CAFSAC Research Document 88/55

CSCPCA Document de
recherche 88/55

Status of the southern Gulf of St. Lawrence Giant scallop (Placopecten magellanicus) stock - 1987

by

Marc Lanteigne and Leslie-Anne Davidson

Department of Fisheries and Oceans
Gulf Fisheries Center
Science Branch
Invertebrate Division
Molluscan Aquaculture/Assessment Section
P.O. Box 5030
Moncton, N.B., E1C 9B6

ABSTRACT

The assessment of the giant sea scallop (Placopecten magellanicus) stock in the southern Gulf of St Lawrence was done by analysing data from logbooks, landing statistics and sea sampling on board commercial fishing vessels.

The comparison of 1986 and 1987 sea sampling size frequency distributions shows similar population structures. In 1987, higher percentages of prerecruits (scallops < 70mm) were observed in most fishing sub-areas. The exceptions were Miminegash/Richibucto, Borden/Cape Tormentine and Pictou Island sub-areas where lower percentage of prerecruits were noticed. Miminegash/Richibucto and Pictou Island size frequency distributions were showing an aging population.

CPUE calculation with logbooks and sea sampling data are contradictory. In 1987, major difficulties in collecting the data hindered the reliability of the CPUE calculations.

Management options proposed for 1988 are presented with the expected modifications of the stock assessment data collection programs. The modifications are aimed at improving the quantity and quality of the data needed for scallop stock assessment.

RESUME

L'évaluation de la population de pétoncles géants (Placopecten magellanicus) dans le sud du golfe du St. Laurent a été effectuée en analysant les données provenant de journeaux de bord, statistiques de débarquements et d'échantillonnages en mer à bord de bateaux de pêche commerciaux.

La comparaison des distributions de fréquences de tailles de 1986 et 1987 montre une similarité dans la structure de la population. En 1987, un plus grand pourcentage de prérecruits (pétoncles < 70mm) est observé dans presque toutes les sous-aires de pêche. Les exceptions sont les sous-aires de Miminegash/Richibucto, Borden/Cape Tormentine et Pictou Island où des pourcentages de prérecrues plus faibles sont observés. Les distributions de fréquences de tailles de Miminegash/Richibucto et Pictou Island montrent une population vieillissante.

Les calculs de PUE avec les données de journeaux de bord et d'échantillonnage en mer sont contradictoires. En 1987, des difficultés majeures lors de la récolte des données ont réduit la fiabilité accordée aux calculs des PUE.

Les options de gestion pour 1988 sont présentées ainsi que les modifications prévues aux programmes de récolte des données utilisées pour l'évaluation des populations. Les modifications ont pour but d'améliorer la qualité et d'augmenter la quantité des données nécessaires à l'évaluation des populations de pétoncles.

INTRODUCTION

The scallop fishery of the southern Gulf of St. Lawrence is characterized by large fluctuations of effort (number of active fishermen, size of dredge) and landings. It is mainly governed by socio-economic factors, and considered as a supplementary fishery with seasons and regulations often established around the lobster fishery. This particular situation of the scallop fishery, and the lack of historical information on the effort level and the catch per unit of effort (CPUE), had always made it difficult to evaluate the resource. From 1921 to 1979, resource surveys were sporadic and were mainly aimed at mapping or evaluating the resource on small commercial beds. Starting in 1982, the emphasis was put on estimating the level of effort and CPUE's. The logbook and the sea sampling programs, used on a small scale prior to 1980, were redesigned to cover all fishing grounds of the southern Gulf.

Using the data gathered from the logbooks, the sea sampling program and the landing statistics, the present paper comments on the status of the giant sea scallop (Placopecten magellanicus) fishery in the southern Gulf of St. Lawrence.

MATERIAL AND METHODS

1 - Commercial sea sampling (Appendix I).

The sea sampling program consisted of a team of observers going onboard commercial fishing vessels to record catch and effort information. For each selected tow, all the scallops from one (1) or more buckets, depending on the quantity of scallops in each bucket, were sampled. The shell height (from umbo to distal margin) of each scallop was measured to the nearest millimeter. The duration of the tow and the width of the bucket(s) were recorded. Data were used to plot size frequency distributions (3 mm size classes) of commercial catches during the regular fishing season. They were also used to calculate the catch per unit of effort (CPUE) in kg of meat/m·hr.

2 - Logbooks.

A voluntary logbook program was organized, financed and monitored by the Science Branch. Data were collected using the same approach as in 1986 (Lanteigne et al., 1987). Instead of distributing logbooks to all scallop fishermen (active and non-active) as with conventional logbooks, a number of fishermen were selected. The selection was based on the level of interest shown by fishermen during the previous year and referrals from fishermen. Each selected fisherman was contacted and given a logbook with the agreement that he was going to fill it. The logsheet returns were monitored throughout the fishing season by research staff. Direction and motivation to participate in the program were given to the fishermen by phone and letter communications. The fishermen selection was not based on the best or the most active fishermen, but was aimed at providing the

best spatial and temporal representation of the fishery.

The logbook was designed to acquire the following information:

- Location of the fishing activity, reported as one or more "fishing square(s)" from a numbered grid covering the southern Gulf (Figure 1).
- Estimation of the daily catch (meat weight).
- Total number of tows for each fishing day reported.
- Average duration of each tow.

3 - Catch per unit of effort (CPUE) calculations.

CPUE's were calculated using commercial sea sampling and logbook data. The CPUE's, expressed as kg of meat per meter (width) of dredge, per hour of towing (kg/m·hr), were calculated for each tow sampled as follows:

$CPUE_i = W_i/(L_i \times T_i)$ where

W_i = total meat weight (kg) of the catch for the i^{th} tow.

L_i = total bucket(s) width (m) for the i^{th} tow.

T_i = duration (hr) for the i^{th} tow.

For the sea sampling, the total meat weight of the catch was estimated by transforming shell height into meat weight using meat weight/shell height relationships calculated from samples collected in 1982 and 1985 (Worms and Chouinard, 1983; Worms, 1984; Worms and Davidson, 1986). Only commercial size scallops ($\geq$70 mm) were considered in the calculations. The parameters of the allometric equations for each sub-area are presented in Table 1. Estimated total meat weights (W) were calculated as:

$$W_i = \left(\sum_{j=1}^{n_i} W_{ij}\right)/1000 \quad \text{where}$$

W_{ij} = calculated meat weight (grams) for the j^{th} scallop of the i^{th} tow.

n_i = total number of scallops $\geq$ 70 mm in the i^{th} tow.

These calculations were performed assuming that:

a) Fishermen are only keeping scallops with shell heights 70 mm.

b) The meat weight/shell height relationships had not changed since 1982.

4 - Landing statistics.

Since 1985, each transaction entered on file by the Statistical Branch was identified with CFV number of the vessel. With this information, the effort can now be calculated in terms of number of active fishermen.

As in 1986, the data provided by the logbook returns and the commercial sea sampling program were sorted by sub-areas within fishing areas (Figure 1). The sub-area delimitations were chosen considering the fishing bed distributions and the fishing community boundaries created by fishermen. Landing statistics were also sorted by sub-areas. A map and a list of the statistical districts are presented in Figure 2.

RESULTS

1 - Sea sampling.

A summary of sea sampling results from 1982 to 1987 is presented in Table 2 for all sub-areas. Size frequency distributions are presented in Figure 3. The average CPUE's calculated for each sub-area are presented Table 3.

Area 21 (Baie des Chaleurs and Miscou/Val Comeau).

The total length of the sea sampling performed in the Baie des Chaleurs sub-area was 14 days in 1987. The shell heights of all the scallops measured range from 11 mm to 146 mm with an average size of 88.6 mm (SD=22.18). Major modes are present at 78 mm and 108 mm (Figure 3). Prerecruits (scallops < 70 mm shell height) represent 23.0% of all the live scallops measured prior to the sorting and discard of undersize scallops by the fishermen. This is almost twice the percentage observed in 1986 (12.0%). The average CPUE for the Baie des Chaleurs sub-area is 0.82 kg/m·hr (SD=0.54, Table 3).

Three (3) days of sea sampling were performed in the Miscou/Val Comeau sub-area. Scallop sizes range from 48 mm to 149 mm with an average size of 92.6 mm (SD=25.55). Modes are present at 66 mm, 93 mm and around 120 - 123 mm (Figure 3). Prerecruits represent 31.5% of all the live scallops measured which is four times the percentage estimated in 1986. The average CPUE for the sub-area is 0.42 kg/m·hr (SD=0.26, Table 3).

Area 22 (Miminegash/Richibucto and Borden/Cape Tormentine).

Six (6) days of sea sampling were performed in the Miminegash/Richibucto sub-area (western section of area 22). Shell heights range from 36 mm to 150 mm (Figure 3) with an average size of 119.5 mm (SD=14.66). A major mode is present at 120 mm. Prerecruits represent 0.4% of the live scallops. This value is about nine times lower than the 1986 value. The average CPUE is 0.71 kg/m·hr (SD=0.32), a decrease of 36% since 1986 (Table 3).

Eight (8) days of sea sampling were performed in the Borden/Cape Tormentine sub-area (eastern section of area 22). The size frequency distribution ranges from 33 mm to 141 mm (Figure 3) with an average size of 97.7 mm (SD=17.37). Modes are not as clearly delineated as in the Miminegash/Richibucto sub-area size distribution. Prerecruits represent 5.9% of the live scallops measured which is 4.5 times lower than the 1986 value. The average CPUE for the sub-area is 0.85 kg/m·hr (SD=0.56). This value is similar to the 1986 value of 0.90 kg/m.hr (SD=0.46, Table 3).

Area 24 (Pictou Island and Boughton Island)

Sixteen (16) and four (4) days of sea sampling were performed in the Pictou Island and Boughton Island sub-areas respectively.

In the Pictou Island sub-area, the scallop shell heights range from 39 mm to 136 mm with an average size of 102.6 mm (SD=12.53). One mode is present at 111 mm. The number of prerecruits is 1.7% of all the live scallops measured, a decrease of 83.2% from the 1986 value. The average CPUE for the sub-area is 1.24 kg/m·hr (SD=0.62). This value is slightly higher than the 1986 value of 1.12 kg/m·hr (SD=0.69, Table 3).

In the Boughton Island sub-area, scallop sizes range from 47 mm to 118 mm with an average size of 85.3 mm (SD=13.3). The major modes are at 74 mm, 86 mm, and 96 mm. Prerecruits represent 13.9% of all the live scallops measured and had increased by 46.3% compared to the 1986 value. The average CPUE for the sub-area is 1.30 kg/m·hr (SD=0.96, Table 3).

2 - Logbook program (Appendix II).

The average CPUE's for each sub-area are presented in Table 4 for 1985, 1986 and 1987. Even with the low number of logsheets returned in 1987, results from the fishing squares reported suggest that the effort distribution in the southern Gulf of St. Lawrence is approximatively the same as in 1986.

3 - Landing statistics.

Scallop landings are presented in Figure 4 for each fishing area and for the entire southern Gulf of St. Lawrence. The number of scallop licences and active fishermen are presented in Table 5 from 1983 to 1987. The 1987 statistical data are preliminary and were not considered in the interpretation of the results herein.

4 - Yield per recruit.

Since last year (1986) assessment, no additional data on natural mortality at age, and historical catch and effort were available to improve the calculation of the yield per recruit.

Therefore, results are not presented again in this paper. Calculation results and discussions can be found in the 1985 and 1986 scallop stock assessment reports (Worms et al., 1986; Lanteigne et al., 1987).

Discussion

Difficulties were encountered during the 1987 data collection:

1 - Fishermen participation in the scallop logbook program has decreased compared to 1985 and 1986. Therefore, results had to be carefully evaluated for each sub-area.

2 - The reliability of the sea sampling data in some sub-areas was questionned. The major concern was that the fishing gear description may not have been recorded properly and this could have affected the CPUE calculation.

A - Baie des Chaleurs sub-area (fishing area 21).

The two (2) modes characterizing the sea sampling size frequency distribution in 1987 were noticed in 1986 (Lanteigne et al., 1987) in the survey and sea sampling data. Looking at the 1985 survey size distribution (Figure 3), it seems that the mode around 38 mm is now recruited to the 1987 fishery as the 74 mm mode. These observations support the assumption of cyclic scallop abundance variations mentionned by Caddy (1979) and that scallop year-class success is strongly influenced by environmental factors (Dickie, 1955; Caddy, 1979). Cycle of good CPUE's and catches were suggested to occur every five (5) years in the Bay of Fundy (Dadswell and Chandler, 1984). Unfortunately, catch and effort data are still incomplete at this time to fully understand and estimate a possible cycle period for the southern Gulf of St. Lawrence scallop stocks.

