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Assessment of Northumberland Strait Scallop Stocks - 1981

by

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Abstract

Spring and summer scallop landings in the Northumberland Strait during 1981 were 95% greater than in 1980. Landed price increased by 20%, resulting in the entry of many previously inactive, but licensed fishermen, into the fishery. Average CPUE changed by +16, -6 and -13% in the eastern, central and western Northumberland Strait respectively, while the number of active fishermen increased by 71, 78 and 2% from 1980 levels. The closed fishing zone for scallop established in June, 1980, was removed before the 1981 fishery. Reductions in some allowable meat counts were introduced, but because meat counts only regulate scallop size at exploitation, no effective conservation of scallops at a high density per unit area was achieved. Extensive mortality of prerecruits has occurred in the western Strait, heightening concern for the viability of the scallop fishery in this area for the foreseeable future.

Résumé

Les débarquements de pétoncle en provenance du détroit de Northumberland au printemps et à l'été 1981 ont été de 95 % supérieurs à ceux de 1980. Les prix au débarquement augmentèrent de 20 %, ce qui a incité plusieurs pêcheurs inactifs mais détenteurs de permis à pratiquer cette pêche. Les PUE moyennes dans les secteurs est, central et ouest du détroit de Northumberland changèrent dans la proportion de +16, -6 et -13 % respectivement, tandis que le nombre de pêcheurs actifs augmentait de 71, 78 et 2 % par rapport aux niveaux de 1980. La zone où la pêche des pétoncles avait été interdite en juin 1980 fut réouverte avant la saison 1981. On introduisit des mesures visant à réduire le nombre de chairs par livre. Cependant, comme ces mesures ne font que contrôler la taille des pétoncles au moment de l'exploitation, elles ne réussirent pas à maintenir le stock à un niveau élevé de densité. Dans l'ouest du Détroit, il s'est produit une forte mortalité des prérecrues, ce qui n'est pas sans causer de l'inquiétude quant à la viabilité future de la pêche des pétoncles dans cette region.

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INTRODUCTION

The Northumberland Strait scallop fishery is a relatively small fishery in the Maritimes, with recent annual landings of about 200 t of adductor muscle. The regional profile of this fishery, however, is relatively high because of the active participation of 300-350 fishermen from New Brunswick, Nova Scotia and Prince Edward Island (Jamieson et al. 1981b), the organization of these fishermen into effective fishermen's associations, and the frequent poor performance of other Northumberland Strait fisheries (Anon. 1981). Fishing as a business in Northumberland Strait typically involves exploitation of a number of species, (e.g. lobster, herring, groundfish, scallops and Irish moss) and, as such, difficulties are encountered in optimally managing each fishery in isolation. The magnitude of landings from each fishery, except perhaps lobsters (the main species fished) may reflect relative fishery performance in dollar value more than stock status. Since scallops command a high price per unit weight, any major increase in abundance is intensively exploited by fishermen, with often a corresponding decrease in effort in other competing fisheries. In the absence of any effective enforceable management policy for scallops, let alone for all exploited species combined, stock status cannot be controlled and optimal exploitation of scallops cannot be achieved. Also delays in establishing regionally approved policy in regulation continue to preclude optimal scallop management.

This report presents a scallop stock assessment based on both resource survey data and commercial fishery log records. Resource surveys have been conducted annually since 1979 (Jamieson et al. 1981a, b) and sufficient data is now available to recommend optimal management policy for scallops as a single fishery.

METHODS

Resource surveys, described in Jamieson et al. (1981b), were conducted in 1981 in all three regions (Fig. 1-3) of Northumberland Strait. The number of stations assigned to each survey area was determined from the combined distribution by area of the 1979 and 1980 commercial catch, as obtained from log records; each area was assigned to one of three catch strata as in Jamieson et al. (1981b). The numbers of stations surveyed in the western, central, and eastern Strait were 56, 43, and 60, respectively. Survey dates and the vesesls used were as follows:

Western Strait, June 1-6. M/V KARLA E., Capt. M. Ellis;
Central Strait, July 7-16, M/V JACLYN SUSANN, Capt. G. Ferguson;
Eastern Strait, June 7-16, M/V MICHAEL AND JASON, Capt. J. Hopkins, and
June 30-July 4, M/V MISS DEBBIE S., Capt. D. Shaw.

Survey gear was the same as used by Jamieson et al. (1981b), and tow distances averaged 817, 672 and 823 m in the western, central and eastern Strait respectively. It was found that when fishing the more conventional scallop grounds in the eastern Strait, the quantity of trash was not as great as suggested in the limited 1980 study (Jamieson et al. 1981b). Optimal tow distance in this region appears similar to that in the western Strait. Regardless of distance actually towed, analyses weight scallop abundance to a tow distance of 800 m. Data analyses were the same as in Jamieson et al. (1981b). Revised areas (km^2) for each survey area and subarea are 30.2 and 7.6 km^2 respectively.

RESULTS AND DISCUSSION

A. RESOURCE SURVEYS

Total relative prerecruit and recruit abundance by strata, region and gear type (maximum catch from either mud or rock drags) is given in Tables 1 and 2. Lined gear catch was used to estimate relative prerecruit (<4 year-olds) abundance, whereas unlined gear catch was used to estimate relative recruit abundance. In the central and eastern regions of Northumberland Strait, average scallop catch, and hence density, of recruited scallops was greatest in the high catch stratum. However, in the western Strait, average scallop density was lowest in the high catch stratum, with the medium catch stratum having the greatest scallop density. This is in contrast to the results of the 1980 survey (Jamieson et al. 1981b), and suggests that recent high commercial catch areas may have been relatively depleted of scallops. Those scallops remaining appear scattered in distribution, and unless concentrations of scallops reform, commercial landings from these areas should remain low since the likelihood of extensive recruitment in the next few years is minimal (few prerecruits were observed). Average recruit density remains relatively high in the eastern Strait (Jamieson et al. 1981a), but because this region was poorly surveyed in 1980 (Jamieson et al. 1981b) a comparison with last year is not possible. However, the relatively strong representation of all recruited year-classes of scallops (Table 3) indicates that among the three regions, the scallop stock in the eastern Strait is the healthiest in that recruitment has been most regular, although apparently not above average in recent years.

There appears to have been very high mortality in the 0-1 year-old scallops first observed last year in the western Strait, as the exceptionally high densities of this year-class were not located in 1981. Using Loran C navigational equipment, repeat tows were made on the same ground, and while some of these scallops were collected alive, densities were much reduced and large numbers of cluckers and separated valves were observed. Some valves showed signs of crustacean predation (Elner and Jamieson 1979), but the actual cause of this extensive disappearance of prerecruits is unknown. High water temperatures were probably not a factor because of both the location of these prerecruit scallop concentrations in relatively deep, cooler water (12-13 fathoms) and the apparent absence of significant natural mortality among larger scallops, assuming no age-specific effect on the upper lethal temperature threshold.

The relatively low abundance of scallops less than 8 years of age (Tables 1-3) in the western Strait supports the conclusion of recent stock assessments (Jamieson et al. 1981a, 1981b): there has been below-average scallop recruitment in the western Strait in recent years. There is no evidence indicating when future recruitment will improve. There are also signs (few prerecruits) of impending recruitment failure in the central Strait, where adult scallop stocks are also at low average densities.

The cause of recent poor recruitment remains unknown. Possible explanations include:

1/ spawning failure.
Since gamete fertilization is external and the species is dioecious, successful reproduction requires the synchronized spawning of both sexes, with individual scallops located close enough to each other to ensure sufficient mixing of eggs and sperm so as to achieve an acceptable level of gamete fertilization. Spawning failure might therefore result from insufficient gonad maturation (Medcof and Bourne 1964); unsynchronized spawning; partial spawnings with the release of too few gametes at any one time; or a population at too low a density per unit area.

