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**STATUS OF THE NORTHEASTERN GULF OF ST. LAWRENCE
ICELAND SCALLOP (CHLAMYS ISLANDICA) STOCK - 1986**

by

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ABSTRACT

The assessment of the northeastern Gulf of St. Lawrence Iceland scallop stock was based on an experimental survey, logbooks, sea samplings and landing statistics. The results of the 1986 experimental survey indicated a stable level of recruitment, and size composition compared with 1985 results. However, the logbook, and landing data indicated a decrease in the catch per unit of effort (CPUE), and the catch per fishing day respectively. The fishing ground expansion and the gear change have been stable since 1984, therefore a decrease in CPUE could be the result of a decrease in the scallop stock density. In order to avoid overfishing, it is suggested that some action be taken to maintain the effort at its actual level. Management option and guidelines for further research are presented.

RESUME

L'évaluation de la population de pétoncle d'Islande dans le nord-est du Golfe du St-Laurent a été effectuée en utilisant les données d'une campagne d'échantillonnage, de journaux de bord, d'échantillonnages en mer sur des navires commerciaux et de statistiques de débarquement. En 1986, les résultats de la campagne d'échantillonnage ont montré un niveau relatif de recrutement et une composition en taille similaire à 1985. Cependant, les journaux de bord et les statistiques de débarquement ont indiqué une diminution de la prise par unité d'effort (PUE) et de la prise par jour respectivement. Puisque l'expansion des aires de pêches et les changements de l'engin de pêche sont stabilisés depuis 1984, une diminution de la PUE pourrait être le résultat d'une diminution de la densité de la population de pétoncle. Afin d'éviter la surpêche, il est suggéré que des actions soient prises pour maintenir l'effort de pêche à son niveau actuel. Des options de gestion et des lignes de conduite pour les recherches futures sont présentées.

Introduction

The Iceland scallop fishery in the Strait of Belle Isle began in 1969. Up to 1981, the fishing effort was concentrated in a triangular area between Anchor Point, Point Charles, and Ferolle Point (see Appendix I). In 1982, the Labrador coast was actively fished, expanding the fishing grounds from Point Charles to Red Bay. The northeast movement continued, and by 1984 draggers were fishing up to York Point. In 1985, Lanteigne *et. al.* (1986) reported that the entire Strait of Belle Isle had been explored and that all the scallop bed locations were known to fishermen. They concluded that the exploration period for new scallop beds was over, and that the fleet movements were made within the Strait on familiar grounds, in order to maintain high catch levels.

Studies on the Iceland scallop resource, in the Strait of Belle Isle were continued in 1986. This paper presents the results of these studies and discusses the status of the resource.

Material and methods

1 - Experimental survey

An experimental survey was conducted in the Strait of Belle Isle (Figure 1), from July 26 to August 1, 1986, to delineate the scallop fishing grounds. The sampling stations were randomly chosen to cover:

- a) the same areas surveyed in 1985 (Lanteigne *et. al.*, 1986).
- b) the areas covered by the fishing squares reported in the 1985 logbook returns.

When possible, the LORAN C coordinates of the sampling stations were recorded. Otherwise, the radar and landmarks were used to position the stations.

A total of 72 tows (10 minutes each at ≈ 2.5 knots) was performed, using a single bucket dredge (Figure 2). All the live scallops and the 'clappers' (dead scallops with valves still attached) were measured to the nearest millimeter. A shrimp net lining (2 cm stretched courene mesh) inside the drag was tried in order to capture small scallops. Because of the low efficiency of the lined fishing gear and the difficulties encountered when handling the dredge, all tows (6) with the lining were deemed unreliable and were not used in the analyses. The data were used to plot size frequency distributions (3 mm size classes). The percentage of clappers was calculated as the proportion of all scallops measured (live and dead). The percentage of prerecruits was calculated as the proportion of scallops (live) < 70 mm shell height.

2 - Commercial sea sampling

Observers were sent on fishing vessels to sample the commercial catches. Live scallops and clappers from approximately one half of the catch of randomly selected tows were measured. The duration and the position of the selected tows were also recorded. The data were used to plot size frequency distributions (3 mm size classes).

3 - Logbooks and questionnaires

Logbooks were distributed to 38 fishermen with experimental fishing permits. Fishermen with licences did not receive logbooks as it was not mandatory for licence holders.

The logbook was designed to gather daily information on estimates of catch, fishing locations, and effort. The fishing locations were reported as 'fishing squares' out of a numbered grid covering the Strait of Belle Isle (Appendix I). The data were used to calculate catch per unit of effort (CPUE, in kg of meat/m h) for each fishing square reported.

The Strait was divided into sub-areas (Figure 3) as outlined by Lanteigne *et. al.* (1986). The sub-areas delineations were rearranged to match the fishing square contours.

4 - Landing statistics

The Iceland scallop fishery in the northern Gulf of St. Lawrence is located in the statistical sub-districts 1, 47, 48, 49, and 50 (Appendix I) and only these sub-districts were considered for the different analyses. Landing statistics were used to calculate effort as the number of days fished during the season, by counting the number of sale slips. If more than one transaction was recorded on a single day for a fisherman, the catches of each transaction were added and the total was considered as the catch of one day. The annual average catch per fishing day (kg of meat/day) was calculated by dividing the total landing for the year by the total number of fishing days, as estimated from the sale slips.

The landing statistics, expressed in live weight, were transformed into meat weight by dividing the live weight by 8.3. This conversion factor is used by the Statistical Branch to convert the landed meat weights into live weights.

Results

1 - Experimental survey and sea sampling

A total of 7800 scallops (live and dead) were measured during the experimental survey (Figure 4), of which 6.6 % were clappers. Shell height varied from 2 mm to 118 mm. Only two (2) scallops were smaller than 12 mm. These scallops were not considered when using the size range for comparison with others size frequency distributions. A summary of the results from 1985 and 1986 experimental surveys is presented in Table 1. Size frequency distributions from 1985 and 1986 have similar average sizes, and percentage of pre-recruits (< 70 mm). The percentage of clappers has increased by 74 % between 1985 and 1986.

Observer staff sampled 17 tows and measured 2582 scallops (live and dead). The results are presented in Table 1.

