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The Grand Manan Scallop Stock Assessment 1988-1989

by

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Abstract

Scallop landings for 1988 in southwest New Brunswick, comprising Statistical Districts 48 to 53, were up from landings reported in 1987 by 75% to 433.9 t and 1989 landings showed a further 69% increase to 735.4 t. This increasing trend in landings over the last two years was generally reflected in all six Statistical Districts and in both offshore (boats ≥ 14.5 m LOA or ≥ 25.5 G.T.) and inshore boats (< 14.5 m LOA). Landing records, based on sales slips, for 1989 indicated that 100% of the offshore licenses were active while only 66% of the inshore licenses were active. This increase in catch was due to a large pulse in recruitment of the 1983 and 1984 year-classes. Landings for the New Brunswick based Bay of Fundy licensed boats came mostly from the "inside 8-mile Digby area" as well as a dense scallop bed off Cape Spencer. Inshore boats also fished the Cape Spencer bed during the summer months. The inshore fishery around Grand Manan took place mainly on the western side of the island where scallop densities were highest.

Results of the annual research survey off Grand Manan and a survey of Cape Spencer in 1989 indicated the presence of two dominant year-classes of newly recruited 4 and 5 year old scallops in both areas. However, the abundance was much greater at Cape Spencer. There was no evidence of another large year-class coming into the fishery so landings are predicted to return to previous levels in the absence of another exceptional year of recruitment.

Résumé

Les débarquements de pétoncles dans le sud-ouest du Nouveau-Brunswick, englobant les districts de statistiques 48 à 53, ont atteint 735,4 t en 1989, ce qui représente un accroissement de 69 % par rapport à ceux de 1988 (433,9 t), lesquels reflétaient déjà une hausse de 75 % sur ceux de 1987. Cette tendance à la hausse au cours des deux dernières années était manifeste dans l'ensemble des débarquements des six arrondissements et autant pour les bateaux de pêche hauturière (bateaux $\geq 14,5$ m de LHT ou $\geq 25,5$ de JB) que pour les bateaux de pêche côtière ($< 14,5$ m de LHT). Les statistiques de débarquements de 1989, provenant des récépissés de vente, révélaient que tous les permis de pêche hauturière étaient exploités, par comparaison à 66 % des permis de pêche côtière. L'augmentation des prises est attribuée à un fort recrutement des classes de 1983 et 1984. Les débarquements de la flottille néo-brunswickoise de la baie de Fundy provenaient essentiellement de la "zone de huit milles autour de Digby" et des riches gisements de pétoncles situés au large du cap Spencer. Ces derniers ont également été exploités par les bateaux de pêche côtière au cours de l'été. La pêche côtière dans les environs de Grand Manan a été concentrée surtout à l'ouest de l'île, où les pétoncles étaient les plus abondants.

Les résultats de la campagne d'évaluation annuelle au large de Grand Manan et d'une évaluation effectuée au cap Spencer en 1989 ont révélé la prédominance de deux classes d'âge de pétoncles de quatre et cinq ans nouvellement recrutés dans les deux zones, leur abondance étant cependant beaucoup plus élevée au cap Spencer. Rien n'indique qu'une autre grosse classe d'âge sera recrutée à la pêche. On prévoit donc que les débarquements reviendront à leurs niveaux antérieurs en l'absence d'une classe exceptionnelle de recrues.

Introduction

Responsibility for the assessment of scallop, Placopecten magellanicus, stocks from Grand Manan and the New Brunswick side of the Bay of Fundy was transferred to the St. Andrews Biological Station from the Halifax Laboratory in 1988. The analysis of the 1988 scallop fishery in southwestern New Brunswick was not presented at the annual 1989 CAFSAC meeting in Halifax; therefore the pertinent parts for 1988 are incorporated into this report.

The scallop fishery in southwest New Brunswick (Statistical Districts 48 to 53) has traditionally centred around the Grand Manan region (Statistical District 50) although there has also been a recent increase in landings in other areas. There are two categories of boats in southwest New Brunswick: 1) small, inshore (<14.5 m LOA), multi-purpose vessels which generally fish local waters and most of which carry a Mid-Bay license and 2) larger, offshore (≥ 14.5 m LOA or > 25.5 G.T) vessels which have the ability to fish anywhere in the Bay of Fundy (usually off the productive Digby area) and carry a Bay of Fundy license. The offshore boats are required to submit log records of fishing activities in order to maintain their license. Regulations governing the scallop fishery in southwestern New Brunswick are similar to those in Nova Scotia. There is a minimum size limit of 76 mm and a meat count of 55 meats per 500 g from October 1 to April 30 and a count of 72 meats per 500 g from May 1 to September 30. A 2-mile conservation line was established in 1986 which extends from Cape Spencer to the southern tip of Deer Island in Passamaquoddy Bay. In addition, there is also a conservation line which surrounds Grand Manan and divides it into an inside and outside area. The inside fishing area in both areas is open for fishing from the second Tuesday in January to April 1 while the outside area is open year round.

The fishery in the Grand Manan area has historically had the highest landings on the New Brunswick side of the Bay of Fundy. The fishery increased significantly in 1980 and peaked in 1981 at close to 500 t of meats. It dropped subsequently to levels of approximately 250 t per year. Landings from the Campobello area (Statistical District 51) have slowly increased from 1980 to levels approaching 100 t. Recent surveys (Robert and Lundy, 1988) in several different areas of the Bay of Fundy have indicated two strong year-classes (1983 and 1984) entering the fishery.

Catch/effort information for the small inshore boat fishery is lacking for southwestern New Brunswick. Unlike the larger offshore boats, the smaller multi-purpose boats are not required to complete fishing log records as a requirement of their license. This makes the analysis of the few logs returned by the larger boats from this area tenuous. It also makes the results from the annual research survey more critical.

