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Grand Manan and Cape Spencer Scallop Stock Update: 1990-1991

by

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Abstract

Landings of scallops in southwest New Brunswick for 1990 remained at the previous historically high peak reached in 1989 at 736 t but, in 1991, landings fell by 45% to 408 t. The loss was generally reflected in all six statistical districts but, affected the offshore boats the most heavily. Activity in the fleet, as measured by submission of sales slips, increased from about 60% in 1989 to 69% in 1991. Analysis of the landings for vessels registered in New Brunswick indicated that only 25% of the vessels were responsible for catching 75% of the landings. The recent increases in the landings were due to the recruitment of a large year-class to the fishery particularly in the Digby and the Cape Spencer areas. Research cruises off Grand Manan indicated that the scallop population was generally in the southern and western inside areas and that the scallop stocks were healthy with a wide range of year-classes available. A small pulse of recruits to the fishery is expected in early 1994. Surveys off Cape Spencer indicated that the stock was composed of only two year-classes and decreasing quickly. There was no sign of recruitment coming into the population. It is predicted to last for one or two more fishing seasons in the absence of another recruitment pulse.

Résumé

En 1990, les débarquements de pétoncles dans le sud-ouest du Nouveau-Brunswick se sont maintenus aux niveaux records enregistrés en 1989 (736 t), mais en 1991, ils ont chuté de 45 p. 100 pour s'établir à 408 t. Ce déclin, apparent dans l'ensemble des six districts de statistiques, a été plus marqué dans la pêche hauturière. L'activité de la flottille, d'après les récépissés de vente, est passée d'environ 60 p. 100 en 1989 à 69 p. 100 en 1991. L'analyse des débarquements des bateaux immatriculés au Nouveau-Brunswick révèle que seulement 25 p. 100 des navires ont capturé 75 p. 100 des débarquements. L'augmentation récente de ces derniers est due au recrutement à la pêche d'une forte classe d'âge, particulièrement dans les régions du cap Spencer et de Digby. Des campagnes d'évaluation effectuées au large de Grand Manan ont révélé que la population de pétoncles se trouvait généralement dans les zones intérieures du sud et de l'ouest et que les stocks étaient en bon état et constitués d'un large éventail de classes d'âge. On attend une modeste vague de recrutement à la pêche au début de 1994. D'après les campagnes d'évaluation effectuées au large du cap Spencer, le stock se compose uniquement de deux classes d'âge et décroît rapidement. La population ne présente aucun signe de recrutement prochain. On prévoit qu'elle subsistera pendant une ou deux autres saisons de pêche.

Introduction

The scallop fishery off Grand Manan started in the early 1980s as a result of an expansion of the scallop fleet out of Digby. While there was a small fishery present before 1980, landings have significantly increased since then and Grand Manan has generally had the highest scallop landings of all the Statistical Districts (S.D.) in New Brunswick. Research surveys in the area have taken place annually since 1980 with the exception of 1984. Cape Spencer has traditionally had a very small scallop population but, there was a very large recruitment to the fishable population in 1988 and a fishery very quickly developed. Annual research surveys in the area have taken place since 1989.

Regulations governing the southwest New Brunswick fishery are similar to those in the other parts of the Bay of Fundy. There are two categories of boats in southwest New Brunswick: 1) small, inshore (<14.5 m LOA [Length over-all]), 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. 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 purpose of this report is to update the status of the scallop stocks from the Grand Manan area in order to maintain a time series and to provide an analysis of the scallop population off Cape Spencer. Since scallop fishermen are starting to venture further afield as local stocks become depleted it has become imperative to obtain a better understanding of the characteristics of the newly exploited ones.

Materials and Methods

Fishery Data

Landing records from the six Statistical Districts (S.D.) (Fig. 1) of southwestern New Brunswick were obtained from Statistics Division, Dept. Fisheries and Oceans, Halifax, Nova Scotia. Information from individual vessels on fishing location, catch, effort, and crew numbers were obtained from fishing log records submitted by

fishermen. Analysis was only carried out on 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 substrata based on historic fishing patterns and past surveys (Robinson and Chandler, 1990). Each substratum was further classified as to high, medium or low (based on historic catch rates) which determined the number of stations sampled within that substratum. For the Cape Spencer area near Saint John, 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 first and third 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 800 m. 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 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

There were 206, 202, and 191 licenses issued in southwestern New Brunswick (SWNB) in 1989, 1990 and 1991 respectively. Of those licences, based on landing records, 61% were active in 1989, 65% in 1990 and 69% in 1991. Landing records for vessels registered in New Brunswick from 1989 to 1991 indicated that approximately 10% of the active fishing boats caught 50% of the landings, 25% caught 75%, and 60% caught 95% (Fig. 4). The larger boats with Bay of Fundy licenses caught proportionally more scallops but, the proportion of landings dropped in 1990 and 1991 compared to 1989 (Fig. 5).

Scallop landings in SWNB for 1990 virtually matched the peak landings for 1989 but, preliminary landing data for 1991 indicated that landings dropped by 45% compared to 1990 (from 736.3 t to 408.3 t). This drop was experienced in all districts for both inshore and offshore boats except for Statistical District (S.D.) 50 (Grand Manan) for the inshore boats which only experienced a drop of 25% and in S.D. 52 (Passamaquoddy Bay) for the inshore boats where there was no appreciable change (Table 2). In 1990, S.D. 50 (Grand Manan) accounted for 42% of the landings, S.D. 51 (Campobello) for 25%, and S.D. 48 (Saint John) for 22%. In 1991, S.D. 50 (Grand Manan) accounted for 44% of the landings, S.D. 51 (Campobello) for 28%, and S.D. 48 (Saint John) for 17%.

