

# Coral Survey at Selected Sites in Arnhem Land

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## SUMMARY

No coral reefs were found; all sites visited (Table 1, Figure 1) had a terrigenous substrate (Table 2). There was a high degree of environment uniformity among the sites. All were essentially composed of irregular to rugged substrates sloping to soft sand at <10m or were completely sand or mud. The water was slightly to moderately turbid. This was in part due to prevailing windy conditions but it would be unlikely that clear would prevail for long periods of time.

Although there was no reef development there were extensive coral communities. These were sometimes very diverse and contained coral colonies that reached maximum sizes for the species. All sites were in pristine condition. There was no evidence of current or past bleaching or other indications of thermal stress except for site 13 (see Table 2). Small numbers of *Acanthaster* were found at several sites but there was no evidence of any outbreak, present or past. *Drupella* were mostly uncommon and there was no conspicuous disease of any form. Some sites had corals and soft corals covered with a flatworm that is common on many coral reefs.

The richest sites for corals were generally partly protected from wave action. These also had high diversities of other invertebrates, especially corallimorpharians and soft corals.

Table 3 is indicative of numbers of species per site although it is noted that 10-20% additional records per site would almost certainly be added with further work. The corals themselves are a subset of Torres Strait species, as would be expected from prevailing currents. Points of specific biogeographic interest in the region are:

- Faviids, especially the genera *Favia*, *Favites*, *Platygyra* and *Goniastrea* are overwhelmingly dominant in most sites. This would be expected in the environments encountered.
- Arnhem Land is the eastern-most limit of a few western Australian species of which *Australomussa rowleyensis* and *Lithophyllon undulatum* are very conspicuous. A few additional species are awaiting detailed study.
- Arnhem Land is the western-most limit of a few eastern Australian species eg. *Favia danae*, *Lobophyllia robusta*, *Montastrea colemani* with some possible additional species awaiting detailed study.
- There has been little immigration from Indonesia (data not shown). The very conspicuous *Euphyllia parancora* has not been previously recorded from Australia, but does occur in both eastern PNG and Indonesia. *Micromussa diminuta* has previously been recorded only from Indonesia.
- The region has several species which are common but which are rare elsewhere in Australia. Of these, *Hydnophora pilosa*, which is common only at Norfolk Island, is

- conspicuous. The conspicuous *Turbinaria bifrons* is common on the west coast but not the east
- A *Symphyllia* was found which is similar to *S. wilsoni*, known only from far south-west Australia (Table 3). This may be a new species.
  - A species closely resembling *Turbinaria irregularis* may also be unique in Australia or an endemic.
  - At least five other species were not satisfactorily identified during the cruise and specimens have been collected for further study.
  - Some genera that are common on both eastern and western Australian coasts were not recorded. Of these, *Caulastrea*, *Cycloseris*, *Ctenactis* and *Anacropora* are surprising as some species are commonly found in non-reef turbid environments.

Further field work would likely add substantially to this study although it is unlikely that the basic conclusions indicated would change.

This report does not attempt a numerical analysis of the records collected although the study has gone a long way to completing detailed records of coral distribution around the entire Australian coastline.

Numerical analysis will also indicate affinities between the corals of Australia and northern neighbours. If undertaken, this analysis would need to be GIS-based. The main interest in this is that such an analysis would reveal (for the first time for any major marine invertebrate group) the capacity of Australia to fulfil a custodial role should diversity in the Indonesian/Philippines global centre of diversity continue to decline.

No specific conservation measures are indicated as fishing practices are non-destructive and population pressures are low.

The relative lack of bleaching observed is of interest as maximum sea surface temperatures would be expected to be higher in this region than those of reefs on both east and west coasts where extensive bleaching has taken place.

## OBJECTIVES

1. To prepare site descriptions including estimates of coral cover and indications of general benthos diversity.
2. To prepare a table of species by site for corals for all sites studied.
3. To provide a description of site conditions, including indication of damage by human or natural events, disease and/or predation.
4. To provide a general interpretation of data collected and to place Arnhem Land corals into context with coral distributions elsewhere in Australia.

