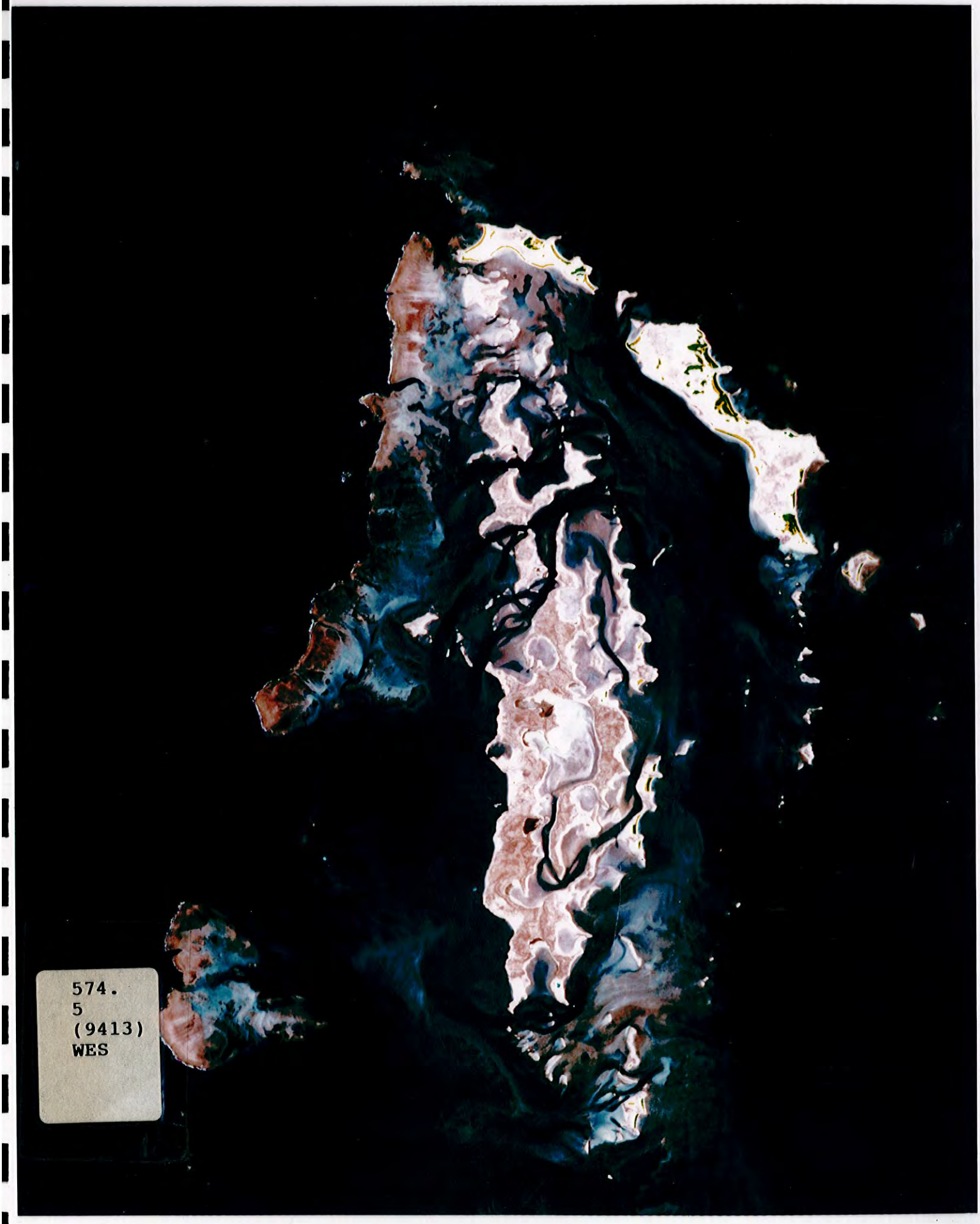
A SURVEY OF THE

MARINE FAUNA AND HABITATS OF THE MONTEBELLO ISLANDS

AUGUST 1993



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SURVEY OF THE MARINE FAUNA AND HABITATS OF THE MONTEBELLO ISLANDS, AUGUST 1993

REPORT TO THE DEPARTMENT OF
CONSERVATION AND LAND MANAGEMENT
BY THE WESTERN AUSTRALIAN MUSEUM

Edited by

P.F. Berry

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CHAPTER 1. SURVEY METHODS, THE PHYSICAL ENVIRONMENT, MARINE HABITATS AND CHARACTERISTICS OF THE FAUNA.

P.F. Berry

INTRODUCTION

The Montebello Islands, named by Nicolas Baudin in 1802 after the Duke of Montebello (Appleton 1992), lie on the continental shelf off the Pilbara coast approximately 120 km WNW of Dampier and 80 km NW of Cape Preston, between latitudes 20 21'S and 22 32'S and longitudes 115 31'E and 115 36'E. The group comprises well over a hundred islands, the majority of which are rocky outcrops, but some are larger such as Hermite Island which has a land area of 939 ha, and Trimouille Island which has an area of 492 ha. Further information on the geographic setting of the Montebellos is summarised by Deegan (1992).

Only sporadic collecting of marine fauna has been undertaken at the Montebellos. Collections were made of molluscs, cephalopods and crustaceans in 1912 by Montegue (described by Iredale 1914, Robson 1914 and Rathburn 1914 respectively), fishes by Hill (1955) , and echinoderms, corals and fishes by members of the WA Museum staff during the 1970s and 1980s.

The survey reported on here is the most intensive conducted so far of marine habitats and fauna of the Montebellos. It was undertaken by the Western Australian Museum (WAM) from 9-27 August 1993 on behalf of the Department of Conservation and Land Management (CALM). Personnel involved and rôles were as follows: G. Allen (fishes), P. Berry (leader, habitat documentation, crustaceans), C. Bryce (molluscs, photography, technical), S. Fritz (CALM observer, habitat documentation), L. Marsh (echinoderms, corals, other cnidarians), M. Osmond (CALM observer, habitat documentation), K. Smith (fishes, technical), S. Slack-Smith (bivalve and cephalopod molluscs) and F. Wells (gastropod molluscs). The work was undertaken from the charter vessel NOR DON, skippered by N. Hallworth.

Objectives of the survey were to:

(1) Identify, describe and map the major marine habitats represented.

(2) Document selected groups of the marine fauna (hard corals and other cnidarians, molluscs, decapod crustaceans, echinoderms and fishes) as an index of biodiversity of the area, and place these in a zoogeographical context.

(3) Determine those areas of high biological diversity and importance to ecosystem functions which are worthy of special protection.

(4) Report on the status of the coral reef systems, with particular reference to coral predators - *Drupella cornus, Drupella rugosa* and *Acanthaster planci.*

(5) Identify habitats and areas/sites of significance which are currently, or likely to be used for recreational and commercial activities.

(6) Assess and discuss the values of the area as a potential conservation reserve based on ecologically derived criteria, and make recommendations for management.

METHODS

Initial characterisation of habitat types and sampling station selection was done using colour aerial photography (DOLA; 850096; runs 1-3; 1:25000; 5/8/85) and Landsat imagery (DOLA; merged SPOT 12/01/92 and TM 27/12/91). Twelve colour prints of the Landsat image, covering the area at a scale of 1:25000 were produced. The aerial photography proved to be the more useful, as ground truthing showed the satellite imagery to be unreliable for distinguishing habitat types. Manipulation of wave bands to try to eliminate spurious habitat signatures

caused by water depth was not successful. The satellite image, captured in digital form was, however, used interactively to produce amended habitat distributions. Using a combination of MICROSTATION and CADSCRIPT software, the final colour map was generated. The resultant "plot file" was reproduced direct from a Hewlett Packard Design Jet 650c ink jet plotter.

Ground truthing of habitats was undertaken by spot dives from the vessel and an inflatable dinghy, and by manta tows.

Specimen sampling stations were selected to give representative coverage of all major habitat types represented. A total of 45 stations was sampled within the immediate precincts of the Montebello group (see accompanying map). In the time available this could not be extended south to the Lowendal group. Although it is considered that all major habitat types were covered, further groundtruthing is needed to refine the distributions of habitats with greater precision.

At each sampling station a specially designed pro-forma was used to record habitat, providing semi-quantitative information suitable for detecting changes through subsequent monitoring. This pro-forma is based on a habitat recording sheet originally produced by Dahl (1978).

At each sampling station, voucher specimens were collected by diving (SCUBA or snorkel), dredging, or in intertidal areas, by walking. In the case of some fishes, identifications were made without collecting. Specimens collected were preserved for subsequent examination at the WAM. This report includes records of specimens from the Montebellos collected on earlier WAM expeditions and the literature. Experience on similar surveys has shown that the sampling effort expended will have documented about 80% of the fauna present. Subsequent sampling will continue to add cryptic, rare and irregularly occurring species.

Localities of sampling stations are summarised in Appendix Table 1. Most positions were obtained using the ship's satellite navigation system, but as the hand-held GPS

system did not function, coordinates of stations away from the vessel were derived using the Landsat image and maps.

Most dredges covered only a short distance (100-200 m) and are recorded as a single fix. However for Station 12, in which approximately 2,000 m was covered, fixes at the start and end are recorded.

The positions of Stations 14A and B are based on fixes taken in Stephenson Channel. In fact, extensive areas of intertidal sand (4C) and rocky shore (4D) habitat in the vicinity were sampled as far as Sherry Lagoon (14E).

THE PHYSICAL ENVIRONMENT

Geography, physiography, climate and oceanography have been summarised by Deegan (1992). These are discussed below in relation to how they affect habitats and fauna.

The water temperature range of 20°-33°C places the Montebellos within Ekman's (1976) tropical faunistic zone which is delineated from the subtropical zone by the 20°C minimum isotherm. In terms of biogeographic provinces determined principally by water temperature, the Montebellos fall within the Dampieran or Northern Australian Tropical Province (Wilson and Allen 1987).

The quantity and quality of suspended particulate matter is an important environmental parameter for marine organisms. The waters of the Montebellos are little influenced by terrigenous sediments from the mainland or the islands themselves because there is insignificant freshwater runoff in the area. Most turbidity is the result of wave action due to the shallowness of the area and the high tidal range. Despite their distance offshore, water turbidity conditions and the fauna of the Montebellos are typical of the mid-shelf and unlike those of the atolls

on the outer shelf edge, such as the Rowley Shoals which are typically oceanic. The semi-diurnal tidal regime with a moderately high range at springs (3.5 m) also contributes to turbidity at the Montebellos.

An important physical environmental factor influencing the marine fauna in shallow water at the Montebellos is the frequency of occurrence of tropical cyclones. Examination of cyclone tracks provided by the Bureau of Meteorology showed that in the 16 years between 1977/78 and 1991/92 a total of 9 cyclones passed within approximately 1° of the islands. Probable recent cyclone damage evident in shallow areas of the lagoons, may have resulted from cyclones "Ian" (Feb/March 1992), "Ilona" (Dec. 1988) and/or "Orson" (April 1989).

In broad morphological terms, the Montebello Islands and associated reefs may be described as being arrowhead-shaped, comprising a central "chain" of islands with unusually irregular or convoluted coastlines lying on a north-south axis. These islands are in close proximity to one other and are separated by narrow channels. The northernmost island in this chain (Northwest Island) forms the apex and from it an almost unbroken barrier reef runs to the south-west and a large elongate island (Trimouille) and series of smaller islands runs to the south-east (see satellite image on cover).

The following major physical environmental units and dominant or conspicuous biotas occur at the Montebellos:

Lagoon. This may be divided into two sections: (i) a shallow western lagoon, between the western barrier reef and the central island chain and (ii) a deeper eastern lagoon between Trimouille Island and the series of islets to the south of it, and the central island chain. Both the western and eastern lagoons are shallowest and most protected in the north and become progressively deeper and more exposed to the south. The lagoons, particularly in the north, are characterised by relatively high turbidity and low wave and current energy, resulting in extensive areas of sand substratum.

Extensive monospecific stands of the brown macroalga *Turbinaria* and large isolated colonies of the coral *Porites cylindrica* characterise the northern lagoon. Sandy substrates support sparse seagrass cover (no dense monospecific stands were encountered) comprised of five species- *Cymodocea angustata, Halophila ovalis, Halophila spinulosa, Halophila ovata, Thalassia hemprickii* and *Syringodium isoetifolium*. Dominant algae on soft substrates are sparse, spreading *Caulerpa* spp. In more exposed areas on rubble and rock, dense stands of *Sargassum* spp occur. Small colonies of hard corals and sponges are scattered throughout the lagoon. The stalked ascidian *Polycarpa clavata* is ubiquitous and conspicuous. The soft and rubble substrates are inhabited by numerous species of bivalve molluscs and are rich in echinoderms.

Channels. These mostly run between the central island chain, connecting the eastern and western lagoons. Stephenson Channel is an exception in that it is a blind channel, approximately 8 km in length, leading into the interior of Hermite Island. The channels are characterised by high turbidity and very high current energy, resulting in coarse sand and rubble substrates with extensive exposures of limestone pavement when scouring occurs.

Scattered hard coral colonies are found on all rocky-sided channels and in some, fringing coral reefs occur.

Intertidal embayments. These are subject mainly to tidal energy and are characterised by fine, soft sandy substrates, generally of low organic content. Some embayments contain simple mangals, consisting of narrow fringes of *Avicenia marina* or *A. marina* in association with *Brugueira exaristata, Ceriops tagal* and/or *Rhizophora stylosa.* Turbidity may be higher where mangals are present. The embayments are important nursery areas in which juvenile fishes are particularly abundant.

Intertidal shorelines. Shorelines are rocky or sandy, depending on their degree of

exposure to wave and/or current energy. Rocky shores predominate at the Montebellos and typically have a double erosion notch. The rock oyster *Saccostra cuccullata*, which is particularly abundant, forms a conspicuous zone (see Figure 1). The ghost crab *Ocypode ceratophthalma* is evident on sandy beaches.

Barrier reef. This is characterised by very high wave energy. The outer reef slope is not steep and, where examined was not dissected by spur and groove formations, but became progressively more broken with depth. The crestal area is indistinct; in some places it has boulder accumulations, but there is no rubble crest. A typical reef flat, largely composed of consolidated coral slabs interspersed with sand, drops off steeply in parts where patch reefs occur. Several large breaks in the reef form deep channels. Tabular *Acropora* spp. reach their highest percentage cover adjacent to and on the margins of some of these channels (see Figure 3 and 4) and isolated patches of 100% cover were recorded. The central region is somewhat deeper than elsewhere and dense *Sargassum* covers hard substratum with small *Acropora* colonies scattered throughout.

Shallow open ocean habitat. Relatively high wave and current energy gives rise to extensive areas of exposed limestone pavement and reef, interspersed with patches of sand veneer overlying the pavement. Turbidity is relatively low compared with the lagoon and channels. The pavement is covered by dense macroalgal growth, particularly of *Sargassum*, with scattered colonies of hard and soft corals, sponges and the ascidian *Polycarpa clavata*. An extensive area of coral bomboras and high relief limestone outcrops with high coral cover occur towards the south-east of the group (see Figure 4).

Based on the physical characteristics of the units described above and the resultant dominant biota present, broad habitat types occurring at the Montebellos have been identified and their distributions are shown on the habitat map that accompanies this report.

Figure 1. Intertidal exposure at low water spring tides showing the double erosion notch and conspicuous oyster zone typical of rocky shores of the Montebellos.

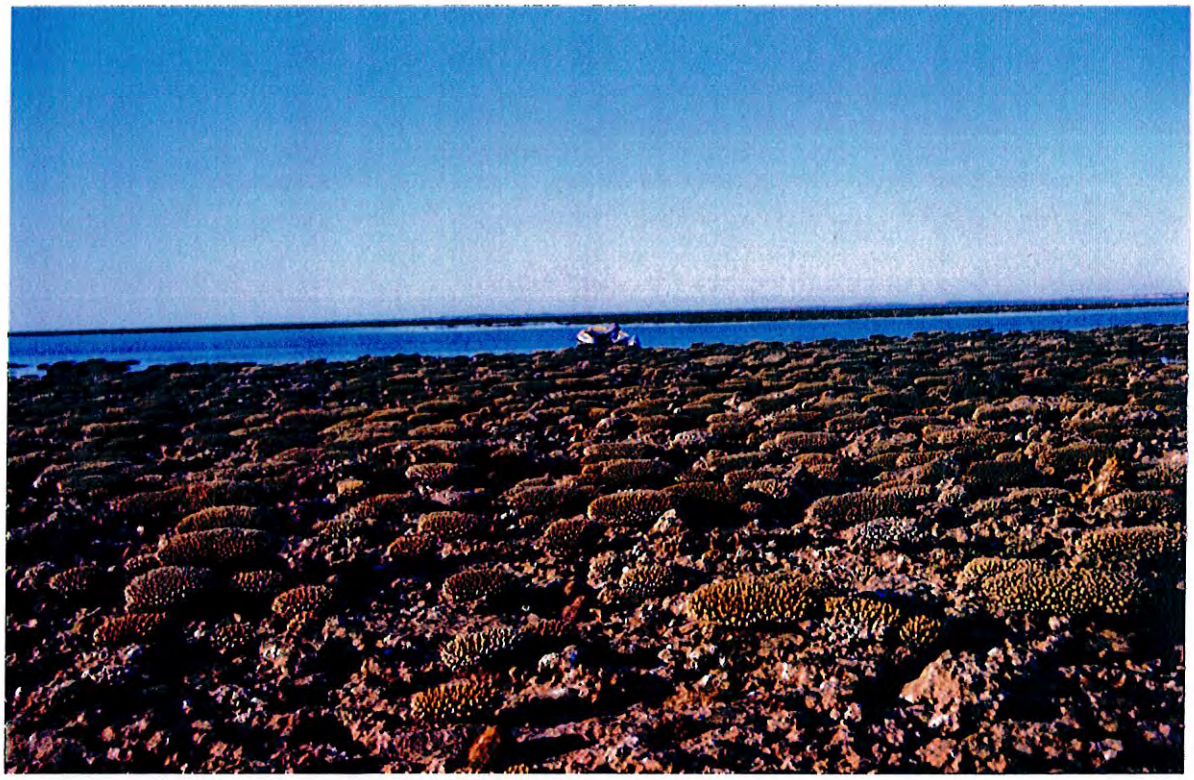

Figure 2. Typical area of high percentage cover of live *Acropora* exposed on the intertidal reef flat of the western barrier reef.

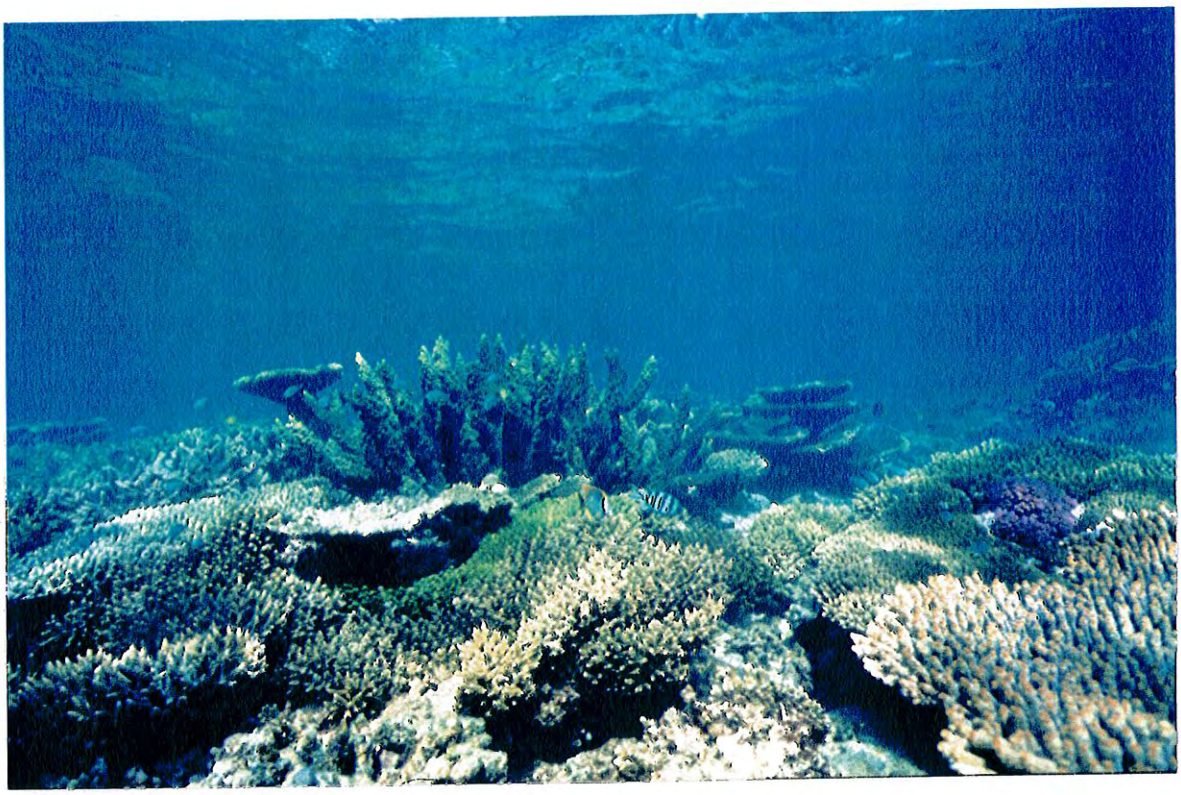

Figure 3. Typical high percentage coral cover, dominated by tabular *Acropora*, in an infratidal situation on the western barrier reef.

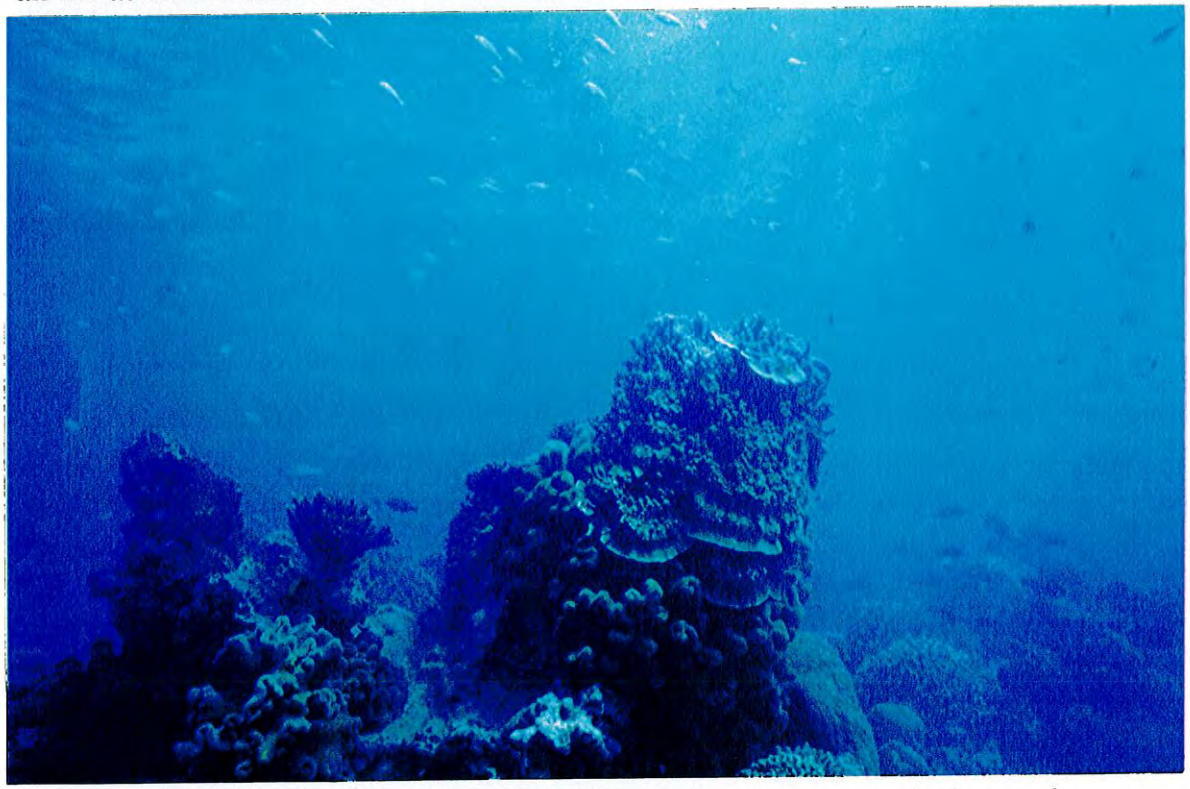

Figure 4. High relief coral reef, typical of extensive areas towards the south-east of the Montebellos.

CHARACTERISTICS OF THE MARINE FAUNA

Detailed accounts of the selected fauna groups studied are contained in Chapters 3-8.
In all groups surveyed relatively high species diversity and in many cases large numbers of individuals were recorded, making the Montebellos an area of particularly high conservation value. Species diversity at the Montebellos and other areas surveyed by the WAM is summarised below.

Taxa	Montebellos	Abrolhos	Ningaloo	Dampier	Rowley/ Scott	Nearshore Kimberley	Ashmore Reef
Fishes	457	290	500	338	550	330	569
Molluscs	595	-	600*	-	261	413	433
Crustaceans	85	-	-	-	-	93	57
Echinoderms	170	172	104	-	132	82	178
Corals	150	184	217	216	233	170	255

Ashmore Reef, because of its proximity to Indonesia which is the centre of distribution of the Indo-west Pacific fauna, and its diversity of habitats, has the richest marine fauna recorded in Western Australia. The numbers of taxa recorded at the Montebellos (over 16 days) compare well with those from Ashmore Reef (with similar levels of collecting effort) and in the case of molluscs is greater. The fauna is also comparable with that of Ningaloo Reef and the Abrolhos, which are based on far greater collecting effort, and that of Rowley Shoals/Scott Reef, with similar collecting effort. In general the fauna of the Montebellos is much more speciose than that of the nearshore Kimberley (recorded during six weeks of survey). It is likely that further collecting will increase the numbers of coral species recorded from the Montebellos to a diversity similar to that of the Dampier Archipelago (see Chapter 3).

Two species of pipefish, *Phoxocampus belcheri* and *Doryrhamphus multiannulatus* were recorded for the first time in Australia. However, it seems unlikely that they are restricted to the Montebellos as they are extremely cryptic species that may have been overlooked elsewhere. Several species of echinoderms are believed to be new records for Australia and some may represent new species.

