NINGALOO MARINE PARK: PRELIMINARY FISH DENSITY ASSESSMENT AND HABITAT SURVEY

With information on coral damage due to *Drupella cornus* grazing

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INTRODUCTION

The Ningaloo Reef system extends for 260 km along the west coast of the North West Cape Peninsula, stretching from about 21°50'S to 23°35'S (figures 1-2). The outer reef is on average only 2.5 km offshore, separated from the coast by a shallow sandy lagoon that averages only 2-4m depth. On the seaward side the reef drops gently to about 8-10m, with a well developed spur and groove structure. The bottom then falls more gently to the 100m isobath 5-6 km outside the reef edge, becoming progressively more sandy. The reef is broken every few kilometres by passes where water depth ranges from 6-8m. A general description of the Ningaloo Reef environment and its present recreational use has been published by the Marine Park Working Group (May et al., 1983).

This area differs from all East Coast reef regions in that the coastline adjacent to the reef is arid, with average annual rainfall around 200mm. As a result there is little terriginous sediment input; the lagoon is floored with white calcareous sand. The northern half of the reef lies next to Cape Range National Park or to unused vacant crown land, while the southern half is fronted by sheep grazing pastoral leases. Recreational use of the coast by visitors is relatively high and it is estimated that almost 55,000 people visited coastal areas adjacent to the reef during 1981-82 (May et al., 1983). An aerial survey of the coast on 4th August 1982, during the period of peak use, showed that there was one camping area for each 5 km of coastline, with a total of almost 1000 people camped on the coast (May et al., 1983). The majority of these people are involved in recreational fishing, either from the shore or in the lagoon from small tin boats, with the most sought after fish species being the north-west snapper (better known as the spangled emperor *Lethrinus nebulosus*).

Only preliminary biological information is available for the Ningaloo Reef tract. A coral species list has been compiled by J.E. Veron of the Australian Insitute of Marine Science and records 203 species of coral from this area (personal communication). A comprehensive fish list has also been presented by G.R. Allen of the West Australian Museum (Allen, 1980). Allen recorded 464 species of fish from 81 families. Preliminary species lists have also been compiled for some other reef groups, notably echinoderms and molluscs.

The purpose of the field work reported here was to delineate the major biological habitats at several sites within the proposed marine park, and to obtain some preliminary information on the density of recreationally important fish species in the selected sites.

Four sites were surveyed: three in the Osprey Bay-Sandy Bay area toward the southern end of the Cape Range National Park where recreational use is only moderate; and a fourth at Neds Camp near the northern end of the terrestrial park where road and boat access is relatively easy and recreational fishing pressure relatively high. The three sites in the Osprey Bay-Sandy Bay area were designated from north to south: Sandy Bay Site; Osprey Bay Pass Site; and South Osprey Bay Site. During the course of the field work it was noted that large numbers of the small muricid gastropod *Drupella cornus* were eating hard corals at all four sites. As a result the survey was extended to cover density estimates of these gastropods at the four major sites and at four additional sites spaced along the reef tract. These additional sites from north to south were: Tantabiddi Creek; North Mandu Mandu; Winderabandi Point; and Coral Bay (see figure 2).

METHODS

Habitat Delineation

Preliminary subdivision of each site into biological habitats was made by examination of colour aerial photographs. The habitats chosen were then verified by field examination and the photographs were then used to determine the area of the major marine habitats at each site. In most cases the habitats occurred in bands parallel to the shore within each site. The survey area within each habitat was located along a line running across each site at right angles to the shore (with the exception of site 2). Two post leads on the shore and buoys across the lagoon were used to define the position of the line. The position of the areas surveyed within each habitat at each site is shown in the attached maps (figures 3-4).

Logistic and weather constraints confined the surveys to inner reef flat and lagoonal habitats for most of the time. The large ocean swells breaking continuously on the front reef limited access to the front reef slope, reef crest and outer reef flat habitats. Partial surveys of single areas within these three habitats were all that was possible.

Quantification of Substratum Type and Cover of Encrusting Organisms

At the survey areas chosen within each habitat five random 20m long line transects were used to measure substratum type and the cover of corals and other encrusting organisms. A fiberglass tape was used to define each transect, run approximately parallel to the shore, and the length of intersection of each organism or each different type of substratum immediately beneath the tape was recorded. Corals were identified to species whenever possible but in some cases it was more useful to group species in similar growth forms within each genus (*Acropora* plates for example). The cover of dead standing hard corals was also recorded. The category of dead standing coral refers to colonies that have died or been eaten but still retain the form of the live coral; the colony has not started to break up into coral rubble. Each group of five randomly positioned transects was run within an area approximately 50m square. In a few cases, when time permitted, two groups of five transects were surveyed in adjacent areas within a single habitat.

In two areas that were considered representative of the coral dominated habitats a further five permanently marked 20m line transects were set up and surveyed in the same way. These areas were located on the reef flat in site 3, and on the pass shoal slope in site 2. The transects were located adjacent to a star picket driven into the bottom and were marked at intervals of 2-6m with 10cm masonry nails driven into massive pieces of coral. It was envisaged that these permanent transects would give a detailed baseline from which to follow changes in the coral communities of these two areas, to complement the more general changes that will be detected from resurveys of the groups of random transects.

Drupella cornus Counts

After a few trials it was found that 5 x 0.5m transects could be searched most adequately for individuals of this coral eating gastropod and that counts of this area recorded sufficient numbers to give a reasonable estimate of density in most areas. These counts were carried out mainly on the back reef flat habitat where coral cover was (or had been) greatest and 10-30 replicates were searched in the areas surveyed. Single groups of 5 replicates were also surveyed in the reef crest and front reef slope habitats.

Fish Counts

Fish were counted along five replicate 50 x 20m belt transects positioned randomly in each area but run approximately parallel to the shore. Each transect was defined using a 50m fiberglass tape and fish within 10m each side of the tape were recorded. For the majority of the groups of counts three observers were used. One observer slowly lays out the central tape while the other two swim along, one each side of the tape, recording target fish that are estimated to be within 10m of the tape. Target species included all fishes in the families lethrinidae (emperors), lutjanidae (snappers or sea-perch), haemulidae (sweetlips), chaetodontidae (butterflyfishes), scaridae (parrotfishes), all non-secretive members of the family serranidae (groupers), and large recreationally important members of the family labridae (wrasses).

Where these fishes were not abundant all target species were recorded during a single pass along the transect, but where some or all of them were abundant the recording observers made a number of passes along the transect counting a different group of species each time. During the first pass species that were repelled by the presence of the observers were counted; it was important that the diver running out the tape kept pace with the two observers during this first pass so as not to get ahead of them and disturb unrecorded fish. Species in this category include all lethrinids and lutjanids along with the serranids and the large labrids. On the second pass scarids and haemulids were counted with chaetodontids being counted on a third pass if necessary. It was important that *Lethrinus nebulosus*, and to a lesser extent *L. mahsena*, was given the most careful attention during the first counting pass, with the observers watching for individuals moving away at the edge of visibility, as these species were the most obviously repelled by the observers.

Fish counts were made in the same areas in which encrusting organisms were surveyed but were spread over a larger section of the target habitat, being run within an area approximately 150 x 100m.

Underwater visibility of about 8m is the minimum in which this size of visual fish count can be surveyed accurately; if the visibility drops below this the width of the transects must be reduced to 10m (5m each side of the tape). During the survey reported here underwater visibility normally ranged from 10-15m.

The total length of all *Lethrinus nebulosus* and *L. mahsena* recorded was estimated so that length frequencies could be constructed for the different habitats and sites. Where these species were present in large numbers all the observers attention was required to make the count and in such a case the lengths of about 50 randomly chosen individuals of each species were recorded between counts in the same area that the counts were run in.

RESULTS

Habitat Description

A total of eight biological habitats were recognised along the transects in the three reef sites (sites 1, 2 & 4), while six additional habitats were recognised in the Pass Site (site 2). These habitats are listed below, along with a brief description of each, and are shown in the accompanying maps (figures 3-4).

Normal Reef Site Habitats:

Outer Reef Slope: The portion of the reef slope on the seaward side of the reef from about 4m depth down to about 8-10m depth (after which the bottom levels out and sand patches begin to occur). A firm coral basement with moderate cover of robust hard corals and moderate cover of dead standing hard corals.

Reef Crest: A narrow band of distinctive habitat immediately beneath the breaking waves on the outer edge of the reef flat. Characterised by high cover of hard corals, notably small clumps of *Acropora digitifera*, and massive domes of *Goniastrea* and *Platygyra*. The coral basement between the corals is extensively burrowed by large numbers of the echinoid *Echinometra*. Corals on the reef crest are exposed on low spring tides.

Outer Reef Flat: Extending from the reef crest about halfway back across the reef flat this habitat is composed of large areas of coral rubble alternating with patches of coral basement extensively burrowed by *Echinometra* at densities of over 50 per sq m. There is some live hard coral on the patches of coral basement and a moderate amount of dead standing coral.

Reef Flat: Coral basement, with some rubble and sand and a high cover of dead standing coral, primarily plate forming *Acropora*, and a variable amount of live hard coral.

Back Reef Edge: The interface between the reef flat and the lagoon floor. A variable habitat made up of sand, staghorn *Acropora* patches, large *Porites* heads, and a coral slope from 1-4m deep.

Coral Lagoon: Some areas in the lagoon are characterised by coral communities, usually growing on patches of hard substratum scattered over the sand and rubble floor. Neds Camp outer and middle lagoon are good examples of this habitat.

Algal Lagoon: Sand or rubble substratum is typical of the lagoon area but in much of the lagoon all available hard substratum, whether pieces of coral rubble or emergent patches of coral basement, is covered with the brown alga *Sargassum* or a variety of other macroalgae. A few corals and sponges occur amongst the algae but generally account for less than 1% of the bottom cover.

Sand Lagoon: Large areas of the lagoon are bare sand with only widely scattered small clumps of macroalgae.

Pass Site Habitats:

Pass Floor: Low coral basement ridges interspersed with sand and coral rubble gutters at 3-6m depth. Moderate cover of hard coral and massive *Millepora* (fire coral) colonies.

Pass Shoal Top: A shoal, slightly deeper than the reef flat, stretching across the pass between the outer reef and the shore. Coral basement with moderate cover of hard coral and extensive areas of dead standing coral.

Pass Shoal Slope: A steep coral slope off the back edge of the shoal, falling to sand or rubble in 3-5m depth. Moderate cover of live hard coral, and massive *Millepora* colonies, with moderate cover of dead standing coral.

Sargassum Slope: Coral basement or rubble slope, descending to a sand floor in 4-6m depth, covered with dense *Sargassum* forest. Hard coral largely absent.

Algal Lagoon: Sand and rubble floor in 1-3m depth, with a high cover of *Sargassum* and other macroalgae.

Inshore Reef Flat: Beach rock platforms close to shore that are exposed on low spring tides, and covered with scattered macroalgae, hard coral largely absent.

Abundance of Hard Corals and Other Encrusting Organisms

The raw data from the line transect surveys of encrusting organisms and substratum type, along with some preliminary analyses, are shown in the tables in Appendix 1. Summaries of mean percentage cover of live hard coral, dead standing hard coral, and macroalgae are shown in table 1.

At the time of this survey live hard corals were moderately abundant on the outer reef slope (20% cover), where the corals were primarily massive favids, especially *Goniastrea*, *Platygyra* and *Leptoria*, and plate and staghorn *Acropora*. Dead standing coral covered 17.7% of the substratum here, about equal to the live coral cover. Sponges were relatively abundant in this habitat, especially the encrusting green-grey sheets of *Sigmadocia. symbiotica.*

The reef crest habitat (surveyed at site 3 only) had a higher cover of live coral than any of the other habitats surveyed with 37.4% cover. Live corals were primarily small clumps of *Acropora* with 28% cover, and massive colonies of *Goniastrea retiformis* and *Platygyra* with 5.8% cover. *Drupella* were not present in large numbers in this habitat and hence dead standing coral was only an infrequent occurrance, accounting for less than 5% cover.

Prior to the *Drupella* infestation the reef flat habitat had been dominated by plate forming *Acropora*; most of the 60-70% cover of dead standing coral in the 6 reef flat survey areas was *Acropora* plates. Live hard coral cover was low in this habitat in Sites 1 & 3, ranging from 3.8-7.1%, and was primarily *Acropora* plates and clumps. At site 4 there was 24.1% cover of live coral, including 12.7% *Acropora* plates, but *Drupella* were very active at this site and many of the live coral colonies were partially eaten at the time of this survey. At site 3 there were some patches of the soft coral *Sarcophyton* on the reef flat with a mean cover of 5.7% in one group of 5 transects.

The back reef edge habitat, where coral patches were interspersed with areas of sand, had a distinctive coral community. Massive *Porites* heads up to 15m in diameter, and stands of staghorn *Acropora* were the most obvious features of this habitat, along with some *Acropora* clumps and plates. Live hard corals accounted for about 10% cover, with dead standing corals covering another 10-20% and sand patches 25-50% of the substratum.

At site 4 the outer and middle lagoon was not dominated by algae but had a coral community similar to the back reef edge with 11.3 and 8.3% hard coral cover

respectively. Here *Pories* finger and *Porites* massive heads were frequent as were *Acropora* clumps and *Acropora* staghorn thickets. Dead standing coral cover was about equal to live coral cover. In these coral lagoon habitats massive *Millepora* colonies were also common, covering 4.1 and 23.5% of the substratum repectively.

In the Algal dominated lagoonal habitats at all sites corals covered less than 1% of the substratum, while sponges also accounted for less than 1%. In some areas not quantified in this survey the erect, strap-like fan sponge *Phyllospongia papyracea* was relatively abundant. *Sargassum* and other macroalgae covered between 15 and 75% of the substratum in these habitats.

Large areas of the lagoon were characterised by a uniform sand substratum with little or no solid substratum to act as an attachment site for either corals or algal. This sand lagoon habitat was featureless apart from a few clumps of algae, and an occasional small coral colony.

In the reef pass at site 2 the pass floor habitat had only 7.5% live coral at the time of the survey, primarily massive faviid species, but *Drupella* activities had resulted in dead standing coral accounting for 62.7% cover. Massive *Millepora* colonies were also common in this habitat with 5.0% cover.

On the top of the pass shoal *Drupella* had also been active resulting in 47.2% cover of dead standing coral. The 11.1% live coral remaining was primarily *Acropora* clumps and plates, with some massive faviids and clumps of *Stylopora pistillata*.

The back slope of the pass shoal was dominated by algae for part of its length but had a rich coral community along the remaining half. Live coral cover was primarily massive faviid species. Massive *Millepora* colonies covered 5.1-8.0% of the substratum here.

Drupella cornus Density

The coral predatory gastropod *Drupella cornus* was present in all areas where coral was dominant but was especially common in the reef flat habitat. Density estimates were made at 7 sites between Coral Bay in the south and Tantabiddi Creek in the north and these are summarised in table 2. As this species was most abundant in the reef flat habitat, most density estimates were made there. Means ranged from 5.3 to 18.5 per sq m in this habitat but the estimates had a very high variance in most areas and numbers as high as 175 per sq m were recorded in single transects. Where coral was present in the lagoon habitats, as at Coral Bay and Neds Camp, *Drupella* occurred in moderate numbers, with a mean density of 5.0 per sq m in the Coral Bay site. On the reef crest and outer reef slope only single sites were surveyed due to access problems. These indicated that *Drupella* was less common in these more exposed habitats with densities of 1.3 and 1.6 per sq m respectively.

Drupella was usually aggregated on the live coral colonies on which they were feeding; only 7.3% of those recorded in one set of 20 counts (site 3, reef flat) were not on partially live coral colonies. They were recorded feeding on a wide variety of coral species (see table 3) but predominantly on all *Acropora* species (especially plates), and most *Montipora* species. To a lesser extent they attacked pocilloporids, poritids and a small proportion of the colonies of a few faviid species notably *Goniastrea retiformis*.

It was noted that *Drupella* grazing had a distinctive effect on many prey corals, removing the softer parts of the skeleton entirely, especially the growing tips of *Acropora* species, and damaging the skeleton around the polyps. In many of the more fragile clumping *Acropora* species many of the branches had been broken off

by the *Drupella* forcing their way down amongst the tightly packed fingers of the skeleton. Hence, it could be inferred with some reliability that the majority of the dead standing coral at all sites surveyed had been killed by *Drupella* grazing.

The feeding rate of *Drupella* was estimated using repeated photographs of 12 *Acropora* plate colonies over a 7 day period. This rate was variable, ranging from 0.6 to 10.1 sq cm of the plate area per mollusc per day, with a mean of 2.6. At this mean rate 16.2 individuals (the mean number found per sq m in this area) could completely eat a plate 1m square in 237 days. Brawley and Adey (1982) also recorded high grazing rates for the related gastropod *Coralliophila abbreviata*, with up to 16 sq cm of coral tissue being eaten per day by each animal.

The relatively small number of sites surveyed for *Drupella* density suggest that the activity of these gastropods has been greatest in the northern part of the Marine Park, between Winderabandi Point and Neds Camp. All areas surveyed in this 100km long area had high densities of *Drupella* and/or large areas of dead standing corals. However, only one survey was made in the southern 200km of the Park (at Coral Bay) and more work is required to determine the status of *Drupella* in this large area.

Fish Counts

The raw data from all the series of fish counts is tabulated in appendix 2, along with the means and standard deviations for each group of counts.

Lethrinidae (Emperors)

Density

Three species of emperors were recorded in the counts although one of these, *Lethrinus variegata*, was only found in small numbers in two areas. A fourth species, *Lethrinus chrysostomus*, was sighted on the outer reef slope but was not recorded in any of the counts. Densities of *Lethrinus nebulosus* (known locally as the NW snapper or spangled emperor), and *Lethrinus mahsena* (yellow-tailed emperor or big-eyed snapper) are summarised in table 4. Of these two species *L. nebulosus* is is the primary target of both recreational and commercial fishermen, although large specimens of *L. mahsena* are retained if taken.

Lethrinus nebulosus was most abundant on the short (550m long) coral dominated portion of the pass shoal slope where densities of 426 per ha (hectare) were recorded. This species was also relatively common in all habitats where areas of sandy substratum were associated with patches of coral or *Sargassum* for shelter, such as on the back reef edge and inner reef flat, and in lagoon habitats where such shelter was sufficient. Densities ranged from 42-114 per ha in these areas. In habitats such as the outer reef slope, outer reef flat and pass floor, where there was little sand cover, this species was either rare or absent.

Single factor analysis of variance was used to test the significance of the density differences for *L. nebulosus* between the habitats in each site. Habitats that had a density of 1 per ha or less were excluded from the analyses. A significant result was detected only for site 2 where there were 30x density differences between habitats; density differences within the other 3 sites ranged from 1.5x to 9.5x but were not significant (see table 5).

The yellow-tailed emperor *L. mahsena* was most abundant in the outer reef flat habitat where densities of 524 per ha were recorded in the single area surveyed in this

habitat. Observations at three other sites suggested that this high density is widespread in this habitat. *L. mahsena* was also abundant on the coral dominated portion of the pass shoal slope with densities of 424 per ha, and on the outer reef slope (112 per ha), the pass floor (152 per ha) and the reef flat habitat (158-294 per ha). This species was reasonably common in all other habitats except those dominated by macroalgae.

Density differences for *L. mahsena* between the habitats in each site were significant in all cases (single factor analysis of variance). With the exclusion of habitats that had a density of 1 per ha or less, density differences within the 4 sites were 5x, 6x, 9x and 13x (see table 5).