B - Miscou/Val Comeau sub-area (fishing area 21).

Due to the lack of logbook returns and the limited sea sampling in 1987 a proper resource evaluation in this sub-area was not possible.

C - Miminegash/Richibucto sub-area (fishing area 22).

The size frequency distribution from the 1987 sea sampling revealed a major mode at a larger size (120 mm) than the mode observed in 1986 (96 mm). Percentage of prerecruits has also decreased from 3.5 % in 1986 to 1.5 % in 1987. These two characteristics indicate an aging population which may suggest that the 1986 recruitment into the fishery was insufficient to maintain the stock structure at a stable level. This could be the result of a recruitment pulse fluctuation generally seen in scallop stocks. It is difficult to consider the CPUE's calculated from sea sampling and logbook data for further

analysis of the fishery. The values calculated from the two sources are contradictory and are assumed to be the result of bias in sea sampling data and/or logbook data.

D - Borden/Cape Tormentine sub-area (fishing area 22).

Since 1982, the scallop size ranges from sea sampling and survey have broadened. The change is more pronounced in 1987 as scallops > 120 mm are getting more abundant. Assuming that the effort in 1987 is similar to 1986, this may suggest that the recruitment potential into the fishery is strong enough to maintain or increase the exploited biomass in this sub-area. Unfortunately, as in Miminegash/Richibucto sub-area, the CPUE's calculated from logbook and sea sampling data are contradictory and cannot be used to support this assumption.

E - North of P.E.I. sub-area (fishing area 23).

Scallop resource in this sub-area has never been investigated. Landings are sporadic from year to year (Figure 4) presumably due to effort fluctuations (number of active fishermen and number of fishing days).

F - Pugwash sub-area (fishing area 24).

The number of active fishermen in the Pugwash sub-area is also limited. The few logbook returns analysed in 1987 do not allow further discussion on the status of the resource. Discussions with fishermen from this sub-area revealed that most of their effort was in the Pictou Island sub-area.

G - Pictou Island sub-area (fishing area 24).

The low abundance of small scallops in 1987 sea samples when compared to 1986 sea samples suggests that a low pulse of recruitment has resulted in an aging scallop population. The abundance of prerecruits has decreased by 83.2 % from 1986 to 1987. This may suggests that future landings may not be as good as the landings experienced in 1986. The 1986 landing value may have been one of the numerous peaks of high landings which characterized most of the areas in the southern Gulf of St Lawrence. Analysis of the historical landings since 1967 (Figure 4), revealed that increases in landings occur over one or two years at the most, and are followed by a drop. It has been suggested that landing fluctuations are related to recruitment pulses at the larval or juveniles stages (Dickie, 1955). It is presently impossible to predict or to quantify the level of these recruitment pulses. Therefore, the amplitude of a theoretical drop in landing that could happen in a near future cannot be estimated. Fishermen from the sub-area have mentionned that the 1987 catches were overall similar to 1986, which supports the similar CPUE's calculated from logbooks in 1986 and 1987 (Table 4). The decrease in landing for 1987 is only the reflection of the decrease in the number of active fishermen (Table 5).

H - Boughton Island sub-area (fishing area 24).

This sub-area also characterized by few logbook returns and little sea sampling data. Size frequency distributions in 1987 are similar to that of 1986 (Figure 3), which may suggest a stable population structure. As in the Pictou Island sub-area, landings are fluctuating and no trend can be detected.

The results of CPUE calculations from logbook and sea sampling data are sometimes contradictory. It is assumed that CPUE's calculated from sea sampling data are more accurate than the ones calculated from logbook data, because sea observers are onboard the fishing vessel collecting the data. However, as mentionned previously, problems were encountered during the 1987 sea sampling. In some sub-areas, the information requested was not recorded properly. It should be mentionned that the sea sampling work is contracted out and not done by the same staff each year, and that the staff may also change during the fishing season. The actual sea sampling program has been in place for 2 years, and still has to be improved.

The logbook program may also have to be revised. CPUE's calculated from logbooks are more subject to bias than those calculated from sea sampling. Catch and effort information (towing time, number of tow for each fishing day) are subjective values, as they are estimated by fishermen at the end of each fishing day. Fishermen have criticized the present logbook for being to complicated and lengthy to fill (see Appendix III). For 1988, a new logsheet format will be issued (see Appendix III). Instead of calculating CPUE's in kg of meat/m·h, the logbook data will be used to calculate catch (kg of meat)/day. These changes will not eliminate the subjectivity of the information received but they are aimed at increasing the fishermen's participation without loosing on the quality of the information.

Since 1985, Canadian Fishing Vessel (CFV) numbers are recorded on each sale transaction. The number of fishing vessel or active fishermen can now be estimated. Catch/day have been calculated from these data but the results were unrealistic. These calculations were based on the assumption that catches are sold daily and that the fishing activities are taking place in the same sub-area where the catches are sold. These assumptions are not always true. Fishermen can keep their catches for up to seven (7) days before selling them in one transaction and they may land catches from one sub-area into a different sub-area. It would be difficult to identify the source of the catch and the number of fishing days involved in a multiple day catch. The catch/day and the number of fishing days estimated from landing statistics would have to be adjusted using correction factors calculated from logbook and sea sampling data. This will imply improving the representativity of the data gathered through the logbook and the sea sampling programs.

Separating landings between sub-areas (Figure 4) did not show any characteristics, or patterns. As mentionned by Jamieson (1978) it seems that the recruitment into the fishery is quickly fished, not allowing the exploited biomass to increase in size.

This may explain part of the sporadic landing fluctuations seen in most of the fishing areas of the southern Gulf. The only exception seems to be area 21 where historical data show smooth fluctuation of landings. This may be related to a more stable cyclic recruitment pattern or/and a fishing strategy different from the rest of the Gulf. More biological data and information on the fishery are needed to fully understand the mechanisims involved.

CONCLUSION

The difficulties in making short or long term predictions on the scallop resource fluctuations in the southern Gulf of St. Lawrence have been mentionned in previous assessment documents (Worms et al., 1986; Lanteigne et al., 1987). The situation prevailing in the scallop fishery makes it difficult to provide a sound evaluation of the resource. The regulations, the fishing gear and the fishing strategies are very different between fishing areas and vary from year to year. These factors can not be considered in the assessment and add to the biases when data are gathered for assessment purposes.

Yield per recruit models have been presented in the past (Worms et al., 1986; Lanteigne et al., 1987) for a range of fishing mortality, natural mortality and age at capture values. But, none of them have been used to their full extend because the actual parameters of the fishery are unknown. If an analytical assessment is to be provided, a consistant year to year description of the effort, catch, and age composition is needed.

The reported landings and estimated effort fluctuations are certainly related to changes in biomass. But, they are also related to complex socio-economical factors. It is suspected that:

1 - Fluctuations in price offered to the fishermen for the scallop meat is known to result in effort fluctuations. Fluctuations may not be seen in terms of number of active fishermen but in terms of number of fishing days. The abundance and market values of other commercial species (crustaceans, molluscans and fishes) can also be important factors as most of the scallop fishermen hold more than one fishing licence.

2 - An increase in the abundance of prerecruits (< 70 mm) in the catches will result in a different fishing strategy. Fishermen will tend to keep more of those small scallops to increase their yield therefore, increasing the meat count. As a result, more landings will not complied to the meat count regulations (number of scallop meats per Kg) in place for each fishing sub-areas. This is most likely to happen when CPUE's are low.

3 - An increase in CPUE's will result in more unreported transactions as fishermen will only need to report part of the catch to obtain maximum unemployment insurance compensation benefits. Therefore, all assessment calculations using landing statistics data may be biased and may not reflect changes in the resource.

4 - The fishing gears and the fishing strategies are changing and improving continuously. Fishermen are getting more efficient, therefore harvesting larger portions of the scallop biomass even if the effort in term of number of fishing hours remains the same. Modifications of the fishing gear are continuously being made and are rarely reported. Therefore the selectivity and efficiency of the dredge are still unknown and cannot be fixed in time.

As a conclusion, considering the lack of historical and biological data to fully understand the fishery, the uncertainty in predicting long term and short term fluctuations in landings, and the actual landing fluctuations at low levels, increasing the effort is not recommended. In terms of resource management, this implies that: 1) no more licences should be issued, 2) meat counts should not be increased and, 3) fishing seasons should not be extended.

MANAGEMENT ACTIONS

Management actions proposed for 1988 are the same as those proposed for 1987 (Lanteigne et al., 1987). They are aimed at improving the actual situation of the fishery and to allow the Science Branch to provide sound evaluations of the resource.

1 - The effort should be limited in terms of specifications of the fishing gear used and/or number of fishermen participating in the fishery. By limiting the number of fishermen in each fishing area, the possible threat of a massive arrival of previously inactive fishermen ("back pocket licences") could be controlled.

2 - Actions should be taken to standardize the specifications of the scallop dredge especially the mesh type and the gear size.

ACKNOWLEDGMENT

We thank Marc Ouellette for providing the technical work and monitoring the sea sampling and logbook programs.

REFERENCES

CADDY, J.F., 1979. Long-term trends and evidence for production cycles in the Bay of Fundy scallop fishery. Rapp. P.-v. Reun. Cons. Int. Explor. Mer, 175: 97-108.

DADSWELL, M.J. and R. CHANDLER, 1984. Southwest New Brunswick and Grand Manan scallop stock assessment, 1983. Can. Atl. Fish. Sci. Adv. Com., Res. Doc. 84/28.

DICKIE, L.M., 1955. Fluctuations in abundance of the giant scallop Placopecten magellanicus (Gmelin) in the Digby area of the Bay of Fundy. J. Fish. Res. Bd. Can., 12 (6): 797-857.

JAMIESON, G.S., 1978. Status and assessment of Northumberland Strait Scallop stocks. Can. Atl. Fish. Sci. Adv. Com., Res. Doc., 78/42.

LANTEIGNE, M., L.A. DAVIDSON and J. WORMS, 1987. Status of the southern Gulf of St. Lawrence scallop sotcks - 1986. Can. Atl. Fish. Adv. Com., Res. Doc. 87/84.

WORMS, J., 1984. Scallop biomass and density estimates in the southern Gulf of St. Lawrence. Can. Atl. Fish. Adv. Com., Res. Doc. 84/90.

WORMS, J. AND G.A. CHOUINARD, 1983. Status of southern Gulf of St. Lawrence. Can. Atl. Fish. Adv. Com., Res. Doc. 83/68.

WORMS, J. AND L.A. DAVIDSON, 1986. The variability of southern Gulf of St. Lawrence sea scallop meat weight-shell height relationships and its implications for resource management. Int. Council Exp. Sea, Shellfish committee C.M. K/24.

WORMS, J., M. LANTEIGNE, and L.A. DAVIDSON, 1986. Status of the southern Gulf of St. Lawrence scallop stocks - 1985. Can. Atl. Fish. Adv. Com., Res. Doc. 86/55.

TABLE 1. Regression parameters of the meat weight/shell height relationship ($W = a H^b$) for eight sub-areas in the southern Gulf of St. Lawrence; W = meat weight in grams, H = shell height (mm), N = number of individuals measured, r = correlation coefficient, a and b are constants (equations were used with sea sampling data to calculate CPUE's, see text).

SUB-AREAS	N	a	b	r
BAIE DES CHALEURS MISCOU/VAL COMEAU MIMINEGASH/RICHIBUCTO NORTH OF P.E.I.	716	$3.263\ 10^{-5}$	2.8126	0.9670
BORDEN/CAPE TORMENTINE PUGWASH	122	$2.291\ 10^{-4}$	2.4198	0.8275
PICTOU ISLAND BOUGHTON ISLAND	964	$5.823\ 10^{-4}$	2.1630	0.7817

TABLE 2. Summary of results obtained form sea samplings from 1982 to 1987.