Besides the fauna groups targeted in this study, the following opportunistic observations were made on other marine animals: Green Turtles were abundant throughout the area, particularly small animals. No other species of turtle was recorded. Sea snakes (probably *Aepysurus laevis*,) were recorded in coral habitat at stations 24,30,31 and 34. No dugongs were recorded and the sparseness of seagrasses makes it seem unlikely that large numbers could be supported. Bottlenose Dolphins were present in small groups. Two Humpback Whales were observed at close quarters; others were sighted in the distance and vocalisation was heard while diving. (The Montebellos are directly in the path of the northward and southward migration of humpback whales [K. and M. Jenner pers. comm.])

CONCLUSIONS

The diversity of habitats within such close proximity make the Montebellos unique in Western Australia. These habitats include a variety of reef types and facies, protected lagoons and embayments, mangals, channels and extensive areas of soft and hard intertidal substrate.

Associated with this high diversity of habitats is an unusually high species diversity which for most faunal groups investigated, is comparable with or exceeds that of other tropical reef systems in Western Australia.

LITERATURE CITED

Appleton, R. and Appleton, B. (1992). *The Cambridge Dictionary of Australian Places*. Cambridge University Press.

Deegan, P.M. (1992). *Monte Bello and Lowendal Islands - Marine Resources Summary Report*. Report prepared for the Department of Conservation and Land Management, Perth: 1-16.

Ekman, S. (1976). *Zoogeography of the sea.* 2nd ed: 1-47. Sidgwick and Jackson, London.

Hill, F.L. (1955). Notes on the Natural History of the Monte Bello Islands. *Proc. Linn. Soc. Lond.* 165 (2): 113-124.

Iredale, T. (1914). Report on Mollusca Collected at the Monte Bello Islands. *Proc. Zool. Soc. Lond.* **11**: 665-675.

Rathburn, M.J. (1914). Stalk-eyed Crustaceans collected at the Monte Bello Islands. *Proc. Zool. Soc. Lond.* **11**: 653-664.

Robson, G.C. (1914). Cephalopoda from the Monte Bello Islands. *Proc. Zool. Soc. Lond.* **11**: 677-680.

Wilson, B.R. and Allen, G.R. (1987). Major Components and Distribution of Marine Fauna. In: *The Fauna of Australia Vol. 1A. General Articles* (*eds* G.R. Dyne and D.W. Walton) Bureau of Flora and Fauna, Canberra.

ACKNOWLEDGEMENTS

This survey of the Montebello Islands was undertaken in part as an Ocean Rescue 2000 Project, funded by the Federal Government through the Western Australian Department of Conservation and Land Management. Funding was also obtained from the Department of Primary Industries and Energy; this was originally provided to facilitate the transfer of control of the islands from the Commonwealth to W.A. in 1992.

Mr G. Oliver (formerly of CALM) carried out some of the early interpretation of the Landsat imagery used as a basis for habitat mapping.

Hadson Energy Limited and West Australian Petroleum Pty Limited provided logistical support that facilitated the work.

Dr I. Le Provost kindly provided a composite aerial photograph of the Montebellos.

The cooperation and assistance of the skipper and crew of the NOR DON, Mr N. Hallworth, Mr G. Jeisman and Ms G. Collett is greatly appreciated.

Appendix Table 1. Sampling station numbers, dates, location, habitats and sampling methods. (See map)

No	Date	Location and habitat	Method
1	10/8	20°27'04", 115°29'15"; isolated patch reef inside barrier reef; 6 m	SCUBA
2	10/8	20°26'41", 115°29'25"; patch reef inside, W barrier reef; 10 m	SCUBA
3	11/8	20°26'32", 115°28'30"; outside W barrier reef; flat algal covered pavement; 5-8 m	SCUBA
4A	11/8	20°23'24", 115°30'01"; channel through W barrier reef; sand bottom, steep sides with corals; 8 m	SCUBA
4B	11/8	20°23'21", 115°30'00"; intertidal reef flat adjacent channel through W barrier reef	Snorkel
5	11/8	20°26'09", 115°30'12"; intertidal sand E of Brooke I.; 0-4 m	Snorkel
6	12/8	20°24'30", 115°30'12"; backreef of W barrier reef; steep slope into lagoon; 8 m	SCUBA
7	12/8	20°23'31":, 115°31'04"; narrow channel NW of Bluebell I.; 9 m	SCUBA
8	13/8	20°24'31", 115°32'33"; NW lagoon; fine silty, grey sand; 3.5 m	Dredge
9	13/8	20°20'52", 115°29'22"; outside NW end of W barrier reef; flat algal covered pavement; 17 m	SCUBA
10	13/8	20°21'16", 115°30'53"; N of Northwest I.; flat algal covered pavement; 4 m	SCUBA
11	14/8	20°25'11", 115°31'46"; channel between Crocus I. and N end of Hermite I.; coarse sand; 4 m	Dredge
12	14/8	20°27'00", 115°33'59"; Gannet I. to entrance of Stephenson Channel; fine grey sand; 4-6 m	Dredge
13	14/8	20°27'26", 115°31'29"; mangal	Walk
14A	14/8	20°29'02", 115°31'46"; intertidal sandbank in Stephenson Passage opposite CALM camp.	Walk
14B	14/8	20°29'53", 115°31'45"; intertidal rocky shore in Stephenson Channel near CALM camp.	Walk
14C	15/8	20°29'10", 115°31'57"; intertidal sand flats between Buttercup and Hermite Is.	Walk

14D	15/8	20°29'16", 115°32'04"; intertidal rocky shore of Hermite I. from CALM camp to Chamberlain Peninsula.	Walk
14E	15/8	20°29'20", 115°31'50"; Sherry Lagoon; intertidal embayment, rocky edge and muddy sand.	Walk
15	15/8	20°28'21", 115°32'27"; Stephenson Channel; coarse sand and shell; 4 m	Dredge
16	15/8	20°29'59", 115°31'50"; Stephenson Channel; coarse sand and rubble; 4 m	Dredge
17	17/8, 24/8	20°28'06", 115°32'42"; Stephenson Channel; fringing reef and sandy bottom of channel; 6 m	Dredge
18	18/8	20°27'04", 115°30'42"; western lagoon, W of Hermite I.; coarse sand and rubble; 6 m	Dredge
19	18/8	20°30'01", 115°27'43"; patch reef on edge of channel through isolated W barrier reef; 8 m	SCUBA
20	18/8	20°30'13", 115°27'07"; intertidal reef flat on isolated W barrier reef.	Walk
21	19/8	20°30'09", 115°29'59"; S of western lagoon, top of sandbank; coarse sand; 3 m	Dredge
22	19/8	20°30'08", 115°29'36"; S of western lagoon; coarse sand, rubble; 5 m	Dredge
23	19/8	20°30'15", 115°26'33"; outside isolated W barrier reef; flat algal covered pavement; 20 m	SCUBA
24	19/8	20°31'35", 115°33'48"; E of Ah Chong I.; high relief coral reef; 15-18 m	SCUBA
25	20/8	20°27'19", 115°28'20"; intertidal flat on W barrier reef.	Walking
26	20/8	20°23'31", 115°29'39"; high intertidal mound on outer reef flat, W barrier reef.	Walking
27	20/8	20°22'32", 115°33'59"; high relief coral reef E of Trimouille I.; 9 m	SCUBA
28A	21/8	20°23'08", 115°32'43"; eastern lagoon, W of Trimouille I.; flat sandy bottom; 3 m	SCUBA
28B	21/8	20°23'09", 115°32'46"; NW tip of Trimouille I.; intertidal with beach rocks and sand.	Walking
29	22/8	20°22'48", 115°32'51"; rocky intertidal isthmus connecting Trimouille I. and Hollyhock I.	Walking

30	22/8	20°29'27", 115°33'53"; coral reef with large bomboras E line of islets S of Flag I.; 11-14 m	SCUBA
31	22/8	20°30'20", 115°33'49"; same as 30; 7-13 m	SCUBA
32A	23/8	20°24'19", 115°33'57"; lagoon W of Main Bay Trimouille I.; Steep sandy slope - possibly of bomb crater; 8-17 m	SCUBA
32B	23/8	20°24'13", 115°34'05"; sandy intertidal and beach of Main Bay, Trimouille I.	Walking
33	23/8	20°24'25", 115°33'37"; lagoon W of Trimouille I.; sand and rubble; 6 m	SCUBA
34	24/8	20°30'27", 115°33'49"; same as 30; 7-13 m	SCUBA
35	24/8	20°31'58", 115°33'54"; E of Ah Chong I.; high relief coral reef drop-off to sand; 4-13 m	SCUBA
36A	24/8	20°28'35", 115°33'03"; lagoon E of Hermite I.; flat with clean, coarse sand; 4 m	SCUBA
36B	24/8	20°28'29", 115°32'43"; sandy intertidal and narrow rock platform below intertidal cliff; 0-2 m	Snorkel
37	25/8	20°28'33", 115°32'15"; embayment with mangal in Stephenson Channel; intertidal rock and sand.	Walking

CHAPTER 2. MANAGEMENT AND CONSERVATION

P.F. Berry

LAND TENURE

Effective from 7 July 1992, the Montebellos Islands were vested in the National Parks and Nature Conservation Authority as two A Class Reserves (infratidal land 42196 and intertidal land 42197) for the purpose of Conservation Park (CALM Act 1984). (The surrounding waters are not included in the vesting). Prior to this they were Vacant Crown Land administered on behalf of the Federal Government by the Department of Defence. A condition of the transfer of vesting to the State Government was that it should establish a marine conservation reserve at the Montebellos. Due to atomic testing carried out during 1952 and 1956, access is restricted to parts of two of the islands (Trimouille and Alpha).

The area is currently subject to various petroleum leases and exploration permits and a pearling lease.

PERTINENT PHYSIOGRAPHIC AND BIOLOGICAL CHARACTERISTICS

The geomorphology of the Montebellos provides a high diversity of habitat types, including protected lagoons, embayments, mangals, channels, rocky and sandy shores and coral reefs. Consequently the biota is diverse, being representative of all these habitat types.

The total shoreline of infratidal land within the Montebellos group is approximately 210 km in length and significantly longer if the margins of intertidal areas, particularly the western barrier reef, are included. An extensive, shallow intertidal zone is therefore contained within a relatively small total area making it more vulnerable to cyclones or oil spillages than the intertidal zone on a straighter coastline such as is typical along much of the Pilbara coast.

The high tidal range and resultant exchange of water within the protected lagoons, embayments and channels provides a physical energy subsidy that contributes towards high biological productivity, resulting in an unusual abundance of some animals, for example predatory reef fishes. Very large populations of cormorants (hundreds) and terns (thousands) are also indicative of high biological productivity.

Water turbidity is typical of the mid-continental shelf. It is lower than on the adjacent coast but conditions are not oceanic as occur off the shelf edge. Oceanic species and those adapted to high turbidity are consequently poorly represented.

The area is prone to tropical cyclones - an average of 1.8 per year passed within approximately 1° of the Montebellos over the last 16 years. The biota, particularly of shallow and intertidal areas is therefore subject to frequent natural perturbation. Communities are consequently likely to be either resilient or transient. An example of the latter is the tabular *Acropora* on the barrier reef flat, the distribution and percentage cover of which appears to be particularly dynamic, probably as a result of cyclones.

The fauna of the Montebellos is dominated by widespread tropical Indo-west Pacific species with a very low representation of west coast species which probably occur as irregular vagrants (e.g. the Western Rock Lobsters). The Montebellos are located in the area where the Leeuwin Current is thought to originate. They may therefore serve as an important recruitment source for tropical species along the west coast.

The distance offshore limits access by people and visitorship is currently not at a high level.

SITES, HABITATS AND SPECIES PARTICULARLY VULNERABLE TO HUMAN ACTIVITIES

Anchorages. The main anchorages used by visiting vessels are in the eastern lagoon in the larger bays along the western shore of Trimouille Island, in the western

lagoon along the western shore of Hermite Island and in Stephenson Passage. These sites are affected by rubbish disposal which has a visual impact on the bottom and adjacent beaches. Accumulation of persistent items is a potential problem in Stephenson Passage because it is a blind passage. Another site is the coral bombora area along the south-east, where charter vessels are likely to cause significant anchor damage if visits become frequent.

Coral Reefs. The coral reef most vulnerable to damage by anchor chains is that mentioned above, because sandy areas suitable for anchor placement are limited. Other reefs most likely to attract divers are patch reefs in the vicinity of stations 1, 2, 6 and 19 inside the western barrier reef and the fringing reef in Stephenson Passage (station 17).

Mangals and Intertidal Embayments . Visitors are attracted to mangals (and those leading off Stephenson Passage are particularly accessible) to collect mud crabs and set gill nets.

Sandy Beaches. Attractive sandy beaches occur along much of the western side of Island. Those likely to be most visited are adjacent to the best anchorages in the larger bays.

Actual or potential artificial factors that may influence the marine environment of the Montebellos are as follows:

Fishing. Amateur fishing is currently conducted mainly by occasional charter vessels, itinerant private vessels, such as yachts, and larger recreational fishing vessels capable of reaching the Montebellos from Onslow or Dampier. Although visitorship is currently not at a particularly high level, some of these vessels have large freezer capacities and the potential to take large catches.

The main commercial fishery in the vicinity is a trap fishery for reef fishes which mainly occurs about 5 nautical miles from the Montebellos in depths of 30-100 m.

Coral reefs and shallow waters are generally avoided by trap fishermen, but the potential exists for fishing within the precincts of the Montebellos. Any of the State's large number of licensed wet-line fishermen could potentially fish the Montebellos. Currently the level of line fishing is thought to be low, but it is subject to fluctuations in participation levels caused by viability of other fisheries and catches elsewhere. There is one licensed shark fisherman operating out of Karratha who could fish the Montebellos (M. Moran and H. Brayford, Fisheries Dept., pers. comm.)

The unusual abundance of large, predatory reef fish at the Montebellos is remarked upon in Chapter 7 (page 83). This abundance probably reflects current low fishing pressure. Increased fishing pressure and removal of predatory fishes may possibly have ecological implications. It is also possible that the Montebellos may be serving as a replenishment area, particularly for lethrinids, to the surrounding commercial trap fishery.

The attractiveness of large fishes to diving tourists needs to be taken into account. In this respect, the Montebellos offers divers the opportunity to see an abundance of large, predatory reef fish not available on the Great Barrier Reef (see page 83).

Aquaculture. There is currently one pearl farm operation at the Montebellos. This survey made no special assessment of any possible impacts it may be having on the marine environment and no adverse impacts were evident.

Shell Collecting. The Montebellos are subject to both commercial shell collecting and casual collecting by visitors from charter vessels. Currently there are 35 license-holders who could potentially collect shells commercially at the Montebellos. Figures for the actual level of collection are not available, but could be extracted from the license returns.

Whale Watching. Humpback Whales pass close to the Montebellos on their annual migrations and whale watching could become a part of charter operations. Operators need to abide by an appropriate code of practices.

Pollution. Disposal of rubbish into the sea is currently a visual problem at popular anchorage sites, notably on the eastern side of Trimouille Island and in Stephenson Passage. The effects on the marine biota are presently unknown. The magnitude of the problem is likely to increase as visitorship increases.

The Montebellos are located in close proximity to existing oil and gas producing fields and may therefore be vulnerable should a major oil spillage occur. Future exploration and possible subsequent production within the precincts of the Montebellos also have the potential to impact on the environment.

Because of the length of coastline and area of intertidal habitat, the Montebellos would be particularly vulnerable to a major oil spill. Enclosed areas such as embayments, many of which contain mangals, and Stephenson Passage would be likely to be worst affected because of entrapment due to the low exchange of water. Intertidal and shallow-water communities are probably adapted to frequent perturbation by cyclones and could be expected to recover quickly in the event of an oil spill. However, recruitment of mangroves and subsequent recovery of mangal communities would be likely to be slow because of the distance of the Montebellos offshore.

RECOMMENDATIONS FOR MANAGEMENT

1. Because of the unique diversity of habitats represented and the associated high faunal species diversity, the Montebellos have outstanding conservation value and a marine conservation reserve for managed multiple use should be created over the waters contained within and immediately surrounding the group. The management plan for this reserve should include implementation of the following recommendations:

2. Information on environmental issues (and possibly at the same time, radiation dangers) should be provided to visitors in the form of static displays and brochures. The latter should be made available to charter operators, dive clubs etc. and if practical, from dispensers located on the shore adjacent to popular

anchorages. ie the west side of Trimouille and Hermite Islands and in Stephenson Passage.

3. Refuse disposal is a problem that is likely to increase. People should be encouraged to take their durable rubbish "home". However, consideration should be given to installing an incinerator that is available for public use for disposal of perishable waste, and a recycling bin for cans and bottles. This could be located at the CALM camp and the information brochure could inform people about it and appropriate refuse disposal procedures. (It is significant that bagged rubbish from visiting yachts was added to that left by the Museum expedition at the CALM camp awaiting transport back to Dampier. People want to do the right thing but need the opportunity and facilities).

4. A more detailed understanding of the operations of the pearl farm should be obtained eg. how they dispose of refuse. There may be opportunities for collaboration between the CALM and the operators who have a continuous presence and a vested interest in maintaining the quality of the environment.

5. Permanent moorings should be installed in collaboration with tour operators at the most popular dive sites to reduce damage by anchor chains.

6. In the event of an oil spill, contingency plans should allow for a floating boom, or other suitable equipment or procedure to be available to prevent oil entering Stephenson Passage, particularly the inner arm where there are four mangals. If this is not practical, one mangal has an entrance channel only about 8m wide which should be easy to occlude. Occlusion should also be considered at Turtle Lagoon, Wild Wave Lagoon and Sherry Lagoon.

   In addition to these enclosed areas, the extensive areas of intertidal habitat, including the entire Western Barrier Reef, are vulnerable to an oil spill. If possible, early action to disperse such a spill before it reaches the Montebellos is recommended.

7. The habitat map produced by this survey should be added to and refined at every opportunity. Through the use of overlays, dynamics of elements such as coral cover on the barrier reef could be monitored over time.

8. On visits to the Montebellos CALM staff should take every opportunity to add to the habitat map (which is interactively accessible on computer) by ground-truthing areas not visited during this survey. The opportunity should also be taken to monitor habitat changes, particularly after perturbations.

9. AIMS or another research institution should be approached with a view to undertaking long term monitoring, particularly of reef fish communities which were identified in this study as containing an unusual abundance of large predatory species. A decline in the average size and abundance of these species associated with an increase in fishing pressure would indicate a need for appropriate action by the management authority.

10. A broad scale survey, similar to the one reported on here, should be undertaken in five years time or after any event that causes major perturbation, to assess whether any gross changes in habitats or faunal diversity and distribution have occurred. In the interim, scientists should be encouraged to visit the Montebellos to increase knowledge of the fauna present.

11. Dr John Huisman, Murdoch University, has recently undertaken fieldwork at the Montebellos to study macroalgae. CALM should seek access to this information.

CHAPTER 3. SCLERACTINIAN CORALS

L.M. Marsh

SUMMARY

The present report lists the first extensive collection of corals from the Montebello Islands but it is likely that many species remain to be found. A total of 141 species of 54 genera are recorded from the present survey and a further 9 species are added from previous records. The coral fauna includes a suite of five genera characteristic of turbid inshore waters but most of the corals are characteristic of moderately clear water conditions. The coral fauna overall is most similar to that of the Dampier Archipelago.

INTRODUCTION

The first published record of a coral from the Montebello Islands is by Totton (1952) who figured a specimen of *Moseleya latistellata* collected by Mr T.H. Haynes, "a gentleman engaged in experimenting upon the artificial cultivation of Pearl Oysters, and in his leisure collected various zoological specimens, which he sent to the British and West Australian Museums". These collections were made some time prior to 1912 when Montague collected at the islands (Montague, 1914). Totton's note is apparently the only published record of a coral from Hayne's collection. Corals are not reported from Montague's expedition. Veron and Marsh (1988) recorded 70 species of 29 genera of hermatypic (reef-building) corals from the Montebellos, mainly from specimens collected by Marsh during a brief visit to the islands in 1979.

Comparative records from Barrow Island (Table 1) are based on a collection, made by Dr L. Hammond in 1974, which probably does not fully represent the coral fauna of the island. There are no records of corals from the Lowendal Islands.

In contrast the coral fauna of the Dampier Archipelago (Table 1) is well known

from collections made by Marsh, Simpson and Veron over many years (Simpson, 1988, Veron and Marsh, 1988).

A total of 141 species in 54 genera of hermatypic corals is recorded from the present survey of the Montebellos and a further nine from previous records, giving a total of 150 species identified. Several species of *Montipora, Acropora, Favia* and *Favites* remain unidentified and the coral fauna is probably still far from completely known, perhaps another 20-30% remains to be discovered. Seven species of ahermatypic (non zooxanthellate) corals were also collected.

The present collections were made by SCUBA diving, dredging, snorkelling and low tide collecting at 45 sites around the Montebello Islands and in the lagoons. Where species could be readily identified underwater they were recorded but not collected and appear in the species list as visual records (V). The nomenclature follows Veron (1986) and Hoeksema (1989).

DISCUSSION

A comparison of the faunal richness of hermatypic corals at various coral reefs off Western Australia is shown in Table 1.

Locality	Genera	Species
Montebello Islands	54	150
Ashmore Reef	56	255
Scott/Rowley Reefs	56	233
Barrow Island	17	32
Dampier Archipelago	57	216
Ningaloo Reefs	54	217
Abrolhos Islands	42	184

It is probable that many more species will be found at the Montebellos when the reefs are more completely surveyed as many uncommon species may not have been

encountered. The species richness of *Acropora* and *Montipora* is likely to be under-recorded because of their great diversity, polymorphesin and taxonomic difficulty.

A suite of species characteristic of upper reef fronts exposed to strong wave action (*Pocillopora eydouxi, Acropora palifera* and *Pavona minuta*) should be found at the Montebellos but this habitat was not able to be sampled and only *P. eydouxi* was found.

The highest diversity of corals was found in back reef areas where huge *Porites* colonies have a rich coral fauna around them, and on the chain of reefs to the south-east of Hermite Island (stns 24, 30, 31, 34 and 35). Tabular and corymbose *Acropora* species dominated the reef flats at stations 46 and 20 which had *c.* 50% live coral cover. The reef top at stn 1 consisted of coarse staghorn *Acropora* rubble being recolonised by small corymbose *Acropora* colonies (*c.* 30% live coral cover) while the back reef slope supported a diverse coral fauna. Complete coral cover was only seen at a few sites e.g. on reef slopes near stn 6, where tabular *Acropora* spp. gave 100% cover.

The coral fauna of the Montebellos is most clearly allied to that of the Dampier Archipelago where a shared suite of turbid water corals is characteristic of inshore waters. These belong to the genera *Caulastrea, Moseleya, Trachyphyllia, Catalaphyllia* and *Duncanopsammia* while *Euphyllia* and *Turbinaria* spp., although not confined to turbid water, are more abundant in such conditions.

MANAGEMENT AND CONSERVATION

The coral reefs of the Montebello Islands, like those of the Dampier Archipelago are subject to denudation by cyclones and therefore may be seen at different stages at different times. In August 1993 they appeared to be in a fairly advanced recovery stage with some very large tabular *Acropora* plates in back, reef areas. As noted above, at stn 1 the reef crest appeared to be in an earlier recovery phase with small *Acropora* colonies. Fast growing *Acropora* species can recover from

severe damage in a few years while slow growing massive species may take 30 years to recover from major damage.

Anecdotal evidence suggests that the western reef was heavily predated by the crown-of-thorns starfish, (*Acanthaster planci*) probably in the early 1970s.

This species is discussed in Chapter 6, Echinoderms.

Human impact by divers and snorkellers on the coral reefs is likely to be of minor significance compared with the damage from cyclones. However the assemblage of turbid water corals found in the lagoons would be very vulnerable to trawling.

LITERATURE CITED

Hoeksema, B.W. (1989). Taxonomy, phylogeny and biogeography of mushroom corals (Scleractinia: Fungiidae). *Zool. Verhandl. Leiden* **254**: 295 pp.

Montague, P.D. (1914). A report on the fauna of the Montebello Islands. *Proc. Zool. Soc. Lond.* **1914**: 625-652.

Simpson, C.J. (1988). Ecology of Scleractinian corals in the Dampier Archipelago, Western Australia. *Env. Protection Authority Tech. Ser.* **23**: 238 pp.

Totton, A.K. (1952). Notes on some little known corals from North West and South Australia. *Ann. Mag. nat. Hist.* **(12)5:** 975-979.

Veron, J.E.N. (1986). *Corals of Australia and the Indo-Pacific.* Angus and Robertson, N.S.W.

Veron, J.E.N. and Marsh, L.M. (1988). Hermatypic corals of Western Australia, records and annotated species list. *Records of the W.A. Museum*, Suppl. No. **29**: 1-136.

