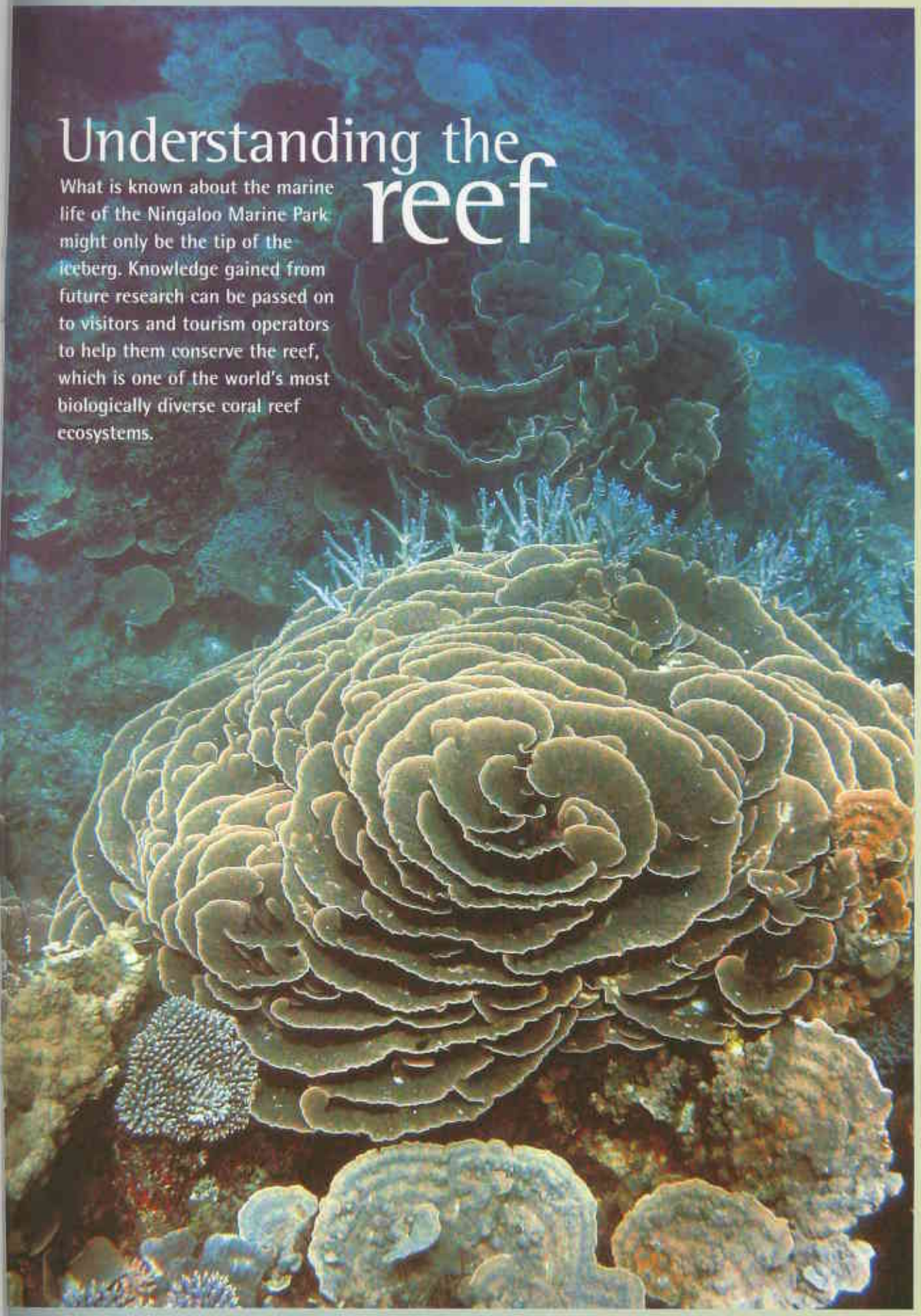
Understanding the reef

What is known about the marine life of the Ningaloo Marine Park might only be the tip of the iceberg. Knowledge gained from future research can be passed on to visitors and tourism operators to help them conserve the reef, which is one of the world's most biologically diverse coral reef ecosystems.



by Glenn Shiell and Ben Fitzpatrick

Stretching for 290 kilometres, Ningaloo Reef is the world's largest fringing coral reef ecosystem. It is the only major tropical coral reef occurring on the western seaboard of any continental landmass. Its presence is due to the strongly flowing Leeuwin Current, which carries warm tropical water south. The Leeuwin Current results in some of the most southerly coral reefs in the world and even the presence of some tropical marine organisms in the Great Australian Bight.