2/ poor survival and settlement of planktonic larvae.
Scallops have a planktonic stage of unknown duration but in the warm waters of Northumberland Strait this may be somewhat less over that found in offshore Atlantic waters. Mortality of larvae related to high water temperatures is a possibility. Adults are intolerant of water temperatures above 20-22°C (Posgay 1953; Dickie 1958) and this water temperature may be reached in the surface layers of the Northumberland Strait (Dobson et al. 1981). Other possible causes of larval mortality include a shortage of food and extensive predation. Settlement location is presumably influenced by current pattern, and hence may not be near the parental site. Larval natural mortality rate is unknown but can be presumed to be high.

3/ high juvenile mortality.
Young scallop are characteristically contagiously distributed (Jamieson and Chandler 1980), and if an entire year-class is concentrated in only a few locations, then excessive mortality for any reason may reduce that year-class's relative abundance. That this may occur is demonstrated by the suggested recent high mortality of 1979 year-class scallops in the western Strait, although a cause for this mortality is unclear. It could be naturally induced from lethal saltations in water temperature or predation, or it could be partially the result of indirect fishing mortality (Medcof and Bourne 1964). Extensive fishing for adult scallops occurred during May, 1981, in the vicinity of the last known location of these small scallops, but the impact of such fishing is not clear.

The only cases from the above that might be influenced by management strategy in an on-going scallop fishery are fertilization success [by facilitating the occurrence of a high adult density per unit area (assuming that gonad maturation occurs), at least in localized areas], and the level of indirect fishing mortality on juveniles (by preventing dragging in locations of high juvenile abundance).

B. COMMERCIAL FISHERY CHARACTERISTICS

1. Gear

For the 91 fishermen for which gear measurements (Table 4) were obtained in 1981, weighted average total gear width for rock drags remained the same as in previous years: 3.6 m. There was a slight increase in average total gear width for mud drags in 1981 to 3.8 m, but this may be an artifact of the smaller, 1981 sample size.

2. Number of fishermen

Since not all licensed fishermen complete logs, the estimated number of active scallop fishermen in 1981 was calculated using the procedure in Jamieson et al. (1981b). The estimated number of active fishermen increased in 1981 by 56% over that number active in 1980 (Table 5).

3. Catch and effort

a. Sales slip statistics

Landing statistics by month, province and lobster district (Table 6-8) indicate that landings increased significantly in 1981 compared to 1980.

The month of greatest landing changed from July to April in the Lobster District 7b1, and substantive increases in landings were reported for Beach Point and Miminegash, PEI; Caribou-Cape John, N.S.; and Murray Corner-Cape Tormentine, N.B.

Average price per kilogram (Table 9) of adductor muscle increased by about 20% in the spring fishery, and it was largely this factor which made scalloping attractive to the licensed fishermen which were inactive in recent years. As described below, CPUE did not change greatly and had less effect on the overall increase in landings.

b. Log record statistics

CPUE by area for 1981 (Table 10) generally decreased over the past year in the western and central regions but increased in the eastern region of the Strait. Average CPUE, weighted by catch, for the top ten catch areas of the western, central and eastern regions of the Strait were 1.50, 1.45 and 2.06 kg/hr-m respectively (Table 11).

Log completion rate can be estimated by comparing the total landing log records to those obtained from sales slips. Completion rate in 1981 (spring fishery) was estimated to be 32%, down slightly from the 36% obtained in 1980 (Jamieson et al. 1981b).

Average monthly CPUE (Table 12) weighted by catch, showed a general decrease in the eastern Strait as the year progressed, with no apparent trend evident in the western and central Strait (Lobster District 8). Highest monthly CPUE was again in the eastern Strait.

The 1981 pattern of distribution of fishing locations in Northumberland Strait (Figs. 4-5), presented as percentages of total regional catch, show some differences over that in 1980 (Jamieson et al. 1981b). In the western Strait, greatest catches were fished off western Prince Edward Island from Cape Wolf to Miminegash, with a smaller catch off Red Head in southern Egmont Bay. Little fishing occurred off West Point in 1981, an area which was extensively fished in the fall of 1980. No major change in fishing locations occurred in the central and eastern Strait, with traditionally exploited ground being most heavily fished.

4. Scallop age-classes

Comparison of scallop age-classes landed on vessels (Fig. 6) with those landed in port (Fig. 7) demonstrates that in the central Strait in particular, considerable culling occurred. This both confirms the presence of younger cohorts and suggests that because of distributional overlap between scallop age-classes, indirect fishing mortality of the younger scallops may be high. No estimate of such mortality can be derived here, but Caddy (1971) has noted that it can equal the magnitude of fishing mortality for commercial-size scallop. It would likely be even higher with prerecruit scallops.

In the western and eastern Strait, relatively little culling was noted; this could be the result of too small a sample size, spatial separation of age cohorts, or the relative absence of prerecruits. From the survey results, this latter possibility seems unlikely in the eastern Northumberland Strait.

5. Meat counts for unit weight

The temporal occurrence in April and May of the period of peak scallop landings in Northumberland Strait scallop has posed difficulties in obtaining biological data from the fishery. A limited number of permanent personnel and the wide geographic distribution of the fishery require the use of temporary summer employees by Resource Branch to collect data, and administrative and training delays frequently prevent their commencement of activities until late May.

Existing demands apparently prevent effective monitoring of scallop meat counts per unit weight by fishery officers; of an estimated 5500 vessel days in the fishery in 1981, only 87 vessel meat counts (2%) were obtained (Table 13). Forty-four and 43 vessels were sampled in Prince Edward Island, and Nova Scotia respectively, while no vessels were sampled in New Brunswick.

Of the limited data available, meat counts in 1981 in the western Strait (average: 21 meats/ 500 g) were generally below the estimated average value of 23 meats/ 500 g, in 1980 (Jamieson et al. 1981b). This very low meat count is consistent with a stock largely composed of older individuals, and again supports the relative absence of recent recruitment. In the eastern Strait, meat counts in 1981 (average: 37 meats/ 500 g) appear to be higher than those of 1980 (estimated average: 28 meats/ 500 g) suggesting that some recruitment had occurred. Insufficient data are available for analysis from the central Strait scallop fishery.

GENERAL DISCUSSION OF MANAGEMENT ALTERNATIVES

Recent characteristics of the Northumberland Strait Scallop fishery have been summarized (Table 14). The continued poor performance of this fishery, particularly in the western Strait, poses difficult management problems. Since older, large meat-yielding scallops are relatively abundant, and because the decrease in landings, and presumably CPUE, has been gradual over the past decade, the argument has been made by some fishermen that the problem is not a serious one. Recent effort increases, and the resulting increase in overall landings, have further suggested that scallop stocks can still support a significant, viable fishery. The problem is periodically worsened by the decline of other Northumberland Strait fisheries, and for multi-species fishermen, there is a natural resistance for economic reasons to have regulations reduce landings in the one remaining effectively unregulated fishery.

From an assessment perspective, stock evaluation is made difficult by the apparent ability of this widely distributed species to form or scatter from commercially exploitable densities per unit area. Thus, areas which may be profitably exploitable one month may not be the next month, and vice versa. Limited survey resources prevent the locating and sampling of all exploitable scallop concentrations, while sampling only once in a calendar year fails to effectively monitor a dynamic system. Thus, there is an inability to conclusively evaluate stock status and set a TAC. Determination of stock health has to depend to a large extent on fishery characteristics (CPUE, landings, etc.).