Materials and Methods

Fishery Data

Information on the scallop landings in the 6 Statistical Districts (S.D.) of southwestern New Brunswick were obtained from Statistics Division, Dept. Fisheries and Oceans, Halifax (Fig. 1). Log records were used to assess the catch-per-unit-effort (CPUE) information from the offshore boats (≥ 14.5 m LOA or > 25.5 G.T.) which are required to submit information on catch, location, effort, gear, and crew number to the Statistics Division in Halifax. Analysis was carried out on only those log records where effort information was complete (Class 1, Robert and Lundy (1988)).

Survey Procedure

Stations were randomly selected according to catch strata proposed by Robert et al. (1984a) in which the Grand Manan area was subdivided into 32 subareas based on historic fishing patterns. Each stratum was further classified as to high, medium or low which determined the number of stations sampled within that substratum. For the Cape Spencer area near Saint John which was surveyed in 1989, stations were randomly selected from an area approximately 1373 km² extending from Point Lepreau to Quaco Head and extending approximately 37 km offshore (Fig. 2). At each station, 8-minute tows were made with a standard 4-gang Digby scallop drag. Each bucket measured 76 cm wide and 23 cm high with bags made of 76 mm diameter rings knitted together with rubber washers. The two inside buckets were lined with 38 mm mesh netting to retain those juvenile scallops between 38 mm and 75 mm shell height (distance from hinge to ventral edge of shell).

During the tow, Loran C bearings were recorded every 30 s to determine distance and location. Tow lengths were later adjusted to 800m. Sampling procedures for each tow generally followed that described by Robert et al. (1984a, 1984b); 1) scallop catches from each bucket were kept separate, weighed whole and shell heights measured in 5 mm increments for both live and dead(clappers) animals, 2) total volume of the catch in each bucket was estimated by counting vertical rings in the bag, 3) depth, bottom type, and major species were recorded.

Catches from the two unlined buckets were averaged, adjusted (x4) for a 4-gang drag, prorated to a standard 800 m tow, and used to determine recruits (> 75 mm) available to the fishery. Catches from the two lined buckets were treated identically and were used to reflect the pre-recruits (< 75 mm). Catches were finally post-stratified into: 1) inside vs outside the 7-mile line and 2) by regions: northern (Wolves Bank area), western (Grand Manan Channel and Seal Island) and southern (large shallow-water southern portion of the island) areas (Fig. 3).

The size distributions were converted to ages using height -at-age von Bertalanffy growth curves determined by Robert and Lundy (1988) for Grand Manan

and by Chandler et al (1989) for Cape Spencer. The growth curve coefficients used were:

Grand Manan:	$H_{\infty} = 134.6$	$k = 0.265$	$t_0 = 1.344$
Cape Spencer:	$H_{\infty} = 118.2$	$k = 0.294$	$t_0 = 0.546$

Results

Landing Statistics

The total number of licenses issued in southwestern New Brunswick in 1989 was 214 (Table 1). Of those, 200 were Mid Bay and 14 were Bay of Fundy. In the latter category, 100% were active, while only 66.5% were active in the former.

Landings for southwestern New Brunswick increased in 1988 by 75% over 1987 to 433.9 t and then increased again in 1989 by 69% over 1988 to 735.4 t (Fig. 4, Table 2). Inshore boats in 1988 showed an increase of 29% over 1987 and the 1989 landings were up 51% from 1988. Offshore boats in 1988 registered a 189% increase over 1987 while 1989 landings were up 90% over 1988. This increase in the past two years differs greatly from the decrease in landings which had been happening since 1983 (Table 2, Table 3). In 1989, this general increase in landings occurred in all six statistical districts. Grand Manan (S.D. 50) accounted for about 49% of the landings in 1989 and Campobello (S.D. 51) for 25%.

There were peaks in landings for inshore boats in southwest New Brunswick in 1989 from January, May, August and September when over 50% of the year's landings occurred however, this pattern differed by statistical area (Table 4). S.D. 48 and 49 had the highest landings during July to September (78%) in 1988 while in 1989 their landings occurred earlier from May to September (75%). Fishing activity occurred throughout 1988 and 1989 in S.D. 50 and 51 (Table 4, Table 5). For the inshore boats in SD 50, over 40% and 75% of the year's catch occurred in the first 5 months of 1988 and 1989 respectively. The landings in S.D. 51 in 1988 were generally equally distributed over the first 10 months of the year however, in 1989 over 70% occurred from May to September. In S.D. 52 and 53 in 1988, landings were scattered throughout the year. In 1989, S.D. 52 was similar to 1988 but S.D. 53 had the majority of landings during May to September (76%).

Landings by month for offshore boats in S.D. 48 and 49 were sporadic in 1988 and in 1989 were mostly from March to September. For S.D. 50 in 1988 and 1989, most of the landings occurred in the October to April period. In S.D. 51, landings from the offshore boats in 1988 and 1989 occurred throughout the year but, in 1989 there was a peak in the August to October period. Landings from offshore boats in S.D. 52 and 53 in both 1988 and 1989 were minimal.

The mean productivity, based on number of active licenses and total landed catch, of the small inshore boats increased in the last two years. Compared to 1987 when it was at its lowest in the last 5 years (0.67 t), the productivity per boat increased in 1988 by 200% with an average landing per boat of 2.02 t of scallop meats. The productivity further increased in 1989 by 46% with an average landing per boat of 2.94 t of scallop meats.

Fishing Logs

Log records from offshore vessels in the Grand Manan area have been dwindling over the last 7 years (Table 6) and even the relative amount of Class 1 catches recorded (i.e. complete information) have declined. In 1988, 6 vessels turned in Class 1 information versus 4 in 1989. In 1989, only 3% of the landed catch was logged compared to 37% in 1983.