List of corals collected at the Montebello Islands

Taxa	Station Number*
Order SCLERACTINIA	
POCILLOPORIDAE	
Pocillopora verrucosa Ellis and Solander, 1786	4bV, 20, 25V
Pocillopora meandrina Dana, 1846	35
Pocillopora eydouxi Edwards and Haime, 1860	1V,3,4bV,27,35V
Pocillopora damicornis Linnaeus, 1758	1V,2V,4bV,5V,6V,7V, 17V,20V,24,25V,27V, 29V,30V,35V
Seriatopora hystrix Dana, 1846	19V,20V,24V,27V
Seriatopora caliendrum Ehrenberg, 1834	1V,30V,33,35V
Stylophora pistillata Esper, 1797	1V,2,6V,20V,23,30V, 35V
ACROPORIDAE	
Acropora samoensis (Brook, 1891)	4b,29
Acropora digitifera (Dana, 1846)	4b,20
Acropora robusta (Dana, 1846)	4b,19V,20V,30V,35V
Acropora nobilis (Dana, 1846)	6
Acropora formosa (Dana, 1846)	M
Acropora glauca (Brook, 1893)	2,6
Acropora abrolhosensis Veron, 1985	17
Acropora aspera (Dana, 1846)	1,20
Acropora paniculata Verrill, 1902	1,30,35
Acropora hyacinthus (Dana, 1846)	3,4b,6,17V,20V,23
Acropora latistella (Brook, 1892)	2,6,17
Acropora subulata (Dana, 1846)	24
Acropora nana (Studer, 1878)	6
Acropora nasuta (Dana, 1846)	1,17,20
Acropora valida (Dana, 1846)	6
Acropora solitaryensis Veron and Wallace, 1984	1,2
Acropora verweyi Veron and Wallace, 1984	6,17,19,20
Acropora millepora (Ehrenberg, 1834)	1,6
Acropora tenuis (Dana, 1846)	4b,6
Acropora cytherea (Dana, 1846)	1
Acropora microclados (Ehrenberg, 1834)	1,17
Acropora grandis (Brook, 1892)	1,17,30
Acropora divaricata (Dana, 1846)	9
Acropora florida (Dana, 1846)	1,2V,5,6V,7,17,19, 27,29,30V
Acropora dendrum (Bassett-Smith, 1890)	3
Acropora cf. *kirstyae* Veron and Wallace, 1984	2,27,30

*** V = Visual**

Acropora spp.	1,4b,6,7,9,16,20,27
Astreopora myriophthalma (Lamarck, 1816)	2V,6V,7,17V,30V,35
Astreopora listeri Bernard, 1896	27
Astreopora ocellata Bernard, 1896	M
Montipora turtlensis Veron and Wallace, 1984	M
Montipora angulata (Lamarck, 1816)	4b,6,7,20
Montipora hispida (Dana, 1846)	2,3
Montipora incrassata (Dana, 1846)	M
Montipora turgescens Bernard, 1897	2,20
Montipora spumosa (Lamarck, 1816)	17
Montipora undata Bernard, 1897	M
Montipora danae (Edwards and Haime, 1851)	1V,6,17V,29
Montipora venosa (Ehrenberg, 1834)	4b,6
Montipora informis Bernard, 1897	2,17,19
Montipora aequituberculata Bernard, 1897	6
Montipora stellata Bernard, 1897	M
Montipora crassituberculata Bernard, 1897	6,19,20
Montipora caliculata (Dana, 1846)	29
Montipora spongodes Bernard, 1897	23
Montipora nodosa (Dana, 1846)	M
Montipora spp.	
1V,3V,4bV,6V,7V,17V	
	19V,20V,25V,30V, 35V
AGARICIIDAE	
Pavona decussata(Dana, 1846)	1,2,6V,17,19V,30V, 35V
Pavona explanulata (Lamarck, 1816)	2,19,35
Pavona varians Verrill, 1864	6
Pavona venosa (Ehrenberg, 1834)	6,17
Leptoseris foliosa Dineson, 1980	35
Gardineroseris planulata (Dana, 1846)	1,2V,6V,27
Pachyseris rugosa (Lamarck, 1801)	2V,4aV,6V,17V,19V, 35V
Pachyseris speciosa (Dana, 1846)	1,2V,19V,30V,35V
SIDERASTREIDAE	
Psammocora superficialis Gardiner, 1898	32b
Psammocora contigua (Esper, 1797)	2,6V,19,20V
Psammocora digitata Edwards and Haime, 1851	6
FUNGIIDAE	
Cycloseris cyclolites (Lamarck, 1801)	8,12,33
Fungia fungites (Linnaeus, 1758)	1V,2V,6,17V,20
Ctenactis echinata (Pallas, 1766)	1,6V,17V
Herpolitha limax (Houttuyn, 1772)	1V,6,17V,19V,24V

Polyphyllia talpina (Lamarck, 1801)	4a,6V,19,30V,35V
Podabacia crustacea (Pallas, 1766)	6,19,24,30V
Lithophyllon undulatum (Rehberg, 1892)	17
PORITIDAE	
Porites lobata Dana, 1846	16,17V,25V,27V
Porites lutea Edwards and Haime, 1860	1V,2V,4b,6,20,24V, 27,29,30V,31V,35V
Porites cylindrica Dana, 1846	2V,6,17,29V,30V
Porites nigrescens Dana, 1848	6,7,19,20V,30V,35
Goniopora djiboutiensis Vaughan, 1907	2
Goniopora columna Dana, 1846	M,2V
Goniopora tenuidens Quelch, 1886	17
Goniopora palmensis Veron and Pichon, 1982	2
Goniopora stutchburyi Wells, 1955	11,16
Alveopora fenestrata (Lamarck, 1816)	6
Alveopora verrilliana Dana, 1872	20
FAVIIDAE	
Barabattoia amicorum (Edwards & Haime, 1850)	24
Caulastrea tumida Matthai, 1928	19
Favia stelligera (Dana, 1846)	M,1V,6V
Favia favus (Forskål, 1775)	M,1V,2V,5V,6V
Favia pallida (Dana, 1846)	2V,4bV,6,20V,29V, 30V,35V
Favia matthaii Vaughan, 1918	7,19
Favia rotumana (Gardiner, 1899)	5,17
Favia speciosa (Dana, 1846)	27
Favia sp. 1	6
Favia sp. 2	27
Favites halicora (Ehrenberg, 1834)	4bV,29V
Favites flexuosa (Dana, 1846)	33
Favites pentagona (Esper, 1794)	1V,2,6V,27,35
Favites complanata (Ehrenberg, 1834)	25
Favites abdita (Ellis and Solander, 1786)	1V,2V,4bV,6V,7,17V, 19,20V,27V,29,30V,33
Favites sp. 1	27
Favites sp. 2	27
Goniastrea retiformis (Lamarck, 1816)	1V,2V,4bV,6V,17V, 20V,25V,29V
Goniastrea edwardsi Chevalier, 1971	2,6V,35V
Goniastrea pectinata (Ehrenberg, 1834)	1,2V,6V,17V,27, 30V,35V
Goniastrea aspera Verrill, 1865	M,4b,20V,25V
Goniastrea favulus (Dana, 1846)	17
Goniastrea australensis (Edwards & Haime, 1857)	4bV
Platygyra daedalea (Ellis and Solander, 1786)	7

Platygyra lamellina (Ehrenberg, 1834)	M
Platygyra sinensis (Edward and Haime, 1849)	4b,7,14d,29
Platygyra pini Chevalier, 1975	1
Platygyra verweyi Wijsman-Best, 1976	29
Leptoria phrygia (Ellis and Solander, 1786)	M,1V,2V,6V,17V,20V, 25V,30V,35V
Oulophyllia crispa (Lamarck, 1816)	2V,24,35
Montastrea curta (Dana, 1846)	M,1V,2V,4bV,6V, 7V,17V,20V,35V
Montastrea magnistellata Chevalier, 1971	M
Montastrea valenciennesi (Edwards and Haime, 1848)	1V,2V,6,17,20V,35V
Plesiastrea versipora (Lamarck, 1816)	14c,14d
Leptastrea purpurea (Dana, 1846)	1,35V
Cyphastrea serailia (Forskål, 1775)	1V,2,4bV,6V,16,17V, 20V,25V,29V,30V
Cyphastrea microphthalma (Lamarck, 1816)	1V,2V,4bV,6V,7,17V, 20V,25V,35V
Echinopora lamellosa (Esper, 1795)	1,2V,6V,17,19, 30V,31V,35V
Moseleya latistellata Quelch, 1884	7,17,19,33V
TRACHYPHYLLIIDAE	
Trachyphyllia geoffroyi Audouin, 1826	16,33
OCULINIDAE	
Galaxea astreata (Lamarck, 1816)	1V,2V,6V,17V,19V, 20V,30V,31
Galaxea fascicularis (Linnaeus, 1767)	1V,2V,6V,17V,19, 20V,27V,29V,35
MERULINIDAE	
Hydnophora exesa (Pallas, 1766)	4bV,6,7V,17V,24, 25V,29,30V
Hydnophora microconos (Lamarck, 1816)	4bV,20,27V,35V
Hydnophora rigida (Dana, 1846)	4bV,6,31
Merulina ampliata (Ellis and Solander, 1786)	1,2V,6V,7V,17V,25V, 30V,35V
Scapophyllia cylindrica (Edwards and Haime, 1848)	27
MUSSIDAE	
Acanthastrea echinata (Dana, 1846)	25
Acanthastrea hillae Wells, 1955	24
Lobophyllia hemprichii (Ehrenberg, 1834)	2V,6V,7,14d,19,24, 25V,30V,33V,35V
Lobophyllia corymbosa (Forskål, 1775)	6,24
Lobophyllia hataii Yabe, Sugiyama and Eguchi, 1936	19,27,33
Symphyllia radians Edwards and Haime, 1849	1V,2V,6V,35V

Scolymia cf. *vitiensis* Brüggemann, 1877	32a
PECTINIIDAE	
Echinophyllia aspera (Ellis and Solander, 1786)	6,14e,17V,24,30V,35V
Echinophyllia echinata (Saville-Kent, 1871)	23,24
Oxypora lacera (Verrill, 1864)	1,2,6,19,24,31
Mycedium elephantotus (Pallas, 1766)	1,2V,19,24,30V,35V
Pectinia paeonia (Dana, 1846)	2V,6V,17,19V,24V
cf. *Pectinia* sp.	17
CARYOPHYLLIIDAE	
Catalaphyllia jardinei (Saville-Kent, 1893)	32a
Euphyllia ancora Veron and Pichon, 1980	19V,24,31V
Euphyllia glabrescens (Chamisso and Eysenhardt, 1821)	13V
Plerogyra sinuosa (Dana, 1846)	13V,30
DENDROPHYLLIIDAE	
Duncanopsammia axifuga (Edwards and Haime, 1848)	32a
Heteropsammia cochlea (Spengler, 1781)	5,8,12,15,18,22,36a
Turbinaria mesenterina (Lamarck, 1816)	2,5,6V,19,33,35V
Turbinaria stellulata (Lamarck, 1816)	2V,6V,24,30,35V
Turbinaria peltata (Esper, 1794)	7,24,35V
Turbinaria frondens (Dana, 1846)	6,17,19
Turbinaria reniformis Bernard, 1896	2V,6V,23,24,30V,33V
Turbinaria bifrons Brüggemann, 1877	5,14d,25
Ahermatypic corals	
RHIZANGIIDAE	
Culicia sp.	4b,12
CARYOPHYLLIIDAE	
Heterocyathus aequicostatus Edwards and Haime, 1848	28a
DENDROPHYLLIIDAE	
Dendrophyllia sp.	1
Tubastrea aurea (Quoy and Gaimard, 1833)	4b,25
Tubastrea diaphana Dana, 1846	1,4b,20,25
Tubastrea micrantha Ehrenberg, 1834	4,24,27
Psammoseris hemispherica (Gray, 1850)	28a

CHAPTER 4. CNIDARIA, OTHER THAN SCLERACTINIAN CORALS

L.M. Marsh

SUMMARY

The Montebellos Islands have a rich and varied cnidarian fauna, apart from corals, including reef-dwelling Alcyoniidae and Nephtheidae and sand-dwelling sea-pens of three families, zoanthids and anemones. The fauna would repay further study by specialists.

Because of the preliminary nature of the identifications no zoogeographical conclusions can be drawn.

INTRODUCTION AND DISCUSSION

Cnidarians, other than corals, particularly the larger alcyonaceans and hydroids were not collected as comprehensively at the Montebellos as the hard corals and many of the present identifications are of a preliminary nature, needing specialist taxonomic expertise, thus no zoogeographical conclusions can be drawn. There is a rich sand dwelling fauna of pennatulids, anemones and zoanthids, not usually found in coral reef areas while Alcyonaceans were common on most reefs, and gorgonians on the reef slopes.

The Blue Coral, *Heliopora coerulea* is evidently rare at the Montebellos as only one dead fragment was found; this species is moderately common on the Ningaloo Reefs. Organ-pipe Coral, *Tubipora musica*, known from the offshore atolls and the Kimberley coast was not seen at the Montebellos, nor were any Corallimorpharians found, these are common at the Abrolhos islands.

The giant anemone, *Heteractis magnifica* were seen once, this species has rarely been found in W.A., off the Ningaloo Reefs, the Rowley Shoals and Ashmore Reef (G. Allen, pers. comm.).

A tentative list follows.

List of cnidarians other than corals collected at the Montebello Islands

Taxa	Station Number**
Cl. **HYDROZOA**	
Or. **HYDROIDA**	
Lytocarpus sp.	29,30V
Aglaophenia cupressina Lamouroux, 1816	29
Solanderia sp.	North West I. (dead)

*** V = Visual**

G. and spp. indet.	29, 36a
Or. **MILLEPORINA**	
Millepora platyphylla Hemprich and Ehrenberg, 1834	1V,6V,19,20V,27V, 29V,30V,31V,35V
Millepora sp.	2V,19,24V
Cl. **SCYPHOZOA**	
Or. **RHIZOSTOMEAE**	
Cassiopeia sp.	7
Cl. **ANTHOZOA**	
S.cl. **OCTOCORALLIA**	
Or. **HELIOPORACEA**	
HELIOPORIDAE	
Heliopora coerulea (Pallas, 1766)	27 (dead)
Or. **ALCYONACEA**	
sub. or. **ALCYONIINA**	
ALCYONIIDAE	
Lobophytum spp.	6,10,14dV,30V,35V
Sarcophyton spp	4b,6,9,10,11,30V, 32a,35V
Sinularia sp.	6
NEPHTHEIDAE	
Litophyton sp.	33
G. and spp. indet.	4b,9,27,28a,30,35V
XENIIDAE	
G. and spp. indet.	4b
sub. or. **SCLERAXONIA**	
MELITHAEIDAE	
Melithaea sp.	1V,9,27
Mopsella sp.	29V
Sub. or. **HOLAXONIA**	
PLEXAURIDAE	
G. and sp. indet.	27
GORGONIIDAE	
G. and sp. indet.	33
ELLISELLIDAE	
Junceella sp.	27,33V

CHRYSOGORGIIDAE	
G. and sp. indet.	32a
Or. **PENNATULACEA**	
VERETILLIDAE	
G. and sp. indet.	21,28a
VIRGULARIIDAE	
G. and spp. indet.	12,14a,28a,15,21,36a
PTEROEIDIDAE	
G. and sp. indet.	12
S.cl. **ZOOANTHARIA**	
Or. **ACTINIARIA**	
STICHODACTYLIDAE	
Heteractis magnifica (Quoy and Gaimard, 1833)	30V
cf. *Heteractis malu* (Haddon and Shackleton, 1893)	14cV,32a,32bV
Stichodactyla cf *haddoni* (Saville-Kent, 1893)	32b
Anemones, family G. and spp. indet.	11,12,14d,18,22, 28a,32b
Or. **ZOANTHIDEA**	
ZOANTHIDAE	
Palythoa sp. 1.	4b,7
Palythoa sp. 2.	29
Palythoa sp. 3.	4b
Palythoa sp. 4.	29
Palythoa sp. 5.	3,27
Zoanthus sp. 1	4b,20,29
Zoanthus sp. 2	32a
Zoanthus sp. 3	11
Sphenopus sp.	12,28a,33
Or. **CERIANTHARIA**	
cf. *Cerianthus* sp.	14cV,32b

CHAPTER 5. MOLLUSCS

F. E. Wells, S. M. Slack-Smith and C. W. Bryce

SUMMARY

Six hundred thirty-three species of molluscs are recorded from the Montebello Islands, north-western Australia. This is the highest diversity of molluscs recorded on any of the surveys of tropical reef systems conducted by the Western Australian Museum. Of those species whose distributions are known, the great majority are widespread Indo-West Pacific species. A single warm-temperate Australian species, *Thais orbita* was collected. The molluscan assemblage at the Montebellos is characteristic of the continental coastline, not the offshore atolls. *Drupella cornus*, a coralliverous species known to cause considerable damage to corals along the Ningaloo Reef Tract in Western Australia, is present at the Montebellos, but no damage to coral populations was found.

INTRODUCTION

Over the last 20 years the Western Australian Museum has conducted a number of surveys of the marine fauna inhabiting coral reefs on the north coast of the state. These include reefs along the inshore coastline such as the Dampier Archipelago, North West Cape and the Houtman Abrolhos, and offshore atolls such as the Rowley Shoals, Scott and Seringapatam Reefs and Ashmore Reef. The molluscan component of the August 1993 survey of the Montebello Islands is reported here.

METHODS

In order to obtain as many species of molluscs as possible of >5 mm in shell length, collecting was undertaken from 8 to 26 August 1993 in a variety of ways, including extensive SCUBA diving and reef walks at low tide, and less extensive dredging and sorting of drift algae. All of the major marine habitats of the

Montebellos were collected: the various types of coral reef, intertidal rocky and sandy shores, and mangroves. The centre portions of the archipelago are characterized by an extensive system of protected channels between the islands. Collecting was done both in the channels and the exposed areas outside of the islands.

In addition, the senior author collected molluscs during a short visit to the Montebellos from 19 to 21 August 1986. Species collected during that trip are included on the present list as station numbers preceded by a W. The stations collected were: W1. West side Trimouille I.; W2. East side Trimouille I.; W3. Tide Pole Bay, Trimouille I.; W4. Northwest corner, Trimouille I.; W5. Northwest I.; W6. Stephenson's Passage; W7. Bay on southern end of Hermite I.; W8. Mangroves near southern end of Hermite I.; W9. Northern Hermite I.

DISCUSSION

The 12,000 km coastline of Western Australia can be divided into three components. The tropical north coast, which extends northeast from North West Cape, is part of the vast Indo-West Pacific province. The south coast, east of Cape Leeuwin is continuous with the remainder of the southern Australian warm temperate province. The west coast, between Cape Leeuwin and North West Cape is an area of overlap between the south coast warm temperate and north coast tropical faunas (Wilson and Gillett, 1971; Wells, 1980; Wilson and Allen, 1987). Being on the north coast, the Montebellos have an essentially tropical molluscan assemblage, with the great majority of those species whose distributions are known falling into this category. One surprise during the survey was the collection of a recently dead specimen of the southern Australian *Thais orbita*, found outside its previously known range of as far north as North West Cape. This was the only southern temperate species of mollusc collected during the survey. Many of the ranges of species are poorly known. Wells (1980) based his analysis of molluscan distribution patterns in Western Australia on the 20 families of gastropods for which there are the best data. In the Montebellos 217 species of these families

were identified at least tentatively to species. Ten of these (4.6%) are known only from Western Australia.

The 633 species collected during the survey demonstrated a far higher molluscan species diversity than was found on any of the previous surveys (Table 1). There are several possible reasons for the increased diversity. The Montebellos expedition was longer than some of the previous surveys; the additional time clearly allowed some additional species to be collected. However, the major reasons appear to be biological. The Montebello Islands and their associated reefs shelter an expanse of relatively shallow waters with a mixture of hard and soft substrates and with generally good water circulation because of the tidal range and the physiography of the bottom. The extent of these sheltered waters is unusual along the Western Australian coast and unique in the Pilbara region.

As a result, in the waters of the Montebellos there is a large concentration of habitat types otherwise uncommon in the area. This range of habitats seems to be associated with an unusually high diversity in the Montebellos of some groups of molluscs. The large expanse of semi-sheltered sandy lagoon supports a high diversity of filter-feeding bivalves living infaunally in soft substrates. Some of the species have much higher population densities than are found in other parts of the Pilbara. Included among these are species of the families Spondylidae, Ostreidae, Gryphaeidae and Chamidae which may be so dense as to actually cover some of the semi-sheltered reefs to which they are cemented. Sand-burrowing scaphopods of the genus *Laevidentalium* and pyramidellid gastropods are also unusually abundant.

In comparison to the abundance of some bivalve groups is the relative sparsity of other species which are common in various parts of the Pilbara. Among these are species of wing shells of the genus *Pteria* (family Pteriidae) which live byssally-attached, mainly to gorgonians.

However the absence of some species is due, as would be expected, to the absence or rarity of some types of habitats, such as those associated with run-off of freshwater bearing terrigenous sediments. Mangals are simple and small, without much species diversity. As a consequence, the molluscan is depauperate. For example, only one record of an ark shell of the genus *Anadara* (family Arcidae) was made, although some fossilised shells were found on dry salt pans. This genus is well represented in Pilbara mainland intertidal and shallow sublittoral sand and mud habitats by generally large populations of a few species. On the other hand both species of *Terebralia* which are associated with Pilbara mangroves were found; *Telescopium*, which occurs in a similar habitat, was not recorded in the Montebellos. The oyster *Hyotissa numisma* is abundant under intertidal rocks in the Dampier Archipelago but only one specimen was obtained during this survey.

Diversity of molluscs in the Montebellos varies considerably between the various classes. Gastropods typically comprise about 80% of the species in the phylum, and 401 species were recorded in the Montebellos, 63.3% of the total. This was a smaller proportion than found on some of the previous expeditions. Bivalves were more diverse than usual, with 223 species (35.2%). Polyplacophorans (4 species), cephalopods (3) and scaphopods (2) were only minor elements of molluscan diversity.

During the last decade population explosions of the neogastropod *Drupella cornus* have occurred along the Ningaloo Reef Tract on the west side of North West Cape, causing considerable damage to the corals (summarized in Turner, 1992). A survey of population densities of the species along the Pilbara coast was undertaken by Hilliard and Chalmer (1992). Their study included the Lowendal Islands, just south of the Montebellos, but did not include the Montebello Islands themselves. Hilliard and Chalmer found feeding aggregations of *D. cornus*, particularly in the western half of the study area, which caused localized damage to coral populations, but no major outbreak. *Drupella cornus* was found at 7 stations during the Museum Montebellos survey. While no attempt was made to quantify the populations of *D. cornus*, only a few individuals were seen and there was no apparent damage to

corals.

Moyer (1982) recorded *Drupella fragum* as one of two species causing coral damage in Japan and the Philippines, and Fujioka and Yamazato (1983) reported damage by *D. fragum* in the Ryukyu Islands. The taxonomy of this genus is difficult, and was recently discussed by Wilson (1992), who concluded that the species identified as *D. fragum* in the two studies is actually *D. rugosa*. *Drupella rugosa* was collected during the Montebellos survey, but only at stations 17 and 30, and there was no apparent damage to corals.

Isolated individuals of two additional coralliverous gastropods, *Coralliophila violacea* and *C. costularis* were found during the survey. While they are both widespread species which occur throughout northern Western Australia, neither has ever been recorded as causing damage to coral populations.

Research during the 1980s showed that the fauna of offshore atolls (Rowley Shoals, Scott and Seringapatam Reefs and Ashmore Reef) differs considerably from that recorded along the continental coastline. Over 20% of the molluscs collected on surveys of these atolls were new records for Western Australia, and many species which are common offshore have been found only incidentally inshore (Wells, 1986). With the location of the Montebellos as the group of islands farthest offshore in the Pilbara region it was thought that the molluscan fauna might be intermediate between that typical of the continental coastline and that which occurs on the offshore atolls. However, this was not the case - almost all of the animals collected were characteristic of the continental coastline. There were three exceptions. *Conus miles* is abundant on the reefs of offshore atolls, but has been found as only 5 lots of specimens from continental shores. The species was recorded from a total of 6 stations in the Montebellos. The only previous record of *Semicassis rufa* in Western Australian waters is a single broken shell collected at Cartier Island in 1986. A single juvenile specimen was found at the Montebellos. *Maculotriton serriale* was found at a single station.

The Montebello Islands are an important area as the type locality of a number of mollusc species described by Preston (1914). Two species, *Rhagada montebelloensis* and *R. plicata*, are land snails. The remainder are marine: four gastropods were described as full species (*Natica ren, Stomatia sculpturata, Trochus montebelloensis*, and *Phasianella montebelloensis*) and three subspecies (*scabrosus, haynesi* and *turriformis*) were described for *Turbo foliaceus*. Two bivalves (*Psammobia excolorata* and *Soletellina haynesi*) were among the species described. All of these are now recognized as synonyms of previously described species except *Turbo haynesi* and *Soletellina haynesi* which are currently considered to be a valid species.

In summary, the collection of 633 species of molluscs during such a short survey indicates that the molluscan component of the marine fauna of the Montebello Islands is unexpectedly diverse. Further collecting would no doubt disclose the presence of additional species, but these would largely be the less common forms or cryptic species not readily collected in large scale surveys. One key aspect of managing mollusc populations in the Montebellos is that a short term survey such as the Museum expedition does not provide information on the seasonal and long term variability of populations. Such data could only be obtained by instituting a long term monitoring programme of key species.

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LITERATURE CITED

Fujioka, Y. and Yamazato, K. (1983). Host selection of some Okinawan coral associated gastropods belonging to the genera *Drupella, Coralliophila* and *Quoyola*. *Galaxea* **2**: 59-73.

Hilliard, R.W. and Chalmer, P.N. (1992). Incidence of *Drupella* on coral monitoring transects Between Serrurier Island and Mermaid Sound. Pp. 19-36. *In*: Turner, S. (Ed.). 1992. *Drupella cornus*: *A synopsis. Proceedings of a workshop held at the Dept. of Conservation and Land Management, Como, Western Australia.* 21-22 November 1992. CALM Occasional Paper No. 3/92.

Moyer, J. T., Emerson, W. K. and Ross, M. (1982). Massive destruction of scleractinian corals by the muricid gastropod *Drupella* in Japan and the Philippines. *Nautilus* **96**: 69-82.

Preston, H. B. (1914). Description of new species of land and marine shells from the Montebello Islands, Western Australia. *Proc. Malac. Soc. Lond.* **11**: 13-18.

Turner, S. (Ed.). (1992). *Drupella cornus*: *A synopsis. Proceedings of a workshop held at the Dept. of Conservation and Land Management, Como, Western Australia.* 21-22 November 1992. CALM Occasional Paper No. 3/92: 1-104.

Wells, F.E. (1980). The distribution of shallow-water marine prosobranch gastropod molluscs along the coastline of Western Australia. *Veliger* **22**: 232-247.

Wells, F.E. (1986). Zoogeographic affinities of prosobranch gastropods on offshore coral reefs in northwestern Australia. *Veliger* **29**: 191-199.

Wells, F.E. (1988a). Survey of the invertebrate fauna of the Kimberley Islands. Ms. rept., W.A. Museum, Perth, 51 pages.

Wells, F.E. (1988b). Part V. Molluscs. *In*: Berry, P.F. (Ed) *Faunal survey of the Cocos (Keeling) Islands (Indian Ocean)*. Report to Australian National Parks & Wildlife Authority. Pp. 36-48.

Wells, F.E. (1990). Comparative zoogeography of marine molluscs from northern Australia, New Guinea and Indonesia. *Veliger* **33**: 140-144.