YEARS AND SUB-AREAS	SIZE RANGE (MM)	NUMBER OF SCALLOPS LIVE AND DEAD	PERCENTAGE OF SCALLOPS		AVERAGE SIZE FOR SCALLOPS	
			DEAD	<70 MM	≥ 70 MM	SD
1982						
BAIE DES CHALEURS	22-142	2709	---	16.1	97.0	16.2
MISCOU/VAL COMEAU	42-152	2582	---	18.5	98.0	19.8
MIMINEGASH/RICHIBUCTO	42-137	2021	---	13.2	101.9	15.6
BORDEN/CAPE TORMENTINE	47-127	6828	---	3.6	92.3	10.0
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	32-137	2810	---	5.7	96.5	14.0
BOUGHTON ISLAND	22-137	1565	---	1.5	106.8	13.2
1983						
BAIE DES CHALEURS	---	---	---	---	---	---
MISCOU/VAL COMEAU	---	---	---	---	---	---
MIMINEGASH/RICHIBUCTO	55-136	1584	---	11.6	91.8	17.8
BORDEN/CAPE TORMENTINE	54-126	1754	---	2.0	94.1	10.4
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	16-132	3784	---	4.8	95.2	12.0
BOUGHTON ISLAND	---	---	---	---	---	---
1984						
BAIE DES CHALEURS	---	---	---	---	---	---
MISCOU/VAL COMEAU	36-149	5293	---	1.4	95.7	14.1
MIMINEGASH/RICHIBUCTO	59-144	2000	---	1.0	91.1	11.1
BORDEN/CAPE TORMENTINE	---	---	---	---	---	---
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	52-137	5167	---	1.5	101.4	15.0
BOUGHTON ISLAND	---	---	---	---	---	---
1985						
BAIE DES CHALEURS	67-138	437	---	0.5	99.2	16.0
MISCOU/VAL COMEAU	18-138	433	---	3.9	102.3	12.5
MIMINEGASH/RICHIBUCTO	13-139	834	---	0.8	96.6	10.6
BORDEN/CAPE TORMENTINE	53-123	306	---	1.6	92.9	9.1
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	43-131	2890	---	1.6	90.4	9.8
BOUGHTON ISLAND	11-130	2886	---	3.7	87.1	11.1

TABLE 2. Continued.

YEARS AND SUB-AREAS	SIZE RANGE (MM)	NUMBER OF SCALLOPS LIVE AND DEAD	PERCENTAGE OF SCALLOPS		AVERAGE SIZE FOR SCALLOPS	
			DEAD	<70 MM	≥ 70 MM	SD
1986						
BAIE DES CHALEURS	10-149	5144	3.7	12.0	102.4	15.0
MISCOU/VAL COMEAU	7-147	2283	4.3	7.5	99.3	13.0
MININEGASH/RICHIBUCTO	33-150	2495	4.6	3.5	99.6	15.7
BORDEN/CAPE TORMENTINE	10-118	1822	2.7	26.5	90.9	10.8
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	9-138	5903	10.7	10.1	96.9	13.0
BOUGHTON ISLAND	3-129	5431	8.9	9.5	90.3	12.1
1987						
BAIE DES CHALEURS	11-146	5286	5.1	23.0	97.1	16.3
MISCOU/VAL COMEAU	48-149	417	4.8	31.5	105.0	20.2
MININEGASH/RICHIBUCTO	34-150	2061	0.2	0.4	119.0	14.1
BORDEN/CAPE TORMENTINE	33-137	2554	0.4	5.9	99.5	15.1
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	11-136	25826	3.0	1.7	102.7	11.6
BOUGHTON ISLAND	47-118	1944	0.4	13.9	88.0	11.3

TABLE 3. Summary of average CPUE (kg/m hr) and standard deviations (SD) calculated from sea sampling data for all sub-areas, in 1986 and 1987.

SUB-AREA	1986 CPUE	1986 SD	1986 n	1987 CPUE	1987 SD	1987 n
BAIE DES CHALEURS	0.54	0.24	341	0.82	0.54	271
MISCOU/VAL COMEAU	0.60	0.33	279	0.42	0.26	37
MIMINEGASH/RICHIBUCTO	1.11	0.79	178	0.71	0.32	76
BORDEN/CAPE TORMENTINE	0.90	0.46	129	0.85	0.56	238
NORTH OF P.E.I.	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---
PICTOU ISLAND	1.12	0.69	400	1.24	0.62	499
BOUGHTON ISLAND	1.05	0.63	264	1.30	0.96	94

TABLE 4. Summary of average CPUE's (kg/m.hr) and standard deviations (SD) calculated from logbook for all sub-areas from 1985 to 1987.

	1985			1986			1987		
SUB-AREA	CPUE	SD	n	CPUE	SD	n	CPUE	SD	n
BAIE DES CHALEURS	0.08	0.26	10	---	---	---	0.61	0.17	4
MISCOU/VAL COMEAU	0.99	0.69	11	0.79	0.4	9	---	---	---
MIMINEGASH/RICHIBUCTO	1.09	0.21	13	0.88	0.23	18	1.12	0.39	7
BORDEN/CAPE TORMENTINE	1.27	0.29	11	1.25	0.24	12	1.72	0.49	5
NORTH OF P.E.I.	---	---	---	---	---	---	---	---	---
PUGWASH	---	---	---	---	---	---	0.61	---	1
PICTOU ISLAND	1.19	0.47	5	1.25	0.15	7	0.91	0.39	5
BOUGHTON ISLAND	---	---	---	1.01	0.04	2	1.08	---	1

TABLE 5. Number of scallop licences issued in the southern Gulf of St. Lawrence (data from the Licencing Branch) and number of active fishermen (data from the Statistical Branch) since 1983. Data were sorted by fishing areas and sub-areas using the fishermen's homeports.

SUB-AREA	1983		1984		1985	
	LICENCES	ACTIVE FISHERMEN	LICENCES	ACTIVE FISHERMEN	LICENCES	ACTIVE FISHERMEN
AREA 21						
BAIE DES CHALEURS	27	-?-	26	11	28	23
MISCOU/VAL COMEAU	68	-?-	77	43	77	75
-*-						1
TOTAL AREA 21	95	-?-	103	54	105	99
AREA 22						
MIMINEGASH/RICHIBUCTO	92	-?-	87	64	84	79
BORDEN/CAPE TORMENTINE	109	-?-	120	85	122	83
-*-						10
TOTAL AREA 22	201	-?-	207	149	206	172
AREA 23						
NORTH OF P.E.I.	52	-?-	50	-?-	50	14
AREA 24						
PUGWASH	21	-?-	20	7	21	10
PICTOU ISLAND	119	-?-	118	69	115	45
BOUGHTON ISLAND	288	-?-	289	193	286	90
-*-						7
TOTAL AREA 24	428	-?-	427	269	422	152
TOTAL FOR THE GULF	776	-?-	787		783	437

TABLE 5. Continued.

SUB-AREA	1986 LICENCES	1986 ACTIVE FISHERMEN	1987 LICENCES	1987 * ACTIVE FISHERMEN
AREA 21				
BAIE DES CHALEURS	28	19	31	4
MISCOU/VAL COMEAU	75	45	64	1
-*-				
TOTAL AREA 21	103	64	95	5
AREA 22				
MIMINEGASH/RICHIBUCTO	83	77	82	37
BORDEN/CAPE TORMENTINE	120	73	114	65
-*-		9		5
TOTAL AREA 22	203	159	196	107
AREA 23				
NORTH OF P.E.I.	51	13	47	1
AREA 24				
PUGWASH	21	5	19	2
PICTOU ISLAND	113	72	110	44
BOUGHTON ISLAND	286	170	276	62
-*-		27		3
TOTAL AREA 24	420	274	405	111
TOTAL FOR THE GULF	777	510	743	224

-*- Fishermen with a homeport in a fishing area different from the one where their licence was issued.

* Preliminary results.

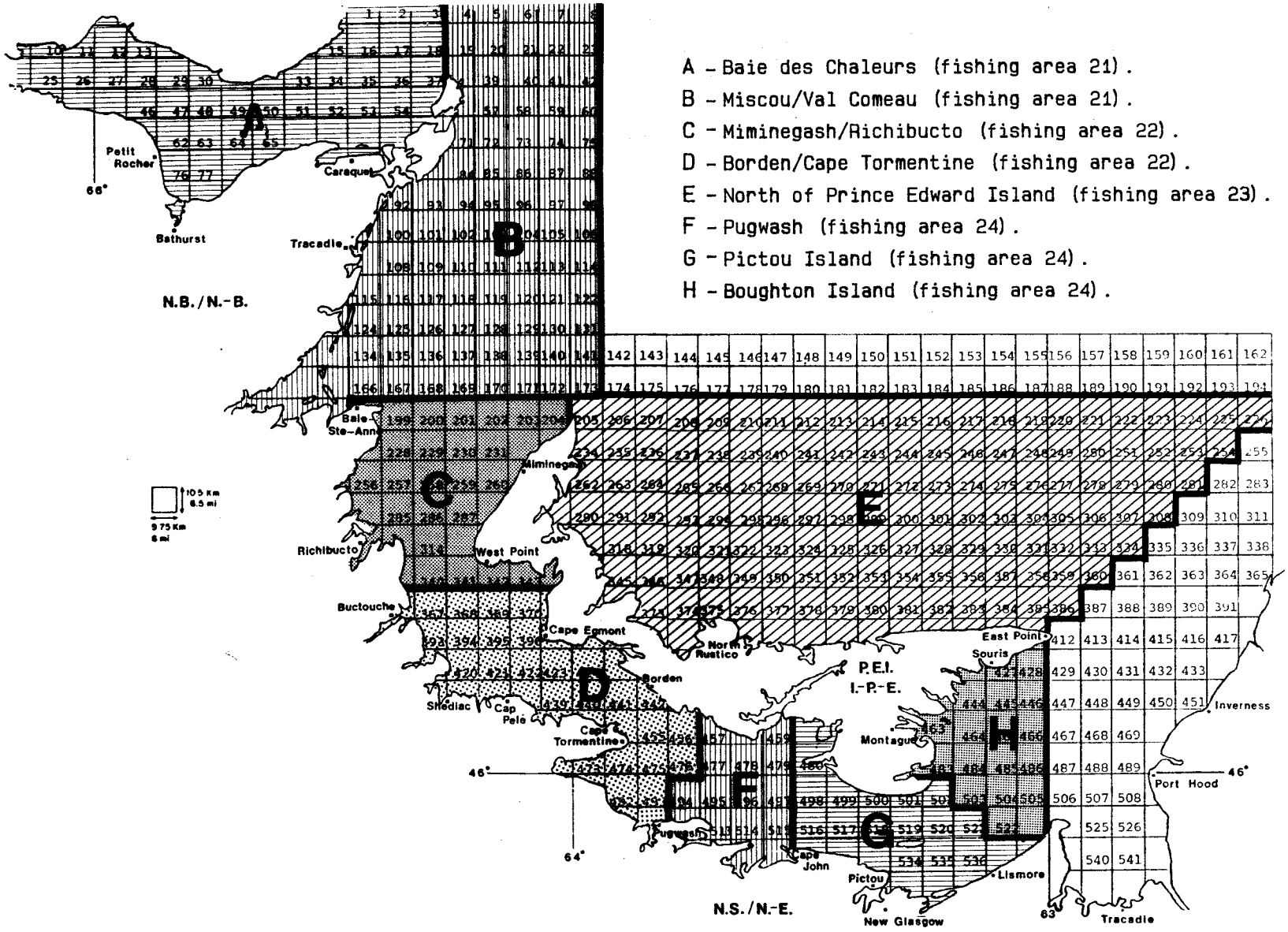
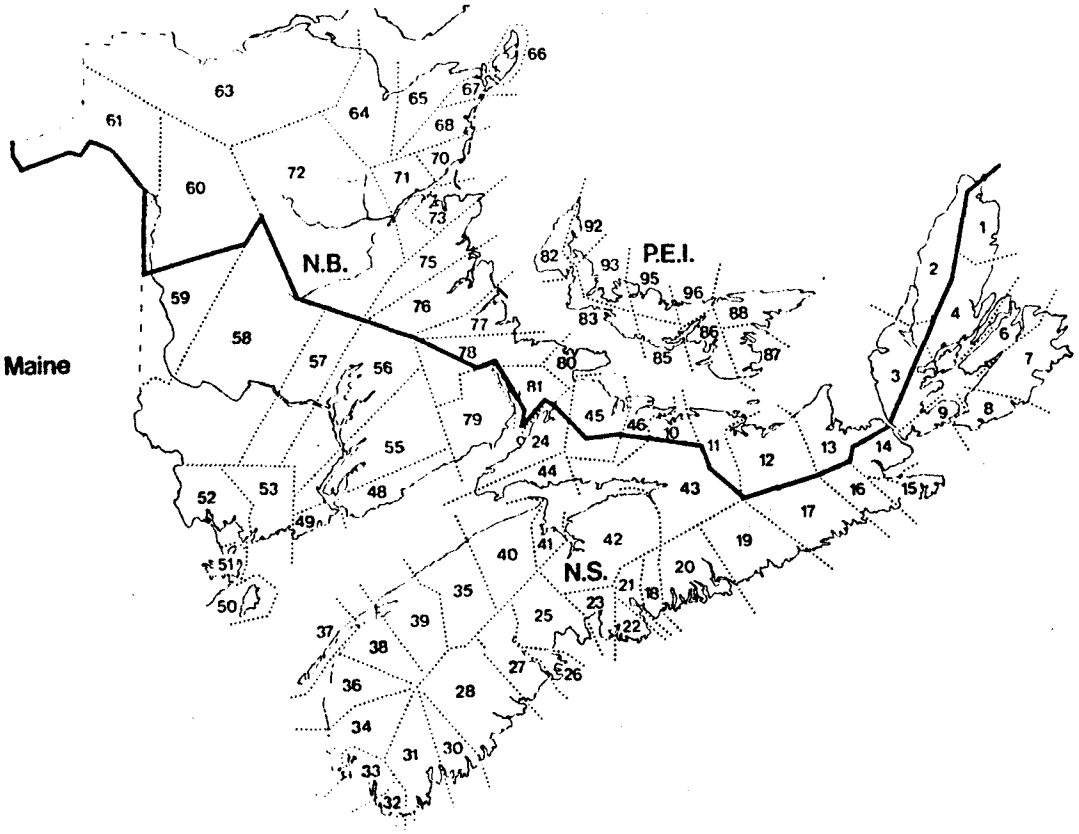


FIGURE 1. Scallop logbook numbered grid used to locate the fishing activity in the southern Gulf of St. Lawrence. The sub-areas used in the present document are also shown.

