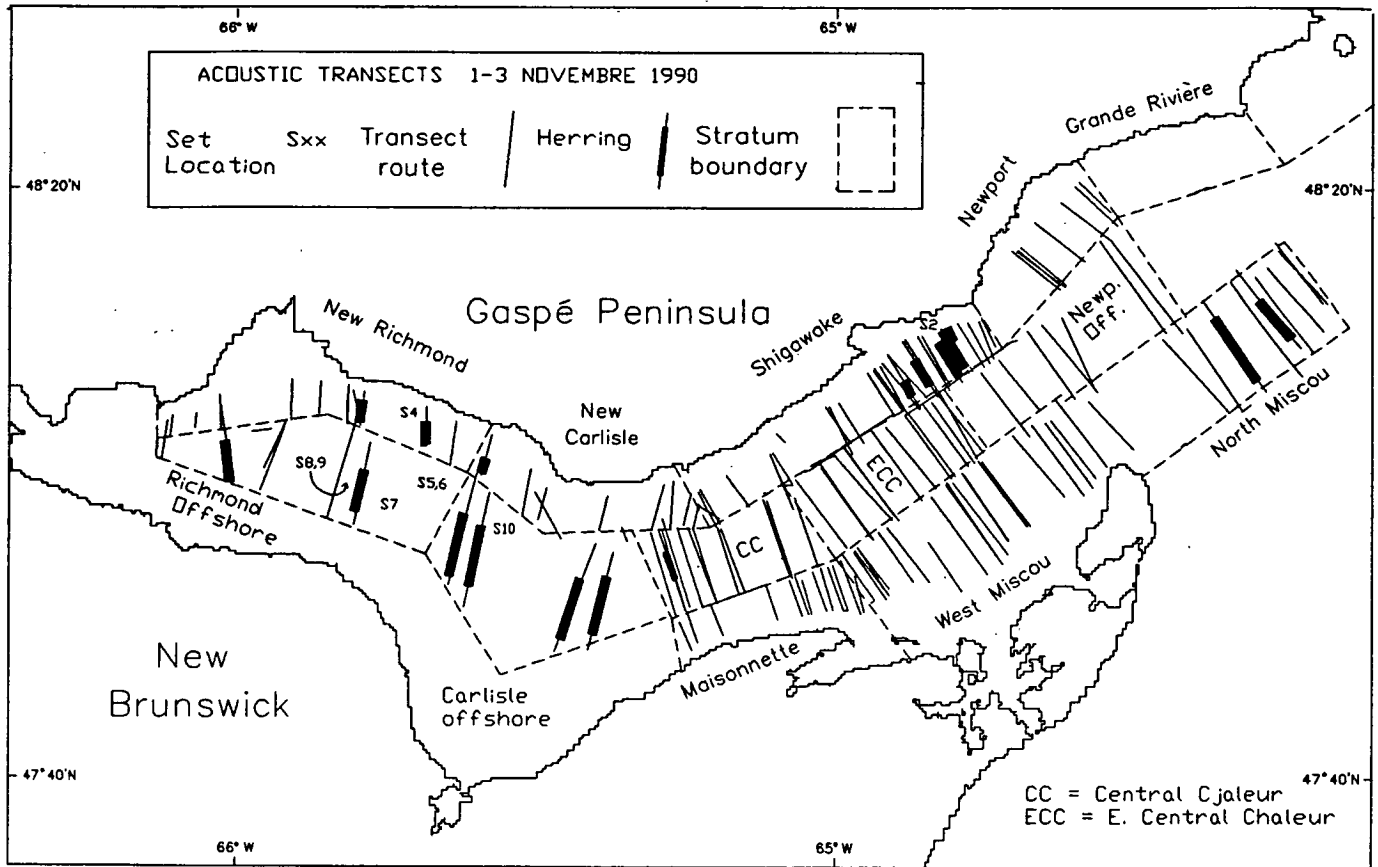


Fig. 6. Acoustic transects, herring distribution, and set locations - Chaleur Bay, Gaspe and East Miscou, 1990.

