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Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 84/28

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Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 84/28

Southwest New Brunswick and Grand Manan scallop stock assessment, 1983

by

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Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur des études en cours.

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ABSTRACT

The status of the southwest New Brunswick-Grand Manan scallop stock in 1983 was assessed on the basis of logged catch and effort records from the commercial fishery and the age-frequency distribution from a research survey cruise.

The number of licenses in this fishery has remained stable at about 275 since 1981 but, according to log records, total days fished has declined by a half. Although total landings has also declined by half, the CPUE has only declined marginally, from 4.53 kg/hm in 1981 to 3.55 kg/hm in 1983. Model age-groups of recruited scallops were seven and eight years, reflecting the dominant 1974 and 1975 year-classes which first entered this fishery during 1979. Catch and effort trends from log data for specific fishing sites suggest there may be movement of scallops from bed to bed.

In spite of high fishing pressure, large scallop year-classes appear in the Bay of Fundy in a cyclic fashion. It is speculated the appearance of these year-classes is caused by environmental factors.

RESUME

On a évalué l'état du stock de pétoncles du sud-ouest du Nouveau-Brunswick (Grand Manan) à partir de données (prise-effort) provenant de la pêche commerciale et d'après la distribution de fréquence d'âges d'une campagne d'évaluation du stock.

Le nombre de participants à cette pêche s'est stabilisé à environ 275 depuis 1981 mais, d'après les journeaux de bord, l'effort de pêche mesuré en jours a diminué de moitié. Bien qu'au total les débarquements aient aussi diminué de moitié les PUE n'ont diminué que de façon marginale, de 4.53 kg/hm en 1981 à 3.55 kg/hm en 1983. Les groupes d'âge principaux (âges 7-8) représentaient les classes d'âge 1974-75 reconnues dans la pêche pour la première fois en 1979. D'après les données de journaux de bord pour des lieux de pêche précis, il semblerait que les pétoncles se déplacent d'un banc à l'autre.

Malgré une pêche intensive, d'importantes classes d'âge de pétoncles se retrouvent dans la baie de Fundy de façon cyclique. On prétend que l'apparition de ces classes d'âge est due à des facteurs de l'environnement.

INTRODUCTION

Until 1980, the scallop grounds around Grand Manan Island and off southwest New Brunswick yielded a relatively small portion of the Bay of Fundy scallop landings. Since then, in response to the very strong 1974 and 1975 year-classes recruiting to the fishery, yields increased to an average of 300 metric tons (MT) of meats a year, a seven-fold increase.

The southwest New Brunswick and Grand Manan scallop assessment involves Bay of Fundy waters from the Wolves to Machias Seal Island (Fig. 1). The report presents information gathered during the 1983 assessment cruise and compares the 1983 fishery characteristics to those of previous years.

METHODS

By regulation, daily log records of fishing activity must be kept by all vessels greater than 25 GT or longer than 14 m. Daily log records supply information on the nature of the catch, its origin and fishing effort. When complete effort data are provided, Class 1 catch rate estimates are possible. Data provided for analysis include days fished, number of tows, tow durations, gear width, and daily catch by fishing site.

Resource survey

The survey was conducted over a 2-wk period in September 1983 using the DFO vessel the "J.L. HART". Sampled stations ranged in depth from 16 to 150 m. Distribution of fishery catch obtained from log records was used to randomly stratify the sampling cruise track in inshore and offshore waters (Fig. 2). A four-gang, 76.5-cm Digby drag, with 76-mm rings was used with buckets 1 and 3 being lined with 38-mm stretched mesh netting. Loran-C readings were taken every 30 sec from beginning to end of tow to determine location and length of tow. Catch data were then adjusted to a standard 800-m tow distance.

Numbers and whole weights of scallops from each tow were recorded by bucket and measured for shell height. Scallop age was inferred from shell height according to the von Bertalanffy growth parameters: $H = 145.5$ mm, $K = 0.24$, $t_0 = 0.8$.

