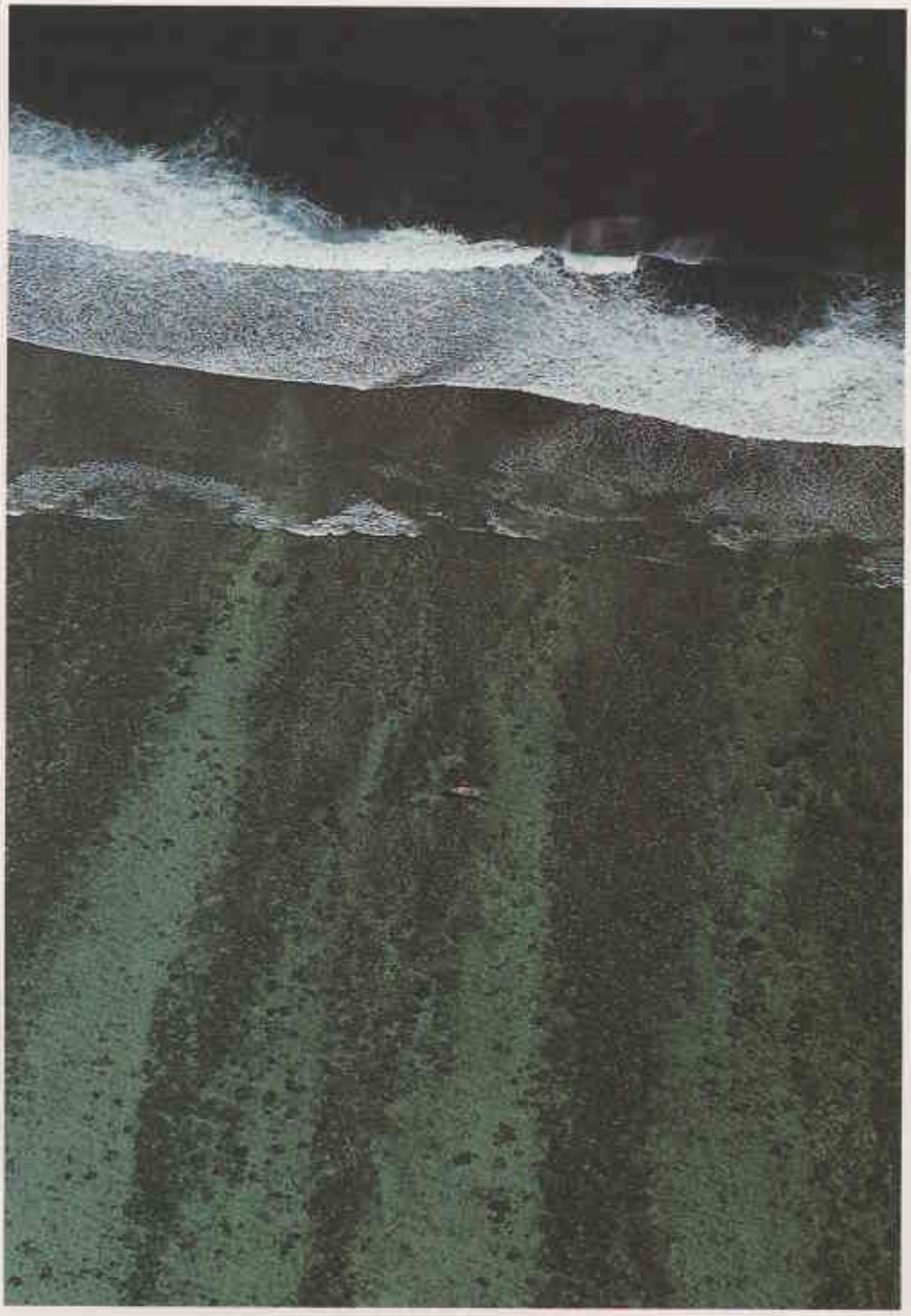
# A Range of Reefs



BY **BARRY WILSON**

Western Australia sits astride the Tropic of Capricorn. The far northern coast faces the verdant tropical island states of south east Asia; the far southern coast faces the Southern Ocean, a vast, uninterrupted tract of cold sea separating our shores from the frozen continent of Antarctica. Imagine the riotous variety of fauna and flora that populates this extensive coastline...

