The Grand Manan area scallop stock assessment - 1987

By

G. Robert and M.J. Lundy
Invertebrates Fisheries and Aquaculture Division
Biological Sciences Branch
Halifax Fisheries Research Laboratory
Department of Fisheries and Oceans
Scotia-Fundy Region
P. O. Box 550
Halifax, N. S.
B3J 2S7

ABSTRACT

Following the Inshore / Offshore Agreement of September 1986, major changes apply to the management of the scallop fishery in Bay of Fundy waters with a series of conservation initiatives for the Bay and its approaches (extension of fishing grounds from 7-mile to the middle of the Bay, extension of the 'conservation' zone, and regulations dealing with meat count, minimum shell height, and maximum over-all width of the gear).

There is little inter-annual variation in the scallop landings from southwest New Brunswick, at around 250 t. per year. Scallop beds in the Grand Manan area make up the majority of landings. On an area basis, CPUE from these beds used to represent the most productive areas. In 1987, the mean CPUE from the five most productive areas was 37 % greater than in 1986 (3.40 vs 2.48 kg./ hm) and represented heavy exploitation of grounds in Passamaquoddy Bay and the Deer Island area. Catches in offshore waters (NAFO 5Yb) have decreased by 50 % from last year. Survey results indicate a slight pulse of young scallops (ages 3 - 5) in the nearshore waters of Grand Manan; otherwise these stocks are at a low level.

RESUME

A la suite de l'Entente de septembre 1986 entre la flotte hauturière et les flottilles côtières, des changements majeurs s'appliquent à la gestion de la pêche aux pétoncles dans la Baie de Fundy avec l'introduction de mesures de conservation pour la Baie et ses approches: extension de la zone de pêche de 7 milles au milieu de la Baie, prolongation de la zone de 'conservation', et règlements concernant le compte de chairs, une hauteur de coquille minimale, et un maximum de la largeur hors-tout de l'engin de pêche.

Les débarquements de pétoncles du sud-ouest du Nouveau Brunswick varient peu d'année en année, à environ 250 t. annuellement. Les bancs de pétoncles de l'Ile de Grand Manan constituent la majorité des débarquements. Sur une base régionale, les P.U.E. de ces bancs avaient représenté les régions les plus productrices. En 1987, la P.U.E. moyenne des cinq régions les plus productrices était 37 % plus élevée que celle de 1986 (3.40 vs 2.48 kg / hm) et correspond à une exploitation intensive des bancs de la Baie de Passamaquoddy et de Deer Island. Les captures des eaux profondes (OPNA 5Yb) ont diminué de 50 % depuis l'année dernière. Les résultats de l'inventaire des stocks indiquent une légère abondance de jeunes pétoncles (3 - 5 ans) dans les eaux côtières de Grand Manan; ailleurs, les stocks sont à un bas niveau.

INTRODUCTION

Following the Inshore / Offshore Agreement of September 1986, major changes apply to the management of the scallop fishery in Bay of Fundy waters with a series of conservation initiatives for the Bay waters and its approaches. Starting with the year 1987, exploitable grounds were extended from 7 miles from the New Brunswick shore to the middle of the Bay of Fundy for the 'inshore' scallop license holders of the southwest shore of New Brunswick. New Brunswick license holders are now referred to as "Mid-Bay" license holders.

The 2-mile 'conservation' zone in Grand Manan waters where fishing is allowed only between the second Tuesday of January and the end of March each year, was also extended to the shoreline of New Brunswick up to the Saint John - Albert county line.

New regulations came into effect in December 1987 with respect to the scallop fishery in Bay of Fundy waters (Canada Gazette Part II, Vol. 121 no.25, SOR / DORS / 87-672). Highlights are the introduction of meat counts, 72 meats per 500 g during the period May 1 to September 30 and 55 meats per 500 g during the period October 1 to April 30 and a minimum shell height of 76 mm. Regulations dealing with scallop fishing gear were modified and expanded; a maximum over-all width of the gear (5.5 m) was re-introduced; offshore rake and 'Green' sweep drag were banned.

There is little inter-annual variation in the scallop landings from southwest New Brunswick after the outstanding record landings of 1981 (over 500 t). The extension of fishing grounds to Mid-Bay license holders did not result in an increase in landings as the productivity of the newly assigned grounds is somewhat marginal.

The aggregations of juvenile scallops first noticed in the 1986 stock survey were observed again in the 1987 survey. This significant increase in numbers of young scallops only took place in localised areas.

METHODS

Fishery Data

All vessels must be licensed for fishing scallops in this area (Mid-Bay or Bay of Fundy scallop license) and must maintain logbooks on a daily basis for vessels over 25.5 G.T. and/or length overall greater than 14 m. Daily log records supply information on the catch and its location, and fishing effort such as hours spent dragging, width of the gear, and number of crew. CPUE estimates may be computed when complete effort data are provided with respect to the catch; these data have been designated as Class 1 data.

The information provided by vessels over 25.5 G.T. form the basis of the fishery analysis presented here. It might not necessarily reflect the fishing performance of vessels under 25.5 G.T. Hence, landings from this sector of the fleet in that geographical area (Statistical Districts 48 to 53) (Fig. 1) are used to represent their contribution to the catches of this area. It is also possible since 1985 to compile landings on a per vessel basis, match these figures to landings per statistical district, and estimate, although roughly, a mean catch per vessel under 25.5 G.T.

Survey Data

Survey work took place in October, 1987 except for a few stations in the Duck Island Sound area which were sampled in December, 1987. 125 sampling locations were randomly selected according to the traditional effort expended from 1983 to 1987 (up to September) in the Grand Manan area according to logged data. It is becoming difficult to stratify the survey locations

according to the commercial catches (with known locations) of the previous year only, fewer catches being logged due in part to the lower stock abundance.

Survey data has been post-stratified two ways. For comparative purposes with surveys of previous years, survey stations have been clustered in two groups: 1) inside 7-mile line; 2) outside 7-mile line. Then, because the outside 7-mile zone covers a bigger geographical area the data were further post-stratified in three areas: 1) southern area (shallow waters to the south of the Island); 2) western area (Grand Manan Channel and Seal Island); 3) northern area (Wolves Bank and vicinity) (Fig. 2).

A four-gang 76.5 cm Digby drag with 76 mm rings linked with rubber washers was used with the two middle buckets lined with 38 mm stretched mesh netting. Survey procedures followed the ones given in Robert et al (1984). Tow track was monitored by the recording of Loran bearings every 30 seconds during a tow.

To interpret the survey catch-rates in terms of stock distribution on an age basis, some scallops were collected throughout the 1986 survey to estimate a growth curve (von Bertalanffy). About 500 shells were ring-read to establish the following growth parameters:

$H_\infty = 134.553$ mm $k = 0.265$ $t_0 = 1.344$

There is no information available on the composition of the commercial catch for these scallop beds.

