The Grand Manan area scallop stock assessment - 1986

By

G. Robert and M.J. Lundy
Invertebrates and Marine Plants 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

The scallop fishery of southwest New Brunswick, more particularly the Grand Manan Island area continued on a declining trend initiated after record landings, over 500t in 1981. Fishery catch-rates have also decreased steadily. According to a short historical catch profile, these stocks are maintaining an average level of productivity under the current, strongly seasonal effort patterns, especially in the waters in the immediate vicinity of Grand Manan. Latest survey results have established the presence of high densities of juvenile scallops in some specific locations.

RESUME

La pêche au pétoncle du sud-ouest du Nouveau-Brunswick, plus particulièrement la région de l'Ile de Grand Manan continue à diminuer après les débarquements records de 1981, au-dessus de 500t. Les taux de capture ont aussi baissés graduellement. D'après un bref profil historique des prises, il semble que ces stocks maintiennent un niveau moyen de production sous le régime très saisonnier d'effort de pêche actuel, surtout dans le voisinage de Grand Manan. Le dernier inventaire de recherche a établi la présence de fortes densités de pétoncles juvéniles en certains endroits spécifiques.

INTRODUCTION

Although scallop landings in southwest New Brunswick are maintained at a relatively high level, over 250 t in 1986, the logged catches indicate a steady decline in effort since 1981 and a sharp drop in catch-rate from 1985 to 1986. About 3/4 of the scallops landed in the area are fished by a fleet of small (under 14 m L.O.A.), inshore vessels that participate in the scallop fishery depending on the performance of other local fisheries they pursue. Analysis of the 1986 fishery performance is given here with results from the latest stock survey which do not suggest any major improvements in stock conditions.

METHODS

Fishery Data

All vessels must be licensed for fishing scallops in this area (7-mile 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, 1986 except for a few stations in the Duck Island Sound area which were sampled in January, 1987. Sampling locations were selected according to the effort expended from 1982 to 1986 (up to September) according to Class 1 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. Because of the management implications of the 7-mile line, survey stations have been clustered in two groups: 1) inside 7-mile line; 2) outside 7-mile line as previously (Dadswell et al 1984; Robert et al 1984). 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 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).

To interpret the survey catch-rates in terms of stock distribution on an age basis, some scallops were collected throughout the 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 is remaining quite constant (Table 1). The number of 7-mile licenses which had reached a maximum in 1981 (Robert et al 1984) remains stable at a fairly high level. The majority of the 7-mile 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 7-mile licenses issued to vessels under 25.5 G.T. annually, it appears that an important percentage (over 50 % ?) have not been used in 1985 or in 1986. Most vessels over 25.5 G.T. hold a Bay of Fundy license and are actively involved in the fishery. Their involvement has been constant for several years now, except that an increasing number have declined to comply with log procedures over the last two years. 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); this downward trend is progressing slowly. For the past two years landings have been slightly more than 250 t; they have yet to revert to pre-1980 values. The geographical location of statistical districts 48 to 53 and designation of relevant NAFO sub-subareas are illustrated in Figure 1.

Tables 3 to 6 give recent landings on a monthly basis by statistical district and by vessel size. The bulk of the landings is generated by 'inshore' vessels using ports on Grand Manan Island (Statistical District 50). In comparison, other districts contribute relatively little. The Saint John district (48) started a trend of greater landings in 1984 which did not last as per the 1986 values. Around the Grand Manan Island area, there is a marked seasonal trend in landing patterns with peak fishing activity taking place in the winter, from January to March inclusive.

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 dimensions 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. In the mean time, table 7 just presents, data being available for only two years, vessel performance estimated as a mean annual catch per vessel for 7-mile 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. Looked under this angle, Grand Manan (statistical district 50) production is higher and more stable than Campobello (statistical district 51). Even if an historical profile of data was available the scope of interpretation from this type of data is fairly limited compared to the information available, especially regarding effort data in logbooks from vessels over 25.5 G.T.