The mandate of the Department of Fisheries and Oceans is to optimally manage fishable stocks. In the absence of hard, conclusive data but with continued apparent recruitment failure, a conservative exploitation policy is recommended as the only acceptable management strategy. As previously discussed, recruitment failure can result from a number of causes, with management only able to perhaps facilitate fertilization success and juvenile survival, the former by preserving locations of high scallop densities and the latter by restricting the opportunity for indirect fishing mortality.

Meat count regulations only benefit the achievement of optimal yield per recruit, and in an older population, fail to preserve stock abundance in the absence of recruitment. Thus, in the western Northumberland Strait, no effective management action was practiced in 1981 to ensure the long-term viability of its scallop fishery. This might be best achieved through establishment of a closed fishing zone (the one established in June, 1980, was removed before the fishery commenced in April, 1981). A TAC or equivalent effort restriction is a poorer, second option, since again an optimal level is largely subjective and a TAC does not facilitate the continued existence of scallops at a high density per unit area. Optimal fisheries management is seldom simple, and economic hardship is usually actively resented and resisted. However, continued failure by managers to adopt a conservative exploitive management strategy may lead to complete scallop fishery collapse in some regions in the foreseeable future.

Basic biological questions relating to the life cycle of scallops still need to be answered, and until the causes of recruitment failure are identified, such research should have a high priority.

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Table 1. Strata designations and average scallop catch per tow by age grouping in each of the three commercial catch strata (low, medium, high) in each region of Northumberland Strait. 4+ year-old scallop abundance was estimated from the catch of an unlined drag, while 1-3 year-old scallop abundance was estimated from the catch of a lined drag.

Stratum	% catch stratum (range)	N (total no. of areas)	N_1 (areas sampled)	N_2 (no. of stations)	Age (yr) 1-3	4-7	8+	Total 4+ yr
WESTERN								
Low	0.00-1.49	39	17	12	9.1	5.2	9.0	14.2
Medium	1.49-2.99	10	9	21	5.2	8.2	15.2	23.4
High	3+	9	7	23	7.6	4.3	9.9	14.2
CENTRAL								
Low	0.00-0.99	37	8	8	0.0	1.5	3.9	5.4
Medium	1.00-3.99	8	5	13	0.0	4.3	1.2	5.5
High	4+	8	8	22	2.1	15.0	5.1	20.1
EASTERN								
Low	0.00-0.99	93	4	13	0.3	0.9	5.4	6.3
Medium	1.00-3.99	12	12	17	1.3	5.5	9.5	15.0
High	4+	8	8	30	15.6	33.5	25.3	58.8

Table 2. Average scallop catch at age per tow for a 4-gang drag in the high catch stratum for lined (A) and unlined (B) rock and mud buckets in the three regions of Northumberland Strait.

Region and gear type	No. of stations	Age (yr) 1	2	3	4	5	6	7	8	9	10	11+
A. LINED GEAR												
West												
Rock	23	1	1	3	1	1	1	1	1	1	1	4
Mud	23	1	2	4	1	1	1	1	0	1	1	3
Central												
Rock	22	0	0	1	3	3	3	2	1	1	0	0
Mud	22	0	0	1	1	2	1	1	1	1	0	0
East												
Rock	30	2	3	4	6	7	4	4	4	2	1	5
Mud	30	2	6	5	6	5	2	2	2	2	1	4
B. UNLINED GEAR												
West												
Rock	23	0	0	0	0	0	1	2	1	1	1	6
Mud	23	0	0	0	0	0	1	1	0	1	1	5
Central												
Rock	22	0	0	0	1	3	4	3	2	1	1	0
Mud	22	0	0	1	3	5	4	3	2	1	1	0
East												
Rock	30	0	1	3	8	11	8	5	5	5	3	10
Mud	30	0	1	1	2	4	4	2	3	1	1	5

Table 3. Average catch per tow (800 m) of a 4-gang rock drag in each strata in each region. Prerecruits (ages 1-3), lined gear; recruits (ages 4+), unlined gear.

Region	Strata	No. stations	Age (yr)										
			1	2	3	4	5	6	7	8	9	10	11+
Western	High	23	1.5	2.2	3.9	0.4	0.5	1.6	1.8	0.7	0.8	1.0	7.4
	Medium	21	1.8	2.0	1.4	1.0	1.9	3.0	2.2	1.8	1.3	1.4	10.6
	Low	12	1.7	5.3	2.2	0.6	1.6	1.6	1.4	2.0	2.1	1.6	3.3
Central	High	22	0.0	0.3	1.7	2.7	4.7	4.5	3.1	2.0	1.4	0.8	0.9
	Medium	13	0.0	0.0	0.0	0.5	1.4	1.9	0.5	0.2	0.1	0.2	0.7
	Low	8	0.0	0.0	0.0	0.0	1.3	0.2	0.0	0.0	0.0	0.4	3.5
Eastern	High	30	3.5	6.4	5.7	7.5	11.3	9.3	5.4	5.9	4.7	3.2	11.5
	Medium	17	0.1	0.4	0.8	0.6	1.6	1.7	1.5	2.1	1.8	1.3	4.2
	Low	13	0.0	0.0	0.3	0.0	0.0	0.4	0.5	0.2	0.1	0.2	4.9

Table 4. Individual bucket width and numbers fished in drag gangs by scallop fishermen in Northumberland Strait in the 1981 (spring) fishery.

	No. buckets	No. fishermen	Mean bucket width(m)	Std. dev. (m)	Total mean gear width (m)
Rock drags	3	2	0.79	-	2.37
	4	29	0.73	0.08	2.92
	5	15	0.65	0.12	3.25
	6	18	0.56	0.14	3.36
	7	5	0.47	0.03	3.29
	8	14	0.58	0.06	4.64
	9	1	0.46	-	4.14
	10	1	0.46	-	4.60
	11	-	-	-	-
	12	7	0.46	-	5.52
		92			
Mud drags	1	7	2.96	0.55	2.96
	2	4	2.44	0.00	4.88
	3	-	-	-	-
	4	1	1.22	-	4.88
		12			

Table 5. Estimated numbers of licensed and active fishermen and the number of fishermen who completed at least one log record in 1980 and 1981 (spring) fishery. Source - Field Services Branch, Halifax, N.S.

Province	Dist.	1980			1981		
		No. licences	Est. no. active	No. submitting logs	No. licences	Est. no. active	No. submitting logs
Nova Scotia	2	3	-	-	2	-	-
	3	5	-	-	5	-	-
	10	3	-	-	3	-	10
	11	56	32	20	62	62	30
	12	14	1	1	8	5	1
	13	28	7	3	27	22	2
	45	0	-	-	1	-	-
	46	0	0	2	6	-	-
New Brunswick	75	14	11	5	13	2	7
	76	29	29	8	30	30	6
	77	17	-	5	14	-	-
	78	20	-	-	18	12	4
	80	66	42	19	66	66	38
Prince Edward Is.	82	36	22	11	31	31	11
	83	13	-	-	12	-	-
	85	6	4	4	6	4	4
	86	34	19	16	28	27	8
	87	154	88	18	160	122	16
	88	61	-	-	83	13	1
Totals:		559	255	112	575	396	138

Table 6. Monthly scallop landings in Northumberland Strait in the 1980 and 1981 (spring) fishery.