Wells, F.E. (1992). Part IV. Molluscs. Pp. 30-42. *In*: Morgan, G.J. (Ed.). *Survey of the Aquatic fauna of the Kimberley islands and reefs, Western Australia.* Unpublished report, W. A. Museum.

Wells, F.E. (1993). Part IV. Molluscs. *In*: Berry, P.F. (Ed.) Faunal Survey of Ashmore Reef, Western Australia. *Rec. West. Aust. Mus. Suppl.* (44): 25-45.

Wells, F.E. and Slack-Smith, S.M. (1986). Part IV. Molluscs. *In*: Berry, P.F. (Ed.) Faunal Survey of the Rowley Shoals and Scott Reef, Western Australia. *Rec. West. Aust. Mus. Suppl.* **25**: 41-58.

Wells, F.E. and Slack-Smith, S.M. (1988). Part V. Molluscs. *In*: Berry, P.F. (Ed) *Faunal survey of Christmas Island (Indian Ocean)*. Report to Australian National Parks & Wildlife Authority. Pp. 36-48.

Wilson, B.R. (1992). Taxonomy of *Drupella* (Gastropoda, Muricidae). Pp. 5-9. In: Turner, S. (Ed.). 1992. *Drupella cornus: A synopsis. Proceedings of a workshop held at the Dept. of Conservation and Land Management, Como, Western Australia*. 21- 22 November 1992. CALM Occasional Paper No. 3/92: 1-104.
Wilson, B.R. and Gillett, K. (1971). *Australian shells*. Reed, Sydney.

Wilson, B.R. and Allen, G.R. (1987). Major components and distribution of marine fauna. Pp. 43-68. *In*: Dyne, G.R. and Walton, D.W. (eds.). *Fauna of Australia. General articles*. Vol. 1A. Aust. Govt. Printing Serv., Canberra.

Table 1. Numbers of mollusc species collected during surveys of the faunas of coral reefs on the north coast of Western Australia and adjacent parts of the Indian Ocean.

Location	Number of mollusc species collected	Number of collecting days	Source
Montebello Is.	631	19	This report
Rowley Shoals	261	8	Wells and Slack-Smith, 1986
Scott/Seringapatam Reefs	279	10	Wells and Slack-Smith, 1986
Ashmore Reef	433	12	Wells, in press
Kimberley (1988)	413	19	Wells, 1988a
Kimberley (1991)	317	19	Wells, 1992
Christmas I.	313	13	Wells and Slack-Smith, 1988
Cocos (Keeling) Is.	346	19	Wells, 1988b

List of Mollusc species collected at the Montebello Islands

Taxa	Station Number
CLASS POLYPLACOPHORA	
ISCHNOCHITONIDAE	
Ischnochiton sp.	1,13
CRYPTOPLACIDAE	
Cryptoplax sp.	4B,W5
CHITONIDAE	
Acanthopleura gemmata Blainville, 1825	7,13,14b,W5,W7
Acanthopleura spinosa (Bruguière, 1792)	13,14b,W5
CLASS GASTROPODA	
HALIOTIDAE	
Haliotis asinina Linnaeus, 1758	2,6,20,W4
Haliotis ? *crebrisculpta* Sowerby, 1833	2
Haliotis ovina (Gmelin, 1791)	2?
Haliotis squamata Reeve, 1846	2,3,10,13,18,19,23,28b,29,32b,36a, W1,W5
Haliotis varia Linnaeus, 1758	1,2,4a?,4b,14b,19,20,28b,29,32b, W3,W4,W9
FISSURELLIDAE	
Diodora jukesii (Reeve, 1849)	1,8,11,12,13,14b,14e, 16,22,32b,37,W9
Diodora ticaonica (Reeve, 1850)	4a,5,8,27
?*Hemitoma* sp.	5,7,27,29,32b,33,W3,W9
Macroschisma munita (Iredale, 1940)	10,11,12,14d,14e,22
Montfortula (*Montfortista*) *panhi* (Quoy and Gaimard, 1834)	16,17,18,27,32b,33,36a
Scutus granulatus Blainville, 1819	1,4b,18,29,32b,
TROCHIDAE	
Angaria delphinus (Linnaeus, 1758)	2,3,16,17,18,25,28, 29,33,37,W5
Astele sp.	18
Calliostoma arruensis (Watson, 1880)	22,36a
"*Calliostoma*" *gilberti* Montrouzier, 1878	10,12,18,28a,28b,36a
Calliostoma sp.	1,6,8,12,22,28a,32b
Cantharidus sp.	7,13,14a,14b,14d,17, 18,30,37
Chrysostoma zeus (Fischer, 1874)	1,2,4a,4b,10,15a,22b, 28b,32b

Clanculus atropurpureus (Gould, 1849)	6,29,30,32b
Clanculus festivus Tapparone-Canefri	20,24,30,35
Ethaliella pulchella (A. Adams)	8,13,18
Euchelus atratus (Gmelin, 1791)	6,13,14b,15a,36a,W6
Euchelus rubrus (A. Adams, 1851)	32a
Euchelus instrictus Gmelin, 1791	29,36a
Euchelus lischkei Pilsbry	2,14b
Eucheulus sp.	2
Gena sp.	6,9,17,29,32a(?)
Gibbula marmorea Pease, 1861	16,20
Hybochelus sp. aff. *H. cancellata* Krauss, 1845	15a,W9
Hybochelus sp. aff. *H. mysticus* Pilsbry 1889	19,36a
Isanda sp.	14b,14c,14e,32b
Monodonta labio (Linnaeus, 1758)	W7,W9
Monilea ? *lentiginosa* A. Adams, 1851	28a,32b
Prothalotia cf. *strigata* Adams, 1853	W3,W7
Pseudostomatella elegans (Grey, 1847)	14d,32b
Pseudostomatella? *pallida* Tapparone-Canefri	5,8,10,13,14a,14d, 15b,18,22,32b
Pseudostomatella (*Stomatolina*) *rufescens* Gray, 1847	6,10,13,14d,18,25, 29,32b,36a,43
Stomatella sp.	4b,W7
Stomatia phymotis (Helbling, 1779)	13,14a,15b,16,18, 36a,W2
Talopena vernicosa (Gould, 1861)	8,11,12,16,17,36a
Tectus pyramis Born, 1778	1,2,3,4a,4b,6,14b, 17,25,27,28,29,31, 35,37,W2,W5,W6,W7, W9
Tectus (*Rochia*) *schleuteri*	16,33
Trochus hanleyanus Reeve, 1843	11,14b,16,28b,32b,37 W4,W6,W7,W9
Trochus ? *maculatus* Linnaeus, 1758	1,2,4b,19,20
TURBINIDAE	
Astralium stellare (Gmelin 1790)	1,7,14b,16,24,30,31,35
Astralium pileola Reeve, 1842	14b,14d,16,28b,31,38, W9
Liotia peroni Kiener, 1839	14b,18,20,27,31,37,W5, W7,W9
Liotia crassilabris	27,36a
Phasianella solida (Born, 1778)	3,13,14b,14d,18,32b
Turbo (*Marmarostoma*) *argyrostoma* Linnaeus 1758	1,2,3,4a,4b,20,27,29, W9
Turbo cinereus Born, 1778	7,14b,W3,W5,W7

Turbo foliaceus Philippi, 1847	W2,W5,W9
Turbo haynesi Preston, 1914	5,14a,18,36a,W6
Turbo petholatus (Linnaeus, 1758)	3?,9,10,13,27,33
Turbo sp.	4b,9,10,13,14,17, 27,31,37
PATELLIDAE	
Cellana radiata (Born, 1778)	5,7,14d,26
Patella flexuosa (Quoy & Gaimard, 1834)	3,6,14b,17,20,27,28a
ACMAEIDAE	
Patelloida flammea (Anderson, 1865)	12,14b,29
Patelloida mimula (Iredale, 1924)	W3,W9
Patelloida profunda (Crosse and Fischer, 1864)	10,12,29,32b
Patelloida saccharina (Linnaeus, 1758)	7,14b,14d,27,28b, 32b,W1,W2,W5,W9
PHASIANELLIDAE	
Phasianella variegata Lamarck, 1822	W2
NERITIDAE	
Nerita albicilla Linnaeus, 1758	13,14b,32b,W1,W2, W4,W5
Nerita plicata Linnaeus, 1758	5,14b,W3,W5,W7
Nerita squamulata (Le Guillou, 1841)	7,13,14b,W3,W7,W9
Nerita undata Linnaeus, 1758	5,7,13,14b,28,32b, W1,W2,W3,W5,W7
LITTORINIDAE	
Littoraria articulata (Philippi, 1846)	W8
Littoraria cingulata (Philippi, 1846)	13
Littoraria filosa (Sowerby, 1832)	13,W8
Littoraria scabra (Linnaeus, 1758)	13,14b,W8,W9
Littoraria undulata(Gray, 1839)	5,14b
Nodilittorina australis (Gray, 1826)	W5
Nodilittorina pyramidalis (Quoy and Gaimard, 1833)	5,13,14b,28,W3,W7, W9
RISSOIDAE	
Rissoina sp.	23,30
TURRITELLIDAE	
Turritella sp.	8,21,32b
MODULIDAE	
Modulus tectum (Gmelin, 1791)	1,2,4a,4b,6,7,14b, 24,27,31,32b,33,35,W4, W5

PLANAXIDAE

Planaxis sulcatus (Born, 1780)	5,7,14b,28,W1,W3,W9

VERMETIDAE

Serpulorbis colubrinus (Röding, 1798)	14a

POTAMIDIDAE

Cerithidea cingulata (Gmelin, 1791)	13,14b,W8,W9
Cerithidea reidi Houbrick, 1986	13,14b,W8,W9
Terebralia palustris (Linnaeus, 1767)	13,14b,W8
Terebralia semistriata (Morch, 1852)	13,14b,W8

CERITHIIDAE

Cerithium atromarginatum Dautzenberg and Bouge, 1933	W5
Cerithium balteatum Philippi, 1848	2,4a,14b,17,19,29,30,35
Cerithium citrinum Sowerby, 1855 27	
Cerithium coralium Kiener, 1843	13,W8,W9
Cerithium echinatum Lamarck, 1822	1,2,3,4a,6,7,14b, 19,24,25,27,28, 30,35,W4,W5,W9
Cerithium nigrobalteatum E. A. Smith, 1884	W5
Cerithium novaehollandiae A. Adams, 1855	1,2,4a,6,7,14b,17, 24,31,32a,33,35, 36a,W2,W5
Cerithium salebrosum Sowerby, 1855	W6
Cerithium tenellum Sowerby, 1855	6
Cerithium trailli (Sowerby, 1855)	4a,17,19,33
Cerithium zonatum (Wood, 1828)	14b,17
Pseudovertagus aluco (Linnaeus, 1758)	13,14a,17,31,33,W5, W6,W9
Rhinoclavis articulatus (Adams and Reeve, 1850)	12,14a,17,18,29,36,W6
Rhinoclavis brettinghami Cernohorsky, 1974	1,2,3,6,7,14a,17,25,27, 28,35,W1,W2,W5
Rhinoclavis fasciatus (Bruguière, 1792)	6,17,24,30,W2,W6
Rhinoclavis kochi (Philippi, 1848)	8,12,14b,22,28,32b,36a
Rhinoclavis sordidula (Gould, 1849)	28
Rhinoclavis vertagus (Linnaeus, 1767)	7,13,14a,W6,W9
Clypeomorus batillariaeformis Habe and Kosuge, 1966	13,14a,14b,W9
Clypeomorus bifasciata (Sowerby, 1855)	13,W2,W3,W7,W9

EPITONIIDAE

Epitonium imperialis (Sowerby, 1844)	14b
Epitonium sp.	14b

EULIMIDAE
Eulimid sp. 14b,28,29,32b,36a

VANIKORIDAE
Vanikoro sp. 32b

HIPPONICIDAE
Antisabia foliacea (Quoy and Gaimard, 1835) 1
Sabia conicus (Schumacher, 1817) 1,2,10,24,25,28

CALYPTRAEIDAE
Cheilea equestris (Linnaeus, 1758) 5,6,7,9,17,18,32a

TRIPHORIDAE
Triphora sp. 10

STROMBIDAE
Lambis chiragra (Linnaeus, 1758) 3,4a,4b,27
Lambis lambis (Linnaeus, 1758) W2
Rimella cancellata (Lamarck, 1816) 32b
Strombus epidromis Linnaeus, 1758 17
Strombus mutabilis Swainson, 1821 4b,5,6,7,9,10,19,20,24, 25,28,32b,33,35,W1, W2,W4,W5,W9
Strombus urceus Linnaeus, 1758 8,14b,17,28,32b,33, 36a,W1,W5
Strombus vittatus Linnaeus, 1758 22,36a
Strombus vomer (Röding, 1798) 5,W1,W5

LAMELLARIIDAE
Chelynotus tonganus (Quoy & Gaimard, 1832) 4b

NATICIDAE
Eunaticina linneana (Recluz, 1844) 36a
Natica alapapilionaceus (Röding, 1798) 2,36a
Natica euzona (Recluz, 1844) 10,35,36a
Natica fasciata (Röding, 1798) 8,13,14a,14b,22,33
Natica gualtierana (Recluz, 1844) 13,14a,14b,32b,36a, W5,W6
Natica picta Recluz, 1844 8,18,28,33,35,46,W6
Natica robillardi Sowerby, 1843 14a
Natica seychellium (Watson, 1885) 14b,17,32b,33
Natica vitellus (Linnaeus, 1758) 14b
Polinices melanostomus (Gmelin, 1791) 8,29,33
Polinices powisiana (Recluz, 1844) W2
Polinices simiae (Deshayes, 1838) 2,32b,W2

Sinum zonale (Quoy and Gaimard, 1832)	14b
CYPRAEIDAE	
Cypraea annulus Linnaeus, 1758	13,14b
Cypraea asellus Linnaeus, 1758	1,4b,17,35,19,24,W1
Cypraea caputserpentis Linnaeus, 1758	1,4b,5,6,14b,20,25,28, 31,W2,W3,W5
Cypraea carneola Linnaeus, 1758	3,30,W1,W2
Cypraea caurica Linnaeus, 1758	W2,1,29,33
Cypraea clandestina Linnaeus, 1767	1,10,14b,29,33,W9
Cypraea cribraria Linnaeus, 1758	3,6,17
Cypraea cylindrica Born, 1778	1,2,4b,17,19,24,30, 31,33,35,W1,W2,W9
Cypraea eglantina Duclos, 1833	1,2,4a,6,20,25,W2
Cypraea erosa Linnaeus, 1758	1,2,4a,4b,24,30,31
Cypraea errones Linnaeus, 1758 2	
Cypreaea gracilis Gaskoin, 1849	1,9,14b,27,28,30,35, W1,W9
Cypraea hammondae Iredale, 1939	9
Cypraea helvola Linnaeus, 1758	1,2,3,4a,5,10,19,20, 23,24,4b,25,28,30,32, 33b,35,W1,W2
Cypraea hirundo Linnaeus, 1758	4a,20,46
Cypraea isabella Linnaeus, 1758	1,3,23,46
Cypraea kieneri Hidalgo, 1906	35
Cypraea leviathan Schilder and Schilder, 1937	7
Cypraea limacina Lamarck, 1810	1,2,3,10,19,35,46
Cypraea lynx Linnaeus, 1758	6,20,23,W1,W2,W5, W9
Cypraea moneta Linnaeus, 1758	2,4a,13,14a,14b,20,31, W1,W5,W6,W9
Cypraea nucleus Linnaeus, 1758	20
Cypraea pallidula Gaskoin, 1849	35
Cypraea staphylaea Linnaeus, 1758	29
Cypraea stolida Linnaeus, 1758	27
Cypraea subviridis Reeve, 1835	18,W1
Cypraea tigris Linnaeus, 1758	7
Cypraea vitellus Linnaeus, 1758	23,W2
OVULIDAE	
Ovula ovum (Linnaeus, 1758)	24,28
TRIVIIDAE	
Trivia oryza (Lamarck, 1810)	2,12,35
CASSIDAE	
Cassis rufa (Linnaeus, 1758)	25

FICIDAE	
Ficus eospila (Peron, 1807)	18,28,W6
TONNIDAE	
Malea pomum (Linnaeus, 1758)	W2
Tonna chinensis (Dillwyn, 1817)	10
Tonna perdix (Linnaeus, 1758)	1,2
Tonna variegata (Lamarck, 1822)	32b
CYMATIIDAE	
Cymatium labsiosum (Wood, 1828)	10
Cymatium moritinctum (Reeve, 1844)	10,22,W4,W5,W6
Cymatium pileare (Linnaeus, 1758)	14b
Gelagna succincta (Linnaeus, 1771)	22
Gutturnium muricinum (Gmelin, 1791)	13,14a,14b,19,W9
Gyrineum pusillum (Broderip, 1833)	23
Septa exarata (Reeve, 1844)	14b
Septa gemmata (Reeve, 1844)	14b,W5,W6
Septa pileare (Linnaeus, 1758)	24,30,W9
Septa vespacea (Lamarck, 1822)	8,10,14b,22,28, 32b,33,36a,W5,W6,W9
Turritriton labiosum (Wood, 1828)	22
BURSIDAE	
Bursa granularis (Röding, 1798)	1,2,4a,6,10,14b,35, W2,W4,W5
MURICIDAE	
Aspella sp.	W4
Chicoreus banksii (Sowerby, 1841)	14a
Chicoreus microphyllus (Lamarck, 1816)	9
Haustellum multiplicatus (Sowerby, 1895)	12
Hexaplex stainforthi (Reeve, 1842)	13,14b,W6,W7
Homalocantha secunda (Lamarck, 1822)	17
Murex acanthostephes Watson, 1883	12,13,14a,14b,32b,W9
Murex pecten soelae Ponder and Vokes, 1988	32a
Pterochelus acanthopterus (Lamarck, 1816)	14b,18,29,W9
Pterocheuls akation Vokes, 1993	13
THAIDIDAE	
Cronia avellana (Reeve, 1846)	1,2,3,4a,4b,5,6,7,13, 14b,17,19,20,23,24,25, 28,30,32a,33,35,W2, W4,W5,W9

Cronia ochrostoma (Blainville, 1832)	23
Drupa cf. *fusconigra* (Dunker, 1846)	13,14b,W7,W9
Drupa cf. *marginalba* (Blainville, 1832)	W5
Drupa morum (Röding, 1798)	14b,26,28,W5
Drupa ricinus (Linnaeus, 1758)	4a,14b,26,28
Drupella cornus (Röding, 1798)	1,2,6,7,19,20,24
Drupella rugosa (Born, 1778)	17,30
Maculotriton serriale (Deshayes, 1834)	14b
Maculotriton cf. *sculptile* (Reeve, 1844)	14b
Mancinella mancinella (Linnaeus, 1758)	14b,26,28,W5
Morula biconica Blainville, 1832	1
Morula granulata (Duclos, 1832)	14b,W4
Morula margariticola (Broderip, 1832)	14b,19,28,W4,W5,W9
Morula spinosa (H. and A. Adams, 1835)	1,2,6,7,14b,20, 24,27,30,31,35,W9
Morula uva (Röding, 1798)	6,7,14b,20,24,28, W5,W9
Nassa serta (Bruguière, 1789)	2,4a,4b,14b,20,W4, W5,W9
Pinaxia versicolor (Gray, 1839)	10,23
Thais aculeata (Deshayes, 1844)	5,7,14b,26,28,W4, W5,W9
Thais echinata (Blainville, 1832)	1,2,8,25,28,30,35
Thais intermedia (Kiener, 1836)	20
Thais kieneri (Deshayes, 1844)	14b,24
Thais orbita (Gmelin, 1791)	14b
Vexilla vexillum (Gmelin, 1791)	9

CORALLIOPHILIDAE

Coralliophila costularis (Lamarck, 1816)	1,2,25
Coralliophila pyriformis Kira, 1959	1,6
Coralliophila violacea (Kiener, 1836)	1,19,23

COLUMBELLIDAE

Mitrella bella (Reeve, 1859)	9,10
Mitrella puella (Sowerby, 1844)	8,12,22,28,32b,36a,W9
Pyrene essingtonensis (Reeve, 1859)	14b
Pyrene flava (Bruguière, 1789)	14b,W6,W9
Pyrene punctata (Bruguière, 1789)	2,27,W5
Pyrene scripta (Lamarck, 1822)	4a,10,14b,19,36a,W2, W4
Pyrene testudinaria (Link, 1807)	10,14b,20,25,W2,W5
Pyrene turturina (Lamarck, 1822)	1,2,3,4b,19,20

BUCCINIDAE

Cantharus erythrostoma (Reeve, 1846)	13,14a,14b,18,24, W5,W6,W9
Cantharus fumosus (Dilwyn, 1817)	4b,13,14b,20,25,W1, W9
Cantharus iostomus (Gray, 1834)	19,20
Cantharus undosus (Linnaeus, 1758)	14b,29,W5
Cominella acutinodosa (Reeve, 1846)	7,13,14a,14b,32b,W9
Pisania ignea (Gmelin, 1791)	27,32b
Pisania gracilis (Reeve, 1846)	4a
Phos cf. *textilis* A. Adams, 1851	8,18,22

MELONGENIDAE

Syrinx aruanus (Linnaeus, 1758)	4a,14b,22,24

NASSARIIDAE

Cyllene sulcata Sowerby, 1859	8,28,36a
Nassarius albescens (Dunker, 1846)	6,W6
Nassarius albina (Thiele, 1930)	14a,14b,20,28,32b
Nassarius clarus (Marrat, 1877)	13,14a,14b,W9
Nassarius comncinnus (Powys, 1835)	14b
Nassarius gaudiosus (Hinds, 1844)	18
Nassarius glans (Linnaeus, 1758)	1,8,12,14a,14b,17, 18,22,29,30,W6,W9
Nassarius pauperus (Gould, 1850)	4a,23
Nassarius reeveanus (Dunker, 1847)	14b,W5
Nassarius sufflatus (Gould, 1860)	14b,29,W5

FASCIOLARIIDAE

Latirus paetelianus (Kobelt, 1874)	14b,17
Latirus polygonus (Gmelin, 1791)	14b,20
Latirus turritus (Gmelin, 1790)	23
Latirus walkeri Melvill, 1893	13,14b
Peristernia incarnata (Kiener, 1840)	1,2,3,4a,4b,6,7, 12,13,14b,19,20,22, 27,28,30,35,W5,W9

OLIVIDAE

Amalda elongata Gray, 1847	8,12
Amalda muscae (Pilsbry, 1926)	W9
Amalda rosea Macpherson, 1951	32b
Ancillista cingulata (Sowerby, 1830)	17,28,36a
Oliva australis Duclos, 1835	32b
Oliva caerulea (Röding, 1798)	10
Oliva lignaria Marrat, 1868	W2

MARGINELLIDAE

Marginella australis	13,14a,W9

MITRIDAE

Cancilla incarnata (Reeve, 1845)	32a
Mitra fraga Quoy and Gaimard, 1833	1,20
Mitra litterata Lamarck, 1811	14b
Mitra luctuosa Adams, 1853	W4
Mitra retusa Lamarck, 1811	29
Mitra scutulata (Gmelin, 1791)	14b,29,32b,W2,W5
Mitra ticaonica Reeve, 1844	20,29
Pterygia scabricula (Linnaeus, 1758)	29
Scabricola lacunosa Reeve, 1844	14b

COSTELLARIIDAE

Vexillum amanda (Reeve, 1845)	32b,36a
Vexillum leucodesmium (Reeve, 1845)	14b
Vexillum obeliscus (Reeve, 1844)	14b
Vexillum microzonias (Lamarck, 1811)	1
Vexillum pacificum (Reeve, 1845)	9,10
Vexillum rugosum (Gmelin, 1791)	13
Vexillum unifasciatum (Wood, 1828)	2
Vexillum vulpecula (Linnaeus, 1758)	2,10,13,14a,14b,17,28, 32a,32b,35,36a,W1,W9
Vexillum zebuense (Reeve, 1844)	1,8,14b,32b,33
Vexillum zelotypum (Reeve, 1845)	14b,36a

VASIDAE

Vasum turbinellum (Linnaeus, 1758)	3

CANCELLARIIDAE

Cancellaria melanostomus westralis Garrard, 1975	8,13
Cancellaria sp.	8

VOLUTIDAE

Amoria damoni Gray, 1864	8,14b,22
Amoria cf. *praetexta* (Reeve, 1849)	18
Amoria grayi Ludbrook, 1953	W1
Aulicina nivosa (Lamarck, 1804)	3,12,14a,18,19,22,28, 32a,33,W1,W6,W7,W9
Melo amphora (Solander, 1786)	1,2,4,5,7,14b,28,31, 32a,32b,33,W1,W2

TURRIDAE

Clavus cf. *unizonalis* (Lamarck, 1822)	6,14b
Daphnella sp.	19
Eucithara coronata (Hinds, 1843)	28,W9

Eucithara cylindrica (Reeve, 1846)	28
Eucithara sp.	10,12
Inquisitor crenularis (Lamarck, 1816)	22,32b
Inquisitor sp.	136a
Inquisitor sp.	232b
Lophiotoma crispa (Lamarck, 1816)	18
Turricula nelliae granobalteatus (Hedley, 1922)	8,12,18,28,32b
Xenoturris cingulifera (Lamarck, 1822)	23

CONIDAE

Conus arenatus Hwass in Bruguière, 1792	1
Conus capitaneus Linnaeus, 1758	W2
Conus ceylanensis Hwass in Bruguière, 1792	1,4a,4b,6,20,25, 27,28,35,W1
Conus chaldeus (Röding, 1798)	14b
Conus coronatus Gmelin, 1791	14b
Conus dorreensis Peron, 1807	4b,10,14b,28,W4,W5
Conus eburneus Hwass in Bruguière, 1792	W2
Conus ebraeus Linnaeus, 1758	14b,28
Conus frigidus Reeve, 1848	14b,46
Conus glans Hwass in Bruguière, 1792	1,20,27,35
Conus lividus Hwass in Bruguière, 1792	4a,9,10,20,25,27,W5
Conus macarae Bernardi, 1857	14b,33
Conus miles Linnaeus, 1758	2,3,4a,19,20,25,27
Conus miliaris Hwass in Bruguière, 1792	19
Conus novaehollandiae A. Adams, 1853	13,W5,W9
Conus rattus Hwass in Bruguière, 1792	4a,10,20,25
Conus reductaspiralis Walls, 1979	17
Conus spectrum Linnaeus, 1758	W2
Conus sponsalis Hwass in Bruguière, 1792	W5
Conus striatus Linnaeus, 1758	27
Conus terebra Born, 1798	25
Conus textile Linnaeus, 1758	3
Conus vexillum Gmelin, 1792	9,23,27,46
Conus victoriae Reeve, 1843	14b,17,W1,W2,W5,W9