Ningaloo Reef is widely acknowledged as a globally significant biological hotspot. It is a major feeding ground for the whale shark, the world's largest fish; provides habitat for marine turtles, manta rays and dugongs; and supports at least 500 species of fish and 200 species of coral. However, there is much more to be learnt about the area. Ningaloo Reef is believed to contain countless new species, and its biological significance is thought to be much greater than current knowledge suggests. To discover more about this spectacular environment, the State

government, through the Department of Conservation and Land Management (CALM) and the Department of Fisheries, has committed $5 million over four years for research in the waters of Ningaloo Marine Park.

Conserving for the future

The relatively pristine nature of Ningaloo Reef contrasts starkly with the often degraded and threatened nature of coral reefs worldwide. Twenty per cent of coral reefs have been lost entirely, and scientists predict that up to 50 per cent of reefs will succumb to the effects of global warming and other forms of degradation over the next 20 years. The distance of Ningaloo Reef from large cities, combined with its relative lack of land-based impacts, such as nutrient-laden freshwater run-off, has protected it from much of the damage being inflicted upon other reefs worldwide. Nevertheless, Ningaloo Reef's close proximity to the shore renders it highly vulnerable to recreational impacts, including damage from boating, fishing, diving and snorkelling. Ningaloo is also now one of Western Australia's premier nature-based tourism destinations. These pressures on the area have increased steadily in recent years

Ningaloo Reef is one of the world's most pristine large coral reef structures and, given Australia's economic position and quality scientific resources, the WA community has an opportunity to conserve the pristine qualities of the reef indefinitely. However, this will require careful planning and a greater emphasis on the benefits of education. The preservation of Ningaloo Reef also requires collaboration between scientists, government bodies, managers and local communities. This will lead to environmentally and socially responsible conservation outcomes.

Information isolation

Despite the ecological significance of Ningaloo Reef, our understanding of the many processes that drive and sustain it is surprisingly limited. The reef's distance from Perth makes research expensive and logistically difficult. Nevertheless, much excellent research has been conducted but, unfortunately, few of the research outcomes are communicated to local interest groups or members of the public. Instead, scientific research findings are often published in specialist journals with limited distribution, or communicated at international conferences, often held thousands of kilometres from the actual site.

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Main Cabbage coral.

Left Racoon butterflyfish are generally found in pairs and may even stay together for life.
Photos – Steven Thorne

Above All 15 families of hard coral found in Australia have been recorded in Ningaloo Marine Park.
Photo – CALM

This is of concern, as the transfer of information directly to local communities can be a highly effective conservation tool, particularly if the information is then passed on to the many thousands of tourists who visit Ningaloo each year, ultimately increasing global awareness of potential threats to the reef. As the number of visitors to Ningaloo increases, it will be important to place more emphasis on education, so users of the resource become more aware of the potential impacts of their actions. The open communication of research findings may also have other benefits, including collaboration between local communities, scientists and government management authorities. This would, in turn, greatly extend the scope of research, and significantly expand potential research infrastructure.

Marine science seminar

In 2003, The University of Western Australia (UWA), in collaboration with researchers and coral reef managers, held the first of what is hoped to be a series of community-based marine science information seminars. Held in Coral Bay, the seminar aimed to foster communication between scientists, managers and the local community, by presenting the results of research into a number of ecological issues affecting both local residents and the overall health of the reef. In particular, the seminar sought to emphasise the importance of facilitated education as a potential conservation tool.

One of the feature topics was the presentation of information about the natural coral die-off events that have repeatedly occurred in Coral Bay. CALM Exmouth District Manager Jennie Cary (previously Senior Marine Ecologist at CALM) explained how coral spawn—consisting of sperm and eggs—could become trapped within embayments during periods of low wind, where it subsequently died. This process, in certain environmental conditions, removes most of the oxygen from the water and effectively suffocates the marine life. This entirely natural phenomenon has impacted parts of Coral Bay at least three times in the last 20 years, resulting in the death of numerous corals (particularly in the nearshore zone) and the death of an estimated one million fish.