RESULTS

The majority of the southwest New Brunswick scallop fleet are Cape Island boats averaging 14 m in length and crewed by two or three men. They traditionally tow 4 or 6 gang Digby type drags; however, during the 1983 offshore season, many boats used the new "Green sweep" drag which is similar to but much lighter than the offshore or new Bedford-type drag. The vessels carry a Bay of Fundy scallop license or an inshore, 7-mile New Brunswick license. A Bay of Fundy scallop license entitles the holder to drag for scallops in NAFO Division 4X, including the entire Bay of Fundy, and under

special trip permit, in Subdivision 5Ze. Inshore licenses (7-mile N.B.) entitle the holder to fish within 7 miles of the Fundy coast and, since 1982, the area defined as Lobster District 2 off Grand Manan (Fig. 1). There were 15 Bay of Fundy licenses in southwest New Brunswick in 1983. The number of inshore licenses increased dramatically in 1981 to over 250 and has remained constant since then (Fig. 3). According to the fisheries officers, however, only 100 vessels actually fished scallops to any extent during 1981 and this number dropped to 40 or 50 vessels during 1983. However, in January and February, when the inshore fishery at Grand Manan is at its peak, as many as 120 boats have been reported to be fishing (L. Tidd, pers. comm.).

Scallop landings increased dramatically in SW New Brunswick during 1980, peaked in 1981, and have remained in the 300-MT range to the present (Table 2). These catches may not all be from local beds but the majority appear to be. Landings also fluctuate according to the market price of meats. Lower prices in 1982 depressed landings and total value of the fishery (Fig. 4). Compared to the prolific inshore Digby fishery, SW New Brunswick accounts for approximately 50% during years of good fishing but declines to insignificant levels during years of poor fishing (Fig. 5).

Log record reporting by participants in this fishery is spotty. During 1982, the last year with complete information available, only 33% of those vessels required to submit logs did so (Table 1). For those reported, however, most contained Class 1 data (Table 1) covering 93% of logged catches during 1983.

Using log records, CPUE ratings were determined for 1981 through 1983 (Table 3). Although both catch and effort have declined by half since 1981, the CPUE has only declined slightly (Table 3) but the decline is significant ($p < 0.05$).

When comparing log records from specific localities, it is apparent that scallop abundance at a site can change markedly from year to year without reference to stock levels (Table 4). The Wolves Bank has sustained similar catches during the last 3 yr with declining effort, causing the CPUE to rise (Fig. 6). At the same time, the catches or the CPUE at other sites has declined markedly (Fig. 7a, b)). Whether this is because of fishing mortality or because of scallop movements is unknown.

Survey work indicates that large scallop year-classes spawned in 1974 and 1975 were recruited to the SW New Brunswick fishery in 1979 (Table 5). They still represented 44% of scallops caught during the 1983 assessment survey. The increase in meat weight of these large year-classes during the last 4 yr has been one factor in maintaining the landing levels to present. Unless another large year-class appears in the near future, landings should be expected to decline rapidly during the next few years. Although assessment survey catches during 1983 were similar to previous years, for the first time the catch of 8+ age scallops was nearly as large as 4-7 age scallops (i.e. 79 vs 87; Table 6).

The cyclic nature of scallop abundance is a well known phenomenon (Caddy 1979). Although assessment biologists have been recently worried about the Bay of Fundy landings remaining good because of fishing pressure (Jamieson et al. 1979), CPUE and catch have both increased recently because

of the 1974 and 1975 year-classes (Fig. 8). These year-classes were produced at a time when landings and CPUE were at their lowest levels since the 1920's. It would appear Caddy was correct in supposing the scallop year-class success is strongly influenced by environment. In the Bay of Fundy, the 18-yr modal cycle causes a strong environmental signal which is often followed after a short lag by better scallop landings (Fig. 8). The correlation coefficient for landings in relation to a 5-yr lag in tides is 0.45 (Fig. 9). It may be possible to use a model developed according to Caddy's methodology to allow predictability of good scallop recruitment.