TEREBRIDAE

Duplicaria australis (E. A. Smith, 1873)	14b,18,36a
Duplicaria bernardi (Deshayes, 1857)	32b
Duplicaria duplicata (Linnaeus, 1758)	14b,22,28,36a
Hastula rufopunctata (E. A. Smith, 1877)	14b,28,32b,36a
Terebra affinis Gray, 1834	30
Terebra amanda Hinds, 1844	27
Terebra areolata (Link, 1807)	W1,W2
Terebra flavofasciata Pilsbry, 1921	23
Terebra laevigata Gray, 1834	6,14b

Terebra marrowae Bratcher and Cernohorsky, 1982	2,6,14a,14b,17,19, 22,28,32b,36a,38
PYRAMIDELLIDAE	
Pyramidella acus (Gmelin, 1791)	2,8,12,18,22,28, 36A,W2
Pyramidella sulcata A. Adams, 1854	22,28
Pyramidella terebellum (Muller, 1774)	36a
Otopleura auriscati (Holten, 1802)	14a,W9
ACTEONIDAE	
Pupa sulcata (Gmelin, 1791)	8,14b,18,19,28,32b,36a
HYDATINIDAE	
Hydatina physis (Linnaeus, 1758)	6,33,36
BULLIDAE	
Bulla ampulla Linnaeus, 1758	6,8,13,19,28,32b,36, W2,W9
Bulla vernicosa Gould, 1859	36a
ATYIDAE	
Atys cylindricus (Helbling, 1779)	12,14a,14b,23,28,32b
Atys naucum (Linnaeus, 1758)	28
Cylichna arachis (Quoy and Gaimard, 1833)	12,18,28,32b,W9
AGLAJIDAE	
Chelidonura amoena Bergh, 1905	1,7,33
Aglaja sp. 1	14a
Aglaja sp. 2	14b,32a,32b
Aglajid sp.	32b
Philinopsis gardneri	14b
PHILINIDAE	
Philine sp.	32b,38
AKERIDAE	
Akera soluta (Gmelin, 1791)	14a,28
APLYSIIDAE	
Aplysia parvula Guilding in Morch, 1863	19,28
Aplysia reticulata Eales, 1960	14b,W6,W9
Bursatella sp.	32b,W6
Dolabella auricularia (Lightfoot, 1786)	32b,W9

PLEUROBRANCHIDAE	
Berthellina citrina (Rüppell and Leuckart, 1828)	4a,11
VOLVATELLIDAE	
Volvatella sp.	5
ELYSIIDAE	
Elysia ornata Swainson, 1840	29
Elysia sp.	32b
Thurdilla sp.	1,6,7,9,19
GONIODORIDIDAE	
Goniodoridid sp.	9
POLYCERIDAE	
Nembrotha cf.*lineolata* Bergh, 1895	7,9,10,33
Nembrotha rutilans Pruvot-Fol, 1931	27,33,35
Nembrotha kubyarana Bergh, 1877	31
Nembrotha cf. *nigerrima* Bergh, 1877	33
Tambja affinis (Eliot, 1904)	7,10,27,28,29,33
GYMNODORIDAE	
Gymnodoris okinawae Baba, 1936	2,6
Gymnodoris sp.	2,6,7,14b,29
cf. *Gymnodoris* sp.	26
AEGIRIDAE	
Notodoris gardineri	26
HEXABRANCHIDAE	
Hexabranchus sanguineus (Rüppell & Leuckart, 1828)	13,14B,W3
DORIDIDAE	
Aphelodoris sp.	1,2,6,17,24,29, 32a,33,35
Asteronotus caespitosus (Hasselt, 1824)	13,20,23,28
Discodoris fragilis (Alder and Hancock, 1864)	6,20
Hoplodoris sp.	4a
Halgerda tessellata (Bergh, 1880)	10,20,35
Halgerda punctata Farran, 1902	35
Platydoris scabra (Cuvier, 1804)	6,14b,20
Platydoris formosa (Alder and Hancock, 1864)	2
Platydoris sp.	14b

CHROMODORIDIDAE

Ceratosoma trilobatum (Gray, 1827)	33
Chromodoris bullocki Collingwood, 1857	1,27,30
Chromodoris cf. *coi*	2,30,31
Chromodoris elisabethina Bergh, 1877	3,4a,4b,24,27,35
Chromodoris cf. *festiva*	14b
Chromodoris cf. *tinctoria* (Rueppel and Leuckart, 1828)	32a
Glossodoris atromarginata (Cuvier, 1804)	6
Risbecia tryoni (Garrett, 1873)	19

DENDRODORIDIDAE

Dendrodoris rubra	14b

PHYLLIDIIDAE

Phyllidia coelistis Bergh, 1905	1,3,4a,9,35
Phyllidia cf. *pustulosa* Cuvier, 1804	2,3,4a,6,7,9,20,24, 30,31,35
Phyllidia cf. *ocellata* Cuvier, 1804	4a,9,23,35
Phyllidia cf. *striata* Bergh, 1889	9,35
Phyllidia cf. *varicosa* Lamarck, 1801	17
Phyllidia sp.	9
Phyllidia sp. (yellow front)	29

GLAUCIDAE

Moridilla brocki (Bergh, 1888)	7,32a,33
Pteraeolidia ianthina (Angas, 1864)	27,32a,32b,33

ARMINIDAE

Armina sp. 1	32b
Armina sp. 2 (purple)	33

SCYLLAEIDAE

Scyllaea pelagica Linnaeus, 1758	28

ONCHIDIIDAE

Onchidium sp.	13,14a,14b,W9

SIPHONARIIDAE

Siphonaria sp. ?*kurracheensis* Reeve, 1856	5,7,14d,14e,28a,29
Siphonaria sp. ?*zelandica* Quoy and Gaimard, 1833	14d,36b

ELLOBIIDAE

Cassidula angulifera (Petit de la Saussaye, 1841)	13,W8

ONCHIDIIDAE

Onchidium sp.

CLASS BIVALVIA

ARCIDAE

Anadara antiquata (Linnaeus, 1758)	19,W1
Arca ventricosa Lamarck, 1819	1,2,4b,6,12,13,14a,15, 15a,17,19,24,29,31,32b, 33,35,W1,W2
Barbatia amygdalumtostum (Röding, 1798)	1,2,3,4a,5,6,7,12,17, 19,20,29,32a,W1,W2
Barbatia helblingii (Bruguière, 1789)	22,35
Barbatia lacerata (Linnaeus, 1758)	6,17,27,33
Barbatia plicata (Dillwyn, 1817)	2,32b,W6
Barbatia cf. *pistachia* Lamarck, 1819	18,20,31,36a,W1
Barbatia tenella (Reeve, 1844)	3,4b,7,19,27
Barbatia verescens	14b
Barbatia sp.	20

NOETIIDAE

Arcopsis afra (Gmelin, 1791)	5,15b,19

GLYCYMERIDIDAE

Glycymeris crebriliratus (Sowerby, 1889)	36a
Glycymeris dampierense Matsukuma, 1984	8,9,10,12,13a,14a,15a, 16,17,18,21,28a,29,30, 32a,32b,33,36a,W1,W2
Glycymeris (*Veletuceta*) *hedleyi* var. (Lamy, 1912)	8,12,14a,15,15a, 15b,16,17,18,36a
Tucetona auriflua (Reeve, 1843)	12,35
Tucetona odhneri Iredale, 1939	8,12,14b,15b,16, 18,30,32b,33,36a,36b

MYTILIDAE

Botula silicula Lamarck, 1819	16,14a
Brachidontes ustulatus (Lamarck, 1819)	5,7,13,13a,14a,14b, 14d,14e,21,29,37
Lioberus pulvillus (Iredale, 1939)	8,12,14b,14d,15, 17,18,28a,36a
Lithophaga ? *nasuta* (Philippi, 1846)	1,10,14a,16,17, 22,24,26,28,29,33
Lithophaga teres (Philippi, 1846)	14a,16,22,24,27,29,35
Modiolus philippinarum (Hanley, 1843)	4b,8,9,10,12,13,13a, 14a,14b,14d,14e,15a, 15b,17,18,21,22,27,29, 37,W7
Musculus sp.	3,4a,4b,5,9
Ryenella cumingiana (Dunker, 1857)	7,14a,14d,15a,15b,36a

Septifer bilocularis (Linnaeus, 1758)	1,2,3,4a,4b,5,6, 7,10, 13a,14b,14d,16,17,20, 21,22,24,25,26,27,29, 32b,37,W2,W9
Stavelia horrida Dunker, 1857	3,14a,14b,14e,16
PINNIDAE	
Atrina pectinata (Linnaeus, 1767)	1,4a,6,8,19
Atrina vexillum (Born, 1778)	1,2,24,35
Pinna bicolor Gmelin, 1791	5,8,9,12,13,13a,14b, 14c,15b,18,19,22,32b, W9
Pinna deltodes Menke, 1843	3,6,7,9,17
Streptopinna saccata (Linnaeus, 1758)	3
PTERIIDAE	
Electroma ?ovata (Quoy & Gaimard, 1834)	1,4b,6,7,17,19,33
Electroma zebra (Reeve, 1857)	17
Pinctada albina (Lamarck, 1819)	4b,6,14b,15a,17, 25,27, 29,31,32b,33,36a,37
Pinctada margaritifera (Linnaeus, 1758)	4a,4b,6,7,9,19,24,27, 31,32b
Pinctada maxima (Jamieson, 1901)	2,6,7,27,32a
Pinctada lata (Gray, 1845)	27,33,35,36b
Pteria penguin (Röding, 1798)	7,27,W1
Pteria sp.	36b,33
ISOGNOMONIDAE	
Crenatula ? viridis (Lamarck, 1819)	7,9,11,14b,15,15b, 16,17,32b,36a,36b
Isognomon isognomum (Linnaeus, 1758)	1,2,4b,6,7,9,13a, 14b,14e,17,19,26, 27, 29,31,33,35,37,W7,W9
Isognomon sp.	3,5,7,9,11,13,13a, 14b,14d,24,25,35,W3
MALLEIDAE	
Malleus sp.	6, 14b
Vulsella vulsella (Linnaeus, 1758)	11,12,14a,16,18,33
PECTINIDAE	
Chlamys australis (Sowerby, 1842)	32b
Chlamys flabellata (Lamarck, 1819)	8
Chlamys funebris (Reeve, 1853)	1,4a,4b,7,12,14d,15,16, 21,27,32b,37,W1,W2, W9

Chlamys lentiginosa (Reeve, 1853)	1,2,3,6,7,10,12,14b, 14d,15,15a,17,18,21,22, 23,27,29,32b,33
Chlamys pallium (Linnaeus, 1758)	1,(1-4),4a,7
Chlamys madreporarum (Sowerby, 1842)	6,17,19
Chlamys radula (Linnaeus, 1758)	1,2,4a,6,7,14c,17,18, 19,21,24,27,30,33,35
Chlamys scabricostata (Sowerby, 1915)	22,28,28a
Chlamys squamosa (Gmelin, 1791)	(1-4),4a,6,7,14b,17,19, 21,24,27,29,30,31,35
Chlamys (*Complicachlamys*) *dringi* (Reeve, 1853)	9,17,27,31
Chlamys (*Comptopallium*) *radula* (Linnaeus, 1758)	4a,6,14c,17,18,24,31
Chlamys (*Excellichlamys*) *histrionica* (Gmelin, 1791)	20,35
Chlamys (*Gloripallium*) *pallium* (Linnaeus, 1758)	7
Hemipecten forbesianus (Adams & Reeve, 1848)	17

PLICATULIDAE

Plicatula ?australis Lamarck, 1819	1,2,3,4b,6,7,10,16, 17,19,22,31,32a,32b
Plicatula ?chinensis Morch, 1853	8,35
Plicatula sp.	6,19,22

SPONDYLIDAE

Spondylus ?lamarcki Chenu, 1845	1,5,6,7,10,17,19, 24,31,32b,35
Spondylus sp. aff. *S. echinatus* Schreibers, 1793	1,2,4a,5,6,7,12,13a, 16,17,19,20,21,24,27, 29,31,35
Spondylus sp. aff. *S. sanguineus* Dunker, 1852	16,19,22,24,32b
Spondylus sp. aff. *S. squamosus* Schreibers, 1793	2,4b,5,6,7,17,22, 24,27,29,31

ANOMIIDAE

Patro sp. (juvenile)	35

PLACUNIDAE

Placuna lobata Sowerby, 1871	22

GRYPHAEIDAE

Hyotissa hyotis (Linnaeus, 1758)	1,2,4a,6,7,17, 19,24,27,31,35
Hyotissa sp.	1,2,17,19,24,27,30,35
Hyotissa numisma (Lamarck, 1819)	14b

OSTREIDAE

Dendostrea folium (Linnaeus, 1758)	1,2,4a,5,6,10,14a,14b, 17,19,27,29,30,31,32b, 35
Ostrea tuberculata Lamarck, 1804	1,2,6,7,17,24,27,30
Ostrea sp.	1,4a,14b,16,32b,W5, W9
Saccostrea ?commercialis (Iredale & Roughley, 1933)	6,7,13,13a
Saccostrea cucullata (Born, 1778)	2,5,6,7,14b,14d,17,26, 29,32b,37,38,W3,W7

LIMIDAE

Ctenoides annulata (Lamarck, 1819)	2,6,7,12,17,19, 24,27,29,31,33,35
Lima lima (Linnaeus, 1758)	1,2,3,4b,6,7,9,11,13, 17,27,28a,29,31,32a,35
Limaria ?basilanica (A. Adams & Reeve, 1850)	1,2,6,8,17,19,33,37
Limaria fragilis (Gmelin, 1791)	2,6,7,16,19,20,21,22, 24,27
Limatula ?japonica Fleming, 1978	2,7,8,12,15b,16,17, 18,21,31,33,36a,37

LUCINIDAE

Anodontia (*Cavatidens*) *?omissa* (Iredale, 1930)	1,8,12,14c,14e,15a,15b, 18,21,22,36a,37
Ctena bella (Conrad, 1837)	1,2,5,6,7,12,14b,14c,19, 21,29,31
Ctena ?transversa Dall, Bartsch & Rehder, 1938	27,35
Divaricella ornata (Reeve, 1850)	14a,18
Divaricella sp.	14a,18,21
Linga (*Bellucina*) *?semperiana* (Issel, 1869)	8,18,21,22,28a
?Pompholigina sp.	18,21,22

UNGULINIDAE

Felaniella (*Zemysia*) sp.	1,5,8,12,14c,15a,15b, 16,17,18,20,29,32a,36a, 36b,37
Numella sp.	12,14c,14e,15a,15b,16, 21,36a,37
Diplodonta sp.	1,5,8,9,11,12,14c, 14e,15,16,17,18,22

GALEOMMATIDAE

Ephippodonta sp.	2

CHAMIDAE

Chama lazarus (Linnaeus, 1758)	1,4a,6,7,17,19,24,3 1,35
Chama sp. aff. *C. fibula* Reeve, 1846	2,4a,4b,6,8,9,15b,17
Chama sp. aff. *C. limbula* Lamarck, 1819	5,7,14b,14e,26?
Chama sp. aff. *C. pacifica* Broderip, 1835	1,14d,14,17,20,25,29, 31,35
Chama sp. aff. *C. plinthota* Cox, 1927	2,6,14b,17,24,27
Pseudochama sp.	7,14b,14e,17,27,29, 32b,37

TRIGONIIDAE

Neotrigonia uniophora (Gray, 1847)	28a,32a

FIMBRIIDAE

Fimbria sowerbyi (Reeve, 1841)	1,8,12,14a,14e,21,28a, 36a,36b

CARDITIDAE

Beguina semiorbiculata (Linnaeus, 1758)	6,7,16,17,19,27,35
Cardita crassicosta Lamarck, 1819	17
Cardita ?marmorea Reeve, 1843	14a,36b
Cardita muricata Sowerby, 1832	9,14b,14d,27,29,32b,37
Cardita preissi Menke, 1843	8,12,13,14b,14d,15a, 18,29,32b,36a,36b,37
Cardita variegata (Bruguière, 1792)	1,24,27,29,31,35,W2
"*Venericardia*" *cardioides* (Reeve, 1843)	12,15a,16,17,18,22,23, 33,36b

CRASSATELLIDAE

Eucrassatella pulchra (Reeve, 1842)	1,8,12,21,28,28a,36a, W6

CARDIIDAE

Acrosterigma alternatum (Sowerby, 1841)	1,2,4a,6,7,10,17,19, 24,29,30,31,32a,33,35
Acrosterigma dupuchense (Reeve, 1845)	5,7,13,13a,14c,14e,29, 37,W1,W2,W9
Acrosterigma reeveanum (Dunker, 1852)	2,3,5,6,10,12,14c,16, 17,21,22,23,29,31,32b, 33,36a,36b,W1,W2,W9
Acrosterigma transcendens (Melvill & Standen, 1899)	8,12,16,17,18,21,22, 25a,28a,33,36a
Acrosterigma ?wilsoni (Voskuil & Hverwagt, 1991)	12,16,22,35,36a

?Ctenocardia peronata (Iredale, 1929)	5,37
Fragum erugatum (Tate, 1889)	12,14c,14e,15a,19,21, 22,32b,36a,36b
Fragum (*Fragum*) *unedo* (Linnaeus, 1758)	5,8,13,13a,14a,14c,14e, 15a,15b,28a,32b,37, W2,W6,W9
Fragum (*Lunulicardia*) *retusum* (Linnaeus, 1767)	8,18,32b,36a
Fulvia aperta (Bruguière, 1789)	5,12,13,13a,14a,14c, 14e,15a,15b,16,17,18, 19,22,28a,29,32a,32b, 33,36a,36b,37
Laevicardium attenuatum (Sowerby, 1841)	1,10,16,23,28a,36a
Laevicardium biradiatum (Bruguière, 1789)	2,17,18,21,23,32a,33
Lyrocardium lyratum (Sowerby, 1841)	18,22,23,32a,32b,33,35
Plagiocardium setosum (Redfeild, 1848)	19,21,22
HEMIDONACIDAE	
Hemidonax donaciformis (Schroeter, 1786)	13,14a,14c,14e,15a, 15b,21,28a,32b,37
TRIDACNIDAE	
Tridacna maxima (Röding, 1798)	1,2,4b,6,7,14d,19, 20,24,25,28,29,31,37, W2
Tridacna squamosa Lamarck, 1819	1,2,6,7,20,24,25,W2
Tridacna squamosa Lamarck, 1819	1,2,4b?,6,7,20?, 24,25,29,31,35,W2
MACTRIDAE	
Lutraria australis Reeve, 1854	6,11,23,33,35
Mactra explanata Reeve, 1854	10,13,18,21,22,23,36a
Mactra incarnata Reeve, 1854	8,15a,18,21,22,28a, 32b,36a
Mactra ?westralis Lamprell & Whitehead, 1990	3
Spisula aspersa (Sowerby, 1825)	35
MESODESMATIDAE	
Paphies striata (Gmelin, 1791)	7,13,13a,14a,14c, 14e,32b,W2,W3
TELLINIDAE	
Exotica (*Exotica*) *?triradiata* (H.Adams, 1876)	22,36a
Exotica (*Loxoglypta*) *?assimilis* (Hanley,1844)	7,14c
Macoma (*Scissulina*) *dispar* (Conrad, 1837)	5,7,12,14c,15b,22
Tellina (*Cadella*) sp.	12,18,21,36a

Tellina (*Clathrotellina*) *elegantissima* Smith, 1885	8,12,15b,18,21,22
Tellina (*Pharaonella*) *rostrata* Linnaeus, 1758	5,14a,14c,14e,15a,15b, 16,22,28a,36b,37
Tellina (*Pinguitellina*) ? *murrayi* Smith,1885	13,14e,16
Tellina (*Pinguitellina*) *robusta* Hanley, 1844	14c,15a,16,28a
Tellina (*Quadrans*) *parvitas* (Iredale, 1931)	36a
Tellina (*Tellinella*) *radians* Deshayes, 1854	7,14a,14c,15b,16,17, 18,31,33,35,36a
Tellina (*Tellinella*) *staurella* Lamarck, 1819	1,2,5,6,7,13a,14c,14e, 16,17,18,19,24,26,33, 36a
Tellina (*Tellinella*) *virgata* Linnaeus, 1758	5,7,13a,14a,14e,19,29
Tellina (*Tellinides*) *ovalis* Sowerby, 1825	18,22
SEMELIDAE	
Leptomya psittacus (Hanley, 1882)	1,5,6,8,17,18,33
Semele casta A. Adams, 1853	1
Semele exarata (A. Adams & Reeve, 1848)	17
Semele ?jukesii (Reeve, 1853)	2,33
DONACIDAE	
Donax cuneatus Linnaeus, 1758	7,14c,28a,29,32b
Donax faba Gmelin, 1791	5,7,14c,36b
Donax veruinus Hedley, 1913	22
TRAPEZIIDAE	
Trapezium bicarinatum (Schumacher, 1817)	2,3,4a,4b,9,13,14e, 26,27,29,31,W4
CULTELLIDAE	
Phaxas cultellus (Linnaeus, 1758)	12,14c,17,18,22,33
SOLENIDAE	
Ensis sp.	8,22
PSAMMOBIIDAE	
Asaphis (*Heteroglypta*) *contraria* (Deshayes, 1863)	27
Gari amethystus (Wood, 1815)	22
Gari maculosa (Lamarck, 1818)	2,27
Gari ?occidens (Gmelin, 1791)	2,4a,6,19,24,27,30,31
Gari ?weinkaufi (Crosse, 1864)	12,18
Gari sp.	2,16,17
Soletellina atrata Reeve, 1857	13,14a,15a,15b,37
Soletellina ?ecolorata (Preston, 1914)	8,14a,14c,15a,15b, 32b,37

Soletellina haynesi (Preston, 1914)	13
Soletellina sp. (see Lamprell & Whitehead, 1992, #413)	1
SOLECURTIDAE	
Azorinus ?minutus (Dunker, 1871)	28a
VENERIDAE	
Anomalocardia squamosa (Linnaeus, 1758)	13,13a,14a,14c,15a,37
Antigona (*Antigona*) *chemntzii* (Hanley, 1844)	32a
Antigona ?persimilis (Iredale, 1930)	1
Callista (*Costacallista*) *impar* (Lamarck, 1818)	13,14a,14c
Callista (*Costacallista*) *planatella* (Lamarck, 1818)	22,32b
Callista (*Striacallista*) *phasianella* (Deshayes, 1854)	14c,18,33
Callista (*Striacallista*) *?roseotincta* (Smith, 1885)	6,12,17,18,28a,32a, 33,36a
Circe scripta (Linnaeus, 1758)	12,18
Circe sulcata Gray, 1838	18
Circe ?numulina (Lamarck, 1818)	12,13,14c
Dosinia bruguierei Gray, 1835	13,17,21,37
Dosinia contusa (Reeve, 1850)	12,21
Dosinia ? exasperata (Philippi, 1847)	1,2,7,12,16,17, 18,28a, 31,33
Dosinia juvenilis (Gmelin, 1791)	2,16,32a,33
Dosinia lucinalis (Lamarck, 1835)	5,14c,14e
Dosinia sculpta (Hanley, 1845)	2,33
Gafrarium sp.	18,W9
Gomphina ?undulosa (Lamarck, 1818)	1,10,11,21,29,32b,36a
Irus sp. aff. *I. irus* (Linnaeus, 1758)	7,13,14a,14b,14c, 19,20,29,31,35,37
Lioconcha ?castrensis (Linnaeus, 1758)	12
Lioconcha fastigiata (Sowerby, 1851)	6,17,19,28a,30,32a,32b
Paphia semirugala (Philippi, 1847)	8,22
Periglypta resticulata (Sowerby, 1853)	2,3,5,6,7,10,12,17,29,33
Periglypta reticulata (Linnaeus, 1758)	3,4b,7,19,20
Periglypta sp.	1,6,13,35
Pitar (*Pitarina*) *affinis* (Gmelin, 1791)	33
Pitar (*Pitarina*) *?japonicus* Kuroda & Kawamoto, 1956	5,37
Pitar (*Pitarina*) *?pellucidus* (Lamarck, 1818)	37
Pitar (*Pitarina*) *trevori* Lamprell & Whitehead, 1990	8,28a
Placamen calophylla (Philippi, 1836)	1
Placamen gravescens (Menke, 1843)	5,8,14a,16,36b,37
Placamen tiara (Dillwyn, 1817)	15a,15b,18,22,28a

Sunetta contempta Smith, 1891	15a,21,W6
Sunetta perexcavata Fulton, 1915	12,15b,17,18
Tapes literatus (Linnaeus, 1758)	13,14a,23,33,36a,37
Tapes ?platyptycha Pilsbry, 1901	1,6,7,9,17,31,33,37
Tapes ?sericeus Matsukuma, 1986	6,13,14c,17,32a,35
Tapes ? sulcarius (Lamarck, 1818)	6,9,13,17,23,27,32b
Tapes (*Ruditapes*) sp.	2,5,13,14a,27,33
Tawera coelata (Menke, 1843)	1,21
Tawera laticostata (Odhner, 1917)	10,16,17,18,21,36a
Tawera subnodulosa (Hanley, 1844)	5,8,12,14a,14c,15a, 18,22,28a,30,32b, 36a,36b
Tawera ?torresiana (Smith, 1884)	22
Tawera sp.	8,12,15a,18,21,36a
Timoclea recognita (Smith, 1885)	1,10,16,21
Ventricolaria embrithes (Melvill & Standen, 1899)	7,9,16,17,22,24,29,35
Ventricolaria toreuma (Gould, 1846)	1,2,3,4a,4b,6,7,9,10, 17,19,20,22,24,25,27, 29,31,35
PETRICOLIDAE	
Mysia sp.	1,8,15b,17,18
Mysia sp.	22,8,12,15a,15b,18,36a
THRACIIDAE	
Thracia alciope Angas, 1872	8,12,14a,14c,15,15b,16, 17,18,28a,33,36a,37
CORBULIDAE	
Corbula ?stolata (Iredale, 1930)	5,8,11,12,15,18,36a
HIATELLIDAE	
Hiatella sp.	11
LATERNULIDAE	
Laternula sp.	8,15,14c,14e,28a,32b, 37
MYOCHAMIDAE	
Myodora sp.	8,12,14a,14b,14c,15a, 15b,18,22,28a,36a
CLAVAGELLIDAE	
Brechites ?australis Chenu, 1843	18,33,W9

GASTROCHAENIDAE	
Gastrochaena ? cuneiformis Spengler, 1783	32b
Gastrochaena sp.	4a,16
CEPHALOPODA	
OCTOPODIDAE	
Octopus ?cyaneus Gray, 1849	4b,6,7,20,25
SEPIIDAE	
Sepia papuensis	W1
Sepia pharonis Ehrenberg, 1837	W1
SCAPHOPODA	
DENTALIIDAE	
Dentalium sp.	11,17,28a,W6,W7
LAEVIDENTALIIDAE	
Laevidentalium n. sp.	4b,5,8,12,14a,14c,15a, 16,17,18,22,28,28a,36a, 37

CHAPTER 6. BRACHYURAN CRABS AND PALINURID LOBSTERS

P.F. Berry

SUMMARY

A total of 85 species of brachyuran crabs is recorded and 3 species of palinurid lobsters. Affinities are strongly Indo-West Pacific and compared with the nearshore Kimberley region and Ashmore Reef, the fauna is a rich one.

