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Soft-Shell Clam Surveys in Charlotte County, New Brunswick - 1983

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SOFT-SHELL CLAM SURVEYS IN CHARLOTTE COUNTY, NEW BRUNSWICK - 1983

By

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Angus, R.B., P. Woo, C.M. Hawkins, and B. Mullen. 1985. Soft-shell clam surveys in Charlotte County, New Brunswick - 1983. Can. MS Rep. Fish. Aquat. Sci. 1812: vi + 69 p.

Assessments of soft-shell clam (*Mya arenaria*) stocks were carried out in three "closed" shellfish-growing areas in the Charlotte County, New Brunswick, area of the Scotia-Fundy Region.

In 1983, standing stocks of pre-recruits (30-41 mm in shell length) ranged from 34.0-89.5 bu/ha. Standing stock of recruits (43+ mm in shell length) ranged from 30.3-173.0 bu/ha. Isopleths of clam density are presented for each study area and indicate little spatial overlap in the distribution of clams within different recruitment categories.

RÉSUMÉ

Angus, R.B., P. Woo, C.M. Hawkins, and B. Mullen. 1985. Soft-shell clam surveys in Charlotte County, New Brunswick - 1983. Can. MS Rep. Fish. Aquat. Sci. 1812: vi + 69 p.

On a réalisé des évaluations des stocks de myes (*Mya arenaria*) dans trois zones de croissance "fermées" dans le comté de Charlotte, N.-B., faisant partie de la région de Scotian-Fundy. En 1983, la biomasse de pré-recrues (coquilles de 30 à 41 mm de longueur) variait de 34,0 à 89,5 bu/ha. La biomasse de recrues (coquilles de 42 mm et plus de longueur) variait de 30,3 à 173,0 bu/ha. On présente les isolignes de densité des myes pour chacune des régions étudiées; elles indiquent qu'i y a très peu de recouvrement spatial dans la répartition des myes pour différentes catégories de recruitment.

INTRODUCTION

Charlotte County, N.B. (Department of Fisheries and Oceans Statistical Districts 52, 53) has the highest soft-shell clam (Mya arenaria) production in New Brunswick, and is responsible for approximately one-quarter of all the Scotia-Fundy Region production (Table 1). This production continues despite the closure of many shellfish-growing areas due to bacteriological pollution (fecal coliform) and the presence of PSP (paralytic shellfish poisoning) during some of the summer months of the year. Information available from the Environmental Protection Service indicates that over 43% of possible clam harvesting areas are closed to clam harvesting due to bacteriological contamination (derived from Waller et al. 1976), and up to 100% can be closed due to PSP (when present).

Current interest in depuration as a means to increase production and relieve fishing pressure in open areas has demonstrated a need for information on the standing stock available for harvest as well as data on recruitment, growth rates, and productivity. These surveys are intended to add to the baseline data available for fishery managers.

Three areas were covered in this survey: the Mackenzies Bar area of the Magaguadavic River, Johnsons Cove in the St. Croix River, and the St. Andrews area (Fig. 1, 2, and 3). The St. Andrews survey continues from a 1982 survey (Yurick, 1982) northward and to the west and was divided into three sections to facilitate sampling.

MATERIALS AND METHODS

Samples were collected from three target areas in Charlotte Co. (Fig. 1, 2, and 3): The Mackenzies Bar area of the Magaguadavic River, Johnson Cove in the St Croix River, and the St. Andrews area. The St. Andrews area was subdivided into three sections (Areas 1, 2, and 3). All areas covered in this survey were closed to clam harvesting due to bacterial contamination.

POPULATION SURVEY

In all areas samples were collected at 20 m intervals along parallel lines 20 m apart and aligned perpendicular to a baseline positioned along the shoreline to give a projected sampling intensity of 0.025%. The baseline was set arbitrarily at the first appearance of live clams in the sediment seaward of the shore. Transect lines were extended from the baseline to a point where sediments were completely covered with water at mean low tide or until they reached extremely soft muds where no clams were found. Proper transect orientation was ensured using a Silva Ranger (Model 15T) compass and a marked 20 m length of rope. Total area surveyed along with total area sampled was calculated with the aid of a Hewlett-Packard 9874A Digitizer.

Several researchers have noted that soft-shell clams may burrow to a depth of 20 cm (Medcof 1950; Robert 1981; Witherspoon 1982; 1983). Consequently, we selected 20 cm as the sampling depth in a 0.1 m^2 quadrat samples. To ensure that small clams (<6 mm shell length) were effectively sampled, we initially removed the top 5 cm of substrate with a garden trowel (cf. Moller and Rosenberg 1983), then bagged and labelled this subsample for processing in the laboratory. The remaining sample (to 20 cm) was removed with a square-nose shovel and immediately washed through a 18 mm then a 6 mm mesh plastic sieve. All soft-shell clams retained by the field sieving process were bagged, labelled, and returned to the laboratory for further analysis. At the laboratory, sediment containing clams from the top 5 cm was washed through a 1 mm sieve and all clams retained were removed for measurement. Clams were measured with the aid of a modified fish measuring board or vernier calipers and grouped into three recruitment categories based on size: early recruits $\leq$ 29 mm in shell length), pre-recruits (30-41 mm in shell length), and recruits (market size - 42+ mm in shell length).

Clam distribution and abundance (clams/m^2) within the above length categories were determined for all survey stations. Frequency distributions were generated using the size categories 0 to 16 mm, 17 to 22 mm, 23 to 29 mm, 30 to 35 mm, 36 to 41 mm, 42 to 48 mm, 49 to 54 mm, 55 to 60 mm, 61 to 67 mm, 68 to 74 mm, and 74+ mm. The percentage composition attributed to each of the recruitment categories was then obtained from these frequency distributions and established for each sample. Using these values and the estimated total number of individuals in a known sampling area, the density of clams within each recruitment category was calculated and plotted for all surveyed areas. Subsequently, density isopleths were drawn by eye to delineate areas of similar concentrations.

RESULTS

In this study the surveyed area refers to the estimated total area of the clam flat, including rocky and other non-productive areas, while the sampled area is that portion of the surveyed area covered by sampling transects. The total area surveyed in Charlotte Co. was 134.0 ha, with 76.4 ha covered with sampling stations (Table 2).

MACKENZIES BAR

A total of 28 transects encompassing 320 stations were established in the Mackenzies Bar area of the Magaguadavic River (Fig. 4). This constituted a surveyed area of 33.9 ha with 13.8 ha (40%) sampled. This resulted in a sampling intensity of 0.024%. Distribution of the sampling stations and transects is shown in Figure 4. Substrate consisted of areas of mud, sand, gravel, and bedrock. Mackenzies Bar showed a prominent modal peak in the size frequency distribution of individuals sampled (Fig. 5). This peak represented individuals from 0-16 mm in shell length and comprised 78% of the total sampled population. Early recruits (≦29 mm) accounted for 88.3% of the sampled population. Pre-recruits (30-41 mm) and recruits (42+ mm) represented 5.2% and 6.5% of the sampled population respectively. Standing stock of pre-recruits in this area was calculated at 62.5 bu/ha (1,404 kg/ha) and recruits at 173 bu/ha (5,208 kg/ha). Isopleths of clam densities in each of the three recruitment categories were generated (Fig. 6, 7, and 8).

JOHNSON COVE

Samples were collected at 328 stations along 46 transects. A total of 17.9 ha were surveyed, while 13.6 ha were sampled (75.9%). This resulted in a sampling intensity of 0.025%. Distribution of the sampling stations and transects are illustrated in Figure 9. Many areas within the Cove have extremely rocky bottoms; these areas were not sampled. A size frequency distribution for clams collected in this area indicates a modal peak in the 0-16 mm shell length range (Fig. 10). This mode comprised 73% of the total sampled population. Early recruits (≦ 29 mm in shell length) accounted for 81.4% of the sampled population, followed by pre-recruits which comprise 12.1% and recruits which comprised 6.5% of the sampled population. Standing stock of pre-recruits in the Johnson Cove area was calculated at 89.5 bu/ha (2,017 kg/ha) and recruits at 85.0 bu/ha (2,537 kg/ha). Isopleths of clam densities in each of the three recruitment categories were generated (Fig. 11, 12, and 13).

ST. ANDREWS

The St. Andrews area extended from Indian Point northward to Pottery Cove (Fig. 3). Large rocky, non-clam-producing areas (Fig. 14, 15, and 16) accounted for about 60% of the total surveyed area. Over the whole area, samples were collected at a total of 1,172 stations along 123 transects covering a surveyed area of 82.2 ha with 49.04 ha sampled (59.7%). Sampling intensity was 0.021% with samples distributed, as shown in Figures 17, 18, and 19. Size frequency distributions for clams collected in each of the three subdivisions of the St. Andrews area indicated that clams 0-16 mm in shell length comprised the largest percentage of the sampled population - 67%, 65%, and 56% respectively.

In Area 1 early recruits (0-29 mm) accounted for 77.0% of the survey population, pre-recruits 10.4%, and recruits 12.6%. Area 1 also exhibited a standing stock of pre-recruits at 44.6 bu/ha (1,005.5 kg/ha) and recruits at 113 bu/ha (3,588 kg/ha) (Table 3). In Area 2, early recruits accounted for 83% of the sampled population; pre-recruits and recruits each represented 8.5%. The standing stock in Area 2 was calculated at 63 bu/ha (1,338 kg/ha) of pre-recruits and 144 bu/ha (4,349 kg/ha) for recruits (Table 3). The surveyed population in Area 3 was composed of 89.7% early recruits, 7.8% pre-recruits, and 2.5% recruits. Pre-recruit standing stock in Area 3 was calculated at 34 bu/ha (741 kg/ha) and recruit standing stock at 30.3 bu/ha (967.5 kg/ha) (Table 3). Isopleths of clam densities in each of the three recruitment categories were generated (Fig. 20 to 28).

A comparison among the areas surveyed and the percentage of the sampled population attributed to each of the three recruitment categories is shown in Table 4. In all areas, early recruits comprised the greatest proportion of the sampled population, with values of pre-recruits and recruits markedly lower. The spatial distribution of each recruitment category is shown in Figures 6 to 8, 11 to 13, and 20 to 28. In general there appears to be little overlap in the pattern of clam density distribution between different recruitment categories.

DISCUSSION

This survey extended a previous survey in the St. Andrews area (Yurick 1982) and covered two additional areas - Mackenzies Bar in the Magaguadavic River, and Johnson Cove in the St. Croix River. These areas were expected to have unexploited clam resources and there was the possibility of "opening" the areas to harvesting for depuration.

Previous population surveys in Charlotte Co. include MacPhail (1948) and Robert and Smith (1980). As both surveys used different sampling methodology and were completed 35 yr and 9 yr ago respectively (Robert's and Smith's survey was completed in July 1974), comparisons are hard to make. However, it must be noted that the Magaguadavic River and the St. Andrews area were then and continue to be good producers.

The 0-16 mm shell length size class was the largest component in the standing stock of each area. The percent frequency of all other size classes dropped off rapidly. The one area (St. Andrews Area 3), that had the lowest number of recruited clams, had a high number of pre-recruits which may indicate a larger population available for harvesting in the future years. The patchiness of distribution as described by Robert and Smith (1980) is very apparent in the density isopleths of the early recruits (Fig. 26, 27, and 28) and, as they suggest, could reflect poor juvenile survival and hence overall recruitment in this area.

Although densities of soft-shell clams in all these areas may support a depuration facility in the short term, there is no evidence that these stocks could support long-term harvesting. This requires more detailed analysis of recruitment and survival in these areas. Comparison of this study with a similar one undertaken in the Annapolis Basin (Angus et al. 1985) during the same year indicates that in all cases Charlotte Co. is a much better clam producer with the standing stock of recruits surpassing that of Annapolis Basin. Annapolis Basin standing stock ranged from 11.4-31.2 bu/ha compared to 30.3-173.0 bu/ha for Charlotte Co.

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We would like to thank Bill Groom of the New Brunswick Department of Fisheries and Section 38 Job Creation Program for supporting the survey; Joe Pomeroy for conducting the survey; and Jamie Young and John Tremblay for reviewing the manuscript.

Table 1. Soft-shell clam landings* in the Scotia-Fundy Region for the last 12 yr.

Year	New Brunswick Scotia-Fundy total (t)	Charlotte Co., N.B., total (t)	% of total landings, New Brunswick	Total Scotia-Fundy landings (t)	% of Scotia-Fundy landed in New Brunswick
1972	1,246	1,246	100.0	2,265	55.0
1973	1,631	1,629	99.8	2,891	56.3
1974	467	460	98.5	1,372	33.5
1975	258	251	97.3	1,254	20.0
1976	183	177	96.7	1,128	15.7
1977	458	458	100.0	1,771	25.9
1978	390	390	100.0	1,963	19.9
1979	412	412	100.0	1,691	24.3
1980	651	651	100.0	2,792	23.3
1981	448	433	96.6	2,583	16.8
1982	943	903	95.7	3,309	27.3
1983	1,062	1,009	95.0	3,084	32.7

*Statistics Division, Management Services Branch, Department of Fisheries and Oceans, Scotia-Fundy Region, Halifax, N.S., B3J 2S7.

Table 2. Areal coverage of study areas in Charlotte Co., N.B.

Location	Surveyed hecatares[1]	Sampled hectares[2]
Mackenzies Bar	33.9	13.8
Johnson Cove	17.9	13.6
St. Andrews	82.2	49.0
Total	134.0	76.4

[1]Surveyed area refers to the estimated total area of the clam flat.
[2]Sampled area refers to that portion of the surveyed area covered by the sampling program.

Table 3. Standing stock of soft-shell clams expressed in bushels* and kilograms per hectare.

	Pre-recruits		Recruits	
Area	(kg/ha)	(kg/ha)	(bu/ha)	(kg/ha)
Mackenzies Bar	62.6	1,404	173.0	5,208
Johnson Cove	89.5	2,017	85.0	2,537
St. Andrews Area 1	44.6	1,005	113.0	3,588
St. Andrews Area 2	63.0	1,338	144.0	4,349
St. Andrews Area 3	34.0	741	30.3	967

*Based on 27.3 kg per bushel (Robert 1981).

Table 4. Percentage of the surveyed population attributed to the three recruitment categories.