2 - Logbooks and questionnaires

A total of 22 fishermen participated in the logbook program by sending in their daily reports. This number corresponded to 95.6 % of all the fishermen with permits who fished one or more fishing days in 1986.

The logbook data were used to calculate CPUE's for each fishing square (Figure 5, Appendix II). Table 2 presents the average CPUE per sub-area for 1985 and 1986. The CPUE values in 1986 varied from 3.35 kg/m.h to 4.76 kg/m h. Considering the CPUE values calculated for each fishing square (Appendix II), the average CPUE for the Strait of Belle Isle was estimated at 4.17 kg/m h (SD= 1.07). This value is lower than the 1985 average CPUE of 5.21 kg/m h (SD= 1.74).

The questionnaire was answered by 108 fishermen representing 78.5 % of the fishermen with licences and 61.5 % of the fishermen with experimental permits. A summary of the results is presented in Table 3. Table 4 shows that the fishing effort distribution in 1986 differed from the effort distribution in 1985. In 1986, the sub-areas E and C (see Figure 3) were still subjected to the highest fishing effort, but the level of fishing effort decreased from 1985 level. Sub-areas D and F also experienced a decrease in their level of fishing effort. Increases in the level of effort were seen in sub-areas A, G, and J. The latter two (2) sub-areas form the major part of the northern section of the Strait of Belle Isle.

3 - Landing statistics

Landings and catch per day (in kg of meat) are presented in Figure 6, and Table 5 respectively. Even if the 1986 landing values are preliminary, the catch per day is considered a reliable estimate for the year as most of the landing data were

collected and compiled at the Statistical Branch level.

Catch per day peaked in 1980, and then decreased each year until 1983. It peaked again in 1984, but at a lower level than 1980, and was followed by a decrease in 1985 and 1986.

4 - Yield per recruit

Yields per recruit (Y/R) using the Thompson and Bell model, were not calculated in this paper, as the parameters used for the calculation (growth, gear selectivity) were the same as last year. For the results and the details on the parameters used, refer to Lanteigne et. al. (1986). Yield isoplethes are reproduced in Appendix III.

Discussion

The size frequency distribution from the 1986 survey had a similar size range as the 1985 survey, and as those presented by Naidu et. al. (1982) for 1980 and 1981. The percentage of prerecruits and the average size of the distribution were similar to those of 1985, suggesting a stable level of recruitment and size composition of the scallop stock. The increase in natural mortality (% of clappers) cannot be explained or be related to any changes in the fishery. Information provided by sea sampling data consisted of only two samples (two fishing days). It was therefore restricted in time and space and was not deemed to represent the overall commercial catch. The limited number of sea samples may explain the differences in size range and average size between the experimental survey and the sea sampling size frequency distributions in 1986.

Results from the logbooks distributed to permit holders and the questionnaires distributed to permit and licence holders indicated that the fishing grounds were distributed throughout the Strait as reported by Lanteigne et. al. (1986). Therefore, the CPUE's calculated from the logbooks were assumed to represent the fishing activity of all the fishermen (with licences or permits). The difference between the distribution of the fishing effort in 1985 and 1986 may be the result of a movement of effort in 1986 towards sub-areas that were less exploited in 1985. The decrease of CPUE's reported in the logbooks, and the lower catch per day in 1986 compared to 1985, could have motivated fishermen to move to less exploited grounds in an attempt to maintain their yields. Two general movements were detected. One was toward the southwest section of the Strait (sub-area A), and a second toward the northeast section of the Strait (sub-areas G and J). These movements were made within the Strait, on fishing grounds which were left years ago, presumably because of low yields. As a result, the CPUE's and catches per day did not improve or stabilize when compared to 1985.

The decrease in catch per day from 1980 to 1983 followed by a peak in 1984, can be related to a change of fishing gear to a more efficient dredge, and the expansion of the fishing grounds (Lanteigne et. al., 1986). As reported for 1985 and 1986, the fishing ground expansion and the gear has not changed since 1984. The overall decrease of CPUE's and catch per day in 1986, and the change in the fishing effort distribution, may be signs of a decrease in the scallop stock density.

The effort, in number of days, for 1985 and 1986 is at its highest values since 1974. Even with stable recruitment, maintaining this level of effort may result in further decreases in CPUE's, and eventually landings.

Presently, more historical catch and effort data are needed. Data such as effort level, dredge efficiency and selectivity, growth, natural mortality, and stock distribution are also needed to provide an assessment of the Iceland scallop stock. As a cautionary measure, management actions should be taken to maintain the effort at its present level by not allowing any additional licences or permits. In addition;

1 - The scallop dredge specifications should be standardized and any changes in specifications should be reported to the Science Branch so that an accurate evaluation of the effort can be made.

2 - Logbooks are only mandatory for permit holders and fishermen can eventually have their permits changed to licences. To assure the access of information on effort and fishing locations, the logbook program should be implemented and mandatory to all fishermen.

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- NAIDU, K.S., F.M. CAHILL, and D.B. LEWIS, 1982. Status and assessments of the Iceland scallop, Chlamys islandica in the northeastern Gulf of St. Lawrence. Can. Atl. Fish. Sci. Adv. Comm., Res. Doc. 82/02, 66 p.

Table 1. Summary of results obtained from: A - experimental surveys, B - sea samplings, conducted on the Iceland scallop resource in the Strait of Belle Isle.

A

Year	Size range (mm)	Number of scallops *	% of scallops		Average (SD) size (mm) *
			<70mm	clappers	
1985	12-121	4500	4.1	3.8	85.5 (8.4)
1986	2-118	7800	4.3	6.6	84.7 (8.7)

B

Year	Size range (mm)	Number of scallops *	% of scallops		Average (SD) size (mm) *
			<70mm	clappers	
1985	---	--	--	--	-- (---)
1986	51-109	2582	1.3	2.6	88.8 (7.3)

* - for live and dead (clappers) scallops combined.

Table 2. Average CPUE's (kg of meat/m·h), and relative index of effort for each sub-area, calculated with the logbook data. The index of effort is expressed in percentage of the total number of fishing days reported in the logbooks.

