

Canadian Atlantic Fisheries
Scientific Advisory Committee

ASSESSMENT OF NORTHUMBERLAND STRAIT SCALLOP STOCKS - 1979

by

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ABSTRACT

Stock assessments in each of the three regions of Northumberland Strait (east, central and west) are presented. Assessments are based both on resource surveys, which determine relative age class frequencies and densities, and CPUE data as obtained from log books, which were introduced in this fishery for the first time in 1979. Significant regional differences in scallop abundance were evident, with average density greatest in the eastern Strait and progressively decreasing in the central and western Strait respectively. Prerecruits were of very low abundance in the western Strait, but were proportionately more abundant in the other regions. In the ten most productive fishing areas in each of the western, central and eastern regions, average CPUE was 1.23, 1.23 and 1.64 kg of meat per hour for each metre of drag width fished respectively.

RESUME

On donne, dans l'article qui suit, les évaluations des stocks de pétoncles dans chacune des trois régions du détroit de Northumberland (est, centrale et ouest). Ces évaluations sont fondées à la fois sur des relevés de la ressource, qui donnent les fréquences et densités relatives des classes d'âge, et sur les données de PUE compilées dans les journals de bord introduits en 1979 dans cette pêche. On constate des différences régionales marquées de l'abondance des pétoncles, la plus forte densité moyenne se trouvant dans le secteur est du détroit et diminuant progressivement dans les secteurs central et ouest respectivement. Dans ce dernier, les prérecrues sont très peu abondantes, mais sont proportionnellement plus abondantes que dans les autres secteurs. Dans les dix zones de pêche les plus productrices de chacun des secteurs ouest, central et est, les PUE moyennes sont de 1,23; 1,23; et 1,64 kg de chairs par heure pour chaque mètre de largeur de drague pêchée respectivement.

INTRODUCTION

The recent decline in scallop landings (Fig. 1) in the Northumberland Strait and status of Northumberland Strait scallops stocks have been previously summarized by Jamieson (1979). The lack of reliable catch and effort data for the scallop fishery in the Northumberland Strait has prevented development of an optimal scallop management plan. As a first attempt to overcome this deficiency, this report presents both the results of scallop resource surveys in three regions (Fig. 2; western, central, and eastern) of the Strait and catch and effort data as derived from both sales slip and log reports. A log system was introduced in this fishery for the first time in 1979; and although logistic handling difficulties and resistance by some fishermen to logs resulted in not all fishing days being reported, a sufficient number of logs (3,311) were completed to allow preliminary characterization of the fishing grounds.

METHODS

A. Resource Surveys

Resource surveys (Fig. 3) in both the western and central regions of the Northumberland Strait were conducted between July 23 and August 2, 1979, and in the eastern region

of the Strait between September 4 and 10, 1979. The greatest effort expenditure in the scallop fishery in the central and western regions of the Strait is in the spring, thus allowing sufficient time by late July for most log records to be processed and areas of scallop concentration to be identified. In contrast, early July is the period of peak fishing in the eastern region of the Strait, and so a resource survey of this region was delayed to allow for log data receipt and processing.

In each region, the percent of the total region's commercial catch was utilized to assign each area (Fig. 4A&B) to one of three catch strata: high, medium, and low (Table 1). Station number per area within a stratum was randomly determined and hence not all areas within a stratum were necessarily sampled (all areas in the high catch stratum were sampled). Within a specific area (if stations were assigned to it), each station location was further randomized by dividing the latitude and longitude of each area into ten equal sections, and then randomly assigning a station's position from the lower right-hand corner [e.g. 2 up (latitude), 5 across (longitude)].

In the central and western surveys, the survey gear (Fig. 5) was a four-gang drag consisting of untoothed, Digby rock buckets (each 0.72 m wide) alternating with toothed, Northumberland Strait (=Gulf) buckets (each 0.46 m and 0.58 m wide in each region respectively). The two centre buckets

each contained a 38 mm stretch mesh, polypropylene liner, while in addition, the centre Digby bucket had a 38 mm mesh hood extending to a height of 1 m above the sea bottom. Data analysis weighted individual bucket catches to a drag width of 0.72 m.

On the basis of gear performance observations made in August, 1979, (unpublished data), the survey gear used in the eastern Strait was subsequently modified to consist of four Northumberland Strait toothed drags (each 0.60 m wide), with one of the end drags containing a mesh liner. In the soft substrate which characterizes most of the bottom of the Strait, untoothed drags quickly fill up with trash and appear to effectively stop fishing sooner than the toothed drags.

Catch comparisons between the two drag types may thus become unreliable since relative fishing distance is then unknown.

Tow duration in the western Strait survey was ten minutes. Tow duration was ten minutes for the first seven tows in the central Strait survey, but was subsequently reduced to seven minutes because of excessive quantities of trash. A seven-minute tow duration was used throughout the eastern Strait survey. Analysis weighted tow duration at ten minutes. Shell height was recorded for all live scallops and cluckers (paired scallop valves), with categorization by 5 mm divisions. Ages were inferred from the Von Bertalanffy growth parameters determined by Jamieson (1979) for the Strait as a whole. Live scallops obtained by port samplers on a monthly

basis were dissected to allow determination of adductor muscle yield relative to shell height, and hence age.

Statistical tests for differences between gear performances or catches per stratum or region utilized Tukey's HSD procedure (Steele and Torrie, 1960).

B. Log Reports

Log books (Table 2) were issued to Northumberland Strait scallop fishermen in order to obtain catch and effort data pertaining to area fished. Previous statistics (Jamieson, 1979) only provided catch data as to port landed, with effort being the number of days in which scallops were sold. Fishing location in the logs was reported as a unit square number obtained from maps of the Strait (Fig. 4A, B) provided in the log book. Each unit square is 2.5 minutes of latitude by 5 minutes of longitude; total area is 12.5 square minutes (22.6 km²). Navigation by fishing vessels in the Strait typically involves only a depth sounder and visual observation of shore topography. Exact fishing location is therefore somewhat subjective, but better definition of locations of scallop concentrations is achieved. Thus, although scallop density can be expected to vary within the present unit areas, use of such areas nevertheless represents a first approach in defining and quantifying areas of scallop location.

Commercial effort is defined as the number of hours the gear is on the bottom during fishing (tow duration multiplied by number of tows) multiplied by gear width (metres). A survey of all active fishermen was undertaken by fisheries officers in both the spring and fall fisheries to determine the total number and sizes of individual drag types used by fishermen in the Strait.

RESULTS

A. Height-Weight Relationships

The magnitude of seasonal weight change of the adductor muscle (meat) of a 90 mm scallop in 1979 was similar to that observed in 1978 (Fig. 6). Lowest meat weight in 1978 and 1979 was in August, and the maximum monthly variation was a change of 30% between September and August. The observation of the past two years raise questions as to the reliability of the 1976 results, which indicated a greater reduction (57%) in meat weight in July. Unfortunately, procedures were not standardized at that time, since the meat weight data collected in 1976 were incidental to other studies, and so the 1976 data would now appear to be unrepresentative of seasonal scallop meat weight change.

Seasonal differences in relative gonad weight for a 90 mm scallop existed between the 1978 and 1979 data. The

suggested double spawning in 1978 was not evident in 1979: gonad weight peaked in July and then declined through August and September. Spawning of scallops in the eastern Northumberland Strait at least would thus appear to commence as early as July, although August and September would appear to be the main spawning period as determined from relative gonad size.

B. Resource Surveys

Survey gear performance studies (Jamieson and Lundy, 1979) of Digby rock drags in the Bay of Fundy indicated that both individual bucket location in a drag gang and the presence of a mesh liner affected scallop catch rate. Unlined buckets fished significantly more commercial-size scallops than lined buckets; and although not statistically significant, end buckets in a seven-bucket gang fished higher catches of commercial-size scallops than did comparable centre buckets. In the Northumberland Strait surveys, a four-bucket gang (Fig. 5) was utilized and it is evident that unlined buckets fished on average a greater number (not significant : $p < .05$) of commercial-size scallops (Fig. 7). The lined, untoothed (Digby) bucket fished more scallops on average than did the lined, toothed (Gulf) bucket in the central Strait, but perhaps because of the small number of scallops actually fished, no significant differences in catch were evident between the different gear types and locations in the gang.

Similar observations were noted for the lined and unlined gear used in the eastern Strait survey.

No scallops were fished by the mesh hood on the centre Digby rock drag in the central Strait (seven minute tow duration), while in the western Strait (ten minute tow duration) the age frequency distribution of scallops retained by the hood reflected that obtained in the lined drags. The greater number of scallops in the hood (average over 24 tows was 2.1 scallops/tow) from the western region may partially result from the longer tow duration. Gear performance studies by divers (unpublished data) undertaken in the Northumberland Strait in August, 1979, suggested that if tow duration is long enough to allow the buckets to completely fill, then scallops, being lighter, will gradually be displaced in the drag by rocks. As they spill out, some scallops pass over the top of the drag, where they would be retained by the hood.

Since the hood was on the lined, Digby bucket, i.e., a rock drag with no teeth, and with the relatively soft substrate of the Strait, the likelihood of this bucket type being completely filled by trash is high. However, although overall scallop abundance as indicated by untoothed drag catches is likely an underestimate, a 10 minute tow duration is not unreasonable with a toothed drag. Log records indicate that ten minutes is a common commercial towing time for toothed gear, and so observed scallop abundance with toothed gear should be unbiased.