FIGURE 2. Statistical districts in the southern Gulf of St. Lawrence (A). Each statistical district is listed with their corresponding sub-area (B).

A.



B.

AREA 21				AREA 22			
BAIE DES CHALEURS		MISCOU/VAL COMEAU		MIMINEGASH/RICHIBUCTO		BORDEN/CAPE TORMENTINE	
63	65	66	70	75	82	77	45
64		67	71	76		78	83
		68	73			80	

AREA 23		AREA 24					
NORTH OF P.E.I.		PUGWASH	PICTOU ISLAND		BOUGHTON ISLAND		
92	95	46	11	86	13	1	
93	96	10	12		3	87	
		85			2	88	

BAIE DES CHALEURS SUB-AREA
(FISHING AREA 21)

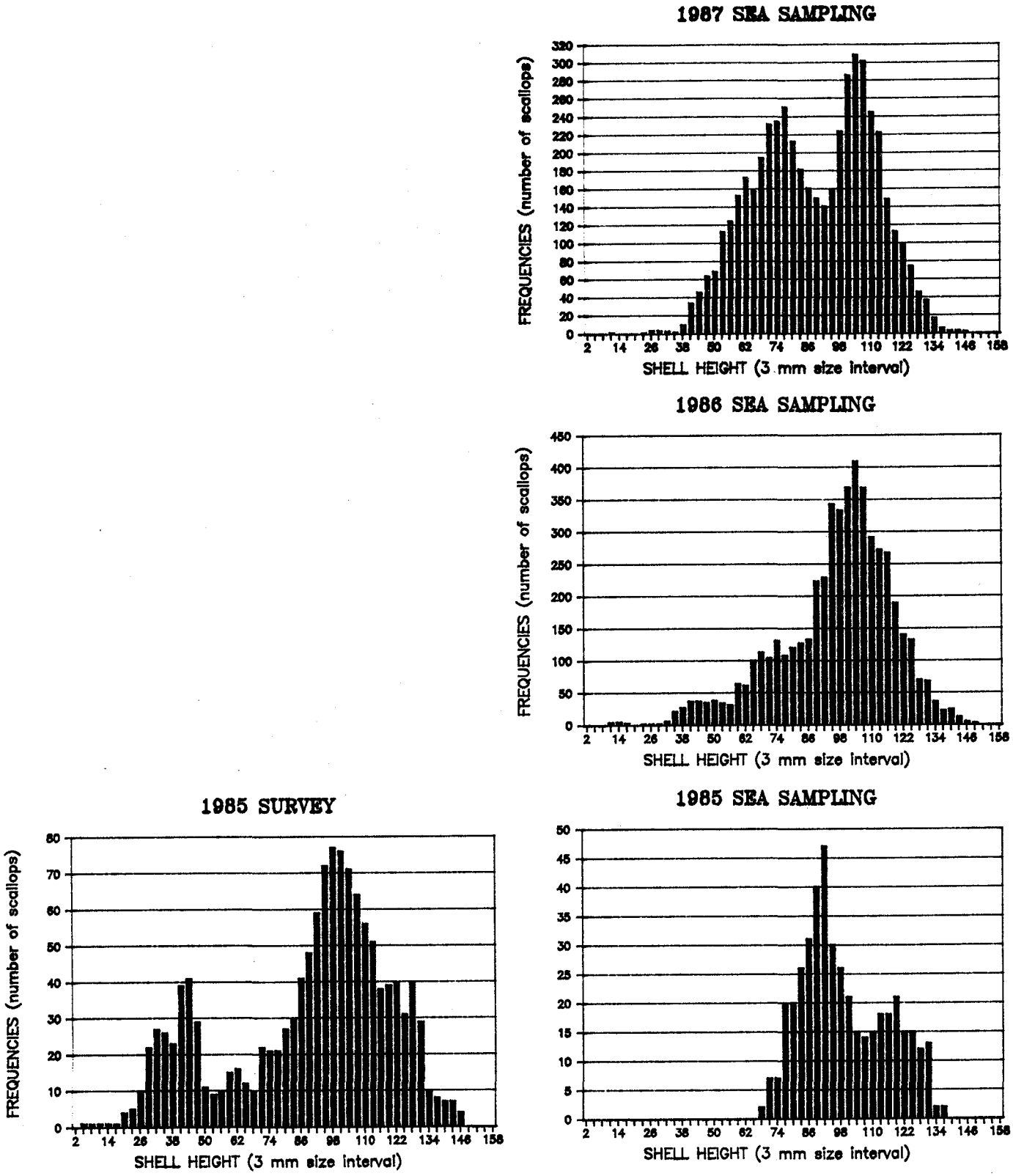
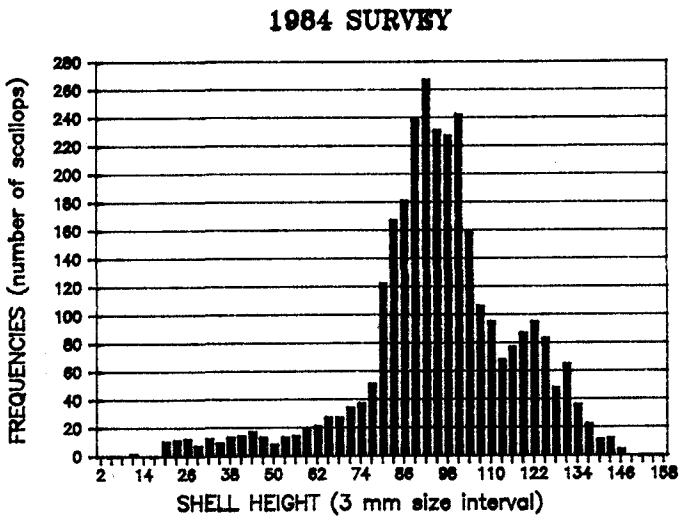
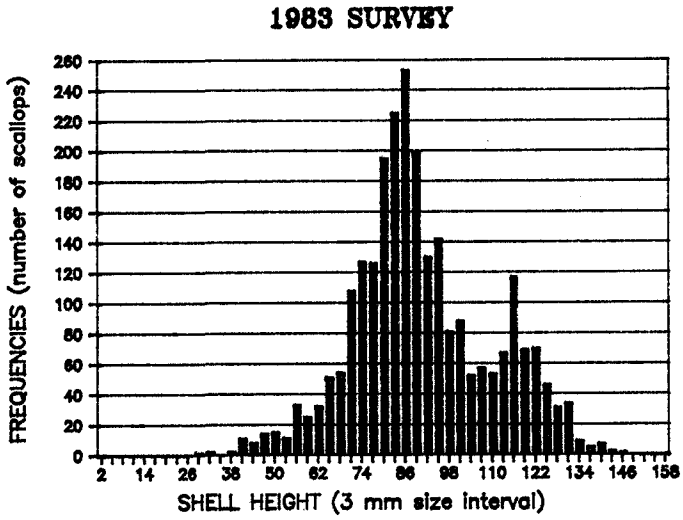


FIGURE 3. Scallop size frequency distributions for experimental survey and sea sampling catches from 1982 to 1987.

BAIE DES CHALEURS SUB-AREA
(FISHING AREA 21)





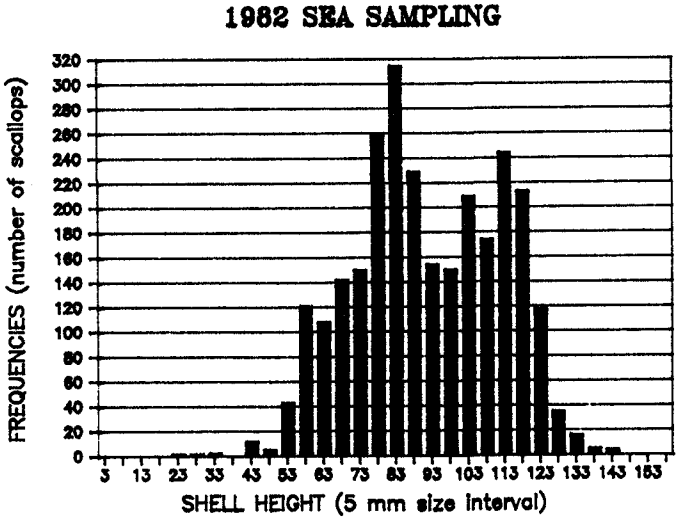


FIGURE 3. Continued.

MISCOU/VAL COMEAU SUB-AREA
(FISHING AREA 21)