Using the habitat map for sites 1-3 (figure 3) it was possible to measure the area of each habitat within the 4km length of coastline that encompassed these 3 sites. Using these habitat areas and the density estimates within the different habitats, an estimate of the total number of each of these species present at the time of the survey in this part of the coast could be made. Estimates were 18,469 for *L. nebulosus* and 77,168 for *L. mahsena.*

Much of the lagoon is less than 1m deep at low tide and the inner reef flat less than 50cm deep. It was thought that the larger fishes may move into deeper areas at this time with a consequent influence on the density estimates. At site 1 separate groups of counts were made at low tide and at high tide in the reef flat habitat and in the outer part of the algal lagoon. There were no significant differences in density between high tide and low tide for either *L. nebulosus* or *L. mahsena* (single factor analysis of variance)

The distribution of these two species was very patchy, both between habitats, and on a smaller scale within each habitat. This was especially so for *L. nebulosus* ; the standard deviation of the five replicates made in each habitat was usually approximately equal to or greater than the mean, and the variance : mean ratio averaged 8.8 for the 14 groups of counts in which the mean density was over 10 per ha. For *L. mahsena* the standard deviation was generally less than half of the mean (lowest value 11% of the mean), and the variance : mean ratio averaged 2.7 for the 15 groups of counts in which the mean density was over 10 per ha. This has important consequences in any attempt to determine the significance of density changes that are detected through time as will be discussed later.

Length Frequencies

Length frequencies for *L. nebulosa* and *L. mahsena* in the different habitats in which they were common are shown in figures 5-7. The minimum takable size for fishermen for both these species is 28cm. The preferred target of fishermen, the NW snapper *L. nebulosus*, showed three significantly different patterns of length frequency distribution (significance of differences tested using Kolmogorov-Smirnov two sample tests). On the site 1 reef flat habitat and the site 1 and 3 back reef edge habitat fish from several different year classes, between 20 and 50cm estimated total length (TL), were present in moderate numbers with a few larger individuals also being recorded. On the pass shoal back slope in site 2 and in the coral lagoon at site 4 *L. nebulosus* populations were dominated by a single size class (26-30cm TL) with few or no large fish being counted in these areas. There was a very different pattern in the combined algal dominated lagoonal habitats. In these areas 63% of fish recorded were between 6 and 15cm TL, with a few individuals in all larger size classes up to 65cm TL. This suggests that the algal dominated lagoonal habitats are nursery areas for this species offering shelter for new recruits and the 0+ age class.

Mean length for this species ranged from 20.5 ± 14.4 cm from all algal habitats to 38.1 ± 7.6 cm from the back reef edge habitat. By summing the individuals in each count that were estimated to be over 28cm in TL it was possible to get a measure of the density of fish that were potentially accessible to fishermen in each habitat. By combining this density with the areas of each habitat in the sites 1-3 area (see estimates of total numbers above) the number of fish over 28cm in the same area could be calculated. It was found that 11,736 *L. nebulosus* in this 4km length of reef were over 28cm, or 63.5% of the total number of this species in this area.

L. mahsena length frequency distributions from the different habitats were all generally similar with only a few exceptions. In most cases the mean length was between 26 and 30 cm, the dominant length class was also 26-30cm, and the majority of fish recorded were between 21 and 35 cm in length. The most notable exception was the combined algal habitats where 77% of individuals recorded were less than 20cm long and 47% were in what is probably the 0+ age class between 6 and 10cm long. It seems likely that these algal dominated habitats act as nursery areas for both these species of *Lethrinus*.

L. mahsena did not grow to such a large size as *L. nebulosus*. The largest *L. mahsena* recorded was estimated at 39cm TL compared with 65cm for *L. nebulosus*. Mean size of *L. mahsena* was 15.6cm in algal dominated habitats, and ranged from 24.5 to 30.5cm in other habitats. Of the estimated total number of this species in the 4km long sites 1-3 area (see above), 38,562 or 50.0% were over 28cm in TL.

A comparison of length frequency patterns between the relatively heavily fished site 4 and the relatively lightly fished sites 1-3 shows no meaningful trends. For *L. nebulosus* the length frequency graph from the coral dominated lagoon habitats at site 4 (the only habitats surveyed in this site where reasonable numbers of this species were recorded) was not significantly different from the similar pass shoal slope habitat in site 2, although both were significantly different from the reef flat in site 1 and the back reef edge of sites 1 and 3. In the latter 2 habitats the mean size was also significantly larger.

Length frequency distributions for *L. mahsena* from the reef flat habitats of sites 1, 3 and 4 also showed no meaningful correlation with fishing level. Sites 3 and 4 showed patterns that were not significantly different and also had very similar mean lengths, although site 1 had a length frequency that was significantly different and a significantly lower mean length.

Other Recreationally Utilized Fishes

Although fishes in the family Lethrinidae are the major species caught by line fishermen a number of other groups are accessible to spearfishermen or are occasionally landed by line fishermen. These include cod (family Serranidae), large snappers (family Lutjanidae), sweetlips (family Haemulidae), baldchins and bluebones (family Labridae; genus *Choerodon*), and large terminal phase parrotfishes (family Scaridae). With the exception of the parrotfishes, none of these groups were recorded in sufficient numbers to make more than the most general comments on their distribution and abundance.

The most abundant serranid was the chinaman cod *Epinephalus rivulatus* that occurred occasionally in most habitats, but was common in all algal dominated habitats with mean densities ranging from 26 to 84 per ha (see table 6). However, the majority of specimens of this species were too small to be taken by spearfishermen. No other serranids were even moderately common; only a single coral trout *Plectropomus leopardus* was recorded in all the counts, and the moderate sized greasy cod *Epinephelus tauvina* occurred at densities of about 2 per ha in coral

dominated habitats (table 6). Although no specimens were recorded in the counts the queensland grouper *Epinephelus lanceolatus* was relatively common and a total of five were sighted during the course of this survey.

No large lutjanids were recorded in any of the counts, although the 25-30cm TL black-spot sea-perch *Lutjanus fulviflamma* was locally common in coral dominated habitats (see table 4).

Four species of sweetlip were recorded in the counts with a combined density of 12.8 per ha in the coral dominated habitats, the majority from 40-50cm TL (see table 6).

The large labrids in the genus *Choerodon*, that are commonly referred to as baldchin groupers or bluebones, are the most prized food fish in this area. Two species were recorded, *C. schoenleinii* and and an undescribed species, and both were most abundant in the deeper habitats associated with coral. Mean combined densities for these two species were about 4.2 per ha (see table 7).

Parrotfishes were very common in most habitats especially on the reef flat and other coral dominated habitats. A total of 17 species were recorded, with combined densities of up to 2320 per ha. In algal dominated habitats the small species *Leptoscarus vaigiensis* was common, especially in dense *Sargassum* forests where it was associated with small numbers of another small algal scarid*Calatomus spinidens*. In the coral dominated habitats the species *Scarus schlegeli* and *S. sordidud* were most abundant, with moderate numbers of *S. pragiognathus, S. psittacus* and *S. frenatus*. *Scarus ghobban* was present in moderate numbers in all areas surveyed. The majority of the scarids recorded were small sized fish; only males of the five largest species are taken by spearfishermen and these averaged only 16 per ha for the coral dominated habitats (see table 7).

Estimates of the total number of individuals of these recreationally utilised species within the 4km length of reef encompassing sites 1-3 are shown in table 8.

Butterflyfishes: Family Chaetodontidae

Many butterflyfishes are obligate feeders on hard or soft corals and measures of the abundance of species in this group can give a good indication of the state of coral populations in an area. On the Ningaloo Reef Tract only 5 species of hard coral feeding chaetodontids were recorded and the combined density of these species was positively correlated with hard coral cover (see figure 8). These species prefer to feed on corals in the family acroporidae and show a better correlation with the combined percentage cover of corals in this family (figure 8).

Although the remaining chaetodons were primarily invertebrate pickers they were largely confined to coral dominated habitats (see table 9). The only exception was the western butterflyfish *C. assarius* that was positively associated with macroalgal cover (see figure 8) and was not found in coral dominated habitats. The most abundant invertebrate picking species apart from *C. assarius* was *C. auriga* with *C. citrinellus* and *C. lunula* also moderately common.

DISCUSSION

Habitats and Coral Cover

In general surveys of the Ningaloo reefs conducted prior to 1980 by members of the West Australian Museum and J. E. Veron, a coral taxonomist from the Australian Institute of Marine Science, the coral communities were reported to be healthy and diverse, with a high percentage cover of live corals (Marsh, 1980; May et al., 1983; Veron, pers. comm.). During the present survey the only area visited that had a rich and diverse coral community was the Coral Bay site. This site probably provides the best indication of the pre-1980 condition for all sites prior to the outbreak of *Drupella cornus* grazing. At Coral Bay the present surveys recorded a percentage cover of live coral of almost 50% in the middle lagoon and 28% on the back reef flat. The percentage cover of dead standing corals at all the other reef sites suggests that such rich coral communities were universal prior to the outbreak of *Drupella* activity.

The coral communities at most of the sites surveyed did not extend far into the lagoon, but were replaced by macroalgal dominated communities or open sand flats. Exceptions were Coral Bay, where coral dominated the entire lagoon, and Neds Camp (site 4) where all patches of hard substratum in the outer half of the lagoon area were dominated by corals.

Algal dominated shallow water communities are a feature of turbid fringing and inshore reefs on the Great Barrier Reef (GBR) where the water visibility is less than a metre for long periods of the year. Hence it seems possible that water conditions in much of the Ningaloo lagoon are also turbid for a large part of the time, although visibility during this survey was usually around 10-12m. Alternatively it may be the movement of the large amount of sand swept across the reef and constantly resuspended and moved within the lagoon by waves and currents that inhibits the growth of corals in this area. Examination of aerial photos of the area suggests that extensive sand drifts move into and along the lagoon, driven by waves and currents, and are an important feature of much of the lagoon environment on the Ningaloo reef tract.

A feature of the back reef edge and lagoonal habitats was the presence of many large massive *Porites* heads; the largest measured during this survey was 15.5m in daimeter, that provide focal points for larger fishes such as drummer *Kyphosus gibsoni*, sweetlips and the occasional queensland grouper *Epinephelus lanceolatus*. These often occurred in clumps emerging from the sandy lagoon floor and probably represent the remains of sand smothered reef areas. The *Porites* may have been able to survive as a result of their massive habit keeping them above the inundating sand.

With the exception of the massive *Porites* heads most of the corals in the lagoon and on the reef flat are fast growing acroporids. On the Neds Camp reef flat, for example, 96% of live hard corals were acroporids, primarily plate forming *Acropora* species. This suggests that these areas are subject to regular disturbance; the coral community that forms on GBR reefs 5-10 years after crown of thorns *Acanthaster planci* destruction is dominated by acroporids, especially plate forming *Acropora* species (T. J. Done, personal communication). Possible sources of this disturbance at Ningaloo are sand smothering in the lagoon, cyclone damage on the reef flat and to some extent in the lagoon and previous *Drupella* outbreaks.

On the outer reef slope, however, acroporids only accounted for 41% of live hard coral at the time of this survey, indicating that this part of the reef may not be as frequently disturbed as the reef flat and lagoon.

The richness of coral cover at Coral Bay, and presumably on the rest of the Ningaloo reef prior to the *Drupella* outbreak, was high compared to most reefs on the GBR. Mean live coral cover at Coral Bay was 43.7%, in spite of some *Drupella* damage, compared to a grand mean coral cover of 24.7% on a selection of 34 reefs between Cairns and Mackay on the GBR (Ayling and Ayling, 1985).

Monitoring of Changes in Coral Communities

Total coral cover should be monitored at a number of sites, as discussed below in relation to *Drupella* monitoring, to get some indication of the progress of the coral damage caused by *Drupella* activities and to keep track of the future recovery of the coral communities. In addition more detailed monitoring of corals should be made at a few sites by making annual surveys of permanently marked transects. During the present survey two groups of five 20m permanent line transects were set up and surveyed: one group on the reef flat at site 3; and another on the pass shoal slope at site 2. Additional groups of permanent transects could be set up if desired at Coral Bay and Neds Camp.

Drupella cornus

The damage done by *Drupella cornus* grazing on the Ningaloo reef tract has been dramatic. No site visited in the Ningaloo Marine Park during this survey was free of *D. cornus*, although the coral communities at the Coral Bay site were still relatively undamaged. As *Drupella* grazing causes distinctive damage to the coral skeleton it was possible to determine that the majority of dead standing coral colonies at all sites were caused by their activities. The sites visited indicate that *Drupella* grazing has caused massive coral damage along at least 100km of reef between Tantabiddi Creek and Winderabandi Point. In this area coral cover has been reduced by a mean of about 86% on the reef flat and other back reef coral dominated habitats since 1980, and by 47% in the single front reef slope site surveyed in this area. The full extent of this outbreak is not known, although it may be more widespread than this survey would indicate; it has been reported that *Drupella* are present on reefs in the Dampier Achipelago 300km north of Ningaloo, and on the Abrolhos Islands 700km to the south (C. Simpson, personal communication).

The extent of the damage to coral communities on the Ningaloo reefs, and the biological features of the damage, are very similar to that resulting from *Acanthaster planci* grazing on the GBR. For example the *Acanthaster planci* outbreak on about 10 mid-shelf reefs off Townsville in 1983-85 also reduced coral cover between 70 and 95% (Ayling and Ayling, 1986). Like *Drupella* the crown of thorns stars selectively prey on the fast growing *Acropora* spp. and *Montipora*spp. and have least effect on faviids. Both sources of grazing leave the coral skeleton relatively intact, a feature that has consequences in the redevelopment of the coral community compared with destructive agents of coral death such as cyclones.

Although several species of *Drupella* are present on the GBR (densities of *Drupella cornus* on Norman Reef off Cairns were 1.1 per sqm in June 1987, unpublished personal data) they have not to date been reported to have caused extensive coral destruction on any reef. However, *Drupella* spp. have been reported in destructive numbers in a number of areas in the tropical Pacific, including Miyake-Jima in southern Japan and Mactan Island in the Philippines (Moyer et al., 1982), and Enewetok Atoll in the Marshall Islands (Boucher, 1986). Moyer et al. (1982) found that coral destruction on Miyake-Jima had amounted to as much as 35% on one small study reef over a period of 2 years. These sources also report that destruction was limited to fast growing foliose corals such as *Montipora, Acropora* and *Pocillopora.* Fujioka and Yamazato (1983) found that *Drupella* spp. on reefs in Sesoko Island,

Okinawa showed a strong host preference for acroporid and pocilloporid genera, and to a lesser extent for *Porites*, and that they actively sought out these corals in host selection experiments. Fujioka and Yamazato (1983) counted coral associated gastropods including *Drupella* spp. along 2 cross reef transects. They recorded mean densities of 0.2 and 0.6 per sqm for *D. cornus* and combined densities of 0.4 and 2.4 per sqm for *Drupella* spp., considerably less than recorded at most sites on the Ningaloo reefs during this survey.

No uniform explanation for destructive outbreaks of *Drupella* spp. has been proposed, although Moyer et al. (1982) suggested that the Miyake-Jima population explosions were correlated with massive siltation following bulldozing and heavy rain. It is hard to postulate such an explanation for the Ningaloo population explosion of these gastropods. The area is semi-desert with average annual rainfall of about 200mm, and the coast for over 500km north and south of Ningaloo also receives less than 250mm annual rainfall. Hence it is unlikely that siltation or freshwater runoff has had much direct influence on the *Drupella cornus* population explosions at Ningaloo, although it is possible that the influence has come from further north via the prevailing Leeuwin Current.

Much of the reef area of the proposed Ningaloo Marine Park has been damaged by this *Drupella cornus* outbreak. By combining the density estimates made during this survey with the approximate area of coral measured from aerial photographs of the 100km of reef affected, it is possible to determine that there are approximately 500 million *Drupella* in the Marine Park. It seems likely that the present outbreak began sometime between 1980 and 1985 (May, personal communication; Simpson, personal communication) and that coral cover will eventually be reduced dramatically over most of the Marine Park. Once populations of the preferred prey corals are completely destroyed it seems likely that *Drupella* populations will decline, allowing coral communities in the Park to recover. Recovery of coral communities on reefs damaged by *Acanthaster* generally takes 10-15 years (T.J. Done, personal communication) and a similar time scale is to be expected for recovery of the Ningaloo reefs from *Drupella* damge. Recovery may, however, be delayed if some *Drupella* are able to survive after the preferred prey species are removed by eating the remaining, normally rejected, coral species; occasionally *Drupella* individuals were found on some faviid species and on *Lobophyllia* and other largely ignored species.

Monitoring of Density Changes in *Drupella cornus* Populations

It is important that *Drupella* population density be monitored at least annually to determine the progress of the present outbreak. The random 5 x 0.5m transects used during the present survey are an appropriate size for future monitoring, being easy to census accurately and covering reasonable numbers of *Drupella*. The variance in the groups of counts was very high and at least 20 replicates should be made at each site, within an area approximately 100m square. Suitable sites would be a reef flat and a lagoonal site at Coral Bay, a Jane Bay reef flat site, an Osprey Bay reef flat site and a Neds Camp reef flat site. These sites would give a good coverage of the Marine Park region.

It would also be useful to make one-off surveys of at least 5 sites between Winderabandi Point and the southern end of the Marine Park to determine the status of *Drupella* populations and coral communities in this area. In addition it may be appropriate to survey about 10 reef flat sites at regular intervals between Tantabiddi Creek and Osprey Bay to get an indication of the smaller scale variation in *Drupella* density and activity. The same survey techniques mentioned above could be used for these two spatial surveys

In addition regular estimates of total live coral cover should be made at all the sites at which *Drupella* numbers are surveyed. These counts can be made very quickly and with a suitable degree of accuracy by summing mentally all live hard coral along a 20m line transect tape in 5 or 10cm increments to get a single figure for total cm intercepts. This figure divided by 20 gives an estimate of percentage cover. With practice the coral intercepts can be summed quickly as the tape is being run out. Five replicate 20m transects should be surveyed at each site.

Fish Counts

The Ningaloo fish fauna is dominated by species that are widely distributed in the tropical Indo-Pacific; 75% of the 501 fish species recorded from the NW Cape region by Allen (1980, and personal communication) are coral reef dwelling Indo-Pacific fishes. Some of these species are primarily restricted to the Indian Ocean and NE Pacific and are not found on the GBR eg *Naso fageni* and *Scarus prasiognathus*. A small percentage of the fauna (4%) are restricted to the NW coast of Australia (from around Shark Bay to Darwin), and a number of these are undescribed or recently described species.

In general terms the fish communities of the Ningaloo reefs can be separated into those that inhabit coral dominated habitats and those of the lagoonal algal dominated habitats. Many of the fish species common in the algal habitats are not normally found in coral reef areas including *Epinelelus rivulatus, Chaetodon assarius, Leptoscarus vaigiensis, Calotomus spinidens, Psudojuloides elongatus, Cleilio inermis, Coris caudimacula, Cymolutes praetextatus, Halichoeres nebulosus* and *Xenojulis margaritaceous*. As far as could be determined fishes were largely absent from the large expanses of sandy lagoon.

The two species most sought after by recreational fishermen, *Lethrinus nebulosus* and *L. mahsena*, were both abundant at all 4 sites surveyed. Although the estimates of density for these two species were very variable with density differences of an order of magnitude between the different habitats within each site there was no evidence that the higher fishing pressure at the Neds Camp site had reduced the numbers of either species at this site compared with comparable habitats in the less heavily fished sites further south. Similarly, although length frequency distributions of these two species were dramatically different between some of the habitats there was also no evidence that the length frequencies were influenced by the supposed differences in fishing pressure between the different sites.

