

A general description of the subtidal habitats of the Dampier Archipelago, Western Australia

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Abstract – Subtidal habitats at 45 locations were recorded on video during the diving surveys of the Dampier Archipelago in 1998 (DA1/98) and 1999 (DA3/99) and analysed for percentage cover in terms of 13 benthic categories. The video recording provided a permanent record of each station while the video transect analysis provided a quantitative description of the benthic habitat to complement the semi-quantitative specimen collections. A statistical comparison of the habitats present indicated that the survey stations could be grouped into seven distinct categories (abiotic – six stations; macroalgae – four stations; gorgonian soft corals – one station; neptheid and alcyoniid soft corals – five stations; foliose non-*Acropora* hard corals – one station; branching *Acropora* – two stations; massive non-*Acropora* – four stations) and one less distinct category (abiotic and hard coral habitats, predominantly massive non-*Acropora* or tabulate *Acropora* species – twenty two stations) based on dominant percentage cover.

INTRODUCTION

The aim of this work was to provide a permanent record of 45 subtidal habitats in the Dampier Archipelago and to describe benthic composition at a functional group level. Biological sampling for the survey was conducted along a 25.0 m transect at each station. Of necessity, however, the band width of the transect varied for each taxonomic group investigated. Biodiversity and benthic assemblage composition varies with habitat type and for comparative purposes stations have been categorised.

MATERIALS AND METHODS

Video recordings at each of 45 stations, 19 in 1998 (DA1/98) and 26 in triplicate (78 transects) in 1999 (DA3/99), were undertaken. Recordings were acquired by movement of a Sony CCD Handycam Video 8 camera in a housing along 25.0 m long transects, according to the protocol developed by the Australian Institute of Marine Science (Carleton and Done, 1995). Each transect was marked by laying a 25.0 m measuring tape along the sea bed at relatively uniform depths. A SCUBA diver maintained a constant speed of 0.2 m/sec. and the video was kept 0.5 m above the surface of the habitat. This captured a band width of approximately 0.6 metre and a total area of 15.0 m²/transect. Data on the depth and habitat type at each station are provided in Tables 1 and 2 while the locations of the stations are illustrated in Figure 1.

Video recordings of the 45 stations were captured electronically, saved to file and then stored on compact discs. The Sinclair Knight Merz Video Transect Analysis System then retrieved the electronically-recorded transect for analysis. The program randomly selects 200 frames from approximately 3,125 recorded along the 25.0 metre transect. Each frame was allocated one randomly placed spot. The substratum types beneath the respective spots were assigned a benthic descriptor.

Once a benthic descriptor was assigned and the respective frame completed, the program advanced the transect to the next randomly-selected frame and this process was repeated until the designated number of frames were completed. Upon completion, the program computed tallied counts and percentage cover (Osborne and Oxley, 1997). The data for each station were exported into an Excel spreadsheet for graphical presentation.

Since the purpose of the transect analysis was to provide a general description of the benthic habitat, the benthos was identified to functional group level rather than species. The mean values obtained for each functional group resident in each habitat at each station were used to create a dissimilarity matrix. A Bray-Curtis dissimilarity correlation was carried out on the data using Systat 10. The dissimilarity matrix was then used in a hierarchical cluster analysis, using the single linkage (nearest neighbour) method. The results of the cluster analysis were presented graphically and used to indicate stations with common characteristics.