Seasonally, 35% of the landings in SWNB occurred in the January to March period for 1990 and 42% in 1991 (Tables 3 and 4). The majority of the landings in S.D. 48 (Saint John) occurred in the April to September period for both 1990 and 1991. In S.D. 49 (Beaver Harbour area), the catch was concentrated in the January to May period for 1990 and 1991. Landings in S.D. 50 (Grand Manan) occurred primarily from January to May for both 1990 and 1991. Landings in S.D. 51 (Campobello) were relatively constant throughout the January to October period for both years. In S.D. 52 and 53 (Passamaquoddy Bay and Letang area) landings occurred mostly from January to March. The percentage of catch for offshore boats in comparison with inshore boats increased in the summer months for S.D. 50 and 51.

The mean productivity, based on number of active licenses and total landed catch, began to drop in 1991. In 1990 the average landing in tonnes of scallop meats per boat was 2.93 while in 1991 it dropped 41% to 1.74. Productivity in 1988 and 1989 was 2.02 t and 2.94 t respectively.

Fishing Logs

The number of vessels submitting log books increased from 6 in 1990 to 12 in 1991. CPUE information (kg/hm) from Class 1 data indicated that 1990 CPUE increased from 3.70 in 1989 to 4.78 in 1990 (Table 5). The CPUE in 1991 fell slightly

to 4.14. Analysis of the fishing areas in 1990 indicated that the highest producing areas were in Bradford's Cove on the western side of Grand Manan and the southern areas. In 1991, Bradford's Cove was much less important and the most productive spots were south of Grand Manan and off Cape Spencer.

Assessment Surveys

A total of 152 tows were done around Grand Manan in 1990 and 146 in 1991. At Cape Spencer, 36 tows were done in both 1990 and 1991.

Results of the survey for Grand Manan indicated that the mode of pre-recruits seen in the western area in 1989 had been recruited into the fishery in 1990. Both pre-recruits and recruits in 1990 and 1991 were found predominantly in the inside zone of the southern and western areas (Table 8). The number of pre-recruits in the inside area increased 128% from 1990 to 1991. The lined gear in 1991 indicated a small pulse of age 2 and 3 year olds in the scallop population (Table 9). This pulse was only about 15% of the large pulse that was seen in the 1985 survey.

The shape of the size frequency distribution substantially differed between Grand Manan and Cape Spencer (Figs. 6 and 7). Grand Manan showed a broad distribution of sizes ranging from 20 to 155 mm with a noticeable pulse or recruitment about to come into the fishery. Cape Spencer had a very narrow distribution of sizes ranging from 60 to 120 mm with no sign of small or very large scallops in the population. The numbers of scallops decreased from 1989 to 1991 in the Cape Spencer area. The total number of scallops captured dropped 47% from 1989 to 1990 and 11% from 1990 to 1991.

Discussion

The participation in the fishery in SWNB appears to be increasing as the percentage of active licenses have increased over the last four years. However, there is still less than 70% of the licenses registering any catch. When the highliners of the New Brunswick fleet are examined, it appears that most of the catch is being taken by a few boats. For example, in 1989, eight boats caught 50% of the entire catch registered to New Brunswick boats. These were mostly larger boats with Bay of Fundy licenses. In 1990 and 1991 more boats had higher catches as approximately 20 and 15 boats in 1990 and 1991 respectively caught 50% of the catch. More of the higher landings were taken by Mid-Bay licensed boats in 1990 and 1991. The increase in activity in the fishery is probably partly a result of the increase in recruitment to the fishery which started to occur in 1988. The large stocks which appeared off Cape Spencer were important to this increase. It appears there is a significant lag by the inactive inshore fishermen in re-entering the fishery when good year-class recruit into the fishery.

Scallop landings in 1990 matched the landings from 1989 but, started to drop

quickly in 1991. The catch that is landed in each of the S.D.'s is traditionally a blend of catches from different parts of the Bay of Fundy, especially in Grand Manan (S.D. 50) and Campobello (S.D. 51). There are several boats on Grand Manan that carry a Bay of Fundy license and fish the productive grounds off Digby in the winter months and also fish off Cape Spencer in the summer. Therefore, landings do not necessarily reflect local abundances of scallops. The decrease in landings for SWNB is probably more a reflection of a decrease in stocks in the Digby area and off Cape Spencer. Inshore boats in all areas except S.D. 51 had comparable catches between 1990 and 1991 for the opening of the inshore area from January to March suggesting that the stocks in these areas remained stable. The scallop beds in the inshore areas of SWNB tend to be small but, fairly consistent over time.

The log records from the fishing boats probably only give a partial picture where the highest density stocks are located because of the few number of boats involved. Therefore, the CPUE figures that show higher catch rates than in 1989 are probably not generally applicable to the fishery as a whole. A small percentage of the fleet sends in log books (6 in 1990 and 12 in 1991) and much of the information contained in the logs is pretty general. However, the high CPUE in Bradford's Cove in 1990 shown in the fishing logs correlated well with our research surveys in the summer of 1989.

The research cruises in 1990 and 1991 showed the same patterns of scallop distribution that were found on previous surveys. Scallops in the Grand Manan area are found predominantly inside in the southern and western areas. The stocks in these areas look healthy with several year-classes of scallops represented and signs of continual recruitment to the population. It appears that there is another small pulse of scallops which will recruit to the fishery in January of 1994. Therefore, catches in the inshore areas of Grand Manan should remain close to previous levels. The fishery at Cape Spencer will continue to decline based on the results from the research surveys in the area. In three years of surveying, there has been no sign of new recruitment into the population and the fishery is existing on one or two year-classes. The population has been significantly reduced since our original survey in 1989 and will probably only last another season or two before catches in this area are reduced below economic feasibility.

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Table 1. Number of licensed and active vessels (in brackets) by license type and statistical areas from 1988 to 1991 (No activity measured for 1988). MB= mid-Bay license, BOF=Bay of Fundy license. Activity measured by the submission of one or more sales slips. Source: Licensing Unit, Fisheries and Oceans, Halifax, Nova Scotia.