No other sovereign state has such a long coastline covering such a wide range of marine habitats. In keeping with this climatic and habitat diversity, the coastal marine fauna and flora of Western Australia are extremely varied. In the north there are sea-turtles, giant saltwater crocodiles, mangroves and coral reefs. In the south there are sea-lions, penguins, sea-grass banks and great white sharks.

The island-filled axis between the south east Asian and Australian continents, which separates the Indian and Pacific Oceans, is both ecologically productive and geologically complex. The diversity of marine species is extremely high; there is probably no place on earth where there are more living species. Northern Australia is part of that centre of high diversity.

Of all coastal ecosystem types, perhaps none is so species-rich and of such universal interest as coral reef. The Western Australian coast has extensive coral reef systems of great scientific interest and value to the recreation and tourism industries.

## CORAL BANKS, PLATFORM REEFS, AND SHELF-EDGE ATOLLS

Because most corals do not like muddy waters, coral reefs are not common along the northern shores of Western Australia. There are many mud-tolerant corals growing on these rocky shores, but coral reef habitats are poorly developed. The extensive onshore coral banks of One Arm Point, in the Kimberley, are an exception.

Offshore, it is another story. On the wide continental shelf off the Kimberley coast there are many large coral banks, some of which bear islands. Little is yet known about the marine communities of these coral reefs, although there is evidence that they may be as rich in species as the reefs of Indonesia, which are only a flip of a whale's tail away.

Still further out lie some of the wonders of the Western Australian marine environment. The edge of the shelf in this region is faulted, and there is a series of shelf-edge fault blocks upon which coral atolls have formed. There is a chain of these atolls. From north to south they are Seringapatam Reef, Scott Reef, and the three reefs comprising the Rowley Shoals: Mermaid, Clerke and Imperieuse. The oceanic waters surrounding these atolls are crystal-clear and ideal for luxuriant coral growth.

The North West shelf-edge atolls lie in a line in the path of the tropical water originating in the Pacific and flowing through the Indonesian island chain and down the Western Australian coast. No doubt their existence is partly due to these warm currents, their faunas

The backreef of Ningaloo Marine Park is safe and easily accessible to divers in small boats.
Photo - Robert Garvey ◄

Morning Reef, part of the Wallabi Group in the Abrolhos, is recommended for declaration as a marine park.
Photo - Patrick Baker ►

The reef and lagoon of Imperieuse Reef, Rowley Shoals, exhibit classical habitat zonation.
Photo - Patrick Baker ▼

Clerke Reef, Rowley Shoals, a typical example of a shelf-edge atoll.
Photo - Patrick Baker ►►

Divers can examine the delicate corals in extraordinarily clear water in Mermaid Reef lagoon.
Photo - Gerhardt Saueracker ▲

A small wrasse sleeps at night among the protective folds of a giant anemone - Morning Reef, Abrolhos.
Photo - Barry Wilson ▶

enriched by larvae carried from the fabulously wealthy faunas to the north.

The Rowley Shoals have been described as the most perfect examples of shelf atolls in Australian waters. They are strikingly similar in dimension, shape and orientation. Each is pear-shaped, rising with near vertical sides from very deep water, and with a rim of reef-flat which bares at low tide. The outer sides of the reefs are exposed to heavy wave action, but inside there are protected lagoons.

Mermaid Reef is 14.5 km long and 7.6 km wide. The reef-flat is 500-600 m wide, shelving into a shallow, coral-rich back-reef zone and then into the lagoon. In this atoll the lagoon is large and up to 20 m deep. There is a single, narrow entrance channel at the north-eastern corner, allowing small vessels to enter the safe anchorage.

Clerke and Imperieuse Reefs are similar to Mermaid but have more complex lagoon systems, and small, unvegetated sandy islands on the reef-flats at their northern end.