In catch comparisons between the high catch strata in the three regions, scallops were significantly ($P < .05$) more abundant in the eastern region than in the two other regions (Fig. 8). Prerecruits in particular were moderately represented in the eastern Strait but were virtually absent in the central and western Straits (Table 1). The 1975 year class (four year olds) in the eastern Strait in the high catch stratum appears relatively poorly represented (Fig. 8), while because of their small size, abundance of one and two year old scallops was likely underestimated. Using unlined gear, the modal age classes of commercial-size scallops (greater than age three) in the eastern and central regions were five and six years, whereas the modal age classes in the western Strait were six and seven years. In the other strata, relative age frequencies differed and modal ages were typically greater.

Although differences in scallop abundance between strata within a region were not statistically significant ($P > .05$), scallop abundance tended to be greatest in the high catch stratum and lower in the middle and low catch strata respectively (Table 1; Fig. 8).

C. Commercial Age Frequencies

Comparison of average monthly scallop age frequencies (Fig. 9) from commercial fishing in each region indicates that the modal age classes fished were five-to-eight year old scallops in the eastern and central Strait, and six-to-eight

year old scallops in the western Strait. In the western Strait, there was a trend for scallop abundance to decrease during the fishing season (May, June, July), with commercial averages of 41, 33, and 27 scallops per bucket per tow respectively. This decline in abundance was most pronounced for scallops greater than age six.

In the central Strait, there was a tendency to fish older scallops as the season progressed while no seasonal change in scallop age class fished was evident in the eastern Strait.

D. Catch and Effort Statistics

1) Sales Slip Statistics

Monthly provincial scallop landings (Table 3) and scallop landings by statistical and lobster districts (Tables 4 and 5) provide comparative 1979 data to annual catch summaries (1976-1978) presented by Jamieson (1979). In comparison to 1978 landings (meat plus gonad), 1979 New Brunswick and Nova Scotia scallop landings are down by 44% and 20% respectively, whereas the Prince Edward Island landing is up by 49% (not supported in personal communication with P.E.I. fishermen). The 1979 landing contained relatively little scallop gonad and this appears to have greatly reduced the scallop landing in Statistical District 80A (Table 4). For the Strait as a whole, the 1979 landing of 218 MT of scallop meat is about the same as that landed in 1978.

Sales slip statistics are known to underestimate actual landings by an unknown percentage. Fishermen claim this to be as high as 30% to 40%. A significant quantity of scallops is sold to local retailers and consumers without being handled by established fish processors and hence no sales slips are prepared.

2. Log Statistics

Log reports in 1979 accounted for 53% of scallop landings reported through sales slips. Although log completion rate is unacceptably low (Table 6), its main value at the present is in delineating the geographical extent of scallop fishing in the Strait (Fig. 4) and in providing realistic catch per unit effort (CPUE) values for the various fishing areas. In the ten most productive squares in the western, central, and eastern regions of the Strait respectively (Table 7), CPUE values in 1979 averaged 1.23, 1.23, and 1.64 kg per hour for each metre of drag fished.

Between provinces, average regional CPUE values for all areas fished in 1979 (Table 8) showed similar differences.

DISCUSSION AND CONCLUSIONS

Randomized resource surveys are a relatively poor method of evaluating the total biomass of a contagiously

distributed species having limited mobility (Jamieson and Lundy, 1979). Northumberland Strait fishing vessels have no precise navigational equipment, making exact delineation of scallop contagion difficult. Although unit survey area can be minimized by having fishermen report location fished as an area in a grid which covers the entire fishing ground, the possibility still exists that in a resource survey with a limited number of sample stations, scallop contagion will nevertheless be missed. Therefore, no attempt is made in this report to quantitatively estimate exploitable population size. Although a randomized station allocation procedure is meaningful statistically, the value of the observations for management may be sacrificed if the extent of contagion is not reflected in number of sample stations. Since degree of contagion is unknown, number of sample stations (60 per region) was determined by availability of vessel time and funding.

Although scallop landings in the eastern Strait are well below those of the early 1970's, the survey indicates that because of the relative high abundance of three to six year old scallops, there are probably sufficient scallops to maintain a low but stable fishery over the next few years. The situation in the central Strait is more serious in that average survey scallop density is significantly lower than in the eastern Strait. However, the greater presence of the younger age classes again suggests that although catches can be expected to remain low, the stock is continuing to maintain itself.

The most serious situation is in the western Strait. Not only was the average survey scallop catch very low but there appears to be a virtual absence of scallops age five or younger, particularly in the most heavily fished areas. However, the low survey catches in the western Strait are not clearly associated with a decline in commercial landings from this region. A significant reduction in catch occurred in 1979 in the western region as a whole; and anecdotal reports indicate that there was a major scallop kill in early spring off the New Brunswick shore, extending from Cape Tormentine to Richibucto. It is also known that in an effort to maintain landings, New Brunswick fishermen in this region have resorted to fishing scallop gear up to 8.3 m in width (R. Pauley, pers. comm.). Average gear widths fished in the western, central, and eastern Strait are 5.1, 3.5, and 3.0 m respectively. However, according to sales slip statistics, although western Strait, New Brunswick landings are reduced, western Strait, Prince Edward Island landings appear to be up significantly. Recent discussions in meetings with P.E.I. fishermen do not support this increase, though, and fishermen feel that actual landings in 1979 were not much greater than those in 1978. Landings may have been up somewhat because a few more boats fished in 1979, but actual catch per boat was reported to be about the same in both years. This suggests that between 1978 and 1979 different proportions of the total catch were recorded through sales slips.

Between the regions of the Strait, catch per tow (Table 1) was disproportionately less relative to commercial CPUE (Table 7) in the western region. Fishermen state that CPUE typically declines during the fishing season in the western Strait (Fig. 9), so that each year commercial fishing normally ceases for economic reasons around late June. The western Strait survey was conducted in late July, and this may partly explain the relatively lower survey CPUE. This phenomenon, if real, is apparently not so evident in the other regions surveyed.

Another possible explanation for low survey scallop abundance in the western Strait is that scallop age class distribution is particularly patchy and that scallop concentrations are in areas other than those sampled. Effort in all three surveys was concentrated in areas presently known to be productive; and although survey stations were widely distributed (Fig. 3), it is quite possible, and indeed likely, that some scallop concentrations were missed. However, catches were consistently reduced in this region (Table 1) and so a reduced overall level of abundance appears real. Some prerecruits were found in the middle and low catch strata; but in general, fishermen admit that, in comparison with other years, there were few prerecruits observed during commercial fishing in 1979. It thus appears that catches in the western Strait will only remain at present levels until the older recruits are fished down to unprofitable fishing densities,

and that landings will then decline sharply. With the lack of prerecruits and a reduced parent stock, recruitment overfishing in the western Strait thus becomes a possibility.

SUMMARY

1. In 1979, in the eastern Strait, meat weight for a 90 mm scallop was lowest in August but had recovered by September. Gonad weight for a 90 mm scallop began to decrease in July and showed no late-summer recovery, suggesting that there was only one major scallop spawning in 1979.
2. Resource surveys indicate significant regional differences in scallop stock abundance, with average scallop density greatest in the eastern Northumberland Strait and progressively decreasing in the central and western Strait respectively.
3. Prerecruits were proportionately more abundant in the eastern and central Strait and appeared to be virtually absent in the presently productive areas of the western Strait.

4. Average survey scallop density was greatest in those unit areas identified from log data to be high catch areas, medium catch areas, and low catch areas respectively.
5. According to sales slip data, which is known to be incomplete, New Brunswick and Nova Scotia scallop landings decreased from 1978 to 1979 by 44% and 20% respectively, whereas Prince Edward Island landings increased by 49%.
6. The total catch reported by the newly introduced log system was 53% of the catch reported through sales slips.
7. For the ten most productive unit areas in the eastern, central, and western Strait respectively, average catch per unit effort from logs was 1.64, 1.23, and 1.23 kg of meat per hour for each metre of drag width fished.

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Table 1. Strata designation and average scallop catches by age grouping in each of the three catch strata in each region of the Northumberland Strait. Scallops were fished with an unlined, toothed bucket, weighted to 0.60 m wide.

Northumberland Strait								
Catch Stratum	%* (stratum range)	n (squares sampled)	n (stations)	Age			Total	SD
				1-3	4-7	8+		
<u>Western:</u>								
High	5+	5	19	0	0.8	1.4	2.2	2.36
Medium	2-5	10	27	0.1	2.8	2.1	5.0	4.55
Low	0-2	7	3	0	3.0	.7	3.7	2.48
		<u>22</u>	<u>49</u>					
<u>Central:</u>								
High	10+	3	22	.7	6.2	2.0	8.9	9.72
Medium	2-10	11	30	0.1	1.0	1.2	2.3	4.93
Low	0-2	7	8	0	2.0	1.9	3.9	5.47
		<u>21</u>	<u>60</u>					
<u>Eastern:</u>								
High	8+	3	20	5.2	9.7	6.7	21.6	24.99
Medium	2-8	10	20	1.3	6.8	9.3	17.4	13.58
Low	0-2	7	7	0	0.4	5.4	5.8	4.41
		<u>20</u>	<u>47</u>					

* Percent of total region's commercial catch fished from each square.