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 8). But, the proportion of logged catches versus catches that are required to be logged according to fishery regulation (section 48 of the Fisheries Act) i.e. offshore landings has been steadily declining, from 48 % in 1981 (Robert et al 1984), to 36 % in 1985, to drop further at 20 % in 1986. 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 and Deer Islands, and Passamaquoddy Bay (NAFO sub-subarea 4Xs in part). While catches were declining, effort remained high and catch-rates were concurrently decreasing to low values to take an even further drop (35 %) in 1986 (Table 9). Tables 10 to 13 present fishery characteristics for individual fishing locations for 1983 to 1986. Table 14 is similar but covers Campobello, Deer Island and Passamaquoddy Bay areas. Scallop beds in the immediate vicinity of Grand Manan are most heavily exploited. 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.

According to Class 1 data the productivity of the exploited grounds has diminished markedly. The mean catch-rate of the five most productive areas has gone down to 2.48 kg/hm in 1986 (Table 15). Over 75 % of the Class 1 catches comes from these five areas. The exploitation of scallop beds in Duck Island Sound, Gannet Rock, The Wolves is intensive as these areas alternate ranks over the years.

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 16) with a sporadic profile of landings. Monthly catches from sub-subarea 5Yb (Tables 17-19) 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 dropped from initial values but have stabilised. In 1986, CPUE offshore is higher than CPUE in waters closer to shore (1.5 kg/hm).

Survey Results

After ship breakdown in 1984 survey work resumed and good coverage of both nearshore and offshore Grand Manan waters was accomplished in 1986 (Table 20). It had not always been the case in the past. Since survey work was first started in 1979, the inside zone has shown greater abundance of scallops than the outside zone (Table 21). For the

past two years numbers of prerecruits have started to increase significantly, especially in the inside zone. However recruited numbers remain low. The post-stratification by area indicates that improvement in the recruitment pattern has taken place to a larger scale in the Western area compared to the two other areas. A closer look determines though that the improvement in recruitment is not caused by a heavy settlement of juvenile scallops over the area in general but by extremely high concentrations of juveniles in very specific locations. Sampling in Bradford Cove revealed hundreds of age 2 scallops per tow; stations near Bull Rock, Shag Head and Three Islands had large numbers also. A detailed profile of catch-at-age (Table 22) shows that although recruitment in Bradford Cove is significant, the outside zone as a whole offers a bleak picture for replenishment of the stock. Recruited age classes have considerably diminished due to heavy exploitation. Whether inside or outside, abundance of recruited scallops is low, the only bright note being relatively higher numbers of ages 2-3 scallops caught in the lined gear, inside 7-mile.

DISCUSSION

Although scallop beds in the immediate vicinity of Grand Manan have sustained landings at over 250 t per year for a number of years now, catch-rates have dropped steadily. High exploitation of more distant scallop beds in NAFO sub-subarea 5Yb has rapidly depleted the available fishable biomass. The perceived improvement in the stock condition suggested by the 1985 survey results had been cautioned against (Robert and Lundy 1986) and rightly so; the apparently strong year-class did not materialise to the levels anticipated although it is strong in a few specific locations. However, improvement in the abundance of ages 2 and 3 scallops noticed in the 1986 survey should allow for at least a small increase in future catches with proper management options.

REFERENCES

Dadswell, M.J., R.A. Chandler, G. Robert, and R.K. Mohn. 1984. Southwest New Brunswick and Grand Manan scallop stock assessment, 1983. Can. Atl. Fish. Sci. Adv. Comm. Res. Doc. 84/28: 21p.

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 7-mile 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

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

Table 3.- 1983 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			0.12		47.66	3.00	3.12	0.72	0.48	0.48		0.12 0.84
Feb			0.12		38.78	3.24	1.44	0.36	0.24	0.72	0.84	0.36
Mar					38.66	4.80	1.56	0.60	0.84	0.12	0.36 0.48	0.36
Apr			0.84	0.84	13.93	0.96	2.16	1.68	1.68	0.48	0.24	0.24
May			2.16	0.84	12.12	1.32	0.84	1.08	1.08	0.60	0.12	0.24
Jun		0.12	2.40	0.96	0.24	21.37	3.48	1.32	4.80	1.80	0.12	0.36 0.24
Jul.	12	0.12	0.72			23.53	1.20	1.80	4.56	2.76	0.60	0.24 0.48 0.36 0.24
Aug.	24	0.36	0.24	2.16	0.48	14.29	2.76	1.92	4.80	1.32	1.20	0.24 0.48 0.84
Se	2.64	0.84	0.12	1.92	0.36	8.40	1.20	0.96	3.48	1.44	2.16	0.12 0.12 0.24 0.72
Oct			0.84	0.36	0.36	3.12	2.64	1.80	0.96	0.24	2.28	0.12 0.12 0.12 0.36
Nov			0.12			0.24	0.12	0.24	0.84	1.20	0.12	
Dec							3.00	0.12	0.72	0.36	0.12	
Total	3.00	1.32	0.48			222.10		17.28		11.40		1.80 2.04 0.24
			11.40	3.48	0.96		27.72		24.60		10.32	2.88 3.12 0.24