Area	Recruitment category		
	% early recruit	% pre-recruit	% recruit
Mackenzies Bar	88.3	5.2	6.5
Johnson Cove	81.4	12.1	6.5
St. Andrews Area 1	77.0	10.4	12.6
St. Andrews Area 2	83.0	8.5	8.5
St. Andrews Area 3	89.7	7.8	2.5

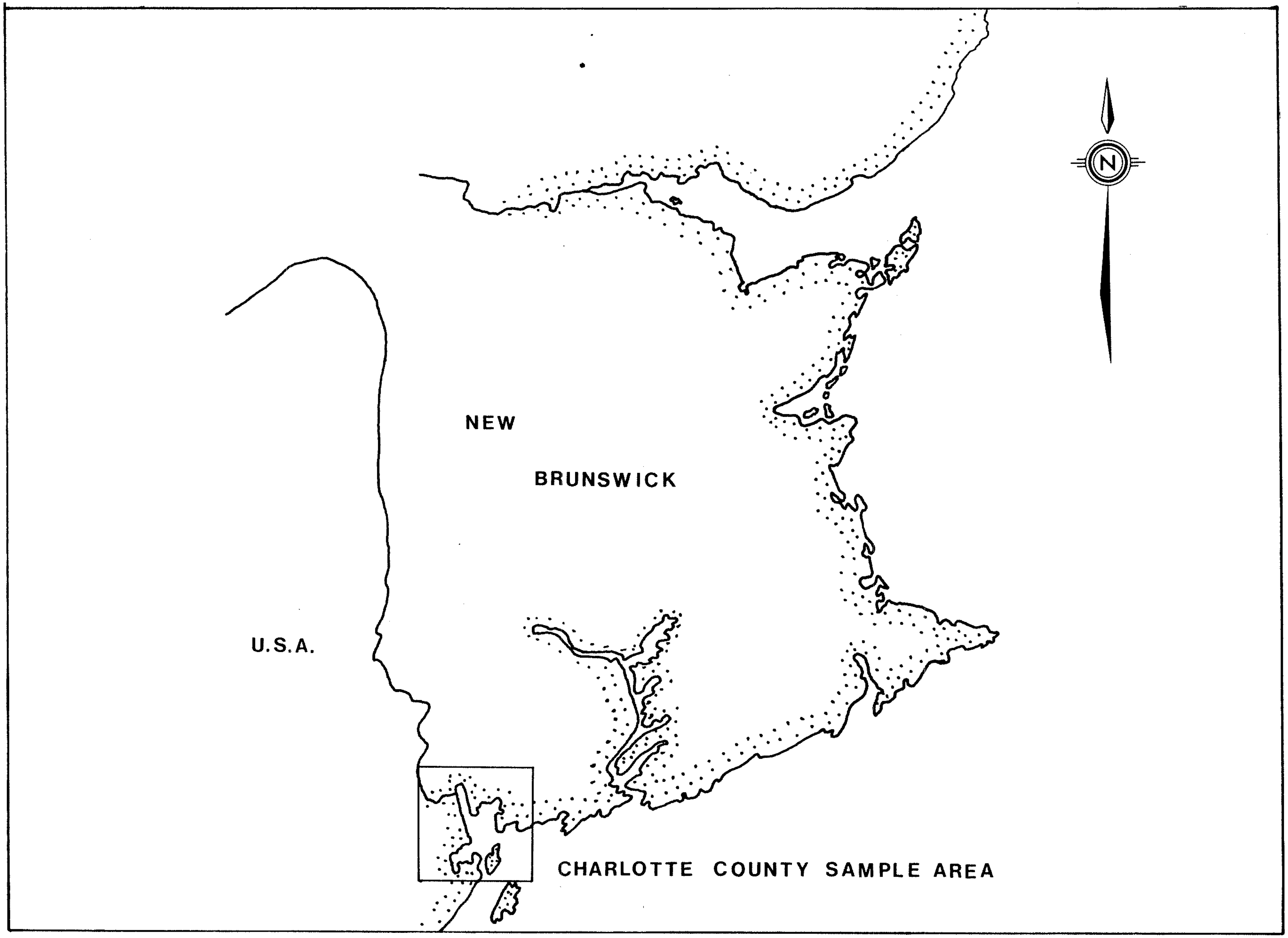

Fig. 1. Charlotte Co. sample area.

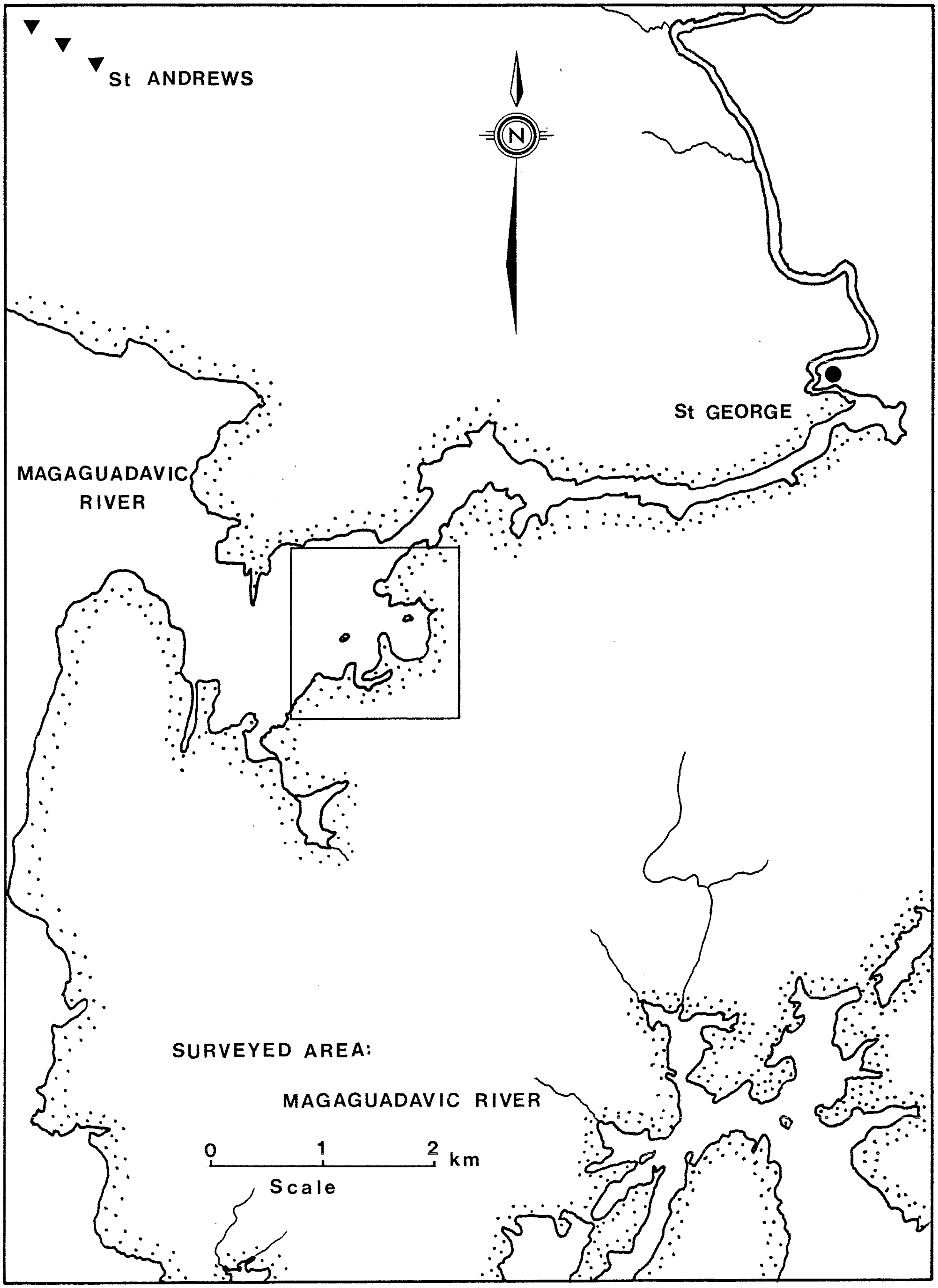

Fig. 2. Mackenzie Bar area of Magaguadavic River.

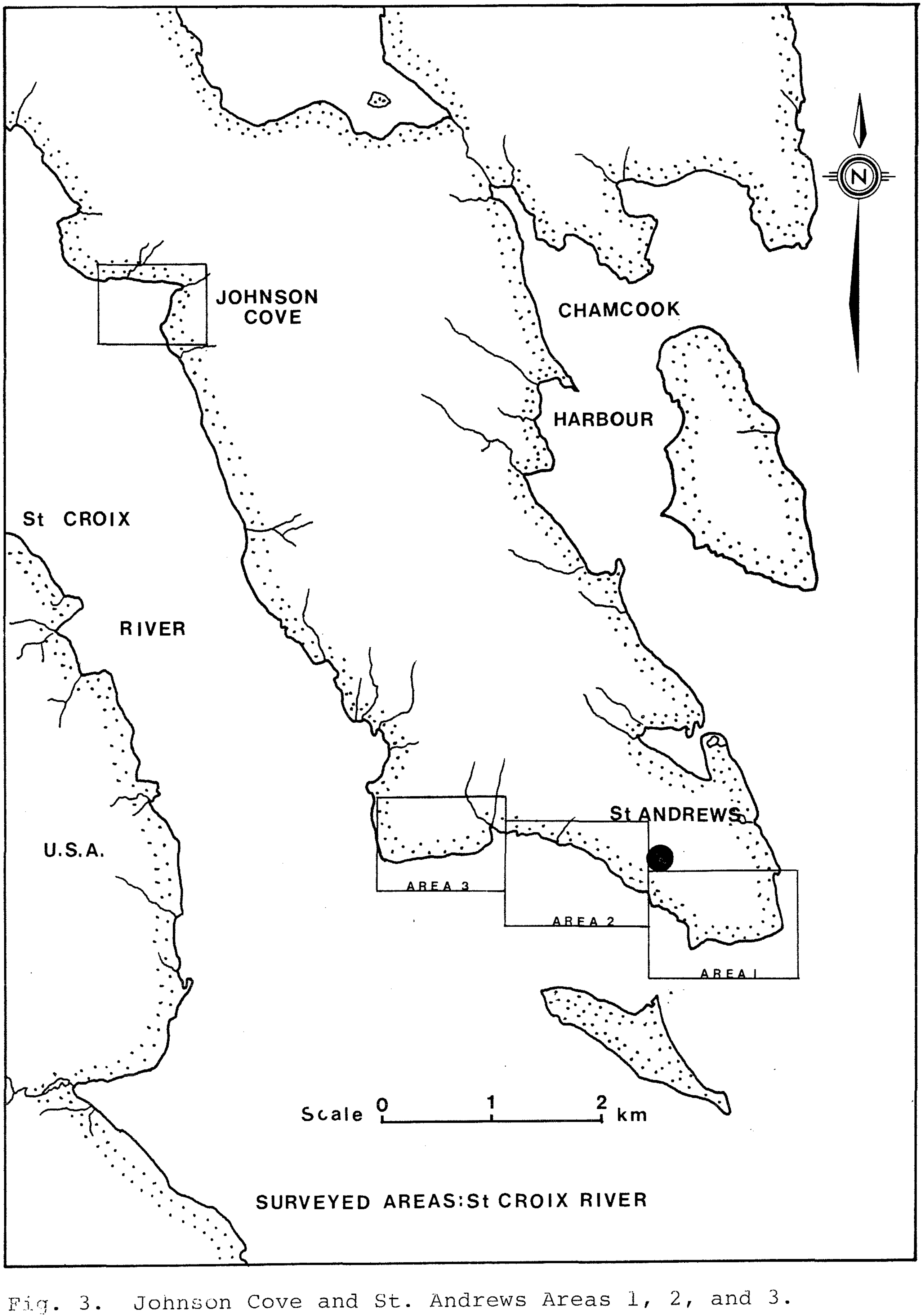

Fig. 3. Johnson Cove and St. Andrews Areas 1, 2, and 3.

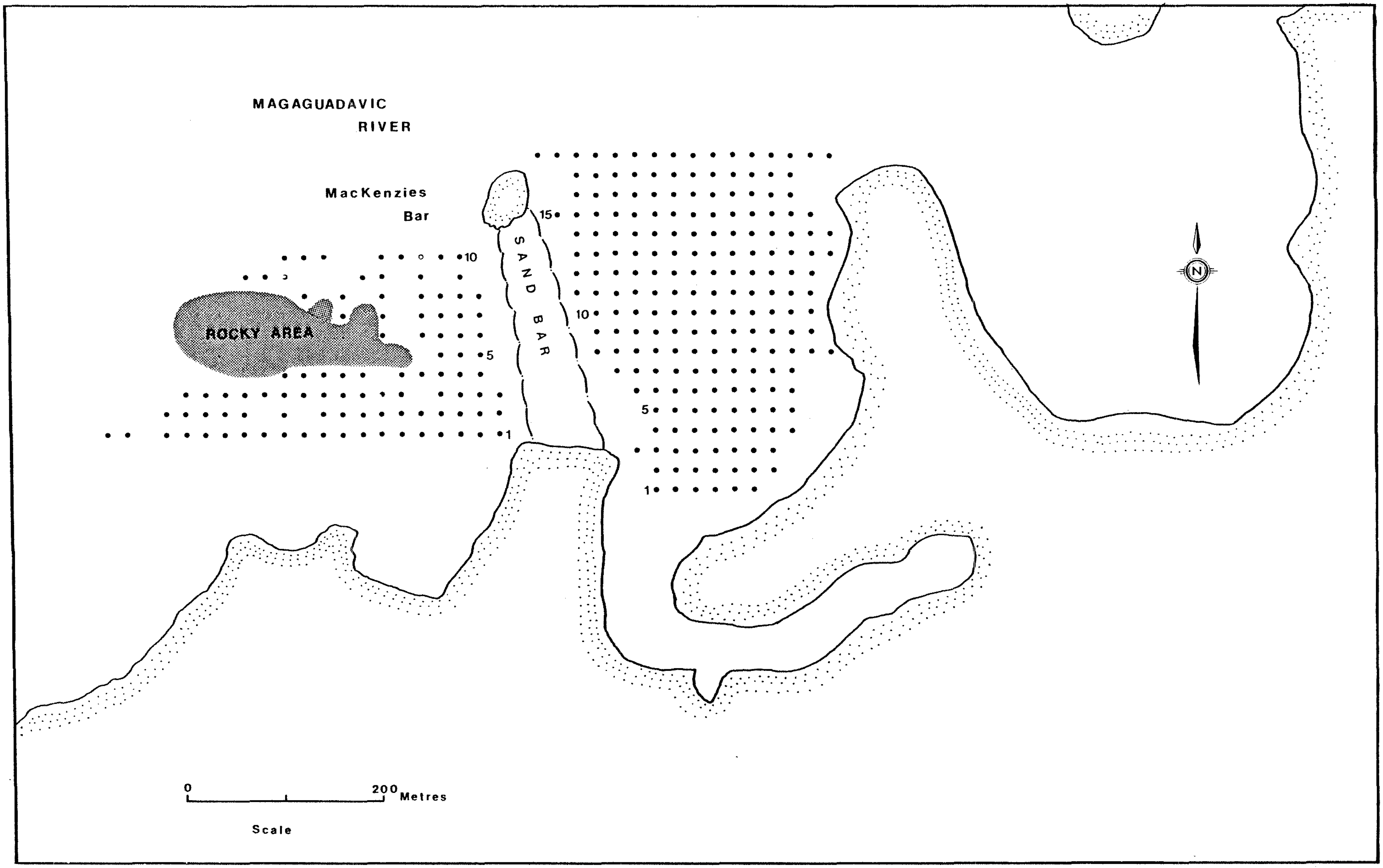

Fig. 4. Mackenzies Bar transects and stations.