## METHODOLOGY

- Visual assessments were made of sites visited noting the characters referred to above. This was done by:
  1. making collections and records using scuba,
  2. underwater still photography,
  3. video photography.
- Only corals requiring taxonomic study were collected. Corals were labelled, cleaned in chlorine bleach, and studied aboard ship. Specimens of continuing interest were sent to AIMS. These specimens were intended indicate what further study is required; they are not adequate for comprehensive species descriptions.
- Corals were identified by Veron in accordance with *Coral ID* (Veron and Stafford-Smith, 2002).
- Where opportunity permitted, a list of species for each site was compiled by scuba diving. This work was restricted as follows:
  1. Coral collecting was not undertaken at some sites in accordance with the wishes of local aboriginal communities.
  2. Scuba diving was not undertaken at some sites due to the proximity of crocodiles.

## DISCUSSION

1. Results of this study can be used as a stand-alone product. Information provided in this report will assist in the following longer-term objectives:
  - ▶ To gather information on the ecological processes that underpin the management of coral reefs.
  - ▶ To describe spatial variability of coral reef biodiversity across NT waters and assess its uniqueness with feed back into reserve and no take area design.
2. It is noted that this study, especially the detailed information provided in the Arnhem Land sites of Table 3, was limited by time. Taxonomic study of collected specimens will assist the completeness of Table 3 although will not alter basic conclusions.
3. GIS analysis using *Coral Geographic* (Veron *et al.*, in prep.) will provide:
  - (a) A diversity contour map for Arnhem Land in the context of all Australian coral regions.
  - (b) measures of similarity between Arnhem Land species and those of other geographic regions globally.
  - (c) preliminary data on the relative abundances and other characteristics of Arnhem Land species.
4. It is recommended that sea surface temperature data for the region should be collected as peak temperatures are likely to be high relative to the Great Barrier Reef and NE Indian Ocean yet no bleaching, past or present, was observed.
5. General descriptions, global distribution maps and illustrations of all species recorded are in Veron (2000). Detailed data about all species are accessible in Veron and Stafford-Smith (2002).
6. This study did not include the Wessel Islands of NE Arnhem Land. These islands may have a higher species diversity than sites visited in this study.

## CONCLUSION

1. Coral communities of northern Arnhem Land do not form reefs but nevertheless are diverse.
2. The coral species have relative abundances substantially different from those previously observed anywhere else in Australia. Some common species of Arnhem Land are rare elsewhere and the species mix is unique.
3. Some species form very large colonies rarely seen elsewhere.
4. Affinities of species are clearly with those of Torres Strait rather than Western Australia or Indonesia.
5. There is no evidence of bleaching, disease, recent *Acanthaster* outbreaks or of human-induced damage. All sites studied are in pristine condition.

## REFERENCES

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## APPENDICES

**Figure 1** Map of sites studied.

**Table 1** Sites studied.

**Table 2** Site descriptions.

**Table 3** Species in sites. Records from this study are imbedded in records for the whole Australian coastline. Except for the Essington Peninsula, records for the whole Australian coastline are in Veron (1993), which gives sources of original data. Updates, including some name changes, are in Veron and Stafford-Smith (2002). Records for the Essington Peninsula have not been previously published.

Figure 1. Map of sites studied.