District	1988		1989		1990		1991	
	MB	BOF	MB	BOF	MB	BOF	MB	BOF
48	4	0	6(5)	0	7(5)	0	8(6)	0
49	17	1	18(16)	1(0)	18(12)	0	18(14)	0
50	75	8	71(41)	8(6)	75(55)	8(6)	73(60)	8(6)
51	59	1	58(38)	3(1)	52(37)	1(1)	50(30)	0
52	18	3	16(7)	2(0)	16(4)	2(0)	15(6)	0
53	20	1	22(10)	1(1)	22(10)	1(1)	18(8)	1(1)
Total	193	14	191(117)	15(8)	190(123)	12(8)	182(124)	9(7)

Table 2. Landings of scallops (t scallop meats) by year, statistical district, and 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
Year	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)+(2)
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					137.76	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		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		24.5	2.0	735.4
1990	120.2	41.5	41.3	12.4	99.7	210.5	84.4	103.0	2.0		12.7	8.6	736.3
1991	55.3	13.6	33.3	6.0	75.2	103.4	47.0	68.2	2.1		2.5	1.7	408.3

Table 3. Monthly scallop landings (t scallop meats) by statistical district and by vessel size for 1990. Landings from vessels \leq 25.5 G.T. are classified as "inshore" and those >25.5 G.T. are classified as "offshore". Source: Statistics Division, Fisheries and Oceans, Halifax.

Month	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	0.4	1.1	4.5	2.2	25.9	35.2	14.2	6.4	1.0		6.5	1.7
Feb	1.6	1.0	4.5	2.1	18.3	18.6	4.3	6.1	0.5		0.6	1.9
Mar	2.2	2.2	10.5	3.4	22.7	32.3	11.8	15.5	0.5		1.3	0.8
Apr	12.5	2.4	7.6	2.5	7.4	29.2	8.6	7.4				
May	16.3	11.8	5.8	0.5	11.8	25.4	7.8	11.0			2.4	
Jun	14.1	6.5	2.4	0.1	2.5	12.4	7.1	8.0			0.8	1.6
Jul	19.9	4.3	1.6		1.5	9.9	4.7	9.4			1.1	2.2
Aug	29.3	7.6	1.9	1.2	1.6	7.8	9.8	13.1				
Sep	16.3	1.9	1.7	0.4	3.5	6.6	6.4	8.1				
Oct	4.5	0.6	0.2		2.7	21.1	4.1	9.2				
Nov	2.1	1.1			1.0	8.3	1.7	5.5				
Dec	1.0	1.0	0.6		0.8	3.7	3.9	3.3				0.4
Total	120.2	41.5	41.3	12.4	99.7	210.5	84.4	103.0	2.0	0.0	12.7	8.6

Table 4. Monthly scallop landings (t scallop meats) by statistical district and by vessel size for 1991. Landings from vessels ≤ 25.5 G.T. are classified as "inshore" and those >25.5 G.T. are classified as "offshore". Source: Statistics Division, Fisheries and Oceans, Halifax.

Month	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	0.4	5.3		30.1	25.4	7.2	4.6	0.5		0.2	0.5
Feb	0.2	1.1	5.9	0.5	23.7	16.8	5.9	7.1	0.2		0.8	0.7
Mar	0.5		4.8	1.0	11.6	11.2	3.6	2.3			0.4	0.5
Apr	4.0	1.9	7.4	1.5	2.7	6.5	3.9	8.1			0.6	
May	4.7	2.4	7.2	3.0	1.0	7.6	7.1	12.1			0.4	
Jun	4.7	2.5	1.0		1.9	3.0	4.7	8.4				
Jul	11.8	1.8			1.3	3.6	3.6	7.2	0.7			
Aug	12.3	1.6	0.8		1.5	5.5	2.8	6.4	0.4		0.1	
Sep	9.4	0.6	0.4		0.7	5.2	5.1	4.5	0.1			
Oct	6.1	1.2	0.5		0.6	9.6	3.1	7.5	0.1			
Nov	1.5	0.1			0.1	5.9			0.1			
Dec						3.1						
Total	55.3	13.6	33.3	6.0	75.2	103.4	47.0	68.2	2.1	0.0	2.5	1.7

Table 5. 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	h-meters	Kg/d	Kg/h	Kg/hm
1983 - 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 - 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 - 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 - 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 - 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 - 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 - 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			
1990 - Class 1	11,557	11.56	100	520	2,418	115.6	22.3	4.78
 Logged	23,953	23.95	191	993	4,618			
1991- Class 1	24,030	24.03	197	1,206	5,804	122.0	19.9	4.14
 Logged	34,476	34.48	293	1,794	8,632			

Table 6. Percent of total class 1 catches and CPUE (kg/hm) from the five most productive areas as reported in log records from 1986 to 1991.

1986 Fishing Areas			1987 Fishing Areas		
	%	CPUE		%	CPUE
Duck Island Sound	32	2.85	St. Andrews	41	3.81
Gannet Rock	17	1.61	Herring Cove	18	5.01
Wolves Bank	10	1.59	Duck Island Sound	11	1.43
Middle Ground	9	3.24	450664 (Letang Hbr)	6	9.76
St. Andrews	7	3.21	Schnooner Cove	5	4.09
	75	*2.48		81	*3.40
1988 Fishing Areas			1989 Fishing Areas		
	%	CPUE		%	CPUE
443664 (S. G.M.)	75	5.38	Duck Island Sound	33	3.19
Letete Passage	15	2.11	Grand Manan	23	3.13
442665 (Ledges)	4	2.77	443664 (S. G.M.)	19	6.13
Maces Bay	2	1.29	White Head	15	3.76
Cook Island	1	1.09	Eastern Bank	4	11.82
	97	*3.62		94	*4.21
1990 Fishing Areas			1991 Fishing Areas		
	%	CPUE		%	CPUE
Bradfords Cove	35	8.17	443665 (S. G.M.)	22	2.92
Grand Manan	15	8.72	Grand Manan	40	4.96
443665 (S. G.M.)	7	5.92	443664 (S. G.M.)	12	2.82
Gannet Rock	6	3.18	442665 (Ledges)	8	6.71
Three Islands	7	3.57	Cape Spencer	8	4.87
	70	*7.19		90	*4.33

* mean weighted by catch

Table 7. Summary of survey stations by year for inside and outside the 7-mile line .