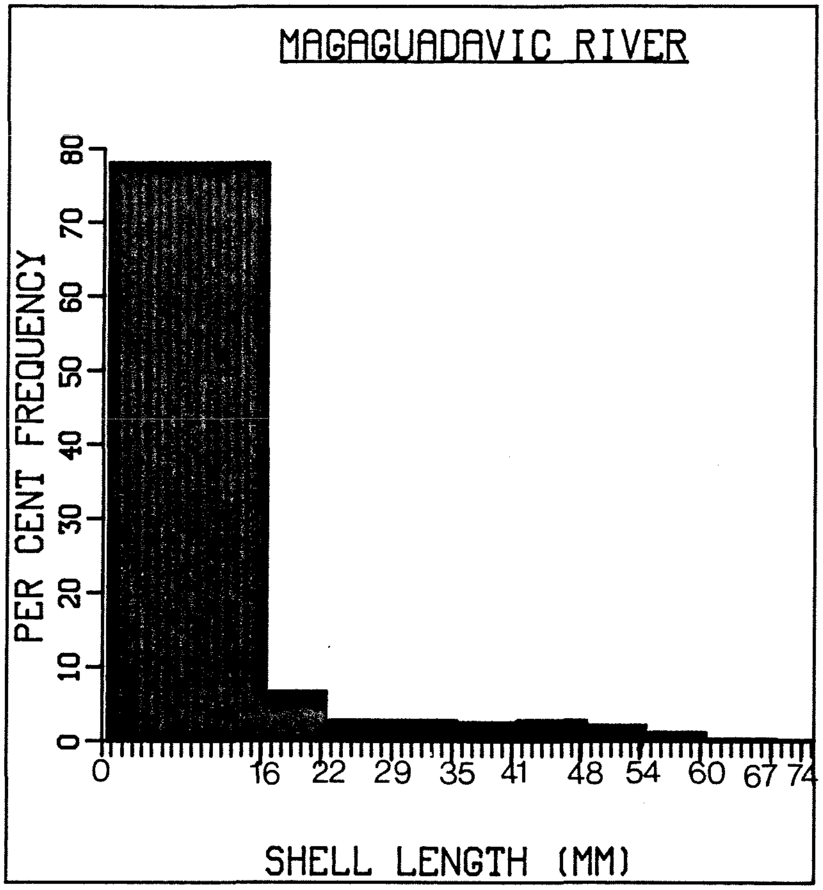

Fig. 5. Mackenzies Bar size frequency distribution.

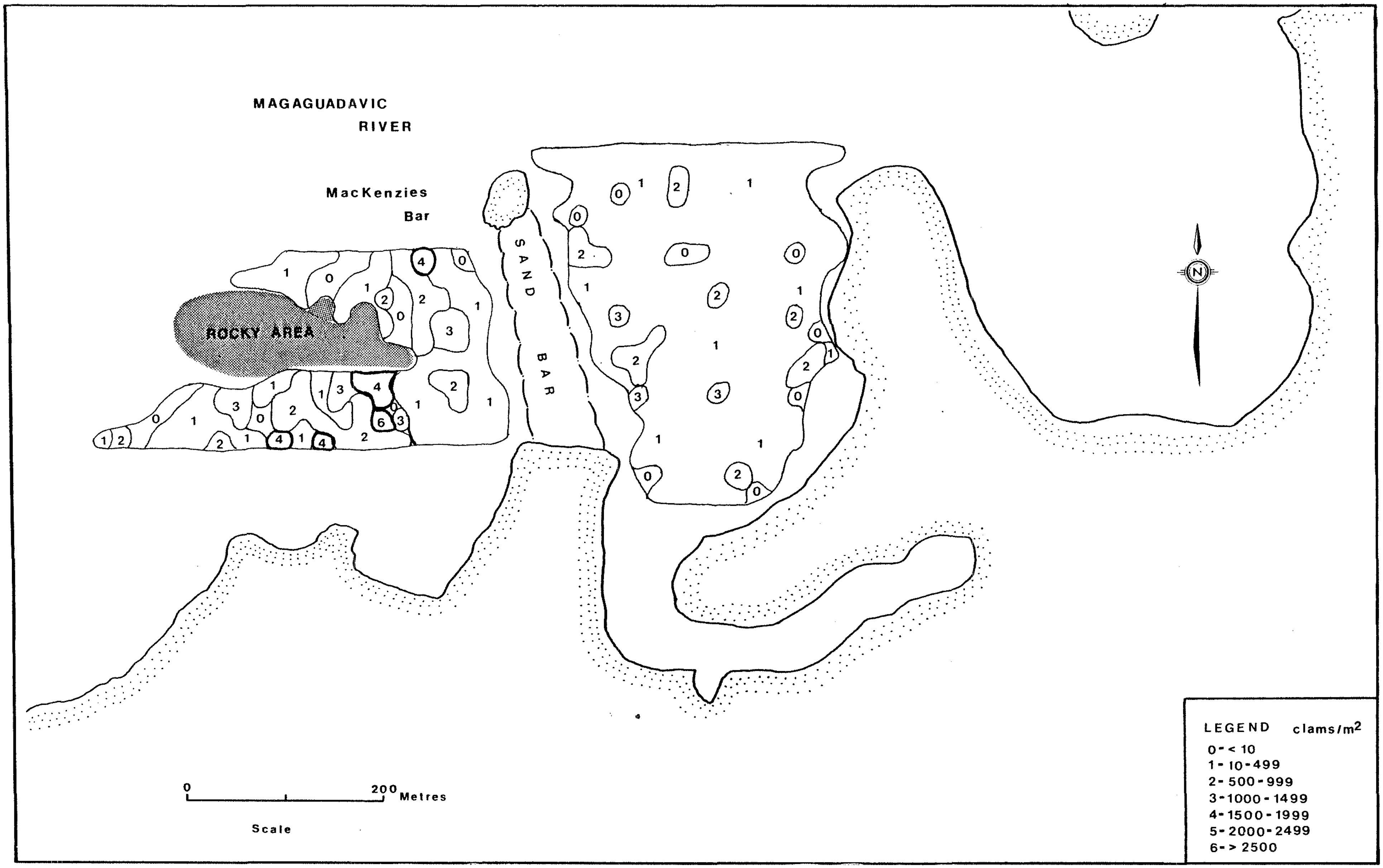

Fig. 6. Mackenzies Bar - isopleths of clam density distribution - early recruits.

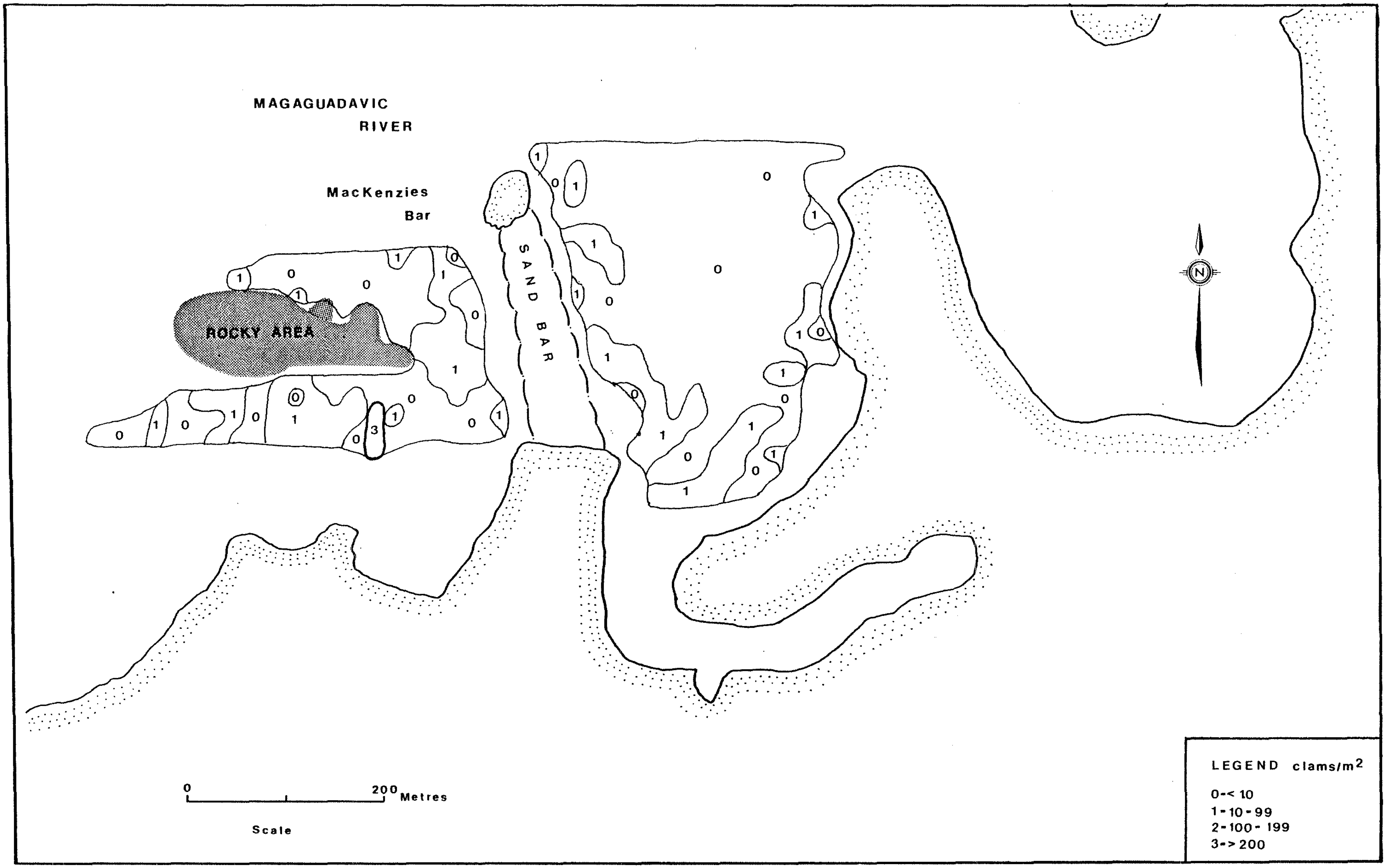

Fig. 7. Mackenzies Bar - isopleths of clam density distribution - pre-recruits.

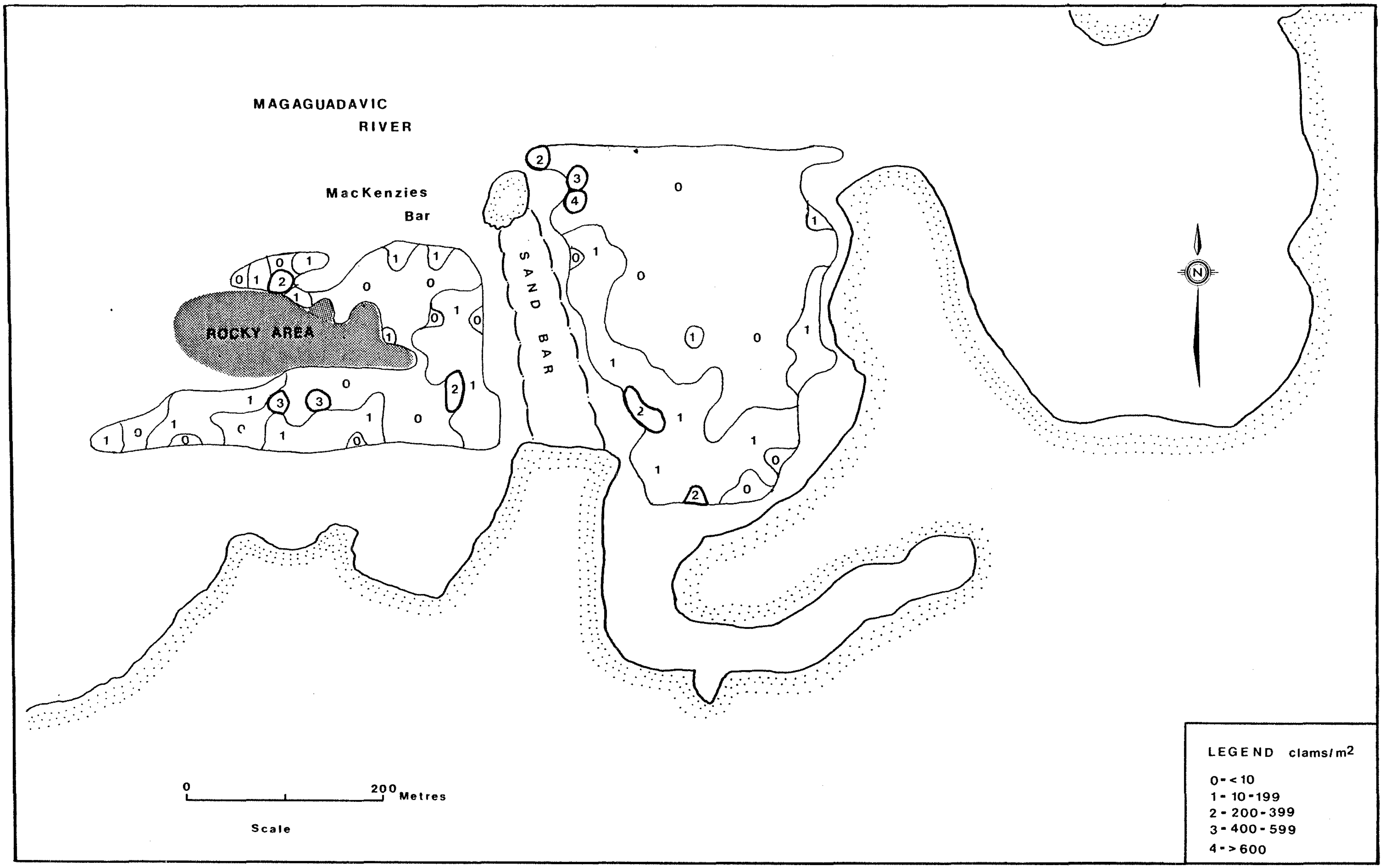

Fig. 8. Mackenzies Bar - isopleths of clam density distribution - recruits.