**ENVIRONMENT CANADA
FISHERIES & MARINE
SCALLOP FISHERY SLIP**

**ENVIRONNEMENT CANADA
PECHES ET SCIENCES DE LA MER
BORDEREAU D'ACHAT POUR PÉTONCLES**

INFORMATION FROM PLANT
RENSEIGNEMENT DE L'USINE

RECORD TYPE

INFORMATION FROM VESSEL
RENSEIGNEMENT DU BATEAU

NAME OF BOAT/nom du bateau

DATE LANDED/date du débarquement

PLACE FISH LANDED/ lieu du débarquement

C F V NO/no du b.p.c.

NAME OF BUYER/nom de l'acheteur

ADDRESS OF BUYER/adresse de l'acheteur

NAME OF SELLER/nom du vendeur

ADDRESS OF SELLER/adresse du vendeur

QUANTITY quantité (lb)	SPECIES espèces	PRICE prix	TOTAL total
	SCALLOP MEAT /Pétoncle - viande		
	SCALLOP ROE / Pétoncle - rave		

GEAR TYPE/type engins de pêche utilisés

BOTTOM TYPE/type de fond

DEPTH (fath)/profondeur (brasses)

ESTIMATED CATCH/estimé des captures (lb)

NO. OF MEN/no. d'hommes

NO. DAYS AT SEA/no. de jours en mer

COMMENTS/remarques

LOCATION FISHED lieu de pêche	NO. OF TOWS /No. de traits	TOW TIME durée d'un trait (min)
SQUARE NO. /No. de carré		
SQUARE NO. /No. de carré		
SQUARE NO. /No. de carré		

Table 2. Log format used in the inshore Northumberland Strait scallop fishery in 1979.

Table 3:

Monthly scallop landings in Northumberland Strait in 1978 and 1979 (values are suggested to be underestimates of actual landings).

	Landings (kg)		
	N.B.	N.S.	P.E.I.
<u>1978:</u>			
April	121,428	-	15,761
May	804,194	-	112,850
June	325,269	12,274	58,911
July	34,327	14,725	143,792
August	-	-	-
September	451	40,924	97,354
October	56	78,294	167,580
November	-	23,498	45,263
December	-	-	1,393
Total Round Weight (kg)	1,285,725*	169,715	642,904
Meat Weight (MT)	155*	20	77
<u>1979:†</u>			
March	-	-	365
April	133,425	7,184	157,734
May	345,052	1,585	152,465
June	225,177	5,856	161,042
July	7,535	40,221	248,147
August	-	-	11,614
September	565	10,628	33,288
October	4,487	32,023	142,027
November	4,894	31,799	45,586
December	-	-	-
Total Round Weight (kg)	721,135	129,296	952,268
Meat Weight (MT)	87	16	115

*Estimated to be 70% meat, 30% gonad.

†3% of total landings may be gonad.

Province	S.D. District	Lobster District	Representative Ports	1978 annual landing (round kg)	1979† annual landing (round kg)
Nova Scotia	11	7a	Caribou, Toney R., Cape John	149,061	108,507
	12	7a	Lismore	900	4,133
	13	7a	Bayfield, Cribben's Pt.	19,754	6,356
	45		Pugwash		5,052
	46		Wallace		5,248
New Brunswick	75	8	Cape St. Louis, Kouchibouquac	50,457	24,704
	76	8	Richibucto, Richibucto Cape	211,936	171,335
	77	8	Buctouche	93,762	89,739
	78	8	Shediac, Cape Bald	98,890*	83,659
	80A	8	Murray Corner, Cape Tormentine	830,680*	351,698
Prince Edward Island	82A	8	Howard Cove, Miminegash	79,156	216,021
	83	8	Borden	58,614	75,853
	85	7a	Victoria	0	1,277
	86	7a	Wood Is., Charlottetown	186,853	203,529
	87	7a	Beach Pt., Gaspereau	313,126	445,587
	88	7a	Annandale	3,155	10,001

*Estimated to be 50% meat, 50% gonad
†3% total landings are roe.

Table 4: District scallop landings in Northumberland Strait in 1978 and 1979.

Table 5:

Monthly Northumberland Strait scallop landings in Lobster Districts 7a and 8 in 1978 and 1979.

Month	1978		1979†	
	eastern 7a	western 8	eastern 7a	western 8
January				
February				
March			365	
April	8,683	128,506	128,531	169,812
May	38,421	878,623	38,899	460,203
June	32,117	364,337	44,244	347,831
July	158,517	34,327	275,775	20,128
August	-	-	11,614	-
September	138,278	451	43,916	565
October	240,709	5,221	169,920	8,617
November	58,124	10,637	71,374	10,905
December		1,393		
Total Round				
Weight (kg)	674,849	1,423,495*	784,638	1,018,061
Meat Weight (MT)	81	172*	95	123

*May be overestimate due to landings of meat and roes.

†3% total landings are gonad.

Table 6. Comparative sales slip and log scallop catch (kg) statistics for each province in each region of the Northumberland Strait in 1979.

	Reported Sales slip Catch (kg)	Reported Log Catch (kg)	% (log/SS)
Western N.B.	34,431	15,325	45
P.E.I.	26,027	9,693	37
Central N.B.	52,453	32,927	63
N.S.	609	0	0
P.E.I.	9,293	6,772	73
Eastern N.S.	14,969	13,316	89
P.E.I.	79,412	36,036	45
Total (kg)	217,194	114,069	
MT	217	114	53

Table 7: Percent of the total catch fished and catch per unit effort (kg meat per hour for each metre of drag fished) from the ten most productive unit areas (Figure 4A&B) in each region of the Northumberland Strait as reported by log records.
 *= weighted average.

Northumberland Strait									
Western			Central			Eastern			
SQ #	%	CPUE	SQ #	%	CPUE	SQ #	%	CPUE	
39	7.55	.97	166	15.05	.98	274	14.72	1.73	
74	6.97	1.02	157	13.66	1.32	256	9.22	1.53	
37	6.51	1.08	158	8.48	1.70	298	6.04	1.46	
55	5.89	1.30	165	6.72	1.30	267	4.71	1.89	
38	5.53	1.43	150	5.29	1.25	248	4.03	1.53	
26	4.43	2.03	174	5.09	1.07	275	3.70	1.63	
91	4.26	1.04	156	3.83	1.54	262	3.43	1.52	
54	4.11	1.26	167	3.52	.89	288	3.25	1.86	
36	3.77	1.20	149	3.12	.88	299	2.97	1.71	
89	3.60	1.07	175	2.89	1.15	252	2.69	1.51	
Total	10	52.62	1.23 *	10	67.65	1.23*	10	54.76	1.64*
Total log catch from region (MT meat)		25			40			49	

Table 8. Average provincial CPUE values for all areas and regions fished in 1979 combined.

Province	Region	CPUE (kg/hr-m)
Prince Edward Island	West	1.37
	Central	1.11
	East	1.68
New Brunswick	West	1.12
	Central	1.21
Nova Scotia	East	1.53