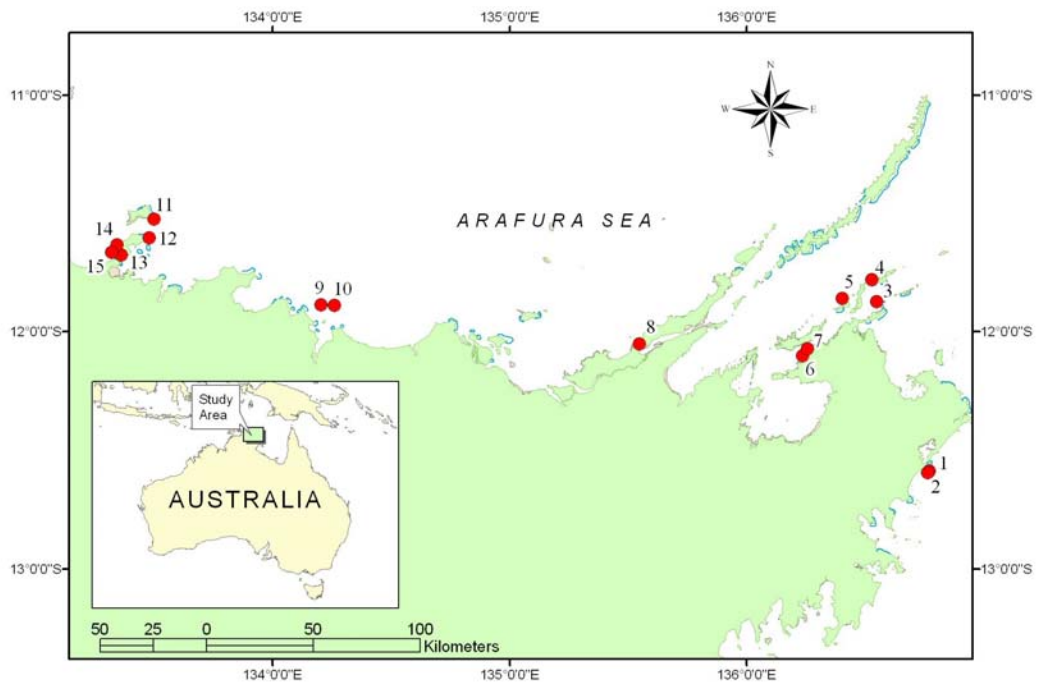


Table I. Sites studied

Site	Place name	Latitude	Longitude
1	Offshore Is off Bawaka, Arnhem Land	12 35.206 S	136 46.327 E
2	Offshore Is off Bawaka, Arnhem Land	12 35.617 S	136 45.889 E
3	Islet 500m NW off Pt. William	11 52.357 S	136 33.020 E
4	Wigram Is	11 46.732 S	136 31.832 E
5	NW Astell Is	11 51.477 S	136 24.320 E
6	Mata Mata	12 06.089 S	136 14.238 E
7	Mata Mata	12 04.332 S	136 15.431 E
8	Galiwinku	12 03.116 S	135 32.988 E
9	Haul Round Is (W side), Maningrida	11 53.136 S	134 12.345 E
10	Haul Round Is (E side), Maningrida	11 53.331 S	134 15.767 E
11	North Goulburn Island (SE Corner)	11 31.385 S	133 30.160 E
12	South Goulburn Island (Near NE Corner)	11 36.148 S	133 28.869 E
13	South Goulburn Island (Near SW Corner)/ Boat-Ramp)	11 40.576 S	133 21.788 E
14	South Goulburn Island (W Corner, off Bottle Rocks)	11 37.908 S	133 20.777 E
15	Sims Island (E side)	11 39.836 S	133 19.351 E

Table 2. Site descriptions.