RESULTS

Fishery Performance

The number of Bay of Fundy licensed vessels has remained constant for the last 3 years (Table 1). The number of Mid-Bay licenses which had reached a maximum in 1981 (Robert et al 1984) remains at a fairly high level although a sizable drop in renewed licenses took place in 1987. The number of active fishing licenses has not changed though. The majority of the Mid-Bay licenses are vessels which do not have to report their fishing activities because of their size. However since 1985, it is possible to compile catch statistics on a per vessel basis and get a crude estimate of the participation rate of vessels under 25.5 G.T. as recorded by sale slip submissions and of catch per vessel. Out of the total number of Mid-Bay licenses issued to vessels under 25.5 G.T. annually, it appears that an important percentage (50 % ?) are not used as no sales slips in the name of the vessel are submitted. However, the ratio of inactive licenses decreased for 1987. Most vessels over 25.5 G.T. hold a Bay of Fundy license and are actively involved in the fishery although not necessarily in the waters of southwest New Brunswick exclusively. Their involvement has been constant for several years now, except that an increasing number have declined to comply with log procedures. This reduction in log compliance impedes the information data base toward analysis of the fishery performance.

Scallop landings from southwest New Brunswick continue to decline after the 1981 record breaking figure (Table 2 and Figure 3); this downward trend is progressing slowly after an initial sharp drop. The geographical location of statistical districts 48 to 53 and designation of relevant NAFO sub-subareas are illustrated in Figure 1. About 250 t were landed in statistical districts 48 - 53 during 1987. Larger vessels (L.O.A. 13 - 19.8 m) conducted some fishing trips to Georges Bank between May and August and exploited the inshore zone of Digby at the opening of the season in October. It is estimated that approximately 40 t landed in southwest New Brunswick, especially district 50, were not caught in the immediate area.

Tables 3 to 5 give recent landings on a monthly basis by statistical district and by vessel size. "Inshore" vessels using ports on Grand Manan Island (district 50) conduct a winter fishery with a marked seasonal trend in landing patterns. With decreasing fishery performance in 1987

January-March landings are reduced. The continued relatively high landings of the 1987 summer originated from Georges Bank. Logged data did not show important fishing activity during the summer time. In comparison, districts other than 50 contributed relatively little.

Since effort data is not available from 'inshore' vessels, evaluation of the performance of that fishery sector is rather difficult. Since these small size vessels are somewhat limited by weather and sea conditions in the geographical coverage and distances to the areas they may possibly fish it is assumed that they exploit fishing grounds in the immediate vicinity of home ports and a vessel's performance is indicative of the status of the stocks in the area. A major caveat to this statement is that these vessels are engaged in a multi-fishery system. If a particular fishery is, at one point in time, getting outstanding results fishermen may elect not to get involved in the scallop fishery for a certain period of time regardless of the status, good or bad, of the scallop resource in the area. Participation in other fisheries in some loose terms has to be considered in the process of interpretation of the performance of vessels involved in the scallop fishery.

Once a data base has been established including more than a few years' worth of results, analysis of vessel performance may become a worthwhile exercise in the present context. Table 6 presents a short time series of catch-rate for inshore vessels on an annual basis for Mid-Bay license holders registered in southwest New Brunswick. There is a great deal of diversity in the exploited scallop beds in this area; a mean annual catch per vessel per district is also calculated. Grand Manan (Statistical district 50) vessel catch-rate experienced an important reduction in 1987 while in the Saint John district (48) and Campobello (51) mean catch per vessel were up considerably.

Fishery characteristics in terms of effort and catch-rate are derived from Class 1 data originating from logbook analysis. Over 70 % of the logged catches contribute to Class 1 data (Table 7). But, the proportion of logged catches compared to all catches that are required to be logged according to Section 48 of the Fisheries Act has been steadily declining. In 1987, a mere 14 % of scallops landed were also reported in logbooks. Such a data base has to be interpreted with caution. Moreso when offshore landings represent about 25 % of the combined inshore-offshore landings for the area.

Southwest New Brunswick

Southwest New Brunswick by opposition to Grand Manan offshore waters designate the shallow waters to the south and southeast of Grand Manan Island, Wolves Bank, Campobello, Deer Island, and Passamaquoddy Bay (NAFO sub-subarea 4Xs in part). Mean catch-rates had suffered quite a drop from 1985 to 1986 (Table 8); but average values have bounced back in 1987. From 1986 to 1987 effort decreased markedly for similar Class 1 catch data. Catch-rates have further rebounded to 1984, 1985 values. Tables 9 to 12 present fishery characteristics for individual fishing locations for 1984 to 1987. Table 13 is similar but covers Campobello, Deer Island and Passamaquoddy Bay areas. Scallop beds in the immediate vicinity of Grand Manan were usually the most heavily exploited. This year, scallop beds of Deer Island and near Saint Andrews have contributed the best areas to the scallop fishery; but their production is quite irregular. Even though the Class 1 catch and catch-rate to a lesser extent, might vary greatly for a single fishing area depending, in part, on the information received for any one year, there is a general trend of decline in both catches and catch-rates best shown when all fishing grounds are examined in a single group. This trend (Table 8) is slightly reversed in 1987 because of the relatively high exploitation of grounds outside Grand Manan waters per se.

This is best illustrated in Table 14 which presents a 5-yr profile of the five most productive areas. Up to 1987, CPUE was declining while the contribution of the top 5 areas was becoming a greater percentage of the areas fished; areas were shifting rank but the same areas (more or less) remained in the top five. In 1987, CPUE rose significantly and the most productive areas represented 81 % of the total areas fished. Most importantly, these areas except for Duck Island Sound had not been in the ranks before.

Grand Manan Offshore Waters

Grand Manan offshore waters define fishing areas outside the 7-mile line like Southwest Bank but also grounds in NAFO sub-subarea 5Yb such as Grand Manan Channel. This area has been exploited recently by vessels under 25.5 G.T. mostly (Table 15) with a sporadic profile of landings. Catches for 1987 show a 50 % reduction compared to last year. Monthly catches from sub-subarea 5Yb (Tables 16-18) follow the same pattern as catches from grounds in the immediate vicinity of Grand Manan with fishery operations peaking in the early part of the year. The fishery performance of Grand Manan offshore waters in Table 19 shows that catch-rates in this area have further dropped after being stable for the three previous years.

Survey Results

Since 1985 the annual stock surveys give good coverage to both nearshore and offshore Grand Manan waters (Table 20). Starting with the first survey in 1979, the inside zone has shown greater abundance of scallops than the outside zone (except for 1980) (Table 21). Area-wise, the northern area mainly representing a scallop aggregation in the vicinity of the Wolves Islands has had low abundance compared to the southern and western areas. In the western area, there is a shift from pre-recruits to recruits from 1986 to 1987. Heavy settlement of juvenile scallops in specific locations of the western area had been observed during the 1986 survey (ages 2 - 3 inside zone). Significant abundances of ages 3 and 4 scallops were further noticed in the 1987 survey (Table 22). Numbers for fully recruited age-classes are remaining very low both inside and outside the 7-mile line. Survey results do not show any sign of pre-recruits for offshore waters (beyond 7-mile line). It therefore appears that a slight pulse of young scallops (ages 3 - 5) in the waters inside 7-mile is the only positive note in an otherwise depleted stock.