	Landings (kg)		
	N.B.	N.S.	P.E.I.
1980:			
April	51,544	3,249	122,844
May	350,628	437	209,479
June	140,163	5,481	103,550
July	34,849	29,579	163,762
August	5,497	-	75
September	1,340	11,828	29,585
October	1,709	48,017	134,271
November	-	51,197	41,017
December	-	-	1,653
Total round weight (kg)	585,730	149,788	806,246
Meat weight* (t)	71	18	97
1981:			
April	96,626	202,074	428,294
May	514,926	28,333	339,989
June	274,354	21,114	196,701
July	32,133	42,114	185,356
August	960	-	13,999
Total round weight (kg)	918,999	293,635	1,164,339
Meat weight* (t)	111	35	140

*Meat weight = round weight ÷ 8.3.

Table 7. Regional scallop landings in Northumberland Strait in the 1980 and 1981 spring fishery.

Province	Stat. Dist.	Lobster District	Representative ports	1980 annual landing (round kg)	1981 spring landing (round kg)
Nova Scotia	11	7bl	Caribou, Toney River, Cape John	141,960	229,910
	12	7bl	Lismore	-	8,770
	13	7bl	Bayfield, Cribben's Pt.	5,370	7,940
	45	8	Pugwash	1,648	-
	46	7bl	Wallace	780	-
New Brunswick	73	8	Baie Ste-Anne, Escuminac	-	53,950
	75	8	Cape St. Louis, Kouchibouquac	14,683	13,280
	76	8	Richibucto, Richibucto Cape	179,374	221,610
	77	8	Buctouche	4,799	45,650
	78	8	Shediac, Cap-Pelê	51,115	24,900
	80A	8	Murray Corner, Cape Tormentine	335,749	468,950
Prince Edward Island	82A	8	Howard Cove, Miminegash	195,357	463,140
	83	8	Borden	44,820	52,290
	85	7bl	Victoria	2,684	1,660
	86	7bl	Wood Island, Charlottetown	209,740	153,550
	87	7bl	Beach Point Gaspereau	339,104	533,690
	88	7bl	Annandale	14,541	43,160
	92	7b	Tignish	-	11,620
	93	7b	Conway, Darnley	-	21,580

Table 8. Monthly Northumberland Strait scallop landings in Lobster Districts 7bl and 8 in the 1980 and 1981 (spring) fishery.

	1980		1981	
	Eastern 7bl	Western 8	Eastern 7bl	Western 8
January				
February				
March				
April	108,997	68,640	608,458	118,536
May	61,702	498,842	138,876	744,372
June	47,961	201,203	90,247	401,922
July	181,071	47,109	225,881	33,722
August	-	5,572	13,999	960
September	40,950	1,803	-	-
October	180,995	3,002	-	-
November	90,850	1,374	-	-
December	1,653	-	-	-
Total round weight (kg)	714,179	827,545	1,077,461	1,299,512
Meat weight* (t)	86	100	130	157

*Meat weight = round weight ÷ 8.3.

Table 9. Average price ($/kg) of scallops sold in the Northumberland Strait in the 1980 and 1981 (spring) fishery.

	1980 Statistical District			1981 Statistical District		
	76	80	87	76	80	87
January						
February						
March						
April		8.27		11.13	10.29	10.11
May	8.64	8.27	8.27	10.15	10.38	10.18
June	8.27	7.72	8.27	9.70	9.38	9.73
July	8.22	7.98	8.11	9.15		9.73
August	7.98	7.72	8.22			
September			8.72			
October	7.98	7.96	8.82			
November	8.71		8.82			
December			9.41			

Table 10. Landings (kg) and weighted average CPUE (kg/h-m) for each designated log area (see Fig.4-5) in the 1981 spring fishery in which a catch greater than 100 kg was reported to have been fished.

Area sq. no.	Landings (kg)	CPUE (kg/h-m)	Area sq. no.	Landings (kg)	CPUE (kg/h-m)
0000	6315.4	-	1480	435.0	2.1
0140	116.1	3.0	1490	738.8	2.0
0160	387.8	1.9	1500	954.4	1.2
0230	225.0	2.6	1504	332.0	1.2
0240	476.7	2.0	1510	449.0	2.0
0250	438.6	1.8	1512	257.2	1.3
0260	608.7	2.0	1514	108.9	2.4
0280	301.6	1.3	1520	197.3	-
0340	909.9	2.0	1523	157.4	1.1
0370	830.1	1.7	1560	1990.4	1.5
0380	737.5	1.4	1570	3717.2	1.5
0390	1730.5	1.5	1571	342.0	1.2
0400	1036.9	1.2	1572	108.9	1.4
0410	509.4	0.9	1574	479.9	1.8
0520	103.9	1.9	1580	610.1	0.9
0530	778.36	1.9	1582	297.1	1.6
0540	1168.5	1.2	1590	178.3	-
0550	832.8	2.6	1600	193.2	-
0560	166.5	2.0	1650	777.9	1.6
0570	105.2	1.0	1651	209.1	1.5
0580	153.8	-	1660	3151.6	1.2
0720	1133.5	1.0	1661	312.5	1.9
0730	1614.8	1.5	1662	166.9	1.6
0740	828.7	1.3	1663	182.3	1.2
0750	350.6	1.4	1664	554.7	3.8
0770	103.4	2.4	1670	426.4	1.0
0780	167.8	1.6	1672	280.8	1.5
0890	274.9	0.7	1674	356.5	-
0900	646.8	1.1	1740	1025.6	1.2
0910	2718.0	1.4	1750	400.5	0.7
0920	107.5	0.9	1751	174.6	1.2
0930	151.5	1.2	1752	240.4	1.5
0980	317.1	-	1753	105.2	1.1
1110	325.2	-	1754	133.4	1.6
1120	121.1	-	1760	119.3	0.9
1130	108.0	-	1761	124.7	1.1
1140	108.0	-	1833	100.7	0.7
1240	230.0	-	2230	156.9	3.1
1250	486.3	4.7	2310	166.0	1.1
1260	299.8	-	2320	133.8	0.9

Table 10 Contd...

Area sq. no.	Landings (kg)	CPUE (kg/h-m)
2321	123.4	3.7
2322	107.5	2.3
2512	158.3	1.9
2520	1149.4	1.7
2524	103.0	-
2550	816.0	1.4
2553	199.6	1.8
2560	501.2	1.4
2561	754.3	2.0
2562	471.7	1.7
2564	213.6	1.5
2572	598.7	1.9
2614	617.3	1.8
2620	1873.4	1.7
2621	174.2	1.9
2622	671.3	1.9
2624	368.3	2.4
2630	1561.3	1.9
2631	750.2	2.1
2632	1256.9	1.9
2633	376.5	1.4
2634	186.0	2.1
2660	266.7	1.4
2670	4322.8	2.1
2680	1759.0	3.2
2681	102.5	2.5
2683	145.2	0.5
2690	361.5	-
2730	270.3	1.3
2740	3859.2	2.8
2741	614.2	2.6
2742	250.8	2.2
2743	160.1	-
2750	303.0	2.3
2870	562.5	4.2
3010	374.2	2.2
3090	498.1	1.6
3100	140.6	2.0
3110	213.6	2.5
3240	252.7	2.0
3330	329.3	-
4150	104.3	1.5
4370	132.0	-

Table 11 . Percent of the total catch fished, and catch per unit effort (kg meat/h for each m of drag fished) for the ten most productive unit areas (see Fig.4-5) in each region of the Northumberland Strait as reported by log records.