Both these lethrinids are present on the GBR but are nowhere as abundant as they are on the Ningaloo reefs (personal observations). In surveys of *Lethrinus nebulosus* on 20 reefs toward the southern end of the GBR the highest mean density recorded was 51 per ha, while the grand mean for all 20 reefs was only 6.5 per ha (Ayling and Ayling, 1986). This compares with a grand mean density for all coral dominated habitats at Ningaloo of 74 per ha and a highest mean density of 426 per ha.

None of the other recreationally utillised fish species occur at the high densities of the two lethrinid species. Of the more preferred species there was an estimated 15 coral trout in the 4km length of reef, lagoon and pass that encompassed sites 1-3, along with 879 *Choerodon* spp., 1,255 *Epinephelus tauvina* and 2,661 sweetlips (*Plectorhinchus* spp.), compared with 18,469 north-west snappers and 77,168 yellow-tailed emperors (see table 8). As with the more abundant lethrinids there is no real evidence from this survey that there has been any significant reduction in the density of any of these other recreational species at the Neds Camp site. None of these species were recorded in sufficient numbers to make any useful comments on the effect of fishing on their length frequency distributions.

Of these species only coral trout (*Pl;ectropomus* spp.) and scarids have been the subject of comprehensive density surveys on the GBR. On turbid inshore GBR reefs where *Sargassum* forms dense forests in shallow water the bar-cheeked coral trout *Plectropomus maculatus* was the dominant species, occurring at grand mean densities of 10.6 per ha on the 16 inner shelf reefs surveyed in 1983-84. Although this species is recorded from the Ningaloo reef algal dominated lagoon (Allen, 1980 and personal communication), no individuals were seen during the present survey. The common coral trout *Plectropomus leopardus* was abundant on most GBR reefs, with grand mean densities on mid-shelf reefs of about 50 per ha. This compares with a grand mean density of only 0.4 per ha for this species in the coral dominated habitats of sites 1-3. The very low densities of coral trout recorded on the Ningaloo reefs are almost certainly not a reflection of excessive fishing pressure but are probably the result of some biological feature of the Ningaloo reefs that differs from the situation on the GBR.

On the other hand, the density of most of the scarid species is comparable or greater on Ningaloo reefs compared with similar habitats on the GBR (J.H. Choat, personal communication). This is possibly a consequence of the creation of a large area of suitable grazing habitat on the Ningaloo reefs by the coral grazing activities of *Drupella cornus*. The algal turf that forms on dead standing coral is the preferred grazing substratum for reef dwelling scarids.

Several studies on the GBR have looked at the distribution and abundance of chaetodontids as indicators of coral reef community structure (Anderson et al., 1981; Sale and Williams, 1982). This group has also been used to look at community differences between different reef habitats (Clarke, 1977). Many chaetodontids are obligate feeders on hard or soft corals and some work has also been done on the relationship of chaetodontid abundance to coral cover (Reese, 1977; Bell and Galzin, 1984; Ayling and Ayling, 1985, 1986).

A total of 14 species of chaetodontid were recorded on Ningaloo reefs during this survey, 5 of which were obligate hard coral feeders, compared with 27 species recorded in similar counts on GBR reefs, 11 of which were hard coral feeders (Ayling and Ayling, 1986). The GBR surveys revealed a strong positive correlation of total density of hard coral feeders with hard coral cover, indicating that these species respond almost immediately to changes in coral cover. Although the number of species feeding of hard coral on the Ningaloo reefs was much lower than on the GBR, the relationship of total density to coral cover was also strongly positive, especially for *Acropora* corals (see figure 8). In fact the hard coral feeders were proportionally more abundant in relation to coral cover on the Ningaloo reefs than on two groups of reefs on the GBR (see figure 9, data from Ayling and Ayling, 1985, 1986).

On algal dominated fringing reefs in the GBR region chaetodontids occurred at very low densities and the species present were the same as those on more offshore reefs. Our own unpublished data from Cape Tribulation fringing reefs showed a combined chaetodontid density of only 12.7 per ha. In the algal dominated lagoon on the Ningaloo reefs chaetodontids were considerably more abundant with a mean combined density of 64 per ha. However, almost 80% of the chaetodontids in the algal dominated habitats were the western butterflyfish *Chaetodon assarius*, a species that was restricted to this habitat. On GBR reefs there is no equivalent chaetodontid restricted to such habitats.

Monitoring of Density Changes in Fish Populations

Given the high variance that was a feature of all groups of counts of the north-west snapper special attention will need to be paid to survey design for future monitoring if any but gross changes in population density are to be detected. The mean variance : mean ratio for all groups of counts with a density greater than 10 per ha was 8.8 indicating that changes will have to be at least an order of magnitude before they can be tested as significant using analysis of variance techniques. For example, using the data from the groups of 5 counts made in this survey and testing for significant differences between the habitats at each site gave non-significant results for 1.5x, 8x and 9.5x differences between habitats. The only significant differences were in site 2 where 30x density differences were recorded. However, in other tests between random groups of counts differences as low as 5.5x gave significant results (see table 5).

This indicates that a powerful heirarchical design should be used for future monitoring, incorporating more groups of counts than was used during the present survey. An appropriate design could be based on two normal reef locations, one in an area open to recreational fishing (Neds Camp or similar), and the other within a no fishing reef appreciation area (Sandy Bay-Osprey Bay or similar). Within each location 6 sites would be surveyed; each site restricted to a segment of reef approximately 150m long and separated from other sites by at least 100m. Each site would be divided into two areas: coral dominated habitats (including reef flat, back reef edge and coral dominated parts of the lagoon where these occur) and algal dominated habitats, and five random replicate counts would be made within a 100 x 150m area in each habitat group. This would give a total of 30 replicates in each area in each location, for a total of 120 counts at each survey time. Subsequent surveys should be made within the same sites. Analysing such a design with a 4 factor analysis of variance should enable the reliable detection of much smaller changes than were possible using the data from the present survey.

The counts made in algal habitats should give an indication of recruitment level for the two lethrinids; during the present survey it was apparent that the algal dominated lagoon was a nursery ground for these species.

Using the same design for the monitoring of changes in populations of *Lethrinus mahsena* should give an even more reliable test of significance as the mean variance : mean ratio for this species in the present survey was 2.7. Single factor analysis of variance testing for differences between groups of counts from the present data for *L. mahsena* were not significant for differences of less than 2.1x, but were consistently significant for differences of 2.1x or greater (see table 5)

It is important that length estimations of these two species are made as part of any future density surveys. If high within-site variance prevents significant testing for density changes of less than about 2x to 5x, comparison of mean length and of length frequency distributions should provide evidence of changes in fish population structure caused by different fishing regimes. In comparisons between fished and protected reefs on the southern GBR it was found that the mean lengths of coral trout *Plectropomus leopardus* were significantly smaller on fished reefs compared with protected reefs (Ayling and Ayling, 1986). This was also reflected in significant differences between length frequency distributions from the two groups of reefs. It has been shown that with suitable training observers can make relatively accurate estimates of the length of large reef fish underwater (Bell et al., 1985).

Given the low densities of the other recreationally utilized species it is unlikely that any future reduction in density will be significant, even using the above design, but these populations should be monitored to detect possible increases in density that may

result from protection. It is probably only worthwhile to count scarids with an estimated total length of greater than 40cm, and group all scarid species into a single category, rather than recording all individuals of all species separately.

It is probably useful to count numbers of all species of chaetodontids as they are easy to detect, have a relatively low variance and provide meaningful information on the state of the reef.

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Table 1. Abundance Summary for Hard Corals, Dead Standing Hard Coral, and Macroalgae in the Different Habitats Within the Four Survey Sites.

Mean percentage cover from five 20m intersect line transects is shown;
np = habitat not present; nr = not recorded; - indicates zero percentage cover.

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Hard Coral					
Outer reef slope	20.0	nr	nr	Pass floor	7.5
Reef crest	nr	37.4	nr	Pass shoal top	11.1
Outer reef flat	nr	nr	nr	Pass shoal slope	19.7
Reef flat	5.5	4.2	24.1	*Sargassum* slope	0.5
Back reef edge	9.7	10.4	nr	Algal lagoon	0.1
Coral lagoon	np	np	9.8	Inshore reef flat	0.4
Algal lagoon	1.0	1.1	0.1		
Sand lagoon	0.1	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Dead Standing Hard Coral					
Outer reef slope	17.7	nr	nr	Pass floor	62.7
Reef crest	nr	<5	nr	Pass shoal top	47.2
Outer reef flat	nr	nr	nr	Pass shoal slope	17.2
Reef flat	68.7	63.3	61.2	*Sargassum* slope	-
Back reef edge	18.5	8.3	nr	Algal lagoon	-
Coral lagoon	np	np	8.3	Inshore reef flat	-
Algal lagoon	-	-	-		
Sand lagoon	-	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Macroalgae					
Outer reef slope	0.1	nr	nr	Pass floor	0.2
Reef crest	nr	nr	nr	Pass shoal top	-
Outer reef flat	nr	nr	nr	Pass shoal slope	-
Reef flat	0.2	0.1	0.1	*Sargassum* slope	56.5
Back reef edge	0.5	1.3	nr	Algal lagoon	52.9
Coral lagoon	np	np	0.2	Inshore reef flat	7.3
Algal lagoon	18.3	44.3	26.3		
Sand lagoon	2.4	nr	nr		

Table 2. Summary of *Drupella cornus* Density and Coral Cover on the Ningaloo Reef Tract

Density recorded from a variable number of 5 x 0.5m transects (2.5 sqm), and converted to number per square metre, along with estimates (where available) of % coral cover and % dead standing coral cover from five 20m long intersect line transects. nr = not recorded

Site #	Site	Habitat	Replicates	*Drupella* per sqm		% Coral Cover	% Dead Coral
				mean	sd		
6	Tantabiddi Creek	reef flat	25	**5.3**	8.5	16.4	nr
4	Neds Camp	reef flat #1	30	**16.1**	18.7	24.1	61.2
4	Neds Camp	reef flat #2	30	**10.4**	13.4	nr	nr
5	North Mandu Mandu	reef flat	25	**18.5**	38.7	2.9	nr
1	Sandy Bay	outer slope	5	**1.6**	2.3	20.0	17.7
3	South Osprey Bay	reef flat #1	20	**9.6**	14.9	4.2	59.3
3	South Osprey Bay	reef flat #2	25	**16.3**	31.2	4.2	65.4
3	South Osprey Bay	reef crest	5	**1.3**	1.0	37.4	<5
8	Winderabandi Point	reef flat	10	**7.0**	8.5	10.2	nr
7	Coral Bay	reef flat	10	**7.4**	5.0	28.0	nr
7	Coral Bay	coral lagoon	10	**5.0**	3.2	43.7	nr

Table 3. Corals Affected by *Drupella cornus* Grazing.

Live or partially live corals in transects on the site 3 reef flat were recorded as either undamaged or as actively being attacked by *Drupella cornus*. The percentage of colonies attacked is recorded.

Family	Species	total colonies	% colonies attacked
Pocilloporidae			
	Seriatopora caliendrum	4	25
	Pocillopora damicornis	5	20
	Stylophora pistillata	3	33
Acroporidae			
	Acropora plates	20	95
	Acropora digitifera	54	31
	Acropora aspera	12	25
	Acropora robusta	2	100
	Acropora formosa	2	100
	Montipora encrusting	10	60
	Montipora hills	14	57
	Astreopora sp.	3	33
Agaricidae			
	Pavona decussata	1	-
	Gardineroseris planulata	1	-
Poritidae			
	Porites massive	3	33
Faviidae			
	Favia/Favites spp.	23	4
	Goniastrea retiformis	12	33
	Cyphastrea serailia	17	-
Oculinidae			
	Galaxea spp.	2	-
Merulinidae			
	Merulina ampliata	1	-
Mussidae			
	Lobophyllia sp.	1	-
	Symphyllia sp.	2	50
	Scolymia sp.	2	-
Pectiniidae			
	Echinophyllia sp.	1	-

Table 4. Abundance Summary for the North-West Snapper *Lethrinus nebulosus*, the Yellow-Tail Emperor *Lethrinus mahsena* and the Black-Spot Sea-Perch *Lutjanus fulviflamma* in the Different Habitats Within the Four Survey Sites.

Mean density from five 50 x 20m transects is shown, converted to number per hectare (ha); np = habitat not present; nr = not recorded; - indicates zero percentage cover.

***Lethrinus nebulosus* (north-west snapper or spangled emperor)**

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Outer reef slope	-	nr	nr	Pass floor	-
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	1	nr	Pass shoal slope	426
Reef flat	114	14	1	*Sargassum* slope	26
Back reef edge	42	110	nr	Algal lagoon	18
Coral lagoon	np	np	78	Inshore reef flat	14
Algal lagoon	12	69	50		
Sand lagoon	-	nr	nr		

***Lethrinus mahsena* (yellow-tail emperor)**

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Outer reef slope	112	nr	nr	Pass floor	152
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	524	nr	Pass shoal slope	424
Reef flat	294	158	74	*Sargassum* slope	68
Back reef edge	60	98	nr	Algal lagoon	1
Coral lagoon	np	np	56	Inshore reef flat	-
Algal lagoon	-	17	16		
Sand lagoon	-	nr	nr		

***Lutjanus fulviflamma* (black-spot sea-perch)**

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Outer reef slope	-	nr	nr	Pass floor	-
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	202
Reef flat	16	20	40	*Sargassum* slope	-
Back reef edge	-	14	nr	Algal lagoon	-
Coral lagoon	np	np	13	Inshore reef flat	-
Algal lagoon	-	-	-		
Sand lagoon	-	nr	nr		

Table 5. Analysis of Variance of Density Estimates of *Lethrinus nebulosus* and *L. mahsena*.

Single factor analysis of variance was used to test the significance of between habitat differences at each site, and to test differences between some selected groups of counts. Difference: indicates the ratio of lowest to highest mean. ns = not significant; * = 0.05>p>0.01; ** = 0.01>p>0.001; *** = p<0.001.

Site	Mean ± Std.Deviation for Each Group				Difference	F ratio	Significance
Lethrinus nebulosus							
1	1.2±1.3	4.2±4.0	11.4±14.2		9.5x	2.23	ns
2	1.4±1.5	1.8±2.5	2.6±5.8	42.6±41.2	30.4x	4.68	*
3	1.4±0.5	4.2±5.1	9.6±8.5	11.0±12.1	7.9x	1.66	ns
4	5.0±5.4	7.8±5.4	7.8±5.6		1.6x	0.43	ns
	7.8±5.4	7.8±5.6	42.6±41.2		5.5x	3.91	*
Lethrinus mahsena							
1	6.0±3.3	11.2±7.4	29.4±8.2	52.4±5.9	8.7x	52.65	***
2	6.8±4.7	15.2±9.9	42.4±10.9		6.2x	21.81	***
3	1.2±1.3	2.2±3.0	9.8±4.6	15.8±2.9	13.2x	23.44	***
4	1.6±1.5	3.6±2.9	7.4±3.8	7.6±3.6	4.8x	4.54	*
	29.4±8.2	46.2±47.3			1.6x	0.68	ns
	3.6±2.9	7.4±3.8	7.6±3.6		2.1x	2.12	ns
	7.4±3.8	15.2±9.9			2.1x	2.69	ns
	7.4±3.8	15.8±2.9			2.1x	15.34	**
	11.2±7.4	29.4±8.2			2.6x	13.57	**
	15.2±9.9	42.4±10.9			2.8x	17.08	**

Table 6. Abundance Summary for the greasy cod *Epinephelus tauvina*, the chinaman cod *Epinephelus rivulatus* and sweetlips *Plectorhinchus* spp. in the Different Habitats Within the Four Survey Sites.

Mean density from five 50 x 20m transects is shown, converted to number per hectare (ha); np = habitat not present; nr = not recorded; - indicates zero percentage cover.

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
***Epinephelus tauvina* (greasy cod)**					
Outer reef slope	8	nr	nr	Pass floor	-
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	-
Reef flat	3	4	-	*Sargassum* slope	-
Back reef edge	-	2	nr	Algal lagoon	-
Coral lagoon	np	np	-	Inshore reef flat	-
Algal lagoon	-	-	-		
Sand lagoon	-	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
***Epinephalus rivulatus* (chinaman cod)**					
Outer reef slope	-	nr	nr	Pass floor	2
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	4
Reef flat	11	4	2	*Sargassum* slope	68
Back reef edge	54	14	nr	Algal lagoon	42
Coral lagoon	np	np	1	Inshore reef flat	4
Algal lagoon	26	65	52		
Sand lagoon	5	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
***Plectorhinchus* spp. (sweetlips)**					
Outer reef slope	8	nr	nr	Pass floor	8
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	20
Reef flat	3	2	10	*Sargassum* slope	2
Back reef edge	-	38	nr	Algal lagoon	-
Coral lagoon	np	np	5	Inshore reef flat	-
Algal lagoon	-	7	-		
Sand lagoon	-	nr	nr		

Table 7. Abundance Summary for Baldchin Groupers and Bluebones *Choerodon* spp., all Scarid Species and all Large Scarids in the Different Habitats Within the Four Survey Sites.

Mean density from five 50 x 20m transects is shown, converted to number per hectare (ha); np = habitat not present; nr = not recorded; - indicates zero percentage cover.

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
***Choerodon* spp. (baldchin grouper, bluebone)**					
Outer reef slope	2	nr	nr	Pass floor	-
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	16
Reef flat	-	-	-	*Sargassum* slope	3
Back reef edge	-	-	nr	Algal lagoon	-
Coral lagoon	np	np	2	Inshore reef flat	-
Algal lagoon	-	6	6		
Sand lagoon	-	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Total Scarids (parrotfishes)					
Outer reef slope	962	nr	nr	Pass floor	2320
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	1340
Reef flat	708	1470	494	*Sargassum* slope	819
Back reef edge	130	530	nr	Algal lagoon	32
Coral lagoon	np	np	567	Inshore reef flat	10
Algal lagoon	92	247	70		
Sand lagoon	1	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Total Scarids Over 40cm Total Length					
Outer reef slope	44	nr	nr	Pass floor	4
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	50
Reef flat	18	36	8	*Sargassum* slope	-
Back reef edge	4	14	nr	Algal lagoon	-
Coral lagoon	np	np	22	Inshore reef flat	2
Algal lagoon	-	6	12		
Sand lagoon	-	nr	nr		

Table 8. Estimates of the Total Numbers of the Different Recreational Fish Species in the Sandy Bay to South Osprey Bay Area.

Estimates of the total numbers of individuals in the 4km length of reef and lagoon that includes sites 1-3.

Name	Common Name	Number
Lethrinus mahsena	yellow-tailed emperor	77,168
L. mahsena >28cm		38,562
Lethrinus nebulosus	north-west snapper	18,469
L. nebulosus >28cm		11,736
Large Scarids (>40cm)	parrotfishes	8,606
Plectorhinchus spp.	sweetlips	2,661
Lutjanus fulviflamma	black-spot sea-perch	1,874
Epinephelus tauvina	greasy cod	1,255
Choerodon spp.	baldies, bluebones	879

Table 9. Abundance Summary for all Chaetodontids (Butterflyfishes), all Hard Coral Feeding Chaetodontids and the Western Butterflyfish *Chaetodon assarius* in the Different Habitats Within the Four Survey Sites.

Mean density from five 50 x 20m transects is shown, converted to number per hectare (ha); np = habitat not present; nr = not recorded; - indicates zero percentage cover.