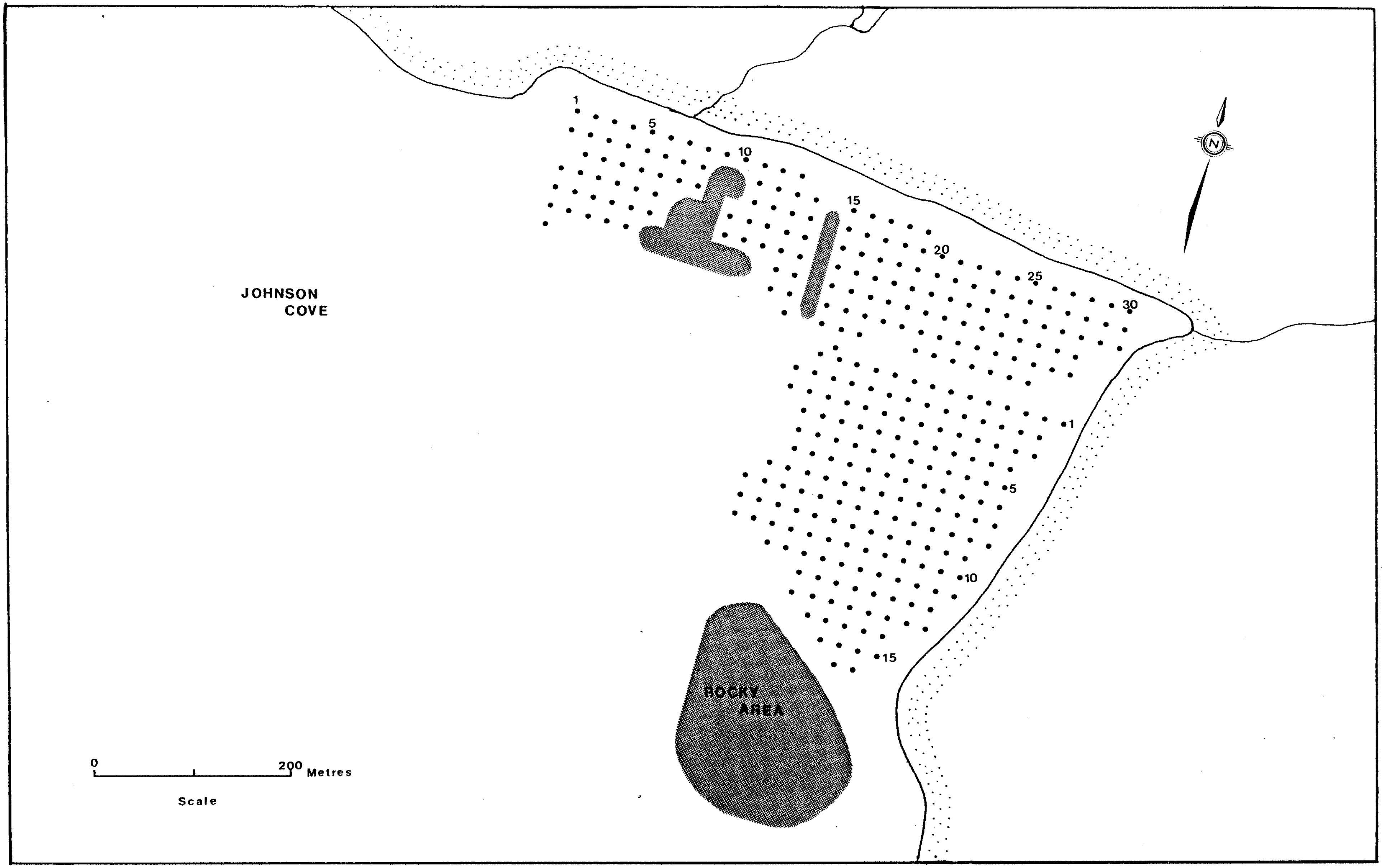

Fig. 9. Johnson Cove sampling distribution.

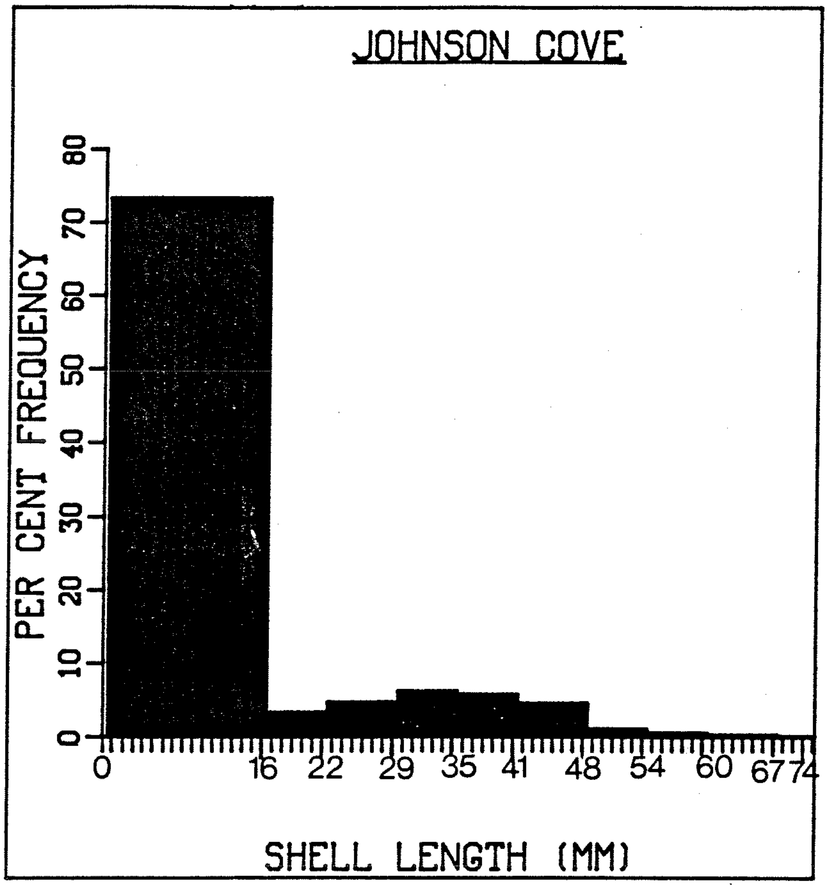

Fig. 10. Johnson Cove size frequency distribution.

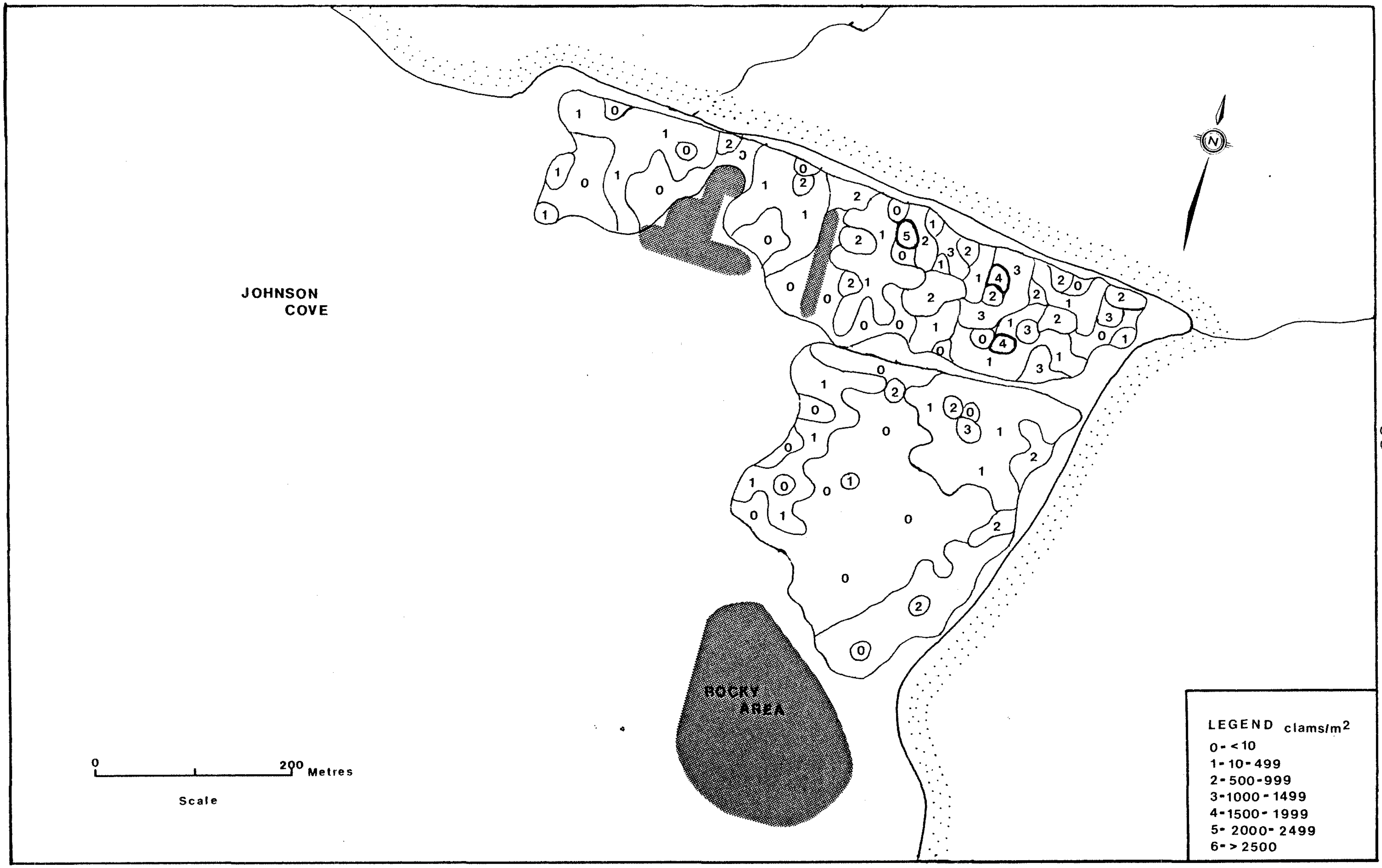

Fig. 11. Johnson Cove - isopleths of clam density distribution - early recruits.

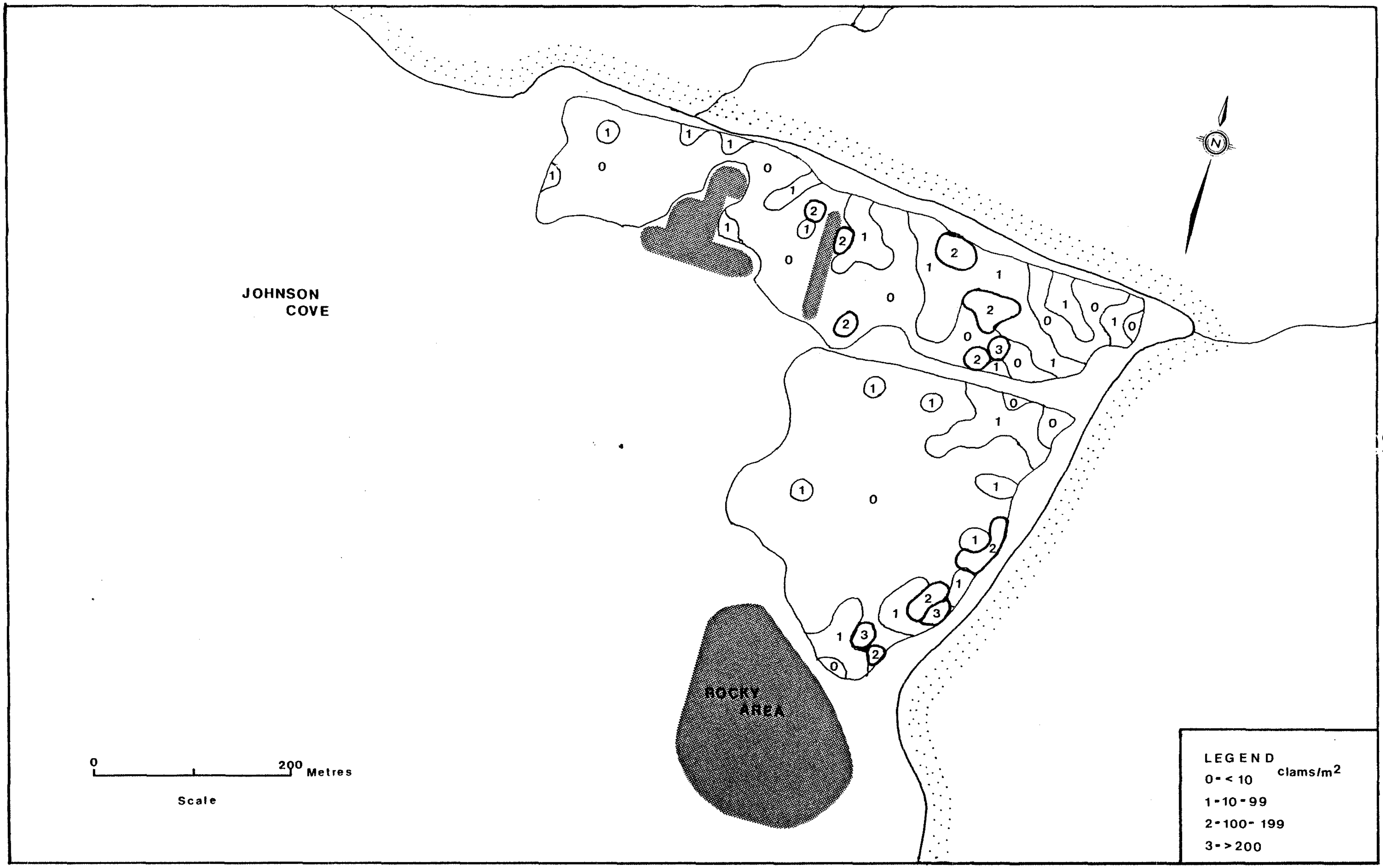

Fig. 12. Johnson Cove - isopleths of clam density distribution - pre-recruits.