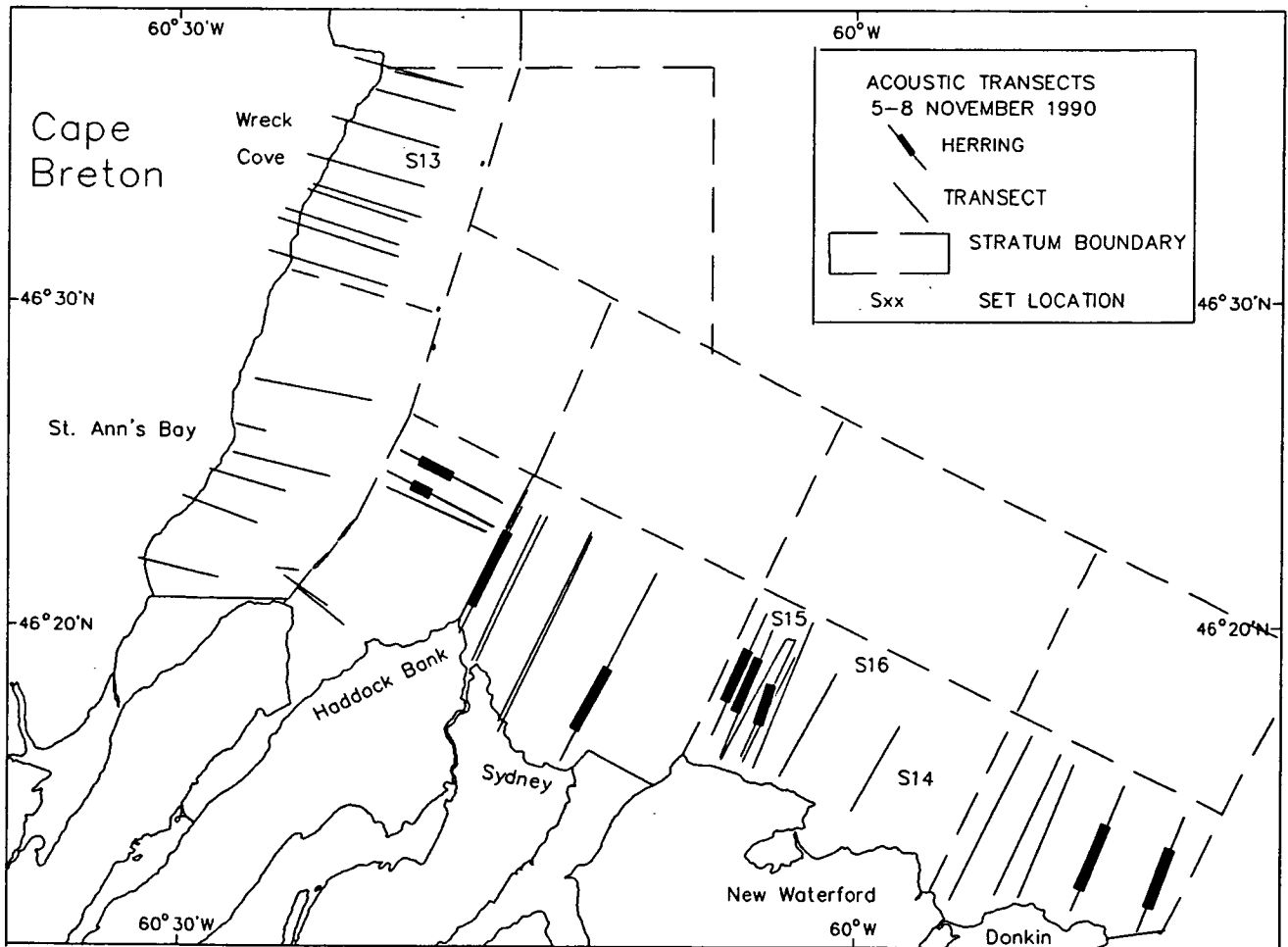
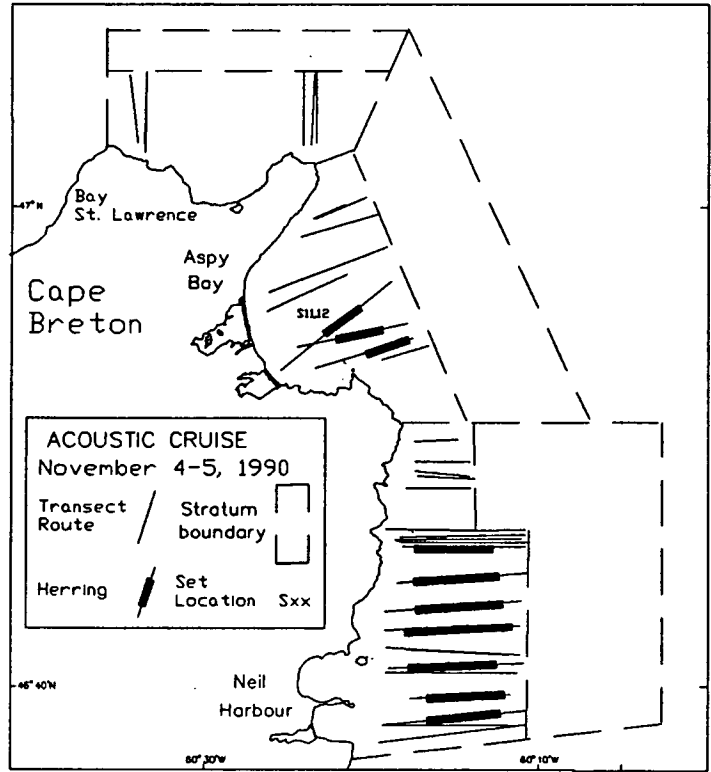
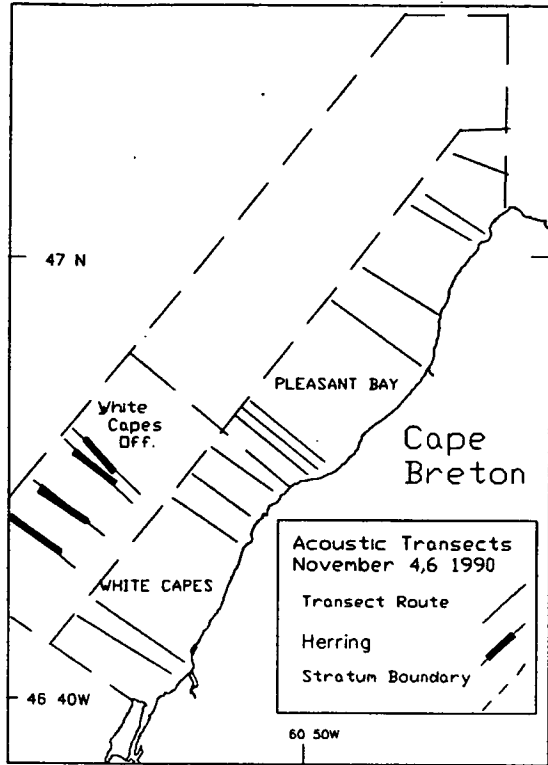


Fig. 7. Acoustic transects, herring distribution, and set locations - Cape Breton, 1990.