ACKNOWLEDGMENTS

Bill McMullon and Frank Cunningham drew the figures. The report was typed by Brenda Fawkes. Captain Francis Guptill and crew of the "J.L. HART" were most helpful.

LITERATURE CITED

- Caddy, J. F. 1979. Long-term trends and evidence for production cycles in the Bay of Fundy scallop fishery. Rapp. P.-v. Réun. Cons. int. Explor. Mer 175: 97-108.
- Jamieson, G. S., H. Stone, and G. Kerr. 1979. Bay of Fundy scallop stock assessment - 1979. CAFSAC Res. Doc. 80/79: 25 p.

Table 1. N.B. vessels in Bay of Fundy holding scallop offshore licences and inshore permits (L. Tidd, pers. comm.) and number of vessels reporting log records (after Robert et al.; in prep.).

Year	No. offshore licences	No. inshore permits	No. required to report logs	No. fished according to sales slips	No. submitted 1+ logs	1+ class 1 logs	Total no. submitted
1978	20	116	-	-	-	-	-
1979	20	42	-	-	-	-	-
1980	20	107	28	-	-	-	-
1981	20	247	57	29	26	21	48
1982	16	258	73	26	23	12	36
1983	15	255	-	-	-	-	35

Table 2. Annual landings (MT meats) by statistical district, 1960-83.

Year	Statistical District						Total
	48	49	50	51	52	53	
1960			2.8				2.8
61			1.9				1.9
62			4.2	5.5		3.8	13.5
63			4.8	5.5		3.3	13.6
64			0.8	4.7		2.4	7.9
65	0.2		7.8	1.8		2.8	12.6
66			0.9	0.9			1.8
67				0.5	1.8	2.8	5.1
68			14.5	3.6	0.5	1.8	20.4
69						0.9	0.9
70			7.7		1.3	1.3	10.3
71			1.8	0.9	1.8	4.9	9.4
72			1.8	0.5		3.6	5.9
73			4.6	1.8		2.8	9.2
74			1.3	1.3		2.4	5.0
75			0.7	2.1		1.1	3.9
76			0.2	1.3			1.5
77			3.5	0.2	0.5		4.2
78			10.2		1.7		11.8
79			24.7	2.0	3.4		30.1
80			145.2	9.0	9.5	0.2	163.9
81	0.1	2.2	487.6	50.6	12.9	8.1	561.5
82	3.4	3.5	240.6	22.0	22.6	1.8	293.9
83	5.0	14.9	265.1	46.1	3.4	6.3	340.8

Table 3. Summary of logged catches and CPUE. Fishery characteristics for SW New Brunswick scallop fishery 1981-83.

Year	Total catch (kg)	Average catch (kg)	Effort			CPUE			No. log records
			Days	Total hour-meters	Average hour-meters	kg/d	kg/h	kg/hm	
1981	52,276	1089 (±1115)	436	11,526	240.1 (±312.6)	119.9 (±116.1)	30.0 (±23.2)	4.53 (±5.1)	48
1982	22,258	618 (±774)	252	6,995	194.3 (±278.7)	88.3 (±49.8)	18.6 (±12.4)	3.18 (±2.48)	36
1983 (Jan-Sept only)	19,311	560 (±826)	195	5,505	157.3 (±226.7)	99.0 (±44.0)	18.4 (±10.2)	3.55 (±1.9)	35

∞

Table 4. Percent of the total class 1 catch and CPUE (kg/hm) from the ten most productive areas in 1981, 1982 and 1983 as reported in log records.