Site	Records	Substrate	Water	Exposure	Coral cover	Bleaching	COTS	General condition	Comments
1	Photo transect, no collection	Rugged terrigenous substrate sloping gradually from rocky foreshore to 14m. Substrate 100% rock at 2m, 90% sand at 14m	Turbid in shallows, visibility to 10m	exposed to moderate wave action	Coral cover was up to 10% at 3m depth, decreasing irregularly to 0% at 8m	None	Slight damage, three large adults observed	Pristine	High diversity of invertebrates, especially Corallimorpharia
2	Collection and detailed species inventory	Rugged terrigenous substrate sloping gradually from rock outcrop to 9m. Substrate 1000% rock at 2m, 95% sand at 8m.	Turbid in shallows, visibility to 5m	Exposed to moderate wave action	Coral cover was up to 30% at 5m depth, decreasing irregularly to 5% at 14m	None	Slight damage, one large adult observed	Pristine	High diversity of invertebrates
3	Collection and detailed species inventory	Sand and rubble sloping very gradually to sand at 8m	Moderately turbid	Protection from strong wave action	80% at 0.5m, 20-60% at 5m <5% at 7m	None	None	Pristine	High diversity of invertebrates. Many corals and soft corals covered with flatworms.
4	Collection and detailed species inventory	Sand and rubble sloping very gradually to sand at 8m	Turbid	Protected from strong wave action	<1% at 1m, 10-30% at 8m	None	None	Pristine	High diversity of invertebrates. Many corals and soft corals covered with flatworms.
5	Descriptive records from video coverage, no species list obtained	Sand and rubble sloping very gradually to sand at 8m	Turbid	Protected from strong wave action	2-10% at 2m, to <1% at 5m	None	None	Pristine	
6	Descriptive records from video coverage, no species list obtained	Sand and rubble sloping very gradually to sand at 8m	Turbid	Protected from strong wave action	2-10% at 2m, to <1% at 4m	None	None	Pristine	
7	Sight records and video coverage	Fringing edge of reef flat at 0m dropping to mud at 5m	Turbid	Partly protected from strong wave action	5-20%	None	None	Pristine	Low diversity generally. First sighting of <i>E. parancora</i> and <i>Duncanopsammia</i>

Site	Records	Substrate	Water	Exposure	Coral cover	Bleaching	COTS	General condition	Comments
8	Descriptive records from video coverage in three locations within 1km of each other, no species list obtained	Fringing edge of reef flat at 0m dropping to mud at 2m	Moderately to very turbid	Protected from strong wave action	<1-5%	None	None	Pristine	Low to moderate diversity with soft corals the dominant biota
9	Collection and detailed species inventory	Rugged sand and rock, 0-8m	Moderately Clear	Partly protected from strong wave action	<1-5%	None	None	Pristine	High diversity of macro-algae and other benthos
10	Collection and detailed species inventory	Sand and rubble	Moderately clear	Exposed to moderate wave action	<1%	None	None	Pristine	Low diversity, mostly macro-algae
11	Collection and detailed species inventory	Sand and rubble	Moderately clear	Exposed to moderate wave action	<1%	None	None	Pristine	Low diversity, mostly macro-algae
12	Collection and detailed species inventory	Sand and horizontal rock	Moderately clear	Exposed to moderate wave action	<1%	None	None	Pristine	Low diversity, mostly macro-algae
13	Collection and detailed species inventory	Sand and coral rubble sloping gradually from 2-8m	Moderately clear	Partly protected from strong wave action	100% in extensive shallows, decreasing to approx 30% at 8m	See endnote 1	None	Pristine	This is the only site visited where <i>Acropora</i> were dominant over <i>Faviids</i>
14	Collection and detailed species inventory	Rock dropping to sand at 12m	Moderately clear	Partly protected from strong wave action		None	None	Extensive damage due to two separate events as described	Low diversity, mostly bare rock

Site	Records	Substrate	Water	Exposure	Coral cover	Bleaching	COTS	General condition	Comments
15	Collection and detailed species inventory	Rock and sand dropping steeply to >30m	Moderately clear	Well protected		None	None	Pristine	See endnote 2

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<sup>1</sup> There were very extensive areas (>1 hectare) of dead branching *Acropora*, probably *A. formosa*. Part of this was overgrown by live plating *Acropora*, mostly *A. digitifera*, *A. millepora* and *A. subulata*. Approximately 20% of this plating *Acropora* was dead or parts of colonies were dead. The time of death of the branching of the *Acropora* would have been in the late 1990's, and the cause is not determinable although as all corals died, it was probably due to bleaching. The time of death of the plating *Acropora* was probably last summer and was due to bleaching. There were extensive colonies of *A. hyacinthus* >3m diameter.

<sup>2</sup> This site had a very high diversity and also had some of the largest coral colonies ever observed. *Galaxea astreata* forms a continuous zone for >100m: most is a uniform blue-grey colour and may have spread from a single original colony. Many corals and soft corals were covered with flatworms.