CPUE results (kg/hm) of the Class 1 logged catches indicate an 31% increase over the last two years from 2.82 kg/hm to 3.70 kg/hm (Table 7). Areas showing the highest CPUE's in 1988 ranged from 1.09 to 5.38 kg/hm while in 1989 the highest CPUE's ranged from 3.13 to 11.82 kg/hm (Table 8). Landings from the NAFO statistical subarea 5Yb area increased to 38 t in 1989. These comprised 5% of the landings from southwestern New Brunswick.

Assessment Survey

Annual surveys in the Grand Manan area have been conducted since 1983 with the exception of 1984 (Table 9). The number of sample stations was increased in 1989 by 38 stations in order to do further exploratory work in the area.

Results of the 1988 and 1989 survey showed similar patterns to those observed in 1987. The abundance of pre-recruits was much greater inside the 7-mile line than outside in all years to date for a standard 800 m tow (Table 10). The western area also showed the highest number of pre-recruits over all years. The pulse of pre-recruits observed in 1986 and 1987 was reflected in the proportional catches of the 4-7 year old scallops in 1988 and 1989. The levels of pre-recruits have declined in the inside area from 1986 to 1989 by about 85% from 79 to 12 individuals per tow.

The profiling of strong year-classes were readily apparent in survey data since 1986 (Table 11, Fig. 5). These strong year-classes seem to be predominantly in the inshore area and there is only a slight indication of their presence in the offshore areas. No sign of another similarly strong year-class entering the fishery was evident.

The catch by age class of standard 800 m tows for the inside area of Grand Manan are compared for the years 1987 to 1989 in relation to the catch rates found in the survey off Cape Spencer in 1989 (Table 12). There were 368% more scallops captured per tow near Cape Spencer than at Grand Manan. Of those, 82% were in the 4 to 5 age-class compared to 42% of the scallops at Grand Manan.

Discussion

Despite the fact that inshore landings increased by 196% over the last two years from 1987, the license activity of the inshore boats was down 7% and was still only about 60% of its potential based on the number of licenses available. Sales slip records from the upcoming 1990 season will show whether there is a lag effect on re-entering the fishery as catches were as high as they have been for some time. The Bay of Fundy licenses were being fully utilized because of the record high lucrative catches obtained from the Digby inshore area.

The increase in the landings and catch rates in southwestern New Brunswick reflected the large 1983 and 1984 year-classes. These strong year-classes were observed in Digby (Robert and Lundy, 1988) and in our surveys at Cape Spencer in 1989 and Grand Manan in 1988 and 1989. The increase in landings for the offshore boats, mostly from Grand Manan, results from the large harvest coming from the inshore Digby waters but, landed at home ports in Grand Manan. Landings from offshore boats in S.D. 51 (Campobello Island) indicate that larger catches were occurring in the summer months. This suggests that these boats were exploiting the large beds off Cape Spencer as the inshore conservation areas were all closed at this time.

The increase in landings of the inshore boats during 1989 was probably caused by the large year-class that recruited to the fishery in 1988. The landings of inshore boats in S.D. 48 and 49 increased dramatically in 1989 to the highest levels recorded for those areas due to the large year-class of 4 to 5 year old scallops off Cape Spencer. The same trend also occurred in S.D. 51 where large catches were recorded during the summer months, presumably from Cape Spencer. Landings from Grand Manan (S.D. 50) mostly occurred during the opening of the inshore conservation area from January to the end of March.

The use of log records to assess the state of the fishery is becoming ineffectual for the southwest New Brunswick fishery due to the low number of records being completed. Another problem is the large number of small multi-purpose boats (Mid-Bay licenses) which take a large proportion of the catch but, are not required to fill out logs. A more effective means of monitoring fishing activities of these vessels would help in the assessment of the stocks.

Recruitment to the scallop stocks in Grand Manan seems to be highest in the inshore waters and especially on the western side of the island according to the survey data. Based on the percentage of each age-class in 1989 (Table 12, Fig. 5), there does appear to be a relatively consistent recruitment to the stocks although there are some years when a large pulse can occur. However, surveys from after

1987 have indicated a drop in the level of recruitment from the highs observed in 1986 and therefore, once that pulse is harvested, the fishery should drop back to traditional levels assuming no more large pulses take place.

The same conclusion applies to the stocks off Cape Spencer. The only difference will be the relative size in the drop in landings. While Cape Spencer stocks have 82% of the animals in the 4 to 5 age-class, Grand Manan only has 42% which suggests that the Grand Manan fishery is slightly better buffered against reductions in scallop abundance levels.

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Table 1. Number of licensed and active vessels in Statistical Districts 48 to 53. Activity measured by submission of one or more sales slips. Source: Licensing Unit, Fisheries and Oceans, Halifax. *Difference due to larger vessels (>25.5 G.T.) being included for these 2 yr, some of which did not have a Bay of Fundy license.

Year	<u>Mid-Bay license</u>		<u>Bay of Fundy License</u>	
	N	Active	N	Active
1983	253	-	17	19*
1984	249	-	17	23*
1985	245	135	15	13
1986	253	123	15	12
1987	206	126	15	13
1988	196	113	16	13
1989	200	117	14	14

Table 2. Annual landings (t of scallop meats) by statistical district, by vessel tonnage, (1): ≤25.5 G.T., (2): >25.5 G.T. 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)
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
1988	30.3	4.1	17.0	3.2	130.2	121.5	34.7	75.7	2.7	0.2	13.6	0.6	433.8
1989	95.3	13.3	37.2	11.4	109.4	254.0	75.2	110.5	2.9	0.0	24.5	2.0	735.4

Table 3. Change in landings from previous year in weight and percent by Statistical District, vessel tonnage, and year. Source: Statistics Division, Fisheries and Oceans, Halifax.