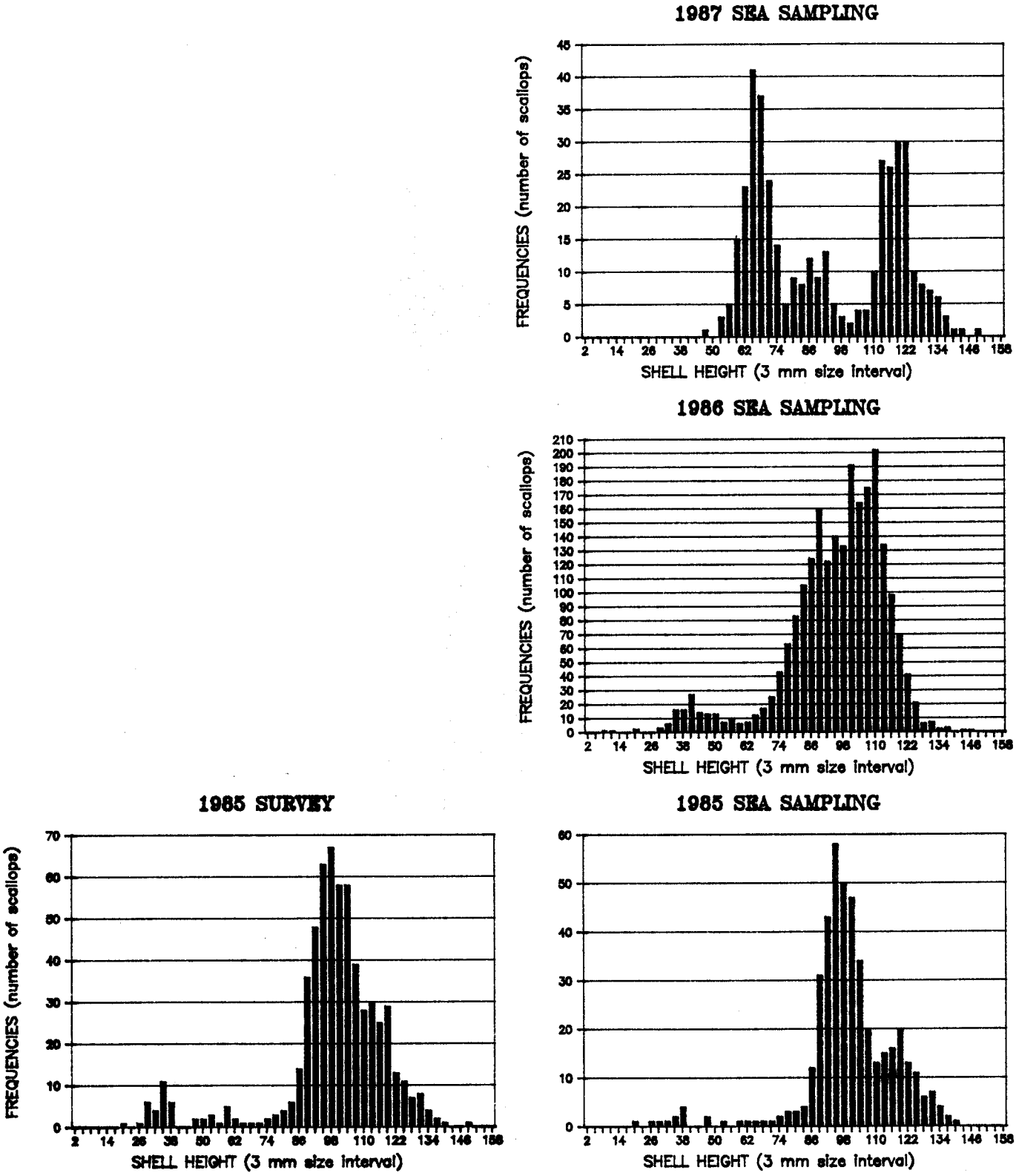
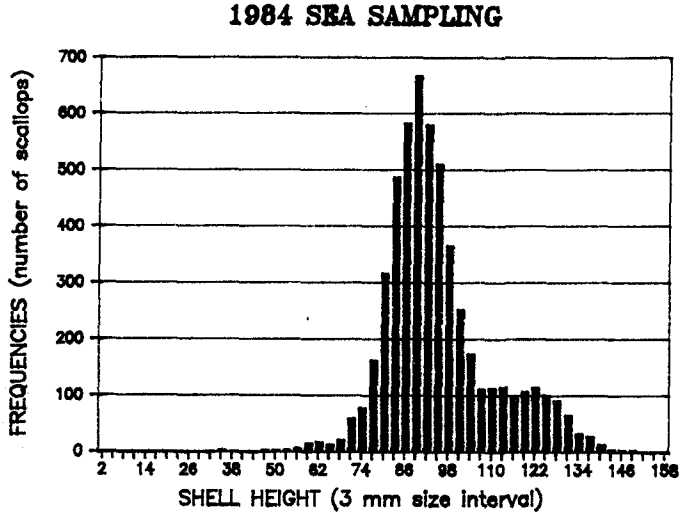
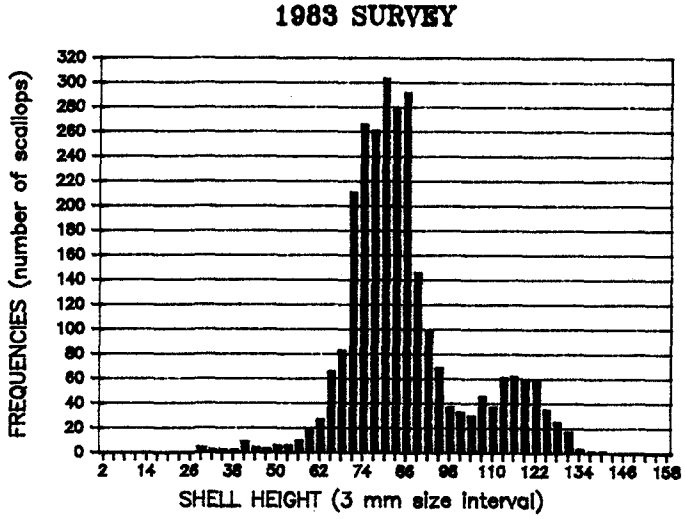


FIGURE 3. Continued.

MISCOU/VAL COMEAU SUB-AREA
(FISHING AREA 21)





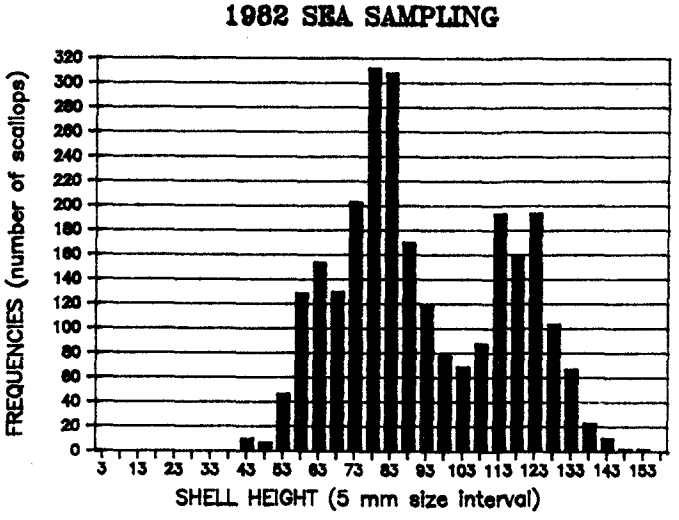


FIGURE 3. Continued.

MIMINEGASH/RICHIBUCTO SUB-AREA (FISHING AREA 22)

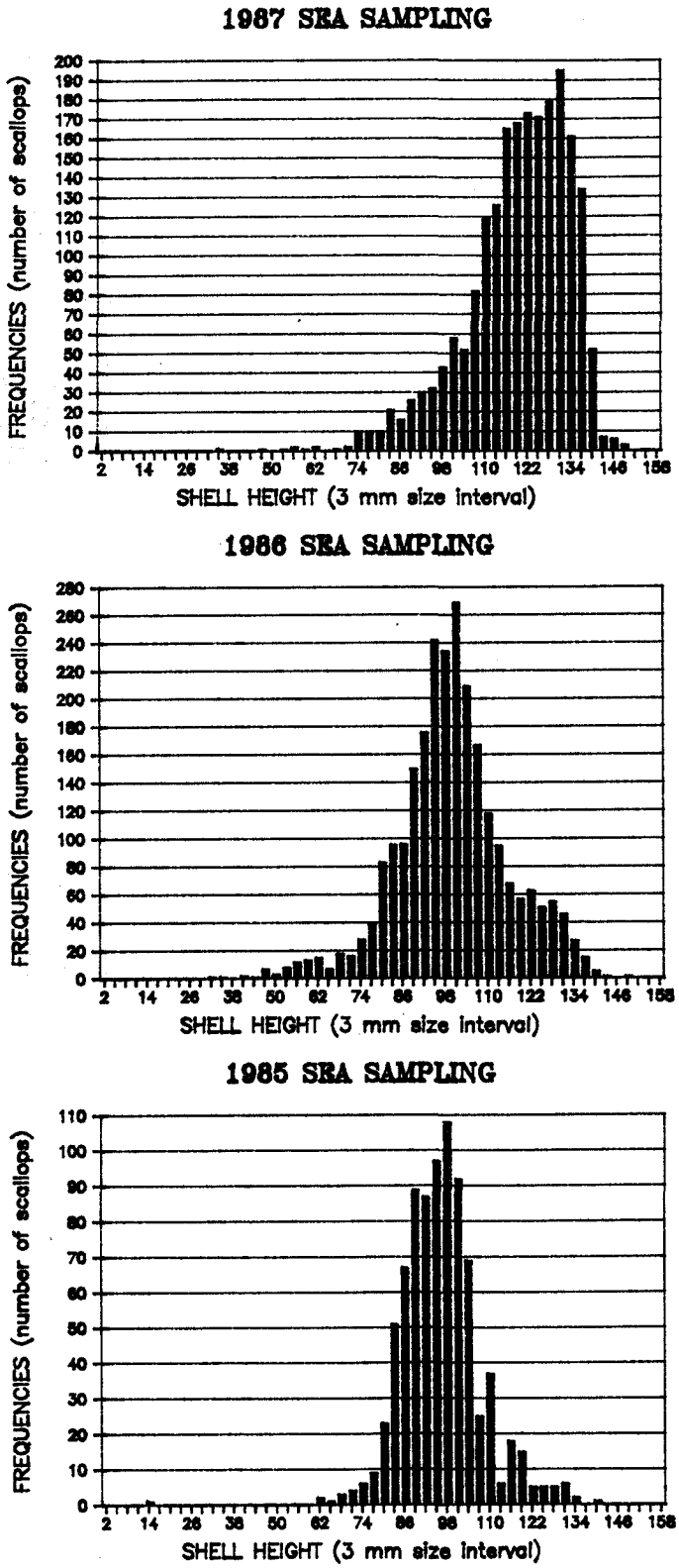


FIGURE 3. Continued.

MIMINEGASH/RICHIBUCTO SUB-AREA (FISHING AREA 22)

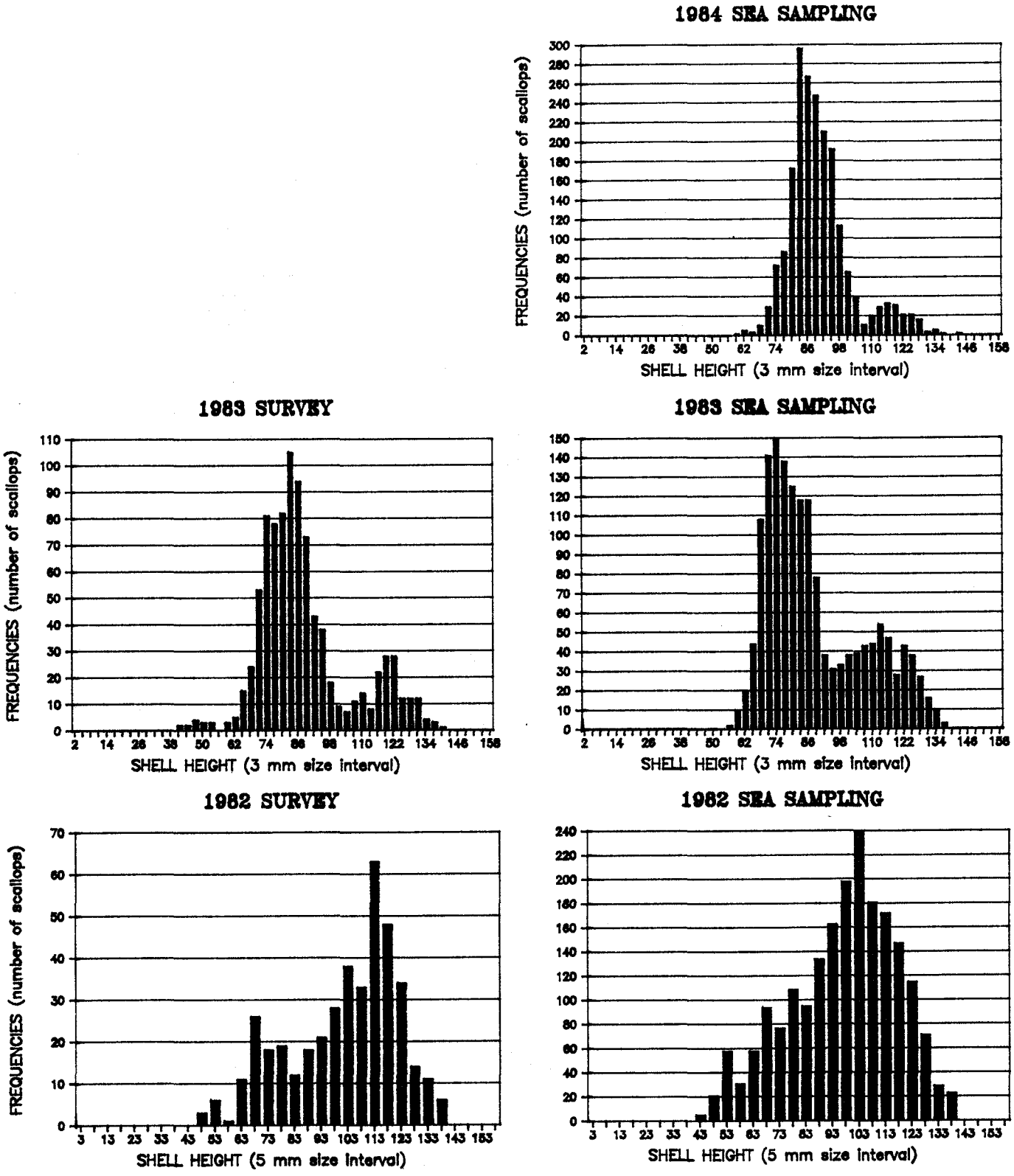


FIGURE 3. Continued.