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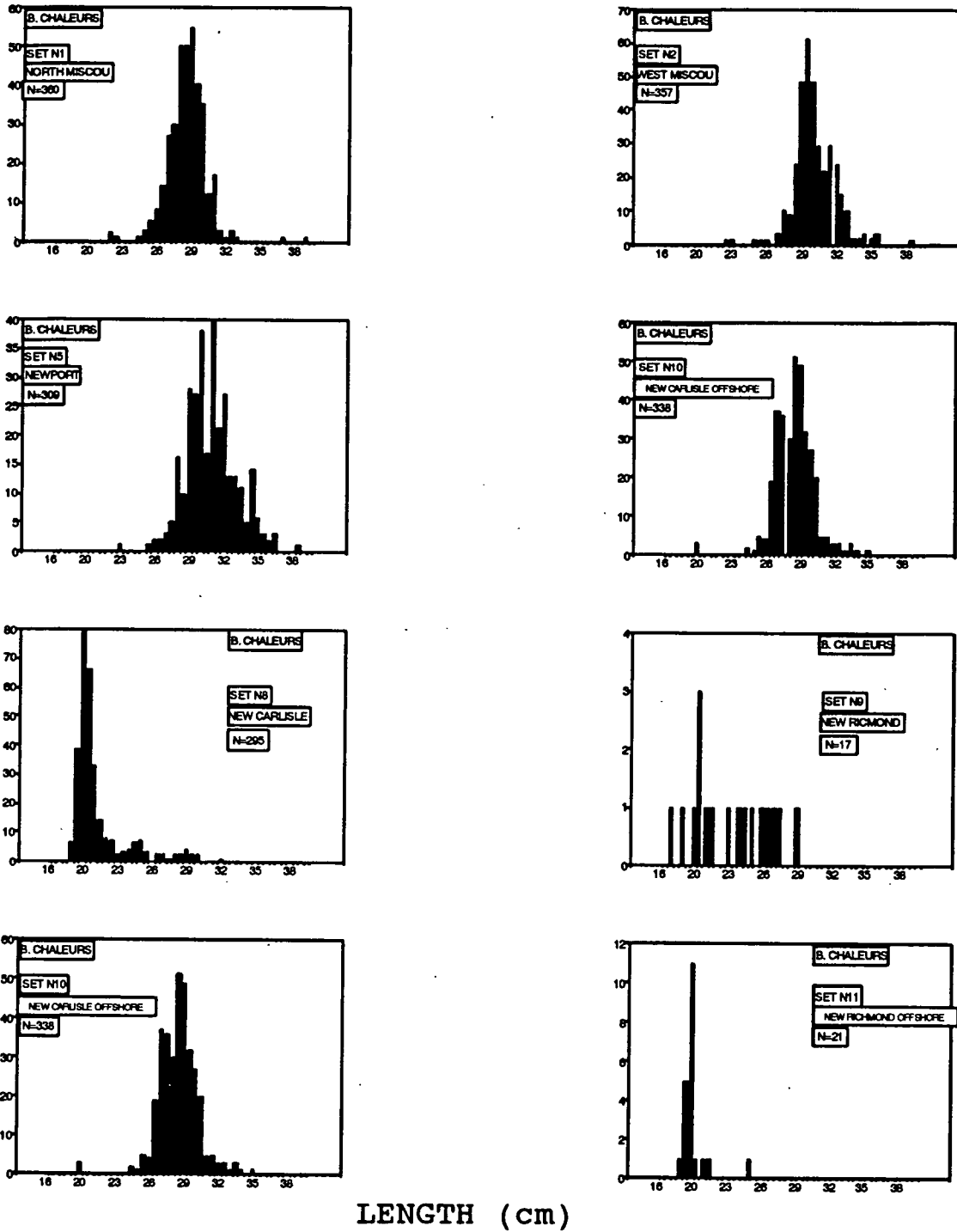


FIG 8a. 1992 Length frequencies of herring in the acoustic survey sets from the Chaleurs Bay area. See fig. 2 for set locations.

