THE MACROBENTHIC INVETEBRATE FAUNA OF PELICAN ROCKS March-April 1977

A REPORT BY JOHN WALLACE

DEPARTMENT OF CONSERVATION & ENVIRONMENT
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INTRODUCTION

A proposal to improve yachting courses in the Swan River involves the dredging of a large area at Pelican Rocks. Details of the proposal are shown on Public Works Department plans Drg. No.1 P.W.D., W.A., 44106. An area of approximately 100 ha would be dredged to a depth of between 2 and 3 metres.

Prior to dredging, studies will be made into the probable outcome of such an operation. They include surveys of the hydrodynamics, the benthic invertebrates, the amateur and professional fishery, and recreational use of the area.

The benthic fauna of the Swan River estuary is well known from past faunal studies (Thomson, 1946; Serventy, 1955; Blackwell, 1969; Chalmers, et. al., 1976). The data collected during these studies was largely qualitative. Also, sampling was most intensive in the lower part of the estuary; that is below the Narrows Bridge.

This study was undertaken to investigate the macrobenthic invertebrate fauna of the Pelican Rocks area. The study objectives were as follows:

(1) Identify the invertebrate species present and determine their preferred habitats.

(2) Provide an index of their relative abundance.

(3) Correlate distribution of these invertebrates with physical data including sediment type, water depth, turbidity, salinity and temperature.

To place the findings of the study in perspective, additional sampling was undertaken in the Swan and Canning Rivers. The river areas were chosen for the comparison because, less information was available on their fauna than for other parts of the estuary; and because they are likely to be subjected to future disturbances in the form of dredging and shoreline developments (see MRPA plan E36, 1968). Samples were also taken in the Applecross area.

METHODS

Thirteen transects were sampled: three at Pelican Rocks; two at Applecross; three in the Swan River; and five in the Canning River (Figure 1). Each transect at Pelican Rocks was sited by at least three markers; the markers being either navigation piles or conspicuous landmarks (Figure 2). Sampling stations were established in each habitat type covered by the transects. Stations were located by siting suitable markers on either side of the transects. At the other transects stations were located in a similar manner. However, siting was less difficult since the transects were shorter and closer to shore.

Sampling was carried out from 23 February to 13 April, 1977. During this period each station was sampled once.

Samples were taken with a corer (38 cm^2) to a depth of 20 cm. Five replicate cores were taken from each station at Pelican Rocks, while two replicates were taken at stations on the other ten transects. An Ekman grab (380 cm^2) was used to sample where water depth exceeded three metres. Samples were washed through a 1 mm mesh and the screenings returned to the laboratory. Animals were removed by hand from the residual debris, identified and counted, before preserving in 5% formalin. Samples were also obtained with a shovel (900 cm^2) on the shallow banks and washed through a 4 mm mesh to ensure the collection of larger species.

The above sampling methods limited the fauna which could be adequately sampled. While they provided reasonably accurate quantitative data on the infauna of the sediments, they did not give reliable measures of either those animals attached to hard substrates, or those which moved quickly in the water. Searches made on logs, rocks and piles provided qualitative information on "attached" species. However, no additional data was collected for mobile species because unlike the infaunal species, they could move away from an unfavourable area, such as dredging sites and so avoid destruction. Hence, mobile species including the blue manna crab *(Portunus pelagicus)* and the prawns *(Penaeus latisulcatus* and *Metapenaeus dalli)* have been excluded from the data analysis. Although no other taxa were intentionally excluded from the analysis the 1 mm sieve did not retain fauna such as nematodes, copepods, ostracods, and juvenile forms of taxa collected.

Physical data including water depth, temperature, salinity and turbidity was recorded for each station. A Beckman salinometer was used to measure temperature and salinity. Light penetration was estimated with a secchi disc and depths were measured with a plumb line. An estimate of the redox discontinuity profile was obtained by recording the depth at which the sediment changed from a light colour (oxygenated) to black (oxygen depleted).

A sample of the top 20 cm of sediment at each station in the Pelican Rocks area was analysed for particle size analysis using a "wet sieve/hydrometer method", by the Public Works Department. No analysis was attempted for other stations, but a subjective assessment was made.

Data collected from stations in the Pelican Rocks area having similar physical characters was lumped to provide an estimate of abundance for each habitat. The overall faunal affinity was calculated using an index developed by Sanders (1960) to measure the relative similarity between habitats. The index was derived by calculating the percentage composition of the species at each habitat. Each habitat was then compared with every other habitat and the lower percentages for every species common to both habitats were summed. The resulting values were the indices for each pair of samples. Since this index was a measure of faunal homogeneity between habitats, it was therefore also a measure of ecological similarity between pairs (Sanders, 1960). A formula developed by Sorenson (1948) was used to calculate faunal affinity between transects because of the reduced sample size of upstream stations. The index was calculated by summing the species common to two samples and dividing this number by the total number of species found in both samples.

RESULTS

Physical

The salinity for both surface and bottom recordings was approximately 35^{o}/oo for each station at Pelican Rocks. The temperature was also uniform at 22-23^{o}C, while light penetration varied between 1.7 and 2.3 metres (Table 1). Salinity decreased slightly with distance upstream; the lowest recording being at Tranby where the surface water was 26.6^{o}/oo. Turbidity was also slightly higher in the river. The method used to estimate oxygenation of the sediment was crude. The discontinuity layer was not always apparent, especially in sandy substrates. However, the data showed the black sulphide smelling muds to be reduced within a centimetre of the surface, while sandy sediments had variable and sometimes thick oxygenated layers (Table 1).

The particle size analysis revealed a distinct difference between the sediments of deep water and bank areas (Table 2). Deep water sediments were composed predominately of silt and clay. At stations in naturally deep water the amount of silt and clay was equal. However in dredged areas the proportion of silt was higher than the proportion of clay. Bank sediments consisted mainly of sand. Those near shore contained mainly medium grain sands, while those offshore contained a greater amount of shell material, which in the analysis was recorded in the very coarse sand fraction.

Faunal Composition

Forty-two taxa were identified from the study area in the Swan River estuary during the sampling period (Table 3). These included 10 species of polychaetes, 7 pelecypods, 4 gastropods, 7 amphipods, 1 isopod, 9 decapods, 1 barnacle, 1 anemone, 1 seasquirt, and a leech.

Faunal diversity was greatestin the Applecross-Pelican Rocks areas and progressively decreased on going upstream in both rivers (Table 4).

Neighbouring transects were most similar, while those separated by the greatest distance were most dissimilar (Fig.3). For example, the fauna of the transects of Applecross and Pelican Rocks was 82% similar, while that of Applecross and Tranby showed a similarity of only 24%. Also, transects in the Swan and Canning Rivers, at similar distances from Pelican Rocks, had reasonably comparable faunas.

An index of abundance for the more common species at each transect is presented in Figures 4 - 16. The highest density recorded for a single species was 36,500 individuals per square metre for the small polychaete, *Capitella capitata*, in the sand flats at Alfred Cove (Fig.8). This area also had the highest density for total individuals of all species: 79,000 $\pm$ 6,500 per m^2. Throughout the rest of the study area numbers were lower. However, single species were often recorded in densities up to 10,000 per m^2.

Table 5 lists and gives a measure of abundance for species found in five habitats at Pelican Rocks. The habitats were based on the physical data collected for this area (see Results, this report). The abundance data were derived by pooling data from stations which were ecologically similar. A greater number of species were found in "bank" habitats than in "deep water" habitats. Only three species were found exclusively in deep water; the rareness of two of them probably accounted for their absence from bank habitats. In-shore banks contained the greatest number of invertebrates per square metre, followed by offshore banks, dredge deep water, and lastly natural deep water. The natural deep water habitat supported less than 10% of the individuals found on inshore banks. The slightly larger number found in the dredged habitat was probably due to the proximity of this area to shallow banks, rather than it being a more favourable environment. The biomass of the banks would have greatly exceeded that of the deep water habitats because none of the larger polychaetes, such as *Marphysa sanguinea, Australonereis ehlersi,* or *Scoloplos simplex,* were found in deep water habitats in any quantity.

Calculation of overall faunal affinity at Pelican Rocks (Fig.17) indicated that:

- dredged and naturally deep habitats were very similar;
- inshore banks with plants closely resembled those without, and both were similar to, but differed equally from, offshore banks;
- deep water habitats were markedly different from those in shallow water. Identical taxa dominated the deep water habitats (Table 5), where two species accounted for 90% of the total number of individuals collected. More species were abundant in the bank habitats where six species accounted for 90% of the numbers collected.

DISCUSSION

At the time of this study the Swan Estuary was in the summer-autumn phase of the annual hydrologic cycle. Marine water extended through the Lower, Middle and much of the Upper Estuary. The benthic invertebrate species at Pelican Rocks included mainly estuarine and a few marine representatives as described by Chalmers et al. (1976). The distribution of invertebrate species in the Swan Estuary, as in all the seasonal estuaries of south-western Australia, was primarily determined by salinity (Hodgkin, 1977).

The concentration of invertebrates in foreshore areas at Pelican Rocks was probably due to the more sandy sediment, shallower water, and relatively well aerated conditions there. The influence of sediment particle size, water depth, and oxygen availability on faunal distribution has been widely investigated (Sanders, 1958; Johnson, 1971; Wharfe, 1976). The polychaete *C. capitata* was shown by Reish (1970) to survive low oxygen concentrations, and it has been reported from relatively polluted areas (Wharfe, 1975). The absence of this polychaete from the black mud areas reflected their poor suitability to invertebrate habitation. However, juvenile specimens of the bivalve *S. trigonella* were only collected from muddy substrates; none were found amongst the dense adult populations on the banks. This distribution was not explained by data collected during the study.

The patchiness of some species resulted in less accurate estimates of their abundance. Little and Boyden (1976) attributed patchiness amongst the infauna to both inter- and intraspecific interactions. For example, exclusion of one species by another, or, clumping of individuals of the same species to facilitate reproduction or protection. However, patchiness may have been a response to subtle environmental factors not considered in this study. Despite localised variation a reasonable estimate of abundance was obtained at Pelican Rocks for the common species, as determined by replicate sampling.

The expected consequences of dredging to the invertebrate fauna include:

- direct destruction of the animal community within the area of operation of the dredge
- The effect on the survival of animals throughout the estuary resulting from the large quantity of bottom sediment placed in suspension by the dredging operation.

The invertebrates at Pelican Rocks were small and fragile. Most of them lived in the near surface layers of the sediment, but a polychaete, *M. sanguinea,* burrowed as deeply as 20 cm into the sediment. The entire fauna at the dredging site will be destroyed, since at least 1 m of sediment will be removed during the operation. Also the deposition of spoil in deep water will probably inundate and destroy the fauna of that area.

Data is insufficient to predict the response of individual species to greatly increased levels of suspended solids. Filter-feeding animals such as mussels and barnacles, can be expected to be worst affected (Perkins, 1974). Prolonged exposure to excessive amounts of suspended material was shown to cause death in the mussel *M. edulis* (Loosanoff, 1961). Burrowing molluscs and polychaetes, which constituted the bulk of the fauna, would probably be little affected. Some of these species might benefit from the extra particulate organic matter thrown up during the dredging. However, excessive deposition of fine material on the near shore sandy zones should be avoided, since a change in the nature of the sediment would likely reduce faunal abundance in that area.

Lenanton (unpubl. data) showed that areas of mud denuded by dredging in Walpole Inlet recovered to predredge status within two years. At Pelican Rocks faunal recovery following dredging was found to be incomplete after a period of twenty years. The dredging operations along the Como foreshore during the 1950's left holes in which fine sediment replaced sand. Only two species out of eight probably common to the area prior to dredging had recolonized these holes. Their present fauna most closely resembled the fauna of the natural deeps (Fig.17).