INTRODUCTION

The decapod fauna of the Montebello Islands was poorly collected and documented prior to the present survey. Mr P.D. Montague made a small collection of crustaceans in 1912 which was described by Rathburn (1914). The collection of the Western Australian Museum contains a small number of specimens from the Montebellos acquired from a variety of sources over the years.

Because the majority of decapod crustaceans are cryptic and difficult to capture, they have been less comprehensively sampled than other faunal groups in previous regional surveys by the Museum. They are therefore not as good as other groups for characterisation of faunal communities, and regional comparisons are limited in this case to the nearshore Kimberley and Ashmore Reef.

Although all decapod crustaceans were collected on the survey, emphasis was placed on brachyuran crabs and palinurid lobsters and only these are reported on here.

A total of 82 crabs and 3 rock lobster species is recorded. This compares with 92 crabs and 2 rock lobster species recorded from the nearshore Kimberley coast (Morgan 1992) and 55 crabs and 2 rock lobster species from Ashmore Reef by Morgan and Berry (1993).

Dominant groups were xanthorids (coral crabs) with 41 taxa and majids (spider crabs) with 12 taxa.

Two tropical rock lobster species, *Panulirus ornatus* and *Panulirus versicolor*, were recorded. Of these the later was most abundant, particularly in coral reef habitat. *P. ornatus* occurred mainly outside the reef.

Two specimens of the western rock lobster *Panulirus cygnus* were obtained together outside the western barrier reef. This record is well outside the normal range of this west coast endemic, the northern limit of its normal range being the southern extremity of the Ningaloo Reef tract.

DISCUSSION

Affinities of the fauna collected at the Montebellos are strongly Indo-West Pacific.

Comparison of the Montebellos brachyuran and palinurid fauna with faunas recorded from other tropical Western Australian regions is limited for reasons outlined above and also because the amount of collecting effort differed on different surveys. However, given that Ashmore Reef supports a particularly rich crustacean fauna and the nearshore Kimberley is a huge region in which a wide range of habitats were sampled over a six week period, the fauna recorded at the Montebellos, which is similar in species richness, appears to be a rich one. Xanthoids are particularly well represented while grapsids and ocypodids were surprisingly poorly represented, given the extensive intertidal habitat of both hard and soft substrates.

It is interesting to note that Rathburn (1914) recorded *Uca flammula* from the Montebellos. This species was not recorded in this survey, *Uca mjobergi* being the only fiddler crab collected. The exact collection locality of Rathburn's specimens is unknown, but it is possible that *U. flammula* no longer occurs at the Montebellos. The mangals are very simple structurally so that specific habitat requirements of

Uca species are limited.

LITERATURE CITED

Morgan, G.J. (1992). Part V. Decapod Crustaceans. *In*: G.R. Morgan (ed.) Survey of the Aquatic Fauna of the Kimberley Islands and Reefs, Western Australia. W.A. Museum Unpublished Report: 45-49.

Morgan, G.J. and Berry P.F. (1993). Part 5. Decapod Crustacea of Ashmore Reef and Cartier Island. *In*: P.F. Berry (ed.) Marine faunal surveys of Ashmore Reef and Cartier Island, Northwestern Australia. *Rec. West. Aust. Mus.*, Supplement (44): 47-51.

Rathburn, M.J. (1914). Stalk-eyed Crustaceans collected at the Monte Bello Islands. *Proc. Zool. Soc. Lond.* **11**: 653-664.

List of Brachyuran Crabs and Palinurid Lobsters collected at the Montebello Islands

Taxa	Station Number***
BRACHYURA Latreille, 1825	
DROMIACEA De Haan, 1839	
DROMIIDAE Alcock, 1899	
Cryptodromia sp.	4b,14b
OXYSTOMATA De Haan, 1841	
LEUCOSIIDAE Dana, 1852	
PHILYRINAE Rathbun, 1937	
Arcania undecimspinosa De Haan, 1839	22
LEUCOSIINAE Miers, 1886	
Leucosia annatum (Herbst, 1783)	18
Leucosia sp. 1	12
Leucosia sp. 2	18,28a
CALAPPIDAE Dana, 1852	
CALAPPINAE Alcock, 1896	
Calappa hepatica (Linnaeus, 1758)	14b,M
Calappa pustulosa Alcock, 1896	22
Matuta banksia Leach, 1871	M
Matuta sp.	M
HYMENOSOMATIDAE MacLeay, 1838	
Trigonoplax unguiformis (De Haan, 1839)	?
MAJIDAE Samouelle, 1819	
Ephippias endeavouri Rathbun, 1918	M
Huenia proteus (de Haan, 1839)	R
Hyastenus cornigerus Sakai, 1938	18,21,22
Hyastenus elongatus Ortmann, 1893	22,33
Hyastenus oryx (A. Milne Edwards)	R
Menaethius monceros (Latreille, 1825)	18,28a
Micippa philyra (Herbst, 1803)	14b,36a
Paranaxia serpulifera (Guerin, 1829)	R
Schizophrys aspera (H. Milne Edwards, 1834)	25,30
Schizophrys dama (Herbst, 1804)	R
Tiarinia angusta Dana, 1852	33
Tiarinia cornigera (Latreille, 1825)	16

* M = Museum collection
R = recorded by Rathburn (1914)

PARTHENOPIDAE Miers, 1879
PARTHENOPINAE Miers, 1879
Daldorfia horrida (Linnaeus, 1758) 2
Parthenope diacanthus De Haan, 1839 18,22
Parthenope (Rhinolambrus) pelagicus (Ruppell, 1830) R

ATELECYCLIDAE Ortmann, 1893
THIINAE Alcock, 1899
Kraussia nitida Stimpson, 1858 8

PORTUNIDAE Rafinesque, 1815
CAPHYRINAE Alcock, 1899
Lissocarcinus orbicularis Dana, 1852
Lissocarcinus laevis Miers, 1886 22

PORTUNINAE Stephenson and Campbell, 1960
Charybdis (Charybdis) orientalis Dana, 1852 10
Portunus (Xiphonectes) hastatoides (Fabricius, 1798) 16
Portunus sp. 1 14b,22
Portunus sp. 2 15,21,22
Scylla serrata (Forskal, 1755) 14b
Thalamita crenata (H. Milne Edwards, 1834) 14a
Thalamita dispar (Rathbun, 1914) R
Thalamitoides quadridens A. Milne Edwards, 1869 14a,14b,16

XANTHIDAE
XANTHINAE
Atergatis floridus (Linnaeus, 1767) 4b,14b,R
Carpilius convexus (Forskal, 1775) 4b,20,25
Demania scaberrima (Walker, 1887) 14b
Liomera laevis (A. Milne Edwards, 1873) 20
Liomera ruber (A. Milne Edwards, 1865) R
Liomera rugata (H. Milne Edwards, 1834) 4b
Liomera sp. 1 14b,29,33
Lophozozymus sp. 2
Macromedaeus distinguendus (De Haan, 1835) 32
Neoxanthias impressus (Lamarck, 1818) 4b,20,25,32
Platypodia granulosa (Ruppell, 1830) 33,R
Ralumia sp. 9
Xanthias elegans (Stimpson, 1858) 14b,20,25,R
Xanthias cf jacquelinae R
Xanthias lamarcki (H. Milne Edwards, 1834) 14b
Xanthias lividus (Lamarck, 1818) 14b
Xanthias samoensis Ward, 1939 29
Zosymus aeneus (Linnaeus, 1758) 4b,20,28

ACTAEINAE Alcock, 1898	
Actaea amoyensis (de Man, 1879)	22
Actaea cavipes (Dana, 1852)	14b,R
(= *Glyptoxanthus cymbifer* Rathbun, 1914)	
Actaea glandifera Rathbun, 1914	R
Actaea polyacantha (Heller, 1861)	14a,14b
Actaea savignyi (H. Milne Edwards, 1834)	33
Actaeodes areolatus (Dana, 1852)	4b,14b,20,25
Actaeodes semoni (Ortman, 1894)	14b
Actaeodes sp. 1	2
Actaeodes sp. 2	2
CHLORODINAE Alcock, 1898	
Chlorodiella laevissima (Dana, 1852)	35
Cymo deplanatus A. Milne Edwards, 1873	4b
Cymo sp.	6
Etisus demani Odhner, 1925	2
Phymodius ungulatus (H. Milne Edwards, 1834)	R
Pilodius areolatus (H. Milne Edwards, 1834)	33,R
MENIPPINAE Ortmannm, 1893	
Eriphia scabricula (Dana, 1852)	4b,26
Eriphia sebena Shaw and Nodder, 1803	26,M, Hermite I.
PILUMNINAE Ortmann, 1893	
Actumnus setifer (de Haanm 1835)	R
Pilumnus caerulescens (A. Milne Edwards, 1873)	R
Pilumnus orbitospinis Rathburn, 1911	26
Pilumnus vespertillio (Fabricius, 1793)	14a,14b,R
TRAPEZIINAE Miers, 1886	
Tetralia glaberrima (Herbst, 1790)	4b,6,20,30
Trapezia cymodoce (Herbst, 1790)	24,33
OCYPODIDAE Ortmann, 1894	
OCYPODINAE Dana, 1851	
Ocypode ceratophthalma (Pallas, 1772)	5
Ocypode cordiana Latreille, 1818	5
Uca flammula Crane, 1975	R
Uca mjoebergii Crane, 1975	37
MICTYRIDAE Dana, 1851	
Mictyris longicarpus (Latreille, 1806)	R
GRAPSIDAE Dana, 1851	
GRAPSINAE Dana, 1851	
Grapsus albolineatus Lamarck, 1818	5,14b

Metograpsus thukuhar (Owen, 1893) 14b

PLAGUSIINAE Dana, 1851
Percnon planissimum (Herbst, 1804) 25

PALINURIDAE
Panulirus cygnus George, 1962
Panulirus ornatus (Fabricius, 1798)
Panulirus versicolor (Latreille, 1804)

CHAPTER 7. ECHINODERMS

L.M. Marsh

SUMMARY

The echinoderm fauna of the Montebello Islands includes species characteristic of the coastal and shelf fauna together with widespread Indo-West Pacific coral reef species. The diversity of habitats and hydrological conditions provided by the geographical complexity of the island group also contribute to the faunal richness of the islands. A total of 170 species is recorded from the present study and the WA Museum collections. This total in comparable to that recorded from the Houtman Abrolhos, where the fauna is a mixture of tropical and temperate species and close to that of Ashmore Reef, which also has elements of "mainland" and "reef" species besides being closer to the central Indo-west Pacific area of greatest species richness. Ashmore Reef with 178 species recorded has the most speciose echinoderm fauna of any area of Western Australia. Several species found at the Montebellos are believed to be new records for Australia and a few may represent undescribed species.

INTRODUCTION

There has been no previous study of the echinoderms of the Montebello Islands apart from a brief visit by the author in 1979 during which 26 species were recorded. During the present survey 164 species were found including all but six of those taken in 1979, making a total of 170 species recorded for the islands.

Samples were collected from as many habitats as possible, by SCUBA, snorkelling, low tide collecting from reefs and sand flats and by dredging where practicable, a total of 45 stations. These are listed in Part 1, Table 1 and indicated on the map. Species readily identified underwater were not collected and are listed as visual records (V).

DISCUSSION

The echinoderm fauna of the Montebello islands is rich in species, compared with most other areas in W.A. and is numerically comparable to that of the Houtman Abrolhos, and close to that of Ashmore Reef where the species richness is highest of any area studied in W.A. A comparison of species numbers for the five classes of echinoderms at the Montebellos with those recorded from other coral reef areas in W.A. is given in Table 1. The Barrow Island data is based on results of the WA Museum-USNM Barrow Island Expedition (1966) and collections made by Dr L. Hammond in 1974. Since the collections were made incidentally to other studies they are probably less complete than the Montebello collection. However the Barrow Island fauna is expected to be considerably less rich than that of the Montebellos because of the lack of extensive coral reefs and the less diverse habitats provided by the less complex geography of the island. Most of the species are in common with the Montebellos. No data is available for the Lowendal Islands and no compilation of data has been made for the Dampier Archipelago, which also lacks high energy seaward reefs.

Table 1. A comparison of the number of echinoderm species recorded from the Montebellos Islands with those from other coral reef areas in Western Australia.

Taxa	Montebellos	Barrow	Ashmore	Rowley/Scott	Ningaloo	Abrolhos
Crinoidea	26	3	38	17	16	28
Asteroidea	22	16	28	23	22	45
Ophiuroidea	54	10	42	42	26	40
Echinoidea	28	11	23	22	18	26
Holothurioidea	40	20	47	28	22	33
Total	170	60	178	132	104	172

For comparison, the Royal Society-Universities of Queensland Expedition to the Northern Region of the Great Barrier Reef, Queensland, which sampled coral reefs, sand flats, and dredged to a depth of *c.* 60 metres found only 140 species of echinoderms (Gibbs, Clark and Clark 1976). The geographical complexity of the Montebellos Islands and reefs and the range of environmental conditions from high energy coral reefs and channels between the islands subjected to strong tidal

currents to totally sheltered conditions in enclosed lagoons provides a diversity of habitats and substrate types unmatched in any other island group in Western Australia.

The Houtman Abrolhos islands are somewhat comparable in habitat complexity to the Montebellos but lack the strong tidal currents between islands. The Abrolhos fauna, comparable in species numbers with that of the Montebellos, is enhanced by the overlap of tropical and temperate species in its marginal position at the southern limit of coral reefs.

The Montebellos echinoderm fauna is composed entirely of tropical species although some of these range into temperate waters.

Comments on the five echinoderm classes follow.

Crinoidea. Feather stars were common in most habitats with species of *Comanthus, comatula* and *Stephanometra* predominating on reef flats, the robust black *Tropiometra afra* on high energy outer reef slopes and the large multi-armed *Comanthina* spp. on more sheltered outer reef areas and inter island channels.

Small Colobometrids and Antedonids are mostly commensal on sponges, algae and gorgonians.

Asteroidea. Sand substrates, both intertidal and deeper are characterised by *Luidia, Astropecten* and *Archaster* all of which bury themselves under the surface. The large oreasterid, *Protoreaster nodulosus* is found on slightly deeper sandy areas while the goniasterid *Stellaster* favours muddy sand.

The blue *Linckia laevigata,* common on most tropical reefs, was only seen at three sites. This species is common on Ningaloo Reef but is not found at Dampier, apparently favouring clear water reefs. *Nardoa galatheae* was the most commonly seen reef species, also found on sand among reefs. *Tamaria tumescens* and

Thromidia catalai, both regarded as continental shelf species, were found outside the reefs.

An unidentified species of *Asterina*, probably undescribed, was found among mangroves in one of the inner lagoons. The coral predator, *Acanthaster planci* is not common at the Montebellos and was seen at only five of the 45 sites.

Ophiuroidea. The rich brittle-star fauna consists of relatively few coral reef species but many sand dwelling species and species commensal with other echinoderms, gorgonians, sponges and algae. A number of species remain to be determined and some may be undescribed. A small ophiurid, *Dictenophiura stellata*, was common at four of the nine dredge sites on clean sand substrates.

Echinoidea. Common coral reef species such as *Echinometra mathaei, Tripneustes gratilla, Diadema* spp. and *Echinothrix* spp. were not as common on the Montebello Reefs as on other coral reefs in W.A. A rich fauna of sand dwelling species (sand dollars and heart urchins) was found, including a rare species, *Pseudomaretia interrupta*, endemic to north-western Australia.

Holothurioidea. Typical coral reef species such as *Actinopyga* and *Bohadschia* spp. were not common but *Holothuria atra* and *H. cinerascens* were found at most sites. No *Holothuria* (*Microthele*) species (teat fish) or *Thelenota* spp. were found. These are favoured commercial species on northern reefs.

Several species may represent new records for Australia, but their identity remains to be confirmed.

Overall the echinoderm fauna of the Montebello Islands includes elements of the endemic north-western Australian coastal and shelf fauna together with some of the offshore reef species, widespread through the Indo-West Pacific.

MANAGEMENT AND CONSERVATION

The Montebello Islands and reefs are periodically subjected to severe environmental perturbations from cyclones, while anecdotal evidence suggests there has also been severe predation of corals by the crown-of-thorns starfish (*Acanthaster planci*) in the past, probably early in the 1970s.

All five of the sites where *A. planci* was found in 1993 are in the southern part of the Montebellos and four of these, where most of the individuals were seen, were on the chain of reefs east of the south end of Hermite Island (stns 24, 30, 31 and 35). Numbers observed on one dive by one diver ranged from four (stn 30) to 16 (stn 31). While these numbers are fairly low there is potential for a population explosion on the southern reefs.

Areas less likely to be disturbed by natural events are the lagoons and channels between the islands. These contain the most interesting faunal elements including many species commensal with sponges and gorgonians. It is recommended that these areas be protected from trawling or any other activity that may disturb the habitat.

LITERATURE CITED

Gibbs, P.E., Clark, A.M. and Clark, C.M. (1976). Echinoderms from the northern region of the Great Barrier Reef, Australia. *Bull. B.M. (N.H.)*, Zoology. **30(4):** 102-144.

List of Echinoderms collected at the Montebello Islands

Taxa	Station Number****
CRINOIDEA	
COMASTERIDAE	
Comanthina nobilis (Carpenter, 1884)	32a
Comanthina variabilis (Bell, 1882)	2,9,10,23
Comanthina sp.	6
Comanthus gisleni Rowe *et al.*, 1986	3,23,27,31,32a
Comanthus parvicirrus (Müller, 1841)	1,6,9,24,27,30,33,35V
Comanthus wahlbergi (Müller, 1843)	4b,9,23,27
Comanthus sp. (juv.)	30
Clarkcomanthus littoralis (Carpenter, 1888)	1,3,6,10
Comatella maculata (Carpenter, 1888)	1,4b,20,23
Comatella stelligera (Carpenter, 1880)	20
Comatula purpurea (Müller, 1843)	4b,9,20,33
Genus and sp. indet. (juv.)	27,29
IMEROMETRIDAE	
Himerometra robustipinna (Carpenter, 1881)	32a
Himerometra magnipinna A.H. Clark, 1908	28a
MARIAMETRIDAE	
Lamprometra palmata (Müller, 1841)	12,14c,22,28a
Lamprometra klunzingeri (Hartlaub, 1890)	12
Stephanometra indica (Smith, 1876)	1,2,6,20
Stephanometra spicata (Carpenter, 1881)	1,2,6,7,20
Genus and sp. indet. (juv.)	36a
COLOBOMETRIDAE	
Oligometra carpenteri (Bell, 1884)	9,33
Oligometrides adeonae (Lamarck, 1816)	5,21,28a,32b,36a
Petasometra clarae (Hartlaub, 1890)	32a,33,35
TROPIOMETRIDAE	
Tropiometra afra (Hartlaub, 1890)	3,9,23V,27
ANTEDONIDAE	
Dorometra nana (Hartlaub, 1890)	27,30
Dorometra parvicirra (Carpenter, 1888)	32a

** M = Museum collection
V = Visual

Dorometra mauritiana (A.H. Clark, 1909)	30
Dorometra cf. *aegyptica* (A.H. Clark, 1911)	32a
Antedon sp.	M
ASTEROIDEA	
LUIDIIDAE	
Luidia maculata Müller and Troschel, 1842	5,14c,21,32bV
ASTROPECTINIDAE	
Astropecten vappa Müller and Troschel, 1843	14a,14c,22,32b,36a,36bV
ARCHASTERIDAE	
Archaster angulatus Müller and Troschel, 1842	12,14cV,15a,15b,22V, 32bV,36a
GONIASTERIDAE	
Stellaster equestris (Retzius, 1805)	8,32b
Goniodiscaster sp.	M
OREASTERIDAE	
Culcita schmideliana (Retzius, 1805)	2V,6V,9V,20,29V,31V,33V, 37V
Gymnanthenea globigera (Döderlein, 1915)	2V,13,27,29V
Protoreaster nodulosus (Perrier, 1876)	5,6V,17V
OPHIDIASTERIDAE	
Fromia indica (Perrier, 1869)	1,6V,9,20,24V,27V,30V,31V
Hacelia helicosticha (Sladen, 1889)	M
Linckia guildingi Gray, 1840	2V,6V,25V,29V
Linckia laevigata (Linnaeus, 1758)	19V,20V,23
Linckia multifora (Lamarck, 1816)	1,2V,4aV,4bV,6V,9,27V, 30V
Nardoa galatheae (Lütken, 1864)	1,2V,3V,4aV,4bV,6V,9, 10V,19V,20V,24,25V,29V, 35V
Ophidiaster granifer (Lütken, 1872)	20
Tamaria tumescens (Koehler, 1910)	9,23
MITHRODIIDAE	
Thromidia catalai Pope and Rowe, 1977	9
ASTERINIDAE	
Asterina n. sp.	13
Nepanthia belcheri (Perrier, 1875)	32b
ACANTHASTERIDAE	
Acanthaster planci (Linnaeus, 1758)	24V,30V,31V,35V

ECHINASTERIDAE	
Echinaster luzonicus (Gray, 1840)	1,2V,4aV,4bV,6V,7V,9V, 19V,20V,30V,31V
Echinaster varicolor H.L. Clark, 1938	2V,10V,30V,33,35V
OPHIUROIDEA	
OPHIOMYXIDAE	
Ophiomyxa australis Lütken, 1869	2,27
AMPHIURIDAE	
Amphioplus (*Unioplus*) cf *repositus* Koehler, 1905	16
Amphioplus (*Unioplus*) sp.	22
Amphipholis squamata (Delle Chiaje, 1828)	14b,17,24
cf. *Amphipholis* sp.	22
Amphiura leucaspis H.L. Clark, 1938	1,8,12
Amphiura septemspinosa H.L. Clark, 1915	27
Amphiura (*Fellaria*) *octacantha* H.L. Clark, 1915	8,9,12,15a,15b
Amphiura sp.	8,11,16,22
Ophiocentrus sp.	11
OPHIACTIDAE	
Ophiactis maculosa Von Martens, 1870	11
Ophiactis savignyi (Müller and Troschel, 1842)	1,2,4b,6,7,9,11,16,17,22, 24,27,35
Ophiactis sp. 1	16
Ophiactis sp. 2	1,9,11,22,28a
Ophiactis sp. 3	8
Ophiactis sp. 4	17
OPHIOTRICHIDAE	
Gymnolophus obscura (Ljungman, 1867)	23,27,32a
Macrophiothrix caenosa Hoggett, 1991	2,4b,9,20,25,27
Macrophiothrix callizona H.L. Clark, 1938	4b
Macrophiothrix megapoma H.L. Clark, 1938	4b,7,9,20
Macrophiothrix paucispina Hoggett, 1991	13,14a,14c,29
Macrophiothrix cf. *variabilis* (Duncan, 1887)	25
Ophiothrix ciliaris (Lamarck, 1816)	2,4b,6,7,9,10,12,14a,17,24, 26,30,32a,33
Ophiothrix exigua Lyman, 1874	1,2,7,8,9,11,17,22,24,27,28a
Ophiothrix cf. *echinotecta* Balinsky, 1957	1,9,11,17
Ophiothrix miles Koehler, 1905	1
Ophiothrix sp. aff. *miles* Koehler, 1905	1,7,9,14a,17,26,32a,33
Ophiothrix spp.	1,9,11,14a,17,24
Ophiothrix (*Keystonea*) *martensi* Lyman, 1874	4b,8,9,10,23,24,25,28a, 29,30,33
Ophiothrix (*Keystonea*) *smaragdina* Studer, 1883	1,7,8,9,10,28

Ophiothrix (Placophiothrix) lineocaerulea H.L. Clark, 1928	9,22,33
Ophiothrix (Placophiothrix) melanosticta (Grube, 1868)	8,9,28a
Ophiogymna elegans Ljungman, 1867	30
Ophiothela danae Verrill, 1869	1,6,7,17,28a,32a,33
Ophiomaza cacaotica Lyman, 1871	6,10,23,32a
OPHIOCOMIDAE	
Ophiocoma dentata Müller and Troschel, 1842	2,3,4b,10,20,27,28b,29
Ophiocoma pusilla (Brock, 1888)	27
Ophiomastix mixta Lütken, 1869	2,4b,20,24,27,29,30,31,35
Ophiomastix variabilis Koehler, 1905	2
OPHIONEREIDIDAE	
Ophionereis dubia (Müller and Troschel, 1842)	5,6,14c,17,29,32b
Ophionereis semoni (Döderlein, 1896)	11,16,22,29
Ophionereis intermedia A.M. Clark, 1953	4b,8,16,20,25
Ophionereis sp.	4b,10
OPHIODERMATIDAE	
Ophiarachna affinis Lütken, 1869	1,2
Ophiarachnella gorgonia (Müller and Troschel, 1842)	2,4b,6,9,20,23,27,29
Ophiarachnella infernalis (Müller and Troschel, 1842)	6
Ophiochasma stellatum (Ljungman, 1867)	5,8,18,32b
Ophiopeza spinosa (Ljungman, 1867)	20
Ophioconis cincta Brock, 1888	9,33,35
Cryptopelta granulifera H.L. Clark, 1909	20
OPHIURIDAE	
Dictenophiura stellata (Studer, 1882)	5,8,12,18,22,28a
Ophiolepis unicolor H.L. Clark, 1938	4b,9
Ophioplocus imbricatus (Müller and Troschel, 1842)	2,3,10,14a,25,29
Ophiuroid family indet.	22,32a
ECHINOIDEA	
CIDARIDAE	
Phyllacanthus longispinus (Mortensen, 1918)	1V,6V,17V,24V,27, 30,31V,35V,37V
Prionocidaris baculosa (Lamarck, 1816)	9
DIADEMATIDAE	
Diadema savignyi Michelin, 1845	1V,2V,6V,19V,35V,37V
Diadema setosum (Leske, 1778)	1V,2V,19V,24V,29V, 30V,31V,35V
Echinothrix calamaris (Pallas, 1774)	1V,20V,27