Sub-area	1985		1986		% of the total number of* fishing days reported in the logbooks	
	CPUE	(SD)	CPUE	(SD)	1985	1986
A	--	--	--	--	--	--
B	--	--	--	--	--	--
C	5.09	1.44	4.60	0.81	22.1	13.3
D	6.09	2.96	3.58	--	8.0	0.1
E	6.59	1.03	4.74	1.43	29.7	32.3
F	5.26	2.41	4.76	1.93	2.4	6.8
G	4.82	2.21	4.51	0.82	2.7	10.8
H	4.97	1.43	4.35	0.52	29.2	29.0
I	--	--	--	--	--	--
J	4.89	0.06	3.35	0.79	5.8	7.7

* - The total numbers of fishing days reported in the logbook, in 1985 and 1986, were 411 and 867 days respectively.

Table 3. Number of fishermen, with permits or licences, active (more than one fishing day) and non-active, who answered the questionnaire.

	Total number of scallop fishermen	Number of fishermen who answered the questionnaire		Total number of answers
		Active	Non-active	
Permits	39	14	10	24
Licences	107	42	42	84
Total	146	56	52	108

Table 4. Summary of the questionnaire's results. For each sub-area, the percentage of fishermen who answered the questionnaire, and the distribution of the fishing effort expressed as percentage of the total number of fishing days reported are presented for 1985 and 1986.

Sub-area	% of fishermen per sub-area who answered the questionnaire		Distribution of the fishing effort as % of the total number of fishing days reported in the questionnaire	
	1985	1986	1985	1986
A	0	0	0.1	8.3
B	14.4	10.7	0	0
C	9.5	7.2	30.7	22.9
D	31.7	32.1	15.0	6.2
E	17.5	25.0	31.9	20.6
F	14.2	10.7	7.8	6.5
G	0	0	2.1	11.8
H	0	0	10.1	10.0
I	0	0	0	0
J	12.7	3.6	2.2	13.7

Table 5. Effort (fishing days) and catch per day, in kg of meat weight, for the C. islandica fishery in the northeastern Gulf of St. Lawrence (Strait of Belle Isle), calculated from landing statistics.

Year	Number of boats actively fishing	Effort in number of fishing days	Catch per day in kg of meat weight
1974	24	269	98.5
1975	0	0	0 *
1976	0	0	0 *
1977	0	0	0 *
1978	0	0	0 *
1979	16	459	106.5
1980	14	774	159.2
1981	24	1262	131.9
1982	24	413	91.8
1983	23	485	83.3
1984	46	1272	120.3
1985	107	2887	96.2
1986	87	2270	94.1 **

* - No fishing reported.

** - Provisional (May 12, 1987).

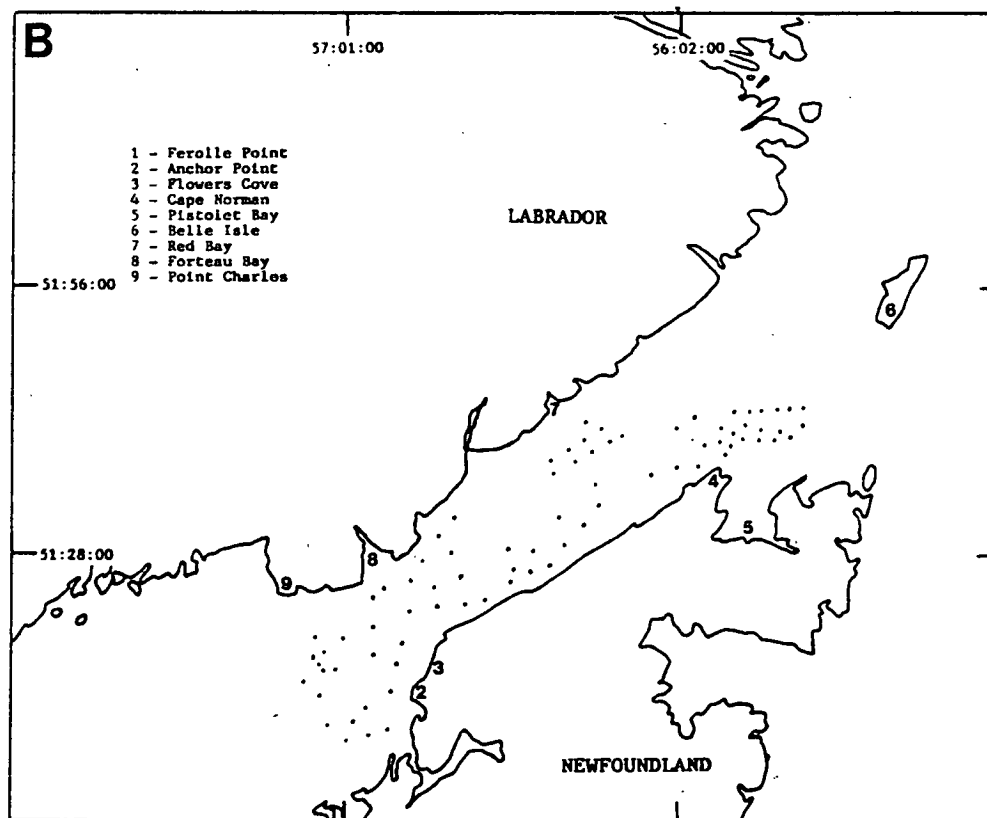
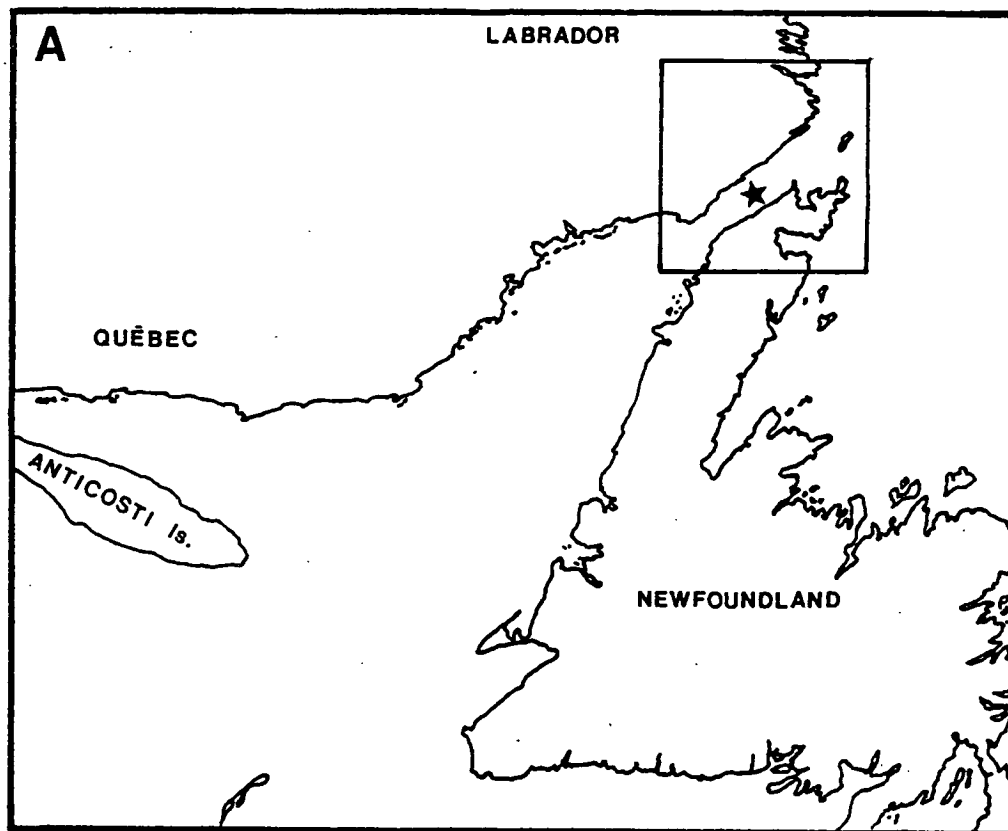