DISCUSSION

Although scallop beds in the immediate vicinity of Grand Manan have sustained landings at about 250 t per year for a number of years now, catch-rates have dropped steadily. This trend continued in 1987; average CPUE for 1987 apparently bounced back because of the introduction in the mean values of high rates reached in newly exploited areas outside of the immediate Grand Manan area. Grand Manan catch-rates per se remained at levels similar to pre-1987 ones. Scallop beds in NAFO sub-subarea 5Yb were rapidly depleted ; recent catches being minimal. A slight improvement to the Grand Manan stocks is taking place with a noticeable pulse of ages 4 - 5 scallops in the 1987 stock survey. Harvesting of these year-classes should be postponed for a few years however to increase the meat yield. At the moment, commercial size year-classes are in low abundance so catches should not rise in any significant way. Over the long term, it is doubtful that Grand Manan and southwest New Brunswick waters may produce over 200 t on average (Fig. 3). Erratic fluctuations in catches could be moderated by controlling the effort and optimising the catch yield. The establishment of the 2-mile 'conservation' zone to the New Brunswick shoreline of the Bay of Fundy (restricting the harvesting of the most productive grounds to a short season) and the introduction of meat counts (initially set at 55 and 72 meats per 500 g depending on the fishing season) are steps in the right direction.

REFERENCES

Robert, G., M.J. Lundy, and R.A. Chandler. 1984. Recent trends in the Grand Manan scallop fishery. Can. Tech. Rep. Fish. Aquat. Sci. 1267: 78p.

Robert, G. and M.J. Lundy. 1986. The Grand Manan scallop stock assessment - 1985. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 86/42: 27p.

Table 1.- Number of 1) licensed vessels registered in Statistical Districts 48 to 53 (Source: Licensing Unit, Fisheries and Oceans, Halifax); 2) active fishing licenses (activity measured as the submission of one or more sales slips); and 3) vessels complying with log procedures out of the number of active fishing licenses for vessels over 25.5 G.T.

Year	1 Mid-Bay licenses* Bay of Fundy licenses	2 under + over 25.5 G.T. when available	3
1983	253	n/a	
	17	19	14
1984	249	n/a	
	17	23	17
1985	245	122 + 13	
	15	6 + 7	14
1986	253	112 + 11	
	15	5 + 7	10
1987	206	111 + 15	
	15	5 + 8	15

* Prior to 1987, 7-mile licenses.

Table 2.- Annual landings (t of scallop meats) by statistical district, by vessel tonnage, (1): ≤25.5 G.T., (2): >25.5 G.T.. Prior to 1967, landings were not divided by vessel tonnage. Source: Statistics Division, Fisheries and Oceans, Halifax.

District	48		49		50		51		52		53		Total
Tonnage	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1) + (2)
1960					2.8								2.8
1961					1.9								1.9
1962					4.2		5.5				3.8		13.6
1963					4.8		5.5				3.3		13.6
1964					0.8		4.7				2.4		8.0
1965		0.2			7.8		1.8				2.8		12.6
1966					0.9		0.9						1.8
1967							0.5			1.8	2.8		5.1
1968					14.5		2.3	1.3		0.5	1.8		20.4
1969											0.9		0.9
1970					7.7				1.3		1.3		10.4
1971					1.8		0.9		1.8		4.9		9.5
1972					1.8		0.5				3.6		5.9
1973					4.6		1.8				2.8		9.2
1974					1.3		1.3				2.4		5.1
1975					0.7		2.1				1.1		3.9
1976					0.2		1.3						1.6
1977					3.5		0.2		0.5				4.2
1978					3.9	6.3			1.7				11.8
1979					24.7		0.1	1.9	3.4				30.1
1980					137.7	7.5	5.3	3.7	6.6	2.9		0.2	164.0
1981		0.1	2.2		430.0	57.6	11.3	39.3	5.4	7.5	2.8	5.3	561.5
1982	3.1	0.4	3.1	0.4	197.0	43.6	10.8	11.2	14.8	7.8	1.8		294.2
1983	3.0	1.8	11.4	4.5	222.1	45.0	24.6	21.7	1.8	2.3	2.9	3.4	344.4
1984	16.1	4.4	10.4	2.5	168.2	38.8	25.6	25.4	1.8	0.8	9.7	2.2	305.9
1985	22.3	5.3	4.1	1.7	150.3	32.0	21.8	11.8	3.1	1.1	10.5	2.0	266.0
1986	4.6	0.7	22.3	1.3	130.8	42.7	18.0	23.7	0.8	0.0	6.7	4.2	255.8
1987	9.5	0.7	33.4	4.1	88.0	44.8	34.9	16.0	1.9	0.8	9.5	4.7	248.3

Table 3.- 1985 monthly landings (t of scallop meats) by statistical district and by vessel size. For statistical purposes, landings from vessels ≤25.5 G.T. are classified as 'inshore' and landings from vessels >25.5 G.T. as 'offshore'. Source: Statistics Division, Fisheries and Oceans, Halifax.

	48			49			50			51			52		53	
	IN	OFF		IN	OFF		IN	OFF		IN	OFF		IN	OFF	IN	OFF
		≤14m	>14m		≤14m	>14m		≤14m	>14m		≤14m	>14m		≤14m >14m		≤14m >14m
Jan				0.24	0.24		37.35	3.49	1.33	1.33	0.24	0.12	0.72		0.72	
Feb	0.12	0.24		0.24	0.24		42.05	3.86	1.45	3.73	0.60	0.48	0.36		0.36	
Mar	2.05	0.24	0.12	0.60	0.48		29.28	2.89	1.08	3.37	0.60	0.12	0.48		1.45	
Apr	4.82	0.84	0.36	0.24			8.80	1.45	1.20	2.53	0.36	0.84		0.12	1.57	0.24
May	9.52	1.81	0.60	0.48			9.52	0.60	1.93	2.53	0.84	1.93	0.60		0.36	0.36
Jun	1.81	0.96	0.12	0.24			5.42	0.96	0.72	1.57	0.72	0.72	0.48	0.60	0.12	
Jul	0.84						4.82	1.81	0.84	0.96			0.12	0.36	0.96	
Aug	1.08			0.12			6.14	1.45	3.49	1.33	1.81	0.24	0.36		1.69	0.12
Sep	1.33			0.72		0.36	4.22	0.48	0.48	2.77	0.72	0.36			1.57	1.08
Oct	0.72			1.08	0.36		1.81	0.36	1.69	1.33	0.48				1.69	0.24
Nov							0.36	0.24		0.12		0.12				
Dec				0.12			0.48	0.24		0.24	0.36	0.12				
Total	22.29	4.09	1.20	4.08	1.32	0.36	150.25	17.83	14.21	21.81	6.73	5.05	3.12	1.08	10.49	2.04

Table 4.- 1986 monthly landings (t of scallop meats) by statistical district and by vessel size. For statistical purposes, landings from vessels ≤25.5 G.T. are classified as 'inshore' and landings from vessels >25.5 G.T. as 'offshore'. Source: Statistics Division, Fisheries and Oceans, Halifax.