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Total Chaetodontids (butterflyfishes)					
Outer reef slope	152	nr	nr	Pass floor	146
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	92
Reef flat	286	86	482	*Sargassum* slope	114
Back reef edge	114	78	nr	Algal lagoon	90
Coral lagoon	np	np	193	Inshore reef flat	40
Algal lagoon	14	50	66		
Sand lagoon	2	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
Total Hard Coral Feeding Chaetodontids					
Outer reef slope	118	nr	nr	Pass floor	50
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	26
Reef flat	227	32	438	*Sargassum* slope	2
Back reef edge	68	44	nr	Algal lagoon	-
Coral lagoon	np	np	144	Inshore reef flat	2
Algal lagoon	-	1	2		
Sand lagoon	-	nr	nr		

	Normal Reef Sites				Pass Site
Habitat	Site 1	Site 3	Site 4	Habitat	Site 2
***Chaetodon assarius* (western butterflyfish)**					
Outer reef slope	-	nr	nr	Pass floor	-
Reef crest	nr	nr	nr	Pass shoal top	nr
Outer reef flat	nr	nr	nr	Pass shoal slope	-
Reef flat	-	-	-	*Sargassum* slope	84
Back reef edge	2	-	nr	Algal lagoon	86
Coral lagoon	np	np	5	Inshore reef flat	36
Algal lagoon	6	30	64		
Sand lagoon	2	nr	nr		

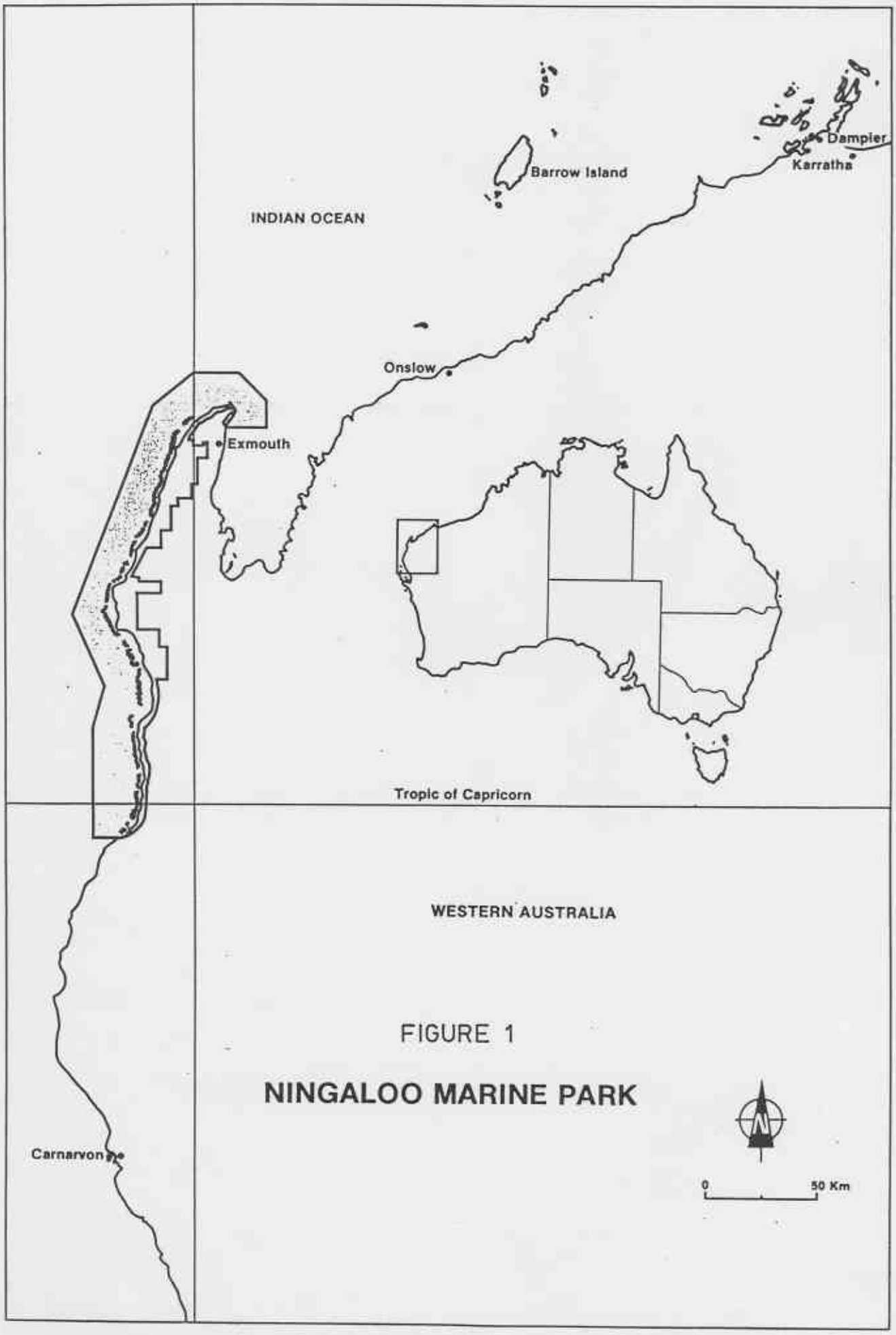


FIGURE 1

NINGALOO MARINE PARK

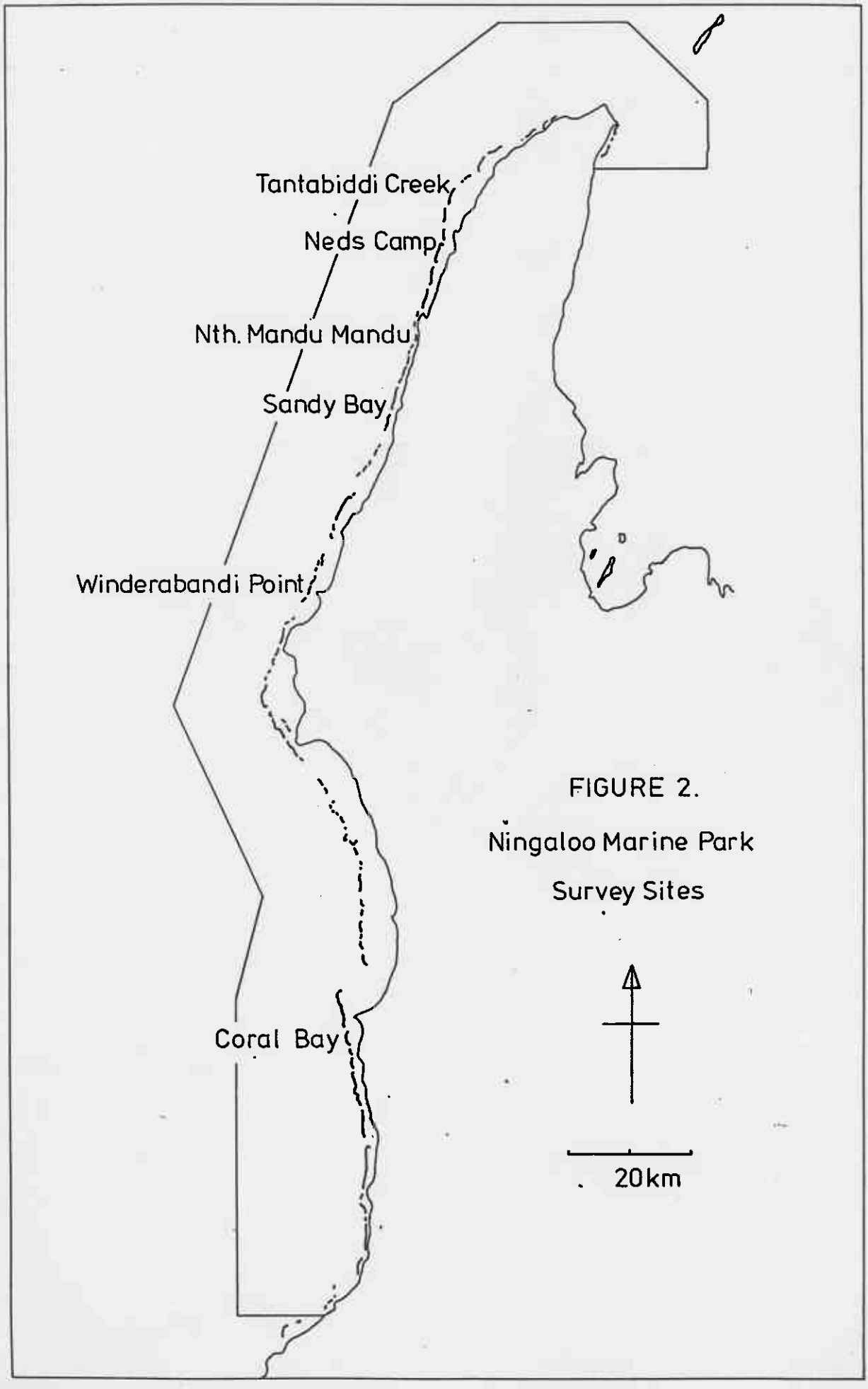


FIGURE 2.

Ningaloo Marine Park

Survey Sites

MAPS OF SURVEY SITES SHOWING BIOLOGICAL HABITATS AND SURVEY LOCATIONS - see figure 3 (sites 1-3) and figure 4 (site 4) following.

Key to Survey Location Numbers:

1	Site 1	outer reef slope
2	Site 1	reef flat
3	Site 1	back reef edge
4	Site 1	algal lagoon
5	Site 1	sand lagoon #1
6	Site 1	sand lagoon #2
7	Site 2	pass floor
8	Site 2	pass shoal top
9	Site 2	pass shoal slope
10	Site 2	Sargassum slope #1
11	Site 2	Sargassum slope #2
12	Site 2	algal lagoon
13	Site 2	inshore reef flat
14	Site 3	reef crest
15	Site 3	outer reef flat
16	Site 3	reef flat
17	Site 3	back reef edge
18	Site 3	algal lagoon #1
19	Site 3	algal lagoon #2
20	Site 4	reef flat
21	Site 4	coral lagoon #1
22	Site 4	coral lagoon #2
23	Site 4	algal lagoon

Key to Habitat Patterns Where Used:

Reef Crest ..... 

Back Reef Edge..... 

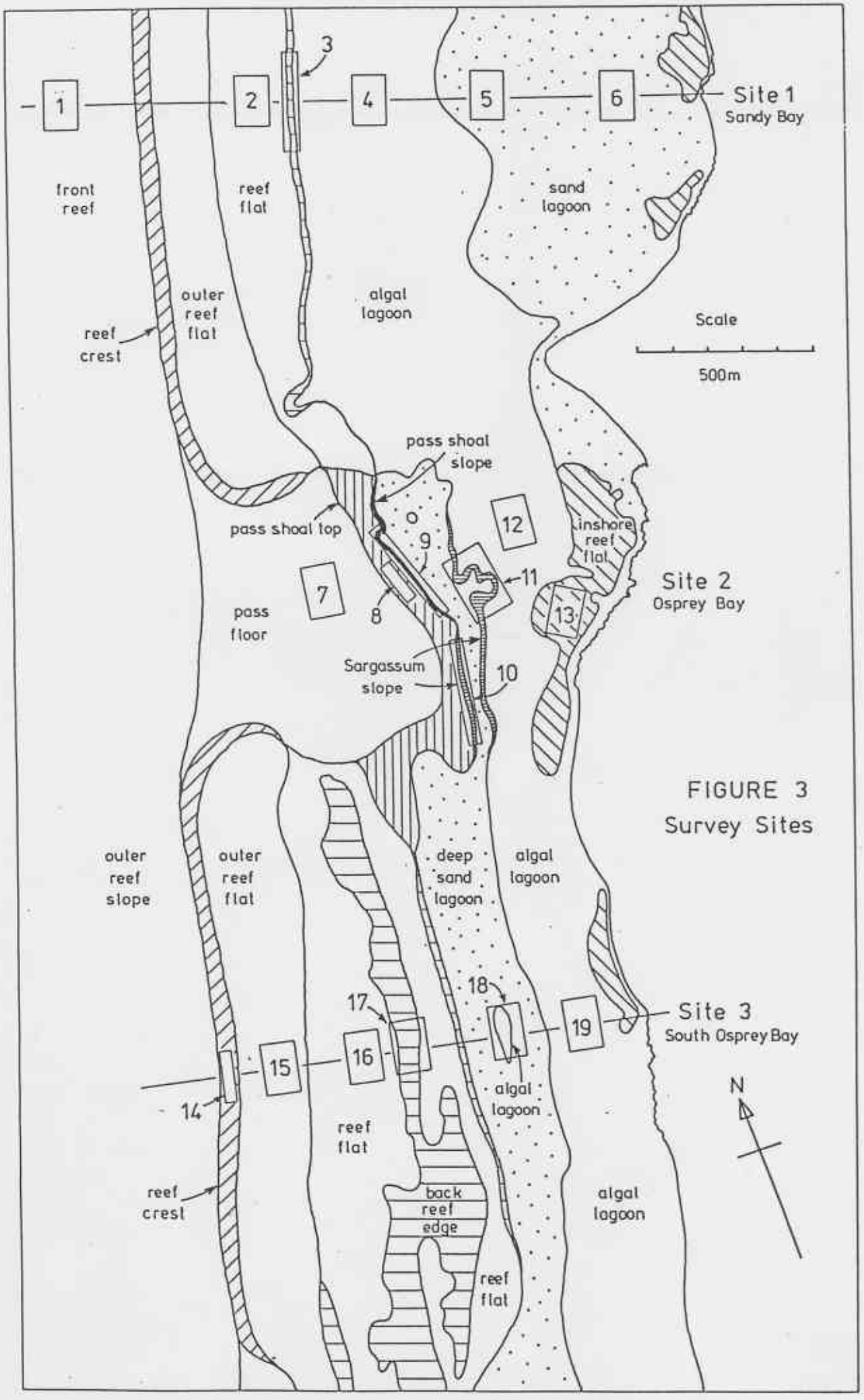
Sand Lagoon..... 

Pass Shoal Top ..... 

Pass Shoal Slope ..... 

Sargassum Slope ..... 

Inshore Reef Flat ..... 


1
2
3
4
5
6
Site 1
Sandy Bay
front reef
reef flat
sand lagoon
outer reef flat
algal lagoon
reef crest
Scale
500m
pass shoal slope
pass shoal top
9
12
inshore reef flat
11
Site 2
Osprey Bay
7
8
13
pass floor
Sargassum slope
10
FIGURE 3
Survey Sites
outer reef slope
outer reef flat
deep sand lagoon
algal lagoon
18
17
19
Site 3
South Osprey Bay
15
16
14
algal lagoon
N
reef flat
reef crest
back reef edge
algal lagoon
reef flat

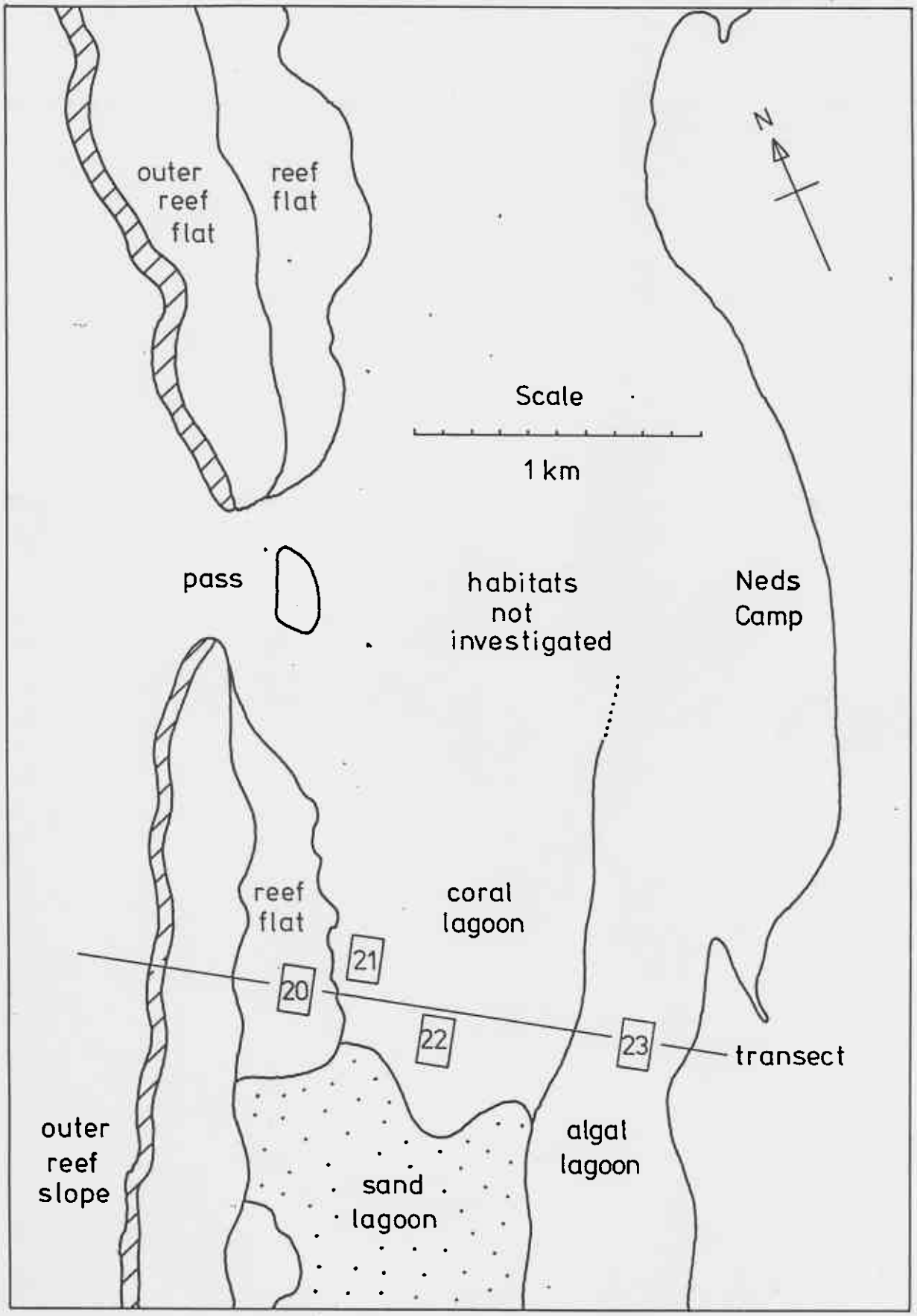


FIGURE 4. Site 4 - Neds Camp - Survey Locations and Habitats (see key for figure 3)

FIGURE 5. LENGTH FREQUENCY GRAPHS FOR *LETHRINUS NEBULOSUS*.

Comparison of length frequencies from the habitats in which this species was common in the four survey sites. Reef flats: combined reef flat habitats (*L. nebulosus* was only common on the reef flat of Site 1). Back reef edge: combined from Sites 1&3. Lagoon coral: combined lagoon habitats where coral was present (Site 4 only). All algal habitats: combined habitats where macroalgae were dominant.