Figure 1. A - Location of the 1986 survey in the northeastern Gulf of St. Lawrence (★ - Strait of Belle Isle). B - Position of tows in the Strait of Belle Isle, Newfoundland.

Width : 3.7 meters
Ring size : 64 mm (bottom)
Mesh size : 100 mm stretched
mesh (top)

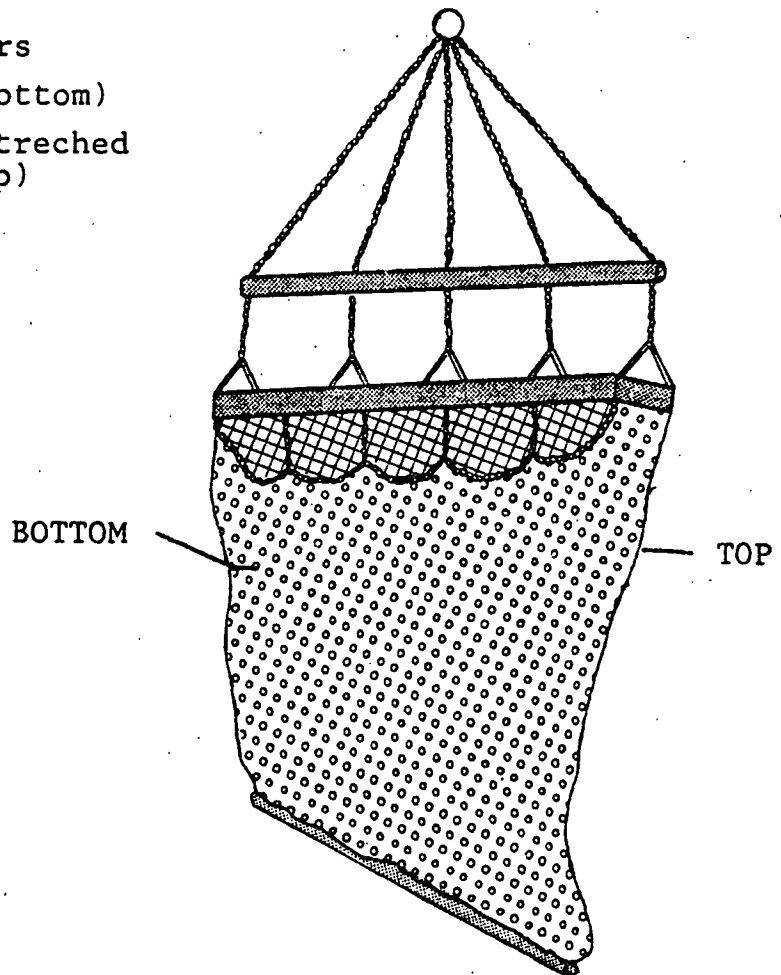


Figure 2. Drag used for the 1986 Iceland scallop survey.