	48		49			50			51			52		53	
	IN	OFF	IN	OFF		IN	OFF		IN	OFF		IN	OFF	IN	OFF
		≤14m >14m		≤14m >14m			≤14m >14m			≤14m	>14m		≤14m >14m		≤14m >14m
Jan			0.36			20.72	4.82	1.45	1.69	0.24				0.36	
Feb			0.72	0.12		44.94	8.43	2.17	3.61	0.84	2.29			1.20	
Mar			0.96	0.12		32.53	4.10	1.08	2.53	0.48				0.96	0.60
Apr	0.24	0.12	1.81	0.12	0.24	4.82	1.57	0.36	0.36	0.60	0.36			0.96	0.12
May	0.72	0.36	1.69	0.12		15.54	9.28	1.57	1.08	0.36	12.05			1.69	
Jun	0.12	0.24	1.45	0.12		4.10	1.20	0.60	1.93		0.60	0.24		0.60	1.08
Jul	1.57		4.70			2.29	1.69		2.17	0.96	1.20			0.12	1.45
Aug	0.72		3.37			3.13	2.65		1.20	0.84	0.36			0.36	0.36
Sep	0.72		4.34	0.36		1.93	0.12		1.45	0.24	1.45			0.36	0.48
Oct	0.48		2.89	0.12		0.48	0.24		1.45	0.48	0.24	0.48		0.12	
Nov							0.72		0.36		0.12	0.12			0.12
Dec						0.36	0.60		0.12						
Total	4.57	0.72	22.29	1.08	0.24	130.84	35.42	7.23	17.95	5.04	18.67	0.84		6.73	4.21

Table 5.- 1987 monthly landings (t of scallop meats) by statistical district and by vessel size. For statistical purposes, landings from vessels ≤25.5 G.T. are classified as 'inshore' and landings from vessels >25.5 G.T. as 'offshore'. Source: Statistics Division, Fisheries and Oceans, Halifax.

	48		49			50			51			52		53		
	IN	OFF	IN	OFF		IN	OFF		IN	OFF		IN	OFF	IN	OFF	
		≤14m >14m		≤14m >14m			≤14m >14m			≤14m >14m			≤14m >14m		≤14m >14m	
Jan			0.36			25.18	3.98	1.57	1.44	0.96	0.48	0.48		1.20	0.24	
Feb			1.20	0.24	0.12	12.89	1.20	0.12	0.96	0.12		0.24		0.60	0.48	0.12
Mar			2.89	0.24		10.48	0.36	0.12	1.33	0.12		0.24		0.72		
Apr	1.57		5.06	0.60		2.17			0.72	0.24				1.57		
May	0.60	0.72	5.78	0.60		5.66	1.57	3.73	1.81	0.48	0.48			1.08		
Jun			2.89	0.48		9.16	1.08	4.22	0.36	0.12				0.72	1.20	
Jul	1.57		4.82			9.76		3.49	5.78			0.24		0.24	1.57	
Aug	2.41		2.53	0.12		4.34		3.73	7.47	0.84		0.36		1.81	0.72	
Sep	1.93		4.22	1.08		1.44			5.66	2.29		0.12		0.24	0.12	
Oct	1.45		3.49	0.60		4.46		7.95	6.87	2.40	1.20	0.12	0.72	0.96	0.24	
Nov						1.93		5.78	1.44	3.01		0.12	0.12			
Dec			0.12			0.48		5.90	1.08	1.32	1.93			0.36		
Total	9.53	0.72	33.36	3.96	0.12	87.95	8.19	36.61	34.92	11.90	4.09	1.92	0.84	9.50	4.57	0.12

Table 6.- Estimate of productivity on a vessel basis for vessels under 25.5 G.T. holding a Mid-Bay license from Statistical Districts 48 to 53 inclusive.

Year	Mean catch (kg) per vessel	Mean catch (kg) per vessel per district					
		48	49	50	51	52	53
1985	1,480	603	249	1,315	545	298	756
1986	1,197	544	690	1,428	447	225	568
1987	672	676	714	733	795	163	377

Table 7.- Percentage of catches (t of scallop meats) from log records for southwestern New Brunswick and Grand Manan offshore waters and landings (inshore and offshore) in Statistical Districts 48 to 53 inclusive.

Year	inshore	offshore			total
	landings	class 1 catch	logged	landings	landings
1983	265.8	22.07	29.45	78.60	344.4
1984	231.8	19.54	26.76	74.16	305.9
1985	212.0	13.56	19.43	53.91	266.0
1986	183.2	10.72	14.58	72.62	255.8
1987	177.2	8.03	9.87	71.10	248.3

	Catches		Landings
	% Class 1 / logged	% logged / landed	% offshore / total
1983	75	37	23
1984	73	36	24
1985	70	36	20
1986	74	20	28
1987	81	14	29

Table 8.- Summary of fishery characteristics for southwestern New Brunswick. Effort pertaining to logged catch is prorated according to the effort which generated class 1 catch.

	Catch		Effort			CPUE		
	kg	t	days	hours	hours-meters	kg/d	kg/h	kg/hm
1983 data								
Class 1	17,243	17.24	236	1,358	6,043	73.1	12.7	2.85
Logged	22,647	22.65	310	1,785	7,946			
1984 data								
Class 1	13,281	13.28	164	1,158	5,487	81.0	11.5	2.42
Logged	18,791	18.79	232	1,638	7,765			
1985 data								
Class 1	10,080	10.08	123	876	4,340	82.0	11.5	2.32
Logged	14,882	14.88	182	1,293	6,415			
1986 data								
Class 1	5,622	5.62	77	748	3,760	73.0	7.5	1.50
Logged	8,892	8.89	122	1,184	5,928			
1987 data								
Class 1	6,175	6.18	71	510	2,192	87.0	12.1	2.82
Logged	6,649	6.65	76	550	2,358			

Table 9.- Fishery characteristics around Grand Manan Island, by area in 1984. Effort data not prorated to logged catch.