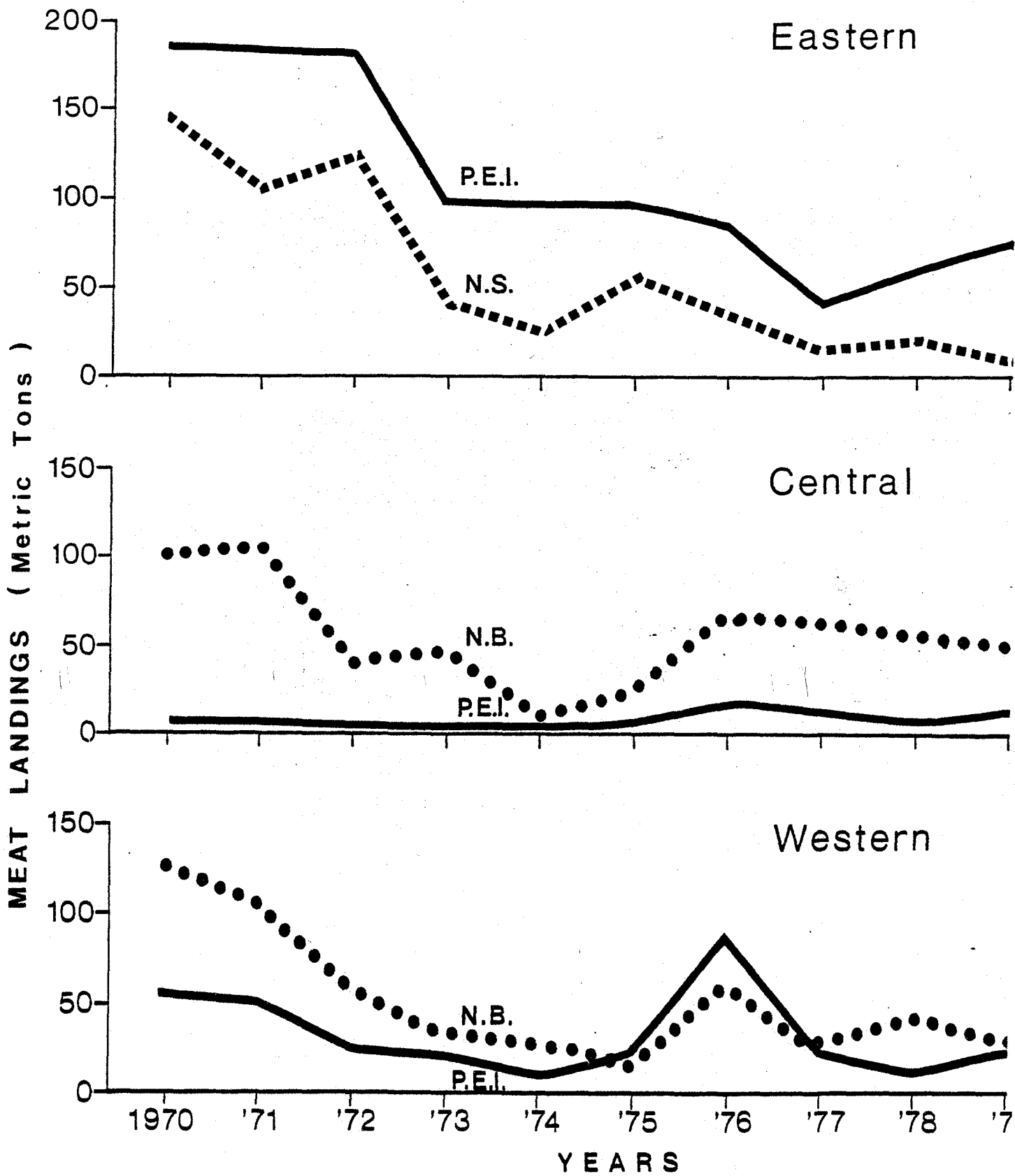


Fig. 1: Annual provincial scallop landings in the three regions of Northumberland Strait.

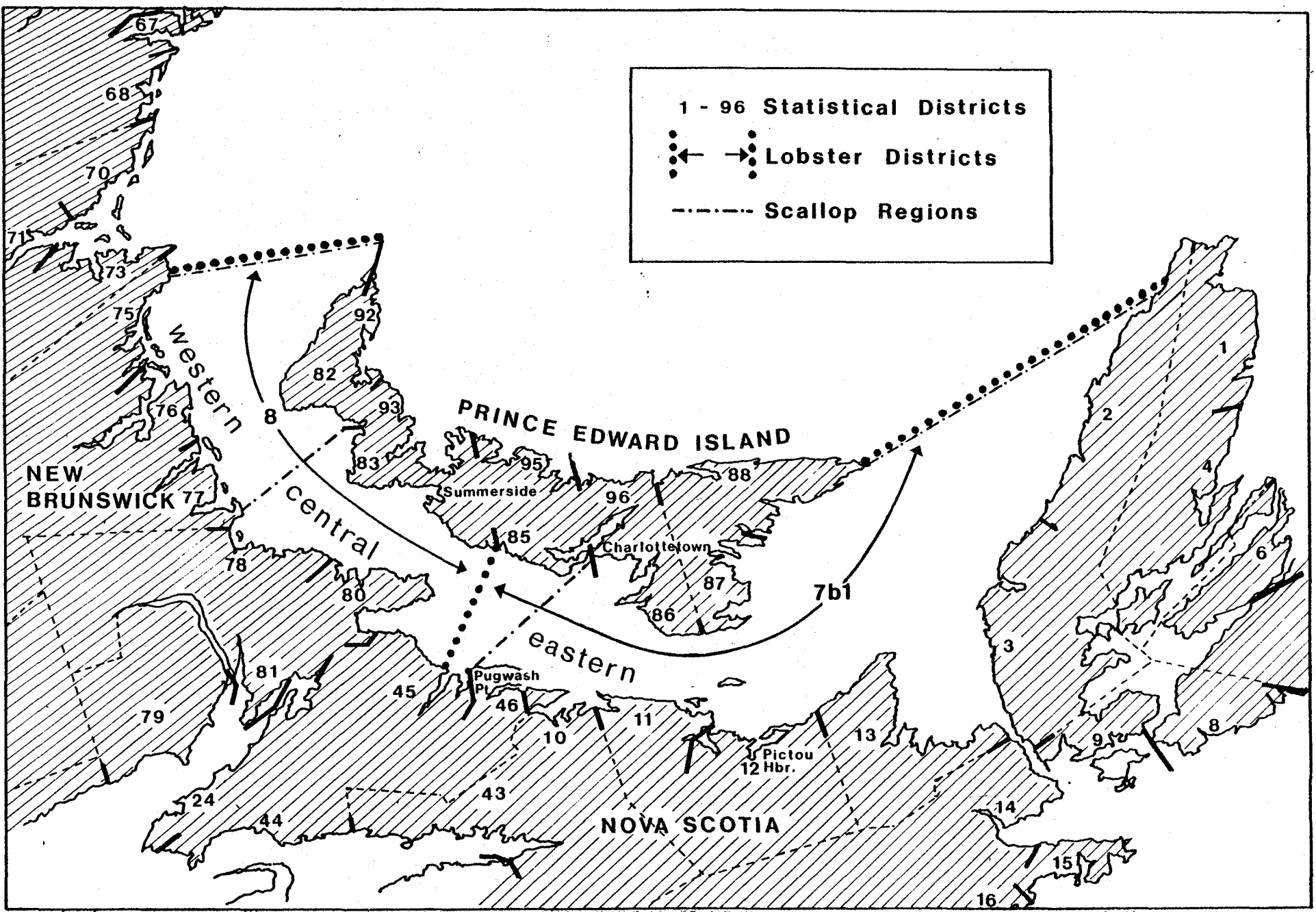


Fig. 2: Boundaries of the three scallop survey regions, two lobster management districts, and 18 statistical fishery data districts in Northumberland Strait. To date, scallop management districts have been the same as the lobster management districts (8 and 7b1).

A

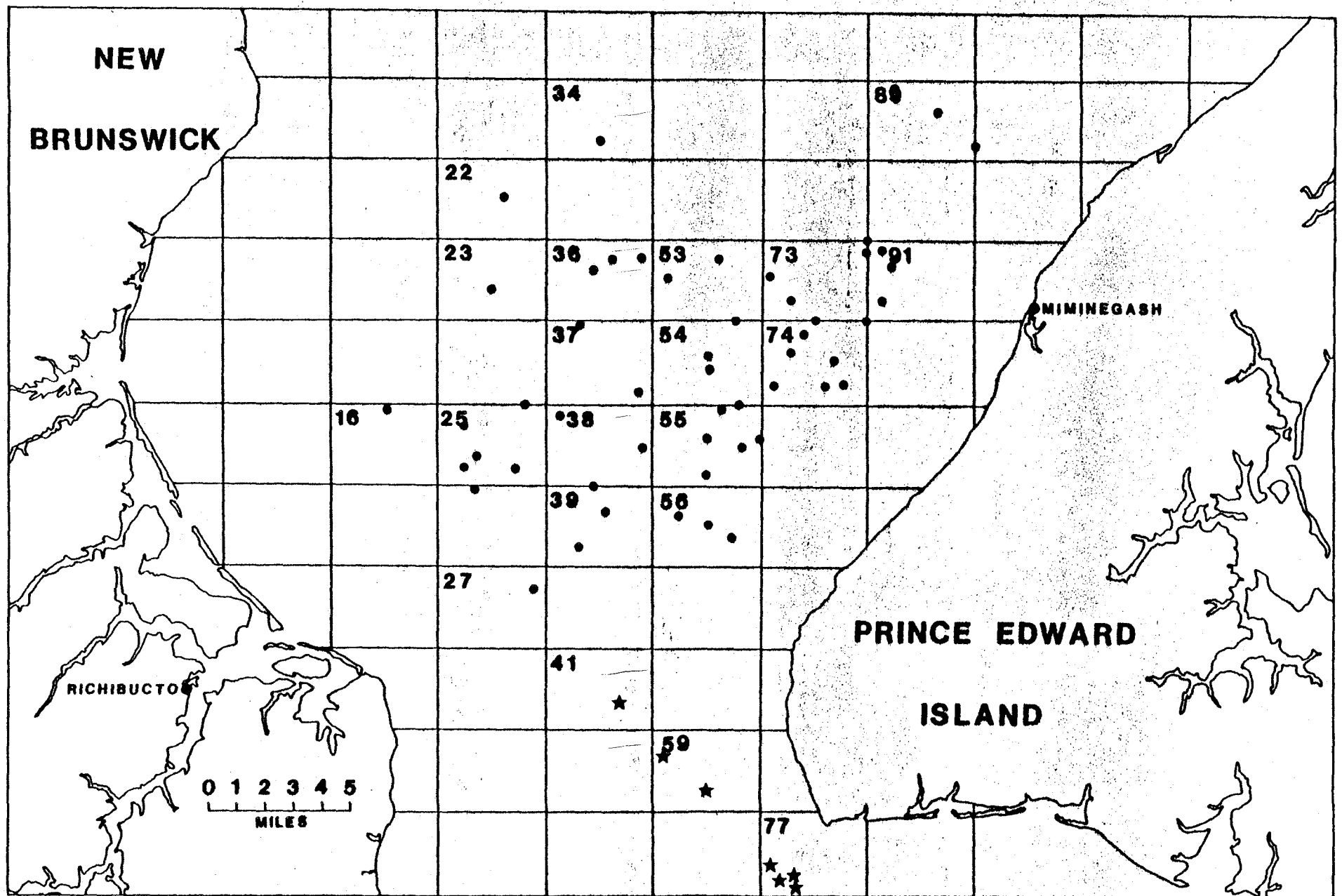


Figure 3. Sample station locations in the resource surveys in the western (A), central (B), and eastern Strait (C). Numbers are area designations (see Figure 7) * = stations not sampled.