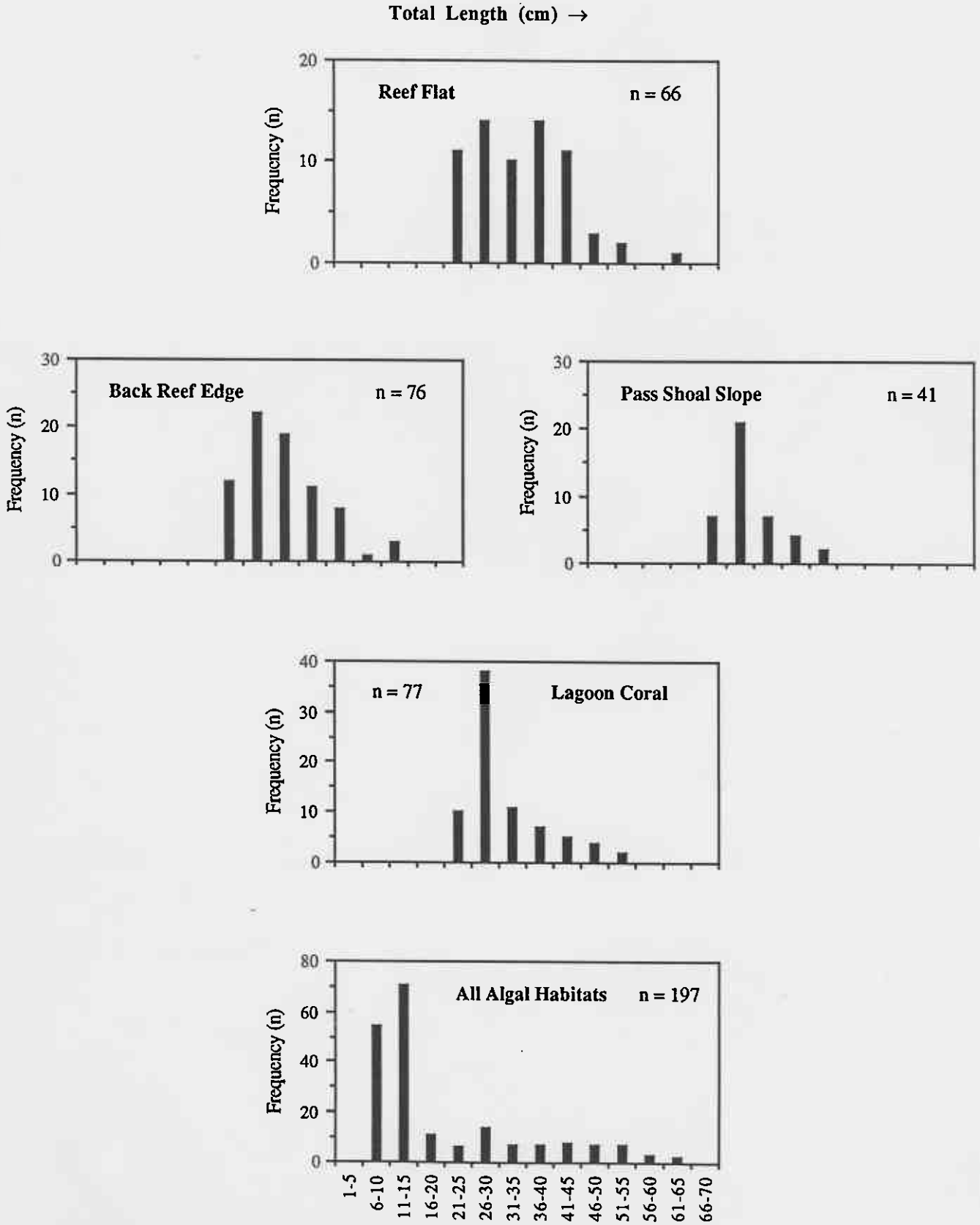


FIGURE 6. LENGTH FREQUENCY GRAPHS FOR *LETHRINUS MAHSENA*.

Comparison of length frequencies from all habitat groups in the four survey sites. Reef flat: combined reef flat habitats. Lagoon coral: combined lagoon habitats where coral was present (Site 4 only). Back reef edge: combined from Sites 1&3. All algal habitats: combined habitats where macroalgae were dominant.

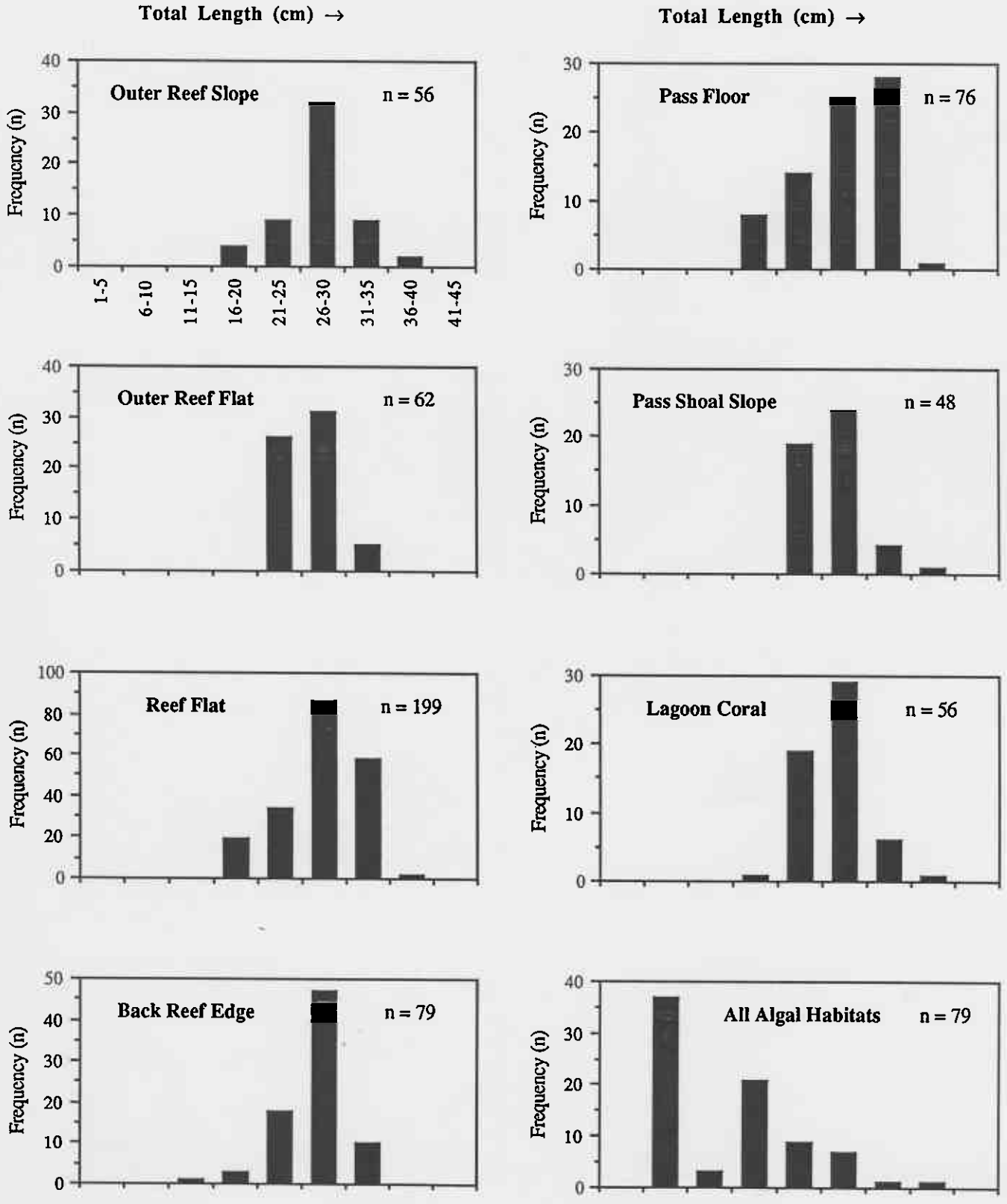


FIGURE 7. LENGTH FREQUENCY GRAPHS FOR *LETHRINUS MAHSENA*.

Comparison of length frequencies from the reef flat habitat in the three reef sites. Site 1 (Sandy Bay) and Site 3 (South Osprey Bay) are the more southerly sites with relatively low fishing pressure compared with Site 4 (Neds Camp) where access and boat launching are much easier and fishing pressure more intense.

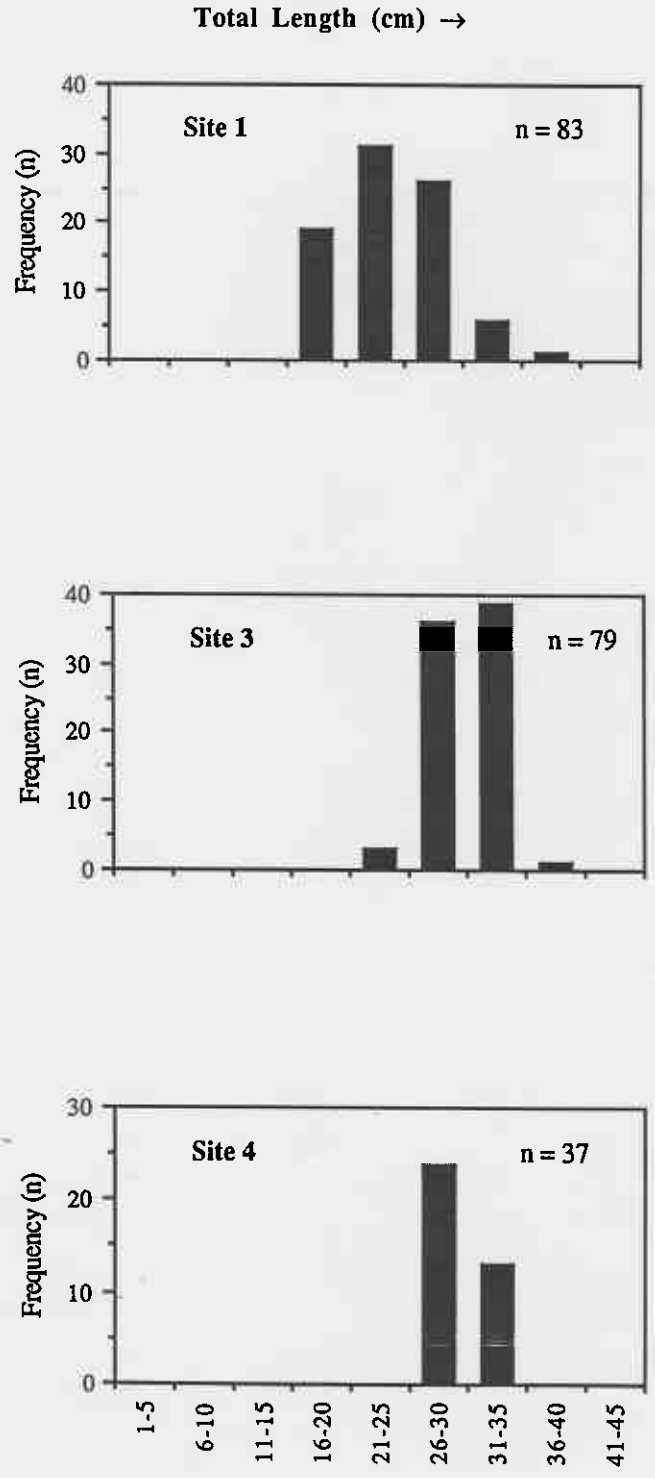
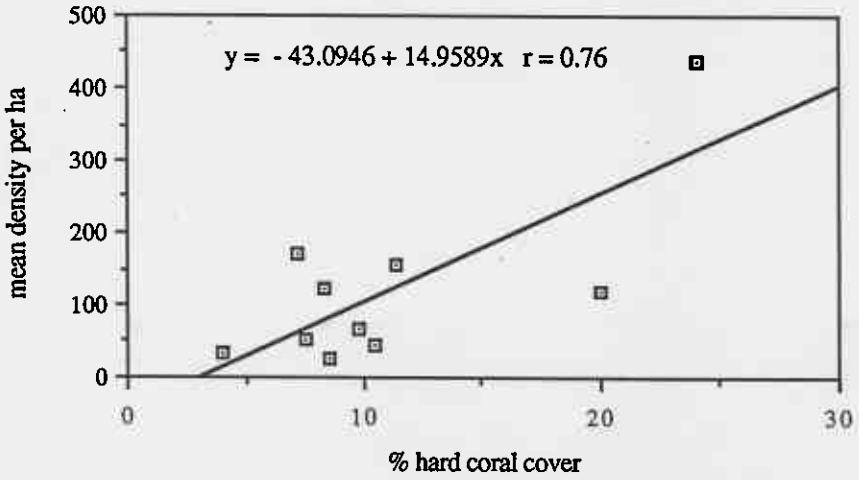
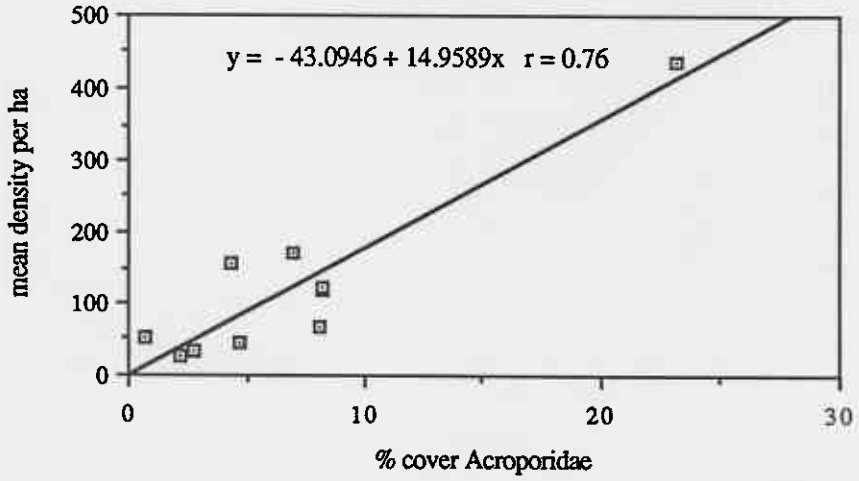


FIGURE 8. PATTERNS IN THE DISTRIBUTION OF CHAETODONID FISHES

A. Relationship of the density of hard coral feeding chaetodontids to total hard coral cover



B. Relationship of the density of hard coral feeding chaetodontids to cover of Acroporid corals



C. Relationship of the density of *Chaetodon assarius* to macroalgal cover

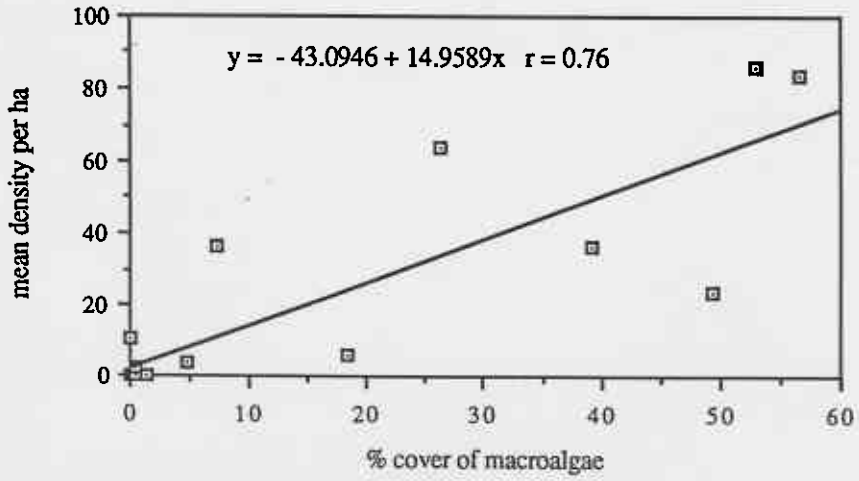
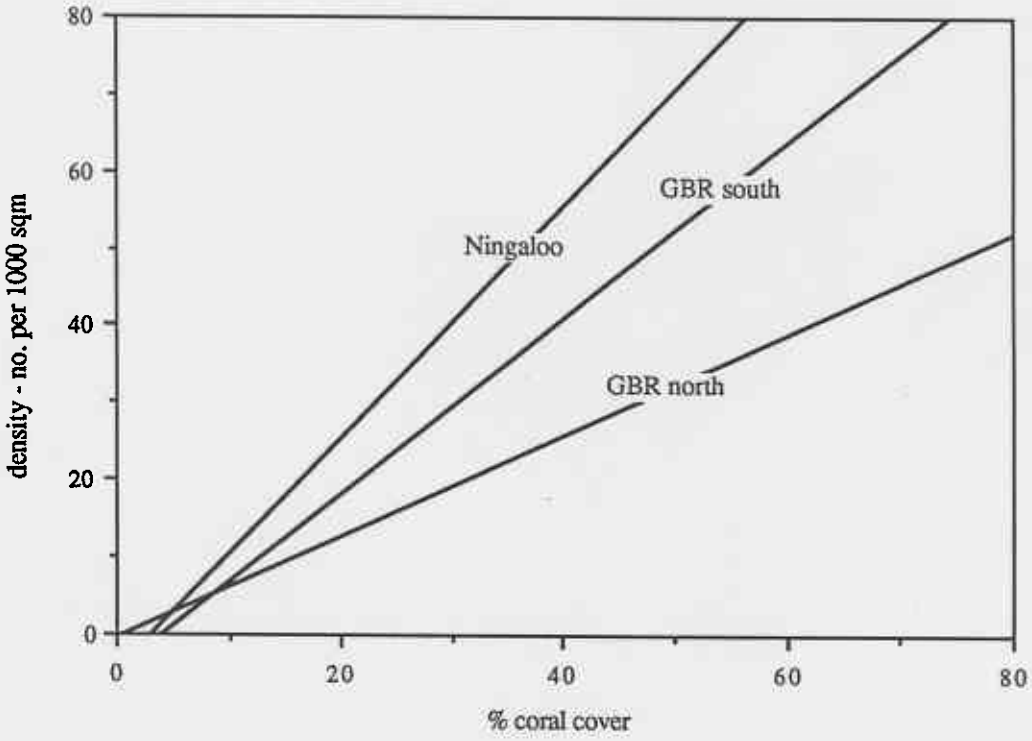


FIGURE 9. COMPARISON OF CHAETODONTID RELATIONSHIPS AT NINGALOO AND ON THE GREAT BARRIER REEF

Regression line for the relationship of total hard coral feeding chaetodontids to percentage live coral cover for 10 sites on the Ningaloo reefs, for 41 sites on different reefs off Townsville and MacKay (GBR north) and for 41 sites on reefs at the southern end of the GBR (GBR south).



APPENDIX 1.