	West			Central			East		
	Sq. No.	%	CPUE	Sq. No.	%	CPUE	Sq. No.	%	CPUE
	34	3.93	2.01	150	4.99	1.28	252	4.10	1.63
	37	3.59	1.68	151	3.04	1.82	255	3.31	1.51
	39	7.47	1.54	156	7.13	1.49	256	6.31	1.70
	40	4.48	1.23	157	17.04	1.48	257	2.53	1.81
	54	5.05	1.22	158	3.87	1.18	261	2.26	1.80
	55	3.60	2.58	165	3.87	1.56	262	9.80	1.80
	72	4.90	1.03	166	16.29	1.59	263	13.02	1.89
	73	6.97	1.48	167	4.36	1.28	267	14.20	2.12
	74	3.58	1.28	174	4.17	1.16	268	6.41	3.16
	91	11.74	1.35	175	3.93	1.17	274	15.62	2.71
Totals:	10	55.31	1.50*	10	68.69	1.45*	10	77.56	2.06*
Total catch from region (t) meat		23			37			32	

* = weighted average.

Table 12. Average monthly CPUE values (kg/h-m) weighted by catch for each of the three Northumberland Strait scallop regions in the 1980 and 1981 (spring) fishery.

Month	Western		Central		Eastern	
	1980	1981	1980	1981	1980	1981
April	1.00	1.27	1.60	1.43	1.94	2.04
May	1.33	1.11	1.32	1.57	1.62	1.91
June	1.46	1.35	1.02	1.01	1.38	1.73
July	0.80	-	-	-	1.64	1.57
August	-	-	-	-	-	-
September	0.60	-	-	-	1.21	-
October	-	-	-	-	-	-
November	-	-	-	-	-	-
December	-	-	-	-	-	-

Table 13. Average commercial scallop meat counts (MC) per 500 g for the spring fishery in the different regions of Northumberland Strait.

Date	MC per 500 g	No. boats sampled	Region	Province
26/05/81	14.7	10	Western	P.E.I.
29/05/81	18.0	7	Western	P.E.I.
29/05/81	13.2	8	Western	P.E.I.
05/06/81	35.0	3	Western	P.E.I.
16/06/81	19.5	8	Western	P.E.I.
05/06/81	43.3	4	Central	P.E.I.
08/07/81	44.0	6	Eastern	N.S.
08/07/81	45.0	6	Eastern	N.S.
08/07/81	16.5	6	Eastern	N.S.
09/07/81	45.0	6	Eastern	N.S.
13/07/81	33.0	6	Eastern	N.S.
13/07/81	44.0	6	Eastern	N.S.
13/07/81	33.0	6	Eastern	N.S.
20/07/81	33.0	4	Eastern	P.E.I.

Table 14. Comparative Northumberland Strait scallop fishery values between 1980 and 1981.

	1980	1981	% change
Price (May) - $/kg	8.50	10.25	+ 21
No. of licences	559	575	+ 3
No. of active fishermen			
Western	62	63	+ 2
Central	46	82	+ 78
Eastern	147	251	+ 71
Total	255	396	+ 55
Catch (t meat)-April to August			
Western	47	96	+104
Central	52	66	+ 27
Eastern	48	131	+173
Total	147	283	+ 93
CPUE (kg/h-m)			
Western	1.72	1.50	- 13
Central	1.54	1.45	- 6
Eastern	1.77	2.06	+ 16

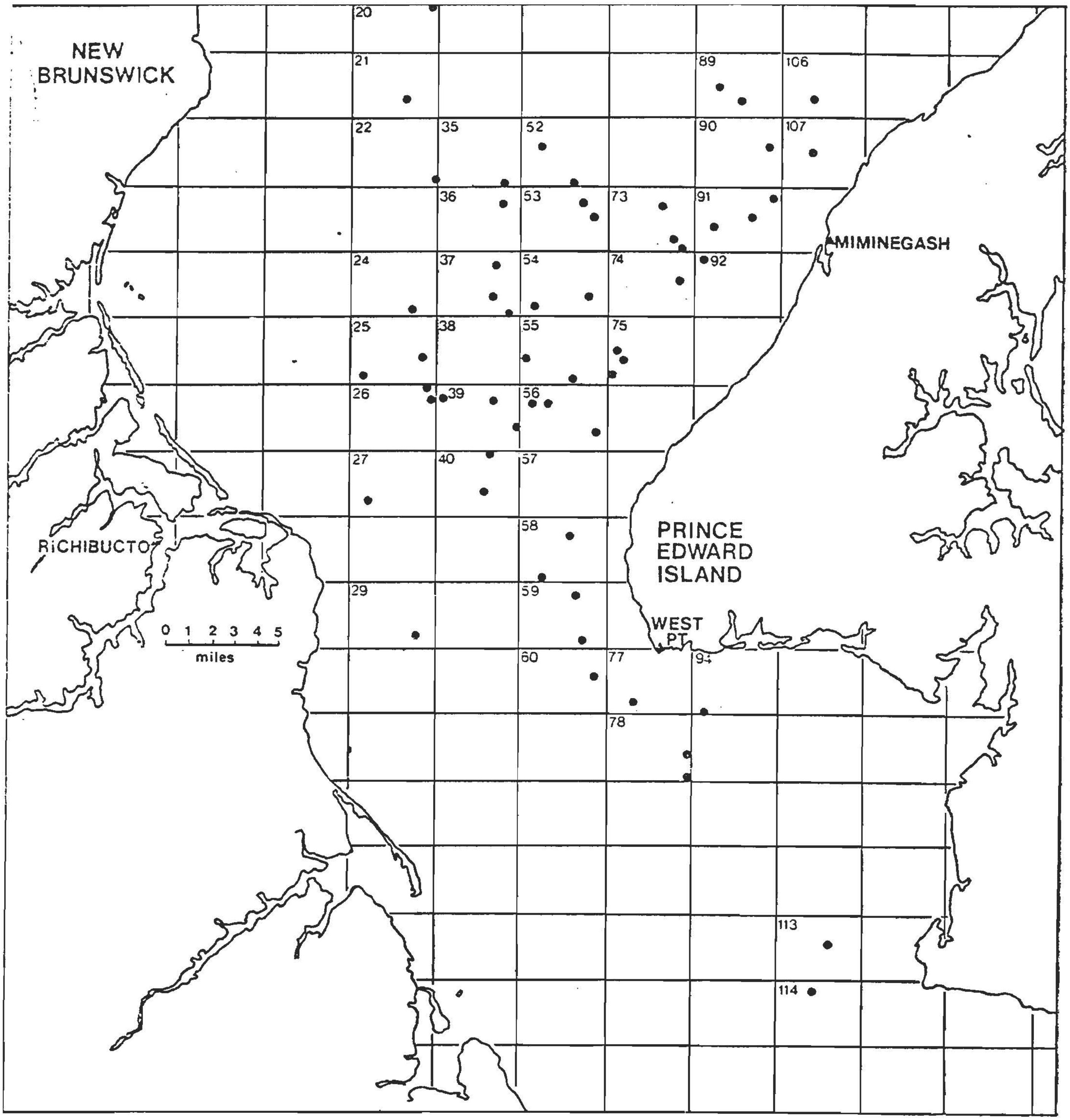

Fig. 1. Resource survey station locations in the western Northumberland Strait. Numbers are area designations.