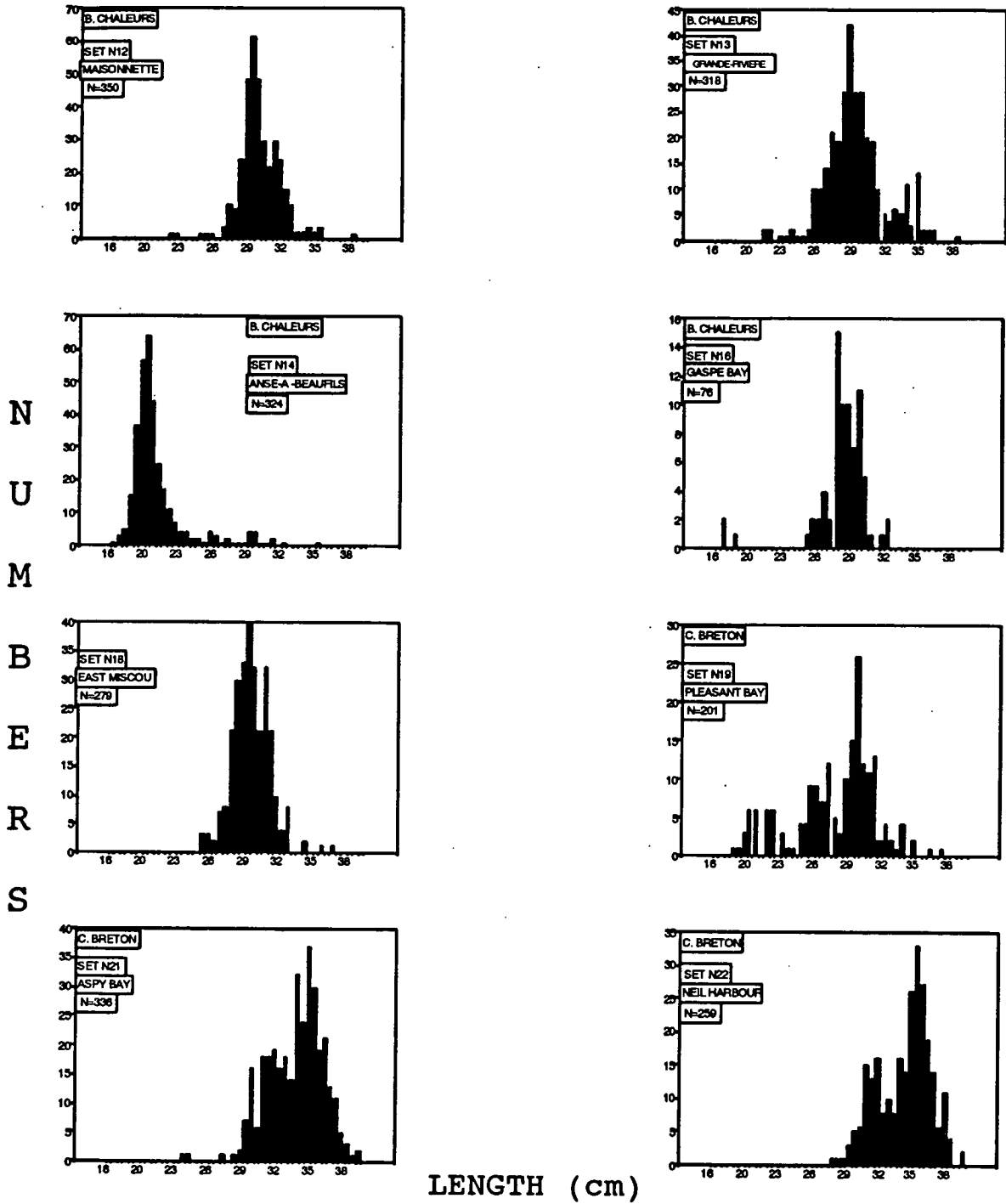
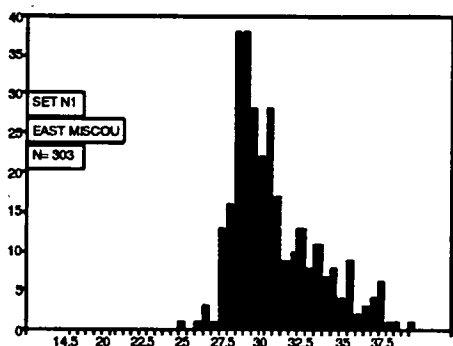
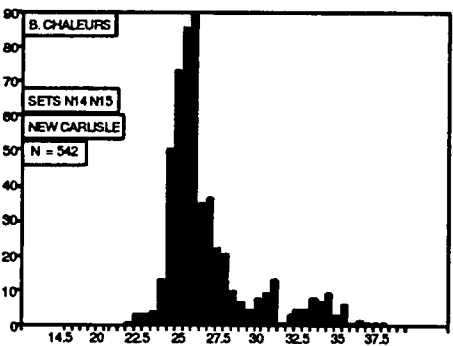
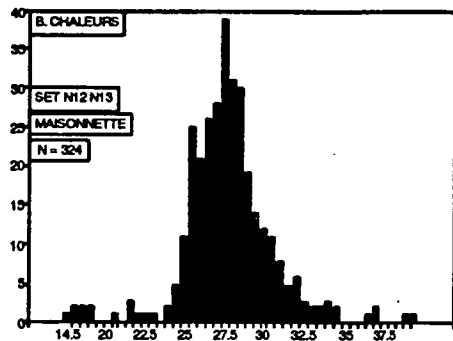
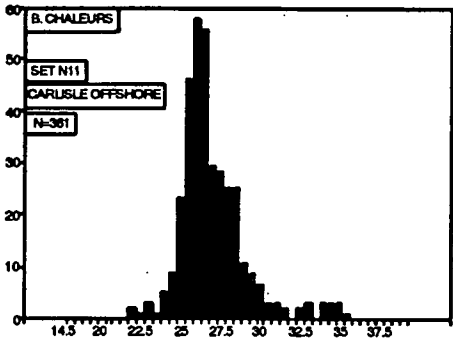
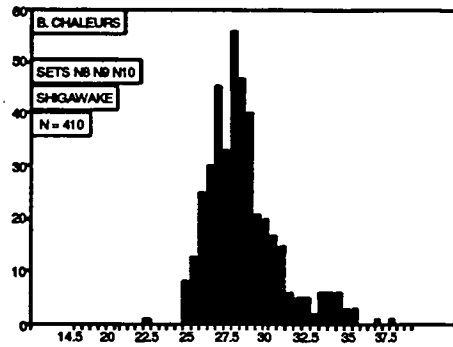
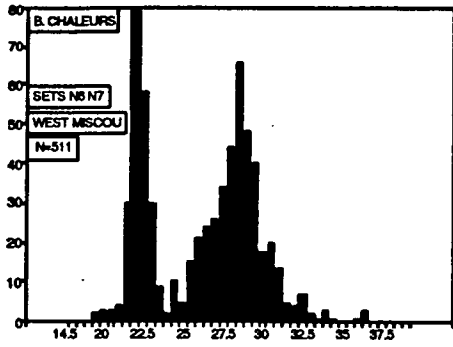


FIG 8b. 1992 Length frequencies of herring in acoustic survey sets from the Chaleur Bay and Cape Breton areas. See fig. 2 and 3 for set locations.

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LENGTH (cm)

FIG 9a. 1991 Length frequencies of herring in acoustic survey sets from the Chaleur Bay area. See fig. 4 for set locations.