ECHINOTHURIIDAE	
Paraphormosoma sp.	M
TEMNOPLEURIDAE	
Salmacis sphaeroides (Linnaeus, 1758)	M
Temnotrema bothryoides L. Agassiz, 1846	8,12,18
TOXOPNEUSTIDAE	
Nudechinus darnleyensis (Tenison Woods 1878)	10,18,21,22,36a
Nudechinus scotiopremnus H.L. Clark, 1912	4b,8,12,14b,14d,15b,16,18
Tripneustes gratilla (Linnaeus, 1758)	1V,2V,3V,5V,20V,23V, 25V,29V,30V
ECHINOMETRIDAE	
Echinometra mathaei (de Blainville, 1825)	20,25V,29V
Echinostrephus molaris (de Blainville, 1825)	1V,2V,24V,25V,29V,35V
Heterocentrotus mammillatus (Linnaeus, 1758)	1
ECHINONEIDAE	
Echinoneus cyclostomus Leske, 1778	4b,17,25
CLYPEASTERIDAE	
Clypeaster telurus H.L. Clark, 1914	36a
ARACHNOIDIDAE	
Arachnoides tenuis H.L. Clark, 1938	21
FIBULARIIDAE	
Echinocyamus planissimus H.L. Clark, 1938	9,12,15b,36a
Fibularia sp.	M
LAGANIDAE	
Peronella lesueuri (Agassiz, 1841)	32b
Peronella orbicularis (Leske, 1778)	5,8,10,12,13,14a,14b, 14c,15a,15b,17,18,19, 22,28a,32b,36a
Peronella tuberculata Mortensen, 1918	5,8,14a,14b,14c,15,18, 22,28a,32b,36a,36b,37
SCUTELLIDAE	
Echinodiscus auritus Leske, 1778	22
ECHINOLAMPADIDAE	
Echinolampas ovata (Leske, 1778)	22,36a

SPATANGIDAE

Pseudomaretia cf. *interrupta* (Studer, 1880)	23

LOVENIIDAE

Breynia desorii Gray, 1851	5,8,12,15a,15b,18,22,28a, 32b,36a
Lovenia elongata (Gray, 1845)	22,36a

BRISSIDAE

Rhynobrissus hemiasteroides A. Agassiz, 1879	28a

HOLOTHURIOIDEA

HOLOTHURIIDAE

Actinopyga echinites (Jaeger, 1833)	2V,6V,10V,14dV,20V, 25V,29V,32bV
Actinopyga mauritiana (Quoy and Gaimard, 1833)	20
Actinopyga sp.	2
Bohadschia argus Jaeger, 1833	19,29V
Bohadschia marmorata Jaeger, 1833	28a
Labidodemas semperianum Selenka, 1867	9,27
Holothuria (*Halodeima*) *atra* Jaeger, 1833	2,3,4bV,5V,6V,9,14dV,17V, 19V,20V,23V,25V,29V,30V, 33V,35V,37V
Holothuria (*Halodeima*) *edulis* Lesson, 1830	1V,2,4aV,6V,17V,19V,29V, 30V,33V,35V,37V
Holothuria (*Lessonothuria*) *lineata* Ludwig, 1875	13,14a,14b,14d
Holothuria (*Mertensiothuria*) *leucospilota* (Brandt, 1835)	6V,9V,14dV,29V
Holothuria (*Mertensiothuria*) sp.	19
Holothuria (*Metriatyla*) *ocellata* Jaeger, 1833	12
Holothuria (*Metriatyla*) *scabra* Jaeger, 1833	1,6,10
Holothuria (*Platyperona*) *difficilis* Semper, 1868	6,20
Holothuria (*Semperothuria*) *cinerascens* (Brandt, 1835)	4a,4bV,6,14b
Holothuria (*Stauropora*) *fuscocinerea* Jaeger, 1833	7
cf. *Holoturia* (*Stauropora*) *imitans* Ludwig, 1875	6,20
Holothuria (*Thymiosycia*) *arenicola* Semper, 1868	4a
Holothuria (*Thymiosycia*) *hilla* Lesson, 1830	1V,2V,6V,27V,29V,30V
Holothuria (*Thymiosycia*) *impatiens* (Forskal, 1775)	2,4b,6,14a,14b,14d,20,33, 36b
Holothuria (*Thymiosycia*) sp.	2,20,30
Holothuria (*Theelothuria*) *michaelseni* Erwe, 1913	8,15b,36aV

STICHOPODIDAE

Stichopus chloronotus Brandt, 1835	2,4bV,5V,6V,10V,20V, 25V,29V
Stichopus horrens Selenka, 1867	1,2,4a,7
Stichopus variegatus Sempter, 1868	1V,2V,4aV,6V,17,19V,33V

Stichopus ap.	2,37
CUCUMARIIDAE	
Pentacta anceps (Quoy and Gaimard, 1833)	28a
Pentacta cf. *australis* (Ludwig, 1874)	16
Pentacta crassa (Ekman, 1918)	22
Pentacta sp.	33
Pseudocolochirus violaceus (Théel, 1886)	32a
Staurothyone distincta H.L. Clark, 1938	2,29
Stolus buccalis (Stimpson, 1855)	33
PHYLLOPHORIDAE	
Afrocucumis africana (Semper, 1868)	29
Cladolabes acicula (Semper, 1868)	25
cf. *Ohshimella ehrenbergi* (Selenka, 1867)	6
SYNAPTIDAE	
Protankyra sp.	12
Synapta maculata (Chamisso and Eysenhardt, 1821)	19
Synaptula Sp. 1	30
Synaptula Sp. 2	28a, 30
Synaptula Sp. 3	14b,14c

CHAPTER 8. FISHES

Gerald R. Allen

SUMMARY

A total of 457 species in 76 families are reported from the Montebellos Islands. *Doryrhamphus multiannulatus* and *Phoxocampus belcheri,* both in the pipefish family Syngnathidae, represent new records for Australia.

The overall fish fauna is typical of reef areas of the mid-continental shelf of north-western Australia. It is relatively impoverished compared to more oceanic offshore areas such as Rowley Shoals and Scott Reef, but in common with these localities, the fish community has strong affinities to the tropical Indo-Pacific fauna.

INTRODUCTION

Australia possesses one of the world's largest marine fish faunas with an estimated total of 3,500 species. Its great wealth of species is considerably enhanced by a favourable geographic position, spanning 35 degrees of latitude and therefore including very distinctive tropical and temperate elements, not too mention a host of species that are endemic to transitional latitudes. The Great Barrier province of Queensland is particularly rich, accounting for nearly 50 percent of the species total. Although coral reefs are far less extensive along Australia's western coast, there nevertheless exists a substantial fish fauna associated with this habitat.

The Montebellos survey helps to fill an important gap in our knowledge of the State's tropical marine fish fauna. In spite of previous collecting activity at the Abrolhos Islands, Ningaloo Reef, Dampier Archipelago, and the Kimberley coast, there remains a genuine and somewhat urgent need for detailed faunal information from areas on the mid-continental shelf. Although a few token collections were obtained in the past, the present expedition is the first concentrated effort to thoroughly document the fishes of the Montebello Islands.

Visual censusing was the primary method employed during this survey. The name of every fish that was encountered during snorkeling and SCUBA dives were recorded on waterproof paper. The author draws on nearly 30 years of experience with Indo-Pacific fishes, therefore all but a few species were recognizable. The small number of doubtful species were excluded from the final list. In order to sample the cryptic fauna 20 collections were made at different sites in a variety of habitat conditions . Specimens were obtained mainly with the use of rotenone powder (a chemical ichthyocide), but a few were also procured with dipnets, by hand during reef walks, and by angling. Several records are based on underwater photographs taken by Clay Bryce.

SPECIES COMPOSITION AND ZOOGEOGRAPHIC RELATIONSHIPS

The fish fauna of the Monte Bello Islands consists primarily of species associated with coral reefs. The most abundant families are summarised in Table 1. The 10 most speciose groups (Gobiidae, Labridae, Pomacentridae, Blenniidae, Apogonidae, Serranidae, Chaetodontidae, Carangidae, Lutjanidae, and Acanthuridae) account for 54 percent of the total fauna. These families are typically abundant throughout the tropical Indo-Pacific region.

The Montebello's fauna is similar, but slightly richer in species than the more inshore Dampier Archipelago. Both of these locations are influenced by relatively heavy siltation and consequent reduced underwater visibility. The large tidal magnitude and resultant currents are largely responsible for this phoenomena. The following species totals have been recorded for other north-western localities: Ningaloo Reef - 500; Rowley Shoals - 550, Kimberley coast - 330. In terms of faunal richness the Monte Bellos are intermediate to the runoff and tidal affected reefs of Kimberleys and the pristine offshore reefs, such as Rowley Shoals. Ningaloo has a richer fish fauna than coastal and midshelf reefs to north. Its higher species total is explained by the arid climate and resultant low runoff from the adjacent land, a smaller tidal fluctuation, and proximity to the edge of the continental shelf, resulting in more oceanic conditions.

MANAGEMENT AND CONSERVATION

The Montebellos region does not appear to represent a haven for any potential threatened or endangered fish species. Most of the species, with the exception of a few north-west regional endemics, have relatively wide distributions in the Indo-west Pacific region. Nearly all species have either pelagic eggs or larvae and are therefore recruited as juveniles from areas outside the Monte Bello Islands.

Despite a lack of any special species worthy of protection, the Monte Bellos Islands, like all other areas has a unique combination of species or community that is worthy of preserving. I was extremely impressed with the overall abundance of fishes in comparison with other areas along the WA coast. Large predators were particularly well represented. I have had considerable diving experience throughout northern Australia, including nearly 300 hours on the Great Barrier Reef. I cannot recall any locality which could match the Montebellos as far as abnndance of coral trout (*Plectropomus* spp.) large sweetlips (*Plectorhinchus schotaf* and *P. gibbosus*) and tuskfish (*Choerodon* spp.) are concerned. In addition, I witnessed unusual and spectacular aggregations of stingrays (*Dasyatis* and *Himantura*), emperors (*Lethrinus*), and monocle bream (*Scolopsis bilineatus*).

The abundance of fishes at the Montebellos is probably a direct reflection of its isolation and resultant low fishing pressure. Relatively few boats are equipped for the long run from the mainland. In my opinion the unique overall community of fishes and its abundant nature are well worth conserving and to this end it would be desirable to establish this area as a marine conservation reserve.

LITERATURE CITED

Allen, G.R. and Swainston, R. (1988). *The marine fishes of north-western Australia.* Perth: Western Australian Museum 201 pp.

Fricke, R. (1983). *Revision of the Indo-Pacific genera and species of the dragonet family Callionymidae (Teleostei).* Braunschweig: Verlag Von J. Cramer 774 pp.

List of fishes collected at the Montebello Islands

The following list includes all fishes thus far recorded from the Montebello Islands or seas immediately adjacent to this group. The majority of these were recorded during the 1993 expedition and a 5-day trip by the author in 1983, but the list also includes specimens from various other sources now lodged in the WAM collection.

The general arrangement of taxa follows Nelson (1984) with slight modification. Genera and species are listed alphabetically within families and genera respectively. Most of the species are illustrated and briefly described in Allen and Swainston (1988).

The initial A (abundant), C (common), O (occasional), and R (rare) refer to general abundance of the species that were collected or observed during the 1993 survey. Abundant species were represented by hundreds of individuals on most dives provided that suitable habitat existed. Common species were also seen on most dives in relatively substantial numbers. Occasional species were seen spasmodically, not necessarily on every dive and in relatively low numbers. Rare species are those in which fewer than five individuals (in most cases only one or two) were observed or collected during all combined dives.

Numbers appearing after the species author names refer to station numbers during the 1993 survey (details provided elsewhere in this report). An M indicates that specimens from the Montebello Islands are deposited in the fish collection at WAM. Species that are accompanied by an M, but without station numbers were collected by other sources prior to the 1993 expedition.

Taxa	Station Number*****
DASYATIDIDAE	
Dasyatis kuhlii (Müller and Henle, 1841)	13 [O]
Dasyatis sephen (Forsskål, 1775)	13 [O]
Himantura granulata (Macleay, 1883)	13 [O]
Himantura uarnak (Forsskål, 1777)	13 [O]
Taeniura lymma (Forsskål, 1775)	7 [O]
MOBULIDAE	
Manta birostris	35 [R]
RHYNCHOBATIDAE	
Rhinobatos sp.	37 [R]
Rhynchobatus djiddensis (Forsskål, 1775)	M
CARCHARHINIDAE	
Carcharhinus melanopterus (Quoy and Gaimard, 1824)	25 [O]
Loxodon macrorhinus Müller and Henle, 1839	M
Rhizoprionodon acutus (Rüppell, 1837)	M
HEMIGALEIDAE	
Triaenodon obesus (Rüppell, 1837)	30 [R]
ORECTOLOBIDAE	
Eucrossorhinus dasypogon (Bleeker, 1867)	17 [R]
Hemiscyllium trispeculare Richardson, 1843	20,25 [O]
Stegostoma fasciatum (Hermann, 1783)	19 [R]
OPHICHTHIDAE	
Callechelys catostoma ?(Bloch and Schneider, 1801)	M 28
Myrichthys colubrinus (Boddaert, 1781)	36b
Ophichthus melanochir Bleeker, 1864	M 13
Ophichthus sp.	M 29
MURAENIDAE	
Echidna nebulosa (Thunberg, 1789)	M 25 [R]
Gymnothorax eurostus (Abbott, 1861)	M 34 [R]
Gymnothorax flavimarginatus (Rüppell, 1830)	M
Gymnothorax javanicus (Bleeker, 1859)	7,17,35 [O]
Gymnothorax undulatus (Lacepede, 1803)	M 37 [R]

*** A = abundant C = common
O = occasional R = rare
M = Museum collection

Gymnothorax sp.	M 14b
Siderea picta (Ahl, 1789)	29 [O]
Siderea thrysoideus (Richardson, 1845)	M 27,29,32a,33,37 [O]
CONGRIDAE	
Conger cinereus Rüppell, 1830	M 28,29,32b [O]
CLUPEIDAE	
Spratelloides delicatulus (Bennett, 1831)	M 7,19,29,36b [A]
PLOTOSIDAE	
Paraplotosus albilabris (Valenciennes, 1840)	M 36b [O]
Paraplotosus sp.	M 27,29,30 [O]
Plotosus lineatus (Thunberg, 1791)	M 6,19,32b [C]
SYNODONTIDAE	
Synodus variegatus (Lacepede, 1803)	M 7,19,20,29,30,31,35 [O]
HARPADONTIDAE	
Saurida gracilis (Quoy and Gaimard, 1824)	M 37 [O]
Saurida undosquamis (Richardson, 1848)	M
BATRACHOIDIDAE	
Halophryne diemensis (Lesueur, 1824)	M 33 [R]
BYTHITIDAE	
Brosmophyciops sp.	M
Ogilbia sp.	M 17 [R]
HEMIRHAMPHIDAE	
Euleptorhamphus viridis (van Hasselt, 1823)	4a [O]
Hemiramphus far (Forsskål, 1775)	4a [O]
BELONIDAE	
Tylosurus gavialoides (Castelnau, 1873)	32 b [O]
Tylosurus crocodilis (Leseur, 1821)	M
ATHERINIDAE	
Atherinomorus endrachtensis (Quoy and Gaimard, 1824)	M 13,37 [A]
Atherinomorus ogilbyi (Whitley, 1930)	M 29 [C]
Craterocephalus capreoli Rendahl, 1922	M 13,37 [A]
HOLOCENTRIDAE	
Myripristis berndti Jordan and Evermann, 1905	M 34,35 [O]
Myripristis hexagona (Lacepede, 1802)	M 17 [C]

Myripristis kuntee Cuvier, 1831	35 [O]
Myripristis violacea Bleeker, 1851	M 17,31,34 [O]
Sargocentron rubrum (Forsskål, 1775)	M 7,19,30,31,35,36b [C]
Sargocentron punctatissimum (Cuvier, 1829)	M 26 [O]
AULOSTOMIDAE	
Aulostomus chinensis (Linnaeus, 1766)	35 [R]
FISTULARIIDAE	
Fistularia commersonii Rüppell, 1838	29,32b,36b [O]
SYNGNATHIDAE	
Campichthys tricarinatus Dawson, 1977	M
Choeroichthys brachysoma (Bleeker, 1855)	M 17,24 [R]
Doryrhamphus janssi (Herald and Randall, 1972)	M
Doryrhamphus multiannulatus (Regan, 1903) [photo] new record Australia	[R]
Festucalex scalaris (Günther, 1870)	M 28,36 [R]
Halicampus brocki (Herald, 1953)	M
Halicampus nitidus (Günther, 1873)	M 17 [R]
Phoxocampus belcheri? (Kaup, 1856) new record for Australia [R]	M 29
SCORPAENIDAE	
Dendrochirus zebra (Cuvier, 1829)	33 [O]
Parascorpaena picta (Kuhl and Van Hasselt, 1829)	M 25 [O]
Pterois volitans (Linnaeus, 1758)	24,30,32a,35 [O]
Scorpaenodes guamensis (Quoy and Gaimard, 1824)	M 26,29 [O]
Scorpaenopsis diabolus (Cuvier, 1829)	M 26 [R]
PLATYCEPHALIDAE	
Cymbacephalus beauforti [photo]	
Cymbacephalus nematophthalamus (Günther, 1860)	M 37 [O]
Platycephalus endrachtensis Quoy and Gaimard, 1825	M 13,37 [O]
PEGASIDAE	
Eurypegasus draconis (Linnaeus, 1766)	M
Pegasus volitans Linnaeus, 1758	M 32a [R]
CENTROPOMIDAE	
Hypopterus macropterus (Günther, 1859)	M 28 [R]
Psammoperca waigiensis (Cuvier, 1828)	7,24,30,31,35,36b [C]
GLAUCOSOMATIDAE	
Glaucosoma magnificum (Ogilby, 1915)	35 [R]
SERRANIDAE	

Cephalopholis argus Bloch and Schneider, 1801	M
Cephalopholis boenak (Bloch, 1790)	M 24,35 [O]
Cephalopholis cyanostigma (Kuhl and van Hasselt, 1828)	7,17,19,30,31,34,25 [O]
Cephalopholis miniata (Forsskål, 1775)	30 [R]
Cromileptes altivelis (Valenciennes, 1828)	17,19,29,33 [O]
Epinephelus areolatus (Forsskål, 1775)	M
Epinephelus bilobatus Randall and Allen, 1987	M 19,23,24,29,30,31,33,35 [C]
Epinephelus coioides (Hamilton, 1822)	M 7, 13, 19,23,31 [O]
Epinephelus fasciatus (Forsskål, 1775)	M 19,23,27,28,30,31,35 [C]
Epinephelus fuscoguttatus (Forsskål, 1775)	7,17,19,24,29,31,35 [O]
Epinephelus lanceolatus (Bloch, 1790)	7 [R]
Epinephelus multinotatus (Peters, 1876)	M 30,35 [O]
Epinephelus polyphekadion (Bleeker, 1849)	29 [R]
Epinephelus quoyanus (Valenciennes, 1830)	M 20,28,29,37 [O]
Epinephelus rivulatus (Valenciennes, 1830)	M7,20,23,28,29,32b,33,36b, 37 [C]
Epinephelus sexfasciatus (Valenciennes, 1828)	M
Plectropomus leopardus (Lacepede, 1802)	M 19,24,27,30,31,33,35 [C]
Plectropomus maculatus (Bloch, 1790)	M7,19,23,24,27,30,31,33,35 [C]
Rainfordia opercularis McCulloch, 1923	M 30 [R]
GRAMMISTIDAE	
Diploprion bifasciatum Cuvier, 1828	M 24,30,31 [O]
PSEUDOCHROMIDAE	
Assiculus punctatus (Richardson, 1846)	M 33 [R]
Labracinus lineatus (Castelnau, 1875)	M 19,31 [O]
Pseudochromis fuscus Müller and Troschel, 1849	M 17,19,24,28,30,31,33, 35,36b,37[C]
Pseudochromis marshallensis Schultz, 1953	M
Pseudochromis wilsoni (Whitley, 1929)	M 7,17,35 [O]
THERAPONIDAE	
Amniataba caudovittatus (Richardson, 1845)	M 13 [O]
Pelates octolineatus (Jenyns, 1840)	M 13 [O]
PRIACANTHIDAE	
Priacanthus hamrur (Forsskål, 1775)	M
Priacanthus macracanthus Cuvier, 1829	M
APOGONIDAE	
Apogon aureus (Lacepede, 1802)	7,19,23,24,30,35 [O]
Apogon coccineus Rüppell, 1838	M 24,26,29,30, 17 [O]
Apogon cookii Macleay, 1881	M 20,23,25,26,28,29,36b,37 [C]

Apogon doederleini Jordan and Snyder, 1901	M 17,23,28,30,35,36b [C]
Apogon exostigma (Jordan and Starks, 1906)	M 17 [O]
Apogon fraenatus Valenciennes, 1832	M 24,30 [O]
Apogon moluccensis Valenciennes, 1832	23,32a [O]
Apogon pallidofasciatus Allen, 1987	36b [R]
Apogon properupta (Whitley, 1964)	M7,17,19,23,24,28,29,30,35 [C]
Apogon rueppellii Günther, 1859	M 7,32b,37 [C]
Apogon taeniophorus Regan, 1908	M 26 [O]
Apogon timorensis Bleeker, 1854	M 29 [R]
Apogon trimaculatus Cuvier, 1828	M17,30 [R]
Archamia fucata (Cantor, 1850)	M19 [O]
Cheilodipterus lineatus Lacepede, 1801	M30 [R]
Cheilodipterus macrodon (Lacepede, 1802)	M17, 19,28,29,30,35,36b [O]
Cheilodipterus quinquelineatus Cuvier, 1828	M7, 17, 19,24,35 [C]
Foa brachygramma (Jenkins, 1903)	M33,37 [O]
Fowleria variegata (Valenciennes, 1832)	M17,37 [O]
Pseudamia gelatinosa Smith, 1955	M13, 17,35 [R]
Pterapogon mirifica (Mees, 1966)	M28,37 [O]
Rhabdamia gracilis (Bleeker, 1856)	23 [O]
SILLAGINIDAE	
Sillago schomburgkii Peters, 1865	M13 [C]
ECHENEIDIDAE	
Echeneis naucrates Linnaeus, 1758	M
CARANGIDAE	
Alepes sp. (undescribed)	M
Carangoides fulvoguttatus (Forsskål, 1775)	M31 [O]
Carangoides gymnostethus (Cuvier, 1833)	M
Carangoides malabaricus (Bloch and Schneider, 1801)	M
Caranx ignobilis (Forsskål, 1775)	7, 19 [O]
Decapterus macrosoma Bleeker, 1851	M
Elagatis bipinnulatus (Quoy and Gaimard, 1824)	M
Gnathanodon speciosus (Forsskål, 1775)	M19,28,30 [O]
Scomberoides commersonnianus Lacepede, 1801	30 [O]
Scomberoides tol (Cuvier, 1832)	32b [R]
Scomberoides lysan (Forsskål, 1775)	M
Selar boops (Cuvier, 1833)	M17,28 [O]
Selar crumenophthalmus (Bloch, 1793)	M
Selar malam Bleeker, 1851	M
Selaroides leptolepis (Cuvier, 1833)	M
Seriolina nigrofasciata (Rüppell, 1829)	M
LUTJANIDAE	
Lutjanus argentimaculatus (Forsskål, 1775)	M 7 [O]

Lutjanus bohar (Forsskål, 1775) 31 [R]	
Lutjanus carponotatus (Richardson, 1842)	M 7,17, 19,23,24,27,29,30,31, 33,34,35,36b [C]
Lutjanus erythropterus Bloch, 1790	M
Lutjanus fulviflamma (Forsskål, 1775)	M 7,13, 17, 19,29,36b,37 [C]
Lutjanus lemniscatus (Valenciennes, 1828)	M 7,19,23,24,26,27,29,31, 34,35[C]
Lutjanus lutjanus Bloch, 1790	30,35 [O]
Lutjanus malabaricus (Bloch and Schneider, 1801)	M
Lutjanus monostigma (Cuvier, 1828)	M 7 [R]
Lutjanus quinquelineatus (Bloch, 1790)	19,24,27,28,30,31,35 [C]
Lutjanus russelli (Bleeker, 1849)	M 19 [R]
Lutjanus sebae (Cuvier, 1828)	M
Lutjanus vitta (Quoy and Gaimard, 1824)	M 31,32a [O]
Symphorus nematophorus (Bleeker, 1860)	M 7, 19,23,24,30,31,33,35 [C]

CAESIONIDAE

Caesio caerulaurea Lacepede, 1801	19,24,27,30,31,35 [C]
Caesio cuning (Bloch, 1790)	7,19,24,27,30,31,35 [C]
Pterocaesio digramma (Bleeker, 1865)	17,19,27,35 [C]

NEMIPTERIDAE

Nemipterus furcosus (Valenciennes, 1830)	M 32a [O]
Nemipterus peronii (Valenciennes, 1830)	M
Pentapodus emeryii (Richardson, 1843)	19,23,30,31,35 [C]
Pentapodus porosus (Valenciennes, 1830)	33 [O]
Scaevius milii (Bory de Saint-Vincent, 1823)	M 7,32a,33,37 [C]
Scolopsis bilineatus (Bloch, 1793)	7,19,24,28,31,35 [C]
Scolopsis monogramma (Cuvier, 1830)	M 7,19,23,24,30,31,35 [C]
Scolopsis trilineatus Kner, 1868	29 [R]