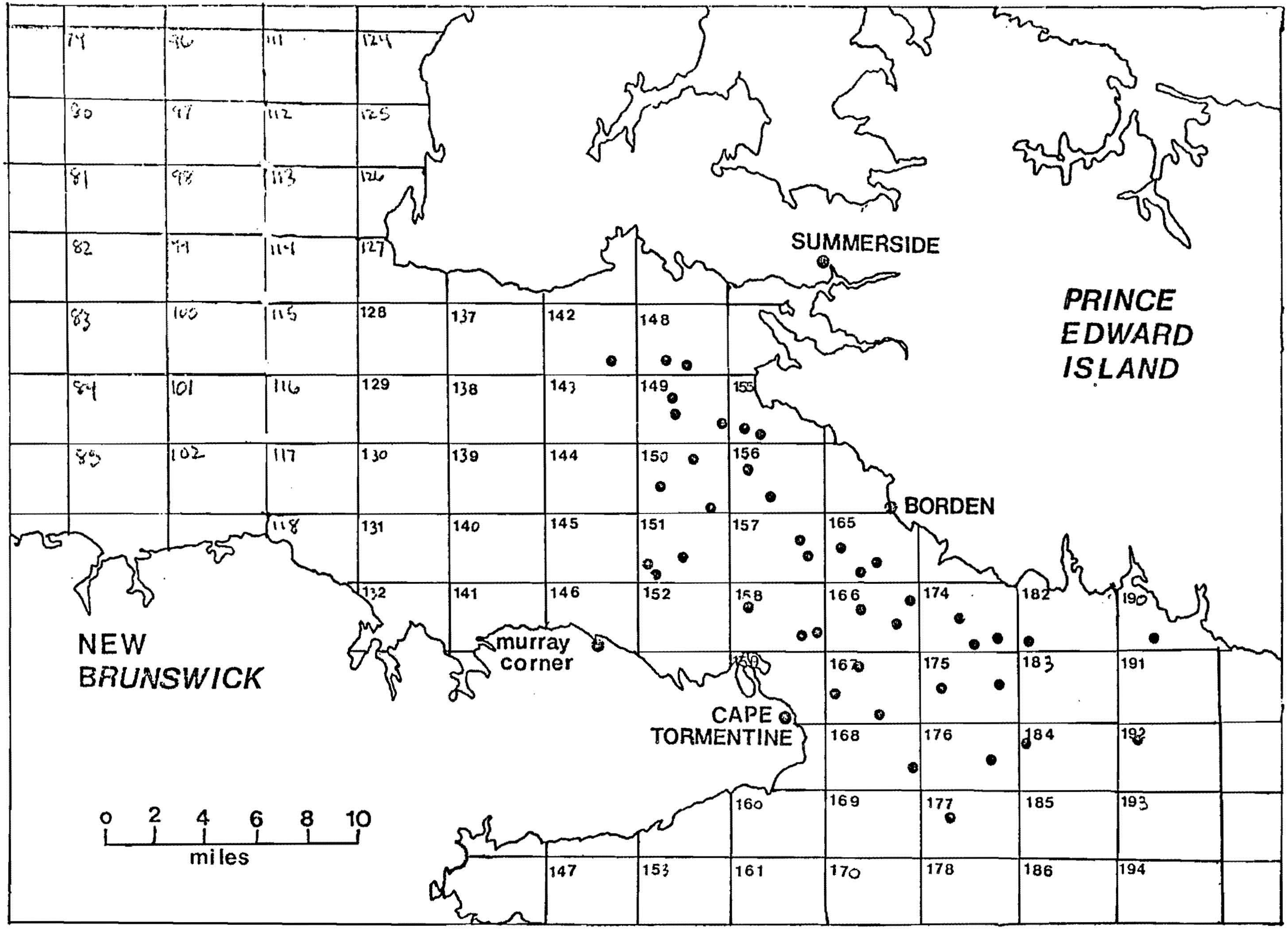

Fig. 2. Resource survey station locations in the central Northumberland Strait. Numbers are area designations.

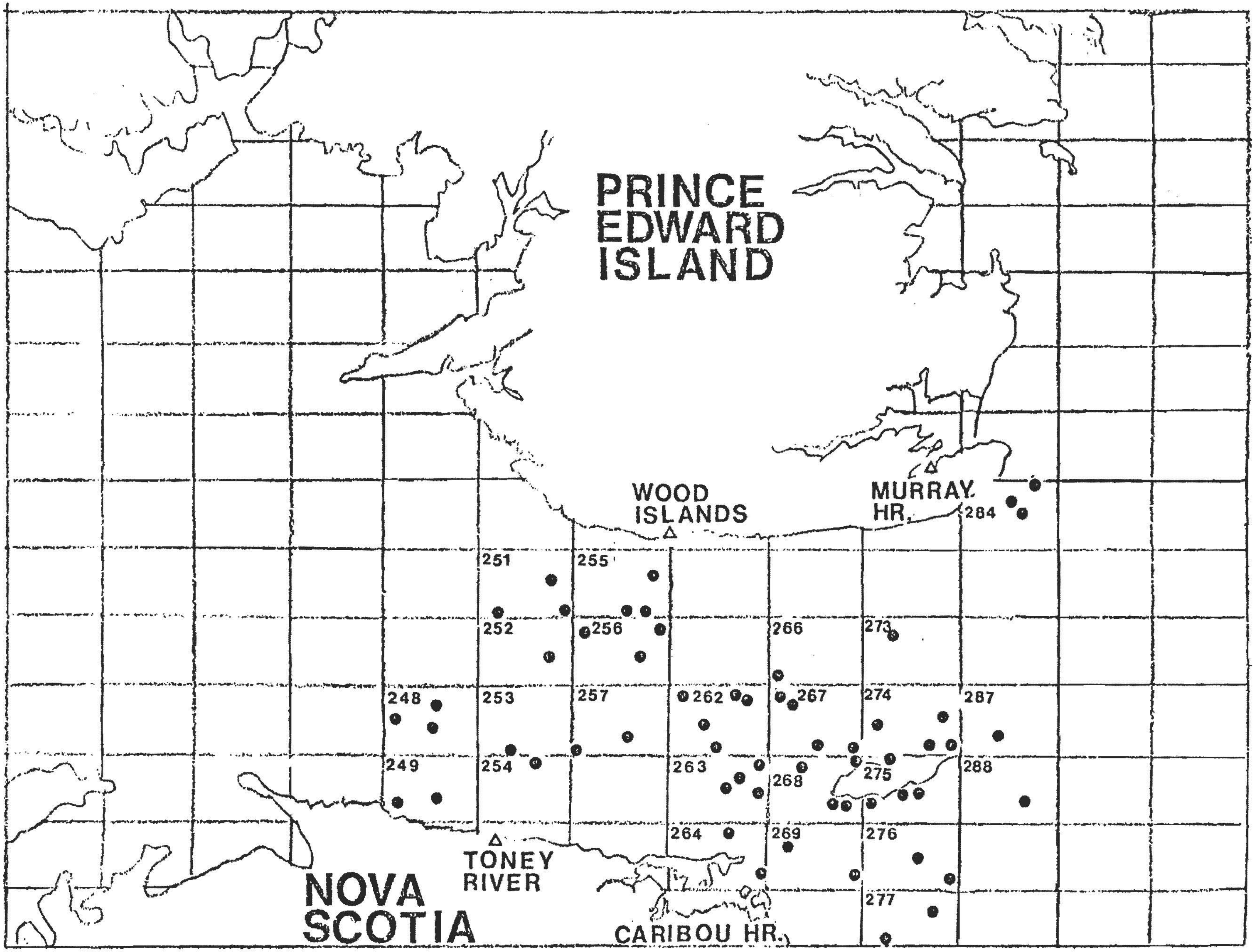

Fig. 3. Resource survey station locations in the eastern Strait. Numbers are area designations.