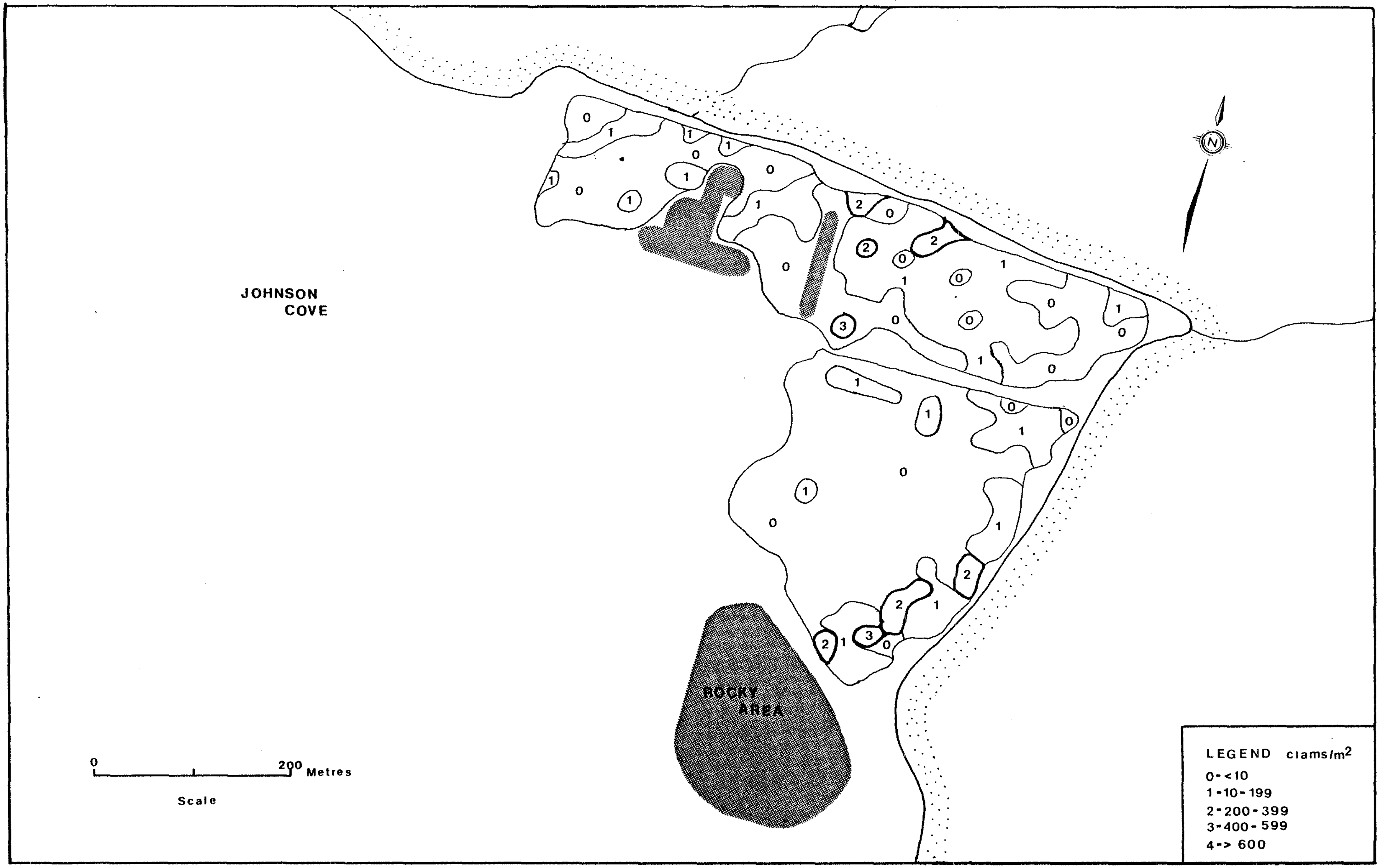

Fig. 13. Johnson Cove - isopleths of clam density distribution - recruits.

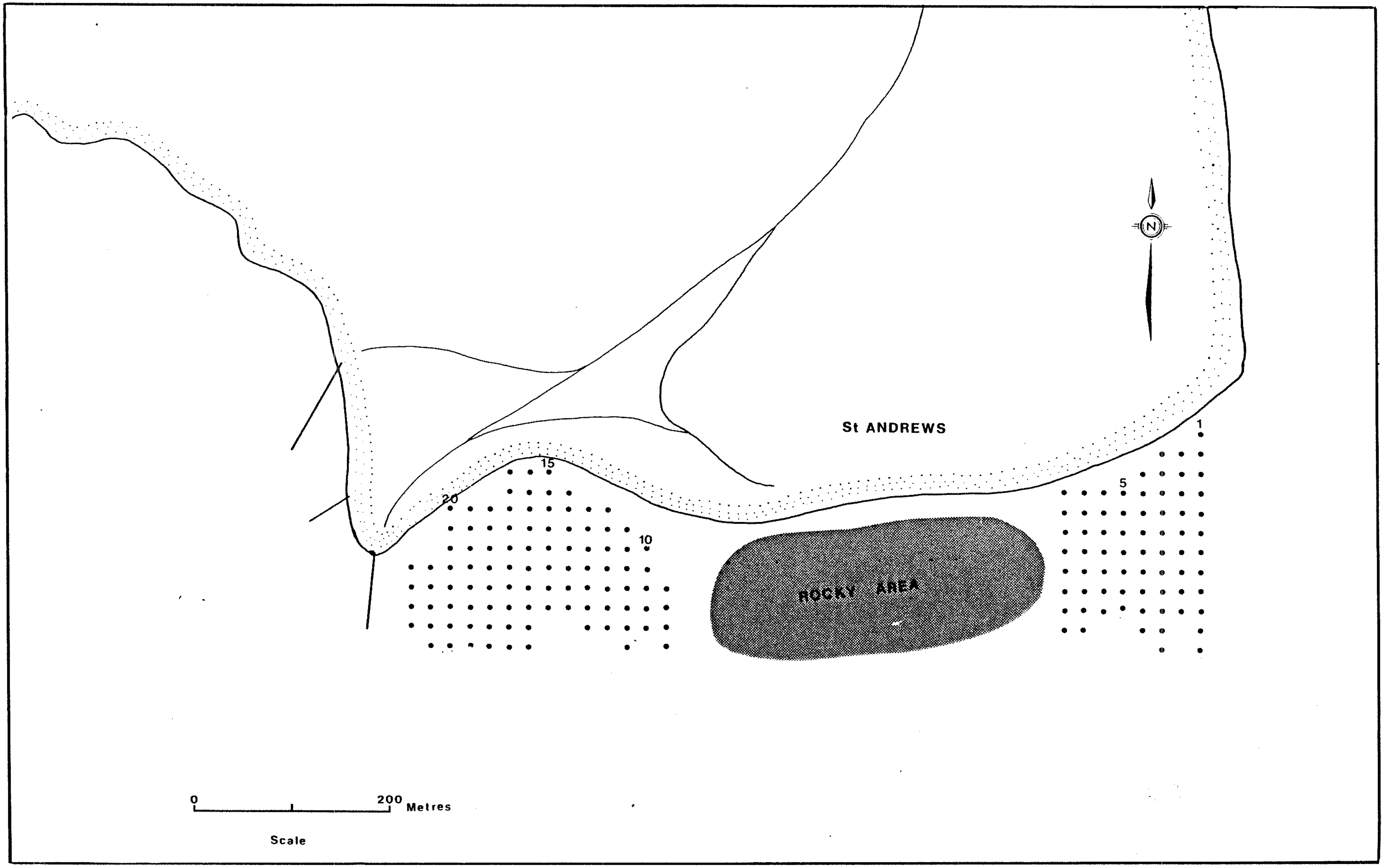

Fig. 14. St. Andrews sampling distribution - Area 1.

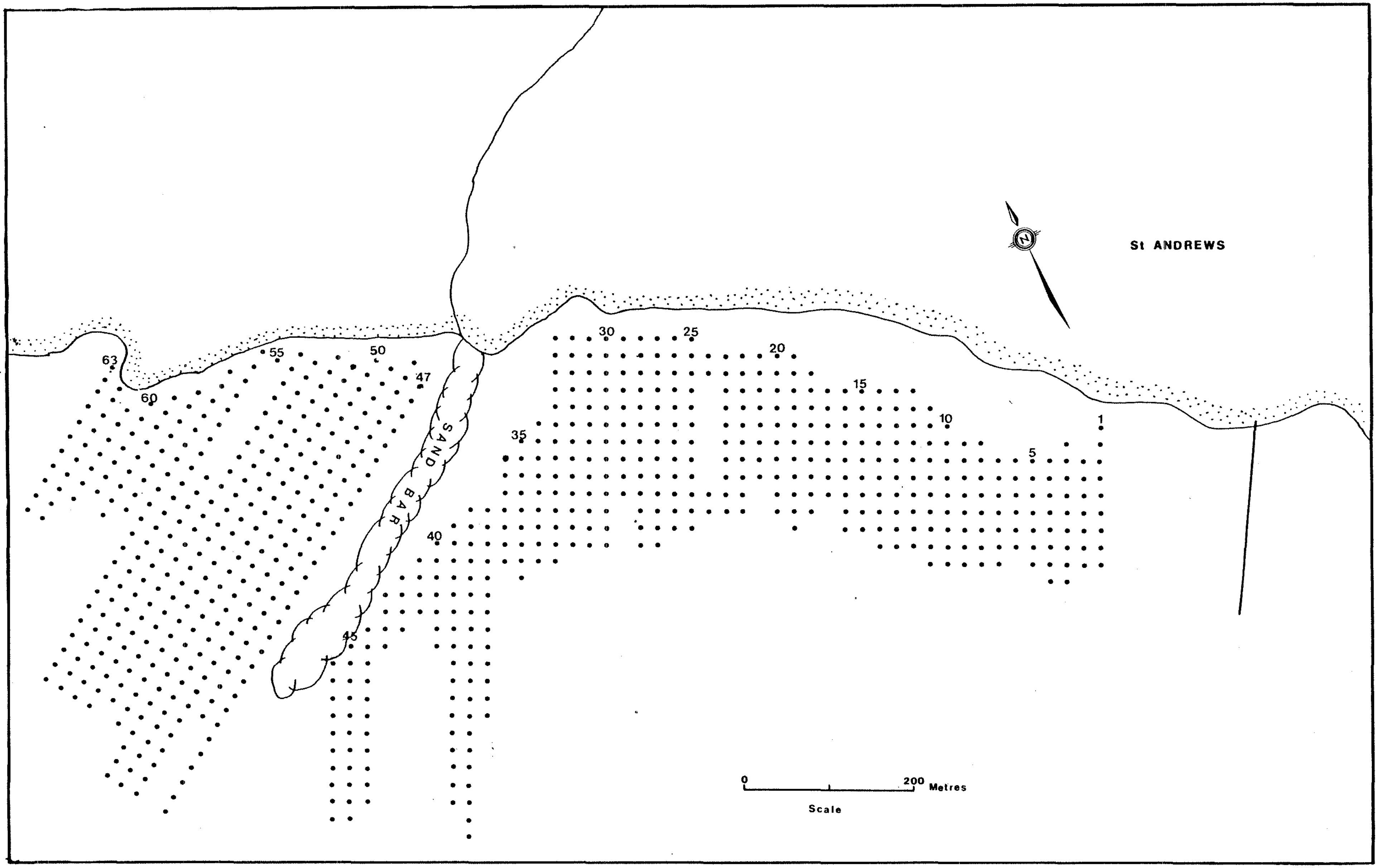

Fig. 15. St. Andrews sampling distribution - Area 2.

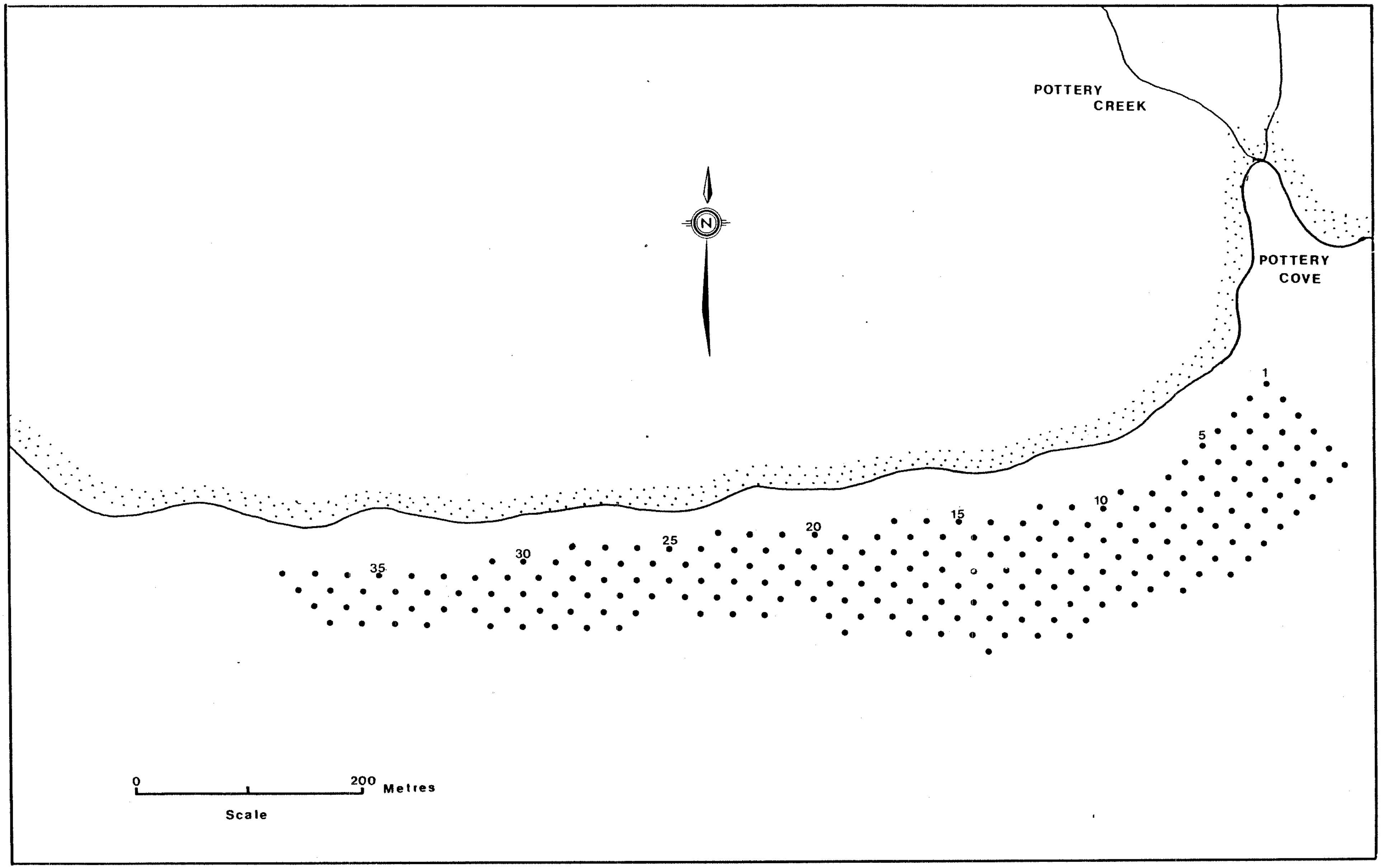

Fig. 16. St. Andrews sampling distribution - Area 3.