Year	Inside	Outside	Total
1983	50	24	74
1984	0	0	0
1985	66	36	102
1986	88	37	125
1987	92	33	125
1988	90	32	122
1989	124	36	160
1990	112	40	152
1991	104	42	146

Table 8. Average scallop catch (numbers of scallops) per tow by age grouping for each survey year off Grand Manan. Abundance of recruits (age 4+) was estimated from the catch of an unlined gear while pre-recruit (1-3 years) abundance was estimated from the catch of lined gear.

Year	Location	Pre-recruits	Recruits	
		1-3 yr	4-7 yr	8+yr
1986	Inside	79	23	16
	Outside	12	10	12
	Southern	46	15	15
	Western	106	25	15
	Northern	23	61	13
1987	Inside	54	77	17
	Outside	5	12	7
	Southern	21	63	17
	Western	82	57	11
	Northern	8	34	4
1988	Inside	48	72	12
	Outside	8	24	20
	Southern	32	20	12
	Western	56	148	12
	Northern	8	12	12
1989	Inside	12	46	14
	Outside	2	13	8
	Southern	4	13	12
	Western	34	128	14
	Northern	4	26	10
1990	Inside	7	30	17
	Outside	1	3	3
	Southern	5	13	16
	Western	2	19	4
	Northern	0	1	1
1991	Inside	16	38	17
	Outside	1	3	2
	Southern	8	16	14
	Western	8	24	6
	Northern	0	1	1

Table 9. Average scallop catch at age per tow for a 4-gang Digby drag for lined and unlined buckets off Grand Manan. Mean total number of scallops per tow and s.d. for year and gear types respectively.

Year	Location	Gear	Age (yr)									Mean	s.d.
			2	3	4	5	6	7	8	9	10+		
1987	Inside	Lined	17	36	36	19	8	3	2	2	7	144	232
		Unlined	3	18	38	25	10	4	3	3	11	138	263
	Outside	Lined	2	3	2	2	3	2	1	1	2	30	40
		Unlined	1	3	3	4	3	2	2	1	4	29	35
1988	Inside	Lined	21	6	13	7	3	1	1	1	3	55	141
		Unlined	6	6	20	10	4	1	1	1	4	54	136
	Outside	Lined	3	2	1	0	1	1	0	0	1	11	18
		Unlined	1	2	2	1	2	1	1	1	3	15	25
1989	Inside	Lined	4	9	10	13	8	2	2	1	6	55	149
		Unlined	1	3	13	18	12	3	2	2	10	64	144
	Outside	Lined	0	2	3	2	3	2	2	2	4	18	32
		Unlined	0	1	4	3	4	2	2	2	4	22	41
1990	Inside	Lined	4	1	3	3	4	1	1	1	5	25	117
		Unlined	0	1	3	7	6	2	2	1	7	30	154
	Outside	Lined	0	0	0	0	0	0	0	0	1	3	17
		Unlined	0	0	1	0	0	0	0	0	1	4	19
1991	Inside	Lined	8	5	3	4	5	3	2	1	4	36	163
		Unlined	1	2	3	6	8	6	3	2	7	36	174
	Outside	Lined	0	0	0	0	0	0	0	0	0	2	8
		Unlined	0	0	0	1	1	1	0	0	1	4	21