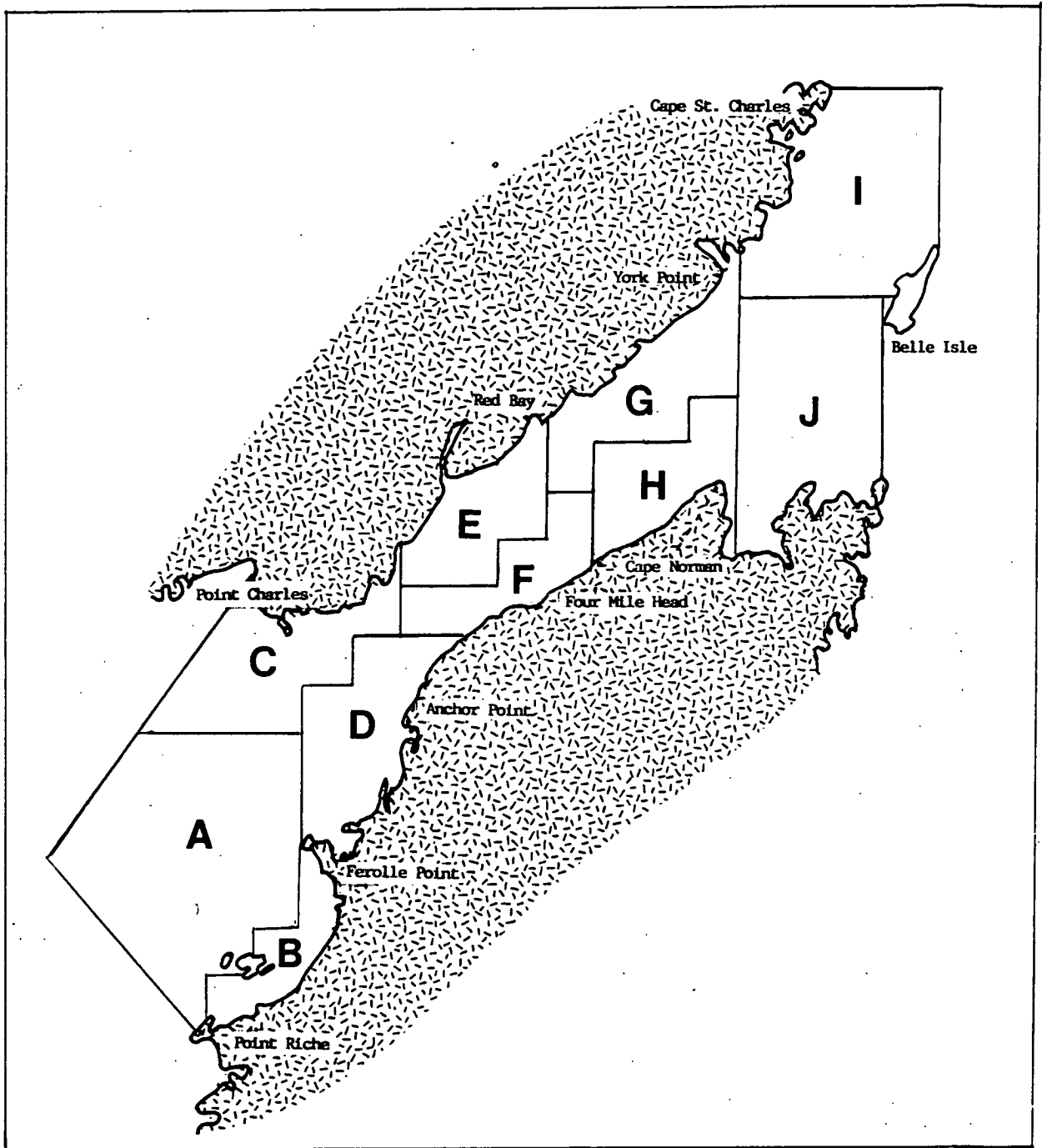


Figure 3. Sub-areas of the Strait of Belle Isle.

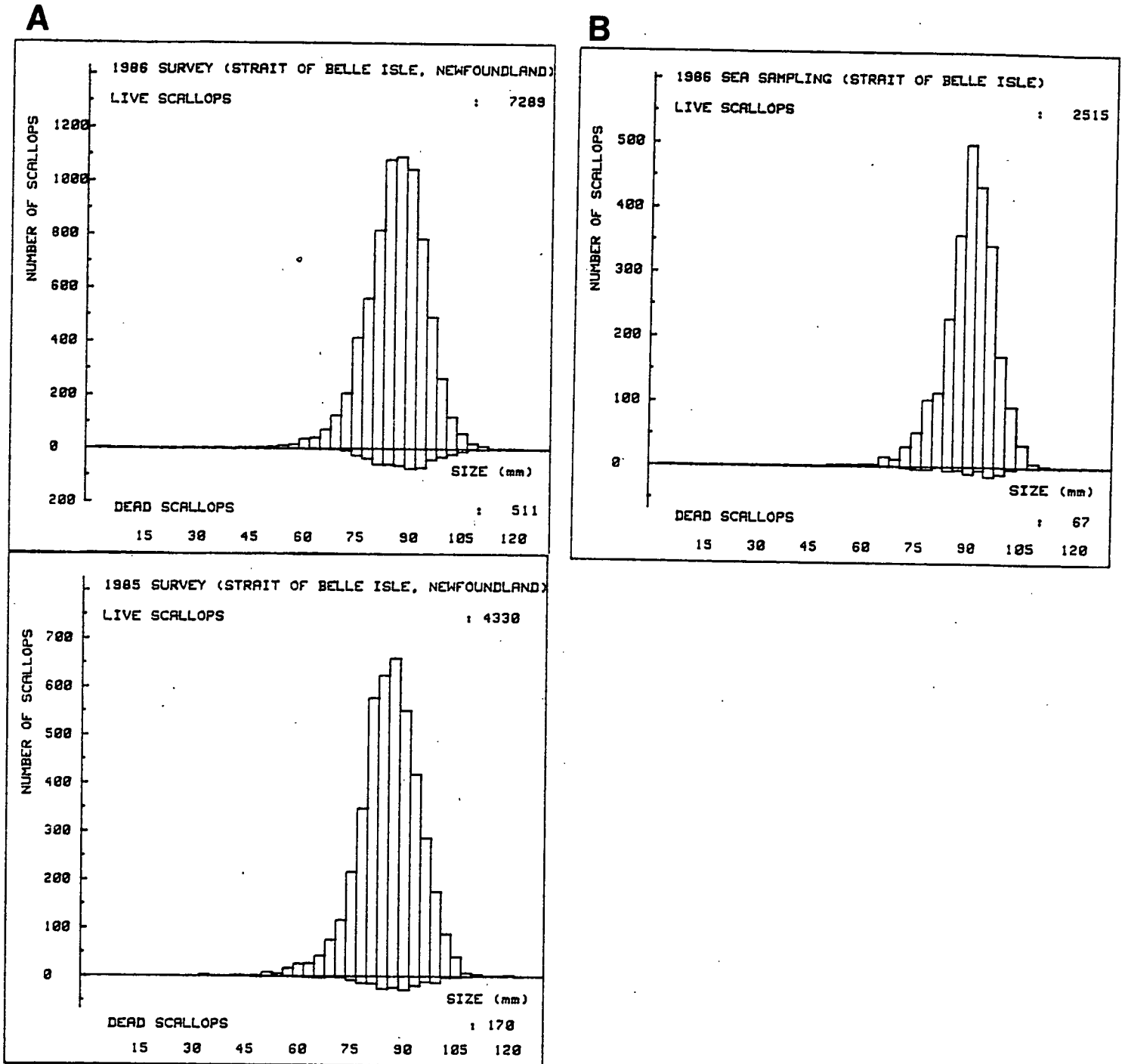
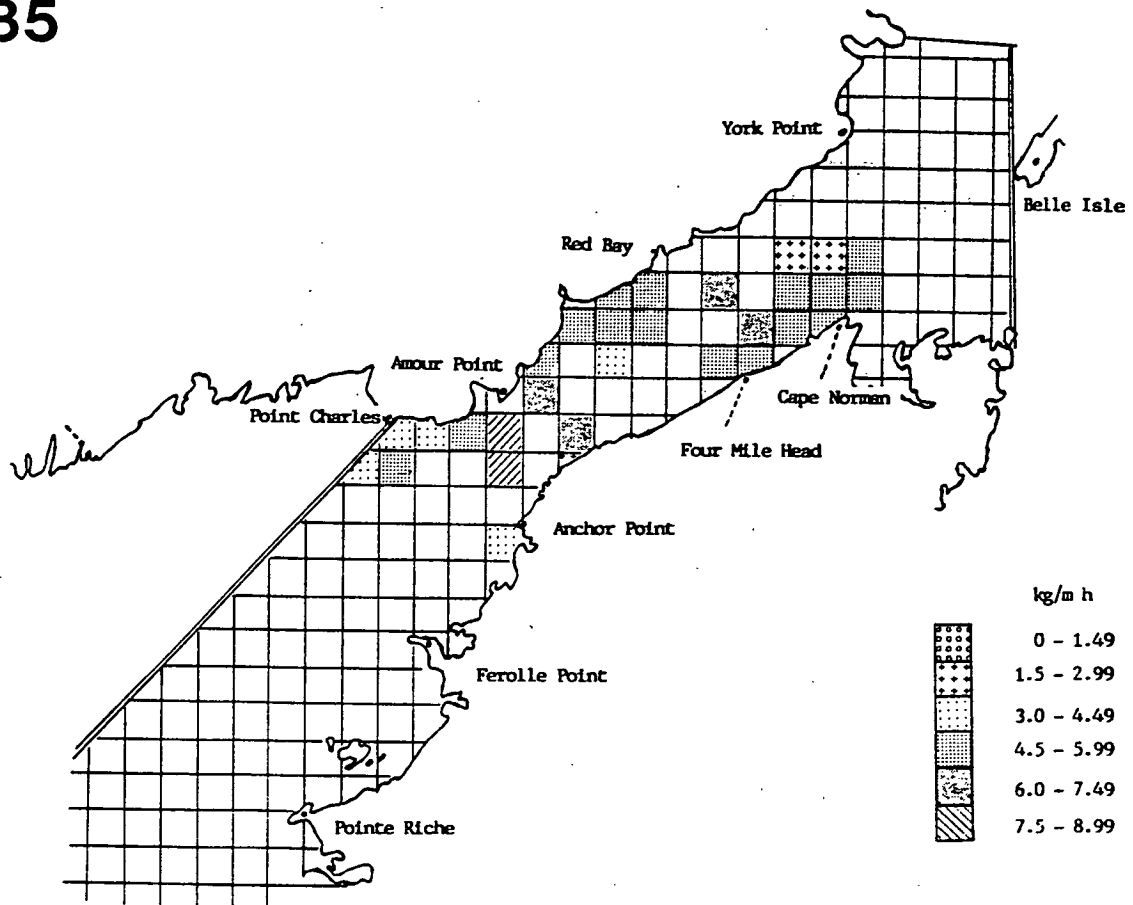