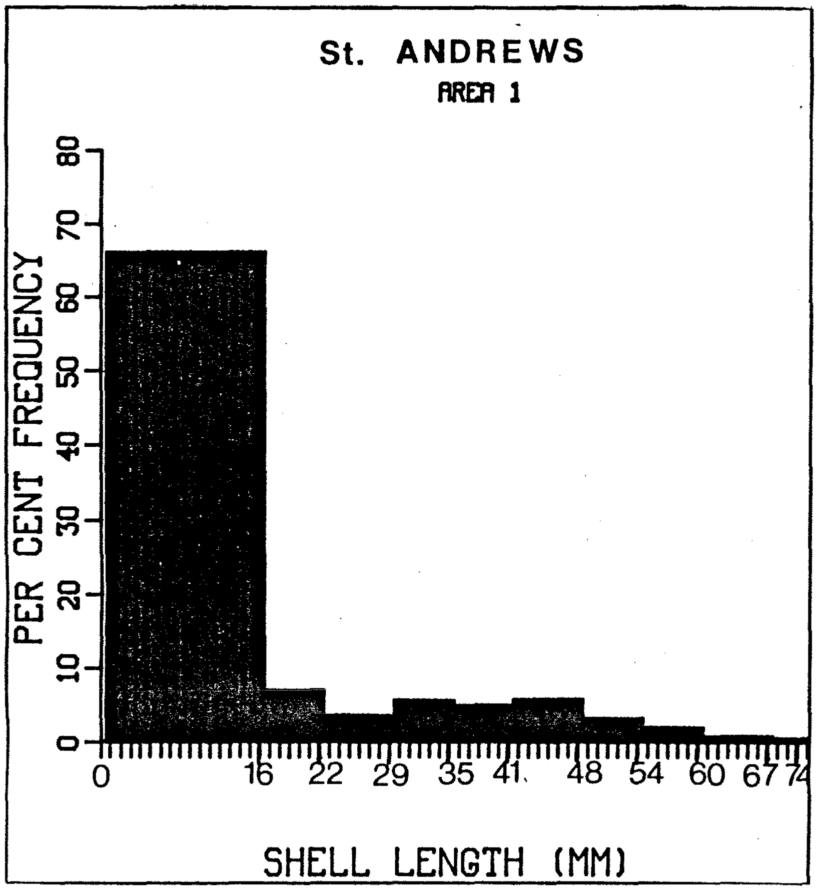

Fig. 17. St. Andrews size frequency distribution - Area 1.

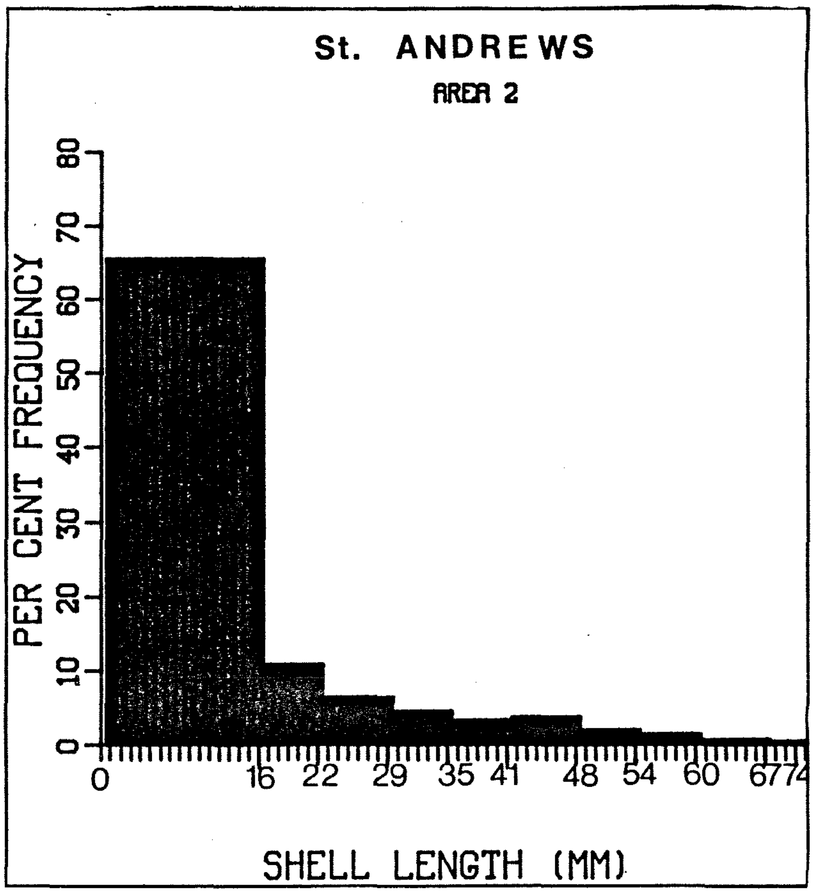

Fig. 18. St. Andrews size frequency distribution - Area 2.

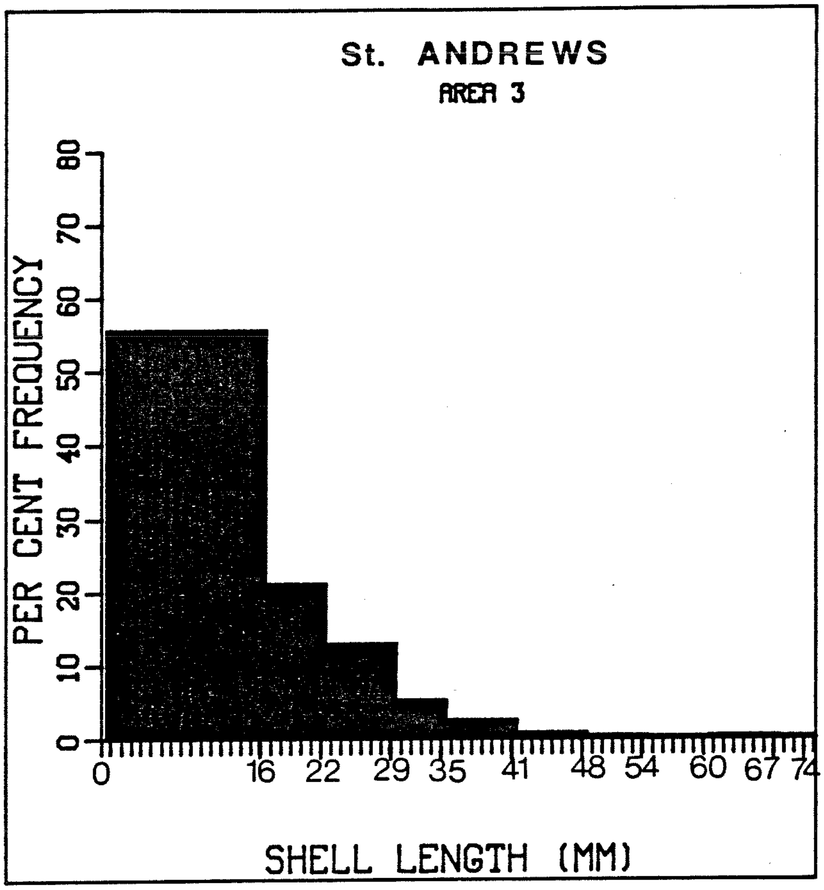

Fig. 19. St. Andrews size frequency distribution - Area 3.

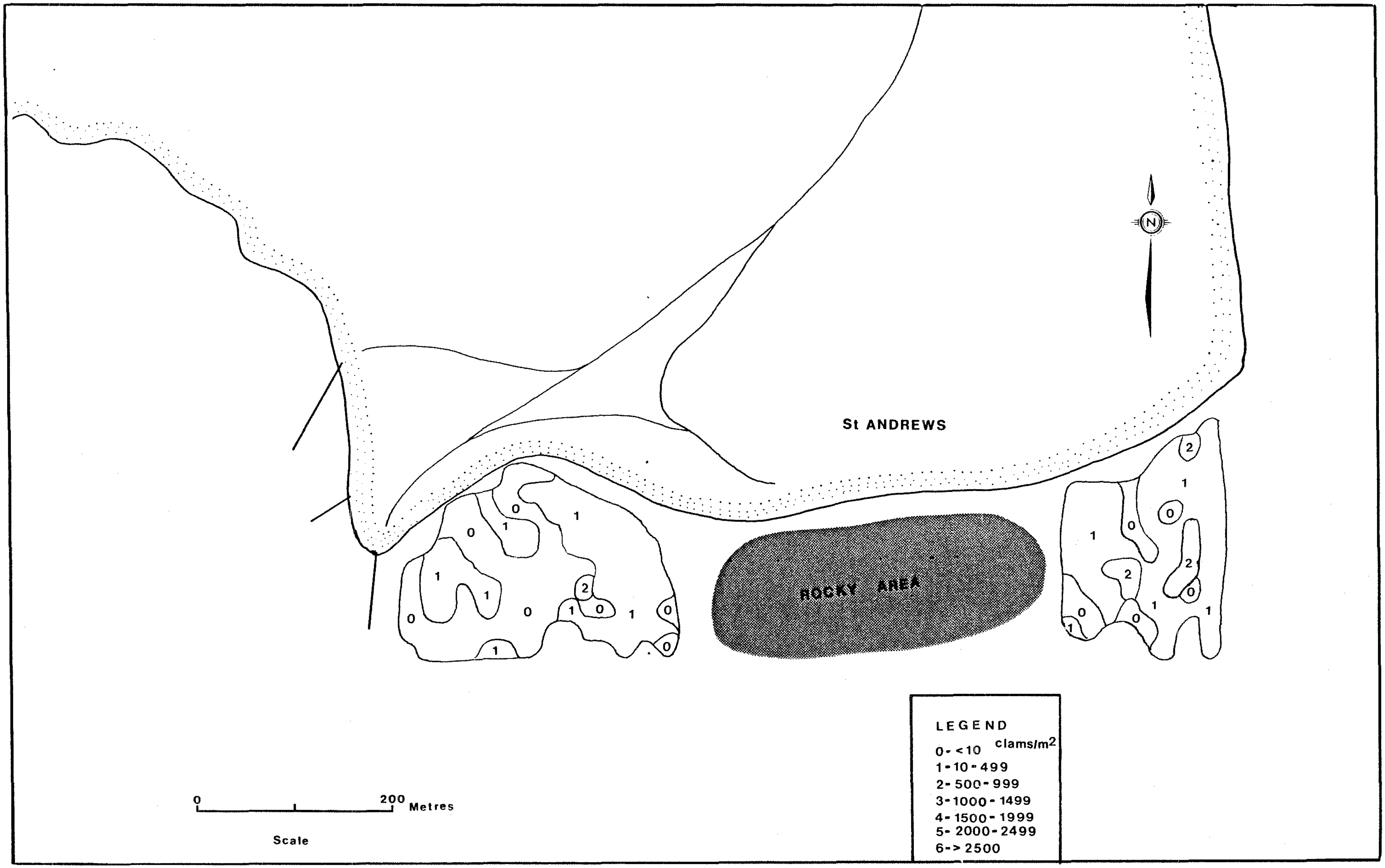

Fig. 20. St. Andrews - Area 1 - isopleths of clam density distribution - early recruits.

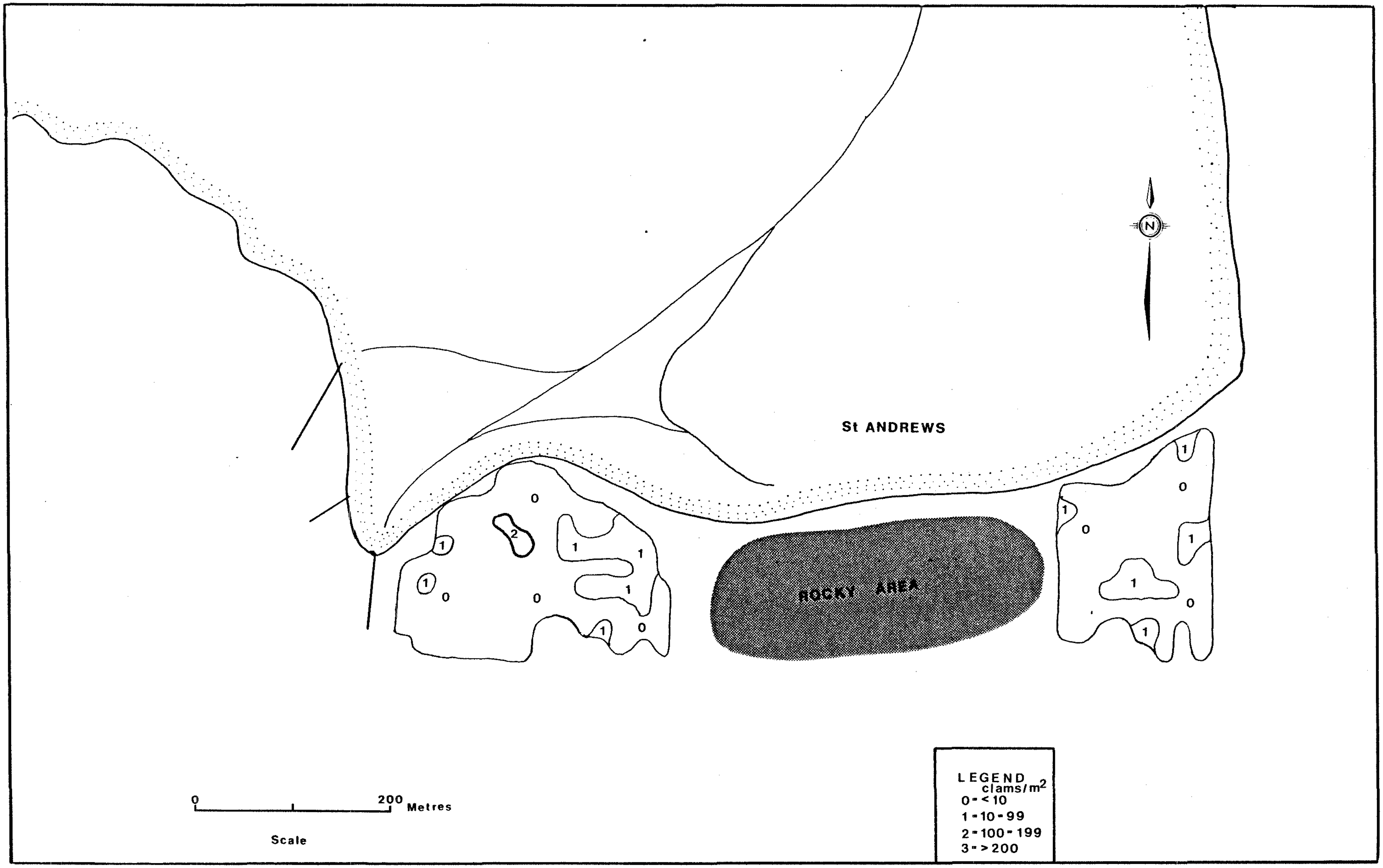

Fig. 21. St. Andrews - Area 1 - isopleths of clam density distribution - pre-recruits.