Table 4 .- 1984 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 Div., 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				0.72	0.12		45.74	5.88	3.12	2.16	0.96	0.36	0.12			0.12	0.12	
Feb				0.36			47.90	6.24	2.40	2.28	0.24	0.84				0.60		
Mar				0.48			36.85	5.76	0.72	2.04	0.36	0.36				0.12		
Apr				1.08	0.12		8.16	0.36	0.96	0.72	0.24					0.60		
May	.60	0.12		1.56	0.84		8.88	0.12	2.40	2.64	1.08	0.48				0.60		
Jun	.72	0.12	0.24	1.32	0.36	0.24	6.96	0.24	1.20	3.36	0.36	0.60	0.12			0.96	0.12	
Jul	.12			0.72		0.36	5.52	0.12	1.80	2.52	0.36	0.12				1.68	0.12	
Au	2.04	0.36		2.64		0.12	4.56	0.12	2.40	2.52	1.08	3.12	0.36			2.16	0.24	
Se	6.48	1.68	0.12	1.08			2.16		0.60	3.36	1.08	4.08	0.24			2.16	0.96	
Oc	5.88	1.32		0.48			1.08	1.44	2.40	3.12	0.60	8.88	0.36	0.60	0.12	0.48	0.60	
Nov	.24	0.48					0.24	0.36	0.12	0.60		0.12	0.48		0.12	0.24		
Dec					0.36		0.12			0.24		0.12	0.12					
Total				10.44	1.80	0.72				25.56	6.36	19.08				9.72	2.16	0.00
	16.08	4.08	0.36				168.17	20.64	18.12				1.80	0.60	0.24			

Table 5.- 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 6.- 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 7.- Estimate of productivity on a vessel basis for vessels under 25.5 G.T. holding a 7-mile 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

Table 8.- 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

	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

Table 9.- 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			

Table 10.- Fishery characteristics around Grand Manan Island, by area in 1983. Effort data not prorated to logged catch.

Area	Catch	Effort			CPUE		
	kg	days	hours	hour-meters	kg/d	kg/h	kg/hm
Duck I. Sound	4008	31	178	632.5	129	22.0	4.47
Gannet Rock	647	5	26	115.8	129	24.8	5.11
Green Island	337	3	14	66.1	112	25.0	5.10
Little Shoal	594	3	7	39.8	198	53.8	9.81
Middle Ground	943	9	39	213.0	105	24.3	4.43
Ox Head	519	4	15	79.6	130	35.8	6.52
Prangle Point	709	7	42	268.2	101	16.9	2.64
Shag Head Breaker	339	2	12	56.0	170	27.7	6.05
Ship Head	263	7	33	212.8	38	7.9	1.24
Sloop Cove	136	2	9	40.0	68	15.5	3.40
Three Island	745	7	21	48.0	106	36.1	5.62
West Isles	142	4	28	126.5	36	5.1	1.12
White Head	296	3	14	78.6	99	21.1	3.76
Wolves Bank	5482	86	586	2361.6	64	9.4	2.32
Grand Manan offshore waters:							
Bradford Cove	193	7	10	45.7	28	4.9	1.07
Bull Rock	298	4	16	72.7	75	19.2	4.10
Grand Manan Chann	473	14	52	236.6	34	5.8	1.26
Long Ledge	446	3	20	89.2	149	22.9	5.00
Murr Ledge	511	5	27	-	102	15.8	-
Southwest Head	136	1	-	-	136	-	-
2 miles "	145	2	10	46.2	73	14.4	3.14
3 miles "	138	1	7	31.7	138	19.9	4.35
Wallace Rock	411	3	17	84.7	137	23.7	4.85
Western Ledge	2007	13	70	317.7	154	28.9	6.32
445664	402	7	31	198.4	57	13.0	2.03
445670	249	7	21	132.8	36	9.9	1.54

Table 11.- 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	23.8	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 12.- 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 13.- 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	8.8	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 14.- Fishery characteristics of Campobello Island and Passamaquoddy Bay from 1984 to 1986. Effort data 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 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

Table 15.- 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 I. Sound	13	4.47	Duck I. 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*

* weighted by catch

1985			1986		
Area	%	CPUE	Area	%	CPUE
Duck I. Sound	34	3.41	Duck I. 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*

* weighted by catch

Table 16.- 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

Table 17.- 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 18.- 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 19.- Fishery characteristics according to log records provided by vessels under 19.8m L.O.A. for Grand Manan offshore waters (NAFO 5Yb). Effort pertaining to class 1 data only.