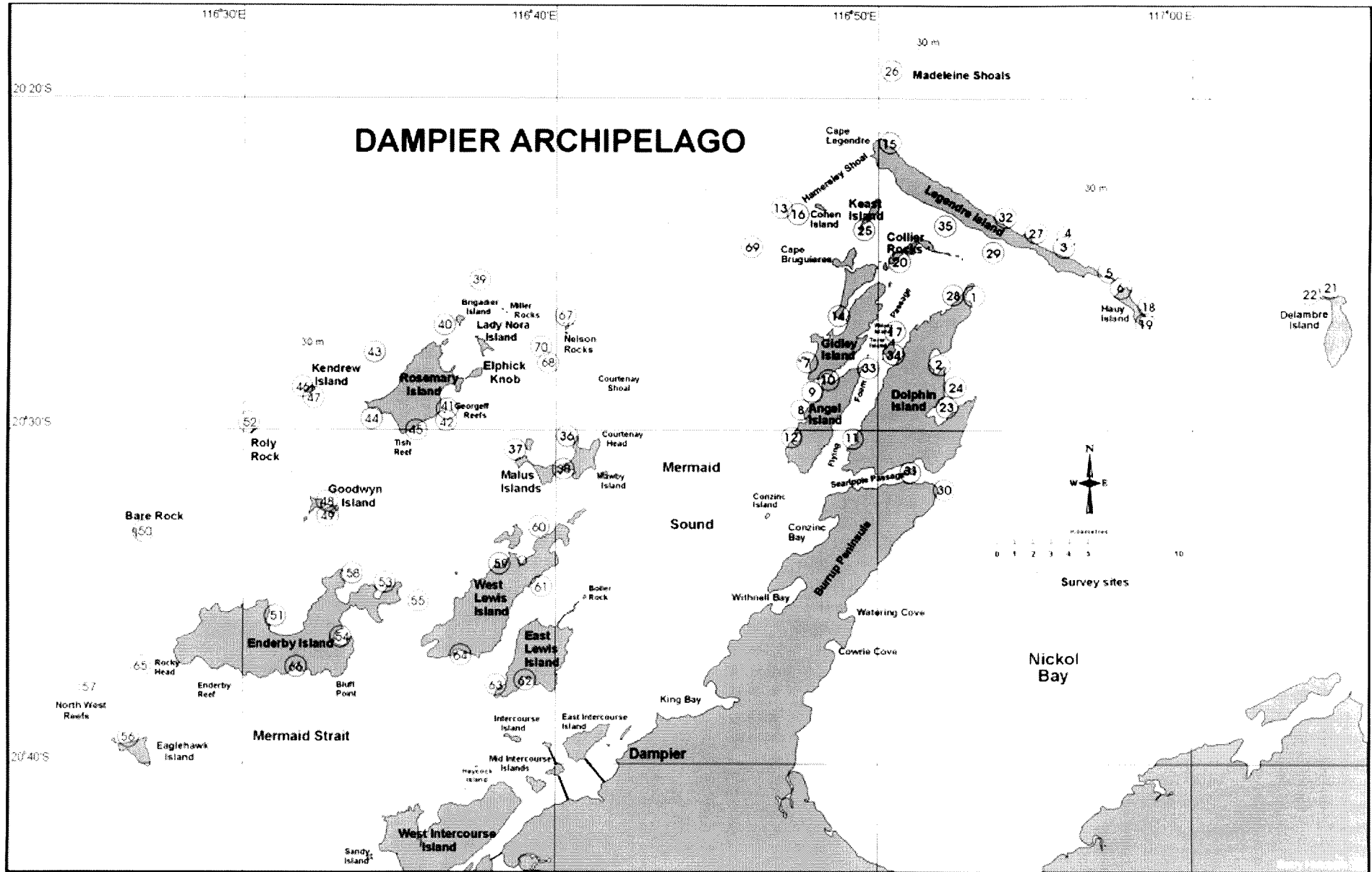


Figure 1 Subtidal sampling station locations for the DA1/98 and DA3/99 diving surveys.

STATION DESCRIPTIONS

The raw percentage cover in terms of each benthic category by station is provided in Tables 3 and 4. The analysis of percentage cover of benthic habitat was described in terms of the following categories:

1. Three abiotic categories (sand, rubble and rock).
2. One macroalgal category.
3. Three soft coral categories (alcyoniids, gorgonians and nephtheids).
4. Eight hard coral categories (branching *Acropora*, corymbose *Acropora*, digitate *Acropora*, tabulate *Acropora*, encrusting non-*Acropora*, foliaceous non-*Acropora* and massive non-*Acropora*).
5. Five additional categories (sponge, anemone, mollusc, echinoderm and ascidian).
6. One general category of 'other fauna'.

Of the above 20 categories, several were either poorly represented (<0.5% cover) or provided little information on their own. For this reason, in the presentation of the data in this report the three abiotic categories were combined and the five additional categories were added to the general category of 'other fauna'. The resulting presentation is, therefore, based on 13 categories of benthic habitat.

The habitat of each subtidal survey station is described in terms of percentage cover of each benthic category, as shown in Figures 2–4.

For the majority of the stations analysed, more than 50% of the surface area of the transect consisted of an abiotic benthic habitat (stations DA1/98/01, 03, 06, 08, 12, 13, 16, 18, 19, 21, 24, 26, 27, 32, 33, 35 and DA3/99/36, 37, 39, 41, 43, 44, 46, 47, 49, 50, 53, 55, 56, 57, 58, 63, 64, 65, 67, 68 and 69) (Figure 2). The abiotic category is excluded in Figure 3 to better depict the living benthic habitat of the stations. In Figure 4, the three soft coral categories are combined into one and the eight hard coral categories are also combined into one.

The results of the hierarchical cluster analysis are shown in Figure 5. The analysis indicated several groupings of one or more stations. Stations DA1/98/03, 06, 16 and DA3/99/41, 43 and 68 were grouped based on their similarity in terms of an abiotic habitat, which was characteristic of these stations. Stations DA3/99/37, 47, 61 and 70 were grouped because they were dominated by macroalgae. Station DA3/99/65 was predominantly gorgonian soft coral while stations DA1/98/15 and 32, and DA3/99/39, 40 and 52 were grouped based on the percentage cover of nephtheid and alcyoniid soft corals. Station DA3/99/60 was widely separated from the other stations, due to the large percentage cover by foliose non-*Acropora* hard corals. Stations DA1/98/22 and 29 formed a cluster based on their predominantly branching *Acropora* hard coral habitat while stations DA1/98/01 and 24, and DA3/99/50 and 63, were grouped due to the predominance of massive non-*Acropora* hard coral habitat.

The remaining 22 stations are difficult to separate further statistically without data from the various specimen collections. They were all dominated by abiotic and a combination of hard coral habitats, predominantly massive non-*Acropora* or tabulate *Acropora* species.

REFERENCES

- Carleton, J.H. and Done, T.J. (1995). Quantitative video sampling of coral reef benthos: large scale application. *Coral Reefs* **14**: 35–46.
- Osborne, K. and Oxley, W.G. (1997). Sampling benthic communities using video transects. In English, S., Wilkinson, C. and Baker, V. (eds), *Survey manual for tropical marine resources*. The Australian Institute of Marine Science, Townsville, Queensland.