Re-establishment of benthic invertebrates in the proposed dredging sites can be expected to be more successful than that noted above if:

i) the resultant substrate is of a coarser nature;

ii) water depth is less;

iii) the bottom is level and without deep enclosed holes.

However, the results of the present study would indicate that any new substrate in more than 2m of water will have a less diverse and less abundant fauna than is present in the existing shallows.

Benthic invertebrates were a major food source for fish, and probably most bird species, of the Blackwood Estuary (Wallace, 1976). The same is likely true for the Swan Estuary. A decrease in invertebrate abundance at the dredging site would have little or no effect on the wading birds at Pelican Rocks, since the present water depth prevents them from feeding. Bird life would be affected if the nearshore fauna was reduced by siltation. Bottom feeding fish, such as whiting, flathead, cobbler, gobies and hardyheads which inhabit the area (Chubb, pers. comm.), would lose a resource of food at present available to them. The numbers of these species may diminish in the area as a result of decreased invertebrate abundance. A more definite prediction is not possible without further and more detailed information.

CONCLUSIONS

The Pelican Rocks area supports a rich invertebrate fauna. This was characterized by low faunal diversity, and high abundance of a few species. Invertebrates were most abundant at the Applecross sites and least abundant at the river transects. The decrease in species number is attributable to the lower salinities experienced upstream, especially in winter. Habitat selection was influenced by sediment particle size, water depth and oxygen conditions of the sediment. Most species preferred sandy, shallow, well aerated conditions, as found in foreshore areas. Few species inhabitated the fine reduced muds of the deep water.

Dredging is expected to have profound effects on the invertrates within the area of operation. The response of animals throughout the estuary to a sediment cloud produced by dredging is less predictable. Previously dredged areas were found to be unfavourable to the reestablishment of invertebrates. An irreversible decrease in abundance of invertebrates at Pelican Rocks would appear to be the likely outcome of the proposed dredging.

The bird fauna at Pelican Rocks was not expected to be affected by dredging. However, the numbers of benthic feeding fish will probably decrease as a consequence of lowered invertebrate abundance. The need to conserve the highly productive shallow foreshore areas was apparent; preservation of these is vital to the survival of both birds and fish in the area. Their area could be increased by filling the holes dredged along the Como foreshore with spoil from any future dredging operations in the area.

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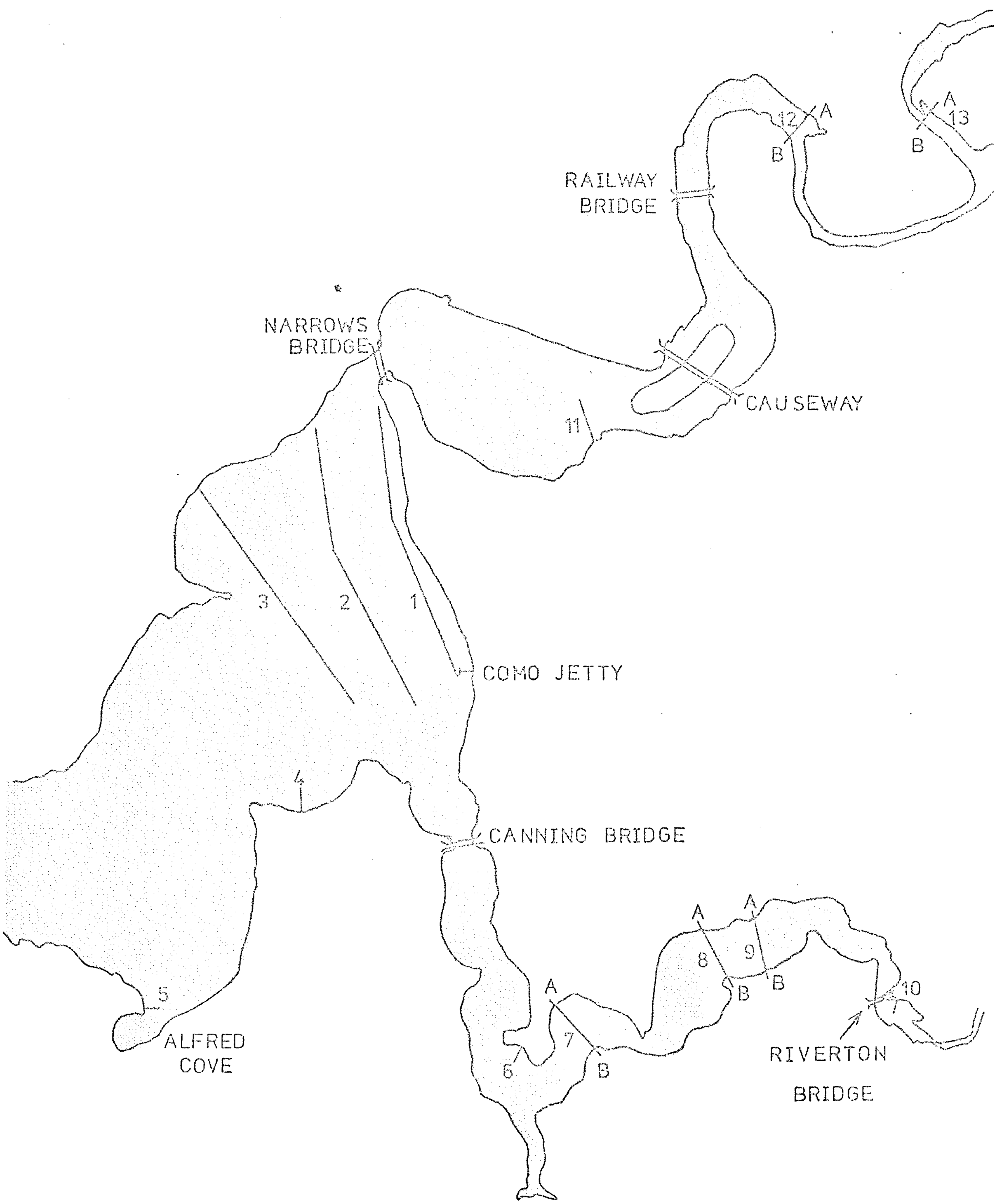
FIGURE 1. Benthic Sampling Locations in the Swan Estuary.