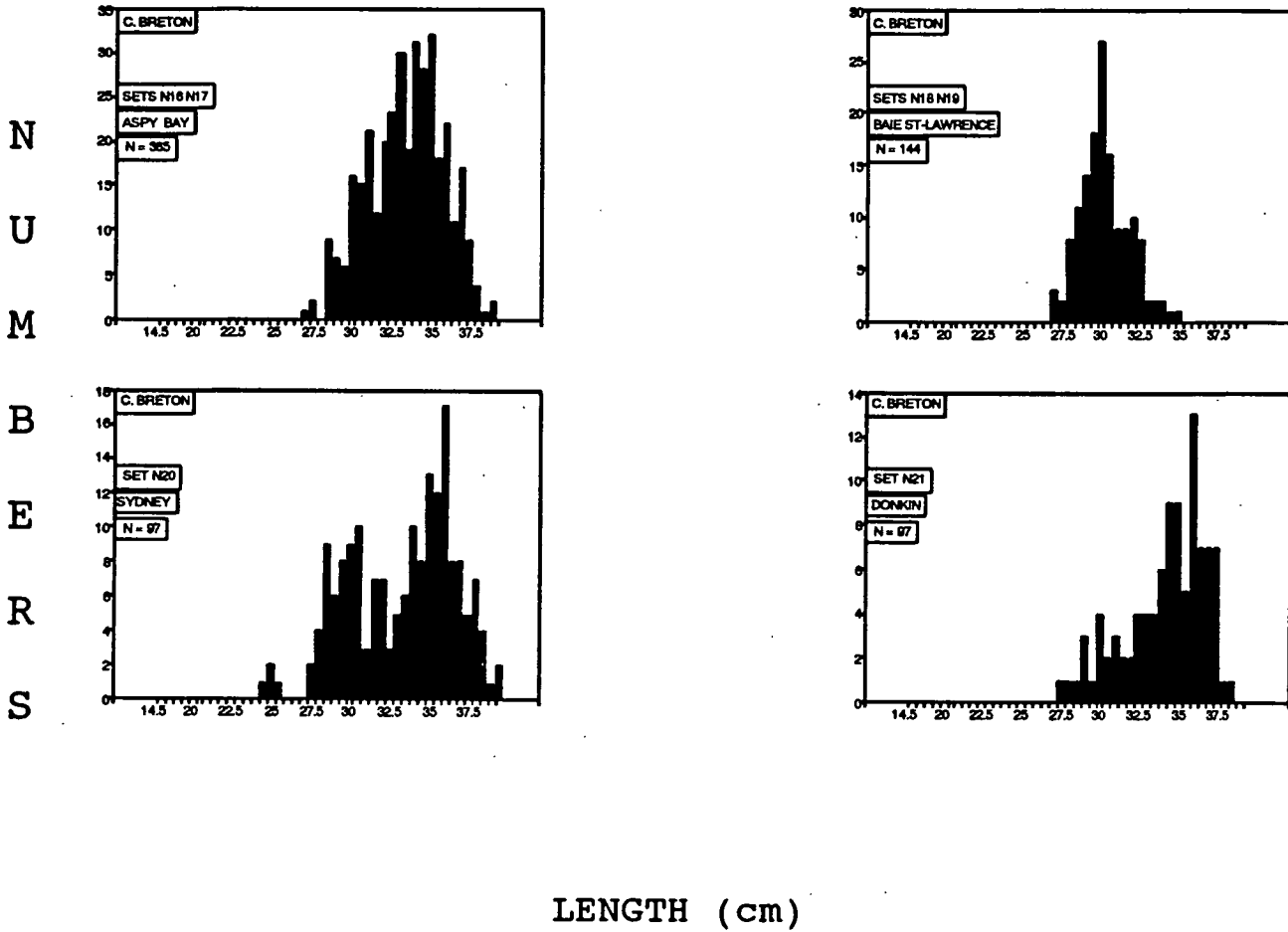
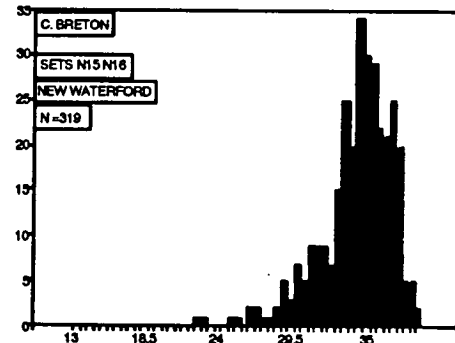
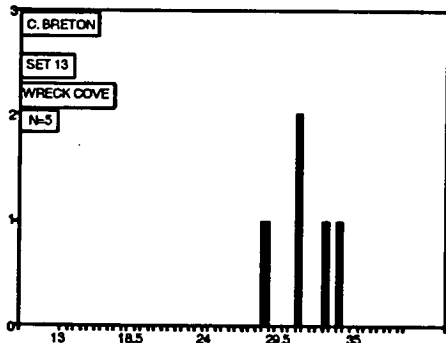
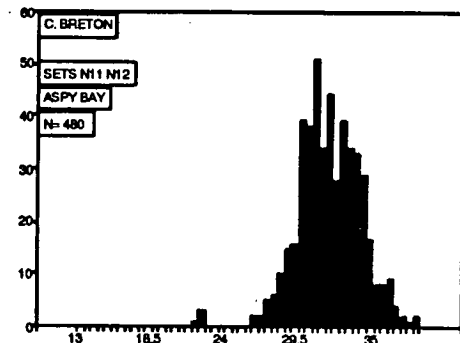
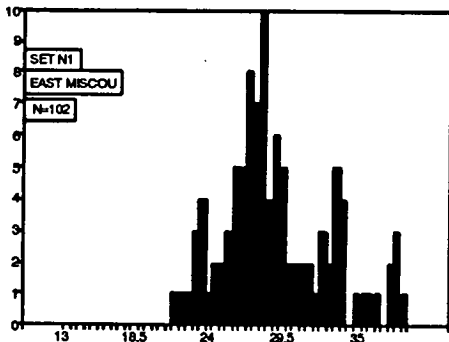
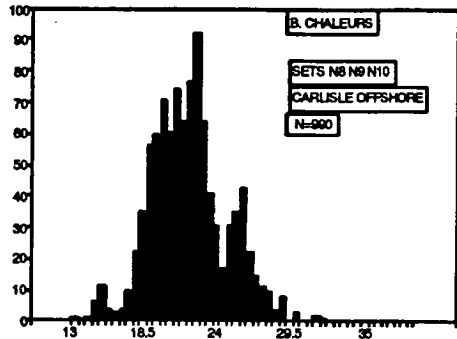
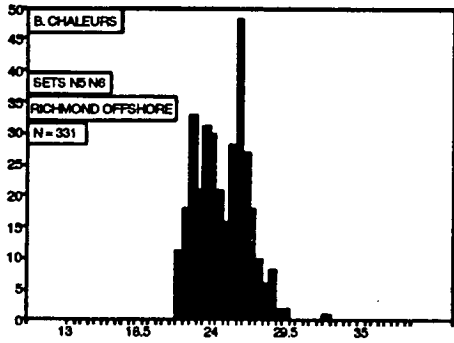
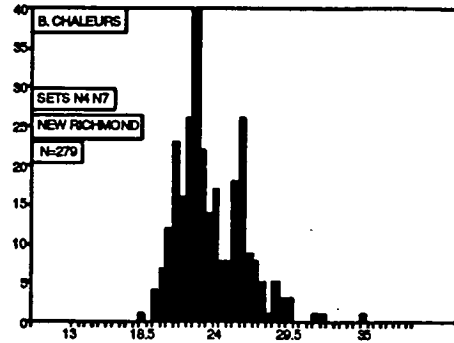
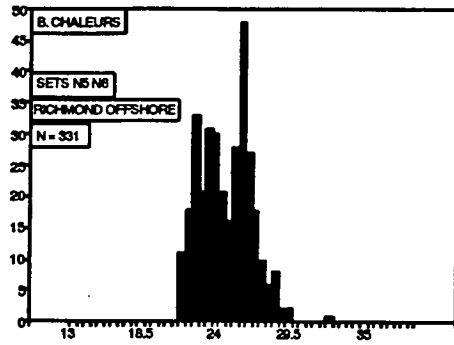