Area	Catch	Effort			CPUE		
	kg	days	hours	hour-meters	kg/d	kg/h	kg/hm
CrossJack Ledge	102	2	9	38.9	51	6.0	1.31
Dixon Rocks	207	2	-	-	104	-	-
Duck I. Sound	2058	15	125	572.2	137	15.9	3.43
Eastern Ledge	108	1	-	-	108	-	-
Gannet Rock	1147	6	52	283.4	191	22.1	4.05
2 miles "	193	1	11	57.6	193	18.4	3.35
Green Island	221	3	15	77.7	74	14.7	2.84
Middle Grounds	561	5	27	153.7	112	21.0	3.65
Ox Head	481	4	27	137.6	120	18.2	3.50
Shag Head Breaker	132	1	-	-	132	-	-
Ship Head	265	7	35	157.7	38	7.7	1.68
St. Mary's Ledge	722	8	44	201.5	90	16.4	3.58
White Horse Head	3024	28	57	297.4	108	15.5	2.98
Wolves Bank	1693	42	231	952.9	40	7.3	1.78
443664	1065	8	43	212.2	133	23.3	4.81
444664	66	1	6	35.2	66	12.0	1.87
445663	25	1	3	13.7	25	8.3	1.82
442665	2295	21	189	979.3	109	12.1	2.34
Grand Manan offshore waters:							
Bradford Cove	332	7	48	238.5	47	6.9	1.39
Bull Rock	946	9	42	205.4	105	16.6	3.36
Long Ledge	121	1	-	-	121	-	-
Murr Ledge	680	10	54	297.4	68	11.9	2.16
Southwest Head	1141	13	68	374.4	88	12.9	2.35
2 miles "	326	4	30	147.5	82	11.0	2.21
3 miles "	272	2	32	173.7	136	8.6	1.57
Seal Island	717	3	34	206.2	239	21.1	3.48
Western Ledge	640	7	9	39.6	91	5.2	1.14
2 miles "	234	2	13	68.6	117	18.7	3.41
Yellow Ledge	522	4	30	183.0	131	17.5	2.85
443665	178	3	13	58.3	59	14.0	3.05
444665	86	2	5	24.2	43	16.4	3.56
443670	536	9	73	381.0	60	7.3	1.41
441673	99	2	6	29.0	50	15.6	3.42

Table 10.- Fishery characteristics around Grand Manan Island, by area in 1985 Effort data not prorated to logged catch.

Area	Catch	Effort			CPUE		
	kg	days	hours	hour-meters	kg/d	kg/h	kg/hm
Dixon Rocks	81	1	5	22.9	81	16.2	3.54
Duck I. Sound	3152	25	172	873.6	126	17.4	3.41
Gannet Rock	583	6	35	169.4	97	16.7	3.44
Green Island	109	2	10	43.7	55	11.5	2.50
Middle Ground	410	4	26	144.0	103	15.6	2.85
Ox Head	64	2	5	26.1	32	13.5	2.46
Ship Head	937	25	189	862.2	37	4.9	1.06
Southeast Ledge	1454	25	-	-	58	-	-
Southern Ledge Shoal	490	8	31	139.4	61	14.1	3.09
St.Mary's Ledge	268	5	28	125.7	54	9.8	2.13
Three Island	67	1	6	25.1	67	12.2	2.66
White Head	1307	16	77	357.3	82	17.0	3.66
Wolves Bank	1389	9	89	452.3	154	15.6	3.07
443664	183	3	10	49.7	61	19.1	3.69
Grand Manan offshore waters:							
Grand Manan Channel	1435	25	177	811.0	57	6.1	1.33
Seal Island	1691	13	63	286.6	130	19.3	4.22
Southwest Head	210	3	13	68.6	70	16.8	3.06
1 mile " "	95	1	5	27.4	95	19.0	3.46
Wallace Rock	491	3	50	228.6	164	9.8	2.15
Western Ledge	315	5	25	112.0	63	12.9	2.81
442670	175	4	5	24.2	44	9.6	1.86
443670	36	1	7	38.0	36	4.9	0.95

Table 11.- Fishery characteristics around Grand Manan Island, by area in 1986. Effort data not prorated to logged catch.

Area	Catch	Effort			CPUE		
	kg	days	hours	hour-meters	kg/d	kg/h	kg/hm
Duck Island Sound	1781	28	131	626.0	94	13.6	2.85
Gannet Rock	55	1	5	20.6	55	12.2	2.67
Green Island	64	1	9	38.4	64	7.1	1.67
1 mile Island	969	13	110	600.7	75	8.9	1.61
Middle Ground	534	4	30	164.6	134	17.8	3.24
Sloop Cove	113	2	14	61.7	57	8.4	1.83
Southern Ledge Shoal	143	2	16	74.3	72	8.3	1.92
Three Island	235	3	36	197.5	78	6.5	1.19
White Head	278	5	26	117.7	56	10.8	2.36
½ mile Head	46	1	8	32.0	46	6.1	1.44
1 mile Head	60	1	6	23.5	60	10.9	2.56
Wolves Bank	541	10	79	339.6	64	6.8	1.59
Grand Manan offshore waters:							
Bradford Cove	365	8	51	218.7	103	7.1	1.67
Bull Rock	682	7	52	237.1	97	13.1	2.88
1 mile Rock	31	1	5	21.3	31	6.2	1.45
Grand Manan Channel	334	3	65	278.1	111	5.1	1.20
Seal Island	771	8	45	221.7	96	17.1	3.48
Southwest Head	1584	14	124	615.4	117	12.8	2.57
1 mile Head	62	1	8	32.0	62	8.3	1.94
1½ mile Head	39	1	7	28.4	39	5.9	1.37
2 miles Head	14	1	3	12.8	14	4.7	1.09
3 miles Head	82	1	-	-	82	-	-
4 miles Head	290	2	17	90.5	145	17.6	3.20
Wallace Rocks	519	5	32	176.9	104	16.1	2.93
½ mile Rocks	31	1	6	26.7	31	5.0	1.16
Western Ledge	139	1	9	48.0	139	15.9	2.90
Yellow Ledge	237	4	16	86.4	59	15.1	2.74

Table 12.- Fishery characteristics around Grand Manan Island, by area in 1987. Effort data not prorated to logged catch.

Area	Catch	Effort			CPUE		
	kg	days	hours	hour-meters	kg / d	kg / h	kg / hm
Dixon Rocks	34	1	7	33.2	34	4.7	1.03
Duck Island Sound	695	10	106	485.6	70	6.6	1.43
Eastern Ledge	157	5	12	55.6	31	13.7	2.82
Grand Manan	226	4	22	96.1	57	10.1	2.35
1/2 mile Green Island	25	1	6	26.7	25	4.0	0.94
White Horse Head	144	5	20	96.9	29	7.1	1.49
1/2 mile White Horse Head	30	1	6	26.7	30	4.8	1.12
Grand Manan offshore waters:							
Bradford Cove	22	1	2	11.4	22	9.4	1.93
Bull Rock	372	9	36	170.3	41	10.4	2.18
Grand Manan Channel	256	4	24	124.8	64	10.8	2.05
Long Ledge	371	9	42	197.0	41	8.8	1.88
Murr Ledges	66	2	11	49.2	33	6.1	1.34
Seal Island	38	2	12	54.9	19	3.2	0.69
Southwest Bank	363	2	17	72.5	182	21.4	5.00
1/2 mile Wallace Rocks	64	2	16	68.3	32	4.0	0.94
Western Ledge	294	9	44	205.3	33	6.6	1.43

Table 13.- Fishery characteristics of Campobello Island and Passamaquoddy Bay from 1984 to 1987. Effort data is not prorated to logged catch.