1981			1982			1983 (Jan-Sept only)		
Area	%	CPUE	Area	%	CPUE	Area	%	CPUE
Murr Ledge	10.54	8.08	Gannet Rock	13.25	2.86	Duck I. Sound	20.75	3.04
White Ledge	7.47	14.56	Bull Rock	11.88	6.80	Wolves Bank	15.48	2.77
Southeast Break	6.45	7.25	Wolves Bank	11.82	2.25	Western Ledge	10.39	6.32
Seal Island	6.21	6.67	444665	7.06	1.25	Middle Ground	4.88	4.43
Wolves Bank	6.14	1.93	Seal Island	5.95	3.63	Three Islands	3.86	2.39
Bull Rock	4.93	8.71	St. Mary's Led.	5.01	4.47	Pangle Point	3.67	2.64
Yellow Ledge	4.79	6.63	Tinker Shoal	4.53	5.83	Gannet Rock	3.35	4.13
444665	3.83	3.47	Duck I. Sound	3.90	5.33	14DG	3.07	4.06
4miles Yellow L.	3.66	9.26	Spruce I.	3.14	6.25	Little Shoal	3.07	9.81
Grand Manan C.	3.59	1.29	Below Yellow L.	2.78	4.01	Murr Ledge	2.69	2.88
Totals	57.61	6.78 ±3.9		69.32	4.27 ±1.81		71.21	4.25 ±2.28

Table 5. Average scallop catch at age per tow for a 4-gang Digby drag inside the 7-mile line for lined middle buckets and unlined outside buckets. In 1979, catches from lined and unlined buckets were measured together.

Gear type and year	Age (yr)										
	1	2	3	4	5	6	7	8	9	10	11+
1979	0	0	4	18	16	7	5	3	2	2	2
Lined gear:											
1980	0	1	6	2	6	17	6	1	1	1	1
1981	0	2	5	4	6	11	10	4	2	1	1
1982	0	1	10	5	4	5	7	5	4	1	1
1983	0	1	2	2	5	10	18	12	5	3	3
Unlined gear:											
1980	0	0	2	3	19	32	12	4	3	1	2
1981	0	0	0	2	11	20	17	6	2	1	1
1982	0	0	2	3	7	11	12	8	5	3	3
1983	0	1	2	2	3	6	12	8	5	2	3

Table 6. Average scallop catch per tow by age grouping in each area by year. Abundance of recruits (age 4+ years) was estimated from the catch of an unlined gear, while prerecruits (1-3 yr inclusive) abundance was estimated from the catch of a lined gear.

Year/area	Prerecruits 1-3 yr	Recruits		
		4-7 yr	8+ yr	Total
<u>1979</u>				
Inside 7-mile line	4	46	8	54
Outside 7-mile line	2	19	0	19
<u>1980</u>				
Inside 7-mile line	8	66	10	76
Outside 7-mile line	2	180	0	180
<u>1981</u>				
Inside 7-mile line	6	49	11	60
Outside 7-mile line	1	25	4	29
<u>1982</u>				
Inside 7-mile line	10	31	19	50
Outside 7-mile line	2	35	6	41
<u>1983</u>				
Inside limit	6	58	42	100
Outside limit	3	29	37	66