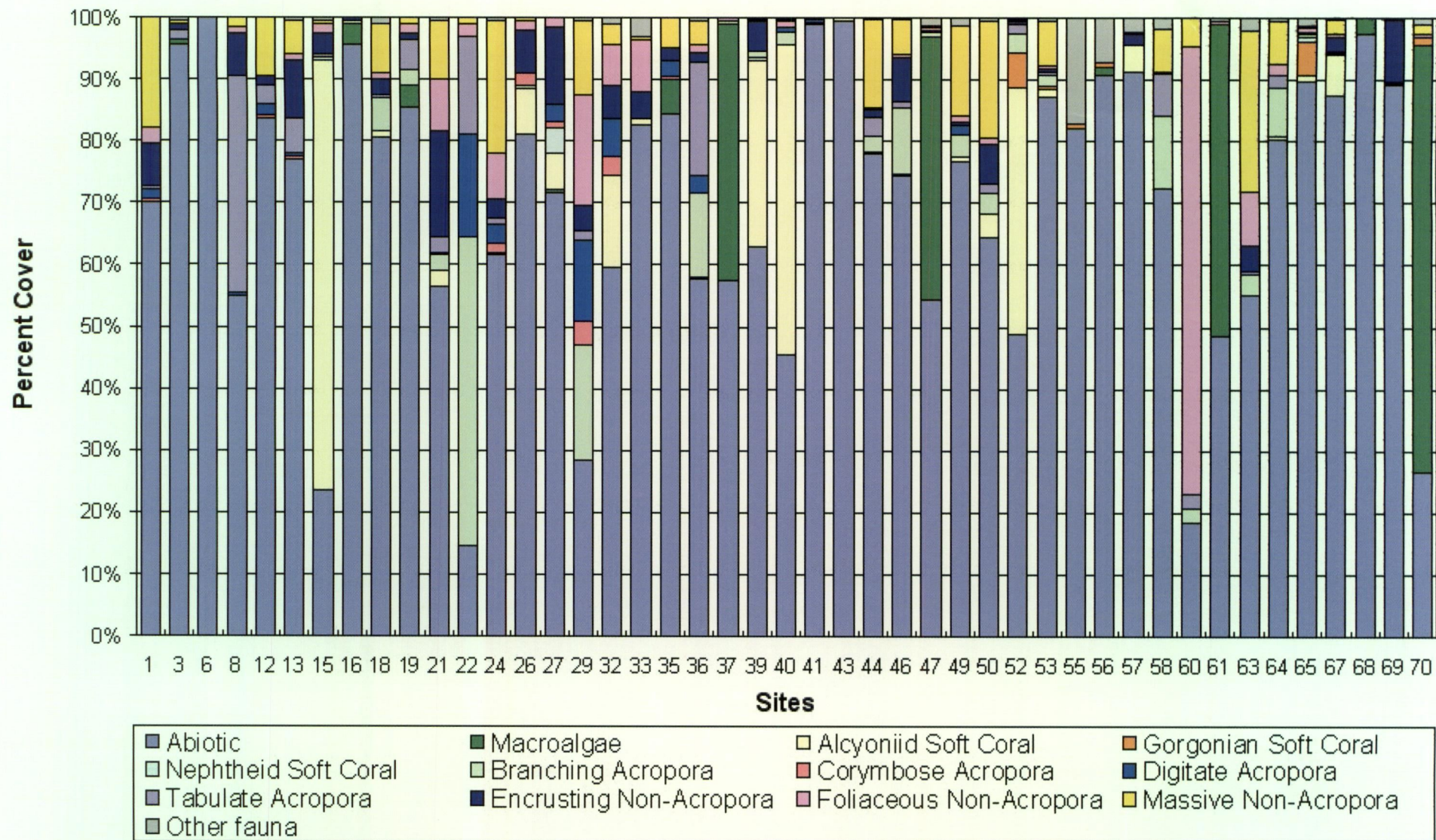


Figure 2 Percentage cover of habitat.