Area	Catch	Effort			CPUE		
	kg	days	hours	hour-meters	kg / d	kg / h	kg / hm
1984							
Deer Island:							
Deer Island	77	4	22	121.2	19	3.5	0.64
Herring Cove	13	1	3	16.0	13	5.2	0.81
Merry-go-round	1204	12	--	---	100	--	---
Eastern Bay	147	6	22	102.1	25	6.6	1.44
Letete Passage	183	5	22	109.7	37	8.3	1.67
Saint Andrews	323	9	50	233.4	36	6.4	1.38
1985							
Campobello Island:							
Adams Island	19	1	5	22.9	19	3.8	0.83
1 mile Adams Island	50	2	12	54.5	25	4.2	0.92
Deer Island:							
Cook Shoal	151	6	25	114.3	25	6.0	1.32
Deer Island	37	1	4	19.1	37	8.9	1.94
Merry-go-round	51	1	5	24.0	51	9.7	2.12
Maces Bay	98	3	14	64.0	33	7.0	1.53
Saint Andrews	191	2	--	---	96	--	---
1986							
Deer Island:							
Cook Shoal	33	3	11	48.8	11	3.1	0.68
Deer Island	23	2	6	25.9	12	4.1	0.89
Merry-go-round	354	4	29	130.3	89	12.4	2.72
Saint Andrews	393	8	29	122.3	49	13.7	3.21
1987							
Deer Island:							
Herring Cove	1109	8	42	221.3	139	26.6	5.01
Saint Andrews	2507	21	176	657.6	121	14.3	3.81

Table 14.- Percent of the total class 1 catches and CPUE (kg/hm) from the five most productive areas as reported in log records.

1983			1984		
Area	%	CPUE	Area	%	CPUE
Wolves Bank	25	2.32	442665	17	2.34
Duck Island Sound	13	4.47	Duck Island Sound	15	3.43
Western Ledge	9	6.32	Wolves Bank	13	1.78
Middle Ground	4	4.43	Gannet Rock	9	4.05
Prangle Point	3	2.64	443664	8	4.81
	54	*3.68		62	*3.04

1985			1986		
Area	%	CPUE	Area	%	CPUE
Duck Island Sound	34	3.41	Duck Island Sound	32	2.85
Wolves Bank	16	3.07	Gannet Rock	17	1.61
White Head	15	3.66	Wolves Bank	10	1.59
Ship Head	10	1.06	Middle Ground	9	3.24
Gannet Rock	7	3.44	Saint Andrews	7	3.21
	82	*3.11		75	*2.48

1987		
Area	%	CPUE
Saint Andrews	41	3.81
Herring Cove	18	5.01
Duck Island Sound	11	1.43
450664 (L'Etang Hbr)	6	9.76
Schooner Cove	5	4.09
	81	*3.40

* mean weighted by catch

Table 15.- Catches (t of scallop meats) from NAFO subdivision 5Yb by year and by vessel size. Source: Statistics Division, Fisheries and Oceans, Halifax.

Year	Vessel size			Total
	under 25.5 G.T.	over 25.5 G.T.		
		under 19.8m	over 19.8m	
1980	0.00	0.00	18.47	18.47
1981	0.00	4.85	0.00	4.85
1982	3.57	3.00	6.57	13.14
1983	116.77	14.44	9.95	141.16
1984	80.60	9.30	6.88	96.78
1985	35.88	2.92	0.00	38.80
1986	30.58	4.54	0.00	35.12
1987	15.24	1.65	0.00	16.89

Table 16- Monthly profile in catches from NAFO subdivision 5Yb for 1983 and 1984 by vessel size. Source: Statistics Division, Fisheries and Oceans, Halifax.

1983	Month	Inshore	Offshore		Total
			≤19.8 m	>19.8 m	
	Jan	1.75	0.47	0.00	2.23
	Feb	10.86	0.89	0.00	11.75
	Mar	24.63	2.39	0.00	27.02
	Apr	11.42	0.66	0.00	12.08
	May	11.72	0.54	0.00	12.27
	Jun	18.97	1.26	0.00	20.23
	Jul	15.86	0.21	0.00	16.07
	Aug	11.92	0.96	4.95	17.83
	Sep	7.56	1.20	2.71	11.48
	Oct	1.86	2.43	2.29	6.58
	Nov	0.14	0.27	0.00	0.41
	Dec	0.06	3.15	0.00	3.21
	Total	116.77	14.44	9.95	141.16

1984	Month	Inshore	Offshore		Total
			≤19.8 m	>19.8 m	
	Jan	7.58	1.98	0.00	9.56
	Feb	23.22	1.60	0.00	24.82
	Mar	19.69	3.30	0.00	22.99
	Apr	6.23	0.10	0.00	6.33
	May	7.00	0.10	0.13	7.22
	Jun	6.40	0.00	0.00	6.40
	Jul	5.33	0.53	6.75	12.60
	Aug	3.09	1.71	0.00	4.80
	Sep	2.06	0.00	0.00	2.06
	Oct	0.00	0.00	0.00	0.00
	Nov	0.00	0.00	0.00	0.00
	Dec	0.00	0.00	0.00	0.00
	Total	80.60	9.30	6.88	96.78

Table 17.- Monthly profile in catches from NAFO subdivision 5Yb for 1985 and 1986 by vessel size. Source: Statistics Division, Fisheries and Oceans, Halifax.

1985	Month	Inshore	Offshore		Total
			≤19.8 m	>19.8 m	
	Jan	1.90	0.14	0.00	2.04
	Feb	9.12	0.00	0.00	9.12
	Mar	10.48	0.58	0.00	11.06
	Apr	1.89	0.00	0.00	1.89
	May	2.06	0.22	0.00	2.28
	Jun	2.35	0.24	0.00	2.59
	Jul	1.40	0.52	0.00	1.93
	Aug	3.77	0.32	0.00	4.09
	Sep	2.13	0.53	0.00	2.66
	Oct	0.76	0.37	0.00	1.13
	Nov	0.00	0.00	0.00	0.00
	Dec	0.00	0.00	0.00	0.00
	Total	35.88	2.92	0.00	38.80

1986	Month	Inshore	Offshore		Total
			≤19.8 m	>19.8 m	
	Jan	0.00	0.00	0.00	0.00
	Feb	7.07	1.58	0.00	8.65
	Mar	14.10	2.34	0.00	16.44
	Apr	2.46	0.17	0.00	2.63
	May	4.45	0.00	0.00	4.45
	Jun	0.85	0.00	0.00	0.85
	Jul	0.15	0.00	0.00	0.15
	Aug	1.09	0.00	0.00	1.09
	Sep	0.40	0.47	0.00	0.87
	Oct	0.00	0.00	0.00	0.00
	Nov	0.00	0.00	0.00	0.00
	Dec	0.00	0.00	0.00	0.00
	Total	30.58	4.54	0.00	35.12

Table 18.- Preliminary monthly catches not segregated by vessel size from NAFO subdivision 5Yb for 1987 Source: Statistics Division, Fisheries and Oceans, Halifax.