Area	Boat	1985		1986		1987		1988		1989	
		Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%
48	≤25.5	6.2	39	-17.7	-79	4.9	107	20.7	218	65.2	216
	>25.5	0.9	20	-4.6	-87	0	0	3.4	486	9.0	220
49	≤25.5	-6.3	-61	18.2	444	11.1	50	-16.4	-49	20.2	119
	>25.5	-0.8	-32	-0.4	-24	2.8	215	-0.9	-22	8.1	253
50	≤25.5	-17.9	-11	-19.5	-13	-42.8	-33	42.1	48	-20.7	-6
	>25.5	-6.8	-18	10.7	33	2.1	5	76.8	171	132.5	109
51	≤25.5	-3.8	-15	-3.8	-17	16.9	94	-0.2	-1	40.2	116
	>25.5	-13.6	-54	11.9	101	-7.7	-32	59.8	374	34.7	46
52	≤25.5	1.3	72	-2.3	-74	1.1	-138	0.9	47	0.1	4
	>25.5	0.3	38	-1.1	-100	0.8	-	-0.6	-75	-0.2	-100
53	≤25.5	0.8	8	-3.8	-36	2.8	42	-0.2	43	11.1	82
	>25.5	-0.2	-9	2.2	110	0.6	12	-4.1	-87	1.3	217
Total		-39.9	-13	-10.2	-4	-7.5	-3	185.6	75	301.5	69

Table 4. 1989 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.

Mon	<u>District 48</u>		<u>District 49</u>		<u>District 50</u>		<u>District 51</u>		<u>District 52</u>		<u>District 53</u>	
	In	Off	In	Off	In	Off	In	Off	In	Off	In	Off
Jan			3.0	0.4	34.1	36.8	6.5	6.0	1.2		0.8	
Feb	3.0	0.2	1.6	0.1	10.8	31.8	2.8	3.9	0.4		0.6	
Mar	6.4	0.2	3.7	1.2	9.6	26.4	3.7	2.9	0.4		0.2	
Apr	7.8	0.6	1.6	0.7	13.3	32.4	6.4	7.7	0.1		0.6	0.5
May	18.1	1.7	0.6	2.7	14.1	21.1	7.7	5.8			3.7	
Jun	13.0	2.9	0.5	0.8	6.4	13.3	9.2	13.0			3.3	
Jul	14.2	5.4	0.8		2.9	11.8	8.4	7.5			1.3	
Aug	15.9	1.7	10.7	2.8	3.3	11.8	13.0	16.9			3.3	0.8
Sep	10.2		12.8	1.5	10.0	2.9	15.8	23.7	0.1		7.2	
Oct	4.9	0.6	1.1	0.2	2.7	28.6	1.6	16.8	0.1		1.1	0.7
Nov	1.1		0.2	0.2	1.2	18.1		5.2	0.6		0.5	
Dec	0.7		0.6	0.8	1.0	19.0	0.1	1.1			1.9	
Total	95.3	13.3	37.2	11.4	109.4	254.0	75.2	110.5	2.9	0	24.5	2.0

Table 5. 1988 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.

Mon	District 48		District 49		District 50		District 51		District 52		District 53	
	In	Off	In	Off	In	Off	In	Off	In	Off	In	Off
Jan	0.1		1.1		37.0	14.6	6.8	7.9	0.7	0.2	3.7	0.4
Feb	0.1		1.3		12.2	11.4	3.1	2.3	0.6		1.5	
Mar	0.1		0.1		12.9	9.5	1.4	7.1	0.5		0.4	
Apr	0.6		1.2	0.2	14.0	15.1	4.0	4.9	0.2		1.2	
May	3.0	1.2	2.9	0.5	12.8	5.1	1.8	3.0	0.5		2.5	0.2
Jun	1.1		1.8	1.1	4.7	2.0	2.5	7.0	0.1			
Jul	7.5		3.1		4.9		6.3	12.2			0.1	
Aug	8.1	1.0	2.3	1.2	6.9		3.0	7.0			0.7	
Sep	7.5	1.4	1.6	0.2	6.9	0.6	4.7	4.2			1.1	
Oct	2.1	0.4	1.6		10.2	23.1	1.0	14.8	0.1		2.4	
Nov	0.1	0.1			0.7	21.3	0.1	5.3				
Dec					7.0	18.8						
Total	30.3	4.1	17.0	3.2	130.2	121.5	34.7	75.7	2.7	0.2	13.6	0.6

Table 6. 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 landings	Offshore			Total landings
		Class 1 catch	Logged	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
1988	190.1	1.69	5.37	178.00	433.8
1989	490.1	4.01	6.35	240.80	735.4

	Catches		Landings
	% <u>Class 1</u> logged	% <u>Logged</u> landed	% <u>Offshore</u> total
1983	73	37	23
1984	73	36	24
1985	70	36	20
1986	74	20	28
1987	81	14	29
1988	31	3	48
1989	74	3	33

Table 7. 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	6.188	71	510	2,192	87.0	12.1	2.82
Logged	6,649	6.65	76	550	2,358			
1988 data								
Class 1	1,691	1.69	21	102	468	80.5	16.5	3.62
Logged	5,367	5.37	53	324	1,485			
1989 data								
Class 1	6,586	6.59	54	369	1,782	122.0	17.9	3.70
Logged	8,961	8.96	62	502	2,425			

Table 8. Percent of the total class 1 catches and CPUE (kg/hm) from the five most productive areas as reported in log records.