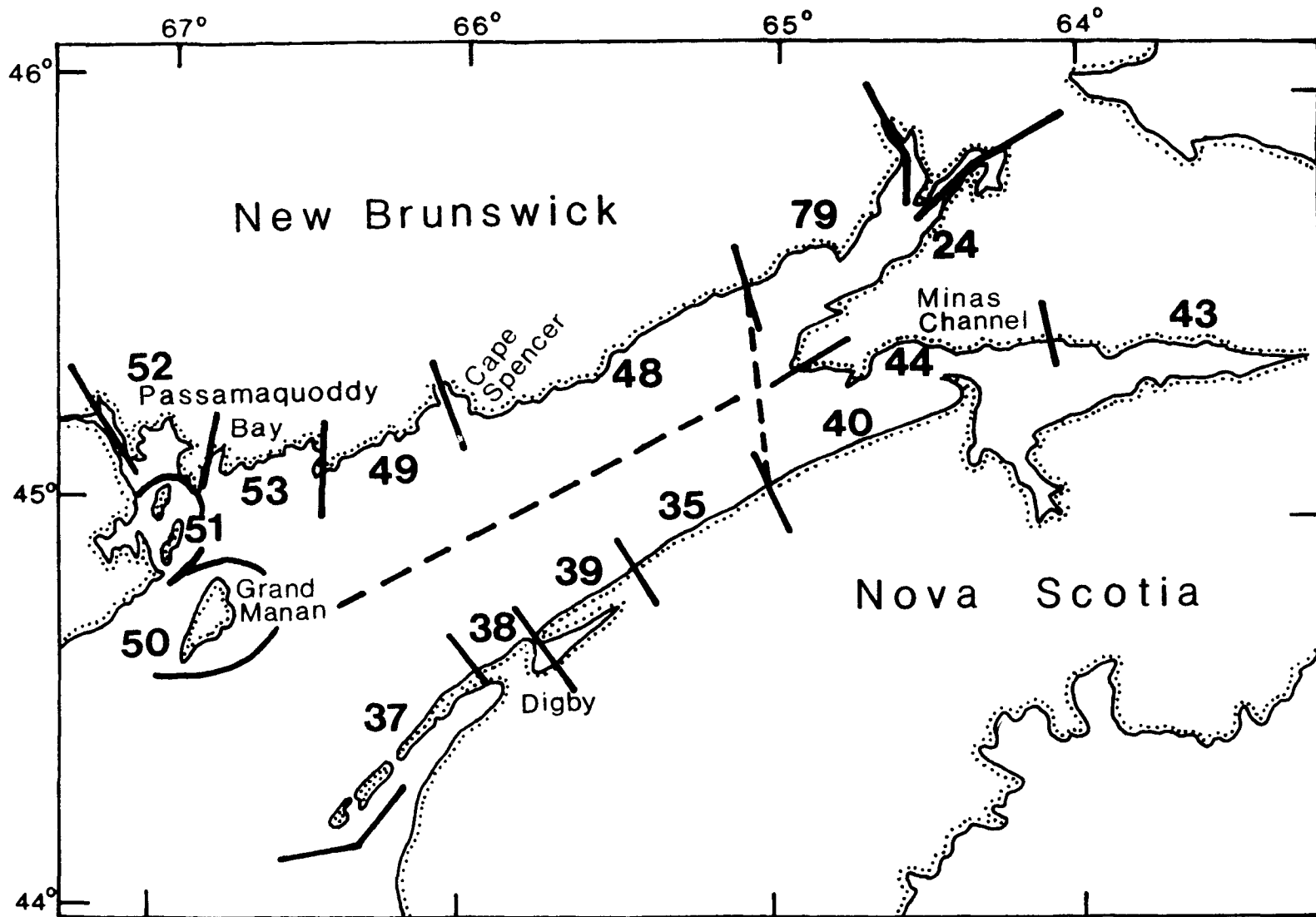


Figure 1. Location and boundaries of Statistical Districts in the Bay of Fundy.

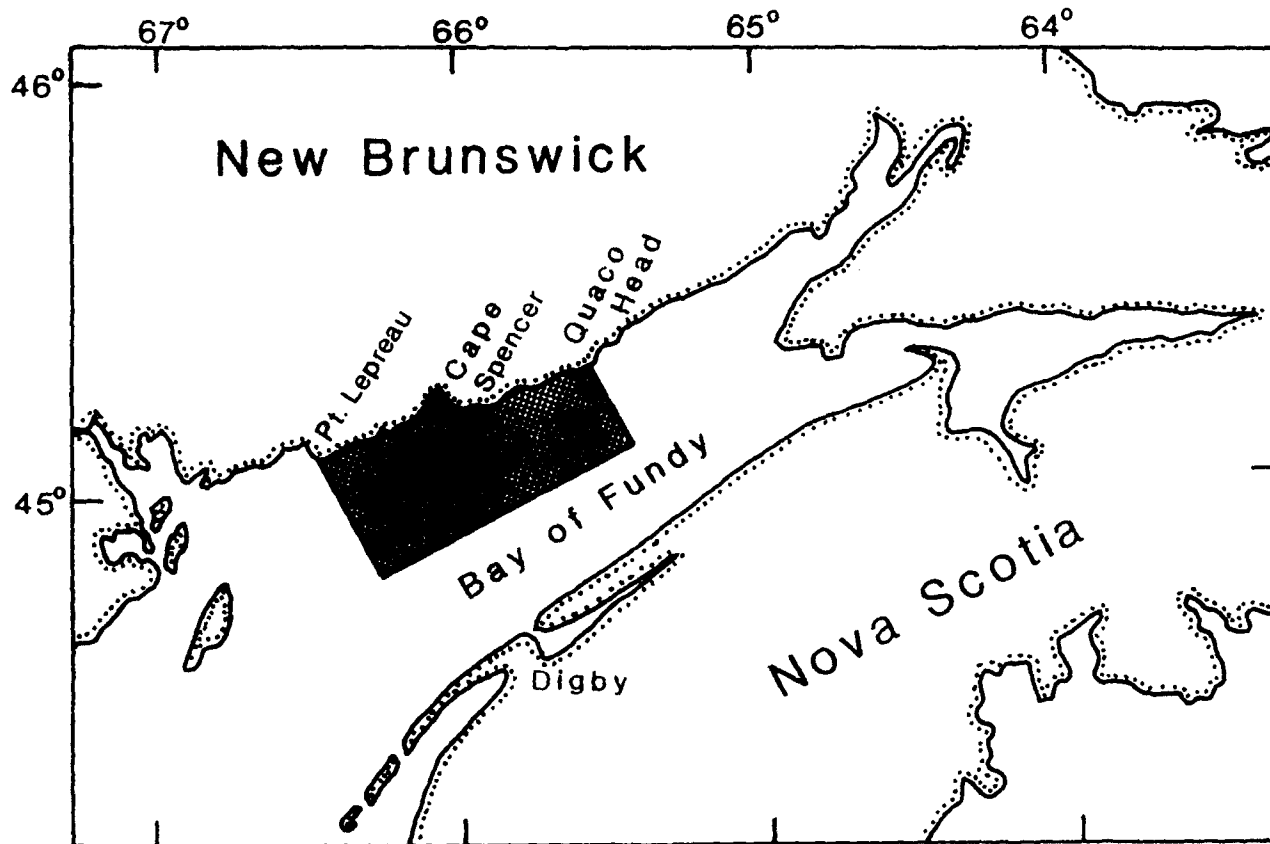


Figure 2. Location of sampling area for assessment cruise off Cape Spencer in 1989 .