Encrusting Organisms and Substratum Type: raw data and preliminary analyses from five 20m intersect line transects in each survey location

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; outer reef slope; 15th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:					
Coral basement	1105	1235	1311	**60.9**	**5.2**
Coral rubble	0	0	0	0.0	0.0
Sand	0	0	0	0.0	0.0
ALGAE & SEAGRASS:					
Sargassum spp.	0	0	0	0.0	0.0
Macroalgae	5	0	0	**0.1**	**0.1**
Seagrass	0	0	0	0.0	0.0
HARD CORALS:					
POCILLOPORIDAE					
Seriatopora caliendrum	0	0	0	0.0	0.0
Pocillopora spp.	8	6	51	**1.1**	**1.3**
Stylophora pistillata	5	27	0	**0.5**	**0.7**
ACROPORIDAE					
Acropora staghorn	79	30	27	**2.3**	**1.5**
Acropora small clumps	44	0	47	**1.5**	**1.3**
Acropora plate	78	93	7	**3.0**	**2.3**
Montipora massive	0	0	0	0.0	0.0
Montipora explanate	7	31	45	**1.4**	**1.0**
Montipora hills	0	0	0	0.0	0.0
AGARICIIDAE					
Pavona spp.	5	0	0	**0.1**	**0.1**
Pachyseris rugosa	0	0	0	0.0	0.0
PORITIDAE					
Goniopora/Alveopora spp.	0	0	0	0.0	0.0
Porites massive	0	0	0	0.0	0.0
Porites finger	0	0	11	**0.2**	**0.3**
FAVIIDAE					
Favia stelligera	16	0	0	**0.3**	**0.5**
Favia/Favites spp.	0	19	37	**0.9**	**0.9**
Goniastrea spp.	41	136	51	**3.8**	**2.6**
Cyphastrea micropthalma	8	0	0	**0.1**	**0.2**
Platygyra spp.	24	27	12	**1.1**	**0.4**
Echinopora explanate	0	0	0	0.0	0.0
Leptoria phrygia	54	91	57	**3.4**	**1.0**
Gardinoceris planulata	0	13	0	**0.2**	**0.4**
Hydnophora spp.	0	0	0	0.0	0.0
OCULINIDAE					
Galaxea spp.	0	0	0	0.0	0.0
MUSSIDAE					
Lobophyllia/Symphyllia spp.	0	0	0	0.0	0.0
OTHER HARD CORALS	0	11	0	**0.2**	**0.3**
TOTAL COVER OF ENCRUSTING ORGANISMS:					
Algae & seagrass	5	0	0	**0.1**	**0.1**
Sponges	16	21	26	**1.1**	**0.3**
Millepora	0	22	0	**0.4**	**0.6**
Hard Corals	369	484	345	**20.0**	**3.7**
Dead Standing Coral	505	238	318	**17.7**	**6.9**
Soft Corals	0	0	0	0.0	0.0

Data from three 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; reef flat #1; 14th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	150	110	220	30	195	**7.1**	**3.8**
Coral rubble	124	132	315	110	46	**7.3**	**5.0**
Sand	699	209	324	109	202	**15.4**	**11.6**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	6	0	0	0	**0.1**	**0.1**
ACROPORIDAE							
Acropora staghorn	22	26	0	0	0	**0.5**	**0.7**
Acropora small clumps	31	16	0	0	21	**0.7**	**0.7**
Acropora plate	0	69	5	11	33	**1.2**	**1.4**
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	12	0	0	0	0	**0.1**	**0.3**
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	2	6	0	28	23	**0.6**	**0.6**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	12	0	**0.1**	**0.3**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	26	12	0	8	**0.5**	**0.5**
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	7	4	**0.1**	**0.2**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	0	0	0.0	0.0
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	67	149	17	58	89	**3.8**	**2.4**
Dead Standing Coral	960	1400	1124	1693	1468	**66.5**	**14.5**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; reef flat #2; 15th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	328	415	255	26	365	**13.9**	**7.6**
Coral rubble	0	69	47	0	0	**1.2**	**1.6**
Sand	85	194	355	0	38	**6.7**	**7.2**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	7	19	0	0	0	**0.3**	**0.4**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	20	0	**0.2**	**0.4**
Acropora small clumps	91	60	119	70	5	**3.5**	**2.1**
Acropora plate	9	37	86	144	0	**2.8**	**3.0**
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	18	0	20	0	**0.4**	**0.5**
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	7	0	**0.1**	**0.2**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	24	0	0	**0.2**	**0.5**
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	7	19	0	0	0	**0.3**	**0.4**
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	100	115	229	261	5	**7.1**	**5.2**
Dead Standing Coral	1480	1188	1114	1713	1592	**70.9**	**12.9**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; back reef edge; 14th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	223	158	132	180	264	**9.6**	**2.6**
Coral rubble	351	292	40	73	105	**8.6**	**7.0**
Sand	977	979	764	1172	1307	**52.0**	**10.4**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	25	0	8	12	0	**0.5**	**0.5**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	5	0	0	0	**0.1**	**0.1**
ACROPORIDAE							
Acropora staghorn	0	0	0	110	20	**1.3**	**2.4**
Acropora small clumps	44	124	54	187	121	**5.3**	**2.9**
Acropora plate	0	0	198	0	0	**2.0**	**4.4**
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	16	0	2	0	0	**0.2**	**0.3**
Montipora hills	0	18	0	0	0	**0.2**	**0.4**
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	25	0	0	**0.3**	**0.6**
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	7	0	0	**0.1**	**0.2**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	3	0	8	0	**0.1**	**0.2**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	22	0	0	**0.2**	**0.5**
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	6	0	0	**0.1**	**0.1**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	25	0	8	12	0	**0.5**	**0.5**
Sponges	13	0	74	0	0	**0.9**	**1.6**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	60	150	314	305	141	**9.7**	**5.6**
Dead Standing Coral	346	421	668	258	153	**18.5**	**9.7**
Soft Corals	5	0	0	0	30	**0.4**	**0.7**

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; algal lagoon; 13th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	96	49	96	0	**2.4**	**2.4**
Coral rubble	0	0	92	93	60	**2.5**	**2.3**
Sand	1838	1505	1459	1279	1578	**76.6**	**10.2**
ALGAE & SEAGRASS:							
Sargassum spp.	21	47	0	0	7	**0.8**	**1.0**
Macroalgae	162	360	393	491	348	**17.5**	**6.0**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	39	7	41	14	**1.0**	**0.9**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	0	0.0	0.0
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	183	407	393	491	355	**18.3**	**5.7**
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	0	39	7	41	14	**1.0**	**0.9**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; sand lagoon #1; 14th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	1934	1934	1844	1943	1874	95.3	2.2
ALGAE & SEAGRASS:							
Sargassum spp.	0	5	5	16	7	0.3	0.3
Macroalgae	66	61	149	41	119	4.4	2.3
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	5	0	0	0.1	0.1
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	0	0.0	0.0
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	66	66	154	57	126	4.7	2.2
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	0	0	5	0	0	0.1	0.1
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 1; sand lagoon #2; 14th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	2000	1995	2000	2000	2000	**100.0**	**0.1**
ALGAE & SEAGRASS:							
Sargassum spp.	0	5	0	0	0	**0.1**	**0.1**
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	0	0.0	0.0
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	5	0	0	0	**0.1**	**0.1**
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	0	0	0	0	0	0.0	0.0
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; pass floor; 17th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	135	50	60	45	2.9	2.4
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	268	640	220	510	510	21.5	8.9
ALGAE & SEAGRASS:							
Sargassum spp.	20	0	0	0	0	0.2	0.4
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	5	0	2	6	0	0.1	0.1
Stylophora pistillata	0	31	21	9	36	1.0	0.7
ACROPORIDAE							
Acropora staghorn	0	0	0	0	5	0.1	0.1
Acropora small clumps	0	0	22	0	0	0.2	0.5
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	8	2	0	0	16	0.3	0.3
Montipora hills	0	12	0	10	0	0.2	0.3
AGARICIIDAE							
Pavona spp.	0	0	0	22	0	0.2	0.5
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	10	0	0.1	0.2
FAVIIDAE							
Favia stelligera	19	28	0	0	13	0.6	0.6
Favia/Favites spp.	34	0	0	7	6	0.5	0.7
Goniastrea spp.	34	24	134	0	22	2.1	2.6
Cyphastrea micropthalma	33	8	14	13	51	1.2	0.9
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	20	0	51	0.7	1.1
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	11	0	0	0	0.1	0.2
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	10	0	0.1	0.2
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	20	0	0	0	0	0.2	0.4
Sponges	0	0	0	0	0	0.0	0.0
Millepora	128	3	280	52	38	5.0	5.5
Hard Corals	133	116	213	87	200	7.5	2.7
Dead Standing Coral	1060	890	745	1155	865	47.2	8.2
Soft Corals	0	0	0	0	13	0.1	0.3

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; pass shoal top; 16th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	785	910	1034	735	631	**41.0**	**7.8**
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	0	0	0	0	0	0.0	0.0
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	6	13	0	0	**0.2**	**0.3**
Stylophora pistillata	6	17	9	5	99	**1.4**	**2.0**
ACROPORIDAE							
Acropora staghorn	3	4	6	20	70	**1.0**	**1.4**
Acropora small clumps	89	64	31	22	171	**3.8**	**3.0**
Acropora plate	0	55	57	43	18	**1.7**	**1.2**
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	54	0	55	**1.1**	**1.5**
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	26	0	0	0	11	**0.4**	**0.6**
Goniastrea spp.	0	12	0	20	60	**0.9**	**1.2**
Cyphastrea micropthalma	31	0	0	0	0	**0.3**	**0.7**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	12	18	0	0	**0.3**	**0.4**
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	5	0	0	**0.1**	**0.1**
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	0	0	0.0	0.0
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	30	28	0	20	**0.8**	**0.7**
Hard Corals	155	170	193	110	484	**11.1**	**7.5**
Dead Standing Coral	1060	890	745	1155	865	**47.2**	**8.2**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; pass shoal slope; 16th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	1041	921	501	767	1158	**43.9**	**12.8**
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	0	0	0	0	0	0.0	0.0
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	12	0	0	0	0	**0.1**	**0.3**
Stylophora pistillata	0	16	13	20	18	**0.7**	**0.4**
ACROPORIDAE							
Acropora staghorn	0	253	0	215	0	**4.7**	**6.4**
Acropora small clumps	16	18	28	23	3	**0.9**	**0.5**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	31	77	0	94	0	**2.0**	**2.2**
Montipora hills	0	0	23	0	0	**0.2**	**0.5**
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	35	0	**0.4**	**0.8**
FAVIIDAE							
Favia stelligera	0	0	115	16	56	**1.9**	**2.5**
Favia/Favites spp.	125	129	29	164	44	**4.9**	**2.9**
Goniastrea spp.	37	40	85	131	101	**3.9**	**2.0**
Cyphastrea micropthalma	109	69	58	73	67	**3.8**	**1.0**
Platygyra spp.	7	0	0	0	0	**0.1**	**0.2**
Echinopora explanate	17	0	0	0	23	**0.4**	**0.6**
Leptoria phrygia	83	71	100	0	54	**3.1**	**1.9**
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	14	46	0	49	0	**1.1**	**1.2**
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	108	0	0	**1.1**	**2.4**
OTHER HARD CORALS	56	0	45	43	31	**1.8**	**1.1**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	0	0	0.0	0.0
Sponges	0	0	5	0	0	**0.1**	**0.1**
Millepora	67	105	220	145	265	**8.0**	**4.1**
Hard Corals	507	719	604	863	397	**30.9**	**9.1**
Dead Standing Coral	385	255	675	225	180	**17.2**	**10.0**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; pass shoal slope-perm.; 21st Apr 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	605	440	695	380	430	**25.5**	**6.7**
Sand	0	0	0	0	0	0.0	0.0
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	6	3	0	0	**0.1**	**0.1**
ACROPORIDAE							
Acropora staghorn	0	0	103	0	0	**1.0**	**2.3**
Acropora small clumps	0	7	21	22	8	**0.6**	**0.5**
Acropora plate	0	0	0	28	0	**0.3**	**0.6**
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	7	0	0	5	**0.1**	**0.2**
Montipora hills	9	0	0	0	0	**0.1**	**0.2**
AGARICIIDAE							
Pavona spp.	0	0	0	0	5	**0.1**	**0.1**
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	25	25	20	0	**0.7**	**0.6**
Favia/Favites spp.	78	91	24	57	0	**2.5**	**1.9**
Goniastrea spp.	4	20	118	17	3	**1.6**	**2.4**
Cyphastrea micropthalma	0	15	30	0	0	**0.5**	**0.7**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	22	0	**0.2**	**0.5**
Leptoria phrygia	0	0	10	16	0	**0.3**	**0.4**
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	16	0	0	**0.2**	**0.4**
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	17	6	0	14	0	**0.4**	**0.4**

TOTAL COVER OF ENCRUSTING ORGANISMS:

NR = not recorded

Algae & seagrass	0	0	0	0	0	0.0	0.0
Sponges	0	0	8	0	0	**0.1**	**0.2**
Millepora	136	158	2	30	187	**5.1**	**4.1**
Hard Corals	108	177	350	196	21	**8.5**	**6.1**
Dead Standing Coral	NR	NR	NR	NR	NR	NR	NR
Soft Corals	0	0	20	0	0	0.2	0.4

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; Sargassum slope #1; 15th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	1077	907	1371	1311	1282	**59.5**	**9.6**
Sand	0	0	0	0	0	0.0	0.0
ALGAE & SEAGRASS:							
Sargassum spp.	720	760	380	590	580	**30.3**	**7.4**
Macroalgae	178	260	230	90	120	**8.8**	**3.6**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	13	**0.1**	**0.3**
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	5	0	0	0	**0.1**	**0.1**
Goniastrea spp.	11	0	0	9	0	**0.2**	**0.3**
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	898	1020	610	680	700	**39.1**	**8.5**
Sponges	2	0	19	0	0	**0.2**	**0.4**
Millepora	12	69	0	0	5	**0.9**	**1.5**
Hard Corals	11	5	0	9	13	**0.4**	**0.3**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; Sargassum slope #2; 17th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	50	110	0	40	165	**3.7**	**3.2**
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	530	240	430	540	460	**22.0**	**6.1**
ALGAE & SEAGRASS:							
Sargassum spp.	155	320	705	110	280	**15.7**	**11.8**
Macroalgae	1252	1318	854	1307	1087	**58.2**	**9.8**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	6	0	**0.1**	**0.1**
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	13	0	0	0	5	**0.2**	**0.3**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	6	0	0	0	**0.1**	**0.1**
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	3	0	3	**0.1**	**0.1**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	6	0	5	0	**0.1**	**0.2**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	1407	1638	1559	1417	1367	**73.9**	**5.8**
Sponges	0	6	0	0	0	**0.1**	**0.1**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	13	12	3	11	8	**0.5**	**0.2**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; algal lagoon; 16th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	840	890	1080	780	1002	**45.9**	**6.1**
ALGAE & SEAGRASS:							
Sargassum spp.	0	55	35	0	15	**1.1**	**1.2**
Macroalgae	1131	1027	885	1165	980	**51.9**	**5.7**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	8	0	0	**0.1**	**0.2**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	5	0	0	0	**0.1**	**0.1**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	1131	1082	920	1165	995	**52.9**	**5.0**
Sponges	29	24	0	55	3	**1.1**	**1.1**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	0	5	8	0	0	**0.1**	**0.2**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 2; inshore reef flat; 15th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	1919	1748	1808	1703	1877	**90.6**	**4.4**
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	0	0	0	0	0	0.0	0.0
ALGAE & SEAGRASS:							
Sargassum spp.	0	25	0	0	0	**0.3**	**0.6**
Macroalgae	55	163	156	248	78	**7.0**	**3.8**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	11	0	0	0	**0.1**	**0.2**
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	5	0	0	0	**0.1**	**0.1**
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	6	0	3	11	5	**0.3**	**0.2**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	55	188	156	248	78	**7.3**	**4.0**
Sponges	20	50	33	38	40	**1.8**	**0.5**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	6	16	3	11	5	**0.4**	**0.3**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 3; reef flat #1; 18th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	490	430	175	510	520	**21.3**	**7.2**
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	160	10	330	60	100	**6.6**	**6.2**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	5	0	**0.1**	**0.1**
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	19	0	0	18	0	**0.4**	**0.5**
Stylophora pistillata	0	0	0	13	0	**0.1**	**0.3**
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	19	58	32	18	**1.3**	**1.1**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	27	0	5	0	24	**0.6**	**0.7**
AGARICIIDAE							
Pavona spp.	0	0	0	73	0	**0.7**	**1.6**
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	34	0	0	**0.3**	**0.8**
Goniastrea spp.	0	14	2	0	18	**0.3**	**0.4**
Cyphastrea micropthalma	0	0	6	8	3	**0.2**	**0.2**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	14	**0.1**	**0.3**
Leptoria phrygia	0	0	15	0	0	**0.2**	**0.3**
Gardinoceris planulata	0	0	7	0	0	**0.1**	**0.2**
Hydnophora spp.	0	10	3	0	0	**0.1**	**0.2**
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	4	**0.0**	**0.1**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	5	0	**0.1**	**0.1**
Sponges	9	10	19	5	9	**0.5**	**0.3**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	46	43	130	144	81	**4.4**	**2.3**
Dead Standing Coral	1295	1507	1346	1276	1290	**67.1**	**4.8**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 3; reef flat #2; 18th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	310	370	340	180	130	13.3	5.3
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	210	305	165	225	330	12.4	3.4
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	15	8	0.2	0.3
Macroalgae	0	0	0	10	0	0.1	0.2
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	15	0	0	4	0.2	0.3
ACROPORIDAE							
Acropora staghorn	0	0	0	0	95	1.0	2.1
Acropora small clumps	25	44	28	15	17	1.3	0.6
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	36	0	0	0	0.4	0.8
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	6	0	0	0	0.1	0.1
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	11	0	15	0.3	0.4
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	15	8	0.2	0.3
Gardinoceris planulata	22	9	0	0	0	0.3	0.5
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	6	10	20	0	0.4	0.4
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	25	8	0.3	0.5
Sponges	0	5	0	27	11	0.4	0.6
Millepora	0	5	0	25	0	0.3	0.5
Hard Corals	47	116	49	50	139	4.0	2.2
Dead Standing Coral	1433	1199	1186	1418	1127	63.6	7.1
Soft Corals	0	0	260	50	255	5.7	6.7

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 3; reef flat-permanent; 21st April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	550	530	545	455	520	**26.0**	**1.9**
Sand	290	15	165	250	310	**10.3**	**6.0**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	6	0	0	0	4	**0.1**	**0.1**
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	6	7	12	35	6	**0.7**	**0.6**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	9	16	0	22	0	**0.5**	**0.5**
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	6	5	0	34	0	**0.5**	**0.7**
Goniastrea spp.	42	42	15	72	6	**1.8**	**1.3**
Cyphastrea micropthalma	26	12	0	18	6	**0.6**	**0.5**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	5	0	0	0	6	**0.1**	**0.2**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	0	0	0.0	0.0
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	100	82	27	181	28	**4.2**	**3.2**
Dead Standing Coral	1059	1373	1263	1089	1142	**59.3**	**6.5**
Soft Corals	0	0	0	25	0	**0.3**	**0.6**