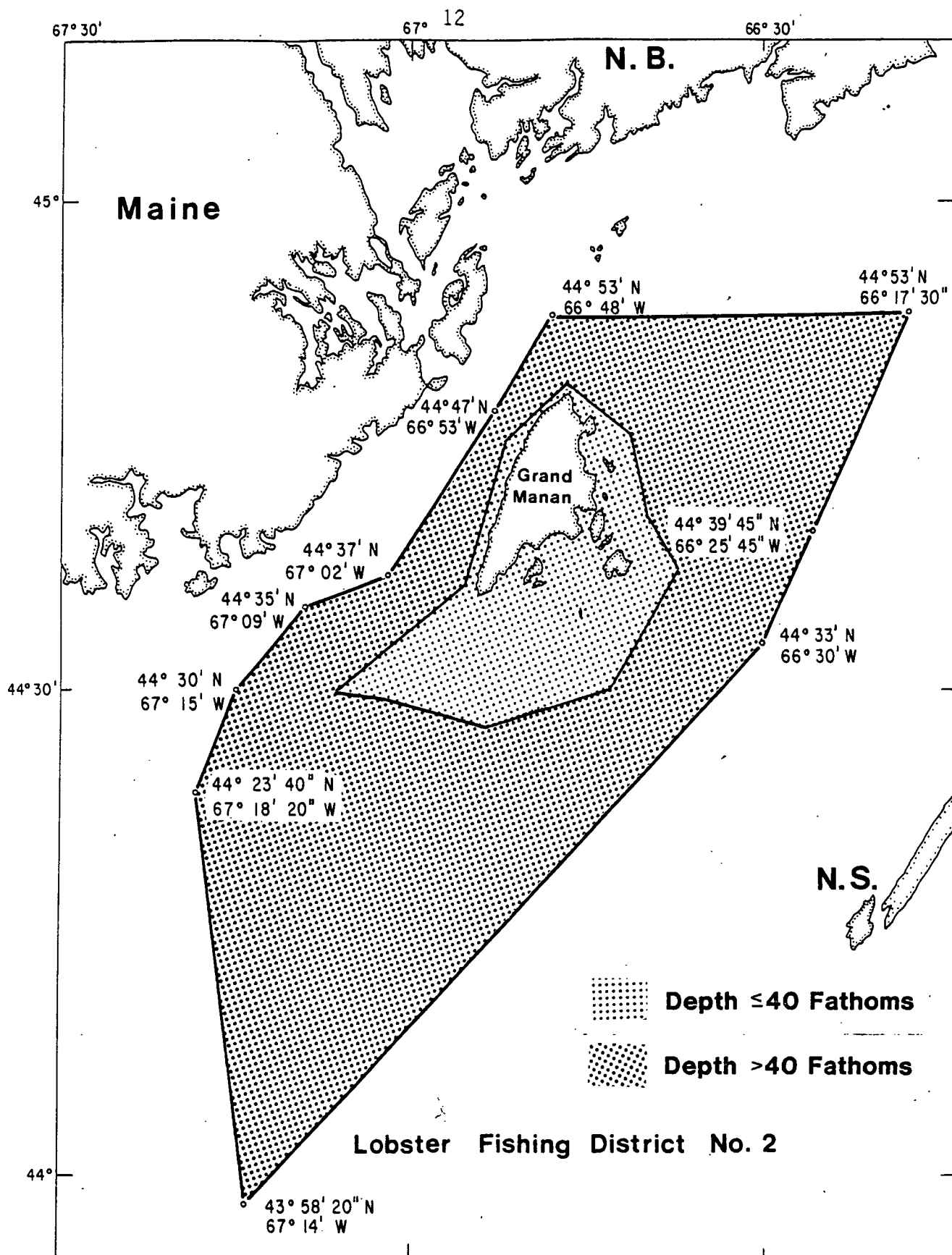


Fig. 1. Southwest New Brunswick and Grand Manan scallop assessment region.

The light-shaded area corresponding to water ≤ 40 fm (73 m) outlines the inside, 7-mile zone. The dark-shaded area with depths > 40 fm includes the remainder of Lobster District 2, the offshore zone.

Fig. 2. The 1983 cruise track and stations occupied

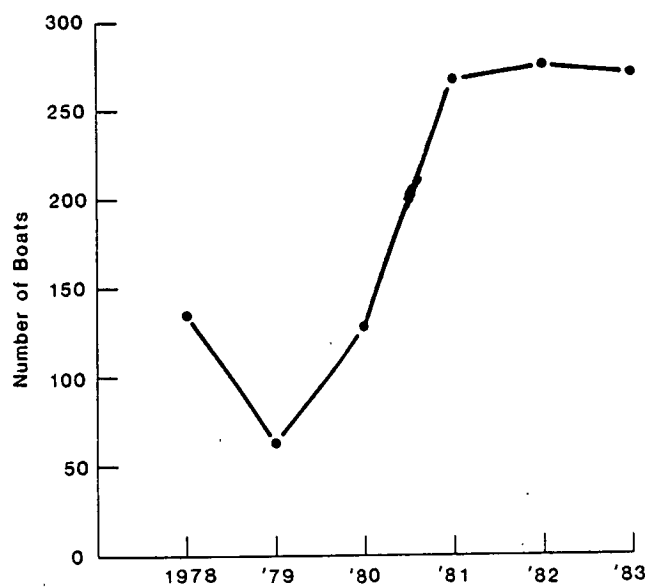


Fig. 3. Number of vessels with scallop licenses issued for southern N.B. waters, 1978-83.