FIG 9b. 1991 Length frequencies of herring in acoustic survey sets from the Cape Breton area. See fig. 5 for set locations.

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LENGTH (cm)

FIG 10. 1990 Length frequencies of herring in acoustic survey sets from the Chaleur Bay and Cape Breton areas. See fig 6 and 7 for set locations.

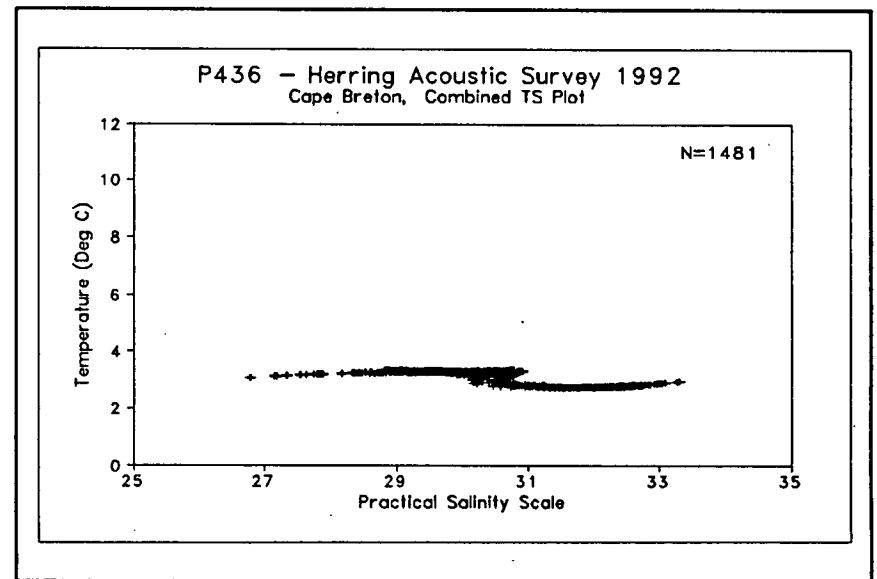
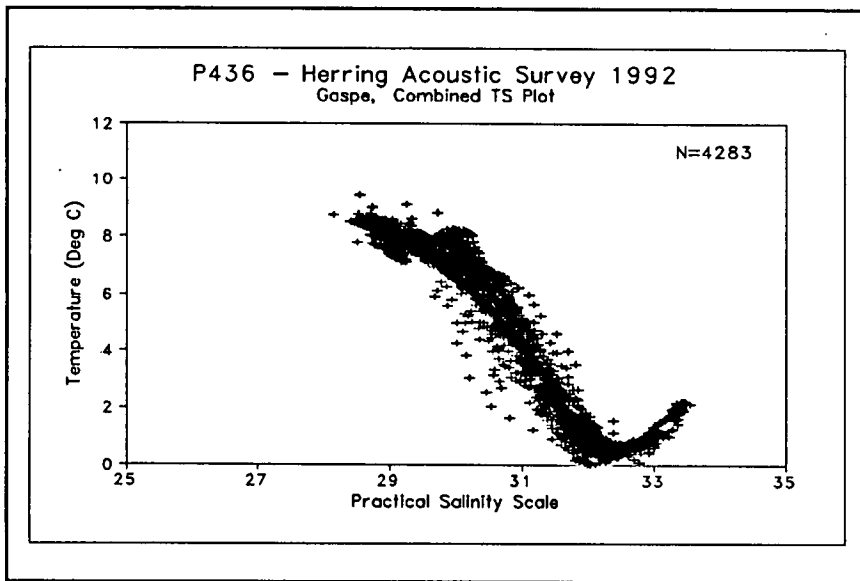
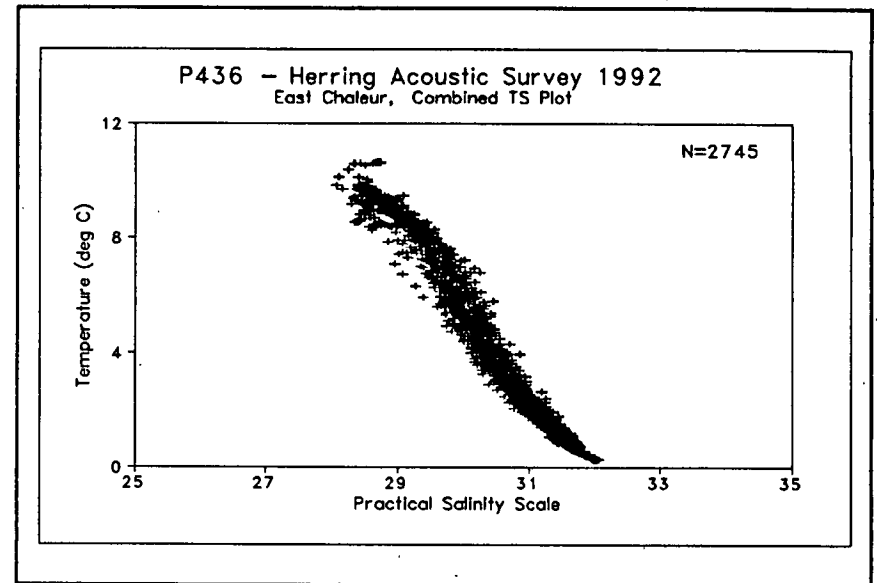
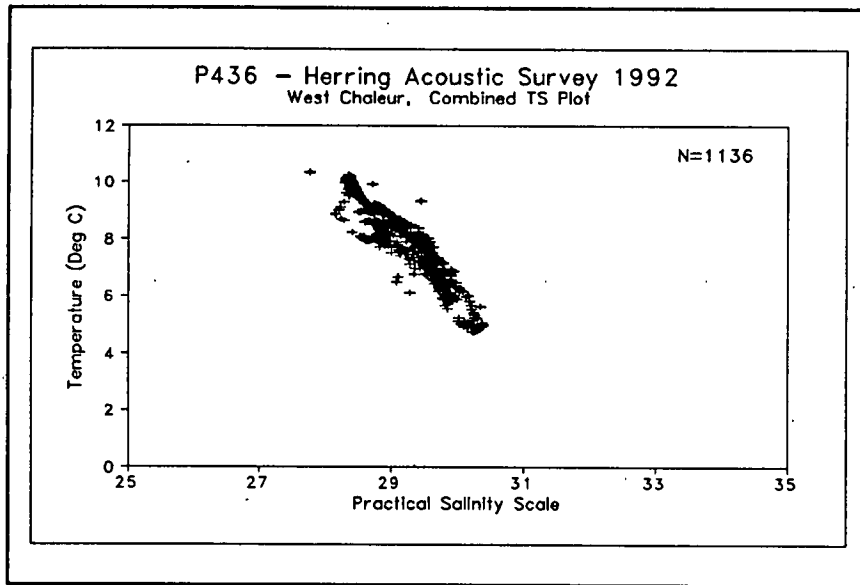