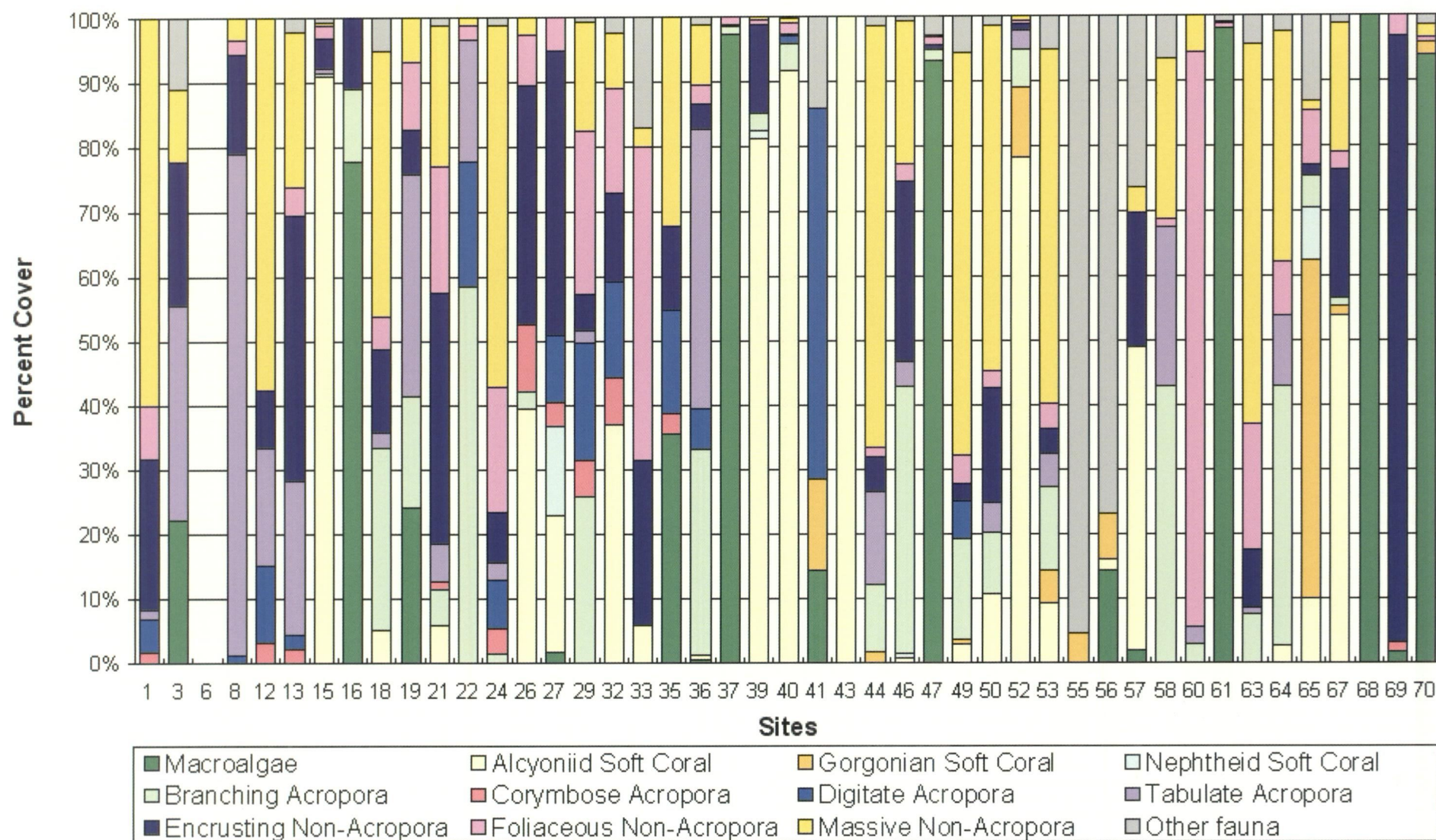


Figure 3 Percentage cover of biota.