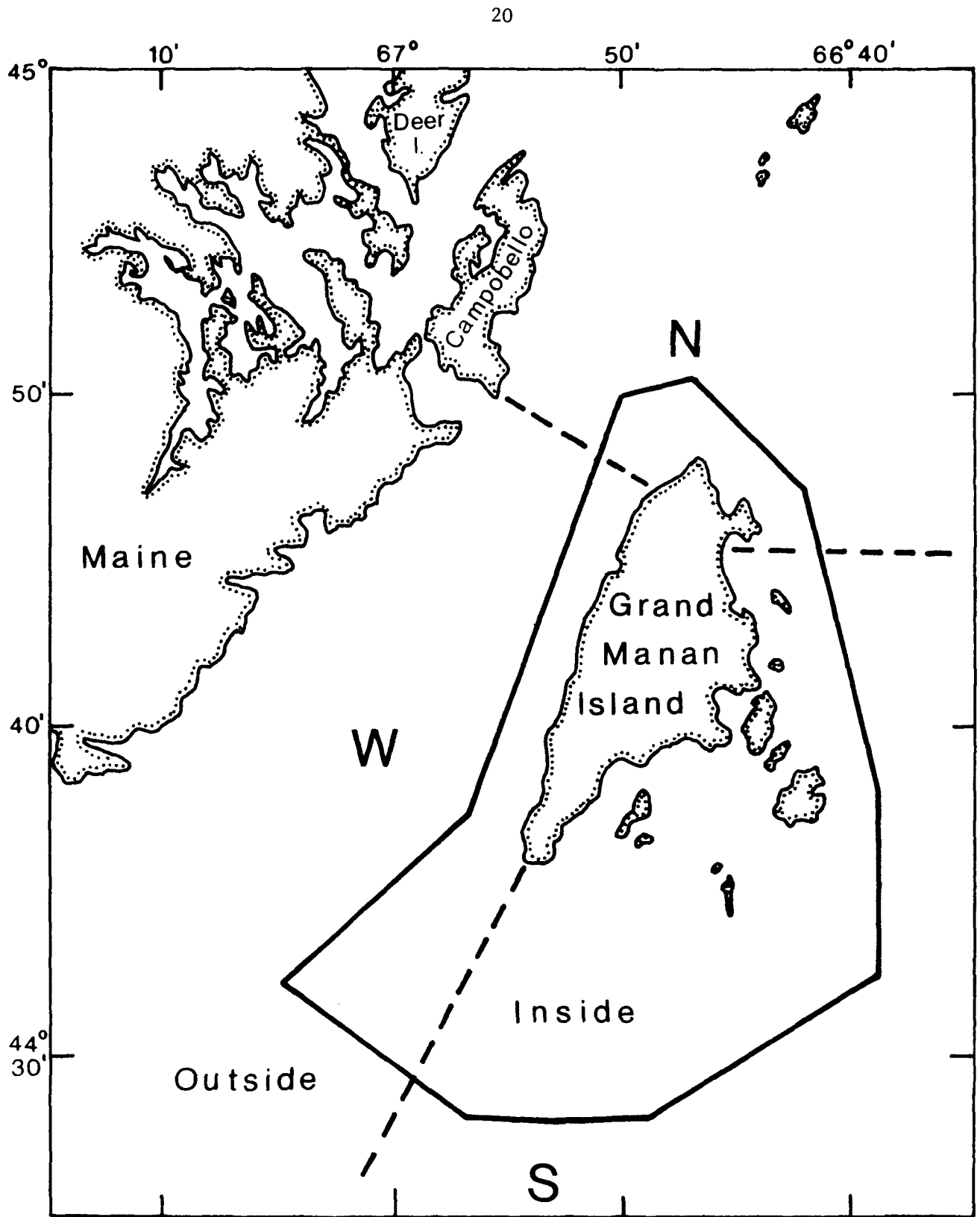


Figure 3. Location of post-stratified areas around Grand Manan.

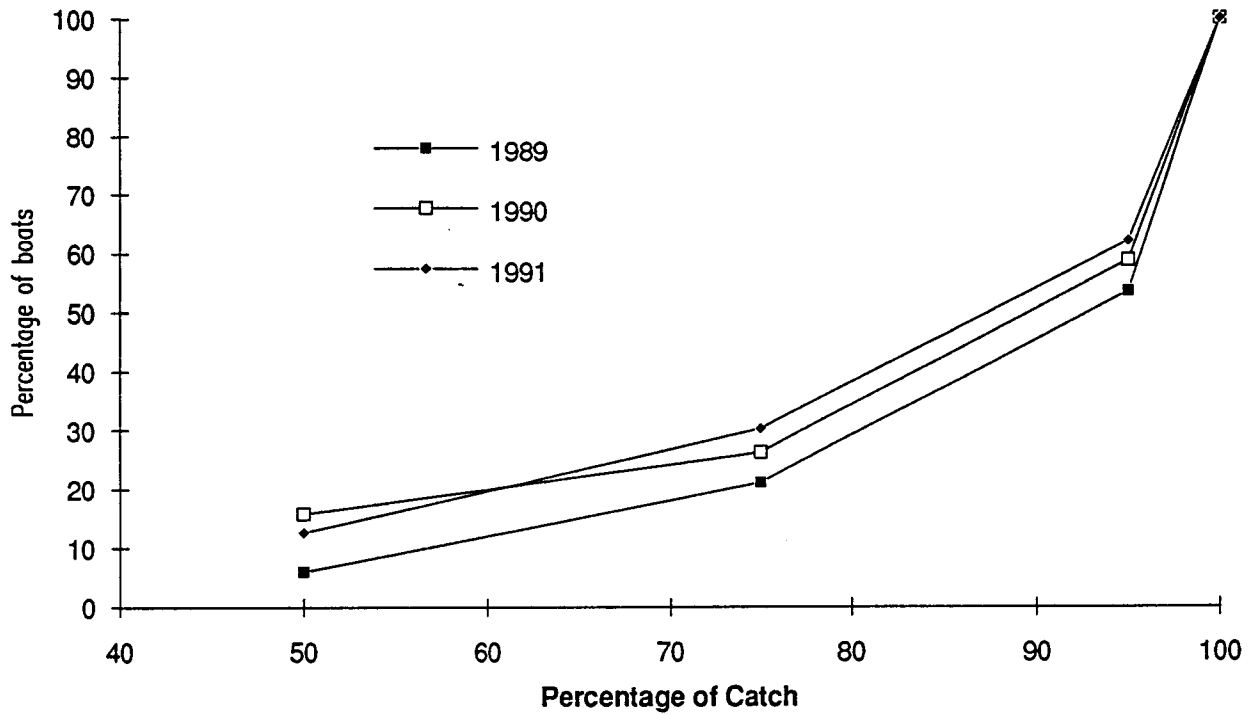


Figure 4. Percentage of the catch taken by the percentage of boats showing landings which were registered in New Brunswick for 1989 to 1991.