<u>1985</u>			<u>1986</u>		
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	<u>7</u>	<u>3.34</u>	St. Andrews	<u>7</u>	<u>3.21</u>
	82	*3.11		75	*2.48

<u>1987</u>			<u>1988</u>		
Area	%	CPUE	Area	%	CPUE
St. Andrews	41	3.81	443664 (S. Gm)	75	5.38
Herring Cove	18	5.01	Letete Passage	15	2.11
Duck Island Sound	11	1.43	442665 (Ledges)	4	2.77
450664 (Letang Hbr)	6	9.76	Maces Bay	2	1.29
Schooner Cove	<u>5</u>	<u>4.09</u>	Cook Island	<u>1</u>	<u>1.09</u>
	81	*3.40		97	*3.62

<u>1989</u>		
Area	%	CPUE
Duck Island Sound	33	3.19
Grand Manan	23	3.13
443664	19	6.13
White Head	15	3.76
Eastern Bank	<u>4</u>	<u>11.82</u>
	94	*4.21

*Mean weighted by catch.

Table 9. 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
1988	90	32	122
1989	124	36	160

Table 10. Average scallop catch per tow by age grouping for each survey year. Abundance of recruits (age 4+) was estimated from the catch of an unlined gear, while pre-recruits (1-3 years) abundance was estimated from the catch of a lined gear.

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

Table 10. (cont'd)

Year	<u>Pre-recruits</u>	<u>Recruits</u>	
	1-3 yr	4-7 yr	8+ yr
<u>1988</u>			
Inside 7-mi line	48	72	12
Outside 7-mi line	8	24	20
OR			
Southern area	32	20	12
Western area	56	148	12
Northern area	8	12	12
<u>1989</u>			
Inside 7-mi line	12	46	14
Outside 7-mi line	2	13	8
OR			
Southern area	4	13	12
Western area	34	128	14
Northern area	4	26	10

Table 11. 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-mi											
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-mi											
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-mi											
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-mi											
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-mi											
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-mi											
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-mi											
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
1988 inside 7-mi											
lined gear	21	6	13	7	3	1	1	1	3	55	141
unlined gear	6	6	20	10	4	1	1	1	4	54	136
1988 outside 7-mi											
lined gear	3	2	1	0	1	1	0	0	1	11	18
unlined gear	1	2	2	1	2	1	1	1	3	15	25
1989 inside 7-mi											
lined gear	4	9	10	13	8	2	2	1	6	55	149
unlined gear	1	3	13	18	12	3	2	2	10	64	144
1989 outside 7-mi											
lined gear	0	2	3	2	3	2	2	2	4	18	32
unlined gear	0	1	4	3	4	2	2	2	4	22	41

Table 12. Catch per 800-m tow with 4-gang Digby drag for inside 7-mi line in Grand Manan and offshore Cape Spencer. Age-classes 2 and 3 estimated from mean of lined gear and age-classes 4-10+ estimated from means of unlined gear.

Age-class	Grand Manan			Cape Spencer 1989
	1987	1988	1989	
2	17	21	4	2
3	36	6	9	21
4	38	20	13	188
5	25	10	18	94
6	10	4	12	12
7	4	1	3	10
8	3	1	2	8
9	3	1	2	4
10+	11	4	10	3
Total	147	68	73	342