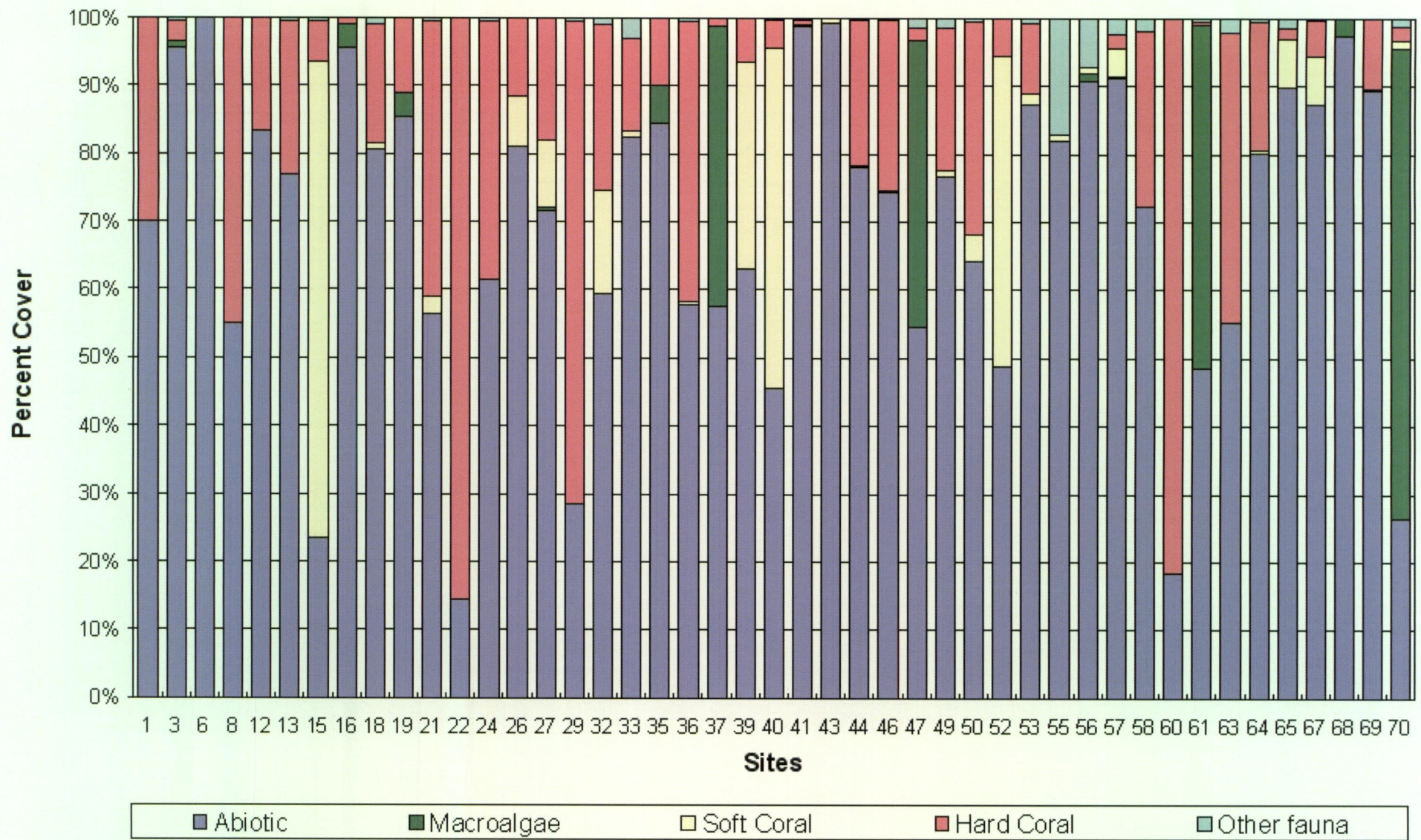


Figure 4 Percentage cover of combined habitat categories.

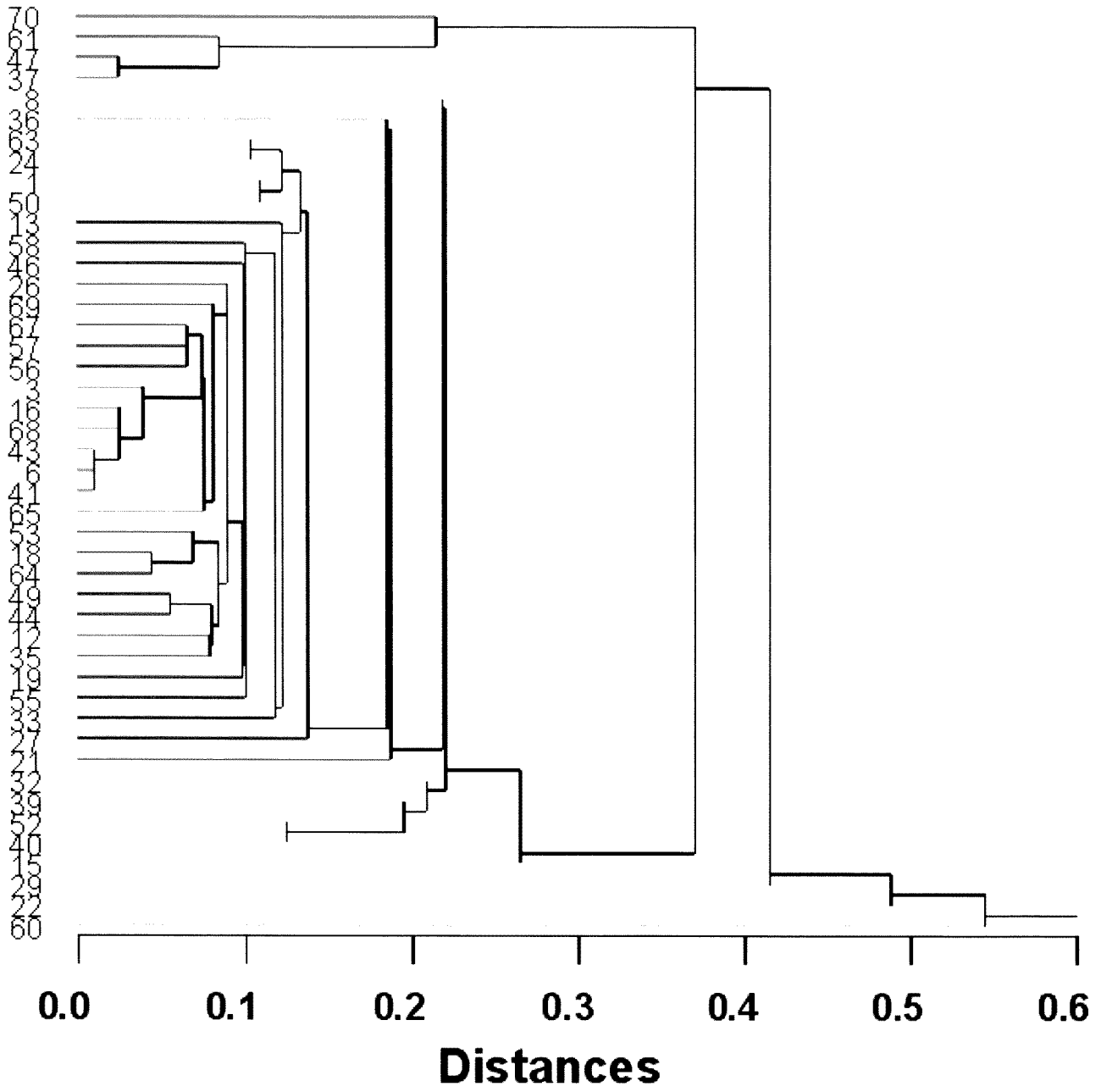


Figure 5 Cluster analysis.

Table 1 Station descriptions for the DA1/98 diving survey.