1987	Month	Inshore	Offshore		Total
			≤19.8 m	>19.8 m	
	Jan	4.22	0.16	0.00	4.38
	Feb	3.15	0.23	0.00	3.37
	Mar	2.52	0.22	0.00	2.74
	Apr	1.08	0.04	0.00	1.12
	May	1.59	0.00	0.00	1.59
	Jun	1.38	0.85	0.00	2.23
	Jul	1.31	0.00	0.00	1.31
	Aug	0.00	0.00	0.00	0.00
	Sep	0.00	0.00	0.00	0.00
	Oct	0.00	0.00	0.00	0.00
	Nov	0.00	0.16	0.00	0.16
	Dec	0.00	0.00	0.00	0.00
	Total	15.24	1.65	0.00	16.89

Table 19.- Fishery characteristics according to log records provided by vessels under 19.8m L.O.A. for Grand Manan offshore waters (NAFO 5Yb). Catch includes all logged catches for that vessel category. Total catch with respect to all vessel categories for NAFO 5Yb. Effort pertaining to class 1 data only.

	Catch (t)	% Logged catch / total catch	Effort			CPUE		
			days	hours	hours-meters	kg/d	kg/h	kg/hm
1983	4.83	3	53	332	1,570	91.1	14.5	3.87
1984	6.26	6	69	518	2,711	90.7	12.1	2.31
1985	4.55	12	56	351	1,630	72.4	9.9	2.13
1986	5.69	16	50	439	2,094	102.0	11.6	2.43
1987	1.65	19	40	204	954	46.2	9.1	1.94

Table 20.- Number of survey stations by year and by area.

Year	Inside 7-mile line	Outside 7-mile line	Total
1983	50	24	74
1984	-	-	0
1985	66	36	102
1986	88	37	125
1987	92	33	125

Table 21.- Average scallop catch per tow by age grouping in each area by year. Abundance of recruits (age 4+) was estimated from the catch of an unlined gear, while pre-recruits (1-3 years inclusive) abundance was estimated from the catch of a lined gear.

Year	Pre-recruits	Recruits	
	1-3 yr	4-7 yr	8+ yr
1979			
Inside 7-mile line	4	46	8
Outside 7-mile line	2	19	0
1980			
Inside 7-mile line	8	66	10
Outside 7-mile line	2	180	0
1981			
Inside 7-mile line	6	49	11
Outside 7-mile line	1	25	4
1982			
Inside 7-mile line	10	31	19
Outside 7-mile line	2	35	6
1983			
Inside 7-mile line	3	23	16
Outside 7-mile line	1	7	9
1985			
Inside 7-mile line	38	32	26
Outside 7-mile line	16	27	3
OR			
Southern area	26	28	27
Western area	67	56	5
Northern area	11	54	3
1986			
Inside 7-mile line	79	23	16
Outside 7-mile line	12	10	12
OR			
Southern area	46	15	15
Western area	106	25	15
Northern area	23	61	13
1987			
Inside 7-mile line	54	77	17
Outside 7-mile line	5	12	7
OR			
Southern area	21	63	17
Western area	82	57	11
Northern area	8	34	4

Table 22.- Average scallop catch at age per tow for a 4-gang Digby drag for lined middle buckets and unlined outside buckets. Mean total number of scallops per tow and s.d. for year and gear types respectively.

Year and gear type	Age (years)									Mean	s.d.
	2	3	4	5	6	7	8	9	10+		
1983 inside 7-mile											
lined gear	1	2	2	5	9	19	12	7	7	89	96
unlined gear	1	4	3	3	6	11	7	5	4	58	63
1985 inside 7-mile											
lined gear	15	23	5	5	5	7	8	6	8	98	122
unlined gear	5	11	6	5	8	13	9	8	9	87	96
1985 outside 7-mile											
lined gear	9	7	4	7	10	6	3	0	0	57	66
unlined gear	2	5	7	15	17	11	4	2	0	70	76
1986 inside 7-mile											
lined gear	54	24	12	4	2	1	2	2	8	138	267
unlined gear	12	13	14	4	3	2	3	3	10	78	163
1986 outside 7-mile											
lined gear	6	6	3	3	2	3	2	1	3	37	47
unlined gear	2	3	2	2	3	4	3	2	7	33	34
1987 inside 7-mile											
lined gear	17	36	36	19	8	3	2	2	7	144	232
unlined gear	3	18	38	25	10	4	3	3	11	138	263
1987 outside 7-mile											
lined gear	2	3	2	2	3	2	1	1	2	30	40
unlined gear	1	3	3	4	3	2	2	1	4	29	35

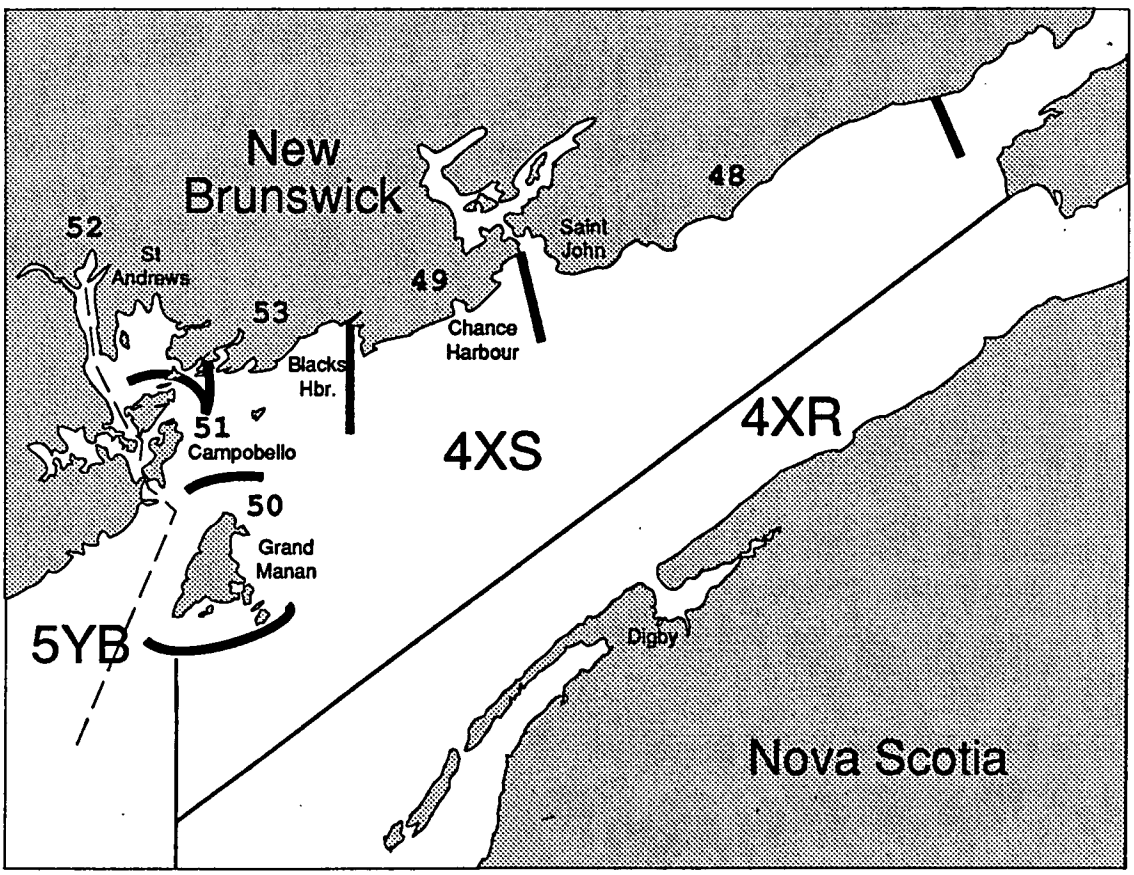

Figure 1.- Geographical location of New Brunswick Statistical Districts 48 to 53 and extent of NAFO sub-areas 4Xr, 4Xs, and 5Yb in the Bay of Fundy and its outer reaches.