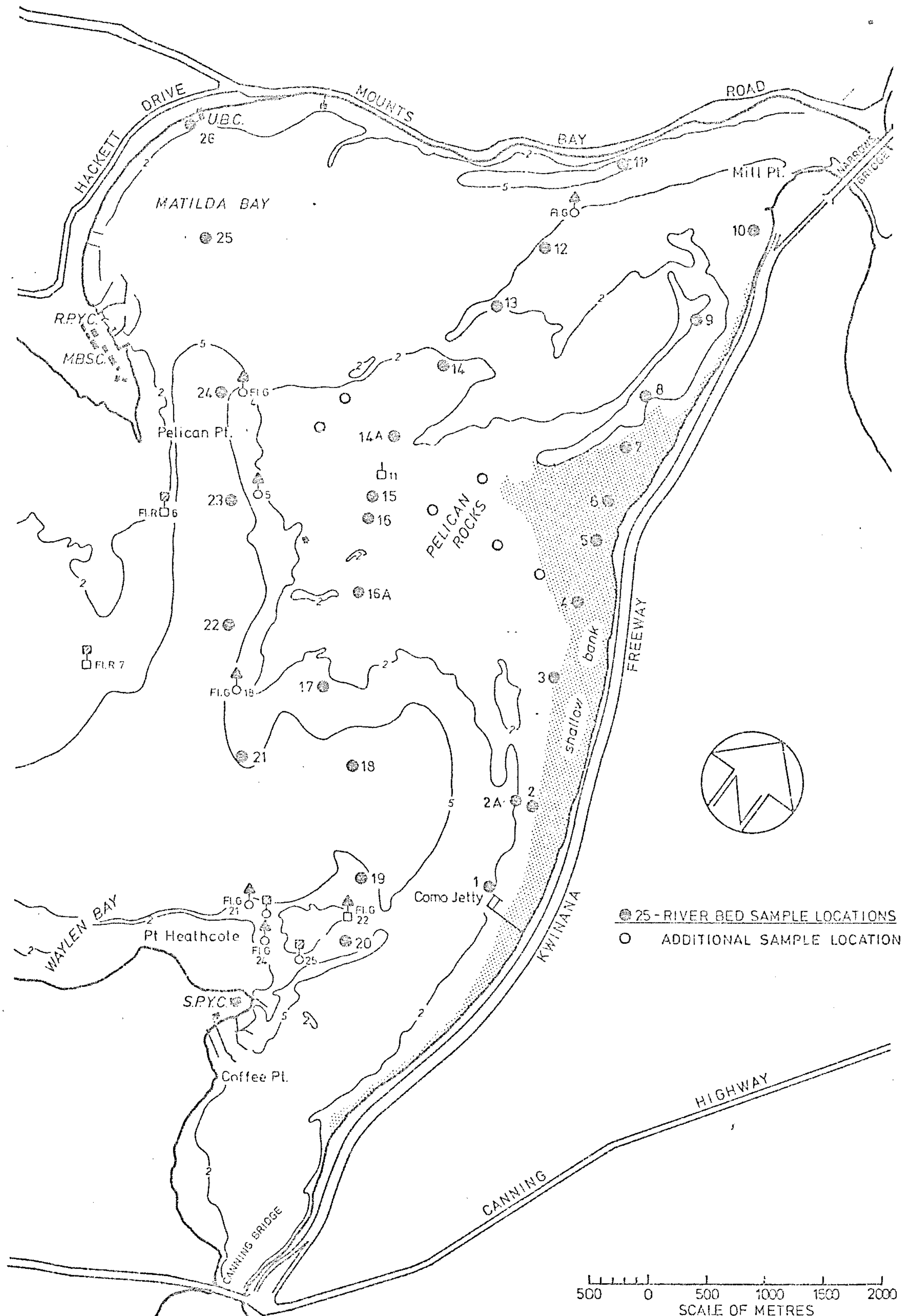


FIGURE 2. BENTHIC SAMPLING STATIONS AT PELICAN ROCKS

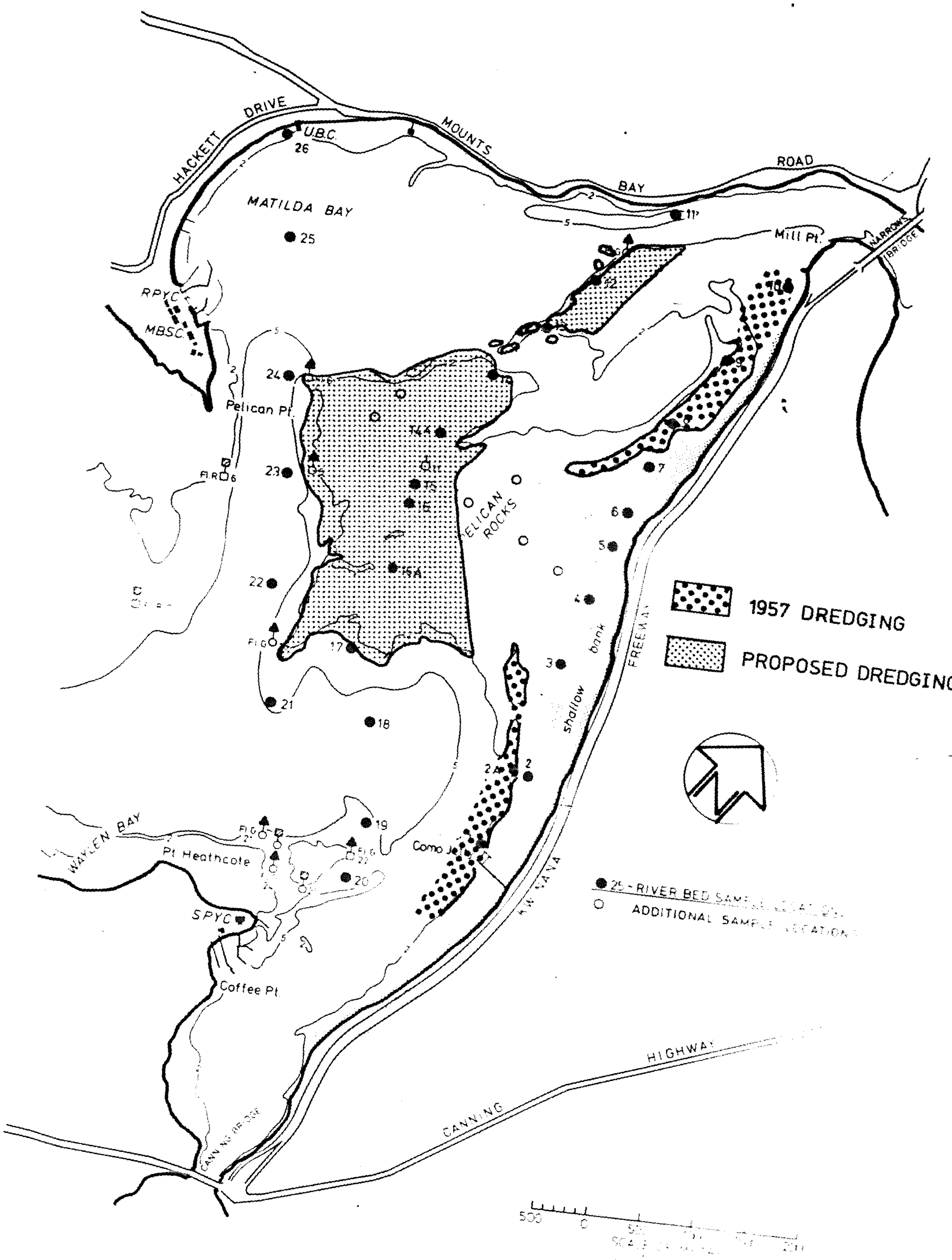


FIGURE 2A. DREDGE SITES AT PELICAN ROCKS

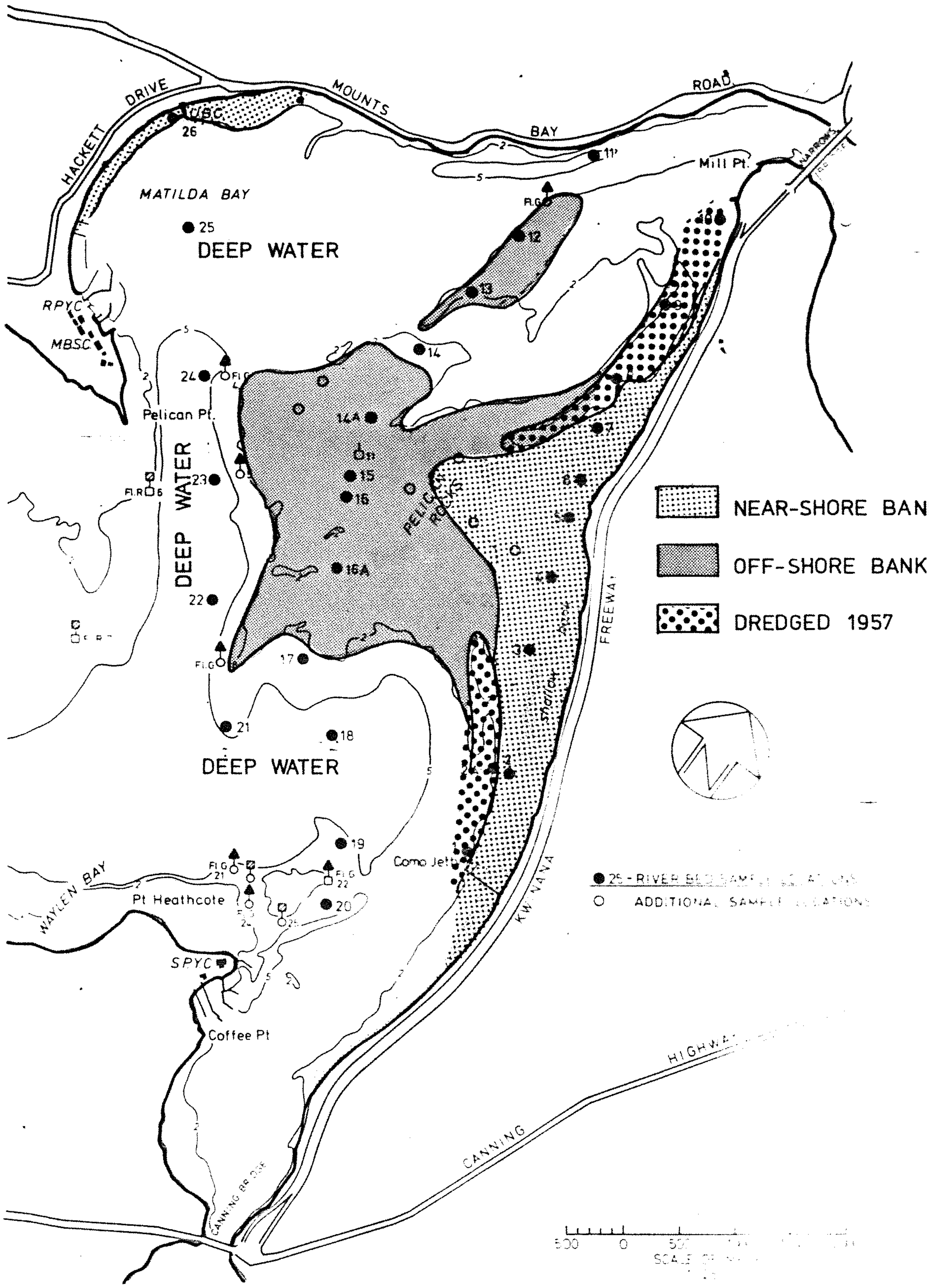


FIGURE 2B. DEPTH CATEGORIES AT PELICAN ROCKS

Figure 3: Trellis diagram of affinity indices (as %) between transects.

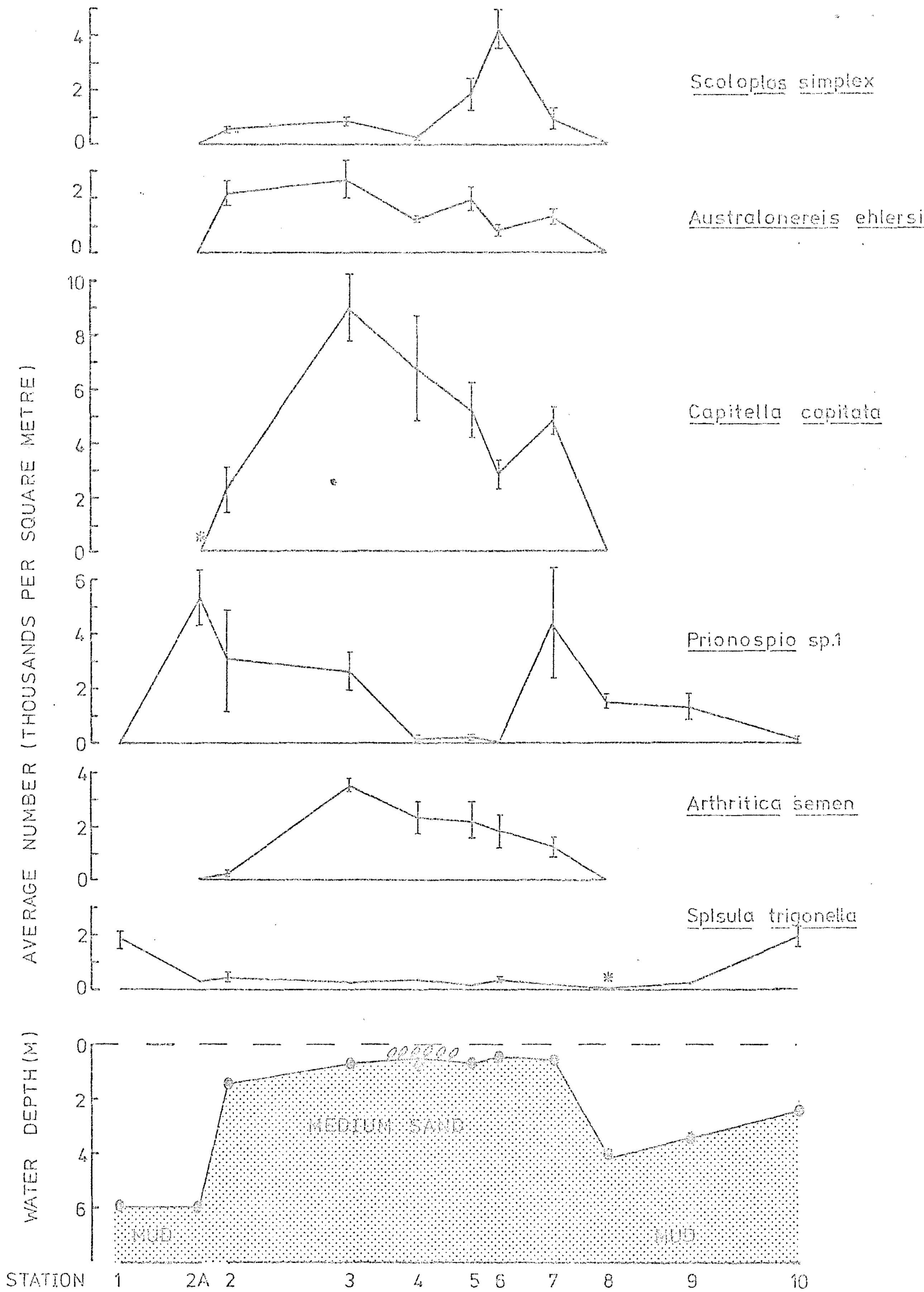
		Melville Water		Swan River			Canning River		
		Alfred Cove Applecross	Pelican Rocks	Perth Water	Belmont	Tranby	Lower Canning	Shelley Basin	Riverton Bridge
Melville Water	Applecross/Alfred Cove								
	Pelican Rocks	82							
Swan River	Perth Water	39	44						
	Belmont	29	30	56					
	Tranby	24	28	56	64				
Canning River	Lower Canning	52	56	55	45	38			
	Shelley Basin	45	45	78	58	50	56		
	Riverton Bridge	29	25	50	47	46	40	53	

KEY TO FIGURES 4 to 16 :–

◉.	Sampling Station
I	Standard Error
*	<100 Individuals
φφφ	*Halophila ovalis*
SSS	*Gracilaria verrucosa*