Although these atolls are typical of oceanic atolls in many respects, they are unusual in having a very high tidal range. When the tide is low, their reef-flats stand like dam walls enclosing huge lakes, several metres above the level of the surrounding sea. Water gushes from the passages in powerful torrents, like waterfalls. At high tide the reefs disappear beneath the sea, with only the sandy islands visible.

The Rowley Shoals support an oceanic marine fauna richer than that of the inshore coral reefs. There is a coral fauna of at least 233 species in 56 genera, and an incredible fish fauna of 688 species in 258 genera at last count. The molluscs and other invertebrates appear to be similarly diverse as well as abundant in these amazing reservoirs of oceanic biodiversity.

On the whole the remoteness of the Rowley Shoals has protected them from exploitation, and they remain almost pristine. They are increasingly popular with tourists as dive sites and have not been fished to any extent: even the great cods, so susceptible to spear-fishing, may still be seen there in numbers. These friendly giants, at the top of the reef food chains, have been long gone from almost all accessible coral reefs throughout the world. The Rowley Shoals are already justly famous for them alone.

## THE NORTH WEST SHELF COASTAL REEFS

The inshore waters along the Pilbara coast are rather muddy, and in this respect very different from the crystal-clear oceanic waters of the shelf-edge, where the atolls have developed. The coral reefs and banks of the inner part of the shelf are not only poorer in species, but have different physical structure and ecosystems.

The best development of coral reefs on the Pilbara coast occurs along the seaward sides of the outer Dampier Archipelago Islands and the Montebello Islands. In the Dampier Archipelago 209 species of coral of 57 genera have so far been recorded after fairly intensive study. Generic diversity is highest in the mid-shore regions of Mermaid Sound, with abundance and reef development greatest on the fringing reefs of the outer islands. The relatively high diversity is no doubt due to the wide range of habitats in the archipelago.

The coral reefs and faunas of the Montebello Islands have not yet been studied, but in view of the structural complexity of these reefs, an abundant and diverse ecosystem is certain to exist there.

## NINGALOO REEF

The ocean currents flowing down the shelf-edge past the Rowley Shoals flood the shore of the mainland along the western side of the Cape Range Peninsula. There too we find major coral reef development.

On the western side of the peninsula the continental shelf is very narrow. Heavy ocean swells wash clear ocean water over the reef. These warm, clear, well-oxygenated waters provide ideal conditions for the growth of corals.

The famous Ningaloo Reef is a nearly continuous wall of coral reef, a veritable 'wall of mouths', stretching 250 km along the coast south of North West Cape (see *LANDSCOPE*, Spring 1988). It is one of

the world's major coral reef systems and supports an assemblage of marine plants and animals typical of Indo-Pacific coral reefs. It is a very large, mainly self-perpetuating system, but there is no doubt that it regularly receives new recruits to its community in the form of planktonic larvae carried by ocean currents from the north.

Ningaloo Reef is a quite different structure from the shelf-edge atolls and fringing reefs of the North West Shelf. The corals grow on ridges of the ancient limestone that forms the huge anticline of the Cape Range Peninsula. For much of its length the reef makes up a rampart protecting a shallow sandy lagoon between itself and the shore. In some places it is possible to swim to the reef from the beach; in other places the reef is several kilometres from shore. Nowhere else on the Australian coast is there a coral reef of such size and quality so easily accessible from the shore. For this reason alone Ningaloo Reef has very special importance as a site for recreation and tourism, but at the same time poses particularly difficult management problems. This is a coral reef which will be easy to 'love to death'.

## THE ABROLHOS

Three hundred kilometres further south, close to the shelf-break some 50 km offshore, lie the Abrolhos Islands, yet another maritime wonder of the west coast. The islands are a series of sandy islands and limestone rocks surrounded by a complex maze of coral banks and channels. Some of the larger islands were connected to the mainland during the Pleistocene Period, several thousand years ago, and they still support relict terrestrial flora and fauna species of that time. Some of them are nesting sites for sea bird colonies and have extreme conservation value for that reason. But the Abrolhos are most noteworthy for their remarkable coral reefs.