B

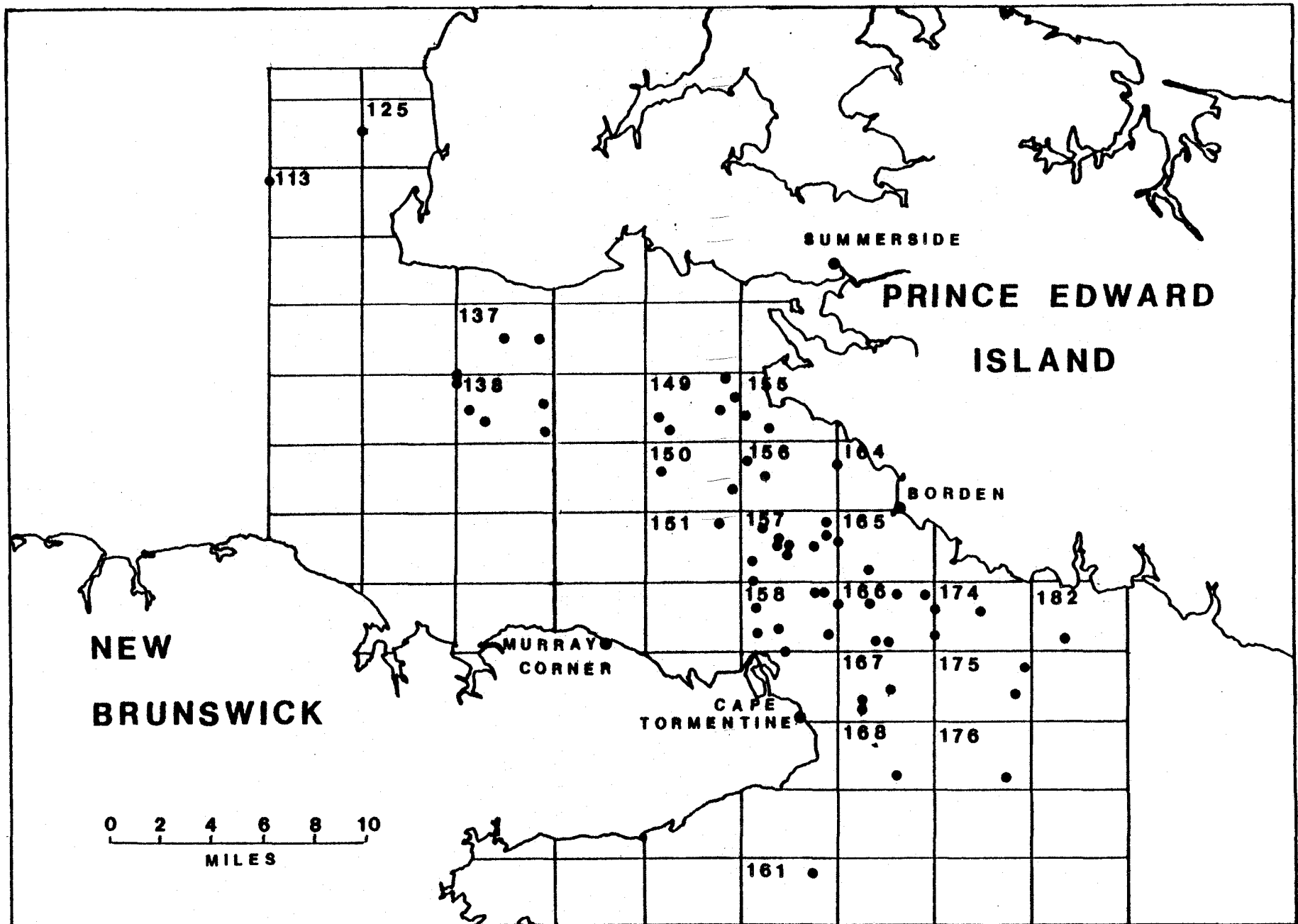


Figure 3 (cont'd)

C

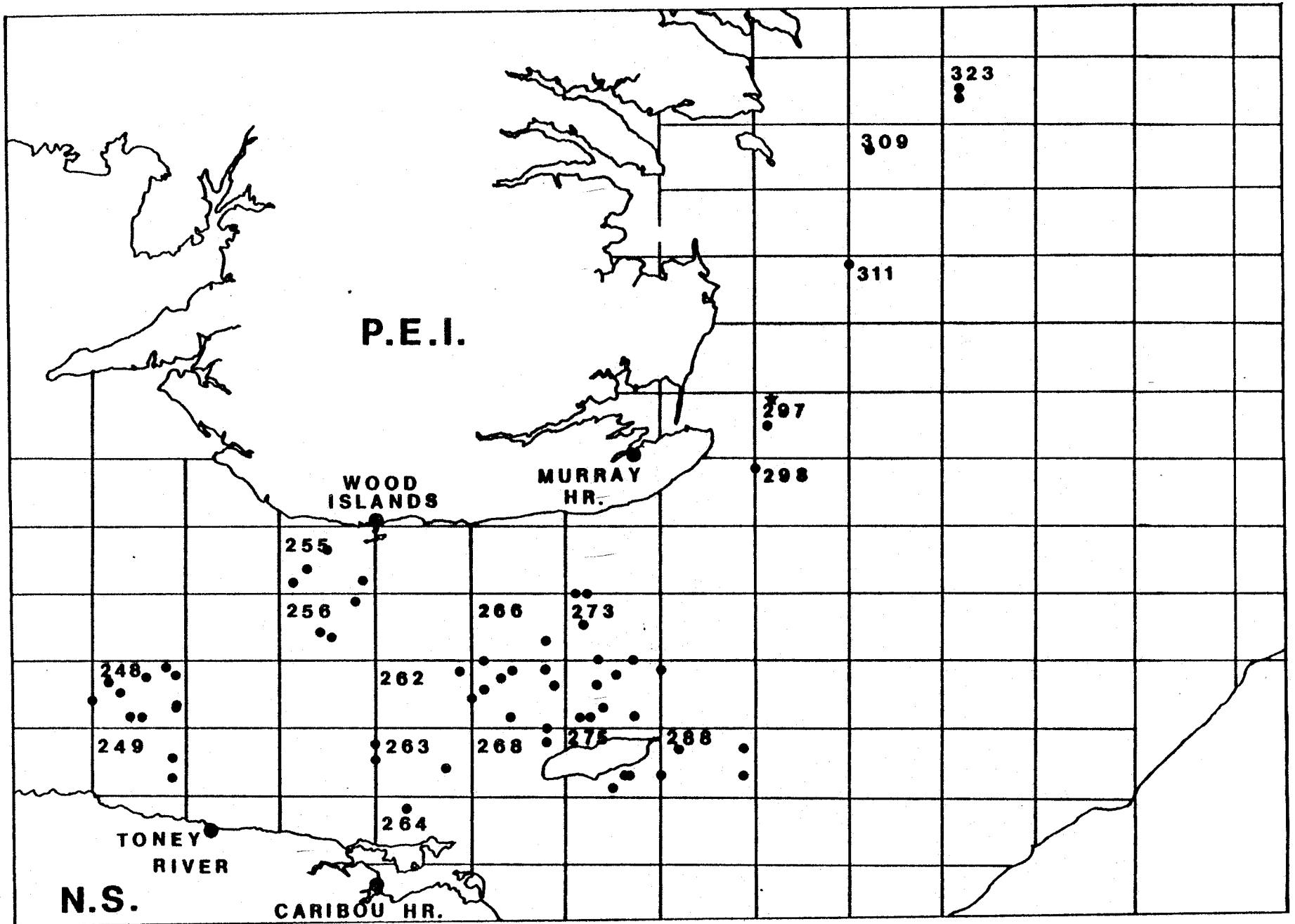
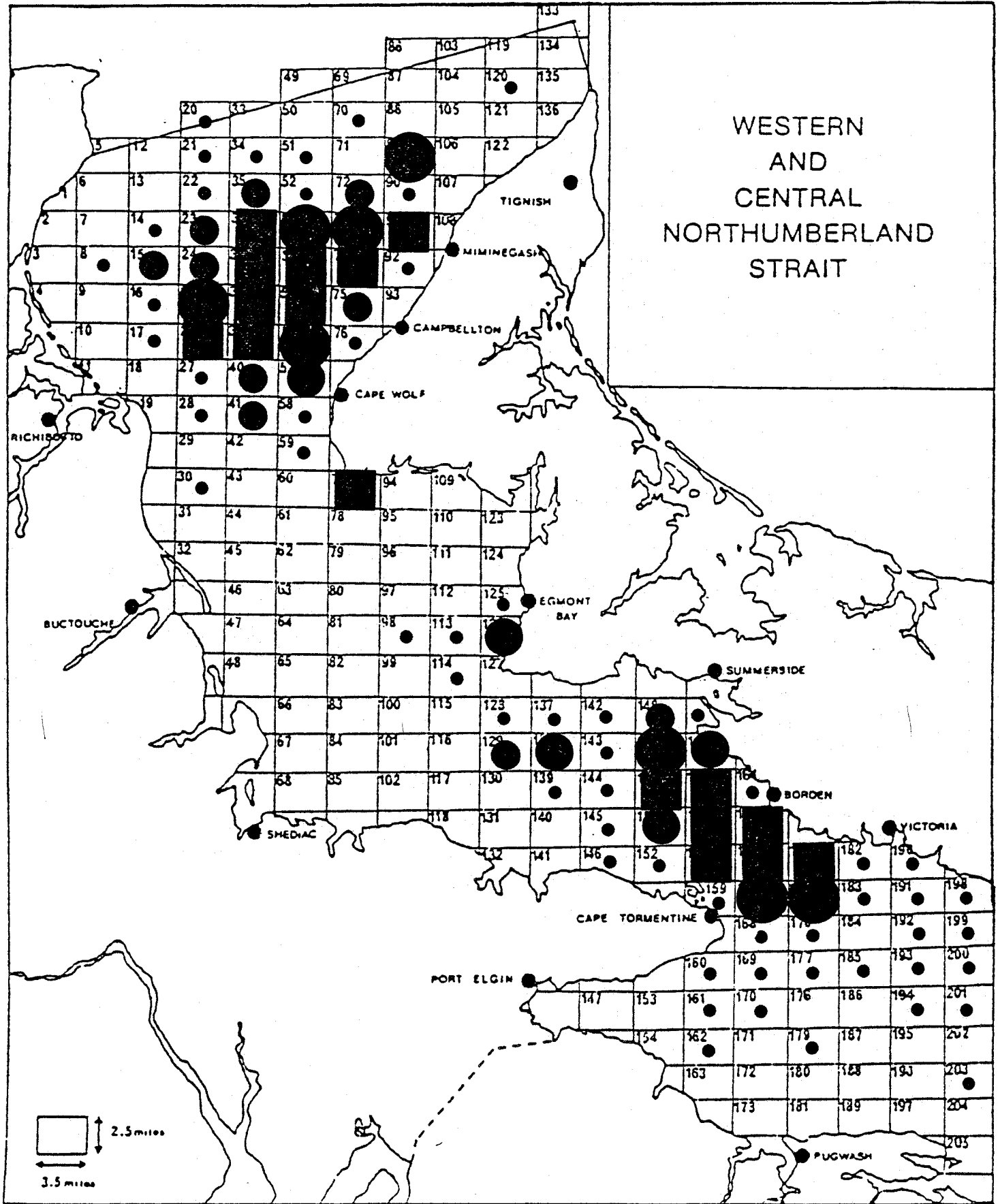