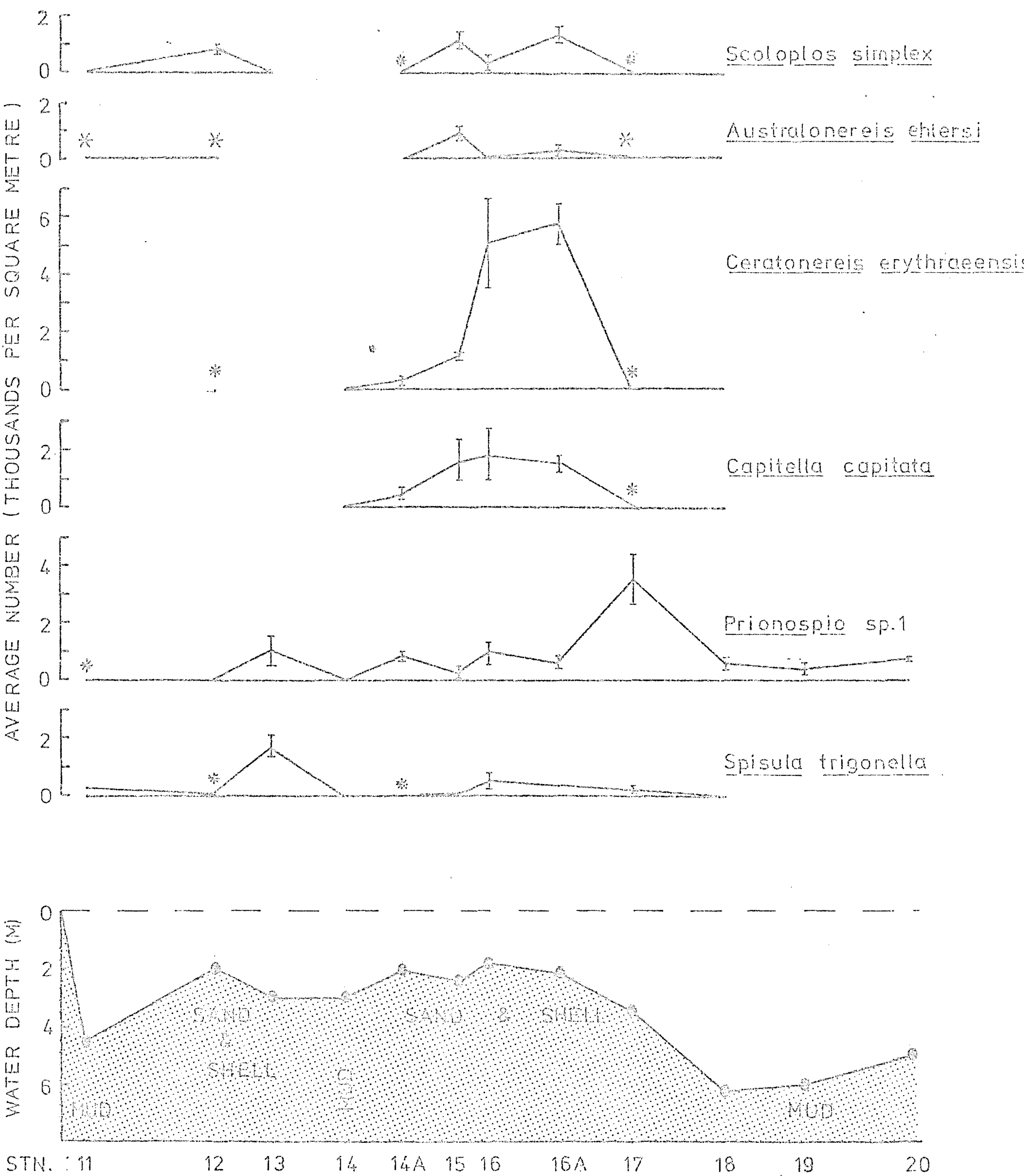
NOTE: Sediment type = 0 - 20 cm

FIGURE 4 : Transect 1, Pelican Rocks



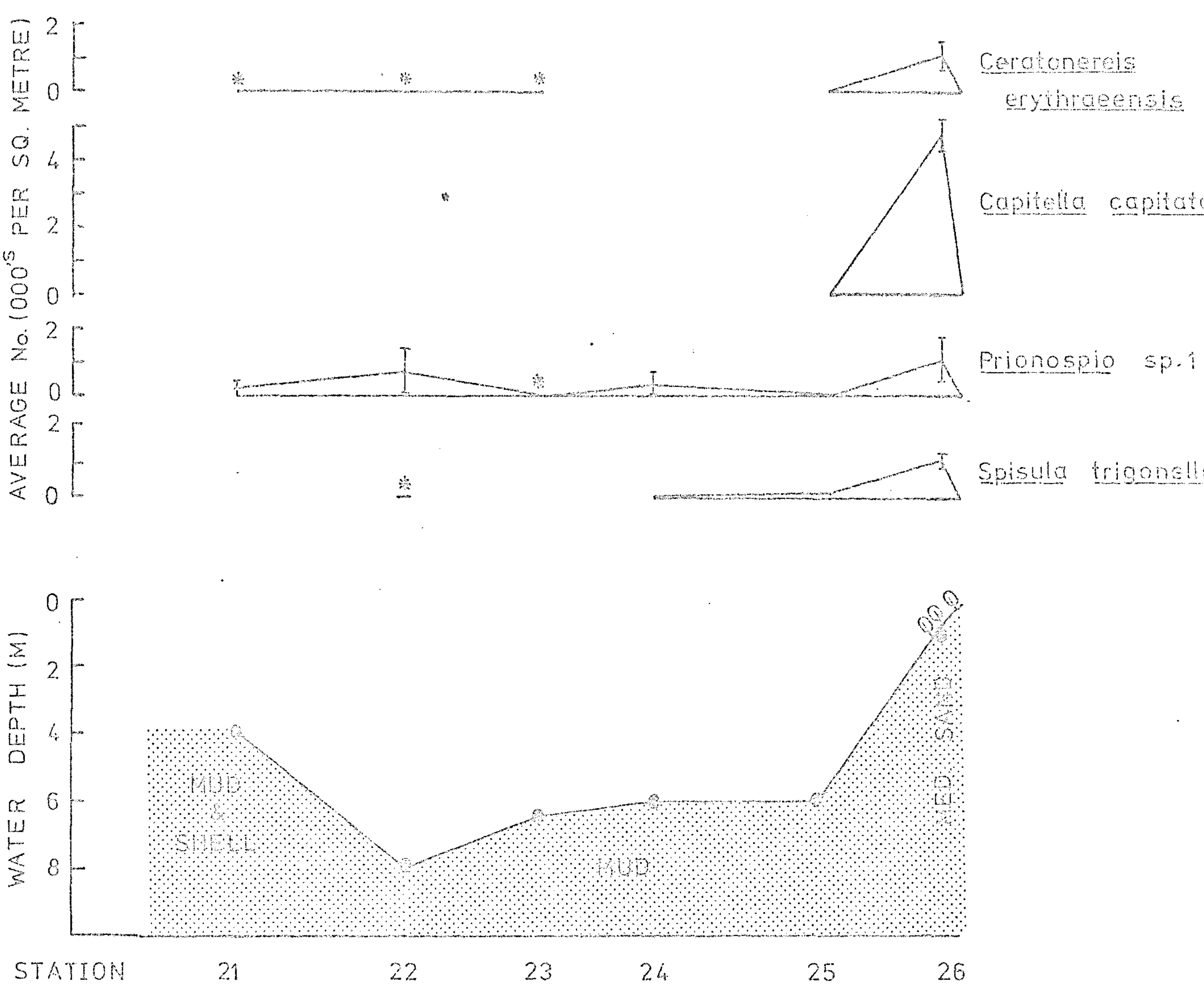
Halophila ovalis ; * <100 individuals

FIGURE 5. *Transect 2, Pelican Rocks*



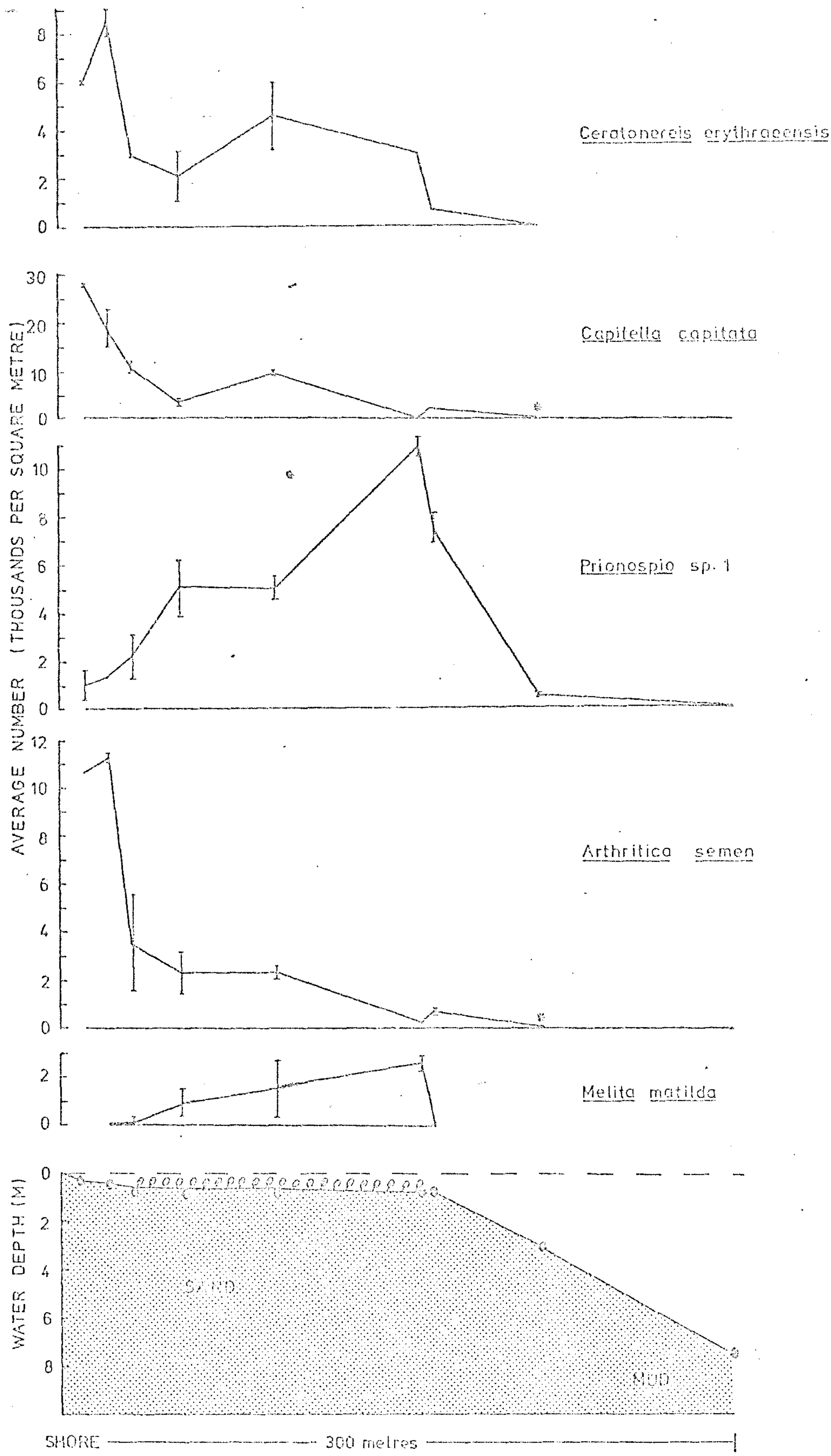
* < 100 individuals

FIGURE 6 Transect 3, Pelican Rocks



ØØØ Halophila ovalis ; X <100 individuals

FIGURE 7 Transect 4 Applecross



Halophila ovalis   * <100 Individuals

FIGURE 8 : Transect 5 Alfred Cove

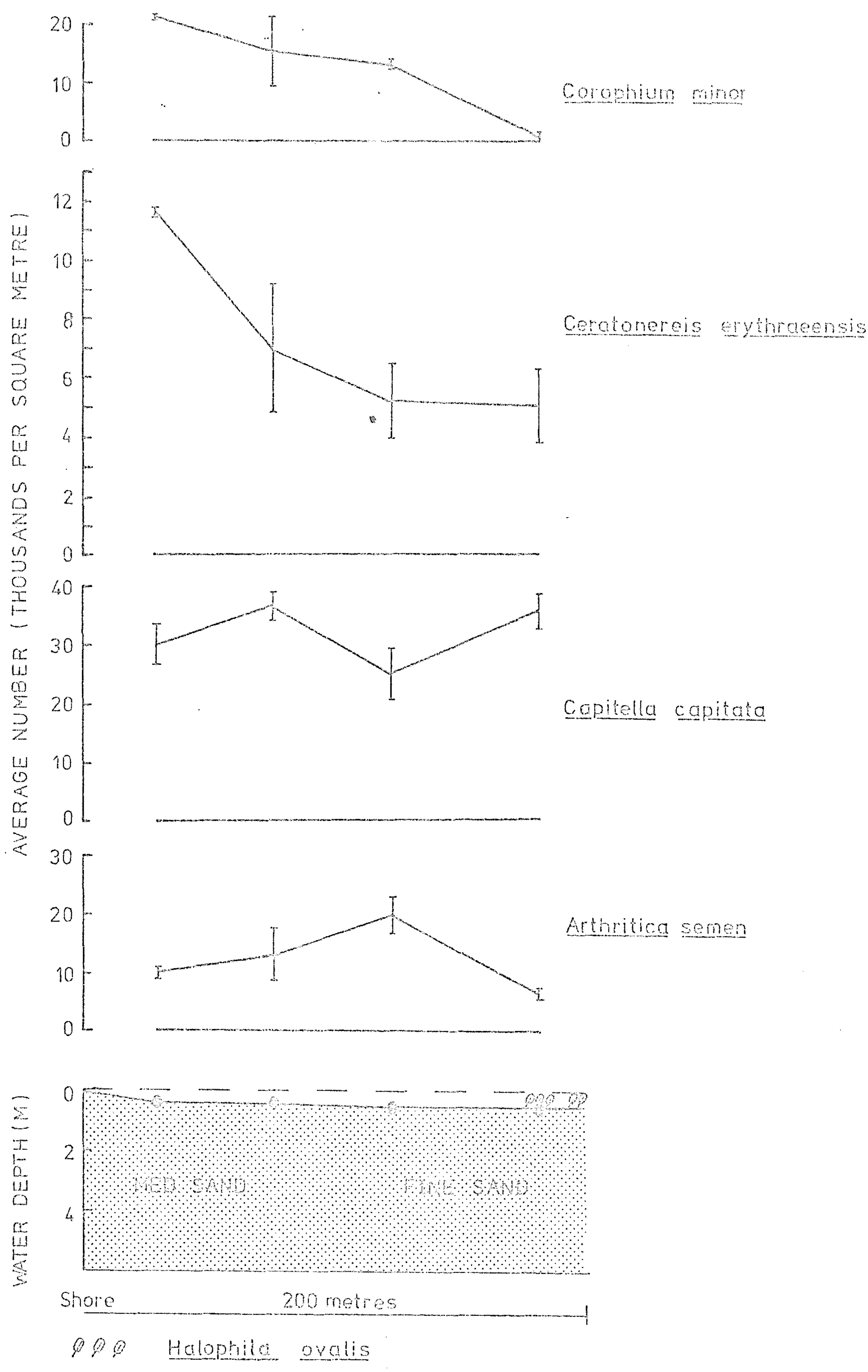


FIGURE 9 Transect 6 Freeway Bridge Site

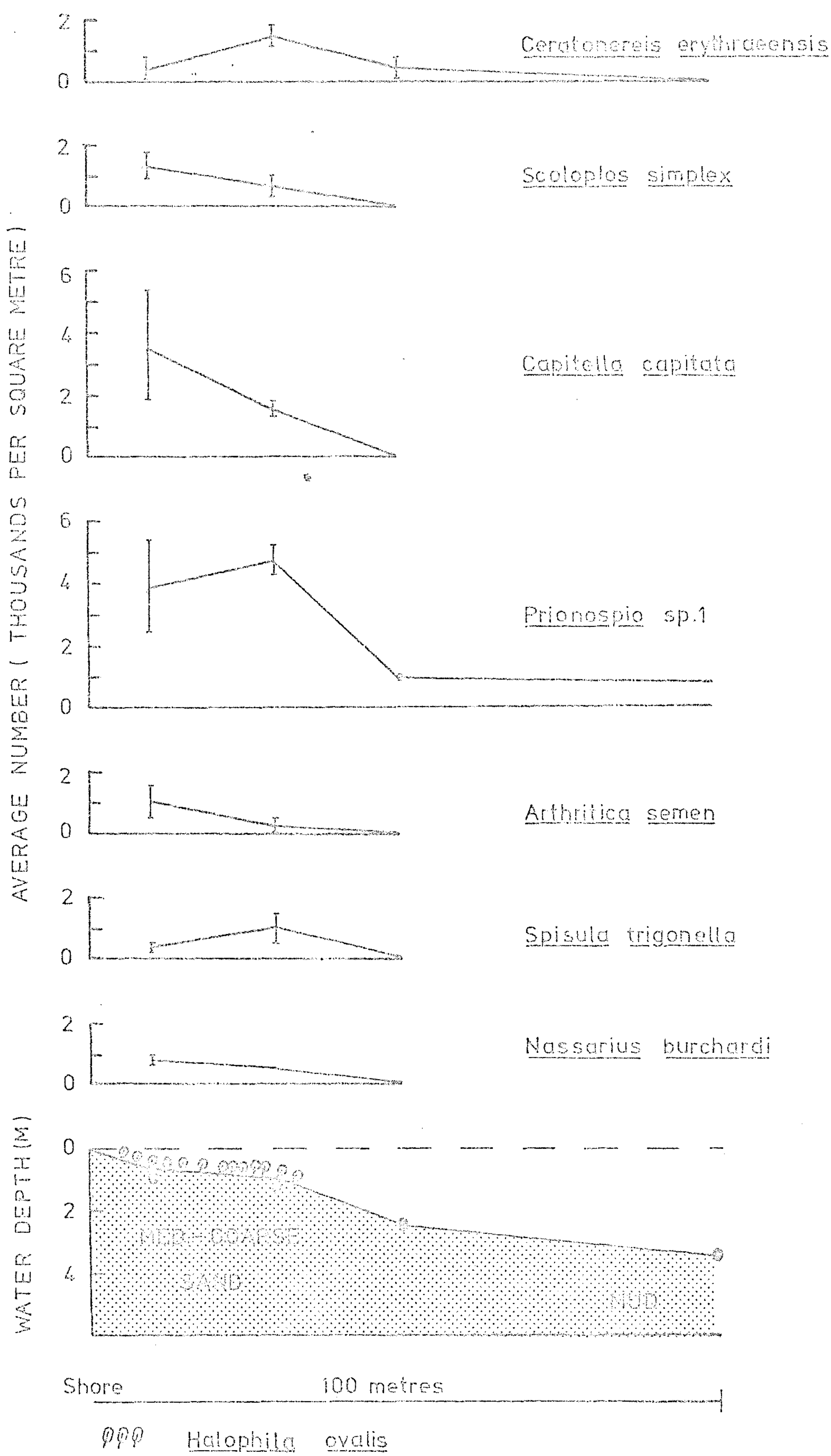