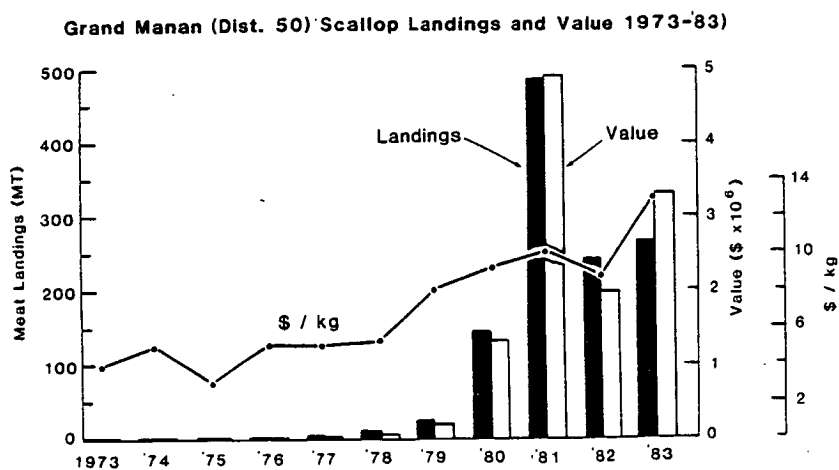


Fig. 4. Grand Manan (Dist. 50) scallop landings and value, 1973-83. Line traces the annual average scallop meat price per kilogram.

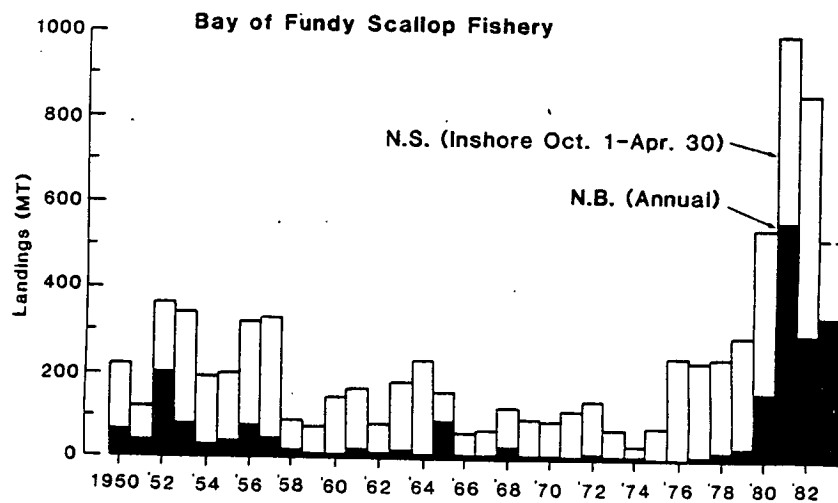


Fig. 5. Bay of Fundy scallop landings for Nova Scotia (inshore Digby fishery) and New Brunswick (SW and Grand Manan).