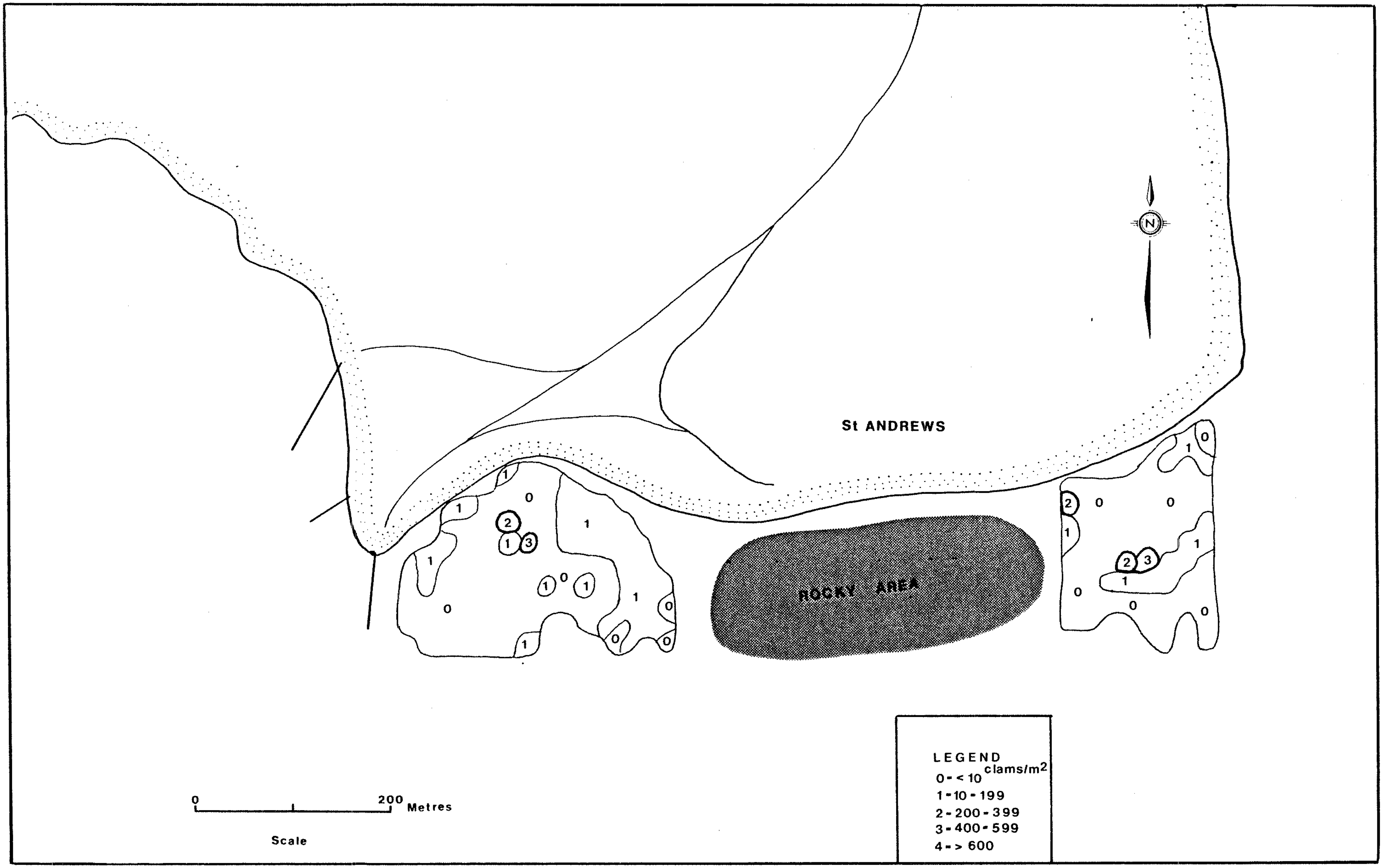

Fig. 22. St. Andrews - Area 1 - isopleths of clam density distribution - recruits.

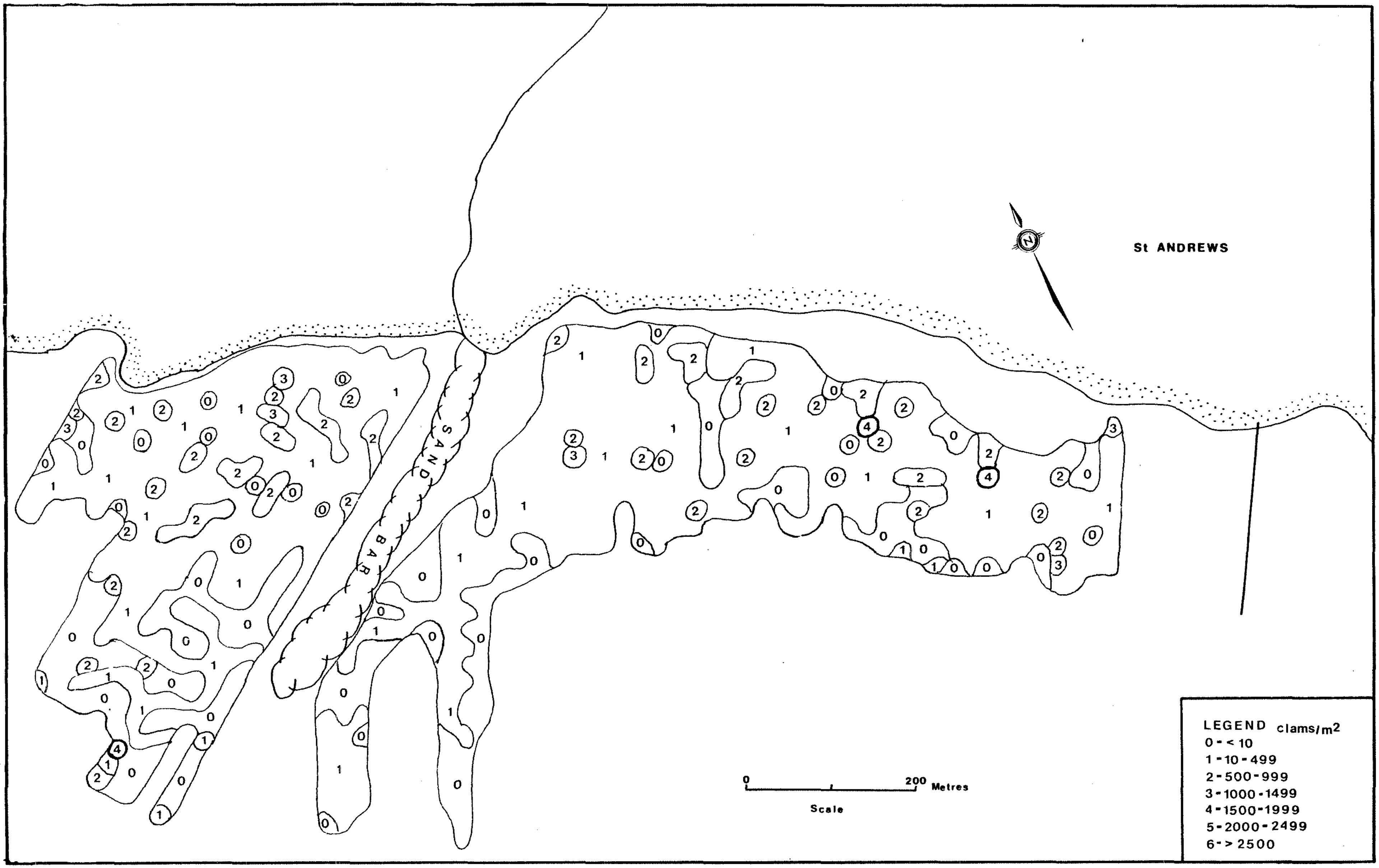

Fig. 23. St. Andrews - Area 2 - isopleths of clam density distribution - early recruits.

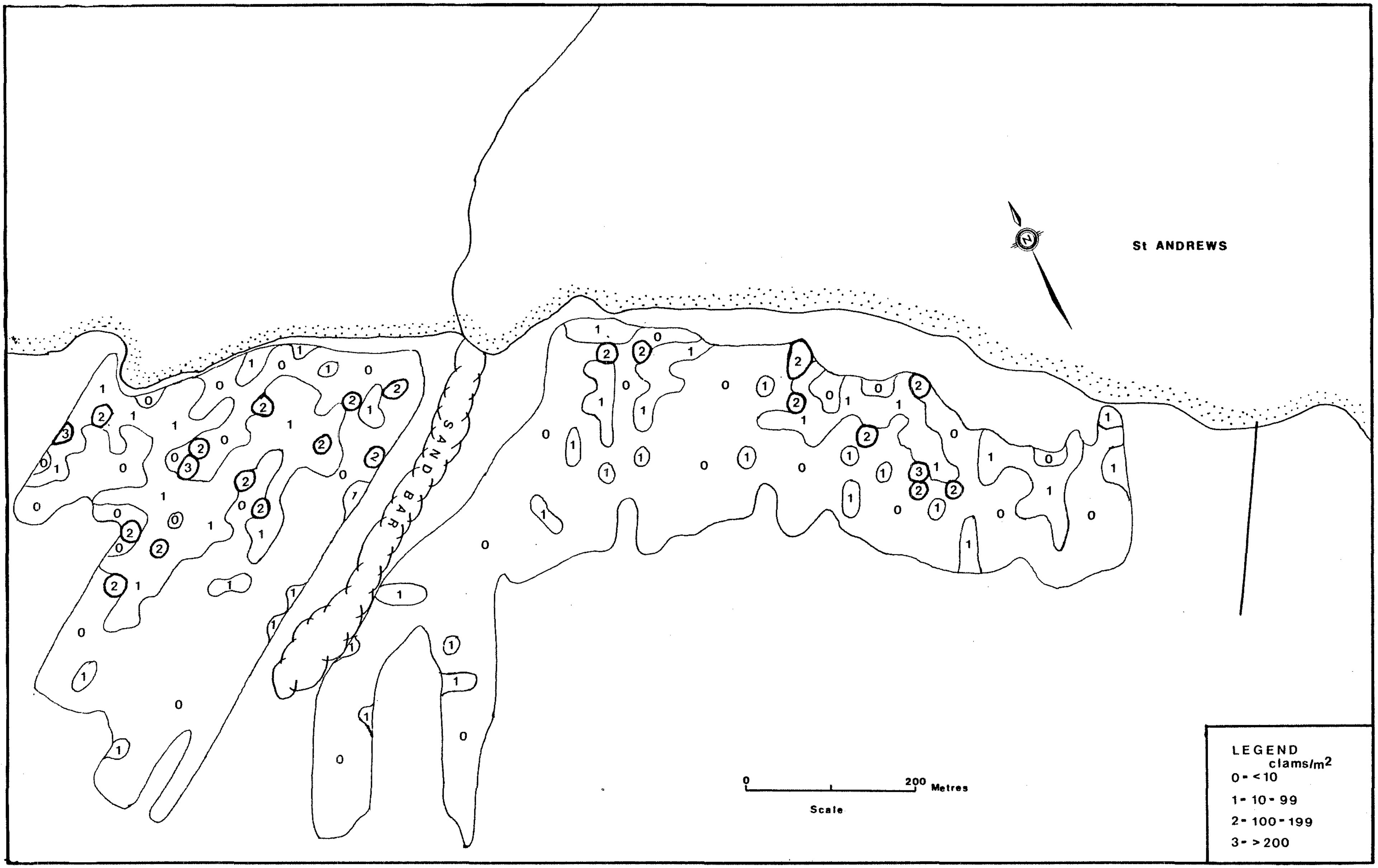

Fig. 24. St. Andrews - Area 2 - isopleths of clam density distribution - pre-recruits.