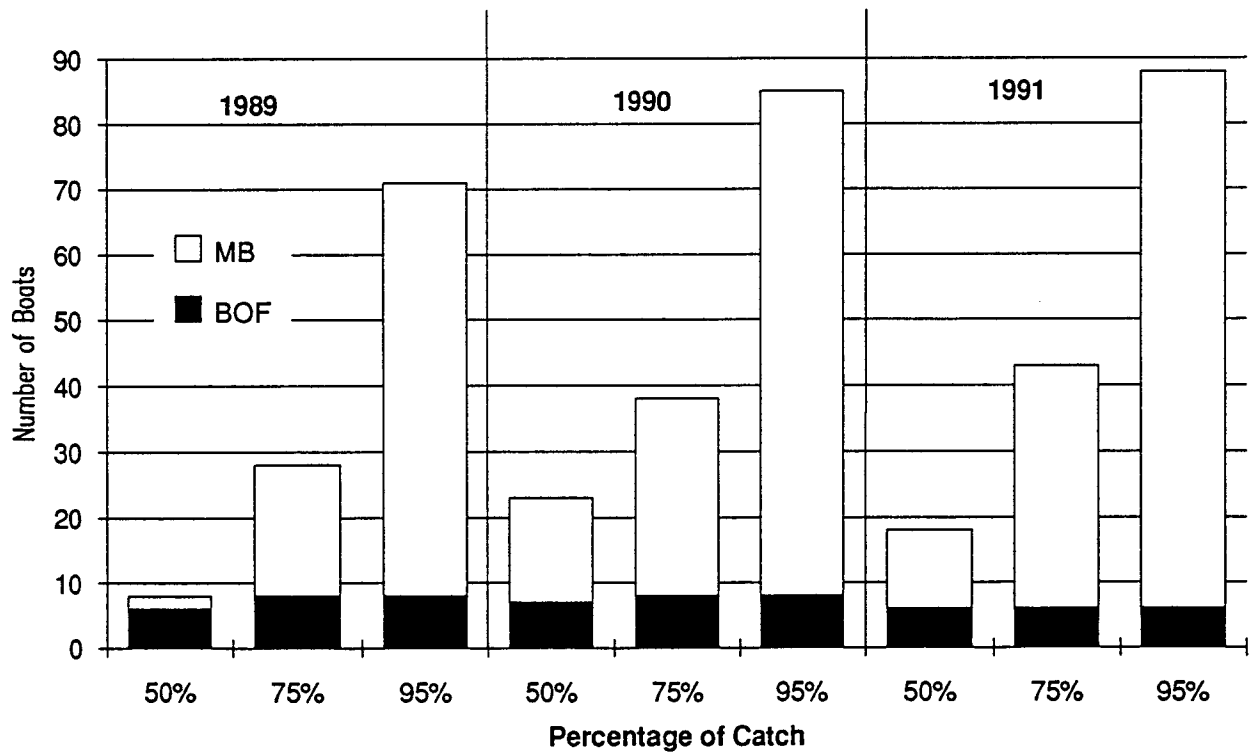


Figure 5. Percentage of the catch taken by the number of boats showing landings by type of license which were registered in New Brunswick for 1989 to 1991.