FIGURE 10. Transect 7 Aquinas College

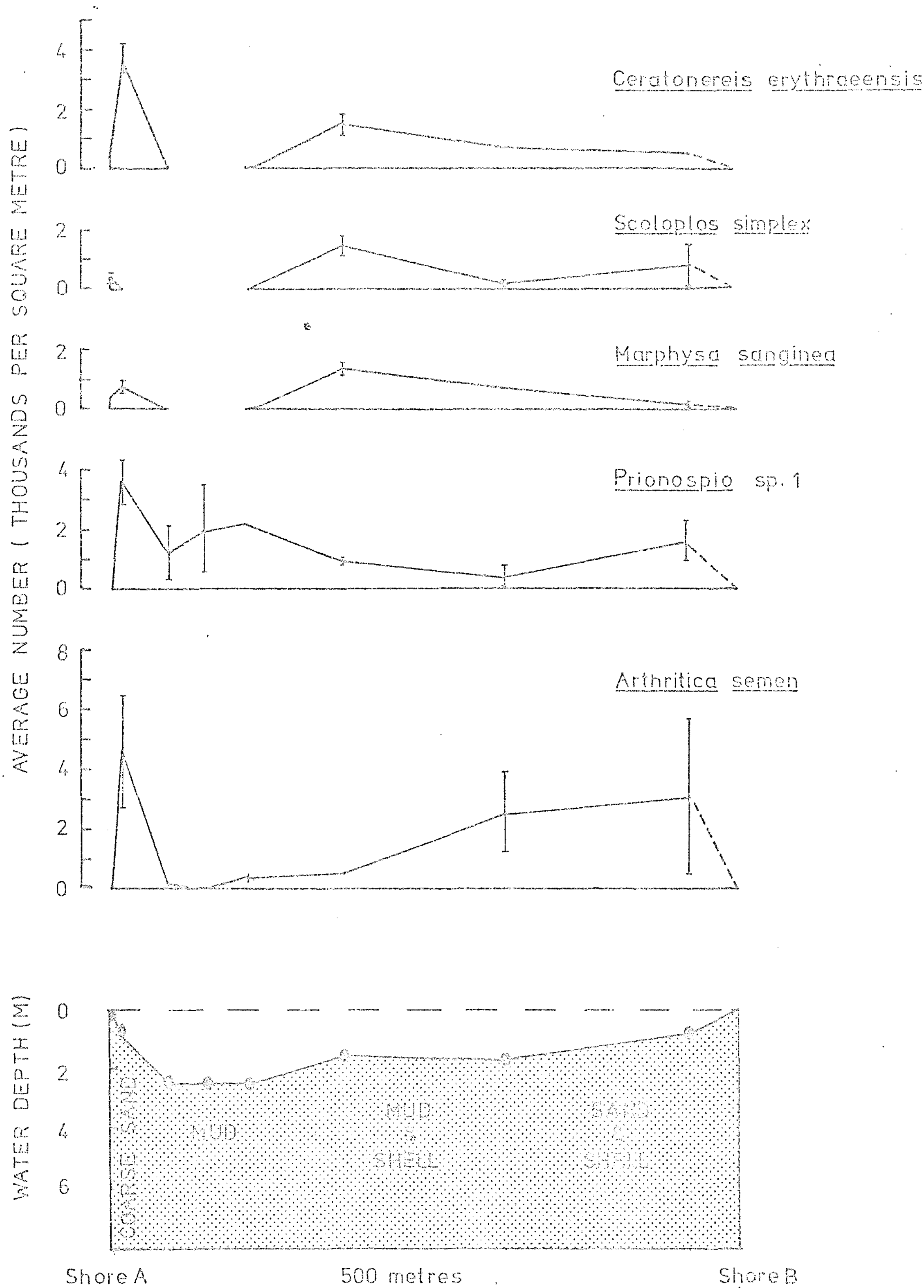


FIGURE 11 Transect 8 Shelley Basin

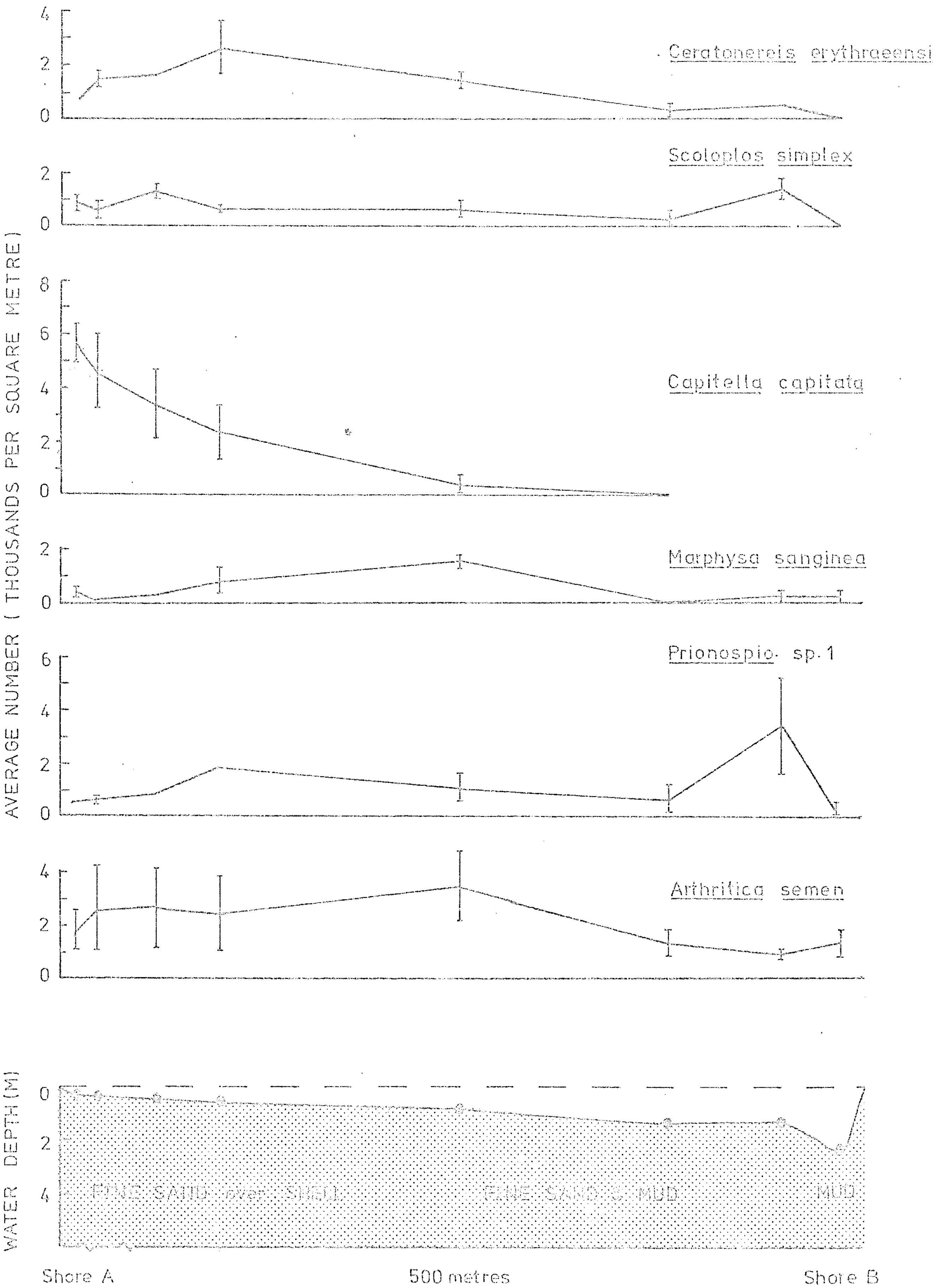


FIGURE 12 Transect 9 Shelley Basin

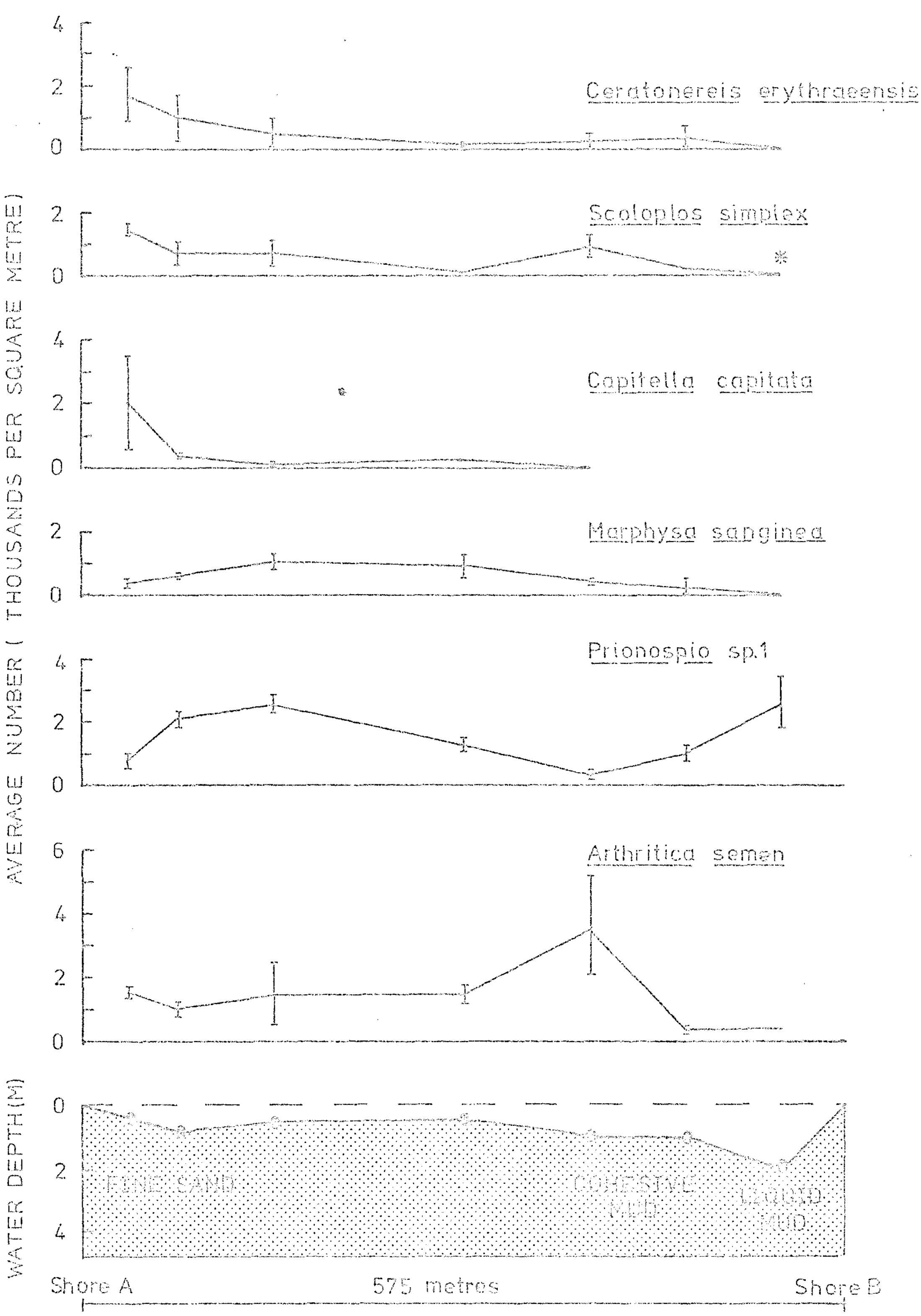


FIGURE 13 Transect 10 Riverton Bridge

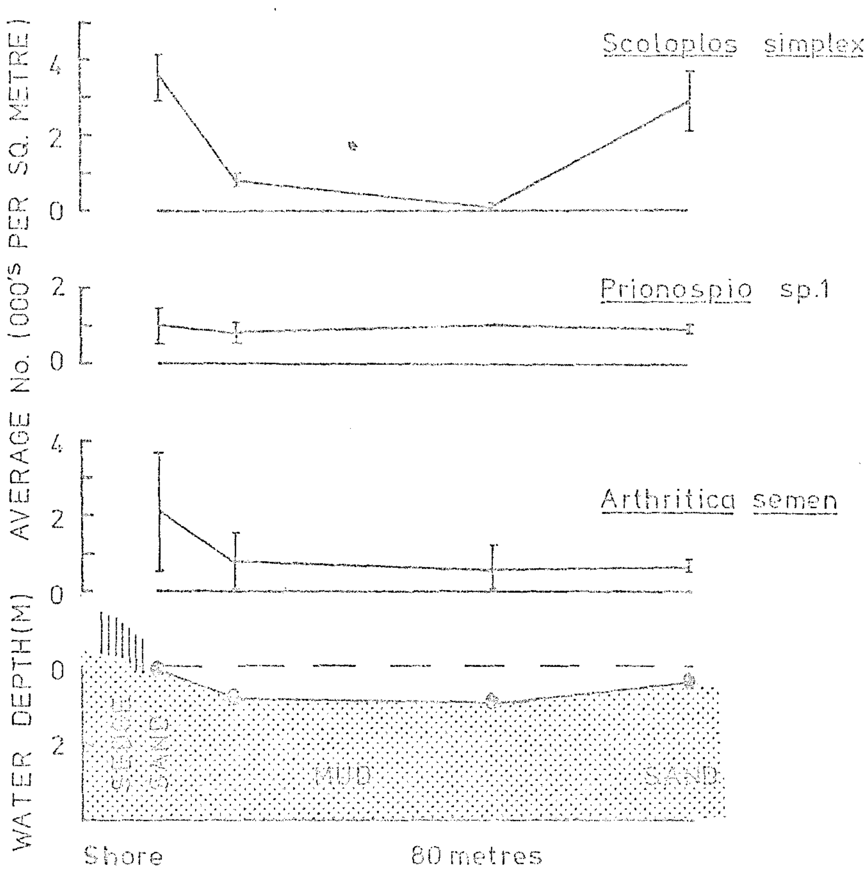


FIGURE 14 Transect 11 Perth Water

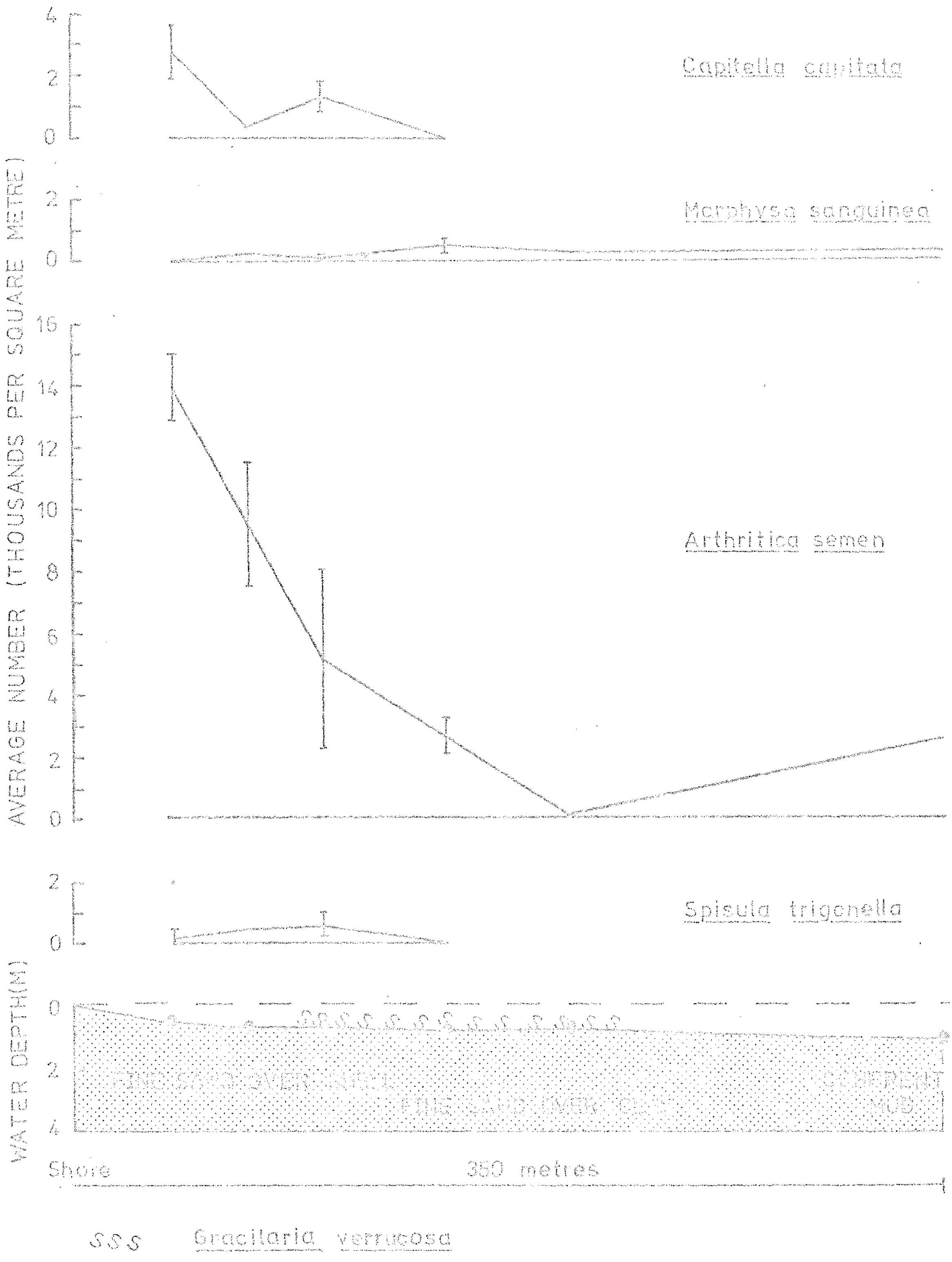
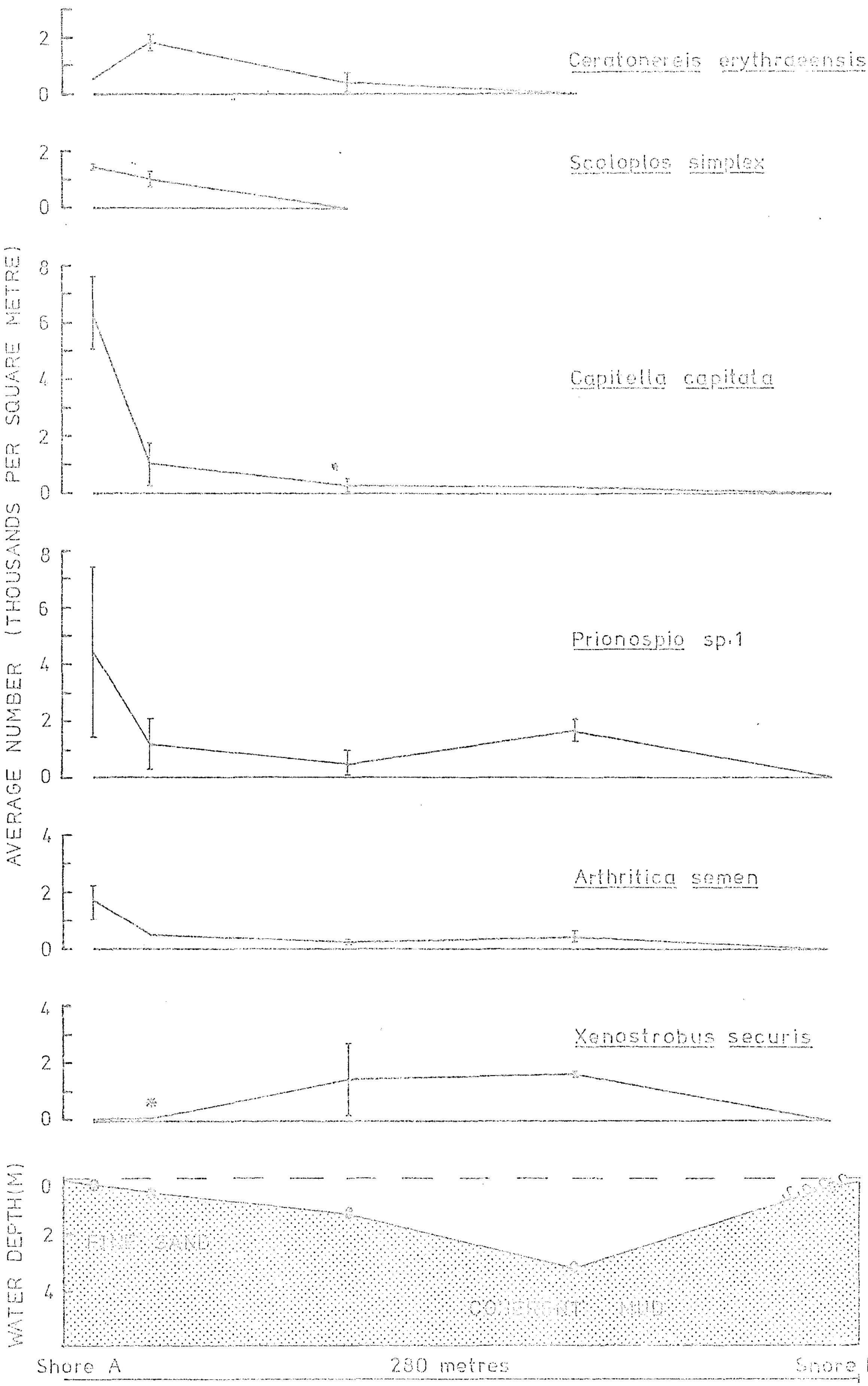


FIGURE 15 Transect 12 Belmont



SSS Gracilaria verrucosa

FIGURE 16 Transect 13 Tranby

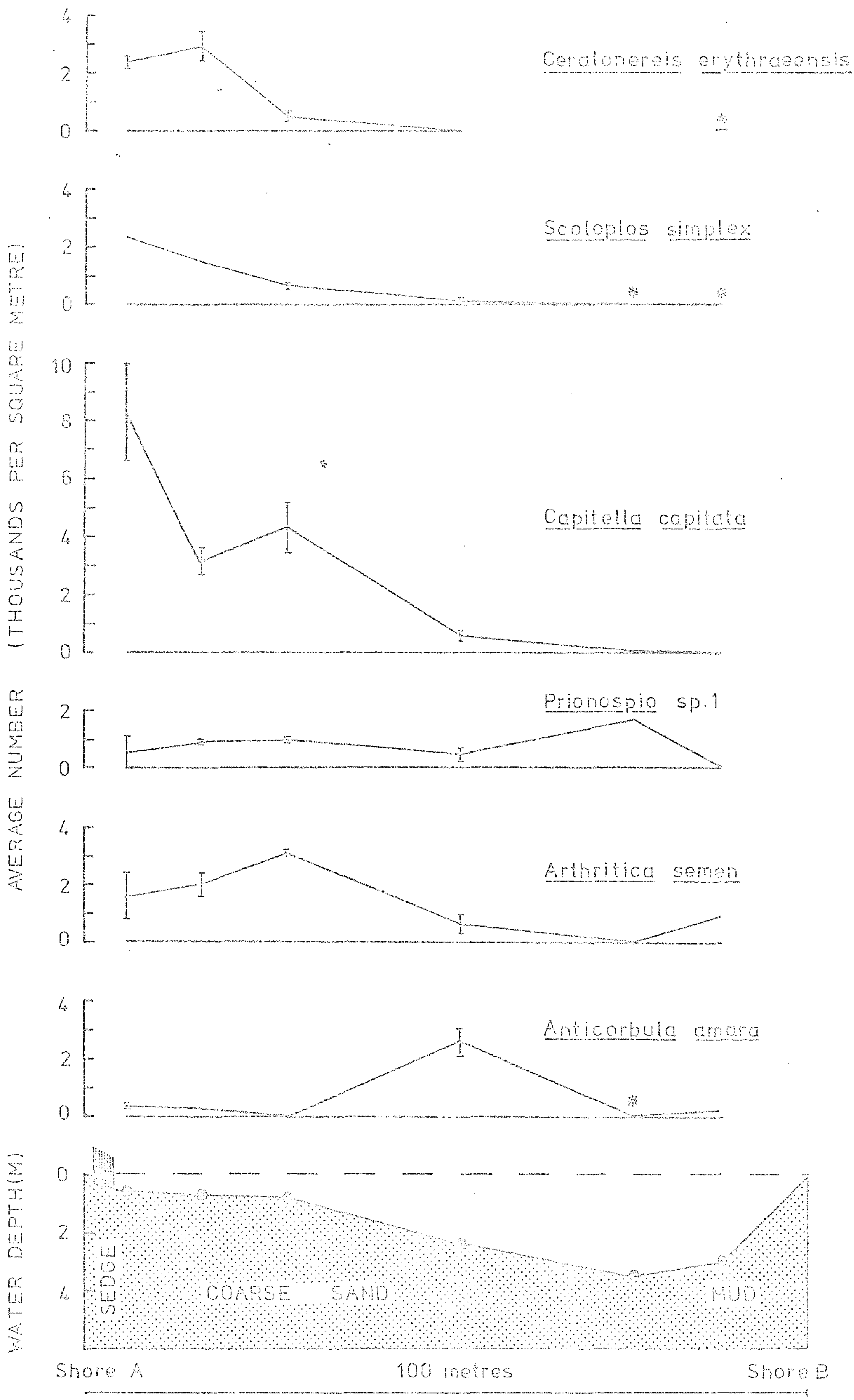


Figure 17 Trellis diagram of affinity indices (as %) between habitats at Pelican Rocks