Station	Year	Habitat	Depth (m)	Latitude	Longitude
DA1/98/01	1998	Coral	6	20 25.852'S	116 52.953'E
DA1/98/03	1998	Coral on dissected limestone reef	8	20 24.320'S	116 56.108'E
DA1/98/06	1998	Patchy coral on limestone pavement	3	20 25.725'S	116 57.580'E
DA1/98/08	1998	Coral on dissected limestone reef	4	20 29.180'S	116 47.711'E
DA1/98/12	1998	Patchy coral on limestone pavement	6	20 30.200'S	116 47.249'E
DA1/98/13	1998	Coral on dissected limestone reef	9	20 23.203'S	116 46.691'E
DA1/98/15	1998	Soft coral on limestone reef	16	20 21.142'S	116 50.579'E
DA1/98/16	1998	Coral regrowth on rubble	4	20 23.240'S	116 47.080'E
DA1/98/18	1998	Coral bommies on sand	11	20 26.400'S	116 58.634'E
DA1/98/19	1998	Macroalgae and coral on sand and rubble	3	20 26.620'S	116 58.390'E
DA1/98/21	1998	Coral	14	20 25.700'S	117 04.220'E
DA1/98/22	1998	Coral	5	20 25.915'S	117 03.655'E
DA1/98/24	1998	Coral	5	20 28.870'S	116 52.380'E
DA1/98/26	1998	Hard coral and soft coral on igneous rock	22	20 19.343'S	116 50.455'E
DA1/98/27	1998	Hard coral and soft coral on limestone pavement	16	20 24.044'S	116 55.041'E
DA1/98/29	1998	Coral	4	20 24.566'S	116 53.714'E
DA1/98/32	1998	Hard coral and soft coral on limestone reef	14	20 23.520'S	116 54.110'E
DA1/98/33	1998	Soft coral and sponge on silt	8	20 27.965'S	116 49.692'E
DA1/98/35	1998	Macroalgae and coral on sand	1	20 23.620'S	116 51.960'E

Table 2 Station descriptions for the DA3/99 diving survey.

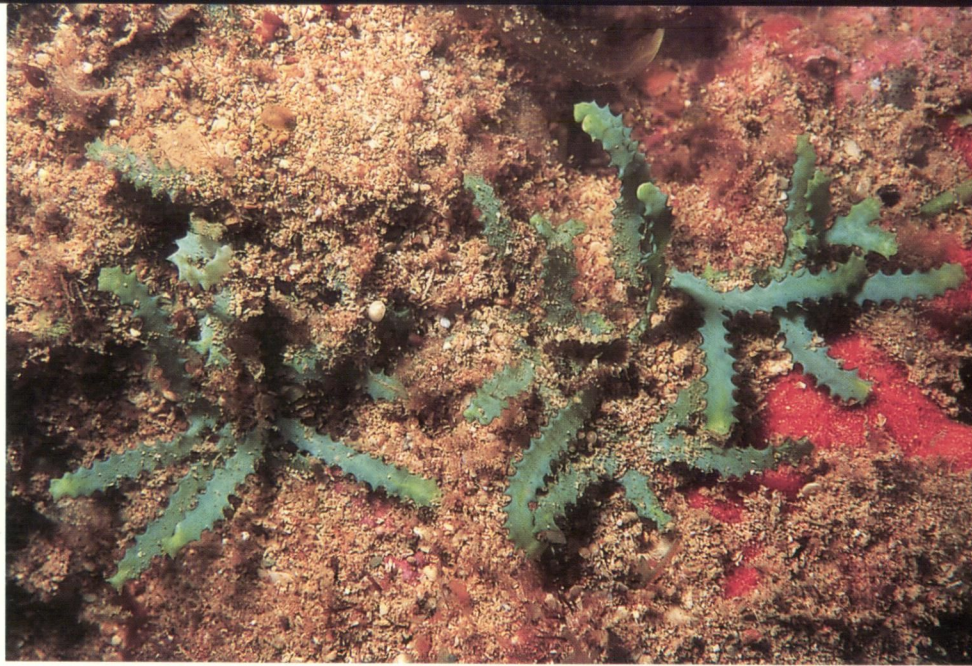
Station	Year	Habitat	Depth (m)	Latitude	Longitude
DA3/99/36	1999	Coral	9	20 30.056'S	116 40.579'E
DA3/99/37	1999	Macroalgae on rubble	4	20 30.612'S	116 38.918'E
DA3/99/39	1999	Soft coral on igneous rock	16	20 25.411'S	116 37.613'E
DA3/99/40	1999	Soft corals	8	20 26.648'S	116 36.522'E
DA3/99/41	1999	Coral bommies on sand	4	20 29.243'S	116 36.974'E
DA3/99/43	1999	Patchy coral on limestone pavement	11	20 27.814'S	116 34.192'E
DA3/99/44	1999	Coral bommies on sand	5	20 29.590'S	116 34.446'E
DA3/99/46	1999	Coral on dissected limestone reef	5	20 28.634'S	116 31.991'E
DA3/99/47	1999	Macroalgae on limestone pavement	4	20 28.967'S	116 32.549'E
DA3/99/49	1999	Coral bommies on sand	5	20 32.433'S	116 32.683'E
DA3/99/50	1999	Coral on dissected limestone reef	15	20 32.849'S	116 26.705'E
DA3/99/52	1999	Soft corals on limestone pavement	15	20 29.741'S	116 30.184'E
DA3/99/53	1999	Patchy coral on sand	5	20 34.528'S	116 34.574'E
DA3/99/55	1999	Sponge and soft corals	17	20 35.111'S	116 35.620'E
DA3/99/56	1999	Sponge and soft corals	9	20 38.939'S	116 26.218'E
DA3/99/57	1999	Soft coral on igneous rock	9	20 37.707'S	116 25.129'E
DA3/99/58	1999	Coral regrowth on rubble	4	20 34.386'S	116 33.558'E
DA3/99/60	1999	Coral	3	20 32.894'S	116 39.513'E
DA3/99/61	1999	Macroalgae and coral on sand and rubble	5	20 34.655'S	116 39.721'E
DA3/99/63	1999	Coral	2	20 37.474'S	116 38.288'E
DA3/99/64	1999	Patchy coral on sand	5	20 36.659'S	116 36.943'E
DA3/99/65	1999	Sponge and soft corals	14	20 37.096'S	116 26.720'E
DA3/99/67	1999	Patchy coral on limestone pavement	17	20 26.505'S	116 40.225'E
DA3/99/68	1999	Sand with patchy soft coral and sponge	7	20 27.979'S	116 39.733'E
DA3/99/69	1999	Rock armoured pipeline	14	20 24.466'S	116 46.298'E
DA3/99/70	1999	Macroalgae on pavement	6	20 27.448'S	116 39.574'E