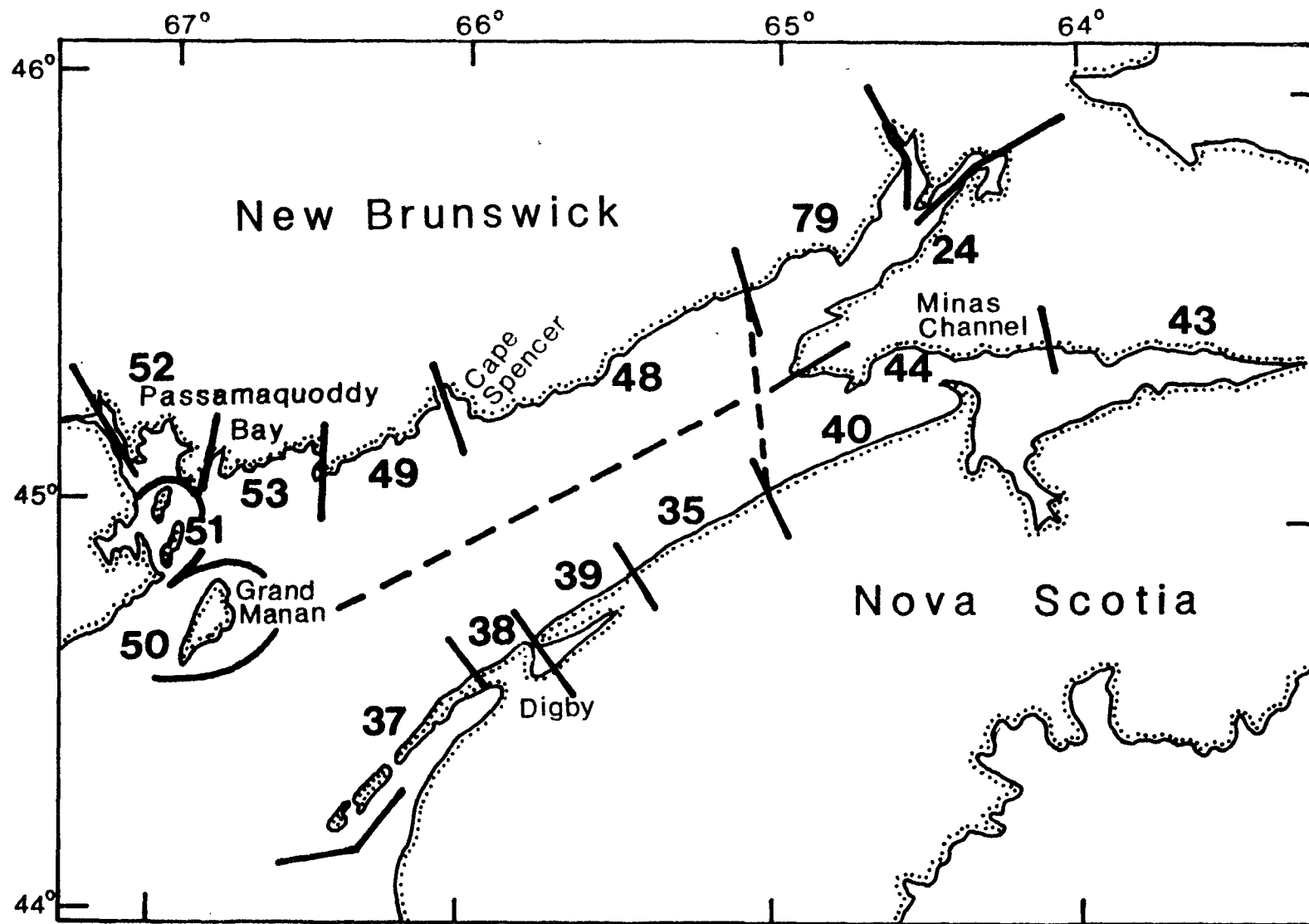


Figure 1. Location and boundaries of Statistical Districts in the Bay of Fundy.

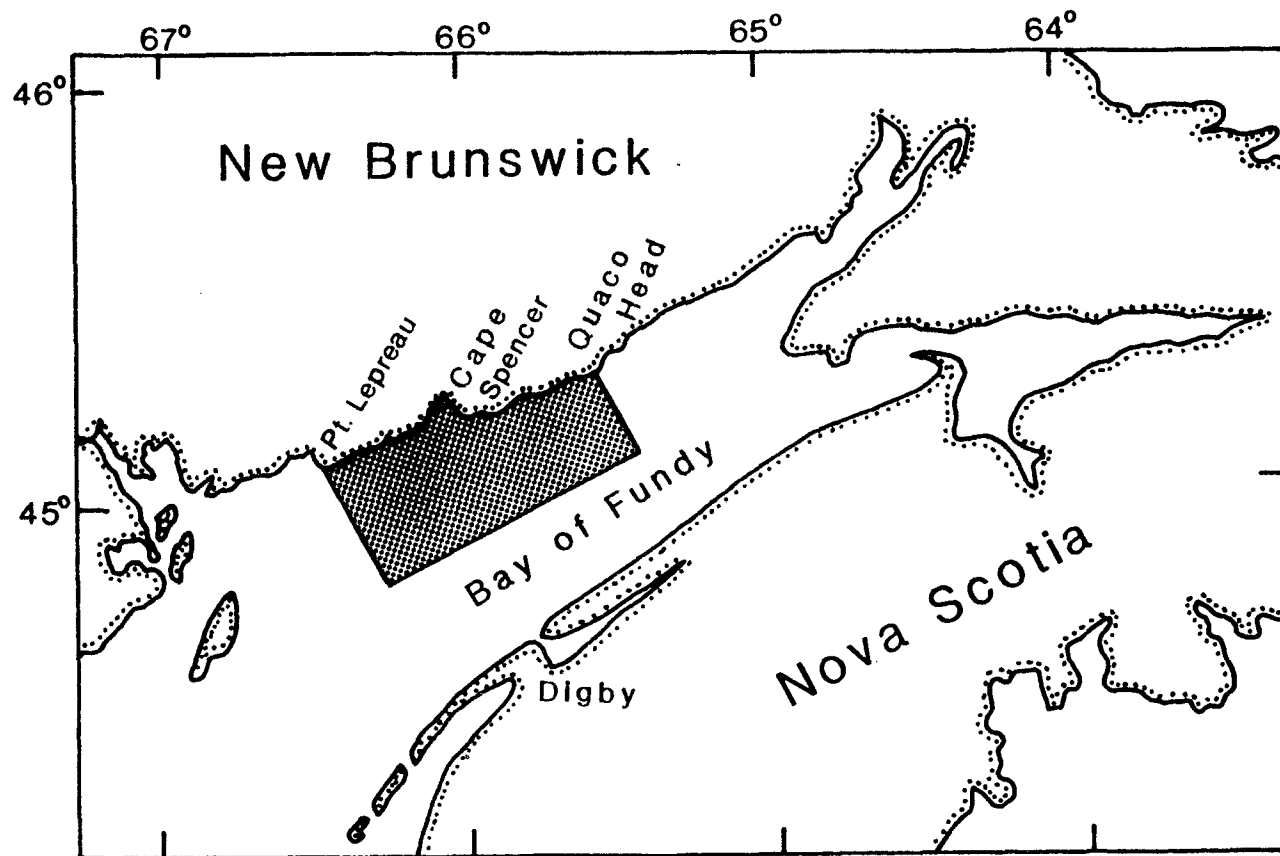


Figure 2. Location of sampling area for assessment cruise off Cape Spencer in 1989 .