Figure 4. Size frequency distributions of live and dead scallops for experimental survey catches (A) in 1985 and 1986 and sea samplings (B), in 1986

1985



1986

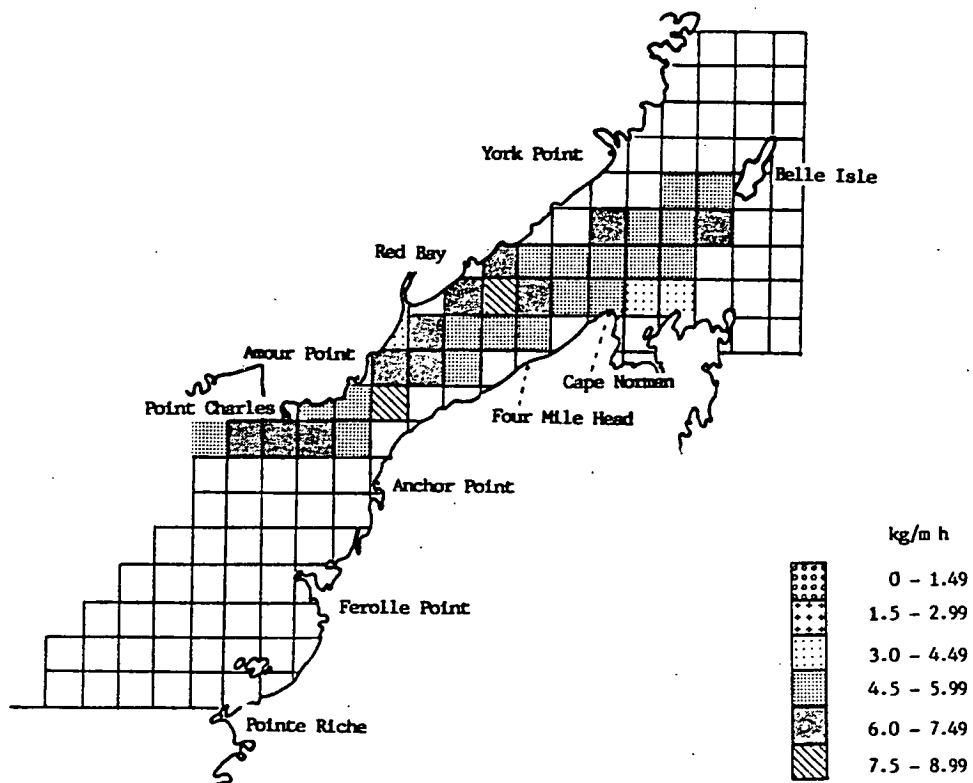


Figure 5. Average CPUE calculated for each fishing square reported in the logbooks, in 1985 and 1986.