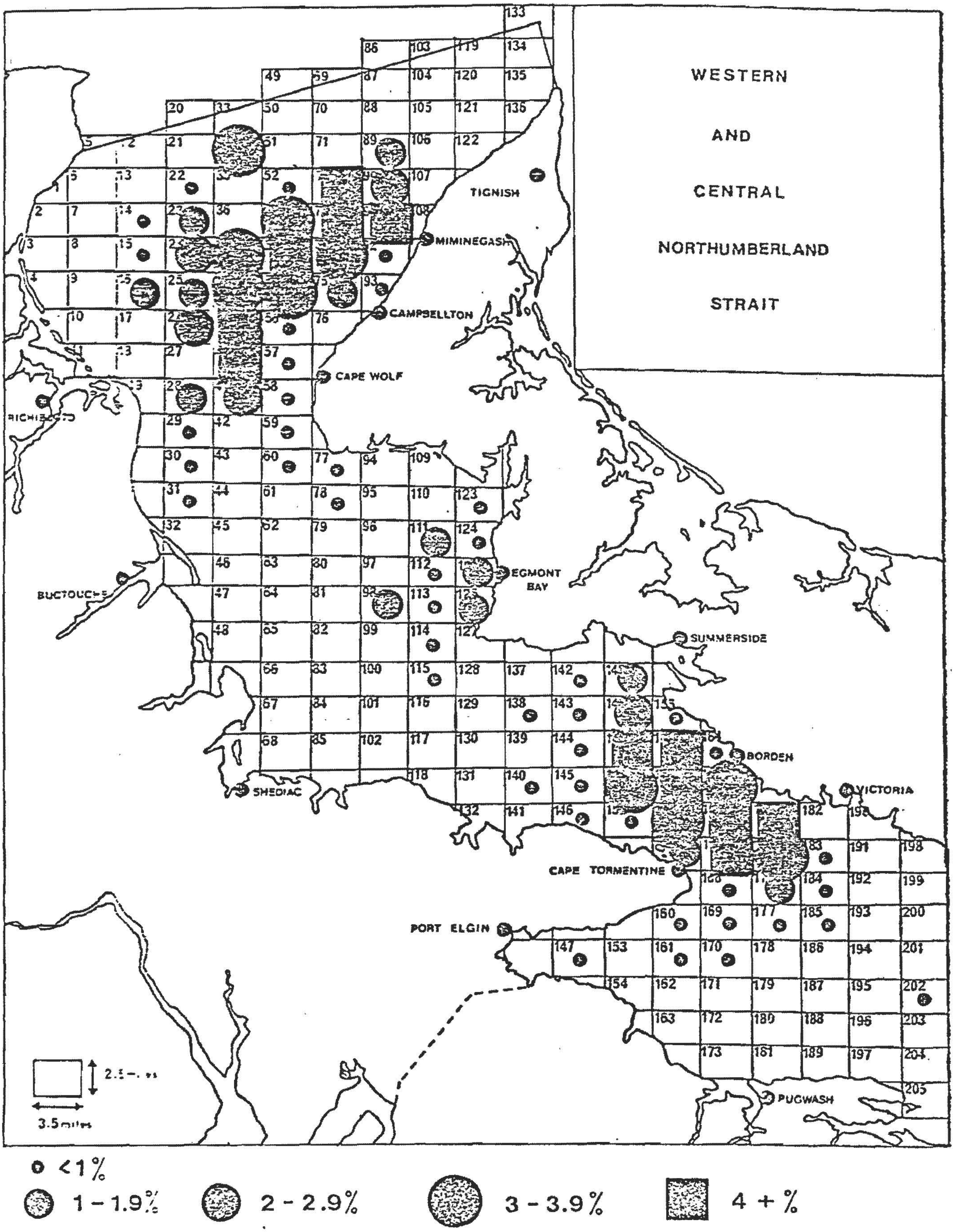

Fig. 4. The geographical distribution and relative magnitude (% of total regional catch) of scallop catches in each area in both the western and central regions of the Northumberland Strait.

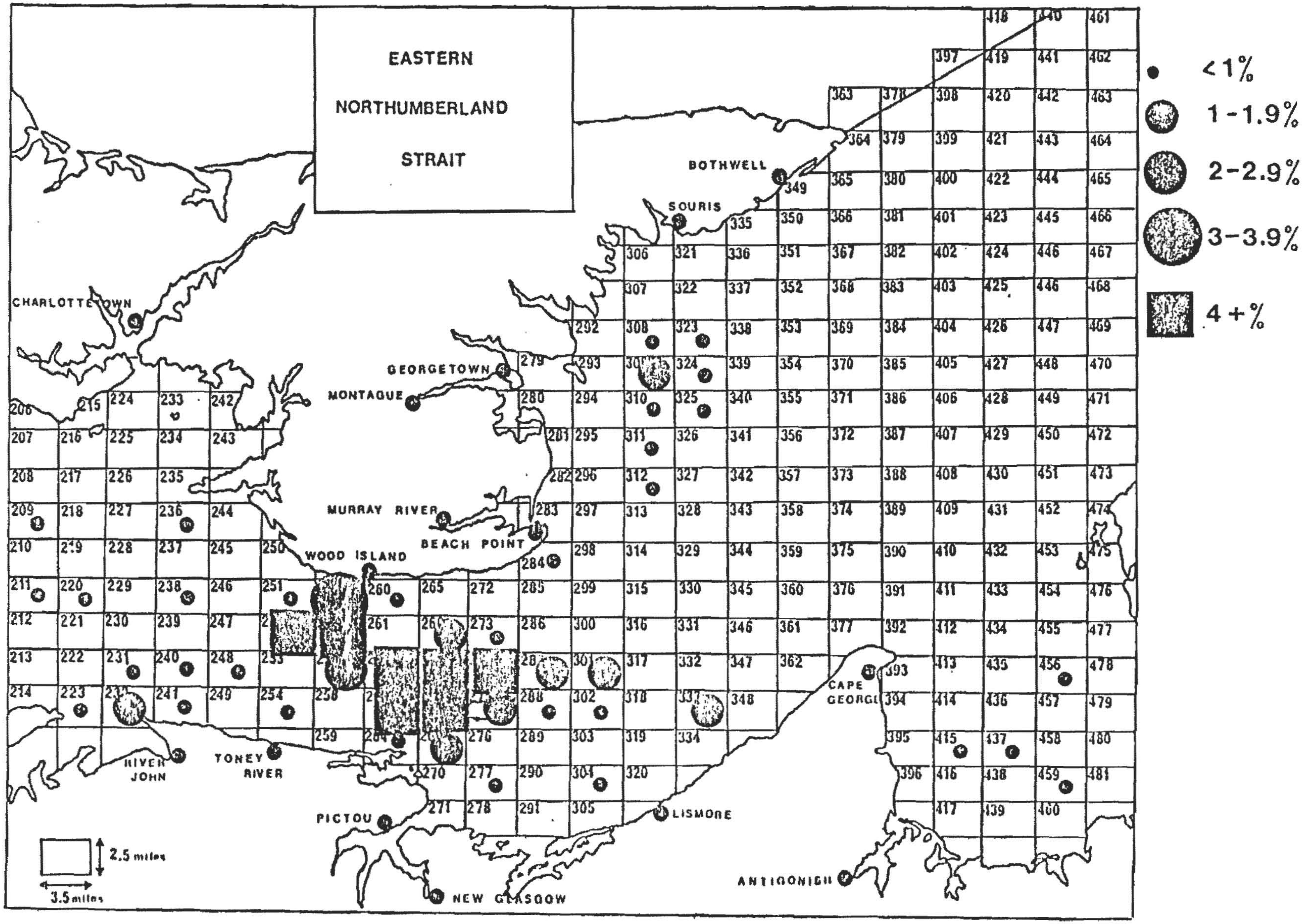

Fig. 5. The geographical distribution and relative magnitude (% of total regional catch) of scallop catches in each area of the eastern region of the Northumberland Strait.