BORDEN/CAPE TORMENTINE SUB-AREA

(FISHING AREA 22)

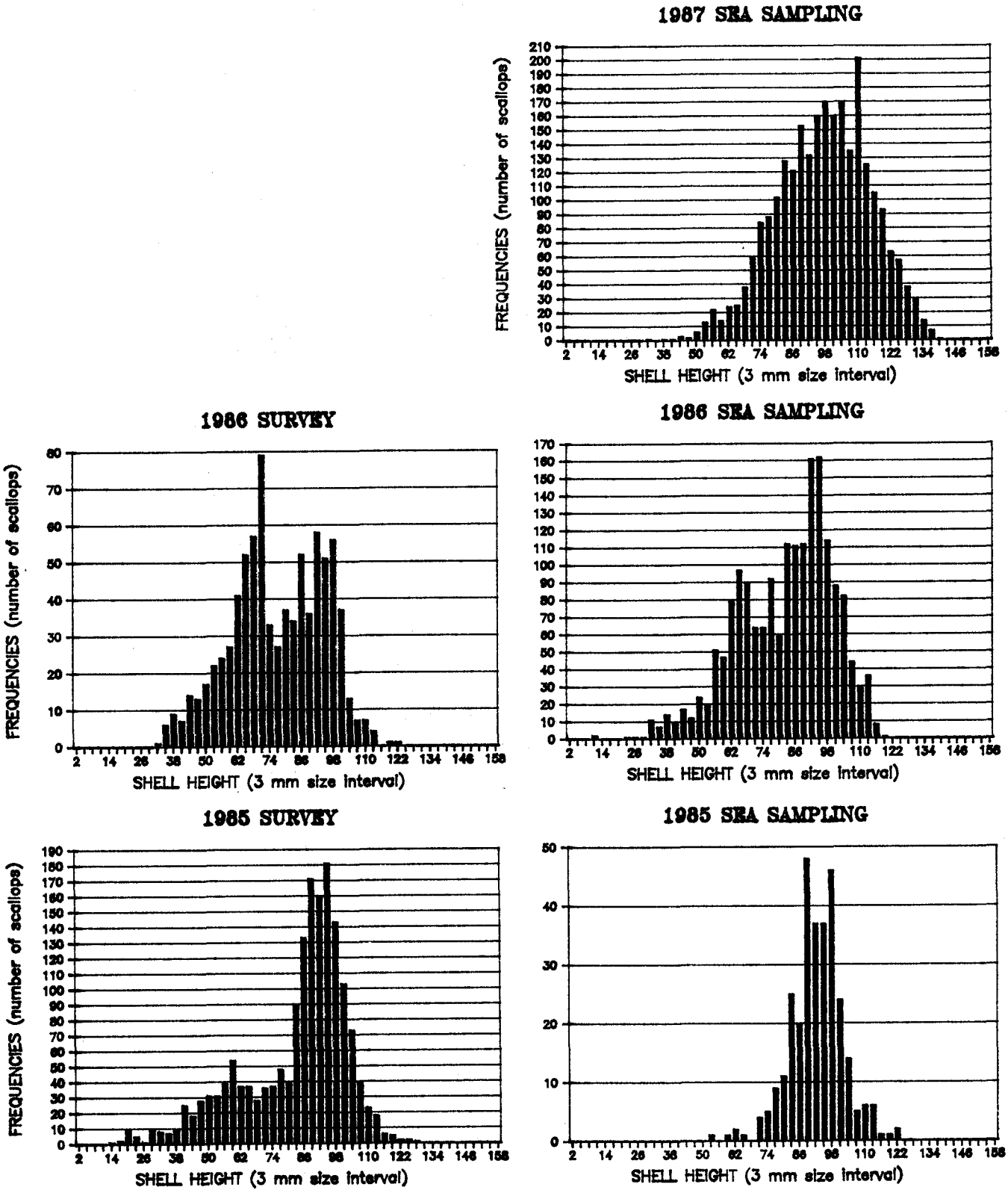


FIGURE 3. Continued.

BORDEN/CAPE TORMENTINE SUB-AREA
(FISHING AREA 22)

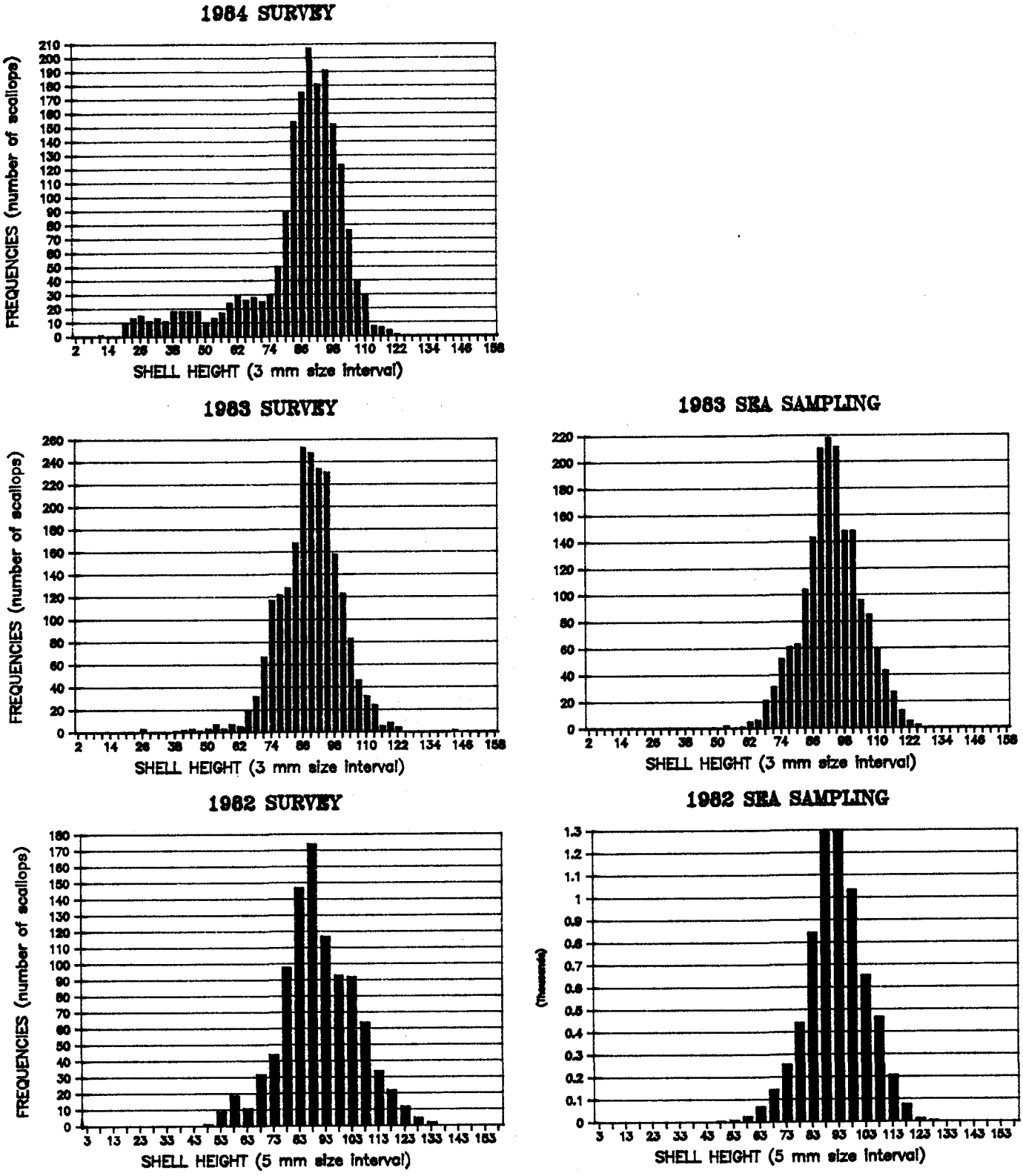
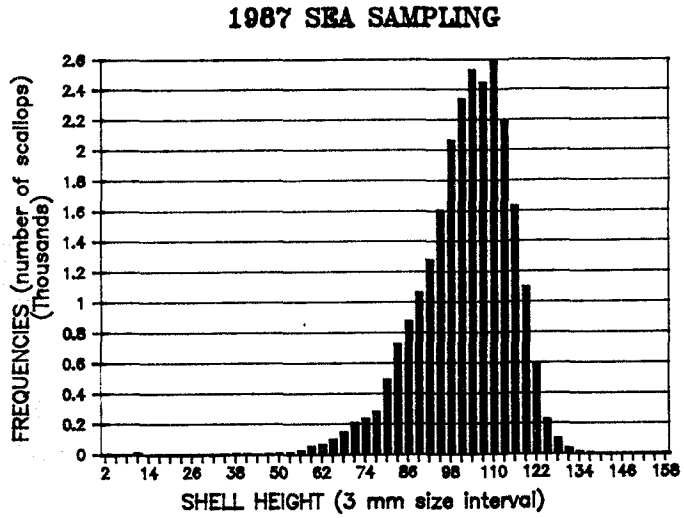
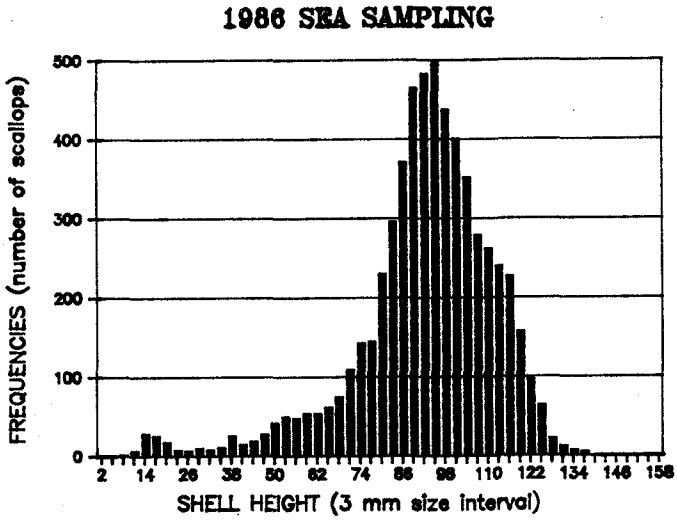
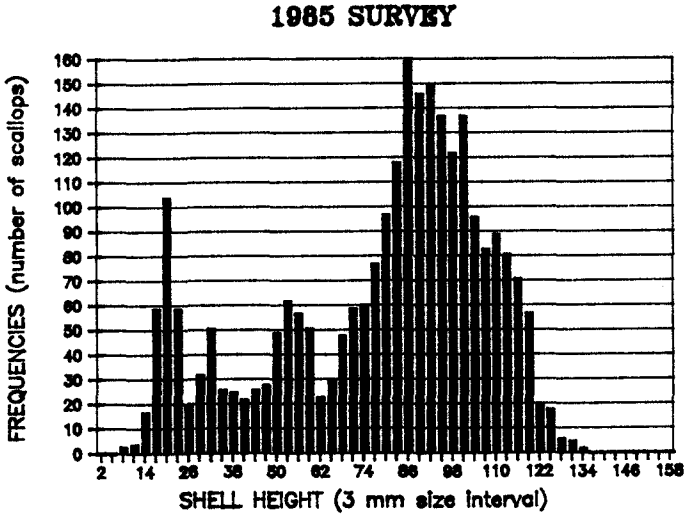


FIGURE 3. Continued.

PICTOU ISLAND SUB-AREA
(FISHING AREA 24)







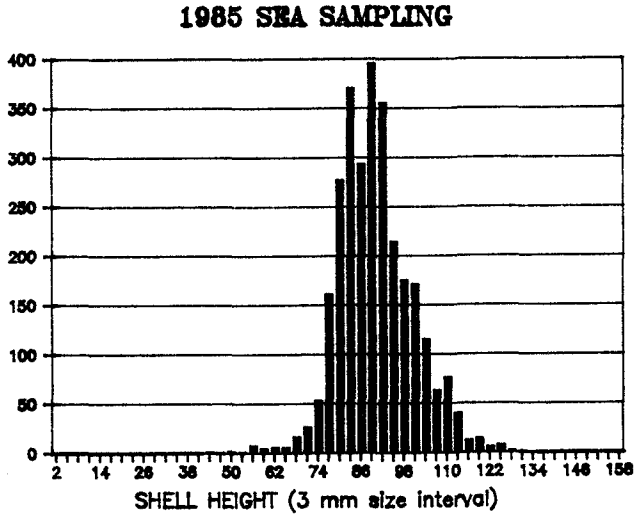


FIGURE 3. Continued.