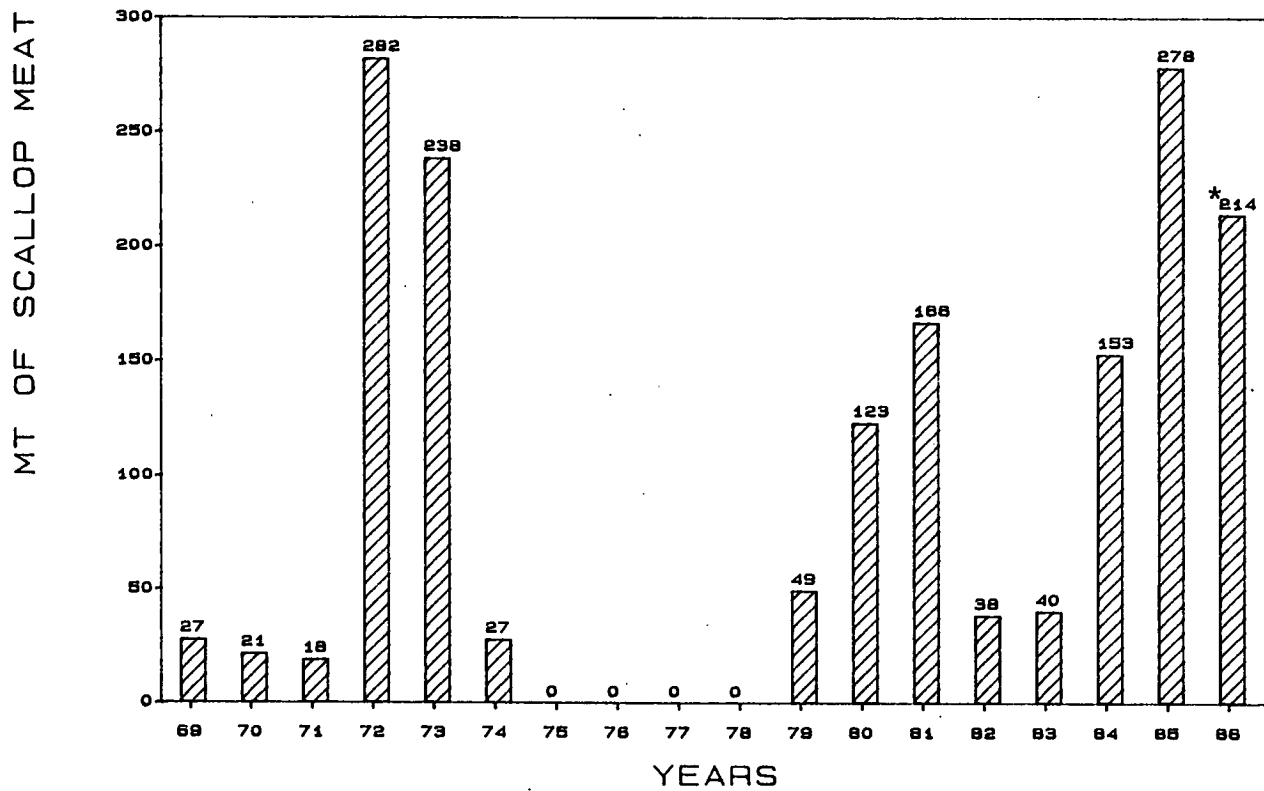
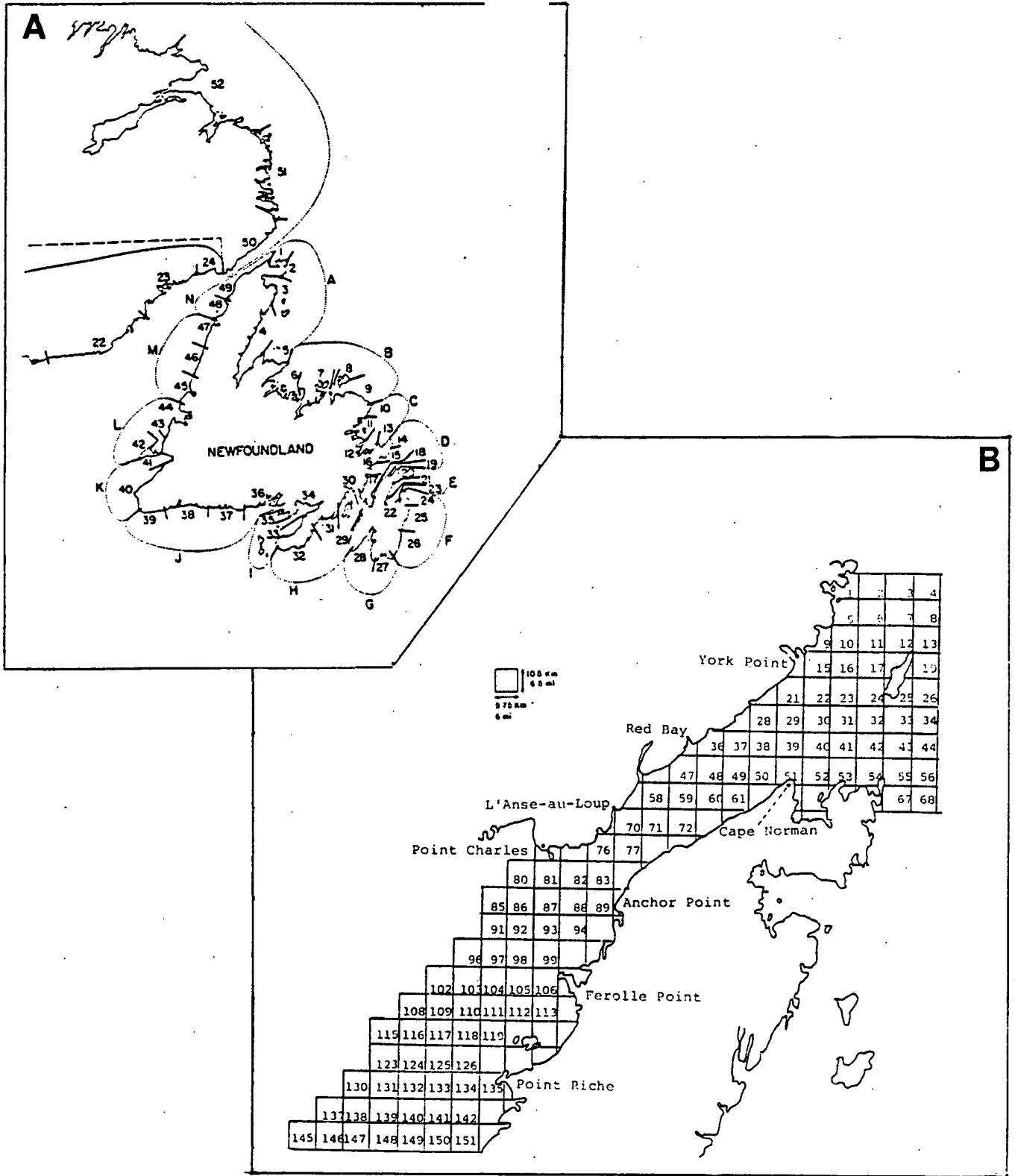


Figure 6. Total landings of Iceland scallops (MT of meat weight) in the northeastern Gulf of St. Lawrence, from 1969 to 1986 (* - provisional data, May 12, 1987).