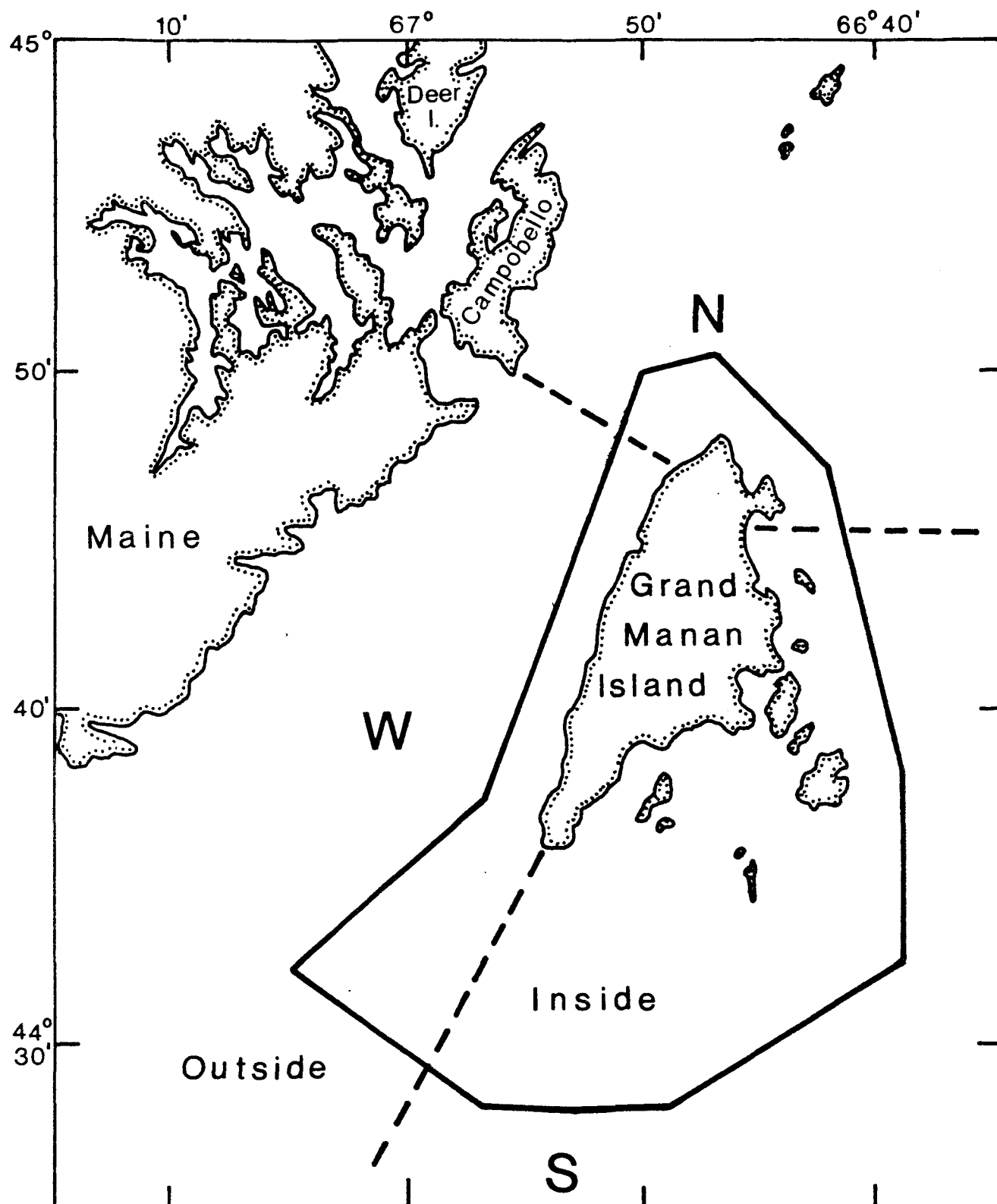


Figure 3. Location of post-stratified areas around Grand Manan.