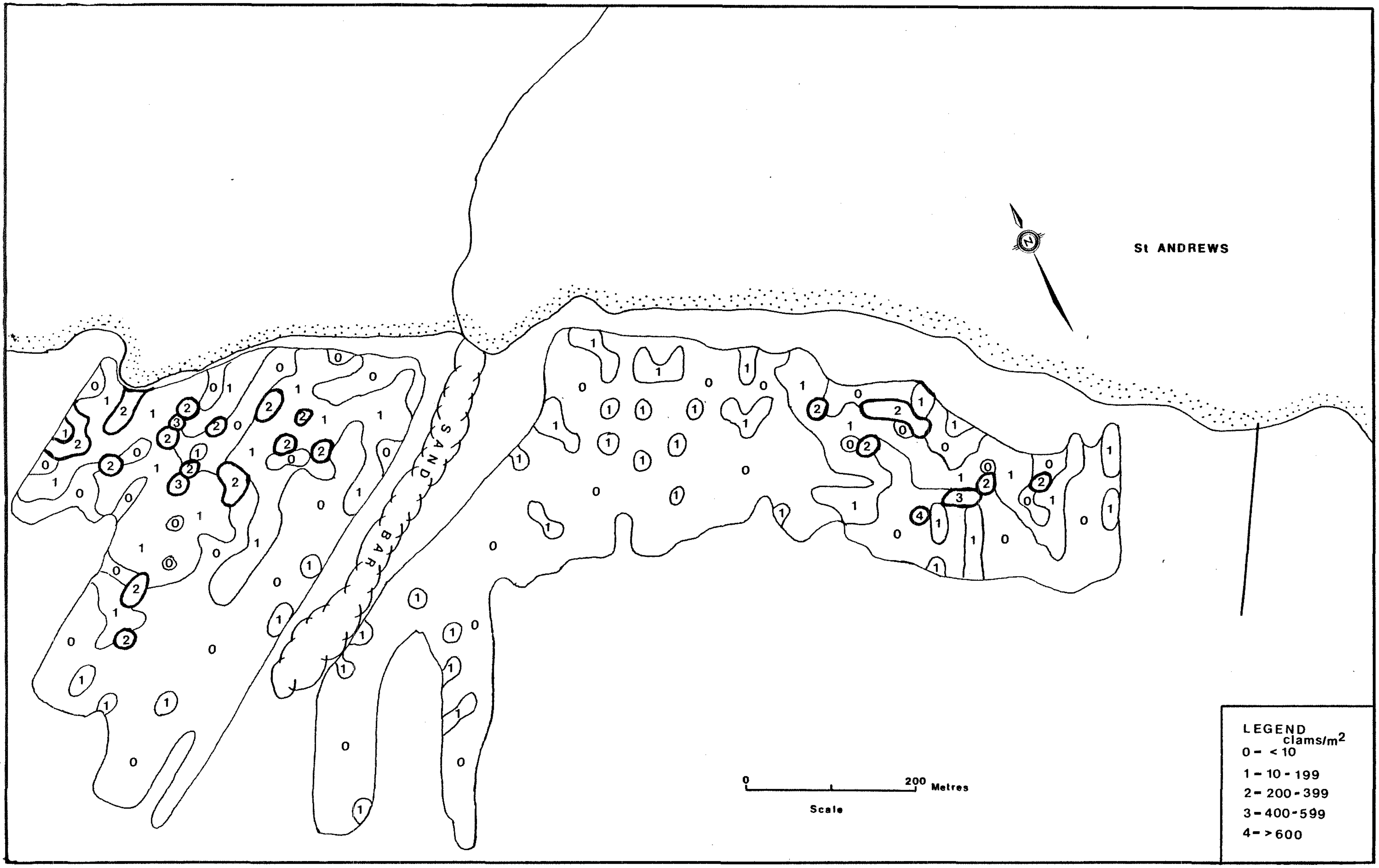

Fig. 25. St. Andrews - Area 2 - isopleths of clam density distribution - recruits.

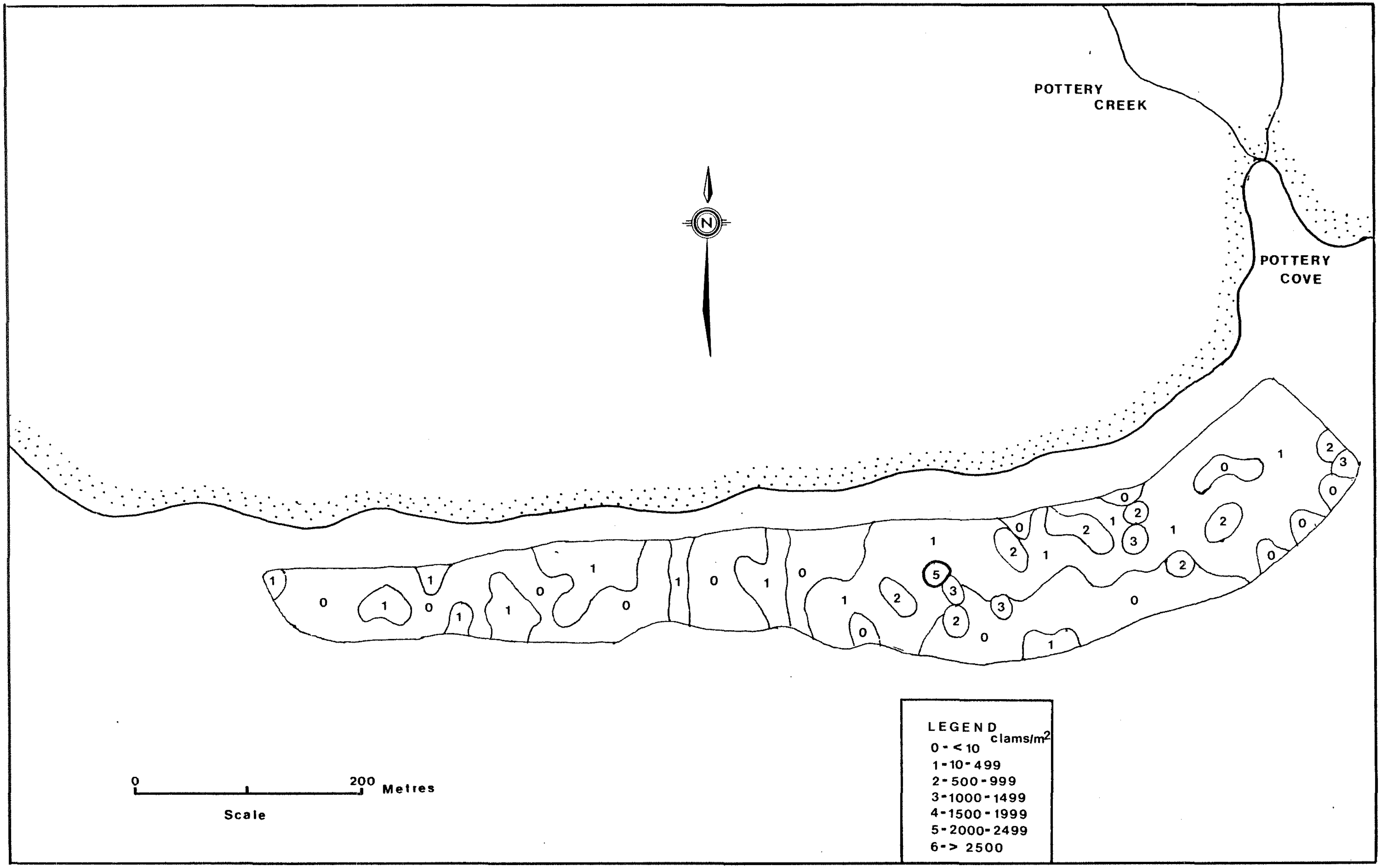

Fig. 26. St. Andrews - Area 3 - isopleths of clam density distribution - early recruits.

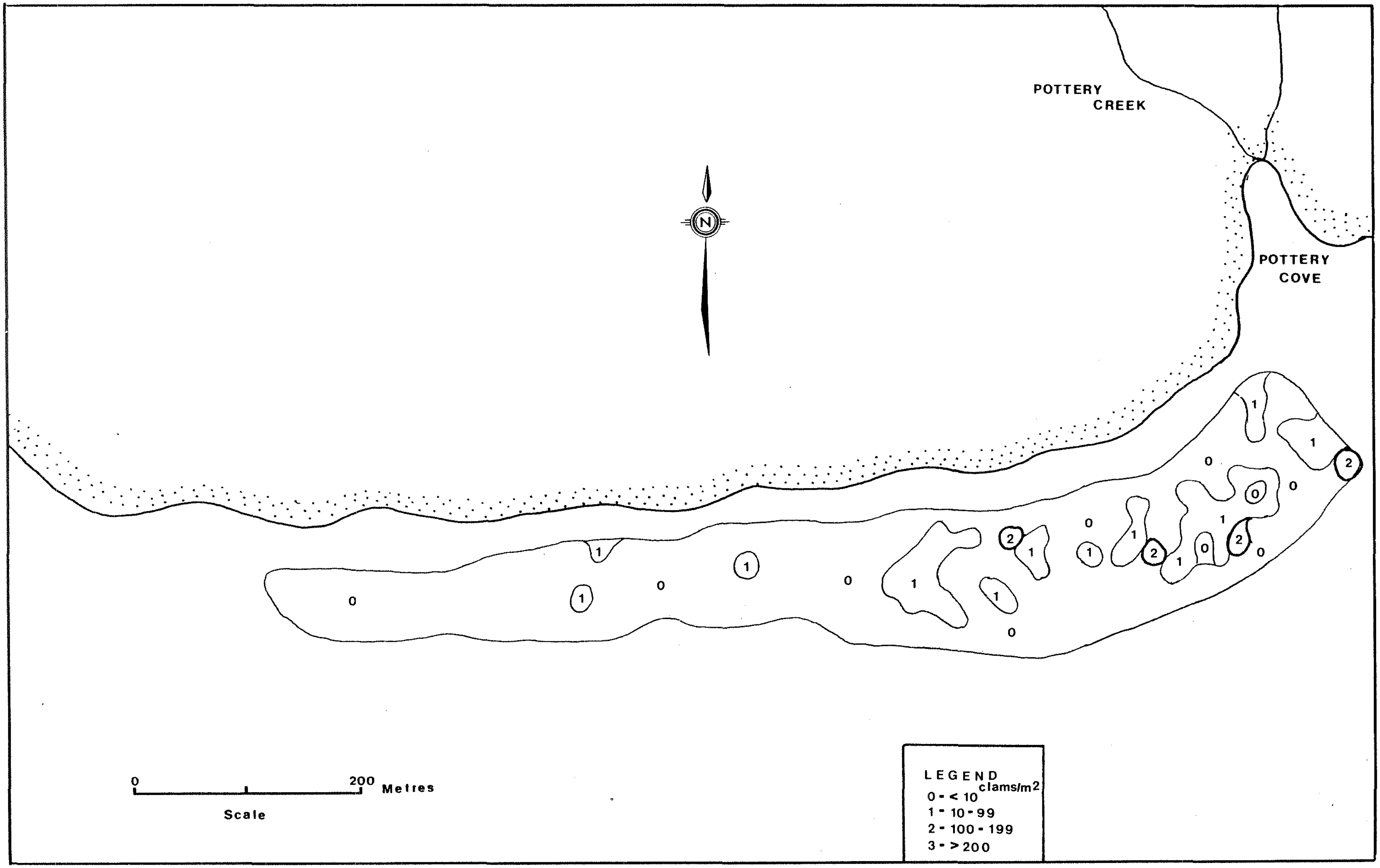

Fig. 27. St. Andrews - Area 3 - isopleths of clam density distribution - pre-recruits.

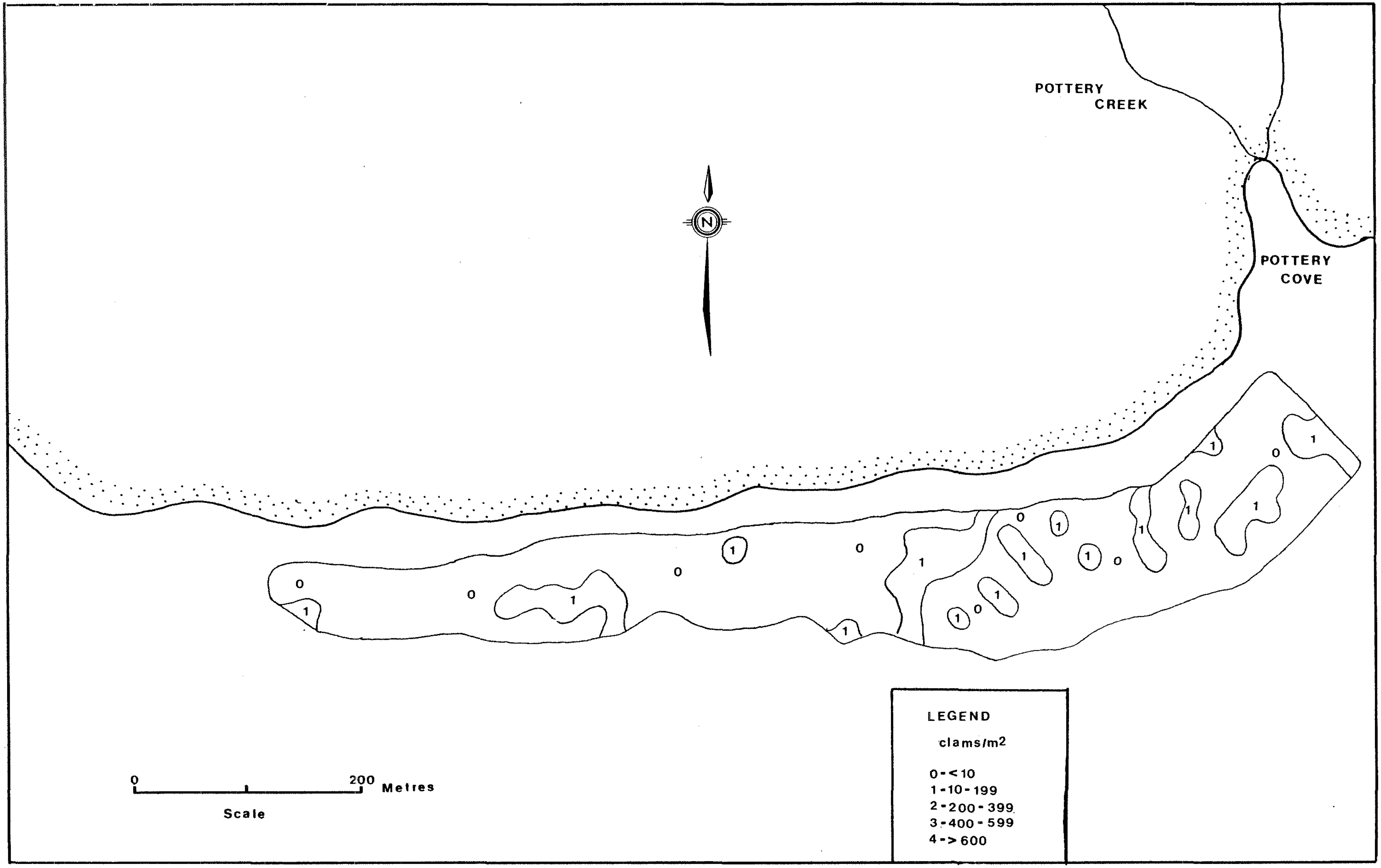

Fig. 28. St. Andrews - Area 3 - isopleths of clam density distribution - recruits.