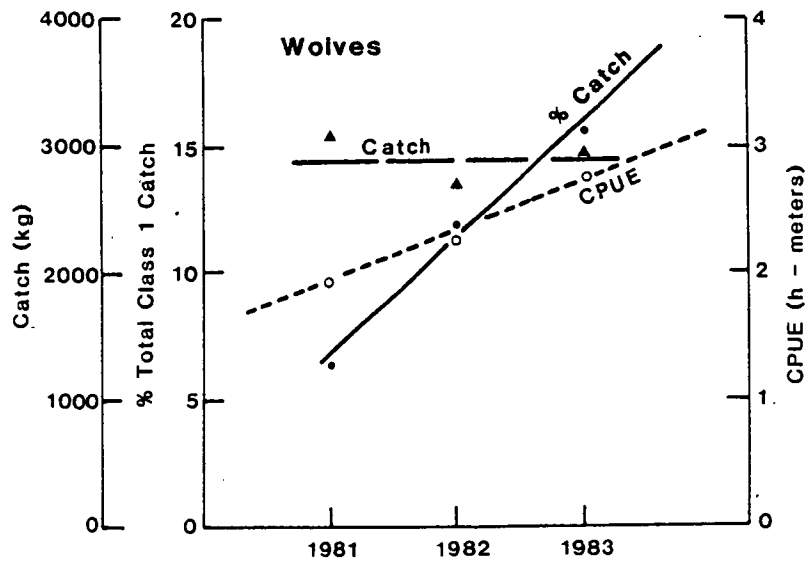


Fig. 6. Catch, CPUE and percent of total Class 1 SW New Brunswick and Grand Manan logged catches for the Wolves Bank.

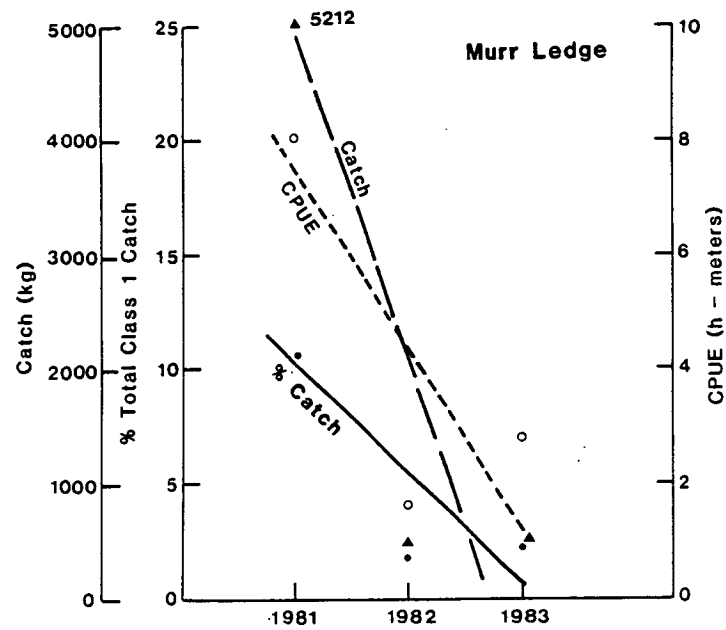


Fig. 7a. Catch, CPUE and percent of total Class 1 SW New Brunswick and Grand Manan logged catches for Murr Ledge.

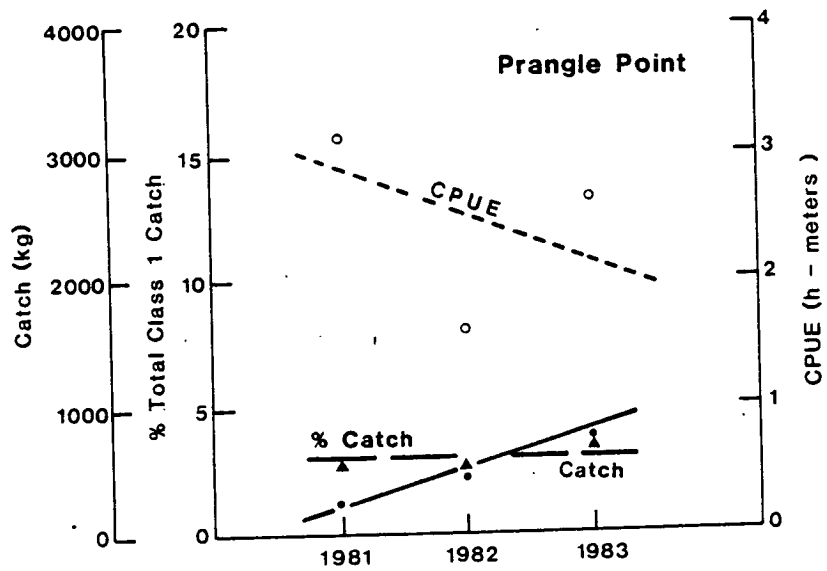


Fig. 7b. Catch, CPUE and percent of total Class 1 SW New Brunswick and Grand Manan logged catches for Prangle Point.