Figure 3 (con'd)



WESTERN
AND
CENTRAL
NORTHUMBERLAND
STRAIT

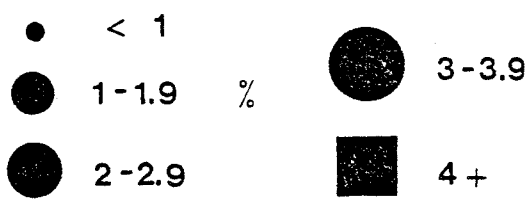


Fig. 4A: Boundaries of the unit areas used to denote fishing location in the western and central regions, and the geographical distribution and relative magnitude of scallop landings in the western and central regions of Northumberland Strait. The percent distribution of catch has been determined for each region independently.

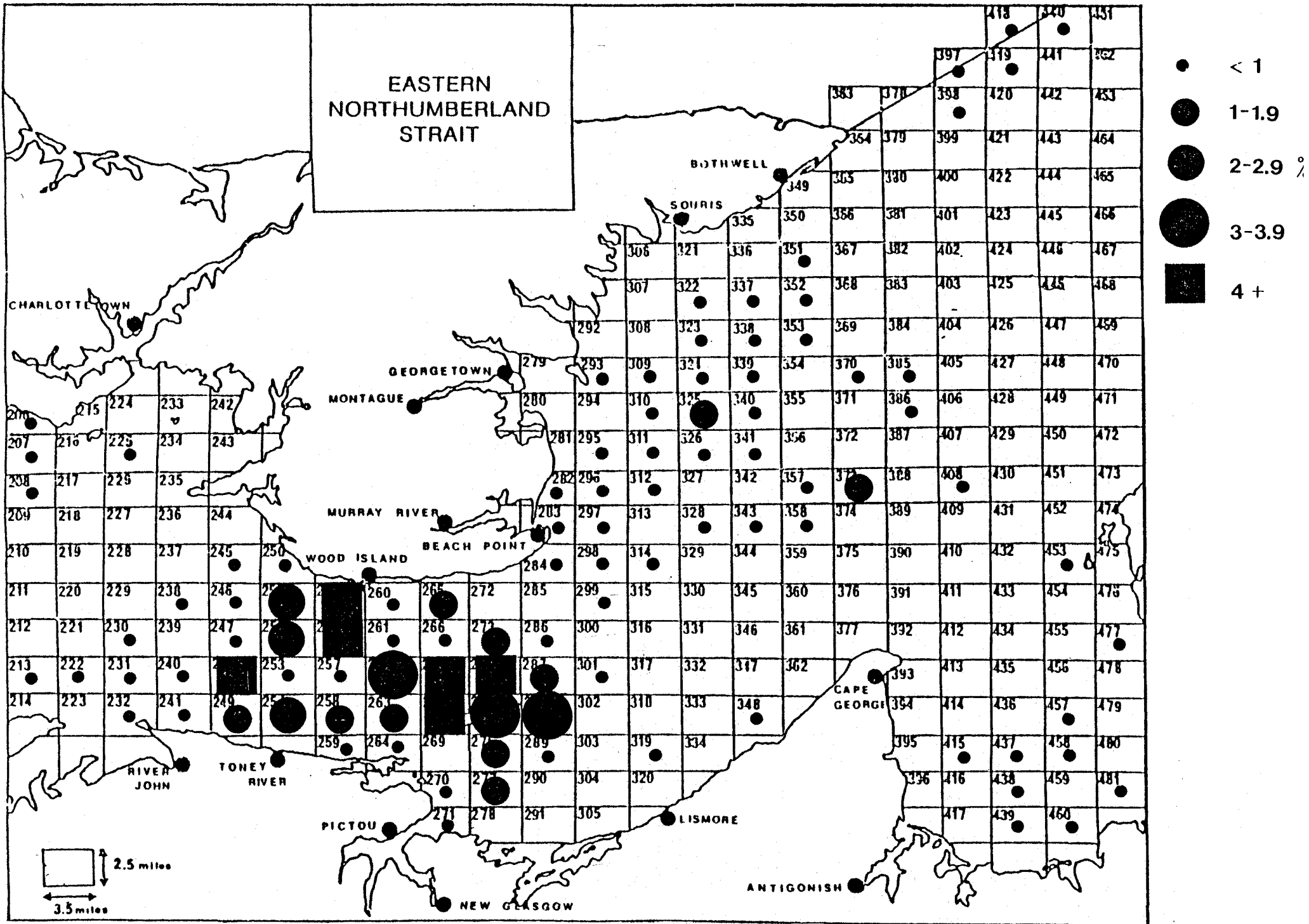
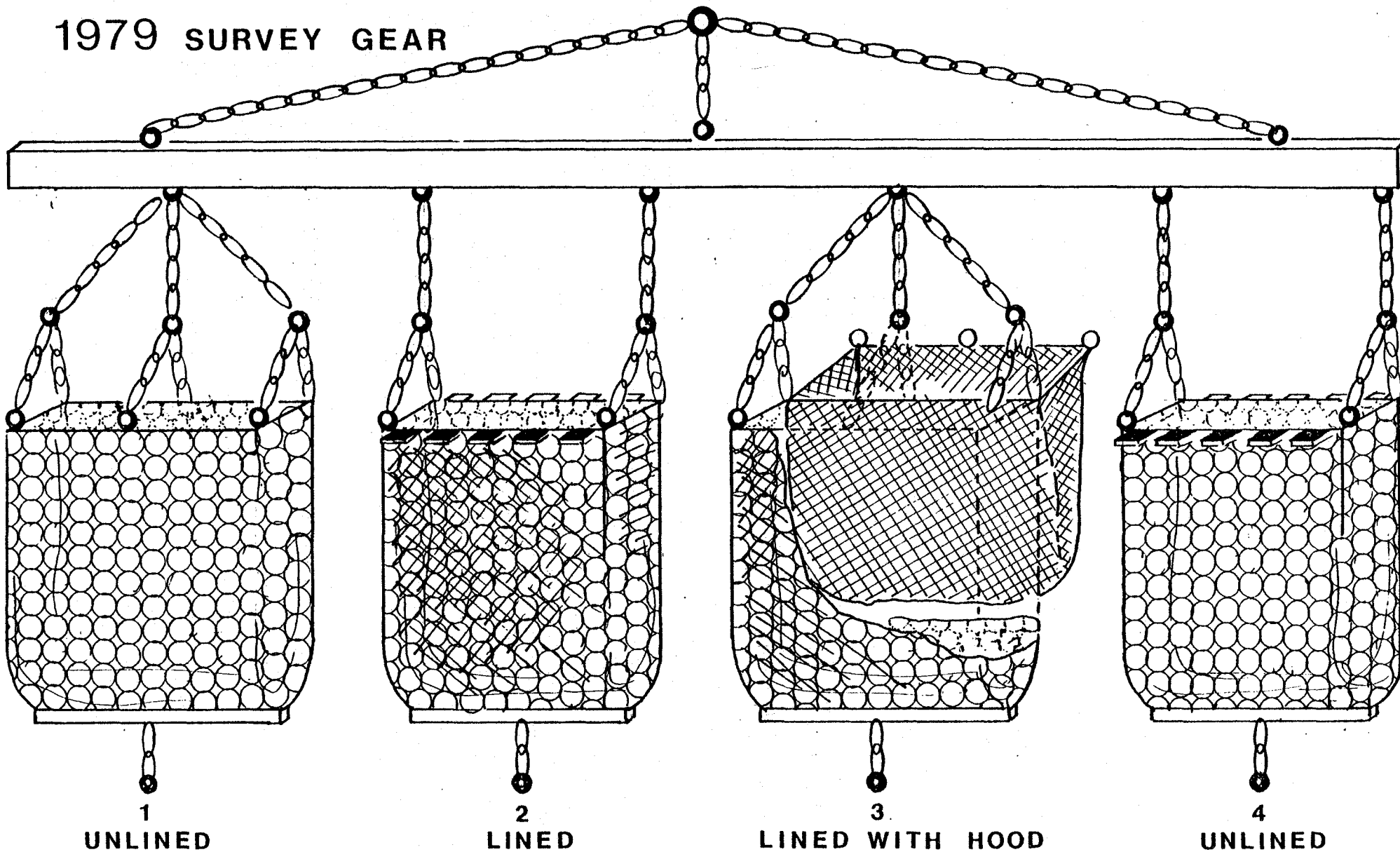