Recovery of corals following these events is painfully slow, likely to take place over years or decades. James Gilmour, a UWA PhD candidate and Australian Institute of Marine Science (AIMS) researcher, explained that knowledge of where and why coral larvae settled was important for conservation and management of reefs, because areas that received high levels of recruitment may recover faster than areas with a low supply of larvae. James Gilmour and his AIMS colleagues have measured differences in coral recruitment at various spatial scales and determined that some parts of the reef have consistently high recruitment, while others, such as Bills Bay (the central Coral Bay lagoon) do not. Consequently, Bills Bay corals have recovered only marginally from the catastrophic mortality following a coral spawning event in 1989.

Several other aspects of the reef's ecology were also outlined: Josie Dean from CALM summarised the success of CALM's *Western Shield* program, which aims to bring threatened animals back from the brink of extinction through baiting for feral animals. Predation by foxes on turtle hatchlings and destruction of nests by recreational vehicles are major threats to Ningaloo's turtle species. The baiting program, which uses the naturally occurring poison 1080, has so far been effective in reducing the number of foxes and has decreased the threat posed by feral animals to the hatchlings and their nests.

UWA's Glenn Shiell presented the findings of his investigation into the ecology and reproduction biology of sea cucumbers. Although they are often incorrectly referred to as 'sea slugs', these creatures are more closely related to sea stars, sea urchins and feather stars. The growing popularity of sea cucumber as a delicacy in China has led to the near extinction of some species in many parts of the world, including Ashmore and Cartier reefs in the far north-west of WA. Science is now striving to better understand the significance of these interesting animals, which have clear benefits for the functioning of coral reef ecosystems. Sea cucumbers ingest sand and other small particles on the seafloor and digest any organic matter, thereby fulfilling an essential role in the recycling of nutrients within coral reef ecosystems.

Diverse ecosystem

Ben Fitzpatrick presented the results of a collaborative survey with Murdoch University into the marine ecology of Bateman Bay (just north of Coral Bay). Ben explained that Bateman Bay was an ecologically diverse ecosystem. Bateman Bay, including its under-appreciated sandy habitats, provides important habitat for many marine creatures, including the spectacular manta rays, humpback whales, Indo-Pacific humpback dolphins and dugongs. Incidental observations and anecdotal evidence provided by charter operators indicate that the bay is a nursing or feeding area for these animals. Fifty five species of juvenile fish are known to inhabit the nearshore reef and seagrass habitats of the bay, including the recreationally

Top left At Coral Bay, Ningaloo Reef lies in very close proximity to the shore.

Centre left Green turtles are quite common in and around Coral Bay.

Left Giant clams are very common in Ningaloo Marine Park and can be seen in shallow water.
Photos – Steven Thorne

Above Whale sharks are an iconic megafauna species of Ningaloo, and draw thousands of tourists each year. *Photo – Jeremy Colman*

Right Frog fish. *Photo – Steven Thorne*

targeted spangled and red emperor species. Bateman Bay also provides nesting and feeding habitat for loggerhead, green and hawksbill turtles. This survey provided an ecological context of the potential effects of a proposed development of a marina and resort complex just north of Coral Bay.

Finally, UWA PhD candidate Sarah Gardner outlined her proposed research into the manta ray aggregations on Ningaloo Reef. The interesting and gentle nature of manta rays has led to a lucrative tourist industry that provides people with an opportunity to swim with these creatures. As this industry continues to expand, there is a clear need for baseline information on the biology and behaviour of manta rays. Sarah aims to research the variability of manta ray populations, their behaviour and habitat use, and the potential impacts of interaction with people.

The seminar was attended by an enthusiastic crowd of more than 100 people, including tour guides, local residents and visitors from outside the region. It was abundantly clear that the local community were extremely appreciative of the delivery of up-to-date information on topics of direct relevance to their local environment and ecology-based businesses. It was clear from the positive feedback that information presented on the night would be passed on to visitors.

One thing is certain. Careful planning, active communication between governments, the local community and research scientists, and a greater emphasis on community education are crucial to efforts to conserve Ningaloo Marine Park. Only such coordination, combined with greater educational resources, can lead to environmentally and socially responsible conservation outcomes.

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