FIG. 11. 1992 combined temperature-salinity plots for four herring acoustic cruise areas.

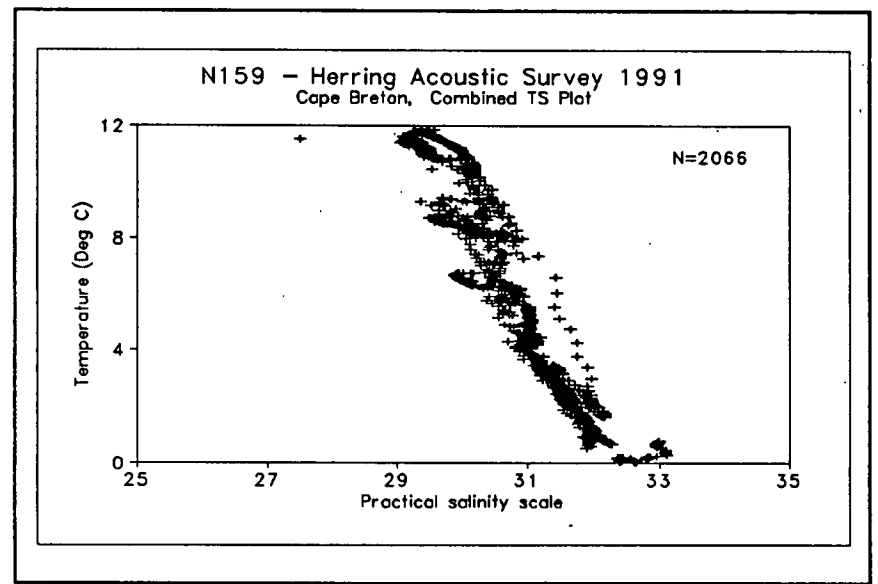
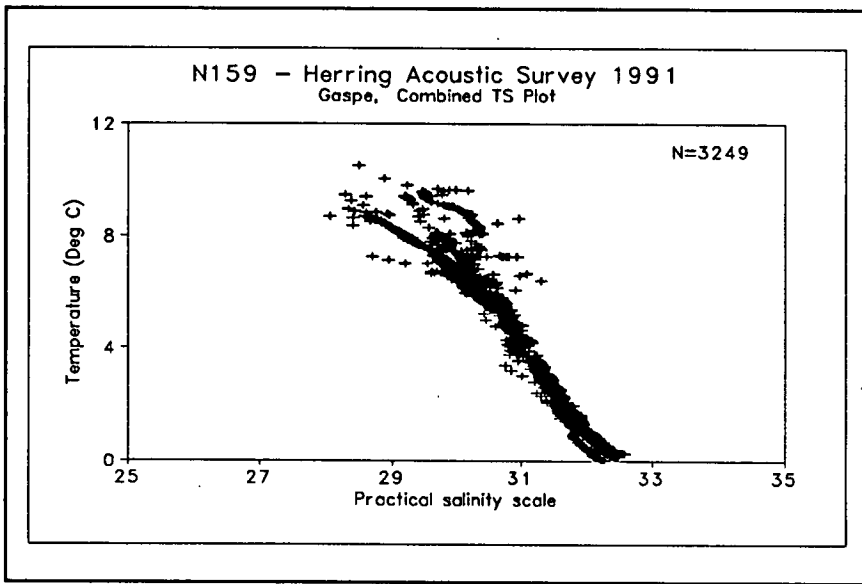
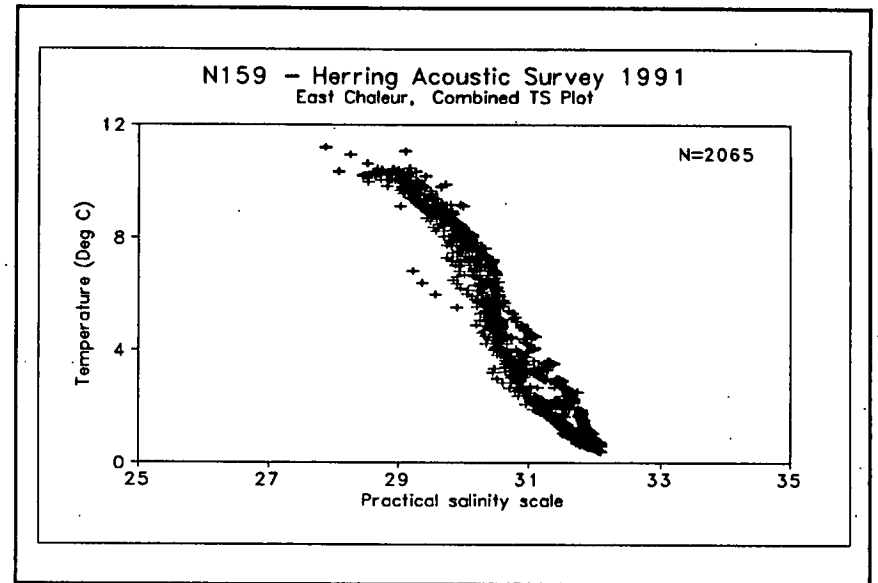
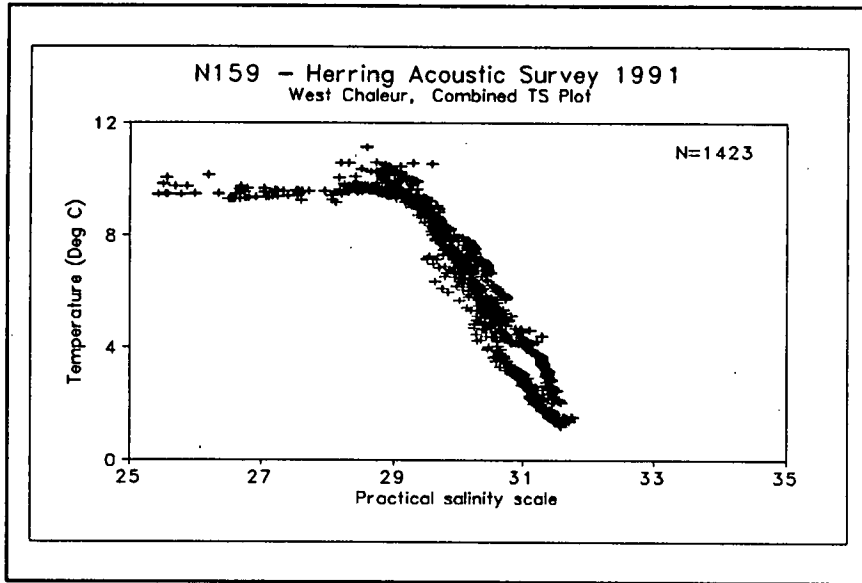