GERREIDAE

Gerres macrosoma? Bleeker, 1854	M 28,32b,37 [C]

HAEMULIDAE

Diagramma pictum (Thunberg, 1792)	7,30,31,33 [C]
Plectorhinchus chaetodontoides Lacepede, 1800	7,30,35 [O]
Plectorhinchus flavomaculatus (Ehrenberg, 1830)	23 [R]
Plectorhinchus gibbosus (Lacepede, 1802)	7 [O]
Plectorhinchus pictus (Cuvier, 1830)	M
Plectorhinchus polytaenia (Bleeker, 1852)	M 30,35 [O]
Plectorhinchus schotaf (Forsskål, 1775)	7,19,32b,35,36b [C]
Pomadasys kaakan (Cuvier, 1830)	M

LETHRINIDAE

Gymnocranius elongatus Senta, 1973	M
Gymnocranius grandoculis (Valenciennes, 1830)	M

Gymnocranius griseus (Schlegel, 1844)	M 28,31,35 [O]
Lethrinus atkinsoni Seale, 1909	M7,17,19,26,27,29,31,32b,35 [C]
Lethrinus laticaudis Alleyne and Macleay, 1877	M 31,35,37 [C]
Lethrinus lentjan (Lacepede, 1802)	19,31 [O]
Lethrinus nebulosus (Forsskål, 1775)	M7,17,19,26,27,29,31,32b,35 [C]
Lethrinus olivaceus Valenciennes, 1830	30 [R]
Lethrinus rubrioperculatus Sato, 1978	M
Lethrinus variegatus Valenciennes, 1830	M 33 [C]
SPARIDAE	
Argyrops spinifer (Forsskål, 1775)	M
MULLIDAE	
Parupeneus barberinoides (Lacepede, 1801)	7,17,19,23,27,30,35,36b [C]
Parupeneus bifasciatus (Lacepede, 1801)	M
Parupeneus chrysopleuron (Schlegel, 1843)	19,35 [O]
Parupeneus cyclostomus (Lacepede, 1801)	27,31 [O]
Parupeneus heptacanthus (Lacepede, 1801)	M 35 [R]
Parupeneus indicus (Shaw, 1803)	M 7,17,19,23,28,29,30,35 [C]
Parupeneus multifasciatus (Quoy and Gaimard, 1825)	27,35 [O]
Parupeneus spilurus (Bleeker, 1854)	7,23,29,30,35 [O]
PEMPHERIDIDAE	
Pempheris analis Waite, 1910	7,19,35 [C]
Pempheris schwenkii Bleeker, 1855	19,28 [O]
Pempheris sp.	M 29,34 [C]
KYPHOSIDAE	
Kyphosus gibsoni Ogilby, 1912	M 7,19,36b [C]
Kyphosus vaigiensis (Quoy and Gaimard, 1825)	29 [O]
EPHIPPIDIDAE	
Platax batavianus Cuvier, 1831	M 7,19,23,32a [O]
Platax pinnatus (Linnaeus, 1758)	24,31 [O]
Platax teira (Forsskål, 1775)	23,31,35 [O]
CHAETODONTIDAE	
Chaetodon adiergastos Seale, 1905	7,17 [R]
Chaetodon aureofasciatus Macleay, 1878	7,17,19,24,27,30,31,35 [C]
Chaetodon auriga Forsskål, 1775	M 7,17,19,24,27,30,31,35 [O]
Chaetodon citrinellus Cuvier, 1831	27 [R]
Chaetodon ephippium Cuvier, 1831	7,17 [R]
Chaetodon lineolatus Cuvier, 1831	7,17,24,31,35 [O]
Chaetodon lunula (Lacepede, 1803)	M 7,17,19,26 [O]
Chaetodon plebeius Cuvier, 1831	7,17,19,24,27,30,31,35 [C]

Chaetodon trifascialis Quoy and Gaimard, 1824	17 [R]
Chaetodon trifasciatus Park, 1797	7,19,30,31,34,35 [C]
Chaetodon ulietensis Cuvier, 1831	7,19,31 [O]
Chelmon marginalis Richardson, 1842	7,17,19,23,28,30,31,35,36b [C]
Coradion chrysozonus (Cuvier, 1831)	30,31 [O]
Forcipiger flavissimus Jordan and McGregor, 1898	35 [R]
Heniochus acuminatus (Linnaeus, 1758)	M7,17,19,23,28,30,31,35,36b [C]
Heniochus singularius Smith and Radcliff, 1911	7,19,27,31,33,35 [C]
Parachaetodon ocellatus (Cuvier, 1831)	32a,33 [R]
POMACANTHIDAE	
Centropyge tibicen (Cuvier, 1831)	19,24,35 [O]
Chaetodontoplus duboulayi (Günther, 1867)	23,30,35 [O]
Chaetodontoplus personifer (McCulloch, 1914)	24,30,31,35 [O]
Euxiphipops sexstriatus (Cuvier, 1831)	7,19,23,28,30,31,35,36b [C]
Pomacanthus semicirculatus (Cuvier, 1831)	M 7,24,26,28,31,34,35 [O]
POMACENTRIDAE	
Abudefduf bengalensis (Bloch, 1787)	M 7,17,19,24,27,28,29, 30,31,32b,33,35,36b,37 [A]
Abudefduf septemfasciatus (Cuvier, 1830)	M
Abudefduf sexfasciatus (Lacepede, 1802)	M 7,17,19,24,27,28,29,30,31, 35,36b,37 [A]
Abudefduf sordidus (Forsskål, 1775)	M 7,28,29,36b [C]
Abudefduf vaigiensis (Quoy and Gaimard, 1825)	M 7,25,26,28,37 [C]
Amblyglyphidodon curacao (Bloch, 1787)	7,19,24,30,31,35 [C]
Amphiprion clarkii (Bennett, 1830)	33 [O]
Amphiprion perideraion Bleeker, 1855	30,31,35 [O]
Amphiprion rubrocinctus Richardson, 1842	7,17,19,29,36b [O]
Chromis atripectoralis Welander and Schultz, 1951	7,17,19,29,35 [C]
Chromis cinerascens (Cuvier, 1830)	24,30,31,35 [C]
Chromis fumea (Tanaka, 1917)	M 23,24,32a [A]
Chromis margaritifer Fowler, 1946	27 [R]
Dascyllus aruanus (Linnaeus, 1758)	7,19,28,29 [O]
Dascyllus reticulatus (Richardson, 1846)	7,19,24,27,28,29,30,31,33,35 [C]
Dascyllus trimaculatus (Rüppell, 1828)	7,19,24,28,29,30,31,33,35 [C]
Dischistodus prosopotaenia (Bleeker, 1852)	17,19 [C]
Hemiglyphidodon plagiometopon (Bleeker, 1852)	M 17,19 [O]
Neoglyphidodon melas (Cuvier, 1830)	7,19,24,30,31,35 [O]
Neoglyphidodon nigroris (Cuvier, 1830)	19,30,31,35 [C]
Neopomacentrus azysron (Bleeker, 1877)	M 17,19,24,30,31,34,35,36b [A]
Neopomacentrus cyanomos (Bleeker, 1856)	7,17,19,23,24,29,30,31,33, 34,35,36b [C]
Neopomacentrus filamentosus (Macleay, 1883)	19 [R]

Plectroglyphidodon lacrymatus (Quoy and Gaimard, 1824)	17,19,30 [O]
Plectroglyphidodon leucozonus (Bleeker, 1859)	M 20,26 [O]
Pomacentrus coelestis Jordan and Starks, 1901	M 7,17,19,20,23,25,26,27,28, 29,30,33 [A]
Pomacentrus littoralis Cuvier, 1830 [photo]	17 [O]
Pomacentrus milleri Taylor, 1964	M 7,17,19,20,24,25,27,28,29, 30,31,33,35,36b [A]
Pomacentrus moluccensis Bleeker, 1853	7,17,19,29,30,31,35 [C]
Pomacentrus nagasakiensis Tanaka, 1917	19,23,24,30,31,33,35 [C]
Pomacentrus nigromanus	19,30,31 [O]
Pomacentrus vaiuli Jordan and Seale, 1906	19 [O]
Pristotis jerdoni (Day, 1873)	28 [R]
Stegastes fasciolatus (Ogilby, 1889)	M
Stegastes lividus (Bloch and Schneider, 1801)	17 [O]
Stegastes nigricans (Lacepede, 1802)	17 [O]
Stegastes obreptus (Whitley, 1948)	M 7,19,20,23,24,27,28,29,30, 31,33,34,35,36 [O]
MUGILIDAE	
Liza vaigiensis (Quoy and Gaimard, 1824)	M
Mugilid sp. (very small juveniles)	M 13,29 [O]
SPHYRAENIDAE	
Sphyraena barracuda (Walbaum, 1792)	M
Sphyraena jello Cuvier, 1829	30,31 [O]
Sphyraena obtusata Cuvier, 1829	M 7,19,23,25 [C]
LABRIDAE	
Anampses caeruleopunctatus Rüppell, 1829	M 26 [R]
Anampses lennardi Scott, 1959	M 23,30,35 [R]
Anampses meleagrides Valenciennes, 1840	27,31 [R]
Bodianus axillaris (Bennett, 1831)	M 19,30,31,35 [O]
Bodianus perditio (Quoy and Gaimard, 1834)	M
Cheilinus chlorurus (Bloch, 1791)	M 7,17,19,24,28,30,31,34,35, 36b,37 [C]
Cheilio inermis (Forsskål, 1775)	20,29,36b [O]
Choerodon cauteroma Gomon and Allen, 1987	7,19,23,30,31,35 [O]
Choerodon cephalotes (Castelnau, 1875)	M 24,30 [R]
Choerodon cyanodus (Richardson, 1843)	M 7,19,24,27,28,29,30,31,33, 34,35,36b,37 [C]
Choerodon schoenleinii (Valenciennes, 1839)	M 7,17,19,24,27,30,31,32a,33, 34,35 [C]
Choerodon sugillatum Gomon, 1987	35 [R]
Cirrhilabrus temmincki Bleeker, 1853	23,32a,35 [O]
Coris aygula Lacepede, 1801	24,31,35 [O]
Coris caudimacula (Quoy and Gaimard, 1834)	23,27 [O]
Coris pictoides Randall and Kuiter, 1982	23,30,32a,35 [O]

Cymolutes praetextatus (Quoy and Gaimard, 1834)	28 [O]
Epibulus insidiator (Pallas, 1770)	7,19,30,31,35 [O]
Gomphosus varius Lacepede, 1801	30,35 [O]
Halichoeres marginatus Rüppell, 1835	M 7,19,26,31 [O]
Halichoeres melanochir Fowler and Bean, 1928	M 7,17,23,30,31,35 [C]
Halichoeres nebulosus (Valenciennes, 1839)	M7,20,23,25,26,33,35,36b,37 [C]
Halichoeres trimaculatus (Quoy and Gaimard, 1834)	29 [R]
Hemigymnus fasciatus (Bloch, 1792)	24,30,31,35 [O]
Hemigymnus melapterus (Bloch, 1791)	7,19,27,30,31,35 [O]
Hologymnosus annulatus (Lacepede, 1801)	M 31,35 [R]
Labrichthys unilineatus (Guichenot, 1847)	19 [R]
Labroides dimidiatus (Valenciennes, 1839)	M 7,17,19,23,24,27,29,30,31, 33,34,35,36b [O]
Leptojulis cyanopleura (Bleeker, 1853)	23 [R]
Macropharyngodon ornatus Randall, 1978	23,27,30,35 [O]
Pteragogus flagellifera (Valenciennes, 1839)	M 23,36b [O]
Stethojulis bandanensis (Bleeker, 1851)	M 7,20,27,36b [C]
Stethojulis interrupta (Bleeker, 1851)	7,19,29 [O]
Stethojulis strigiventer (Bennett, 1832)	M 36b [O]
Thalassoma amblycephalum (Bleeker, 1856)	27 [R]
Thalassoma lunare (Linnaeus, 1758)	M 17,19,26,27,29,30,31,35 [C]
Thalassoma lutescens (Lay and Bennett, 1839)	17,19,23,26,27,30,31 [O]
Xyrichtys jacksonensis? (Ramsay, 1881)	M
Xyrichtys sp. [photo] 36a	[R]

SCARIDAE

Bolbometopon muricatum (Valenciennes, 1840)	1 [R]
Hipposcarus longiceps (Valenciennes, 1840)	7,19 [O]
Scarus chameleon Choat and Randall, 1986	35 [O]
Scarus ghobban Forsskål, 1775	7,19,23,24,29,30,31,37 [C]
Scarus microrhinos Bleeker, 1854	19 [R]
Scarus prasiognathus Valenciennes, 1839	26,35 [O]
Scarus rivulatus Valenciennes, 1840	7,19,30,31,35 [O]
Scarus rubroviolaceus Bleeker, 1847	26 [R]
Scarus schlegeli (Bleeker, 1861)	7,19,23,24,30,31,35 [C]
Scarus sordidus Forsskål, 1775	7,19,31,35 [C]

OPISTOGNATHIDAE

Opistognathus darwiniensis Macleay, 1878	M 7,13,29,32a,37 [O]
0pistognathus latitabundus (Whitley, 1937) [photo]	

PINGUIPEDIDAE

Parapercis clathrata Ogilby, 1911	27 [R]
Parapercis snyderi? Jordan and Starks, 1905	M 32a [O]

BLENNIIDAE

Aspidontus taeniatus Quoy and Gaimard, 1834	19,30 [R]
Atrosalarius fuscus holomelas (Günther, 1872)	19,36b [O]
Cirripectes castaneus (Valenciennes, 1836)	M 26 [R]
Cirripectes filamentosus (Alleyne and Macleay, 1877)	M 7,19,20,25,29,35,36b [C]
Crossosalarias macrospilus Smith-Vaniz and Springer, 1971 [photo]	
Ecsenius bicolor (Day, 1888)	M 26,27,30,34,35 [O]
Ecsenius lineatus Klausewitz, 1962	M 23,24 [R]
Ecsenius oculatus Springer, 1988	M 26 [R]
Ecsenius yaeyamensis (Aoyagi, 1954)	M 7,19,27,29,30,31,34,35 [C]
Entomacrodus decussatus (Bleeker, 1858)	M 26 [O]
Entomacrodus striatus (Quoy and Gaimard, 1836)	M 26,29 [C]
Entomacrodus thalassinus (Jordan and Seale, 1906)	M
Istiblennius chrysospilos (Bleeker, 1857)	M 7,20,26,29 [C]
Istiblennius edentulus (Forster, 1801)	M 26 [R]
Istiblennius lineatus (Valenciennes, 1836)	M
Istiblennius meleagris (Valenciennes, 1836)	M 36b [O]
Laiphognathus multimaculatus Smith, 1955	M 24 [R]
Meiacanthus grammistes (Valenciennes, 1836)	M 7,19,24,29,35 [O]
Mimoblennius atrocinctus (Regan, 1909)	M
Omobranchus germaini (Sauvage, 1883)	M 29,36b,37 [O]
Omobranchus rotundiceps (Macleay, 1881)	M
Petroscirtes breviceps Valenciennes, 1836	M 33 [O]
Petroscirtes mitratus Rüppell, 1830	M 7,13,29,37 [O]
Plagiotremus rhinorhynchos (Bleeker, 1852)	23,35 [O]
Plagiotremus tapeinosoma (Bleeker, 1857)	M 24,33 [O]
Rhabdoblennius ellipes? (Jordan and Starks, 1906)	[O]
Salarias fasciatus (Bloch, 1786)	M 7,19,20,37 [O]
Stanulus talboti Springer, 1968	M 26, [O]

CONGROGADIDAE

Blennodesmus scapularis Günther, 1872	M 17,20,29,37 [O]
Congrogadus spinifer (Borodin, 1933)	M
Congrogadus subducens (Richardson, 1843)	28 [R]

NOTOGRAPTIDAE

Notograptus guttatus Günther, 1867	M 20,37 [O]

TRIPTERYGIIDAE

Enneapterygius tusitilae Jordan and Seale, 1906	M 29,32,35,36b [O]
Helcogramma striata Hansen, 1986	M 23,24,35 [C]
Norfolkia brachylepis (Schultz, 1960)	M 30,35 [O]

CALLIONYMIDAE

Callionymus enneactis Bleeker, 1879	M 29 [O]

Callionymus margaretae australis Fricke, 1983	M [in Fricke, 1983]
Callionymus moretonensis? Johnson, 1971	M 29 [R]
Diplogrammicus xenicus (Jordan and Thompson, 1914)	M 29 [C]
Synchiropus picturatus occidentalis Fricke, 1983	17 [R]
Synchiropus rameus (McCulloch, 1926) [in Fricke, 1983]	

GOBIESOCIDAE

Diademichthys lineatus (Sauvage, 1883)	M 7,19,30,35 [O]
Lepadichthys frenatus Waite, 1904	M 24,30 [O]

GOBIIDAE

Amblyeleotris gymnocephalus [photo]	33 [R]
Amblyeleotris periophthalma (Bleeker, 1853)	33 [R]
Amblygobius bynoensis (Richardson, 1844)	M 13 [R]
Amblygobius nocturnus (Herre, 1945)	17 [O]
Amblygobius phalaena (Valenciennes, 1837)	M 7,13,19,33 [C]
Asterropteryx semipunctatus Rüppell, 1828	M 13 [A]
Barbuligobius boehlkei Lachner and Mckinney, 1974	M 24 [R]
Bathygobius cocosensis (Bleeker, 1854)	M 20,29,36b [C]
Bathygobius fuscus (Rüppell, 1830)	M 13,29,37 [C]
Bathygobius laddi (Fowler, 1931)	M 20,28,29 [O]
Bryaninops amplus (Larson, 1985)	M 23 [R]
Callogobius sclateri (Steindachner, 1880)	[NTM]
Cryptocentrus cinctus (Herre, 1936) [photo]	33 [O]
Cryptocentrus fasciatus (Playfair and Günther, 1867)	33, [NTM] [R]
Cryptocentrus strigilliceps (Jordan and Seale, 1906)	7,19,33 [O]
Cryptocentrus obliquus (Herre, 1934)	7 [R]
Ctenogobiops pomastictus Lubbock and Polunin, 1977	33 [O]
Eviota prasina? (Klunzinger, 1871)	M 20,29 [C]
Eviota zebrina Lachner and Karnella, 1978	M 24,32,35 [C]
Favonigobius sp.	M 29[R]
Fusigobius neophytus (Günther, 1877)	M 17 [C]
Fusigobius sp. [DFH-2]	M 17,30 [O]
Gnatholepis scapulostigma Herre, 1953	M 19,24,29 [O]
Gobiid (undescribed genus and species)	M 32 [O]
Gobiodon axillaris De Vis, 1884	M 29 [O]
Gobiodon quinquestrigatus (Valenciennes, 1837)	M 29 [O]
Gobiopsis angustifrons Lachner and McKinney, 1978	M
Istigobius goldmanni (Bleeker, 1852)	M 29,35 [C]
Istigobius nigroocellatus (Günther, 1873)	M 7,24,29,32,35 [C]
Istigobius ornatus (Rüppell, 1830)	M 37 [R]
Macrodontigobius wilburi Herre, 1936	M 17 [O]
Oplopomops sp.	M 28 [R]
Pandaka lidwilli (McCulloch, 1917)	M 13 [O]
Paragobiodon echinocephalus (Rüppell, 1830)	M 33 [O]
Paragobiodon melanosoma (Bleeker, 1852)	M 33 [O]

Paragobiodon lacunicolus (Kendall and Goldsborough, 1911)	M
Paragobiodon xanthosoma (Bleeker, 1852)	M 33 [O]
Pleurosicya mossambica Smith, 1959	M 33 [O]
Pleurosicya plicata Larson, 1990	M 29 [R]
Priolepis nuchifasciatus (Günther, 1874)	M 24,29,30 [O]
Trimma okinawae (Aoyagi, 1949)	M 30,35 [O]
Valenciennea longipinnis (Lay and Bennett, 1839)	M 28,32b,33 [O]
Valenciennea muralis (Valenciennes, 1837)	M 33 [R]
Vanderhorstia ornatissima Smith, 1959	19 [C]

MICRODESMIDAE

Gunnelichthys monostigma Smith, 1958	17 [photo] [O]
Ptereleotris hanae (Jordan and Snyder, 1901)	33 [R]

ACANTHURIDAE

Acanthurus dussumieri Valenciennes, 1835	23,29,36b [C]
Acanthurus grammoptilus Richardson, 1843	7,17,19,23,24,27,28,29,30,31,33,35[A]
Acanthurus nigricans (Linnaeus, 1758)	M 27 [R]
Acanthurus nigrofuscus (Forsskål, 1775)	26,31,35 [O]
Acanthurus olivaceus Forster, 1801	27 [R]
Acanthurus triostegus (Linnaeus, 1758)	M 4b,20,27,29 [O]
Ctenochaetus strigosus (Bennett, 1828)	M 19,27,31,35 [C]
Naso brevirostris (Valenciennes, 1835)	7 [O]
Naso unicornis (Forsskål, 1775)	7,19,31,35 [O]
Zebrasoma scopas (Cuvier, 1829)	19,31,35 [O]
Zebrasoma veliferum (Bloch, 1797)	17 [R]

ZANCLIDAE

Zanclus cornutus (Linnaeus, 1758)	M 7,30,31,35 [O]

SIGANIDAE

Siganus fuscescens (Houttuyn, 1782)	M 29 [O]
Siganus doliatus Cuvier, 1830	M 7,19,24,26,35 [A]
Siganus lineatus (Valenciennes, 1835)	7,19,29 [C]
Siganus punctatus (Forster, 1801)	7,31 [O]
Siganus trispilos Woodland and Allen, 1977	M 7,19,30,31,35 [O]

SCOMBRIDAE

Euthynnus affinis (Cantor, 1849)	30 [O]
Scomberomorus commerson (Lacepede, 1800)	31 [O]
Scomberomorus queenslandicus Munro, 1943	32 [O]

PSETTODIDAE

Psettodes erumei (Bloch and Schneider, 1801)	M

SOLEIDAE

Aesopia heterorhinos (Bleeker, 1856)	M 29 [R]
Aseraggodes melanostictus (Peters, 1876)	M 22,28 [R]

CYNOGLOSIDAE

Cynoglossus maculipinnis Rendahl, 1921	M 22,28 [R]
Paraplagusia bilineata (Bloch, 1787)	M

BALISTIDAE

Abalistes stellatus (Lacepede, 1798)	28,30 [R]
Pseudobalistes fuscus (Bloch and Schneider, 1801)	23 [R]
Rhinecanthus aculeatus (Linnaeus, 1758)	29,32b [O]
Sufflamen chrysopterus (Bloch and Schneider, 1801)	27 [O]
Sufflamen fraenatus Latreille, 1804	23 [O]

MONACANTHIDAE

Aluterus monoceros (Linnaeus, 1758)	M
Cantherines pardalis (Rüppell, 1837)	M 25,26,35 [O]
Chaetodermis pencilligera (Cuvier, 1817)	M 37 [R]
Monacanthus chinensis (Osbeck, 1765)	19 [R]
Oxymonacanthus longirostris (Bloch and Schneider, 1801)	7,19 [O]
Paramonacanthus choirocephalus (Bleeker, 1852)	M 28 [R]
Paramonacanthus peroni (Hollard, 1854)	M 30,35 [R]
Pervagor janthinosoma (Bleeker, 1854)	35 [R]

OSTRACIIDAE

Lactoria cornuta (Linnaeus, 1758)	36b [O]
Ostracion cubicus Linnaeus, 1758	6,19,28,31,35 [R]
Ostracion meleagris Shaw, 1796	27 [R]

TETRAODONTIDAE

Arothron hispidus (Linnaeus, 1758)	25,28,29 [R]
Arothron manilensis (de Proce, 1822)	33 [R]
Arothron mappa (Lesson, 1830)	33 [R]
Arothron stellatus (Bloch and Schneider, 1801)	30 [R]
Canthigaster coronata (Vaillant and Sauvage, 1875)	23,32a,35 [O]

DIODONTIDAE

Diodon hystrix Linnaeus, 1758	31 [R]

Table 1. 10 Most speciose families at Montebello Islands

FAMILY	NO. SPECIES
GOBIIDAE	43
LABRIDAE	39
POMACENTRIDAE	37
BLENNIIDAE	28
APOGONIDAE	22
SERRANIDAE	19
CHAETODONTIDAE	17
CARANGIDAE	16
LUTJANIDAE	14
ACANTHURIDAE	11

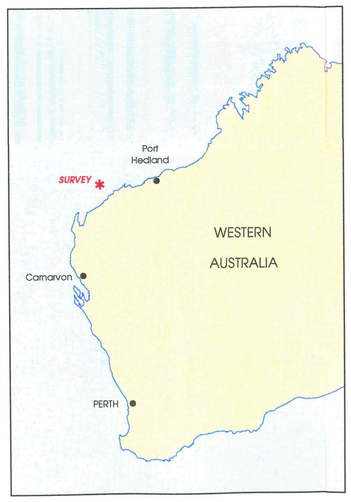
MARINE FAUNA SURVEY OF THE MONTEBELLOS ISLANDS

Broad Habitat Classification and Sampling Station Localities
August 1993

LEGEND

- SUPRATIDAL (LAND)
- BARRIER REEF / LOW CORAL *(ACROPORA)* COVER (0-20%)
- BARRIER REEF / HIGH CORAL *(ACROPORA)* COVER (21-100%)
- OTHER CORAL REEF (PATCH / FRINGING / BOMBORAS)
- LIMESTONE PAVEMENT OR REEF / SAND VENEER / MACROALGAE / SCATTERED HARD AND SOFT CORALS / SPONGES
- SAND / CORAL RUBBLE,CORAL SLABS / SCATTERED MACROALGAE / SPARSE SEAGRASSES / ISOLATED LIVING CORALS
- SAND / CORAL RUBBLE,CORAL SLABS / DENSE MACROALGAE *(TURBINARIA and SARGASSUM)* / ISOLATED LIVING CORALS
- MANGAL
- ▲ 31 SAMPLING STATION

LOCALITY GUIDE



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SCALE 1:50 000

0 1 2 3 4 5 6 7 8 9 10 kilometres

Produced by Land Information Branch, Department of Conservation and Land Management
from information obtained from a field survey conducted by the Western Australian Museum in August 1993

NOTE : Inclusion of a name on this map does not imply its approval by the relevant nomenclature authority.

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
APRIL 1994