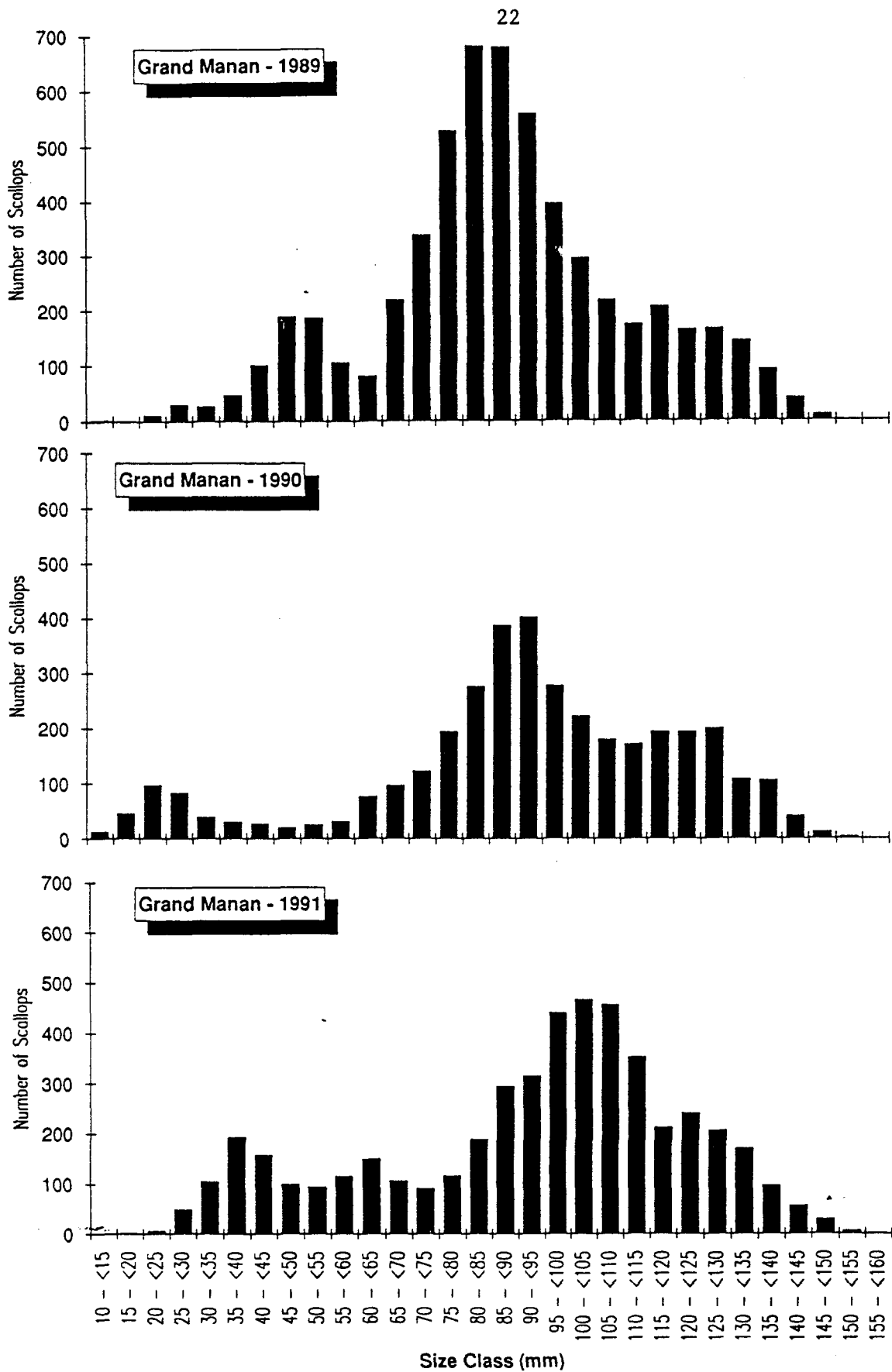


Figure 6. Size frequency of scallops captured in assessment surveys off Grand Manan from 1989 to 1991.

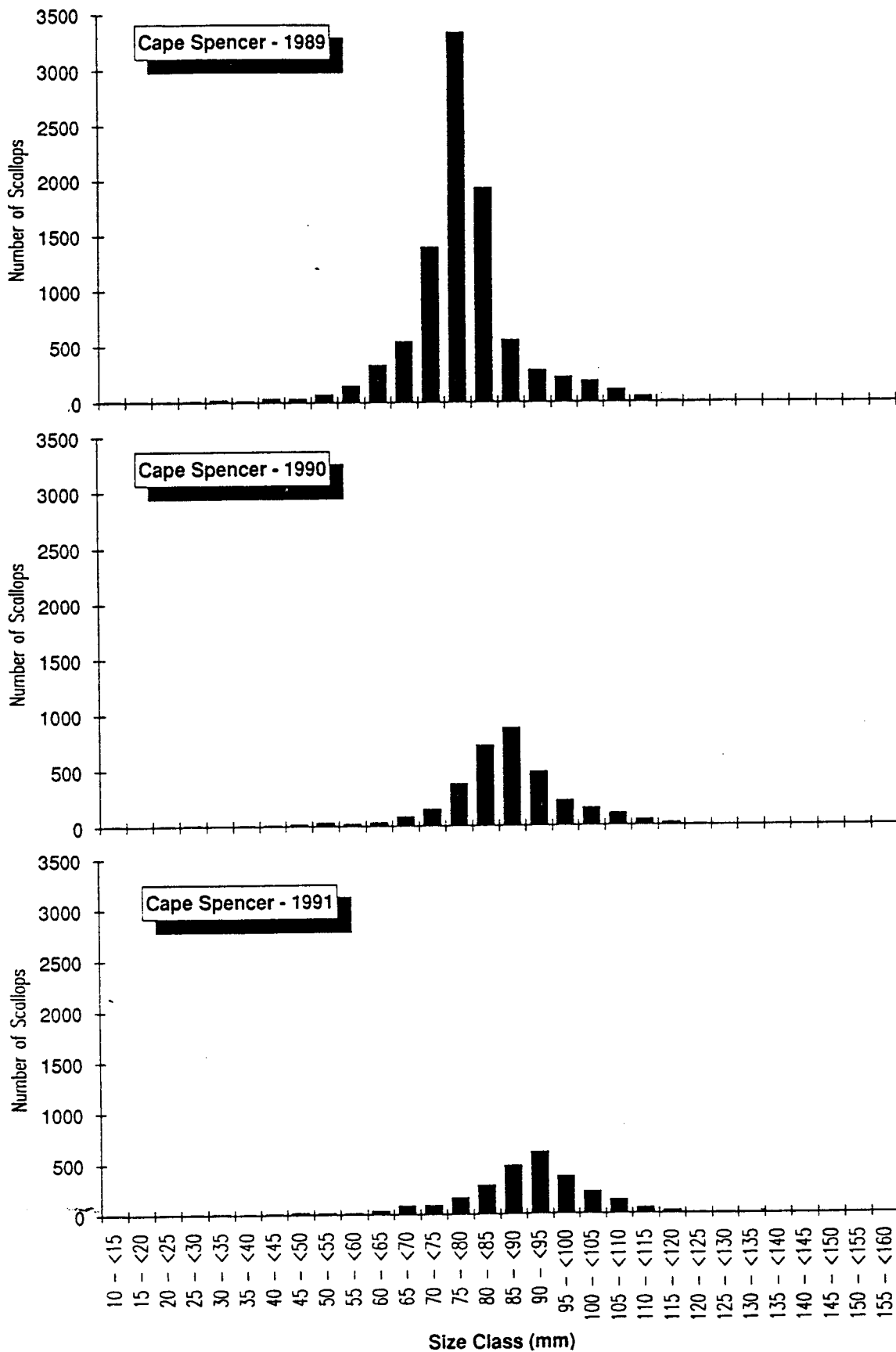


Figure 7. Size frequency of scallops captured in assessment surveys off Cape Spencer from 1989 to 1991.