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 3; back reef edge; 18th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	110	829	593	1403	832	**37.7**	**23.4**
Coral rubble	710	0	170	240	200	**13.2**	**13.3**
Sand	1012	430	730	0	420	**25.9**	**19.0**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	10	100	0	20	**1.3**	**2.1**
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	21	37	7	0	0	**0.7**	**0.8**
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	155	0	97	0	**2.5**	**3.6**
Acropora small clumps	14	0	23	15	0	**0.5**	**0.5**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	47	74	0	35	0	**1.6**	**1.6**
AGARICIIDAE							
Pavona spp.	0	0	5	0	0	**0.1**	**0.1**
Pachyseris rugosa	0	76	0	0	0	**0.8**	**1.7**
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	60	0	107	**1.7**	**2.4**
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	11	44	0	21	**0.8**	**0.9**
Goniastrea spp.	0	2	31	5	9	**0.5**	**0.6**
Cyphastrea micropthalma	16	0	0	2	0	**0.2**	**0.3**
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	5	**0.1**	**0.1**
Gardinoceris planulata	3	0	0	25	13	**0.4**	**0.5**
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	12	11	24	0	37	**0.8**	**0.7**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	10	100	0	20	**1.3**	**2.1**
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	9	100	216	**3.3**	**4.7**
Hard Corals	113	366	194	179	192	**10.4**	**4.7**
Dead Standing Coral	55	365	215	78	120	**8.3**	**6.3**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 3; algal lagoon #1; 18th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	25	0	0	0	0	**0.3**	**0.6**
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	1120	959	854	956	908	**48.0**	**5.0**
ALGAE & SEAGRASS:							
Sargassum spp.	840	1020	1030	1020	1030	**49.4**	**4.1**
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	16	0	0	0	**0.2**	**0.4**
Montipora explanate	0	0	33	0	0	**0.3**	**0.7**
Montipora hills	15	0	0	24	0	**0.4**	**0.6**
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	20	0	0	**0.2**	**0.4**
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	0	0.0	0.0
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	15	0	49	**0.6**	**1.1**
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	840	1020	1030	1020	1030	**49.4**	**4.1**
Sponges	0	5	48	0	13	**0.7**	**1.0**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	15	16	68	24	49	**1.7**	**1.2**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 3; algal lagoon #2; 18th April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	55	45	0	80	0	1.8	1.8
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	1243	1480	1235	951	896	58.1	11.9
ALGAE & SEAGRASS:							
Sargassum spp.	670	470	720	910	990	37.6	10.3
Macroalgae	25	0	45	25	60	1.6	1.1
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	14	11	0.3	0.3
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	0	0.0	0.0
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	17	0.2	0.4
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	695	470	765	935	1050	39.2	11.2
Sponges	7	5	0	20	26	0.6	0.5
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	0	0	0	14	28	0.4	0.6
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 4; reef flat; 22nd April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	25	155	50	75	45	3.5	2.5
Coral rubble	195	0	80	220	613	11.1	11.8
Sand	0	0	0	0	0	0.0	0.0
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	10	0	0	0	0.1	0.2
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	3	0.0	0.1
Pocillopora spp.	0	0	0	0	11	0.1	0.2
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	105	53	94	124	110	4.9	1.3
Acropora plate	447	329	232	222	35	12.7	7.6
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	42	271	124	80	45	5.6	4.7
AGARICIIDAE							
Pavona spp.	0	0	8	0	0	0.1	0.2
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	18	0	2	15	0.4	0.4
Goniastrea spp.	18	0	0	5	2	0.3	0.4
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	6	10	0	0	0.2	0.2
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	10	0	0	0	0.1	0.2
Sponges	0	0	0	0	0	0.0	0.0
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	612	677	468	433	221	24.1	8.9
Dead Standing Coral	1168	1158	1402	1272	1121	61.2	5.7
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 4; coral lagoon #1; 23rd April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	625	368	435	156	695	**22.8**	**10.7**
Coral rubble	190	1010	370	1240	580	**33.9**	**21.9**
Sand	410	117	670	200	296	**16.9**	**10.8**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	3	5	23	**0.3**	**0.5**
Seagrass	10	0	0	0	0	**0.1**	**0.2**
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	15	0	0	0	**0.2**	**0.3**
Acropora small clumps	224	45	9	75	8	**3.6**	**4.5**
Acropora plate	25	0	0	0	0	**0.3**	**0.6**
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	15	0	0	0	0	**0.2**	**0.3**
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	43	0	0	0	**0.4**	**1.0**
Porites finger	16	57	377	73	80	**6.0**	**7.3**
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	0	0.0	0.0
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	33	30	**0.6**	**0.9**
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	10	0	3	5	23	**0.4**	**0.5**
Sponges	0	5	0	0	0	**0.1**	**0.1**
Millepora	214	0	40	0	155	**4.1**	**4.9**
Hard Corals	280	160	386	181	118	**11.3**	**5.4**
Dead Standing Coral	271	340	96	218	133	**10.6**	**5.0**
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 4; coral lagoon #2; 23rd April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	220	0	105	419	190	**9.3**	**7.8**
Coral rubble	0	160	160	0	0	**3.2**	**4.4**
Sand	730	1550	1260	593	416	**45.5**	**23.8**
ALGAE & SEAGRASS:							
Sargassum spp.	0	0	0	0	0	0.0	0.0
Macroalgae	0	0	0	0	0	0.0	0.0
Seagrass	0	0	0	0	0	0.0	0.0
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	8	0	**0.1**	**0.2**
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	20	16	0	0	720	**7.6**	**15.9**
Acropora small clumps	30	20	0	0	7	**0.6**	**0.7**
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	5	4	**0.1**	**0.1**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	0	0	0	0	0	0.0	0.0
Sponges	0	0	0	0	0	0.0	0.0
Millepora	888	85	240	525	608	**23.5**	**15.8**
Hard Corals	50	36	0	13	731	**8.3**	**15.8**
Dead Standing Coral	102	19	20	395	55	**5.9**	**7.9**
Soft Corals	10	150	215	57	0	**4.3**	**4.7**

Data from five 20m intersect line transects as total cm intersects with mean % cover

ENCRUSTING ORGANISMS and SUBSTRATUM TYPE: NINGALOO; Site 4; algal lagoon; 22nd April 1987

Transect #	1 (cm)	2 (cm)	3 (cm)	4 (cm)	5 (cm)	mean (% cover)	std.dev. (% cover)
SUBSTRATUM TYPE:							
Coral basement	0	0	0	0	0	0.0	0.0
Coral rubble	0	0	0	0	0	0.0	0.0
Sand	1128	1455	1750	1555	1467	**73.6**	**11.3**
ALGAE & SEAGRASS:							
Sargassum spp.	350	255	40	10	210	**8.7**	**7.2**
Macroalgae	500	280	180	430	310	**17.0**	**6.3**
Seagrass	20	10	30	0	0	**0.6**	**0.7**
HARD CORALS:							
POCILLOPORIDAE							
Seriatopora caliendrum	0	0	0	0	0	0.0	0.0
Pocillopora spp.	0	0	0	0	0	0.0	0.0
Stylophora pistillata	0	0	0	0	0	0.0	0.0
ACROPORIDAE							
Acropora staghorn	0	0	0	0	0	0.0	0.0
Acropora small clumps	0	0	0	0	0	0.0	0.0
Acropora plate	0	0	0	0	0	0.0	0.0
Montipora massive	0	0	0	0	0	0.0	0.0
Montipora explanate	0	0	0	0	0	0.0	0.0
Montipora hills	0	0	0	0	0	0.0	0.0
AGARICIIDAE							
Pavona spp.	0	0	0	0	0	0.0	0.0
Pachyseris rugosa	0	0	0	0	0	0.0	0.0
PORITIDAE							
Goniopora/Alveopora spp.	0	0	0	0	0	0.0	0.0
Porites massive	0	0	0	0	0	0.0	0.0
Porites finger	0	0	0	0	0	0.0	0.0
FAVIIDAE							
Favia stelligera	0	0	0	0	0	0.0	0.0
Favia/Favites spp.	0	0	0	0	6	**0.1**	**0.1**
Goniastrea spp.	0	0	0	0	0	0.0	0.0
Cyphastrea micropthalma	0	0	0	0	0	0.0	0.0
Platygyra spp.	0	0	0	0	0	0.0	0.0
Echinopora explanate	0	0	0	0	0	0.0	0.0
Leptoria phrygia	0	0	0	0	0	0.0	0.0
Gardinoceris planulata	0	0	0	0	0	0.0	0.0
Hydnophora spp.	0	0	0	0	0	0.0	0.0
OCULINIDAE							
Galaxea spp.	0	0	0	0	0	0.0	0.0
MUSSIDAE							
Lobophyllia/Symphyllia spp.	0	0	0	0	0	0.0	0.0
OTHER HARD CORALS	0	0	0	0	0	0.0	0.0
TOTAL COVER OF ENCRUSTING ORGANISMS:							
Algae & seagrass	870	545	250	440	520	**26.3**	**11.2**
Sponges	2	0	0	5	9	**0.2**	**0.2**
Millepora	0	0	0	0	0	0.0	0.0
Hard Corals	0	0	0	0	6	**0.1**	**0.1**
Dead Standing Coral	0	0	0	0	0	0.0	0.0
Soft Corals	0	0	0	0	0	0.0	0.0

Data from five 20m intersect line transects as total cm intersects with mean % cover

APPENDIX 2.

Fish Counts: raw data and preliminary analyses from five 50 x 20m belt transects in each survey location

FISH COUNTS: NINGALOO MARINE PARK; Site 1; outer reef slope habitat; 15th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	1	0	0	**0.2**	**0.4**
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	1	1	2	**0.8**	**0.8**
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	0	0	0.0	0.0
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	1	0	2	0	1	**0.8**	**0.8**
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	8	24	10	9	5	**11.2**	**7.4**
Lethrinus nebulosus	0	0	0	0	0	0.0	0.0
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	0	2	4	0	0	**1.2**	**1.8**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	3	2	0	0	**1.0**	**1.4**
Chaetodon lunula	2	0	2	0	1	**1.0**	**1.0**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	2	0	2	**0.8**	**1.1**
Chaetodon plebeius	13	12	6	7	4	**8.4**	**3.9**
Chaetodon trifascialis	0	1	3	0	1	**1.0**	**1.2**
Chaetodon trifasciatus	0	2	2	2	2	**1.6**	**0.9**
Chaetodon unimaculatus	1	0	0	0	0	**0.2**	**0.4**
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	16	20	21	9	10	**15.2**	**5.5**
LABRIDAE							
Choerodon schoenleinii	0	1	0	0	0	**0.2**	**0.4**
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	0	0.0	0.0
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	1	4	0	0	0	**1.0**	**1.7**
Scarus frenatus	26	11	40	9	9	**19.0**	**13.7**
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	3	0	0	0	0	**0.6**	**1.3**
Scarus globiceps	6	3	3	0	0	**2.4**	**2.5**
Scarus prasiognathos	36	10	13	11	17	**17.4**	**10.7**
Scarus psittacus	24	4	31	1	0	**12.0**	**14.4**
Scarus rivulatus	0	4	14	0	0	**3.6**	**6.1**
Scarus rubroviolaceus	3	0	8	1	2	**2.8**	**3.1**
Scarus schlegeli	40	33	8	9	8	**19.6**	**15.6**
Scarus sordidus	18	30	18	12	11	**17.8**	**7.6**
Total Scaridae	157	99	135	43	47	**96.2**	**51.1**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; reef flat habitat; high tide; 14th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	1	1	0	0	0	**0.4**	**0.5**
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	5	0	2	0	2	**1.8**	**2.0**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	1	0	**0.2**	**0.4**
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	130	17	33	31	20	**46.2**	**47.3**
Lethrinus nebulosus	72	1	2	2	1	**15.6**	**31.5**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	14	6	4	2	4	**6.0**	**4.7**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	1	**0.2**	**0.4**
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	21	10	9	13	16	**13.8**	**4.9**
Chaetodon trifascialis	4	7	0	1	3	**3.0**	**2.7**
Chaetodon trifasciatus	2	0	0	0	0	**0.4**	**0.9**
Chaetodon unimaculatus	1	0	0	0	0	**0.2**	**0.4**
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	42	23	13	16	24	**23.6**	**11.3**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	6	0	1	3	0	**2.0**	**2.5**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	1	0	0	1	0	**0.4**	**0.5**
Scarus chameleon	9	0	2	0	0	**2.2**	**3.9**
Scarus frenatus	3	2	3	0	4	**2.4**	**1.5**
Scarus ghobban	9	11	4	3	5	**6.4**	**3.4**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	5	8	5	9	8	**7.0**	**1.9**
Scarus psittacus	0	0	5	1	0	**1.2**	**2.2**
Scarus rivulatus	6	3	10	6	5	**6.0**	**2.5**
Scarus rubroviolaceus	2	0	0	0	3	**1.0**	**1.4**
Scarus schlegeli	44	36	15	15	13	**24.6**	**14.4**
Scarus sordidus	27	24	17	7	13	**17.6**	**8.1**
Total Scaridae	112	84	62	45	51	**70.8**	**27.4**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; reef flat habitat; low tide; 16th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	1	0	0	0	0	**0.2**	**0.4**
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	2	0	**0.4**	**0.9**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	2	4	0	1	1	**1.6**	**1.5**
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	1	0	1	0	0	**0.4**	**0.5**
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	28	33	26	41	19	**29.4**	**8.2**
Lethrinus nebulosus	10	36	5	6	0	**11.4**	**14.2**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	7	2	3	6	4	**4.4**	**2.1**
Chaetodon citrinellus	0	0	0	3	0	**0.6**	**1.3**
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	1	0	**0.2**	**0.4**
Chaetodon lunula	0	1	0	0	0	**0.2**	**0.4**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	14	14	11	21	21	**16.2**	**4.5**
Chaetodon trifascialis	6	13	6	16	17	**11.6**	**5.3**
Chaetodon trifasciatus	0	1	0	1	0	**0.4**	**0.5**
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	27	31	20	48	42	**33.6**	**11.3**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	3	0	1	0	**0.8**	**1.3**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	1	0	**0.2**	**0.4**
Scarus frenatus	4	1	2	0	0	**1.4**	**1.7**
Scarus ghobban	4	3	4	0	3	**2.8**	**1.6**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	9	4	3	0	4	**4.0**	**3.2**
Scarus psittacus	2	0	2	1	2	**1.4**	**0.9**
Scarus rivulatus	4	6	1	0	0	**2.2**	**2.7**
Scarus rubroviolaceus	3	0	0	0	0	**0.6**	**1.3**
Scarus schlegeli	16	8	11	4	7	**9.2**	**4.5**
Scarus sordidus	6	8	7	3	12	**7.2**	**3.3**
Total Scaridae	48	33	30	10	28	**29.8**	**13.6**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; back reef edge habitat; 13th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	1	5	5	6	10	5.4	3.2
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	7	10	7	1	5	6.0	3.3
Lethrinus nebulosus	10	5	1	5	0	4.2	4.0
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	1	0	0	0	0.2	0.4
Chaetodon auriga	2	7	0	4	4	3.4	2.6
Chaetodon citrinellus	2	0	2	0	1	1.0	1.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	14	4	6	1	2	5.4	5.2
Chaetodon trifascialis	5	2	0	0	0	1.4	2.2
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	23	14	8	5	7	11.4	7.3
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	2	2	5	0	2	2.2	1.8
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	2	1	6	1	0	2.0	2.3
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	1	0	1	0	0.4	0.5
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	0	0	6	2	2	2.0	2.4
Scarus rivulatus	0	5	5	4	0	2.8	2.6
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	2	0	3	0	0	1.0	1.4
Scarus sordidus	8	2	3	0	0	2.6	3.3
Total Scaridae	14	11	28	8	4	13.0	9.2

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; algal lagoon habitat; high tide; 16th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	5	1	5	3	4	**3.6**	**1.7**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	0	0	0	2	**0.4**	**0.9**
Lethrinus nebulosus	0	3	2	0	1	**1.2**	**1.3**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	1	0	1	1	**0.6**	**0.5**
Chaetodon auriga	0	1	1	2	2	**1.2**	**0.8**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	0	2	1	3	3	**1.8**	**1.3**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	0	0.0	0.0
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	1	**0.2**	**0.4**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	2	0	0	0	1	**0.6**	**0.9**
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	2	0	0	0	2	**0.8**	**1.1**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; algal lagoon habitat; low tide; 13th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	1	**0.2**	**0.4**
Epinephalus rivulatus	1	1	2	1	3	**1.6**	**0.9**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	0	0	0	0	0.0	0.0
Lethrinus nebulosus	2	0	1	0	0	**0.6**	**0.9**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	1	2	**0.6**	**0.9**
Chaetodon auriga	2	0	0	0	0	**0.4**	**0.9**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	2	0	0	1	2	**1.0**	**1.0**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	12	4	2	4	17	**7.8**	**6.4**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	2	0	2	0	2	**1.2**	**1.1**
Scarus rivulatus	0	0	0	0	1	**0.2**	**0.4**
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	14	4	4	4	20	**9.2**	**7.4**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; sand lagoon habitat #1; 14th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	4	1	**1.0**	**1.7**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	0	0	0	0	0.0	0.0
Lethrinus nebulosus	0	0	0	0	0	0.0	0.0
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	2	0	**0.4**	**0.9**
Chaetodon auriga	0	0	0	0	0	0.0	0.0
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	0	0	0	2	0	**0.4**	**0.9**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	1	0	0	0	**0.2**	**0.4**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	0	0	0	0	0	0.0	0.0
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	0	1	0	0	0	**0.2**	**0.4**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 1; sand lagoon habitat #2; 14th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	0	0	0.0	0.0
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	0	0	0	0	0.0	0.0
Lethrinus nebulosus	0	0	0	0	0	0.0	0.0
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	0	0	0	0	0	0.0	0.0
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	0	0	0	0	0	0.0	0.0
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	0	0.0	0.0
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	0	0	0	0	0	0.0	0.0
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	0	0	0	0	0	0.0	0.0

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 2; pass floor habitat; 17th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	1	0	0	0	0	**0.2**	**0.4**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	1	0	1	2	**0.8**	**0.8**
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	31	9	5	15	16	**15.2**	**9.9**
Lethrinus nebulosus	0	0	0	0	0	0.0	0.0
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	3	0	1	0	0	**0.8**	**1.3**
Chaetodon citrinellus	6	8	9	8	9	**8.0**	**1.2**
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	1	1	0	0	0	**0.4**	**0.5**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	7	3	3	4	0	**3.4**	**2.5**
Chaetodon trifascialis	1	1	0	5	1	**1.6**	**1.9**
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	2	0	0	0	**0.4**	**0.9**
Total Chaetodontidae	18	15	13	17	10	**14.6**	**3.2**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	1	1	1	2	0	**1.0**	**0.7**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	6	8	13	7	5	**7.8**	**3.1**
Scarus frenatus	6	7	5	12	12	**8.4**	**3.4**
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	3	0	**0.6**	**1.3**
Scarus prasiognathos	7	3	10	6	5	**6.2**	**2.6**
Scarus psittacus	7	38	15	15	14	**17.8**	**11.8**
Scarus rivulatus	2	12	6	5	5	**6.0**	**3.7**
Scarus rubroviolaceus	1	0	4	0	0	**1.0**	**1.7**
Scarus schlegeli	82	107	173	129	186	**135.4**	**43.8**
Scarus sordidus	35	40	61	46	57	**47.8**	**11.0**
Total Scaridae	147	216	288	225	284	**232.0**	**57.8**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 2; pass shoal slope habitat; 16th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	1	0	1	0	0.4	0.5
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	1	0	0	0.2	0.4
Lutjanus fulviflamma	12	3	48	26	12	20.2	17.6
Lutjanus monostigma	0	0	0	1	0	0.2	0.4
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	1	0	2	0	0	0.6	0.9
Plectorhinchus flavomaculatus	2	0	2	1	0	1.0	1.0
Plectorhinchus multivittatus	0	0	1	0	1	0.4	0.5
LETHRINIDAE							
Lethrinus mahsena	44	30	36	59	43	42.4	10.9
Lethrinus nebulosus	41	18	114	26	14	42.6	41.2
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	1	4	2	4	4	3.0	1.4
Chaetodon citrinellus	3	2	2	4	0	2.2	1.5
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	1	0	0	0	0.2	0.4
Chaetodon lunula	1	2	0	2	0	1.0	1.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	3	1	2	4	1	2.2	1.3
Chaetodon trifascialis	0	1	0	1	0	0.4	0.5
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	1	0	0	0	0.2	0.4
Total Chaetodontidae	8	12	6	15	5	9.2	4.2
LABRIDAE							
Choerodon schoenleinii	1	0	0	1	0	0.4	0.5
Choerodon n.sp.	3	0	2	1	0	1.2	1.3
SCARIDAE *							
Leptoscarus vaigiensis	0	0				0.0	0.0
Calotomus spinidens	0	0				0.0	0.0
Hipposcarus longiceps	0	0				0.0	0.0
Scarus chameleon	4	6				5.0	1.4
Scarus frenatus	3	8				5.5	3.5
Scarus ghobban	0	4				2.0	2.8
Scarus gibbus	0	4				2.0	2.8
Scarus globiceps	4	7				5.5	2.1
Scarus prasiognathos	6	45				25.5	27.6
Scarus psittacus	2	5				3.5	2.1
Scarus rivulatus	6	22				14.0	11.3
Scarus rubroviolaceus	1	2				1.5	0.7
Scarus schlegeli	37	45				41.0	5.7
Scarus sordidus	27	30				28.5	2.1
Total Scaridae	90	178				134.0	62.2