Coral growth has been intermittent at the Abrolhos since the beginning of the Pleistocene. They lie between latitudes 28°S and 29°S, far south of the tropical zone. Yet the modern reefs of the present time are extraordinarily rich in coral species and genera, and in many areas the growth of *Acropora* and *Montipora*

The friendly giant cods of Rowley Shoals Marine Park are a special feature of these atolls.
Photo - Eva Boogard ◄

Islands of the Easter Group, Abrolhos, are surrounded by a complex system of coral reefs, channels, and deep 'blue holes'.
Photo - Barry Wilson ▼

species is exceptionally luxuriant and spectacular. Although the low, wind-swept islands offer a harsh (though interesting) environment for the human visitor, the underwater scenery and biological richness provide for some of the best diving in the country.

The Abrolhos coral reefs seem to owe their existence so far south of the tropics to the southerly-flowing Leeuwin Current, which brings warm water and the larvae of tropical animals from the reef systems further north. Besides the corals there are many tropical marine species of fish, molluscs, crustaceans and other invertebrates in the reef communities. But there are also many species of southern, temperate origin. It is partly this unique blend of tropical and temperate species which makes the Abrolhos reefs of such exceptional scientific interest.

Another aspect of particular interest is the dominance of brown algae in some parts of the reefs. The algae appears to contribute the vast amounts of organic material that drive the ecological energy cycles of this exceptionally productive ecosystem. In this respect the Abrolhos reefs are very different from those of the truly tropical north.

It is only during the last decade that the Abrolhos coral reefs have received the scientific attention they deserve. Studies by State Government, CSIRO and university scientists have documented the fauna and flora of the reefs and shown them to be exceptional in many ways.

## A CORAL REEF RESERVE SYSTEM

The coral reefs of Western Australia comprise a remarkable collection of very different types. There are mid-shelf platform reefs and coral banks, shelf-edge atolls, a large and outstanding example of the fringing reef type, and a group of very unusual pseudo-atolls far south of the usual tropical coral reef zone. The State's marine reserve system seeks to represent a selection of these areas and to ensure that they are wisely used and preserved for posterity. Two coral reef marine parks are already declared, and several others are under consideration.

## THE ROWLEY SHOALS MARINE PARK

Of the three atolls in the Rowley Shoals, Clerke and Imperieuse Reefs are now marine parks. The invertebrate animals there, including the shells, are protected under fisheries legislation. Recreational fishing is controlled under the recreational fishing regulations. The giant cods are also fully protected. The Department of Conservation and Land Management, in collaboration with the State Fisheries Department, will prepare a management plan for these marine parks defining some areas as recreational fishing places and others as fauna sanctuaries. The main objective will be to manage these remote atolls as marine wilderness areas, accessible to divers and students of coral reef natural history, but preserved forever as two of the world's last unexploited coral atolls.

## NINGALOO MARINE PARK

Ningaloo Reef, its lagoon, and the waters within a 10-nautical-mile offshore boundary, have been reserved as marine park. The inner area is reserved under Western Australian State legislation, the outer under Federal legislation.

Adjacent as it is to the arid and wildly beautiful Cape Range National Park, the Ningaloo Marine Park is destined to become one of Australia's most popular recreational areas. Its easy accessiblity from the shore makes it particularly valuable as a recreation and tourist resource. But with people come increasing problems. Management objectives for the Ningaloo Marine Park are aimed at providing access to the joys of this fabulous reef, while ensuring that its natural values do not become degraded by excessive use.

Green turtles mating on the reef-flat, Ningaloo Marine Park.
Photo - Barry Wilson ▲

Branching and plate colonies of *Acropora* corals dominate the back-reef habitat of the Ningaloo Marine Park.
Photo - Robert Garvey ▼

## MARMION MARINE PARK

There are no coral reefs south of the Abrolhos, but many species of tropical coral extend their range much further south into the temperate waters of the State. There are at least a dozen species in Marmion Marine Park near Perth, living as isolated colonies attached to rocks on the sea bed. They add a different dimension to the underwater landscapes of the park.

## PARKS IN THE PIPELINE

On the North West Shelf, close attention is being given to two areas as candidates for marine parks: fringing reefs of the Dampier Archipelago, and the platform reef complex of the Montebello Islands.