Fig. 4B: Boundaries of the unit areas used to denote fishing location in the eastern region, and the geographical distribution and relative magnitude of scallop landings in the eastern region of Northumberland Strait. The percent distribution of catch has been determined for this region independently.

1979 SURVEY GEAR

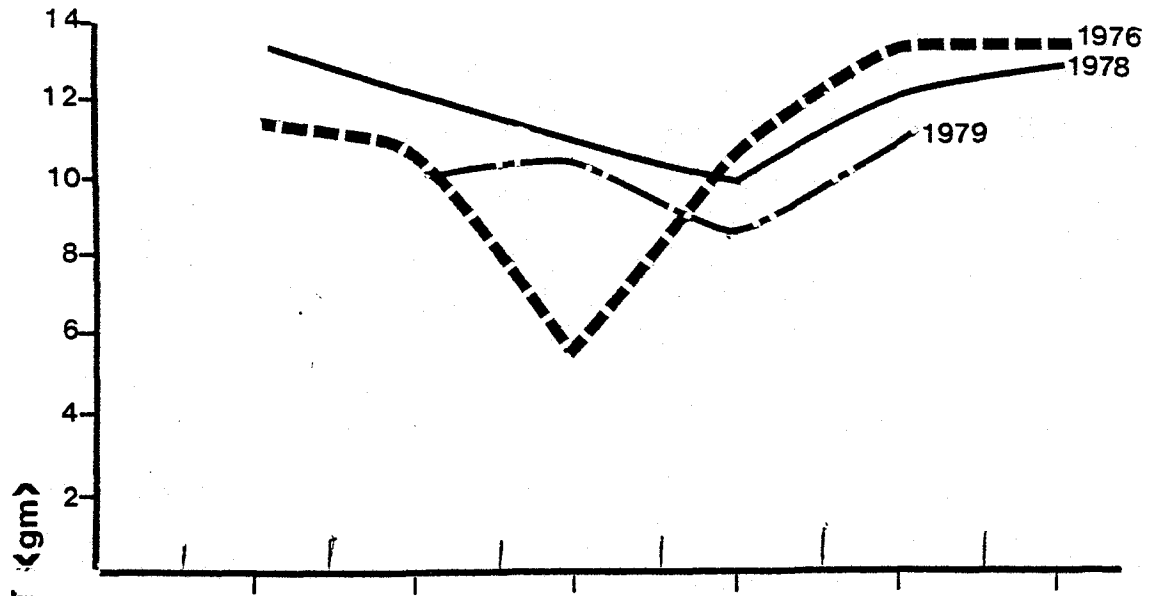


1 & 3: Digby Rock Drags

2 & 4: Gulf Rock Drags (toothed)

Fig. 5: The resource survey gear used in the western and central Northumberland Strait. In the eastern Strait, bucket 1 was a lined, Gulf rock drag and buckets 2, 3 and 4 were all unlined, Gulf rock drags.

A



B

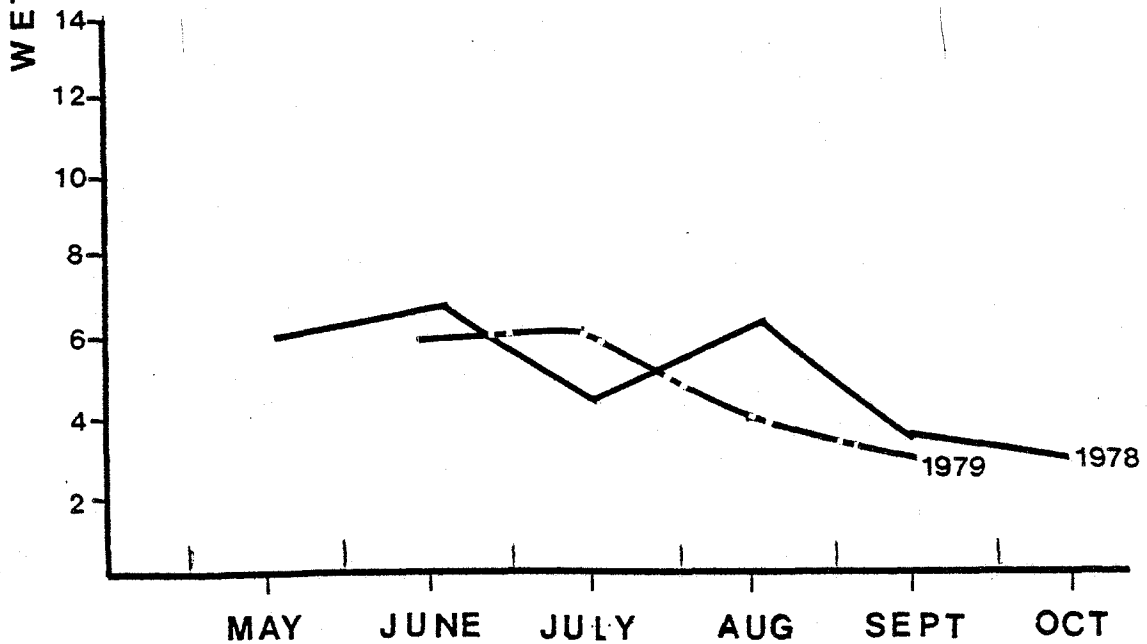


Fig. 6: Seasonal fluctuations in meat (A) and gonad (B) wet weights for a 90 mm scallop in the eastern region of Northumberland Strait during 1976, 1978 and 1979. No gonad wet weight data is available for 1976.

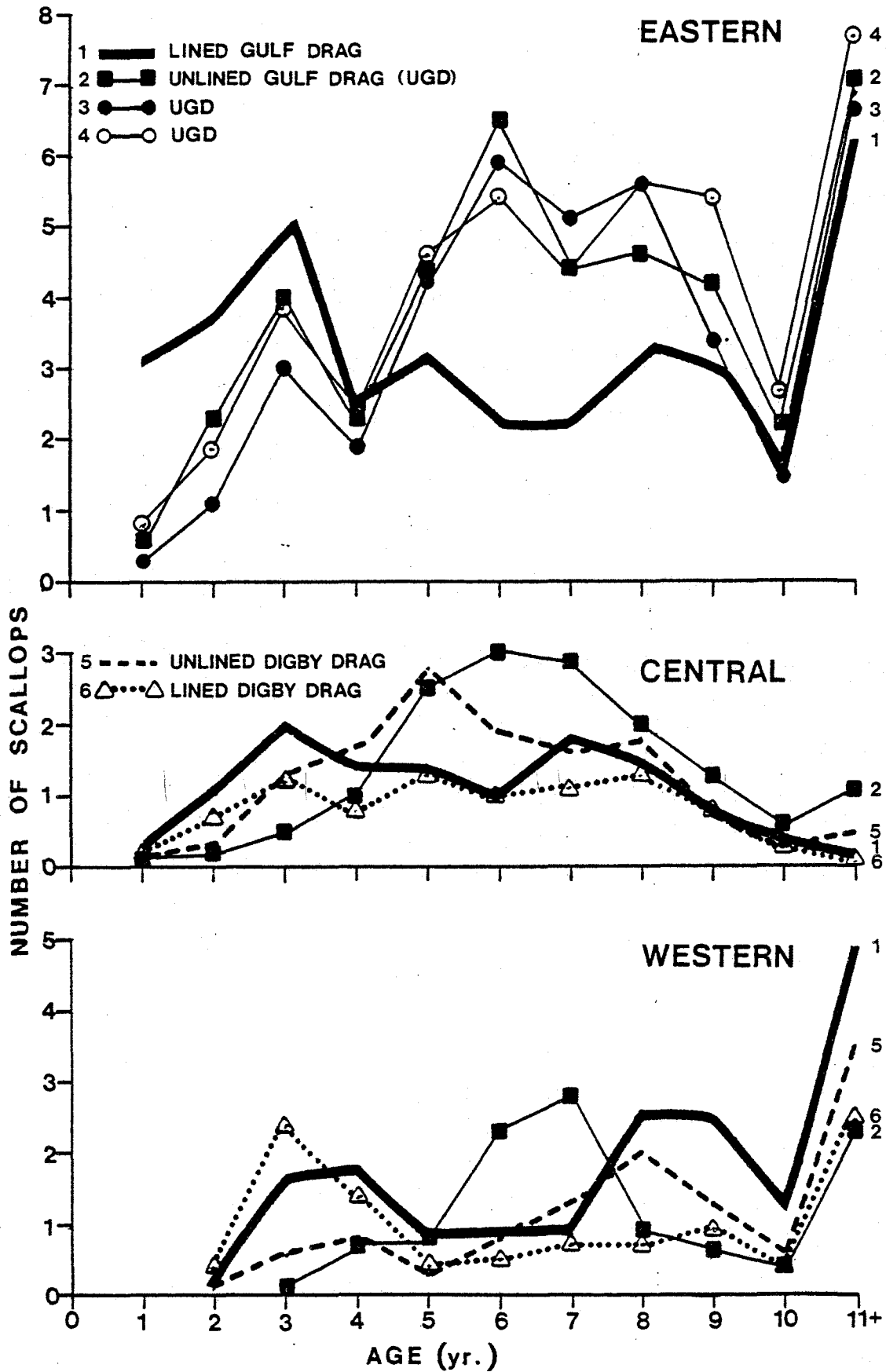


Fig. 7: Average catches of the four individual buckets in each region of Northumberland Strait. Scallop bucket width was standardized at 0.72m.