	Catch	%	Logged catch	Effort			CPUE		
	t		total catch	days	hours	hours-meters	kg/d	kg/h	kg/hm
1983	4.83		33	53	332	1,570	91.1	14.5	3.87
1984	6.26		67	69	518	2,711	90.7	12.1	2.31
1985	4.55		100?	56	351	1,630	72.4	9.9	2.13
1986	5.69		16	50	439	2,094	102.0	11.6	2.43

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

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 1-3 yr	Recruits 4-7 yr	Recruits 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

Table 22.- Average scallop catch at age per tow for a 4-gang Digby drag for lined middle buckets and unlined outside buckets. N: total number of scallops per tow.

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

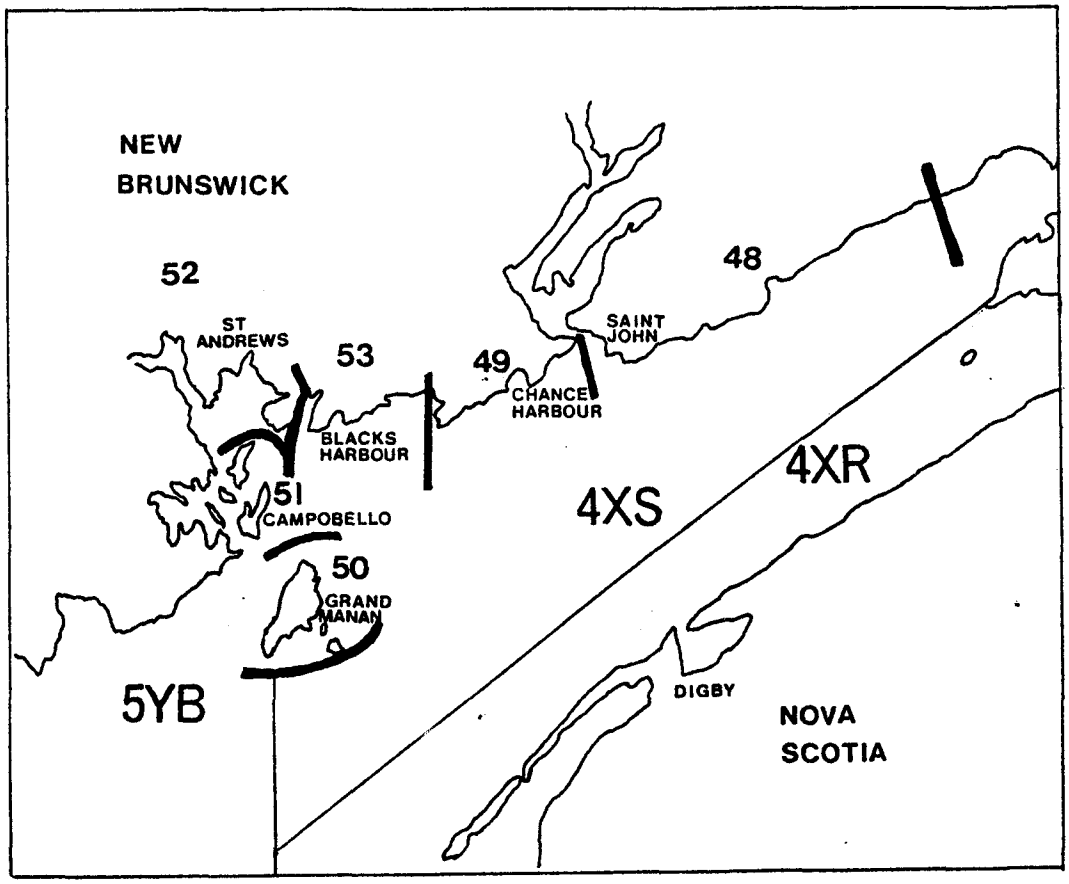

Figure 1.- Geographical location of New Brunswick Statistical Districts 48 to 53 and extent of NAFO sub-areas 4XR, 4XS, and 5YB in the Bay of Fundy and its outer reaches.