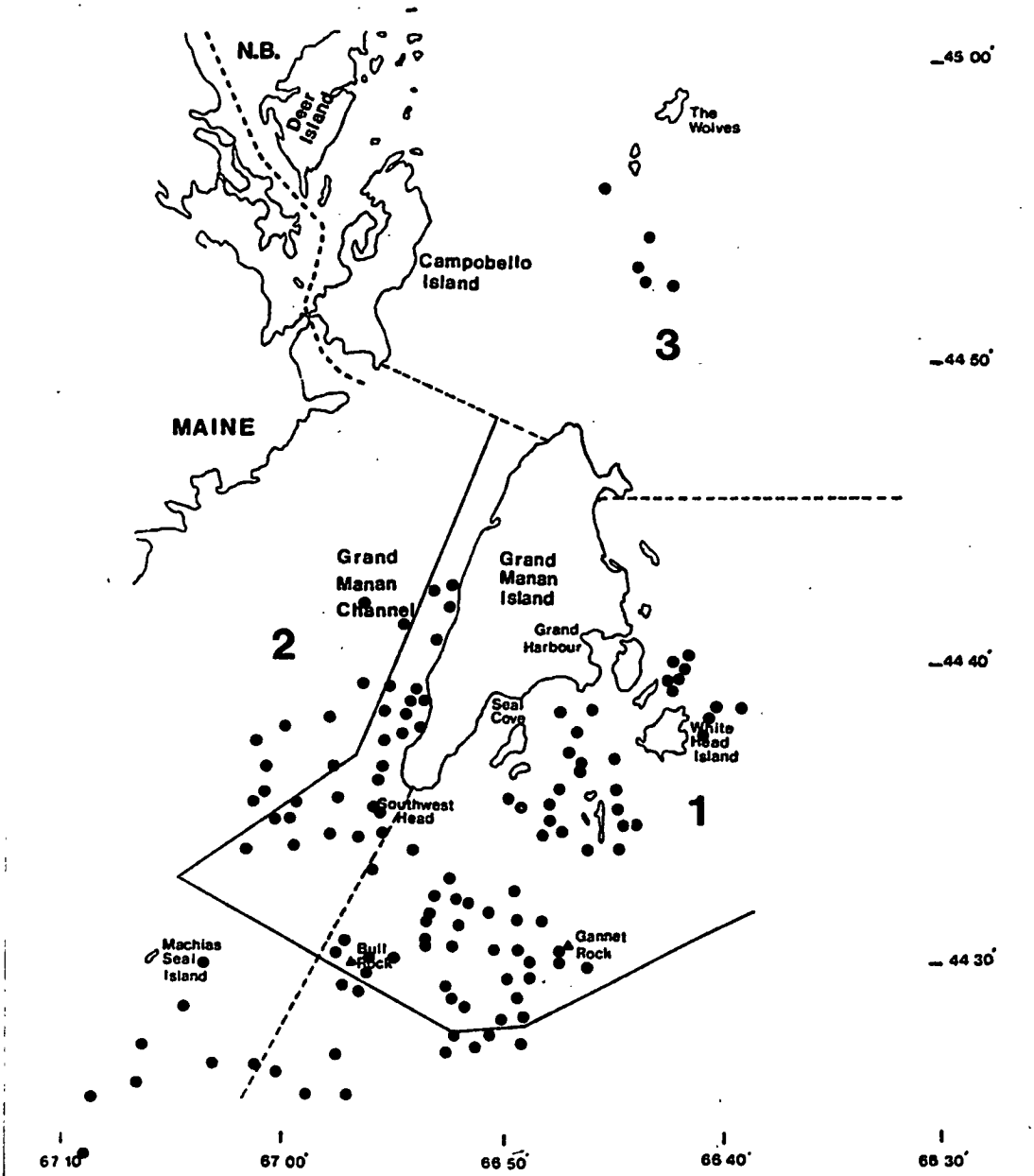

Figure 2.- 1987 survey sampling sites. The continuous line delimits the inside / outside 7-mile zone while the dashed line segregates areas 1) southern, 2) western, and 3) northern.

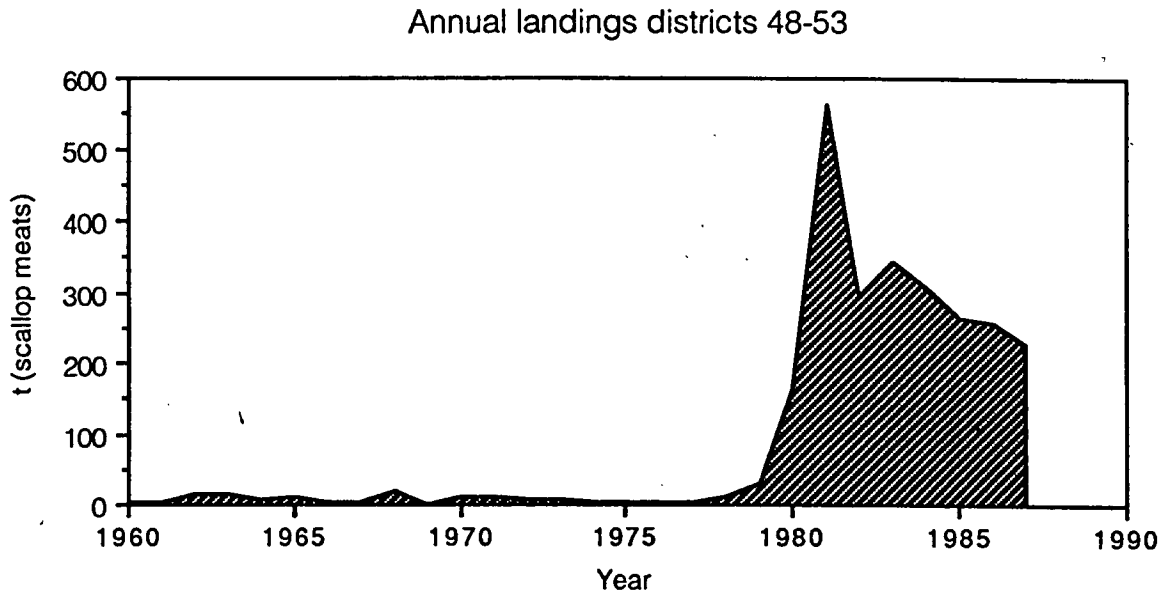

Figure 3.- Profile of the annual landings (t of scallop meats) for the statistical districts of southwest New Brunswick since 1960. Landings were negligible prior to the 1980s at which time, they rose remarquably in 1981 (562 t) to maintain an annual level in the order of 250t afterward.