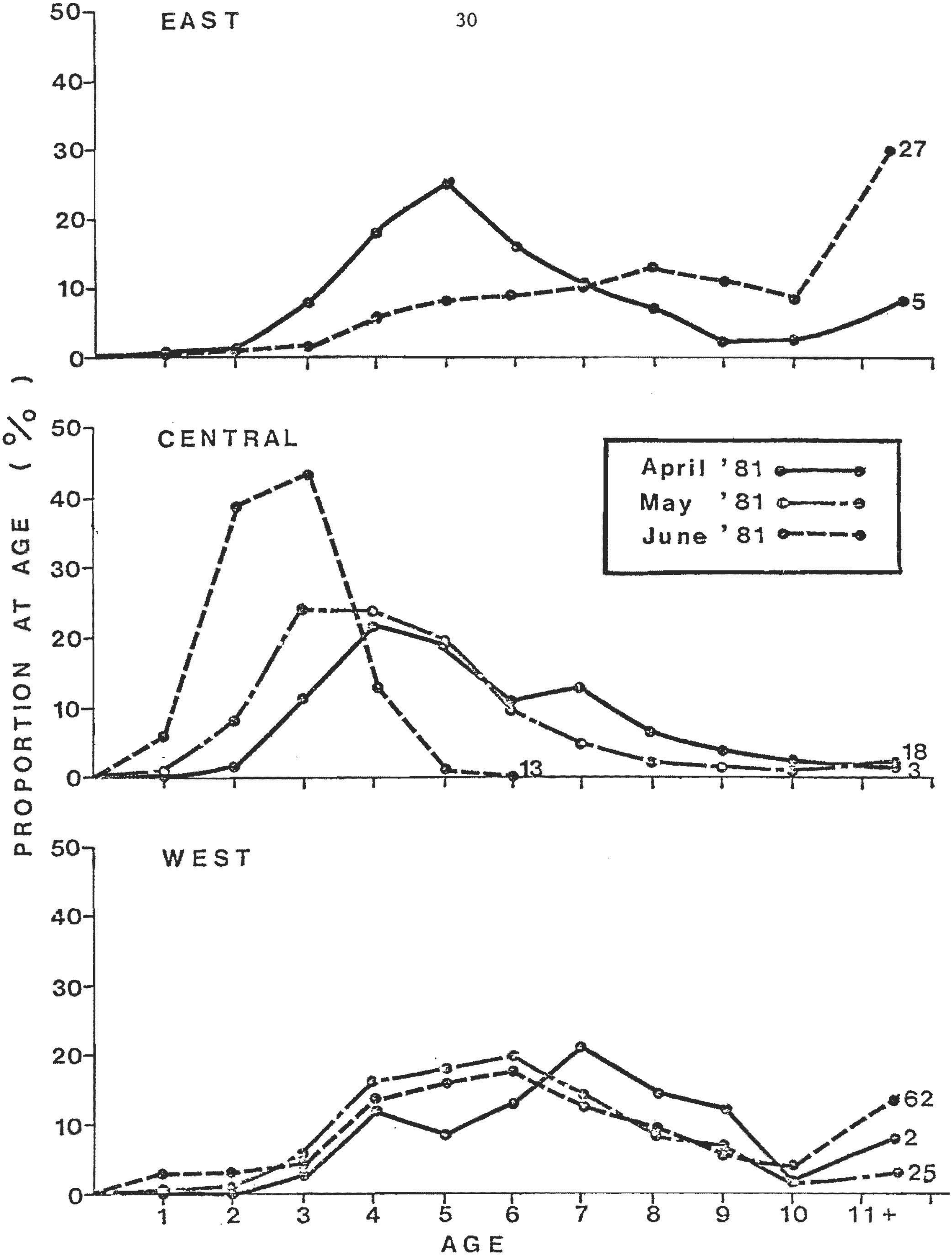

Fig. 6. The monthly age frequencies of scallops as landed on vessels in commercial fishing in Northumberland Strait. Values = no. of tows.

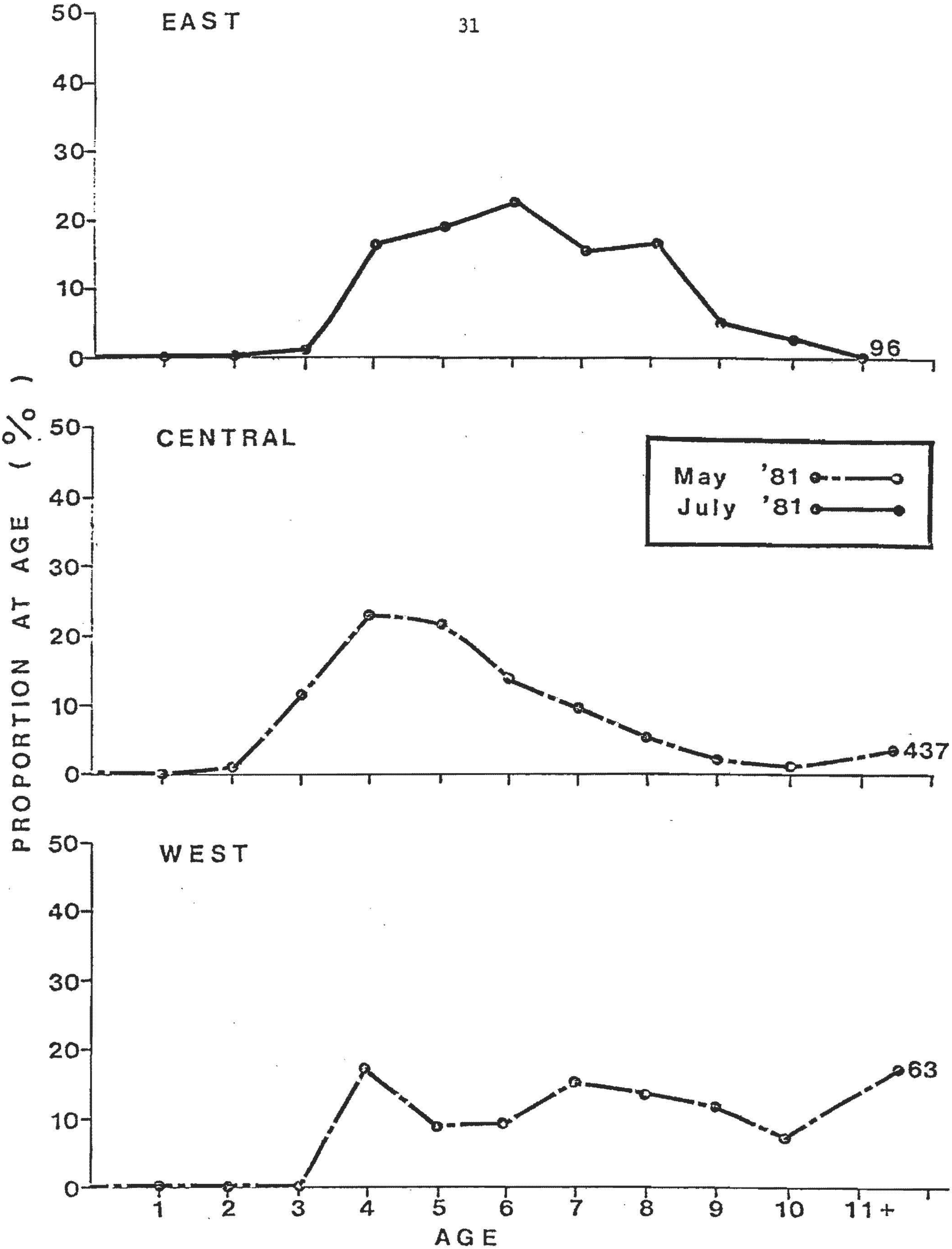

Fig. 7. The monthly age frequencies of scallops as landed at port in commercial fishing in Northumberland Strait. Values = no. of scallops.