PICTOU ISLAND SUB-AREA
(FISHING AREA 24)

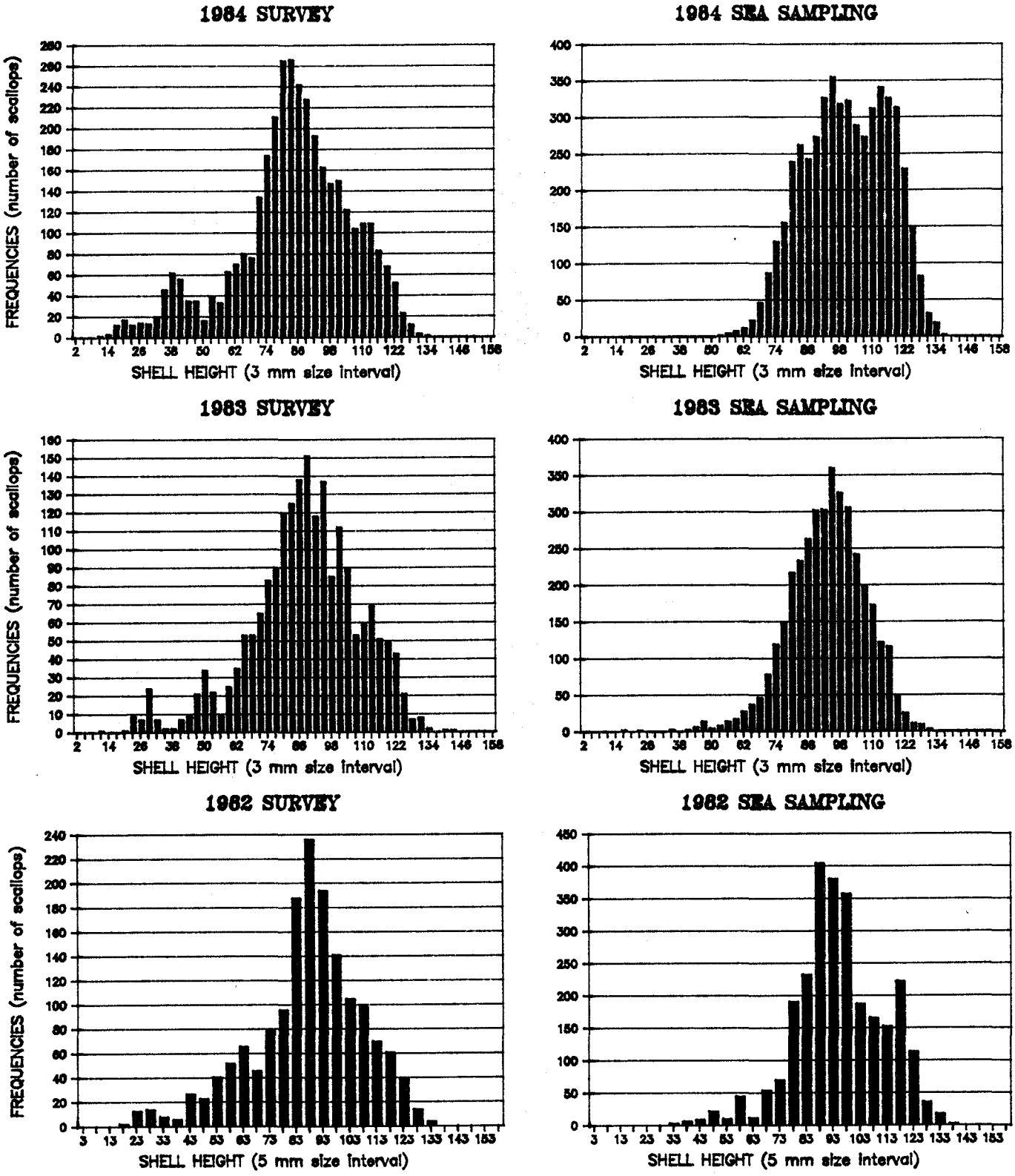


FIGURE 3. Continued.

BOUGHTON ISLAND SUB-AREA
(FISHING AREA 24)

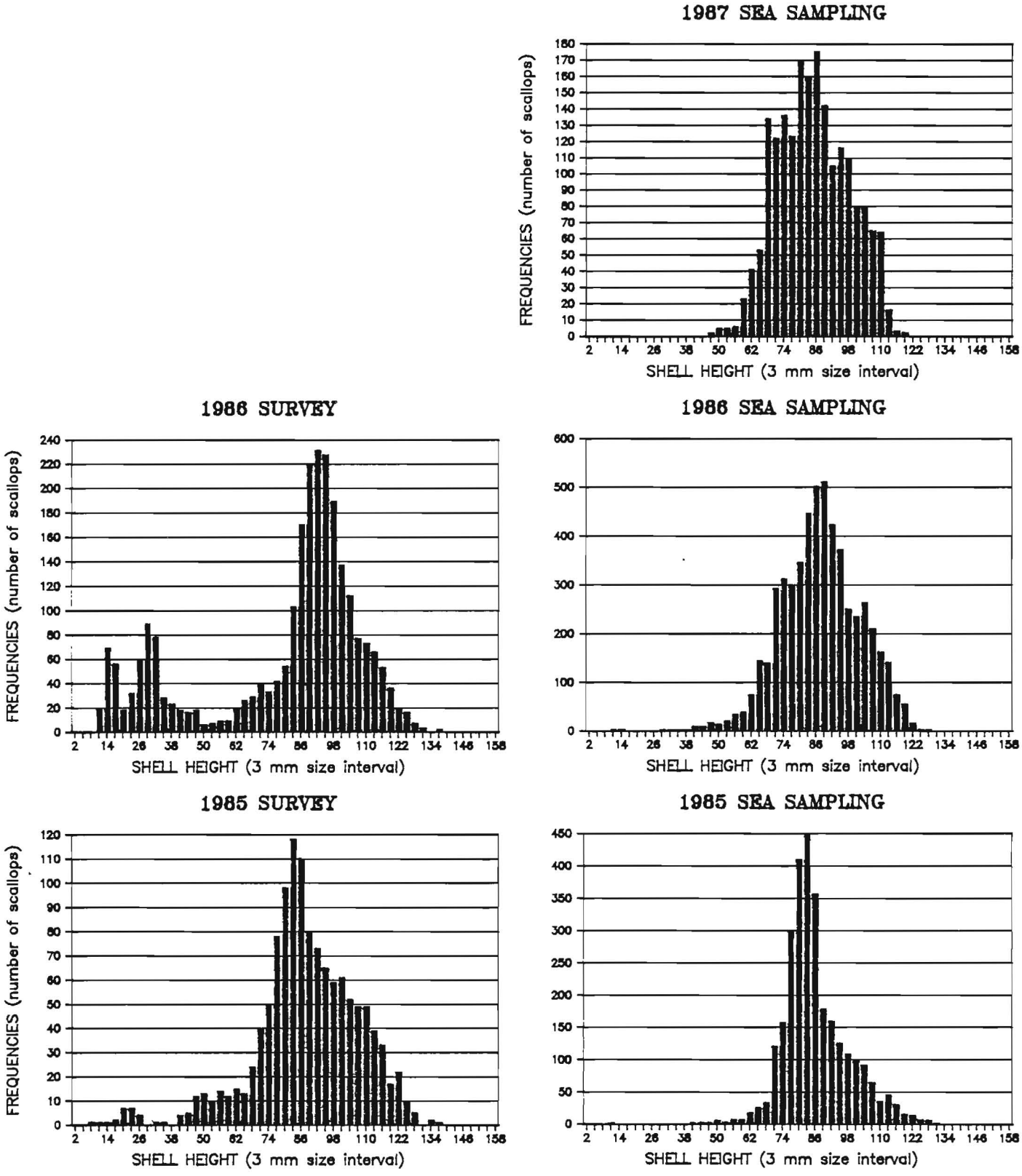
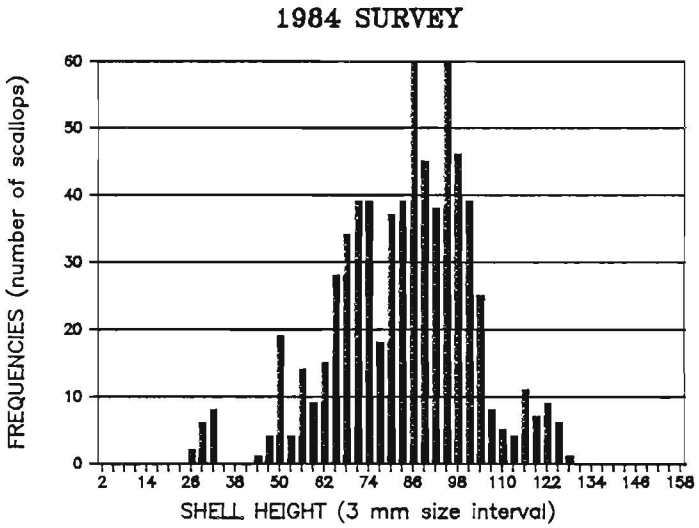


FIGURE 3. Continued.

BOUGHTON ISLAND SUB-AREA
(FISHING AREA 24)



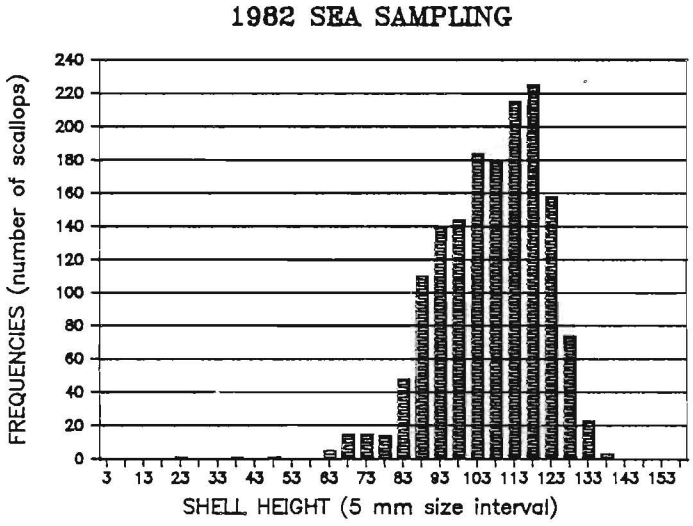


FIGURE 3. Continued.