FIG. 12. 1991 combined temperature-salinity plots for four herring acoustic cruise areas.

Appendix 1. Formulas used in calculating values given in Tables 2-8. Unless otherwise indicated, lengths are in m, areas are in m^2 , time is in hours, area scattering coefficient is in sr^{-1} , total backscattering is in $m^2 sr^{-1}$, and mass is in tonnes.

Table 2-4 Formulas for individual transects

$$\text{Transect area} = 200 \times \text{transect length}$$

$$\text{Target strength in dB kg}^{-1} = (20 \log \text{ length} - 71.9) - 10 \log \text{ weight}$$

Notes: This equation is from Foote (1987). Length is mean length of fish in cm. Weight is mean weight in kg at this length.

$$\text{Total backscattering} = \text{transect area} \times \text{area scattering coefficient}$$

$$\text{Biomass density in kg m}^{-2} = \frac{\text{Area scattering coefficient}}{10^{\left(\frac{\text{target strength}}{10}\right)}}$$

$$\text{Total biomass in tonnes transect}^{-1} = \frac{0.001 \times \text{total backscattering}}{10^{\left(\frac{\text{target strength}}{10}\right)}}$$

Table 5-7 Formulas for strata

$$\text{Weighting factor} = \frac{\text{transect area}}{\text{mean transect area}}$$

$$\text{Stratum area scattering coefficient} = \frac{1}{\text{number of transects}} \times \left\{ \begin{array}{l} \text{weighting} \\ \text{factor} \end{array} \right\} \times \text{area scattering coefficient for each transect}$$

$$\text{Mean total backscattering per stratum} = \text{stratum area scattering coefficient} \times \text{stratum area}$$

$$\text{Variance of area scattering coefficient} = \frac{\left\{ \begin{array}{l} \text{weighting}^2 \\ \text{factor} \end{array} \right\} \times \left(\text{area scattering coefficient} - \frac{\text{mean of weighted area scattering coefficient}}{\text{number of transects}} \right)^2}{\text{number of transects} \times (\text{number of transects} - 1)}$$

$$\text{Variance of total backscattering} = \left(\frac{\text{stratum}}{\text{area}} \right)^2 \times \text{variance of area scattering coefficient}$$

Standard error of total backscattering = $\sqrt{\text{variance of total backscattering}}$

Stratum biomass density in kg m^{-2} = $\frac{\text{stratum area scattering coefficient}}{10} \times \frac{(\text{target strength})}{10}$

Total stratum biomass = $0.001 \times \text{stratum area} \times \text{stratum biomass density}$

Variance of biomass density = $\frac{\sum \text{weighting factor}^2 \times (\text{biomass density} - \text{mean of weighted biomass density})^2}{\text{number of transects} \times (\text{number of transects} - 1)}$

Standard error of total stratum biomass = $\sqrt{0.001^2 \times \text{stratum area}^2 \times \text{variance of biomass density}}$

Table 8 Formulas for survey areas

Mean total backscattering per survey area = $\sum \text{total backscattering for strata in survey area}$

Variance total backscattering per survey area = $\sum \text{stratum area}^2 \times \text{variance of stratum area scattering coefficient}$

Coefficient of variation of total backscattering per survey area = $\frac{\sqrt{\text{variance total backscattering per survey area}}}{\text{mean total backscattering per survey area}}$

Mean biomass per survey area = $\sum \text{biomass for strata in survey area}$

Variance of biomass per survey area = $0.001^2 \times \sum \text{stratum area}^2 \times \text{variance biomass density within strata}$

Coefficient of variation of biomass per survey area = $\frac{\sqrt{\text{variance of biomass per survey area}}}{\text{mean biomass per survey area}}$