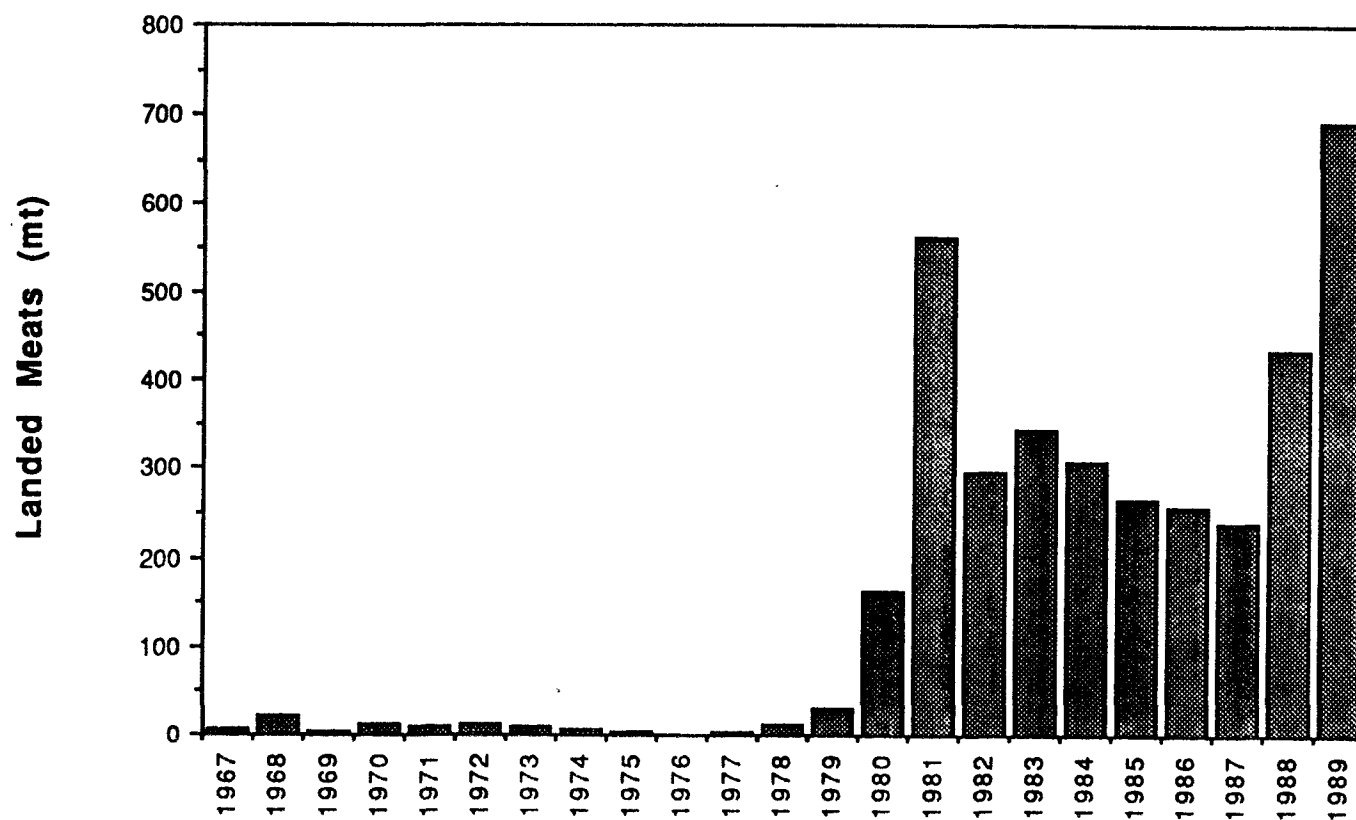


Figure 4. Historical landings from southwest New Brunswick (Statistical Districts 48 to 53) for the years 1967 to 1989. Source: Statistics Branch, Fisheries and Oceans, Halifax.

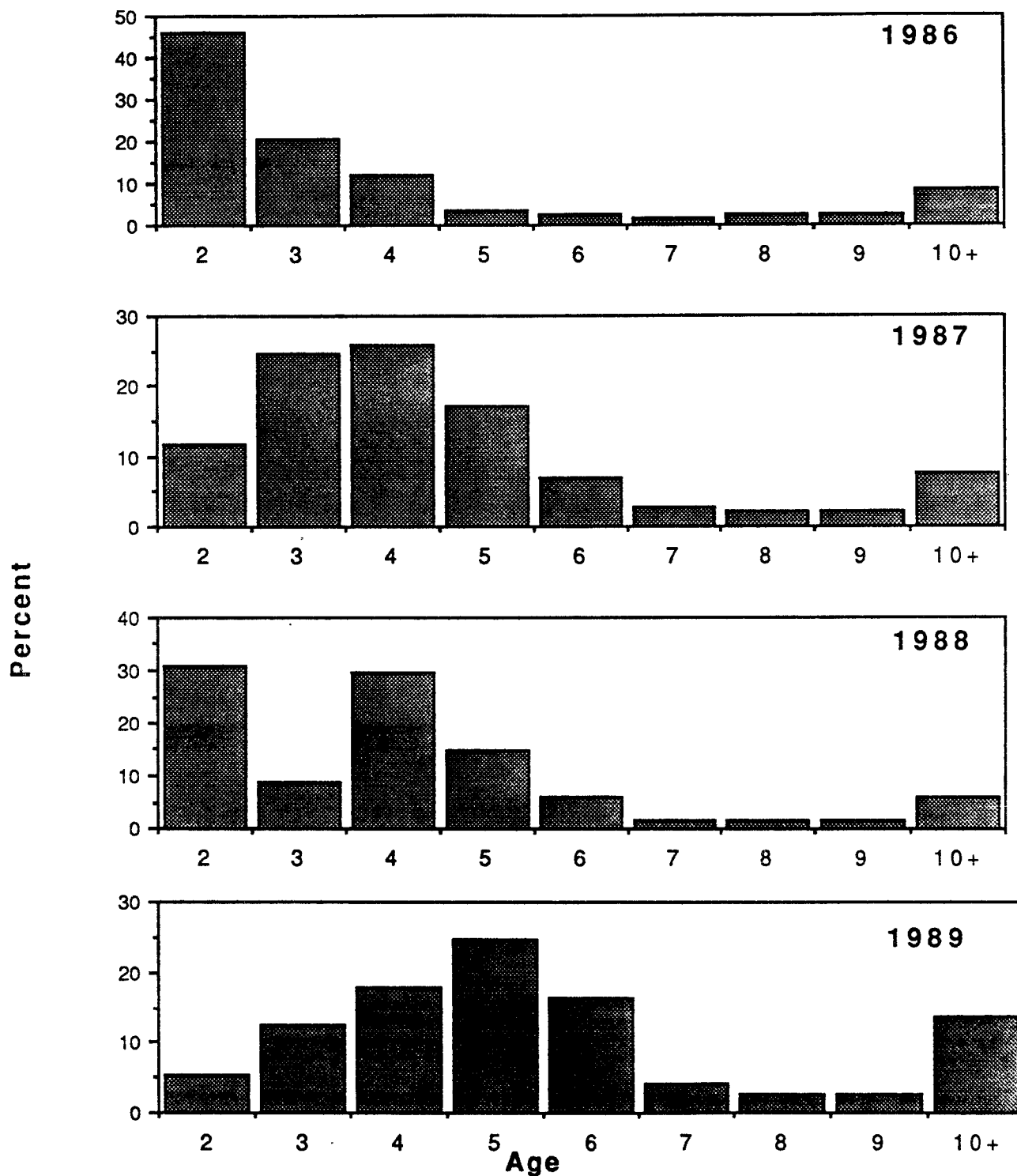


Figure 5. Percentage of captured scallops per 800m tow with a 4-gang Digby drag by age class for the years 1986 to 1989 inclusive. 1986 and 1987 data from Robert and Lundy(1988).