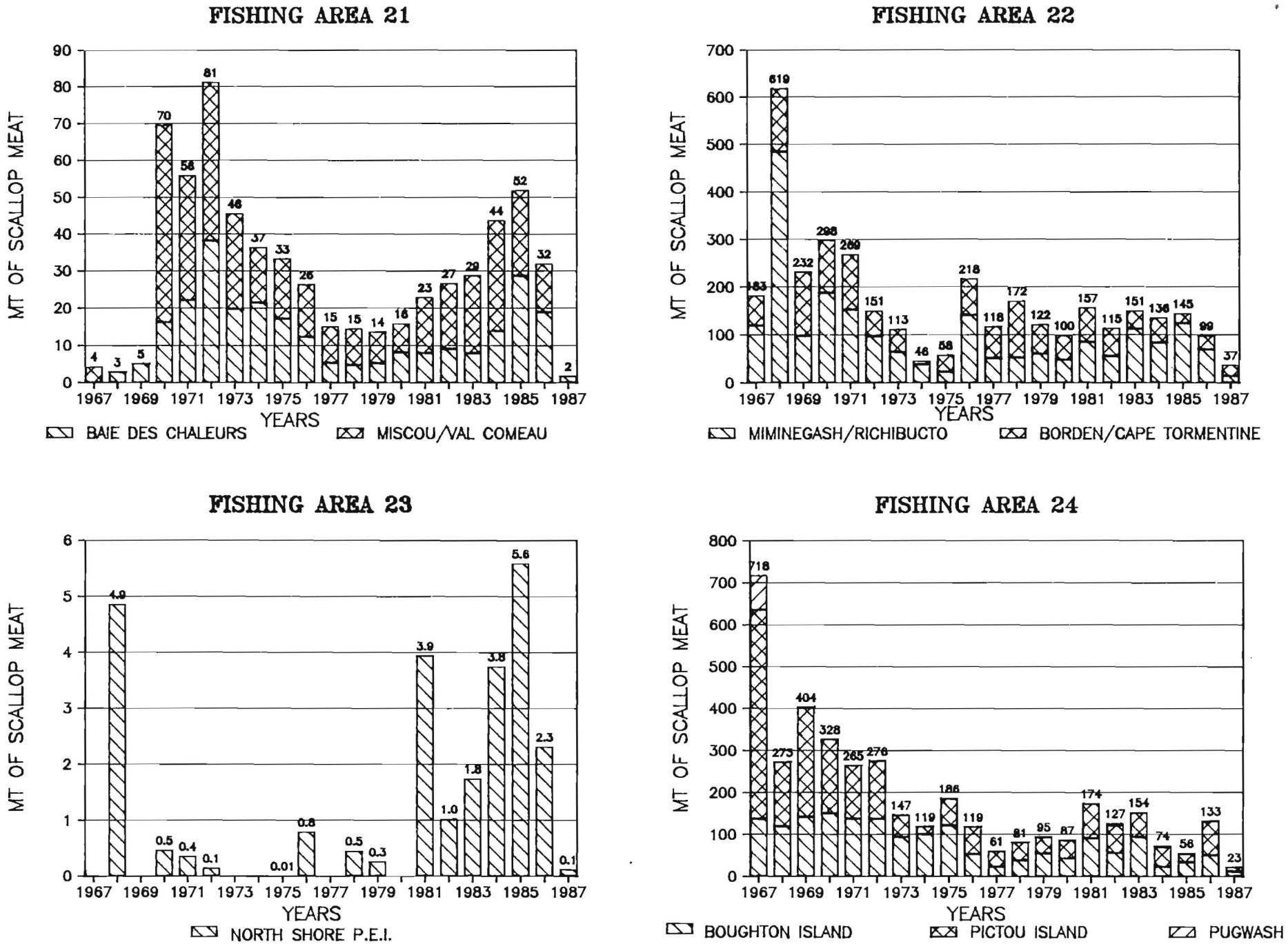


FIGURE 4. Scallop landings in four fishing areas of the southern Gulf of St. Lawrence and contribution of each sub-area. (1987 values are provisional).

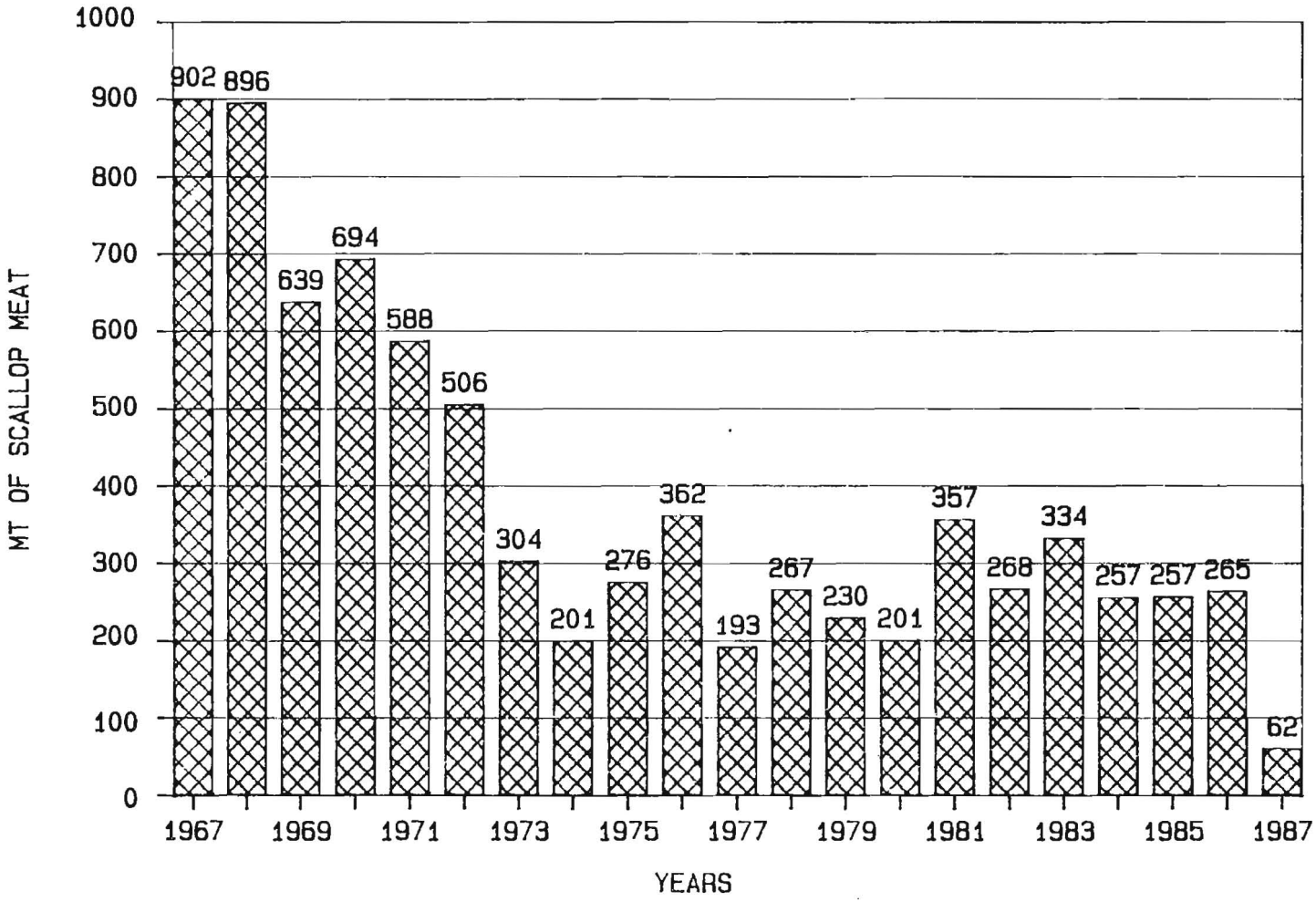


FIGURE 4. Continued.

APPENDIX I. Summary of the sea sampling program conducted in the southern Gulf of St. Lawrence, in 1987. Date of sampling and numbers tows sampled are presented for each sub-area.

Date	Number of tows sampled	Date	Number of tows sampled
	Baie des Chaleurs sub-area (area 21)		
03/07/87	15	08/09/87	21
04/07/87	6	18/09/87	17
03/08/87	19	23/09/87	10
04/08/87	31	29/09/87	22
10/08/87	30	06/10/87	22
17/08/87	21	19/10/87	16
25/08/87	14	03/11/87	28

Date	Number of tows sampled	Date	Number of tows sampled
	Miscou/Val Comeau sub-area (area 21)		
30/07/87	7	19/08/87	10
07/08/87	22		

Date	Number of tows sampled	Date	Number of tows sampled
	Miminegash/Richibucto sub-area (area 22)		
06/05/87	14	13/06/87	19
18/05/87	10	19/06/87	21
08/06/87	14	26/06/87	19

Date	Number of tows sampled	Date	Number of tows sampled
	Borden/Cape Tormentine sub-area (area 22)		
02/06/87	19	11/06/87	29
03/06/87	26	17/06/87	30
05/06/87	32	18/06/87	53
06/06/87	19	23/06/87	32

APPENDIX I. continued

Date	Number of tows sampled	Date	Number of tows sampled
	Pictou Island sub-area (area 24)		
08/05/97	20	17/06/87	35
29/05/87	28	18/06/87	32
03/06/87	44	24/06/87	23
04/06/87	46	26/06/87	29
08/06/87	20	29/06/87	27
09/06/87	48	30/06/87	21
11/06/87	53	23/10/87	23
15/06/87	27	28/10/87	24

Date	Number of tows sampled	Date	Number of tows sampled
	Boughton Island sub-area (area 24)		
02/06/87	20	16/10/87	27
08/06/87	22	24/10/87	26

APPENDIX II. CPUE's calculated from logbook data for all fishing squares reported in 1987.

SUB-AREA	FISHING SQUARES	CPUE (KG/M-HR)	STANDARD DEVIATION (SD)	NUMBER OF FISHING DAYS (n)
BAIE DES CHALEURS (AREA 21)	25	0.76	0.14	6
	26	0.75	0.15	38
	62	0.45	0.22	2
	76	0.59	0.14	5
MISCOU/VAL COMEAU (AREA 21)	---	---	---	---
MIMINEGASH/RICHIBUCTO (AREA 22)	200	1.09	0.14	4
	202	0.97	0.34	5
	230	0.84	0.09	2
	231	1.04	0.46	13
	259	0.78	---	1
	260	1.17	0.69	6
	287	1.96	0.09	2
BORDEN/CAPE TORMENTINE (AREA 22)	341	1.50	0.35	21
	342	1.24	0.39	28
	343	1.86	0.31	6
	396	1.52	---	1
	287	1.96	0.09	2
NORTH OF P.E.I. (AREA 23)	---	---	---	---
PUGWASH (AREA 24)	513	0.61	0.18	7
PICTOU ISLAND (AREA 24)	516	1.05	0.38	3
	517	0.74	---	1
	518	0.61	0.11	5
	533	0.62	0.15	26
	534	1.54	0.45	18
BOUGHTON ISLAND (AREA 24)	464	1.08	0.19	8

APPENDIX III. A: Scallop logsheet used in 1986 and 1987.
B: Proposed logsheet for 1988.

A

GOVERNMENT OF CANADA / GOUVERNEMENT DU CANADA
FISHERIES AND OCEANS / PÊCHES ET OCÉANS

ONE PAGE PER FISHING DAY / UNE PAGE PAR JOUR DE PECHE

Date landed
Date de débarquement .....
Place landed
Lieu de débarquement .....

Gear / Engin
Rock drag/Drague à fond dur ☐
Sweep drag/Drague à fond mou ☐

Time of first tow
Heure du premier trait .....
Time of last tow
Heure du dernier trait .....
Actual hours spent fishing (circle number)
Nombre d'heures de pêche (encerclez) 2 4 6 8 10 12 14 +

Estimated catch (lbs) / Prise estimée (lbs)
Meat / Viande .....
Roe / Reve .....
With shell / Avec coquille .....

Square no./ No. du carré or / ou LORAN C	Number of tow per day/ Nombre de traits par jour	Time per tow/ Durée d'un trait	Mean depth/ Profondeur moyenne

Comments (sick scallops, quality of meat, engine problems)
Commentaires (pétoncles malades, qualité de la viande)

Catch description / Description de la capture	Few/ Peu	Many/ Beaucoup
Young scallops (less than 2¾" or 7 cm) / Pétoncles jeunes (moins de 2¾" ou 7 cm)	☐	☐
Cluckers (dead scallops) / Coquilles vides	☐	☐

Bottom type / Nature du fond

Soft/Mou	Shells/Coquilles	Rocky/Rocheux	Other/Autre
☐	☐	☐	☐

Canada

Nº 006350

B

SCALLOP LOGBOOK / JOURNAL DE BORD DU PETONCLE *

DATE LANDED
day month year
jour mois annee
DATE DE DEBARQUEMENT

NUMBER OF HOURS SPENT FISHING
(from the time you leave until the time you return to the wharf)
2 4 6 8 10 12 14 16 18 20 22 24
NOMBRE D'HEURES DE PECHE
(de l'heure du depart a l'heure d'arrivee au port)

LORAN C POSITION
POSITION LORAN C

if your catch landed is for more than one fishing day, please specify: _____ days
Si votre prise debarquee est pour plus d'une journee de peche, s.v.p. specifiez: _____ jours

WATER DEPTH (FATHOMS) / PROFONDEUR (BRASSES)

CATCH / PRISE

SCALLOP MEAT / VIANDE DE PETONCLE		POUNDS / LIVRES
SCALLOP ROE / GONADE DE PETONCLE		POUNDS / LIVRES
SCALLOP IN SHELL / PETONCLE DANS LA COQUILLE		POUNDS / LIVRES

COMMENTS / COMMENTAIRES
Ex: weather, tide, current, ice, scallop size or meat count
Ex: meteo, maree, courant, glace, compte de viande

* This is strictly confidential information between the Department of Fisheries and Oceans and the scallop fishermen. The information will be use for biological purposes only.

La presente information est strictement confidentielle entre le ministere des Peches et Oceans et les pecheurs de petoncles. L'information sera utilisee pour des fins biologiques seulement.