Table 3 Habitat percentage cover at each station during the DA1/98 diving survey.

Benthos type	Stations																		
	1	3	6	8	12	13	15	16	18	19	21	22	24	26	27	29	32	33	35
Abiotic	70.0	95.5	100	55.0	83.5	77.0	23.5	95.5	80.5	85.5	56.5	14.5	61.5	81.0	71.5	28.5	59.5	82.5	84.5
Macroalgae		1.0						3.5		3.5					0.5				5.5
Alcyoniid soft coral							69.5		1.0		2.5			7.5	6.0		15.0	1.0	
Gorgonian soft coral																			
Nephtheid soft coral								0.5							4.0				
Branching <i>Acropora</i>								0.5	5.5	2.5	2.5	50.0	0.5	0.5		18.5			
Corymbose <i>Acropora</i>	0.5				0.5	0.5					0.5		1.5	2.0	1.0	4.0	3.0		0.5
Digitate <i>Acropora</i>	1.5			0.5	2.0	0.5							16.5	3.0	3.0	13.0	6.0		2.5
Tabulate <i>Acropora</i>	0.5	1.5		35.0	3.0	5.5	0.5		0.5	5.0	2.5	16.0	1.0			1.5			
Encrusting non- <i>Acropora</i>	7.0	1.0		7.0	1.5	9.5	3.5	0.5	2.5	1.0	17.0		3.0	7.0	12.5	4.0	5.5	4.5	2.0
Foliaceous non- <i>Acropora</i>	2.5			1.0	1.0	1.			1.0	1.5	8.5	2.0	7.5	1.5	1.5	18.0	6.5	8.5	
Massive non- <i>Acropora</i>	18.0	0.5		1.5	9.5	5.5	0.5		8.0	1.0	9.5	1.0	21.5	0.5		12.0	3.5	0.5	5.0
Other fauna		0.5				0.5	0.5		1.0		0.5		0.5			0.5	1.0	3.0	

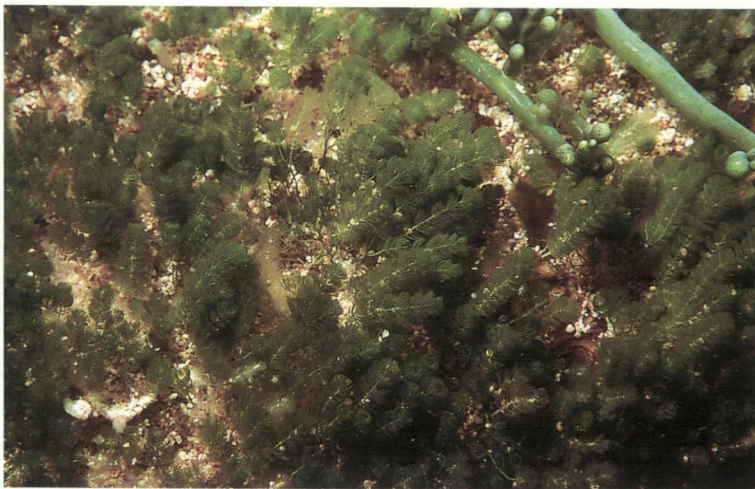
Table 4 Habitat percentage cover at each station during the DA3/99 diving survey.