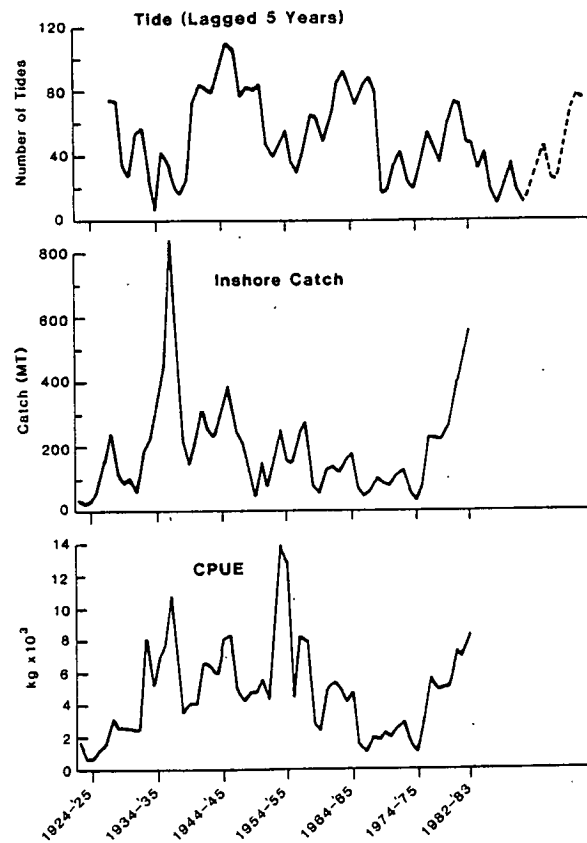


Fig. 8. Top. Number of large spring tides/annum (less than +1 ft datum) for Saint John.

Middle. Digby inshore scallop landings, 1925-83.

Bottom. CPUE for Digby scallop fishery 1925-83.

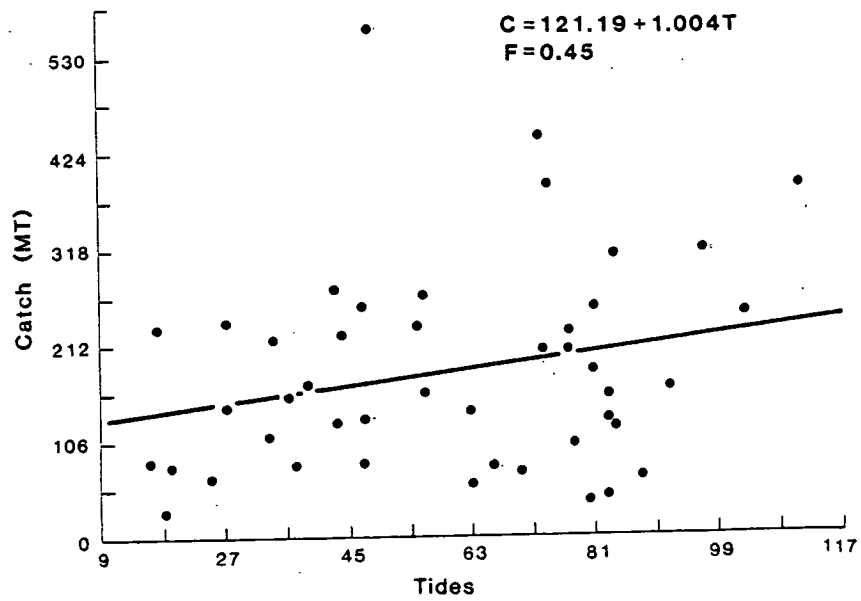


Fig. 9. Regression of Digby landings lagged 5 yr on number of large spring tides.