	Inshore Clear*	Inshore Weed	Offshore	Natural Deep	Dredged Deep
Inshore/Clear					
Inshore/Weed	78				
Offshore	66	60			
Natural Deep	23	14	13		
Dredged deep	22	13	12	83	

TABLE 1 Physical Data

Pelican Rocks Transects 8th March 1977, sunny day with slight east wind

Station	Time (Hrs)	Water Depth (m)	Salinity (°/oo) Top	Salinity (°/oo) Bottom	Temperature (°C) Top	Temperature (°C) Bottom	Secchi disc (m)	Redox disconta uity (cm
1	0910	6	35.0	35.14	22.6	22.7	2.1	0
2A	0920	6	34.9	35.0	22.6	22.6	2.0	0
2	-	1.5	-	-	-	-	*	10
3	0925	0.8	34.8		22.6		*	5-7
4	0930	0.6	35.0		23.1		*	10
5	0940	0.8	33.5		22.1		*	3
6	0945	0.5	34.4		22.2		*	1
7	0950	0.6	* 34.4		22.9		*	2-5
8	1000	4.2	34.6	34.6	22.8	22.7	1.8	1
9	1005	3.5	34.3	34.4	22.8	22.7	1.9	0
10	1010	2.5	34.6	34.6	22.9	22.5	1.9	1
11	1020	4.5	34.6	35.0	22.9	22.5	1.75	1
12	-	2	-	-	-	-	-	1
13	-	3	-	-	-	-	-	1
14	1030	3	34.3	34.6	22.7	22.7	1.85	0
15	1055	2.5	34.5	35.0	23.4	23.3	1.8	**
16	-	1.8	-	-	-	-	-	**
17	-	3.5	-	-	-	-	-	**
18	-	7	-	-	-	-	-	1
19	-	6	-	-	-	-	-	0
20A	0905	5	34.8	35.0	22.7	22.7	1.8	1
21	0855	4	34.6	35.1	22.5	22.6	2.0	
22	0845	8	34.5	35.1	22.4	22.4	1.9	1
23	0835	6.5	34.6	34.8	22.9	22.6	2.3	0
24	0825	6	34.5	34.7	22.3	22.6	2.0	0
25	0820	6	34.5	34.0	22.2	22.0	-	0
26	-	0.8	-	-	-	-	-	8