The first of these marine areas surrounds islands which themselves are important conservation and recreation reserves. Like the Ningaloo Marine Park, management there would emphasise recreational use and the protection of the coral reefs and other sites, such as the turtle and sea-bird nesting sites. On the other hand, the Montebello Islands are remote from shore, and recreational use is limited. It is likely that more emphasis would be given to protecting the reef ecosystems, or parts of them, from any interference.

Another example where special environmental management is needed are the Abrolhos. These islands and reefs have very high scientific and conservation values, yet they are also the site of valuable existing fishing and potential tourism industries.

Several years ago the State Government undertook to develop a management strategy which would strike an appropriate balance between these competing uses. Resulting from this, most of the islands (excluding the areas where the fishers live) will become a national park. Three marine areas of special quality from the scientific and tourism points of view will become marine parks, while the remainder will be declared a special fishing management area under the State's fisheries legislation. Plans for implementing these proposals are well advanced.

The outer sides of the shelf-edge atolls rise from great depths as vertical walls, draped with delicate soft corals and gorgonians.
Photo - Barry Wilson ◄

The accessible reef and lagoon of the Ningaloo Marine Park is backed by the arid hills of Cape Range.
Photo - Robert Garvey ▼

## TO CARE AND PROTECT

In 1897, fisheries biologist Saville-Kent visited the Abrolhos and wrote these prophetic words:

*At some future date, when the Colony of Western Australia shall have passed its present lusty adolescence, and arrived at that maturer age when it shall possess its own University and Chairs of Natural History, it may be safely prophesized that these Abrolhos reefs, within a twenty-four hour journey from Perth, or but three or four hours' sail from Geraldton, will constitute one of the happiest and most productive hunting grounds and fields for biological investigation to the associated students and graduates in Natural Science.*

He continued:

*In addition to the unprecedented facilities here offered for the most exhaustive study of living Stony Corals or Madreporaria, either individually or in bulk, abundant material is also to hand for the observation and record of the numerous phenomena of wider scope relating to the formation and growth of the reefs, to their environments and food supply, and also to the complex questions of their rise or subsistence.*

Western Australia is no longer a colony and, though it may remain 'lusty', it has certainly passed its adolescence. With four universities, several marine research agencies, and such easy access to a range of coral reefs, the natural sciences have outstanding opportunities to explore the intricacies of coral reef biology and geology in this State.

For the community as a whole, the Western Australian coral reefs offer unparalleled opportunities for recreation and enjoyment of one of Earth's most fascinating and beautiful ecosystems. We must explore them and use them with care and respect. ◘

Barry Wilson is Director for Nature Conservation at CALM. He can be contacted at the Crawley office on (09) 386 8811.

*In the central Kimberley, a screw-pine-surrounded creek - just one of the threatened areas in this fragile frontier. Turn to page 22.*

# LANDSCOPE

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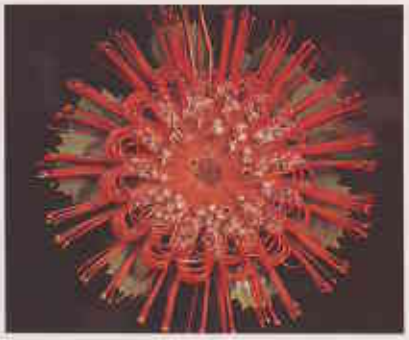

*Public awareness and involvement is vital in the conservation of WA's rare and endangered flora. Page 49.*

*Ten WA mammal species have become extinct in the last 200 years. What can be done to ensure no more are lost forever? Page 28.*

*Until 1984 more was known about what was underneath the Nullarbor than what was on top. But with such a vast area to study, where do we start? See page 16.*

*Forests protect our environment. They also provide timber. How do we strike a balance? Turn to page 35.*

## FEATURES



## REGULARS



## SPECIALS



## COVER

*Dolphins and whales are perhaps the best-known inhabitants of Western Australia's coastal waters. But this unique area is also home to an astonishing range of marine flora and fauna, from sea-turtles and coral reefs in the north to sea-grass banks and great white sharks in the south. See page 10.*

*Illustrated by Martin Thompson.*

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