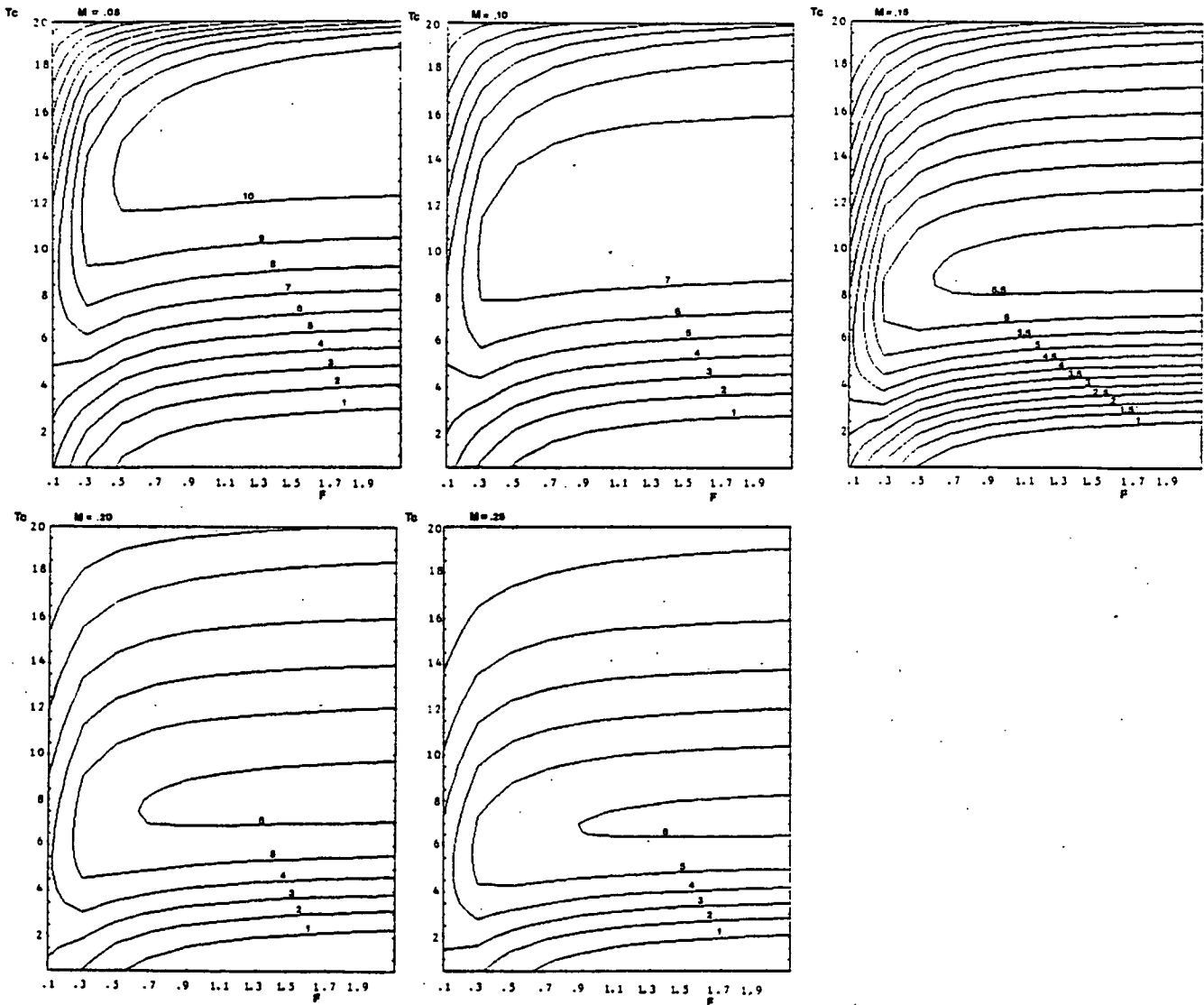


Appendix I. A - Statistical sub-districts for Newfoundland and Labrador
 B - Map of the Strait of Belle Isle and the 'fishing square' grid used in the logbooks.

Appendix II. Number of logsheets returned (days reported), and average CPUE (kg of meat/m.h) for each fishing square, (SD = standard deviation of the CPUE).

Fishing square number	Number of days	CPUE	(SD)
unknow	40	3.18	0.52
23	2	3.76	0.15
24	1	3.29	--
29	1	5.13	--
30	8	3.03	0.58
31	3	3.13	0.16
32	2	5.05	0.50
36	13	5.31	1.44
37	39	3.78	0.76
38	41	3.82	0.68
39	46	4.00	1.20
40	33	3.43	0.84
41	6	3.56	0.84
46	1	1.77	--
47	75	4.92	1.44
48	30	6.17	2.12
49	11	5.21	2.44
50	61	4.16	1.44

Fishing square number	Number of days	CPUE	(SD)
51	111	3.95	1.23
52	7	2.67	0.87
53	5	2.22	1.10
58	58	5.23	1.38
59	44	4.32	1.49
60	22	3.20	0.75
61	22	4.41	1.41
70	28	5.60	1.70
71	44	5.14	1.33
72	35	3.39	0.49
75	6	4.12	1.12
76	38	4.40	1.27
77	2	6.12	3.20
79	1	3.42	--
80	20	5.77	1.06
81	15	5.07	1.71
82	35	4.84	1.55
83	1	3.58	--



Appendix III. Yield per single recruit isoplethes for different values of natural mortality (M) in the Strait of Belle Isle. F = instantaneous rate of fishing mortality, T_c = age at first capture, (from Lanteigne *et. al.*, 1986).