Canning River : 29th March - Overcast day

Station	Time	Water Depth (m)	Salinity (°/oo) Top	Salinity (°/oo) Bottom	Temperature (°C) Top	Temperature (°C) Bottom	Secchi disc (m)
Lower Canning	1200	2.0	33.9	34.3	20.6	20.8	1.2
Shelley Basin	1030	2.0	32.0	32.0	20.8	20.8	N.A.
Riverton Bridge	0900	1.7	29.4	30.0	20.6	21.0	0.9

Swan River : 18th April - Sunny day

Station	Time	Water Depth (m)	Salinity (°/oo) Top	Salinity (°/oo) Bottom	Temperature (°C) Top	Temperature (°C) Bottom	Secchi disc (m)
Belmont	1045	3.2	29.0	30.8	21.5	21.1	N.A.
Tranby	1280	3.5	26.6	29.1	19.9	20.5	N.A.

* clear to bottom
** layer not obvious

Table 2 Sediment Analysis for Pelican Rocks Area

	% SAMPLE FRACTION						
	CLAY	SILT	FINE	MED	COARSE	VERY COARSE & SHELLS	Md mm
	0.001	0.002	0.06	0.2	2.0		
1	18	57	18	2	1	4	0.035
2		3	9	72	15	1	0.38
3		2	16	75	5	2	0.34
4		1	7	61	28	3	0.48
5		1	11	61	20	7	0.4
6		2.5	6.5	61	27	3	0.48
7		1	11	64	19	5	0.4
8	13	63	23	0.6	0.4	-	0.031
9	16	60	20	0.5	0.5	3	0.023
10	28	31	13	8	1	19	0.028
11	46	46	5	2	1	-	0.024
12	9	16	28	32	9	6	0.17
13	17	11	18	27	15	12	0.23
14	28	40	18	7	3	4	0.015
14a		2	7	51	30	10	0.5
15		4	14	54	17	11	0.4
16	9	3	18	53	13	4	0.34
17		1	3	32	49	15	0.8
18	40	52	7	1	-	-	0.0042
19	35	55	9	1	-	-	0.0042
20	22	35	11	4	2	25	0.035
21	22	20	13	12	8	25	0.13
22	17	80	1	-	-	2	0.016
23	42	43	9	1	1	4	0.0045
24	33	58	3	0.5	0.5	-	0.006
25	30	50	12	1	0.5	6.5	0.01
26		7	20	60	9	4	0.3

TABLE 3 Benthic invertebrate species recorded in the study area, March - April, 1977

		Usual Habitat					
		In Sediment Surface Layer	In Sediment to 10 cm	In Sediment to 20 cm	Attached to solid Substrate	Amongst Mytilids on piles	Free Swimming or Amongst Plants
ANNELIDA	POLYCHAETA						
Orbiniidae	*Scoloplos simplex* (Hutchings)		X			X	
Capitellidae	*Capitella capitata* (Fabricius)		X				
Serpulidae	*Mercierella enigmatica* (Fauvel)				X		
Nereidae	*Australonereis ehlersi* (Augener)			X			
	Ceratonereis erythraeensis Fauvel		X			X	
	Nereis sp.		X				
Eunicidae	*Marphysa sanguinea* (Montagu)			X			
Spionidae	*Prionospio* sp.1		X			X	
	Prionospio sp.2		X				
Cirratulidae	Cirratulid sp.		X				
	Hirudinea 1 sp. unid.						X
MOLLUSCA	PELECYPODA						
Mytilidae	*Mytilus edulis planulatus* (Lamark)				X		
	Xenostrobus securis (Lamark)	X			X		
Mactridae	*Spisula (Notospisula) trigonella* (Lamark)	X					
Tellinidae	*Tellina (Macomona) deltoidalis* Lamark		X				
Veneridae	*Venerupis crenata* Lamark	X			X		
Laptonidae	*Arthritica semen* (Menke)	X					
Lyonsiidae	*Anticorbula amara* (Laseron)	X			X		
MOLLUSCA	GASTROPODA						
Nassariidae	*Nassarius burchardi* (Philippi)	X					
Potamididae	*Batillaria (Velacumantus) australis* (Quoy & Gaimard)	X					
Hydrobiidae	*Tatea preissi* (Philippi)	X					
	Nudibranch						X
CRUSTACEA							
Gammaridae	*Melita matilda* (Barnard)					X	X
	Melita sp.1 (sp nov. 1969)					X	X
Corophidae	*Paracorophium excavatum* G.M. Thomson					X	X
	Corophium minor G.M. Thomson	X					
Caprellidae	*Caprella* sp.					X	X
Apseudidae	*Apseudes* sp.					X	
Tanaidae	*Paratanais* sp.					X	
Sphaeromatidae	*Syncassidina aestuaria* (Baker)					X	
Cirripedia	*Balanus amphitrite*				X		
Palaemonidae	*Palaemonetes australis* (Dakin)						X
	Palaemonetes atrinubes (Bray)						X
Penaeinae	*Metapenaeus dalli* (Racek)		X				
	Penaeus latisulcatus (Kishinouye)		X				
Synalpheidae	*Alpheus euphrosyne* (de Man)						X
Hymenosomatidae	*Halicarcinus australis* (Haswell)					X	
	Halicarcinus bedfordi (Montgomery)					X	
Xanthidae	*Heteropanope serratifrons* (Kinahan)					X	
Portuninae	*Portunus pelagicus* (Linnaeus)						X
COELENTERATA	Anthozoa						
	Unidentified sp.				X		
ASCIDIACEA							
	Unidentified sp.				X		

Table 4 Distribution of benthic invertebrates in the study area, March - April, 1977

(X = present in samples; P = present, supplementary collection)

	Melville Water						Swan River			Canning River				
	Alfred Cove 5	Applecross 4	Pelican Rocks 1	Pelican Rocks 2	Pelican Rocks 3	Pelican Rocks Rocks	Perth Water 11	Belmont 12	Tranby 13	Freeway Bridge 6	Aquinas Bay 7	Shelley Basin 8	Shelley Basin 9	Riverton Bridge 10
Scoloplos simplex	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Capitella capitata	X	X	X	X	X		X	X	X	X	X	X	X	X
Mercierella enigmatica	P	P	X	X	X	X	P	P		P	P	P	P	P
Australonereis ehlersi		X	X	X	X									
Nereis sp.		X		X							X			
Ceratonereis erythraeensis	X	X	X	X	X	X		X	X	X	X	X	X	
Marphysa sanguinea	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Prionospio sp.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Prionospio sp.2		X	X	X	X									
Cirratulid sp.				X	X									
Anticorbula amara				X			X		X				X	
Mytilus edulis planulatus		P				X								
Xenostrobus securis	P			X		X	X	X	X	X	X	X	X	X
Arthritica semen	X	X	X	X	X		X	X	X	X	X	X	X	X
Spisula trigonella	X	X	X	X	X		X			X	X		X	
Tellina deltoidalis	X	X	X	X										
Venerupis crenata	X	X		X		X								
Nassarius burchardi	X	X	X	X			X	X	X	X	X	X	X	
Velacumantus australis	X	X	X	X	X					X	X			
Tatea preissi								X					X	
Nudibranch	X	X				X				X	X			
Melita matilda	X	X		X		X	X				X	X	X	
Melita sp.1	X													
Paracorophium excavatum		X				X	X	X			X	X	X	
Corophium minor	X													
Caprella sp.	X	X	X	X	X	X	X					X	X	
Apseudes sp.	X					X								
Paratanais sp.						X					X			
Syncassidina aestuaria	X	X		X						X	X			
Halicarcinus bedfordi		X		X										
Halicarcinus australis								X						
Heteropanope serratifrons		X				X								
Palaemonetes australis							X	P	P					
Palaemonetes atrinubes		P				P								
Balanus amphitrite		P				P	P			P	P	P	P	P
Anemone	X												X	Y
Ascidian		P		X										
Hirudinea										X				
TOTAL:-	31			31			15	[illegible]	10	19		17		9

Table 5 An estimate of abundance (nos/m^2) for infaunal species in five habitat types at Pelican Rocks, March 1977

Figures in brackets show standard errors

HABITAT:										
Category	Inshore bank		Inshore bank		Offshore bank		Natural deep		Dredged se	
Sediment type	med-coarse sand		med-coarse sand		shell fragments in muddy-sand		Gelatinous Black mud		Gelatinous Black mud	
Dominant Plant	No plants		*Halophila ovalis*		sparse *Gracillaria* sp.		No Plants		No Plants	
Water depth	< 1 m		< 1 m		1 - 3 m		3 m		3 m	
Species:										
Ceratonereis erythraeensis	860	(± 189)	1210	(± 163)	1716	(± 421)	3.7	(± 2.6)	0	
Australonereis ehlersi	1521	(± 200)	316	(± 87)	509	(± 171)	3.7	(± 3.7)	0	
Nereis sp.	0		0		10	(± 10)	0		1.8	(± 1.8
Marphysa sanguinea	97	(NA)	79	(± 39)	274	(± 60	0			
Scoloplos simplex	1302	(± 242)	1605	(± 505)	926	(± 194)	0		0	
Capitella capitata	4202	(± 492)	4447	(±1073)	1102	(± 237)	0		3.7	(± 3.7
Prionospio sp.1	1984	(± 458)	474	(± 158)	642	(± 118	410	(± 191)	1339	(± 486
Prionospio sp.2	0		0		0		102	(± 29)	13	(± 6
Velacumantus australis	29	(± 13)	26	(± 21)	10	(± 10)	0		0	
Nassarius burchardi	58	(± 21)	657	(± 158	29	(± 16)	0		0	
Arthritica semen	1571	(± 232)	1658	(± 321	537	(± 184)	0		0	
Spisula trigonella	792	(± 129)	1026	(± 237	97	(± 32)	274	(± 166)	620	(± 233)
Tellina deltoidalis	0		0		0		1.8	(± 1.8)	3.7	(± 3.7)
Melita matilda	0		0		147	(± 78)	1.8	(± 1.8)	0	
Paracorophium excavatum	0		0		39	(± 24)	0		0	
Caprella sp.	0		316	(±158)	29	(± 16)	0		0	
Syncassidina aestuaria	0		0		50	(± 50)	0		0	
Halicarcinus bedfordi	0		79	(± 79)	0		0		0	
Ascidian	0		0		0		3.7	(± 3.7)	0	
Total N°/m^2	12,486		11,893		6,116		800		1,983	
Total N° species	10		12		15		8		7	
N° species comprising 90% of fauna	6		7		7		3		2	
Area Sampled (m^2)	0.14		0.04		0.07		0.52		0.56	