Benthos type	Stations																										
	36	37	39	40	41	43	44	46	47	49	50	52	53	55	56	57	58	60	61	63	64	65	67	68	69	70	
Abiotic	57.7	57.5	63.0	45.5	98.8	99.3	78.0	74.3	54.5	76.7	64.3	48.8	87.2	82.0	90.7	91.2	72.3	18.5	48.5	55.3	80.2	89.8	87.3	97.5	89.3	26.5	
Macroalgae	0.2	41.3	0.0	0.0	0.2	0.0	0.0	0.0	42.3	0.0	0.0	0.0	0.0	0.0	1.3	0.2	0.0	0.0	50.5	0.0	0.0	0.0	0.0	2.5	0.2	69.0	
Alcyoniid soft coral	0.3	0.0	30.0	50.0	0.0	0.7	0.0	0.2	0.0	0.7	3.8	40.0	1.2	0.0	0.2	4.2	0.0	0.0	0.0	0.0	0.5	1.0	6.8	0.0	0.0	0.0	
Gorgonian soft coral	0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.2	0.0	5.5	0.7	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.2	0.0	0.0	1.3	
Nephtheid soft coral	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	
Branching <i>Acropora</i>	13.5	0.5	1.0	2.2	0.0	0.0	2.3	10.7	0.8	3.7	3.3	3.0	1.7	0.0	0.0	0.0	11.8	2.3	0.0	3.3	8.0	0.5	0.2	0.0	0.0	0.0	
Corymbose <i>Acropora</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	
Digitate <i>Acropora</i>	2.7	0.2	0.0	0.7	0.7	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabulate <i>Acropora</i>	18.3	0.0	0.0	0.2	0.0	0.0	3.2	1.0	0.0	0.0	1.7	1.5	0.7	0.0	0.0	0.0	6.8	2.2	0.0	0.5	2.2	0.0	0.0	0.0	0.0	0.0	
Encrusting non- <i>Acropora</i>	1.7	0.0	5.0	0.0	0.0	1.2	7.2	0.3	0.7	6.3	0.5	0.5	0.0	0.0	1.8	0.0	0.0	0.0	4.0	0.0	0.2	2.5	0.0	10.0	0.0		
Foliaceous non- <i>Acropora</i>	1.2	0.5	0.3	1.0	0.0	0.0	0.3	0.7	0.5	1.0	1.0	0.3	0.5	0.0	0.0	0.0	0.3	72.3	0.3	8.7	1.7	0.8	0.3	0.0	0.3	0.7	
Massive non- <i>Acropora</i>	4.0	0.0	0.2	0.3	0.0	0.0	14.3	5.7	0.2	14.5	19.0	0.3	7.0	0.0	0.0	0.3	6.8	4.7	0.2	26.2	7.0	0.2	2.5	0.0	0.0	1.3	
Other fauna	0.5	0.0	0.0	0.2	0.2	0.0	0.3	0.2	1.3	1.3	0.5	0.0	0.7	17.2	7.2	2.3	1.8	0.0	0.5	2.0	0.5	1.3	0.2	0.0	0.0	1.2	



Caulerpa serrulata, with its distinctive toothed margins, at Rosemary Island.
Photograph: John Huisman.

Udotea argentea, an unusual green alga that anchors itself in sand substrata with a massive holdfast (not visible).
Photograph: John Huisman.

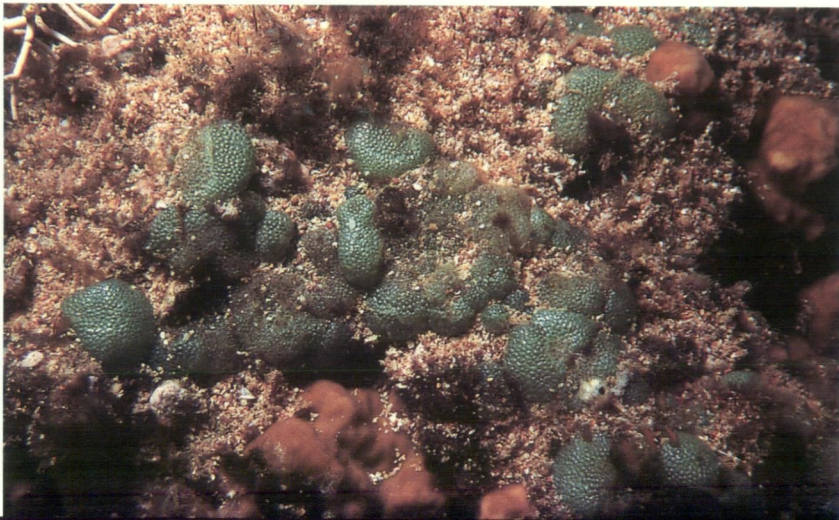


Caulerpa verticillata, forming a turf in the shallow subtidal at Kendrew Island. Photograph: John Huisman.



Caulerpa racemosa, showing the creeping stolons characteristic of this genus. Photograph: John Huisman.

Dictyosphaeria versluysii, a green alga found in tropical seas worldwide. Photograph: John Huisman.



Neomeris van-bosseae, a calcified green alga.
Photograph: John Huisman.





Patenocarpus paraphysiferis, one of several genera of calcified red algae at the Dampier Archipelago. Photograph: John Huisman.



Dictyopteris woodwardia, a common brown alga in northwest Australia. Photograph: John Huisman.



Sargassum decurrens, one of several species of the genus at the Dampier Archipelago. Photograph: John Huisman.



Chondria armata, a red alga, at Kendrew Island. Photograph: John Huisman.

Asparagopsis taxiformis, with its characteristic 'fox-tail' appearance, at Malus Island. Photograph: John Huisman.



Galaxaura rugosa, a calcified red alga found in most tropical seas. Photograph: John Huisman.