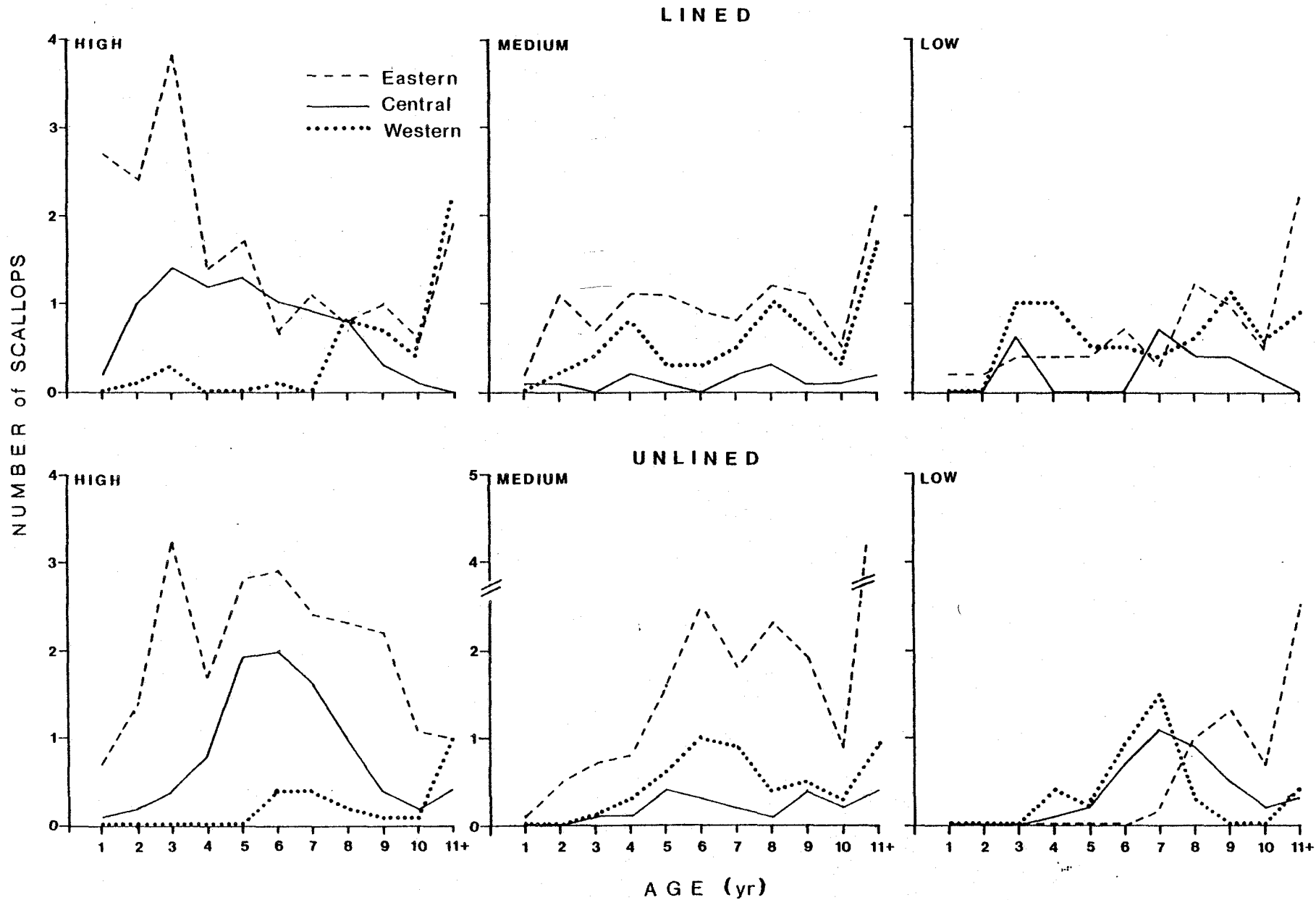


Fig. 8: Catch comparisons of a lined and unlined, Gulf rock bucket (0.72 m wide) in each region in each catch stratum (high, medium and low) in Northumberland Strait.

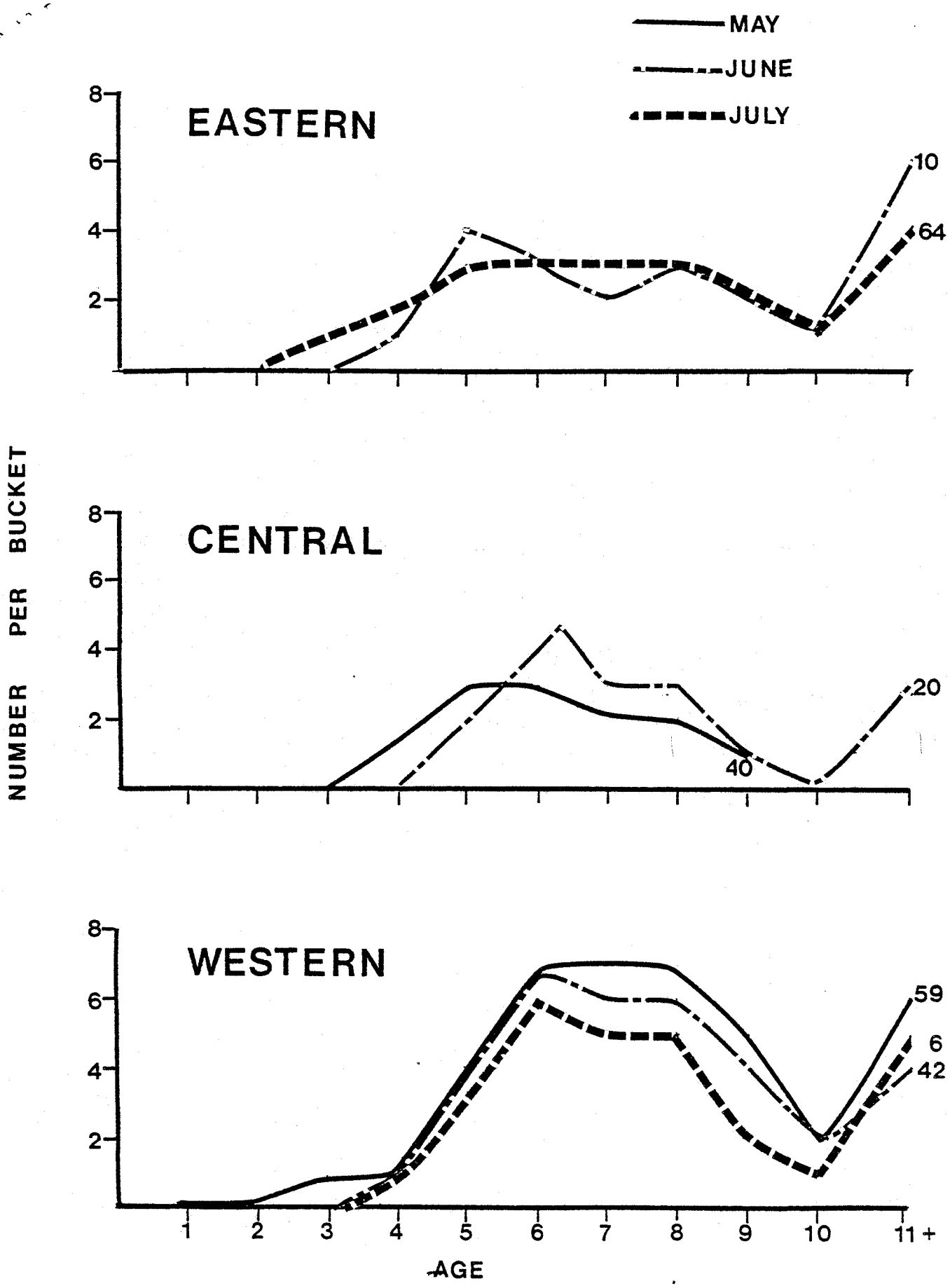


Fig. 9: Monthly scallop age frequencies per tow from commercial sampling in each region of the Northumberland Strait. Values equal number of tows sampled.