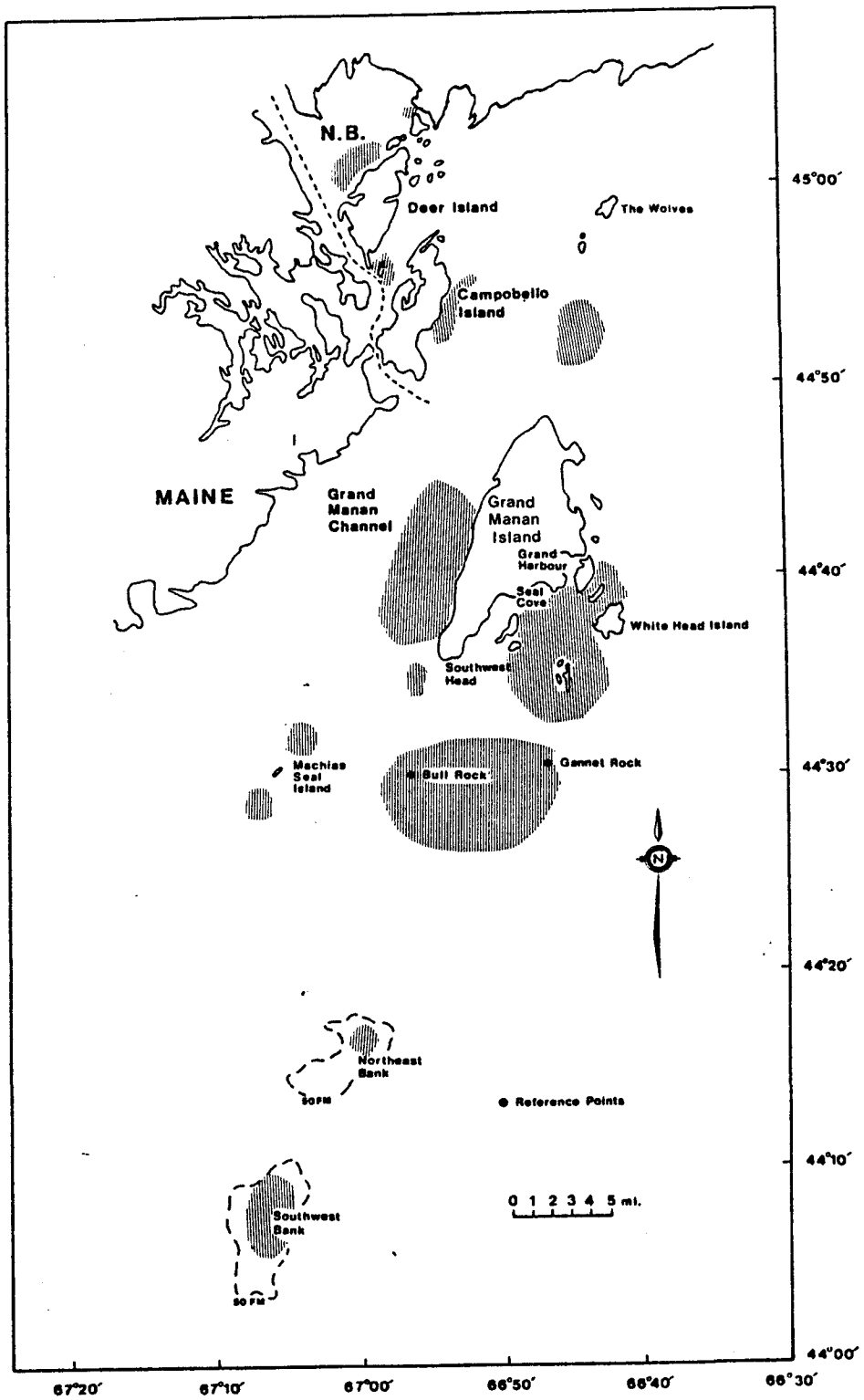

Figure 2.- Estimated location of scallop fishing grounds exploited by New Brunswick-based vessels, mainly on Grand Manan Island.