* two counts only

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 2; Sargassum slope habitat; group 1; 15th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	12	11	7	13	6	**9.8**	**3.1**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	2	0	0	**0.4**	**0.9**
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	0	0	0	0	0.0	0.0
Lethrinus nebulosus	8	1	0	0	2	**2.2**	**3.3**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	4	6	8	9	4	**6.2**	**2.3**
Chaetodon auriga	1	2	2	2	0	**1.4**	**0.9**
Chaetodon citrinellus	0	2	3	1	2	**1.6**	**1.1**
Chaetodon kleinii	0	1	0	0	0	**0.2**	**0.4**
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	5	11	13	12	6	**9.4**	**3.6**
LABRIDAE							
Choerodon schoenleinii	0	0	0	1	0	**0.2**	**0.4**
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	34	24	6	2	8	**14.8**	**13.6**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	4	14	12	2	7	**7.8**	**5.1**
Scarus rivulatus	0	2	0	0	0	**0.4**	**0.9**
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	38	40	18	4	15	**23.0**	**15.5**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 2; Sargassum slope habitat; group 2; 16th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	3	1	5	7	3	**3.8**	**2.3**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	8	10	12	3	1	**6.8**	**4.7**
Lethrinus nebulosus	0	0	13	0	0	**2.6**	**5.8**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	15	10	10	11	7	**10.6**	**2.9**
Chaetodon auriga	4	0	6	0	1	**2.2**	**2.7**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	1	0	0	**0.2**	**0.4**
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	2	0	0	0	0	**0.4**	**0.9**
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	21	10	17	11	8	**13.4**	**5.4**
LABRIDAE							
Choerodon schoenleinii	2	0	0	0	0	**0.4**	**0.9**
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	73	246	151	86	18	**114.8**	**87.3**
Calotomus spinidens	4	7	4	1	1	**3.4**	**2.5**
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	3	0	0	1	3	**1.4**	**1.5**
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	33	22	39	9	3	**21.2**	**15.3**
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	113	275	194	97	25	**140.8**	**96.1**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 2; algal lagoon habitat; 16th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	5	5	6	1	4	**4.2**	**1.9**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	1	0	0	0	**0.2**	**0.4**
Lethrinus nebulosus	0	7	1	1	0	**1.8**	**2.9**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	10	10	9	2	12	**8.6**	**3.8**
Chaetodon auriga	0	0	2	0	0	**0.4**	**0.9**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	10	10	11	2	12	**9.0**	**4.0**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	1	4	2	6	1	**2.8**	**2.2**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	0	0	0	0	0.0	0.0
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	1	0	1	0	0	**0.4**	**0.5**
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	2	4	3	6	1	**3.2**	**1.9**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 2; inshore reef flat habitat; 15th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	1	0	1	**0.4**	**0.5**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	0	0	1	0	**0.2**	**0.4**
Lethrinus nebulosus	0	1	3	3	0	**1.4**	**1.5**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	1	1	1	10	5	**3.6**	**4.0**
Chaetodon auriga	0	1	0	0	0	**0.2**	**0.4**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	1	0	**0.2**	**0.4**
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	1	2	1	11	5	**4.0**	**4.2**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	0	0.0	0.0
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	0	1	0	3	0	**0.8**	**1.3**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	0	0	0	0	0	0.0	0.0
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	1	0	0	0	**0.2**	**0.4**
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	0	2	0	3	0	**1.0**	**1.4**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 3; reef flat habitat; 18th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	2	0	0	0	0	0.4	0.9
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	0	2	0.4	0.9
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	1	2	1	5	1	2.0	1.7
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	1	0	0	0.2	0.4
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	19	16	14	18	12	15.8	2.9
Lethrinus nebulosus	1	1	2	1	2	1.4	0.5
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	2	6	3	6	1	3.6	2.3
Chaetodon citrinellus	0	0	0	0	1	0.2	0.4
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	1	1	2	1	1	1.2	0.4
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	5	3	1.6	2.3
Chaetodon trifascialis	0	0	1	2	2	1.0	1.0
Chaetodon trifasciatus	2	0	0	1	0	0.6	0.9
Chaetodon unimaculatus	0	0	0	0	1	0.2	0.4
Chelmon rostratus	0	0	0	0	1	0.2	0.4
Total Chaetodontidae	5	7	6	15	10	8.6	4.0
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	0	0.0	0.0
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	4	0	1	2	1.4	1.7
Scarus chameleon	0	0	1	0	0	0.2	0.4
Scarus frenatus	7	5	7	4	5	5.6	1.3
Scarus ghobban	5	5	0	4	3	3.4	2.1
Scarus gibbus	2	0	0	0	0	0.4	0.9
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	9	5	1	4	4	4.6	2.9
Scarus psittacus	7	4	7	5	7	6.0	1.4
Scarus rivulatus	11	11	1	8	2	6.6	4.8
Scarus rubroviolaceus	1	1	0	3	0	1.0	1.2
Scarus schlegeli	77	40	27	79	62	57.0	22.9
Scarus sordidus	79	38	58	59	70	60.8	15.4
Total Scaridae	198	113	102	167	155	147.0	39.5

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 3; back reef edge habitat; 19th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	1	0	0	0	0	**0.2**	**0.4**
Epinephalus tauvina	0	0	1	0	0	**0.2**	**0.4**
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	1	1	4	1	0	**1.4**	**1.5**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	2	1	3	1	0	**1.4**	**1.1**
Lutjanus monostigma	1	0	1	0	0	**0.4**	**0.5**
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	1	0	**0.2**	**0.4**
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	13	0	0	1	4	**3.6**	**5.5**
LETHRINIDAE							
Lethrinus mahsena	17	5	9	7	11	**9.8**	**4.6**
Lethrinus nebulosus	17	0	1	8	29	**11.0**	**12.1**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	0	2	3	4	3	**2.4**	**1.5**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	2	0	0	0	0	**0.4**	**0.9**
Chaetodon lunula	2	0	0	0	0	**0.4**	**0.9**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	1	2	7	2	**2.4**	**2.7**
Chaetodon trifascialis	0	0	1	0	1	**0.4**	**0.5**
Chaetodon trifasciatus	2	0	4	0	2	**1.6**	**1.7**
Chaetodon unimaculatus	0	0	0	1	0	**0.2**	**0.4**
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	6	3	10	12	8	**7.8**	**3.5**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	0	0.0	0.0
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	5	1	1	16	1	**4.8**	**6.5**
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	3	3	5	6	4	**4.2**	**1.3**
Scarus ghobban	2	0	0	2	0	**0.8**	**1.1**
Scarus gibbus	0	0	0	1	0	**0.2**	**0.4**
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	1	0	0	3	**0.8**	**1.3**
Scarus psittacus	2	0	2	0	0	**0.8**	**1.1**
Scarus rivulatus	1	0	1	0	0	**0.4**	**0.5**
Scarus rubroviolaceus	0	0	0	1	0	**0.2**	**0.4**
Scarus schlegeli	20	5	13	42	24	**20.8**	**13.9**
Scarus sordidus	32	2	28	27	11	**20.0**	**12.9**
Total Scaridae	65	12	50	95	43	**53.0**	**30.4**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 3; algal lagoon habitat #1; 19th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	5	6	3	5	4	4.6	1.1
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	6	0	0	0	0	1.2	2.7
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	1	0	0	0	0.2	0.4
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	6	0	5	0	2.2	3.0
Lethrinus nebulosus	13	4	2	2	0	4.2	5.1
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	6	3	0	3	0	2.4	2.5
Chaetodon auriga	3	0	2	0	2	1.4	1.3
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	1	2	0	0	0	0.6	0.9
Chaetodon melannotus	0	1	0	0	0	0.2	0.4
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	0	0	0	0.0	0.0
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	10	6	2	3	2	4.6	3.4
LABRIDAE							
Choerodon schoenleinii	0	0	1	0	0	0.2	0.4
Choerodon n.sp.	0	2	0	1	0	0.6	0.9
SCARIDAE							
Leptoscarus vaigiensis	0	10	3	4	1	3.6	3.9
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	7	10	0	7	1	5.0	4.3
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	6	3	0	3	0	2.4	2.5
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	1	0	0	0	0	0.2	0.4
Scarus psittacus	3	1	0	2	0	1.2	1.3
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	2	0	0	0	0	0.4	0.9
Total Scaridae	19	24	3	16	2	12.8	9.8

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 3; algal lagoon habitat #2; 18th April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	11	6	11	10	4	**8.4**	**3.2**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	0	2	1	3	0	**1.2**	**1.3**
Lethrinus nebulosus	0	6	17	20	5	**9.6**	**8.5**
Lethrinus variegatus	0	6	2	0	10	**3.6**	**4.3**
CHAETODONTIDAE							
Chaetodon assarius	6	2	5	4	1	**3.6**	**2.1**
Chaetodon auriga	2	2	4	0	0	**1.6**	**1.7**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	0	1	0	0	**0.2**	**0.4**
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	8	4	10	4	1	**5.4**	**3.6**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	18	40	38	64	15	**35.0**	**19.8**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	1	0	0	0	**0.2**	**0.4**
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	2	2	1	2	0	**1.4**	**0.9**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	0	0	0	0	0	0.0	0.0
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	20	43	39	66	15	**36.6**	**20.3**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 4; reef flat habitat; 22nd April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	0	1	**0.2**	**0.4**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	1	0	0	1	0	**0.4**	**0.5**
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	3	3	11	2	1	**4.0**	**4.0**
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	1	0	0	**0.2**	**0.4**
Plectorhinchus multivittatus	0	2	1	0	1	**0.8**	**0.8**
LETHRINIDAE							
Lethrinus mahsena	5	7	13	9	3	**7.4**	**3.8**
Lethrinus nebulosus	0	0	1	0	0	**0.2**	**0.4**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	0	2	3	0	2	**1.4**	**1.3**
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	1	2	0	0	**0.6**	**0.9**
Chaetodon lunula	0	4	2	0	6	**2.4**	**2.6**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	22	21	27	26	18	**22.8**	**3.7**
Chaetodon trifascialis	17	17	19	23	24	**20.0**	**3.3**
Chaetodon trifasciatus	2	2	1	0	0	**1.0**	**1.0**
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	41	47	54	49	50	**48.2**	**4.8**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	0	0	1	**0.2**	**0.4**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	1	**0.2**	**0.4**
Scarus frenatus	1	0	1	2	3	**1.4**	**1.1**
Scarus ghobban	1	1	2	0	4	**1.6**	**1.5**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	28	2	22	4	0	**11.2**	**12.9**
Scarus rivulatus	1	1	0	1	0	**0.6**	**0.5**
Scarus rubroviolaceus	0	1	0	0	0	**0.2**	**0.4**
Scarus schlegeli	9	12	1	16	15	**10.6**	**6.0**
Scarus sordidus	25	21	27	19	25	**23.4**	**3.3**
Total Scaridae	65	38	53	42	49	**49.4**	**10.5**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 4; coral lagoon habitat #1; 23rd April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	0	0	0	0	0	0.0	0.0
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	1	0	0	0	1	**0.4**	**0.5**
LETHRINIDAE							
Lethrinus mahsena	13	7	8	3	7	**7.6**	**3.6**
Lethrinus nebulosus	3	8	17	6	5	**7.8**	**5.4**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	0	0	0	0	0	0.0	0.0
Chaetodon auriga	2	2	2	0	2	**1.6**	**0.9**
Chaetodon citrinellus	2	2	6	0	2	**2.4**	**2.2**
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	2	1	0	0	0	**0.6**	**0.9**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	12	7	7	14	15	**11.0**	**3.8**
Chaetodon trifascialis	4	2	2	12	5	**5.0**	**4.1**
Chaetodon trifasciatus	0	1	0	0	2	**0.6**	**0.9**
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	1	2	0	1	0	**0.8**	**0.8**
Total Chaetodontidae	23	17	17	27	26	**22.0**	**4.8**
LABRIDAE							
Choerodon schoenleinii	0	0	0	0	0	0.0	0.0
Choerodon n.sp.	0	0	0	0	1	**0.2**	**0.4**
SCARIDAE							
Leptoscarus vaigiensis	1	1	2	0	0	**0.8**	**0.8**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	1	5	2	3	0	**2.2**	**1.9**
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	4	0	5	4	3	**3.2**	**1.9**
Scarus gibbus	0	1	0	0	0	**0.2**	**0.4**
Scarus globiceps	3	0	0	0	0	**0.6**	**1.3**
Scarus prasiognathos	4	1	0	0	0	**1.0**	**1.7**
Scarus psittacus	3	3	5	7	9	**5.4**	**2.6**
Scarus rivulatus	16	6	12	9	10	**10.6**	**3.7**
Scarus rubroviolaceus	0	0	0	0	1	**0.2**	**0.4**
Scarus schlegeli	28	24	22	10	19	**20.6**	**6.8**
Scarus sordidus	30	14	11	12	15	**16.4**	**7.8**
Total Scaridae	90	55	59	45	57	**61.2**	**17.0**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 4; coral lagoon habitat #2; 23rd April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	1	0	0	0	0	**0.2**	**0.4**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	1	0	6	5	1	**2.6**	**2.7**
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	1	0	2	0	0	**0.6**	**0.9**
LETHRINIDAE							
Lethrinus mahsena	8	1	5	2	2	**3.6**	**2.9**
Lethrinus nebulosus	12	1	9	3	14	**7.8**	**5.6**
Lethrinus variegatus	0	0	0	0	11	**2.2**	**4.9**
CHAETODONTIDAE							
Chaetodon assarius	0	2	2	0	1	**1.0**	**1.0**
Chaetodon auriga	2	2	2	0	0	**1.2**	**1.1**
Chaetodon citrinellus	2	0	0	4	0	**1.2**	**1.8**
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	1	0	4	0	0	**1.0**	**1.7**
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	9	8	16	13	7	**10.6**	**3.8**
Chaetodon trifascialis	1	0	2	1	0	**0.8**	**0.8**
Chaetodon trifasciatus	0	0	0	4	0	**0.8**	**1.8**
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	15	12	26	22	8	**16.6**	**7.3**
LABRIDAE							
Choerodon schoenleinii	0	1	0	0	0	**0.2**	**0.4**
Choerodon n.sp.	0	0	0	0	0	0.0	0.0
SCARIDAE							
Leptoscarus vaigiensis	0	0	1	0	0	**0.2**	**0.4**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	6	1	2	1	4	**2.8**	**2.2**
Scarus frenatus	1	0	1	1	0	**0.6**	**0.5**
Scarus ghobban	9	3	7	2	5	**5.2**	**2.9**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	4	1	0	**1.0**	**1.7**
Scarus psittacus	6	8	7	14	12	**9.4**	**3.4**
Scarus rivulatus	2	2	7	4	0	**3.0**	**2.6**
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	18	17	33	14	9	**18.2**	**9.0**
Scarus sordidus	11	13	14	15	6	**11.8**	**3.6**
Total Scaridae	53	44	76	52	36	**52.2**	**15.0**

Data from five 50 x 20m transect counts

FISH COUNTS: NINGALOO MARINE PARK; Site 4; algal lagoon habitat; 22nd April 1987

Transect #	1	2	3	4	5	mean	std.dev.
SERRANIDAE							
Cephalopholis argus	0	0	0	0	0	0.0	0.0
Epinephalus microdon	0	0	0	0	0	0.0	0.0
Epinephalus tauvina	0	0	0	0	0	0.0	0.0
Epinephalus bilobatus	0	0	0	0	0	0.0	0.0
Epinephalus rivulatus	5	6	11	2	2	**5.2**	**3.7**
Plectropomus leopardus	0	0	0	0	0	0.0	0.0
LUTJANIDAE							
Lutjanus bohar	0	0	0	0	0	0.0	0.0
Lutjanus carponotatus	0	0	0	0	0	0.0	0.0
Lutjanus fulviflamma	0	0	0	0	0	0.0	0.0
Lutjanus monostigma	0	0	0	0	0	0.0	0.0
HAEMULIDAE							
Diagramma pictum	0	0	0	0	0	0.0	0.0
Plectorhinchus chubbi	0	0	0	0	0	0.0	0.0
Plectorhinchus flavomaculatus	0	0	0	0	0	0.0	0.0
Plectorhinchus multivittatus	0	0	0	0	0	0.0	0.0
LETHRINIDAE							
Lethrinus mahsena	1	2	4	0	1	**1.6**	**1.5**
Lethrinus nebulosus	2	6	2	14	1	**5.0**	**5.4**
Lethrinus variegatus	0	0	0	0	0	0.0	0.0
CHAETODONTIDAE							
Chaetodon assarius	10	9	7	4	2	**6.4**	**3.4**
Chaetodon auriga	0	0	0	0	0	0.0	0.0
Chaetodon citrinellus	0	0	0	0	0	0.0	0.0
Chaetodon kleinii	0	0	0	0	0	0.0	0.0
Chaetodon lineolatus	0	0	0	0	0	0.0	0.0
Chaetodon lunula	0	0	0	0	0	0.0	0.0
Chaetodon melannotus	0	0	0	0	0	0.0	0.0
Chaetodon ornatissimus	0	0	0	0	0	0.0	0.0
Chaetodon plebeius	0	1	0	0	0	**0.2**	**0.4**
Chaetodon trifascialis	0	0	0	0	0	0.0	0.0
Chaetodon trifasciatus	0	0	0	0	0	0.0	0.0
Chaetodon unimaculatus	0	0	0	0	0	0.0	0.0
Chelmon rostratus	0	0	0	0	0	0.0	0.0
Total Chaetodontidae	10	10	7	4	2	**6.6**	**3.6**
LABRIDAE							
Choerodon schoenleinii	0	1	1	0	0	**0.4**	**0.5**
Choerodon n.sp.	0	0	0	1	0	**0.2**	**0.4**
SCARIDAE							
Leptoscarus vaigiensis	0	2	0	14	0	**3.2**	**6.1**
Calotomus spinidens	0	0	0	0	0	0.0	0.0
Hipposcarus longiceps	0	0	0	0	0	0.0	0.0
Scarus chameleon	0	0	0	0	0	0.0	0.0
Scarus frenatus	0	0	0	0	0	0.0	0.0
Scarus ghobban	2	6	3	0	0	**2.2**	**2.5**
Scarus gibbus	0	0	0	0	0	0.0	0.0
Scarus globiceps	0	0	0	0	0	0.0	0.0
Scarus prasiognathos	0	0	0	0	0	0.0	0.0
Scarus psittacus	2	6	0	0	0	**1.6**	**2.6**
Scarus rivulatus	0	0	0	0	0	0.0	0.0
Scarus rubroviolaceus	0	0	0	0	0	0.0	0.0
Scarus schlegeli	0	0	0	0	0	0.0	0.0
Scarus sordidus	0	0	0	0	0	0.0	0.0
Total Scaridae	4	14	3	14	0	**7.0**	**6.6**

Data from five 50 x 20m transect counts