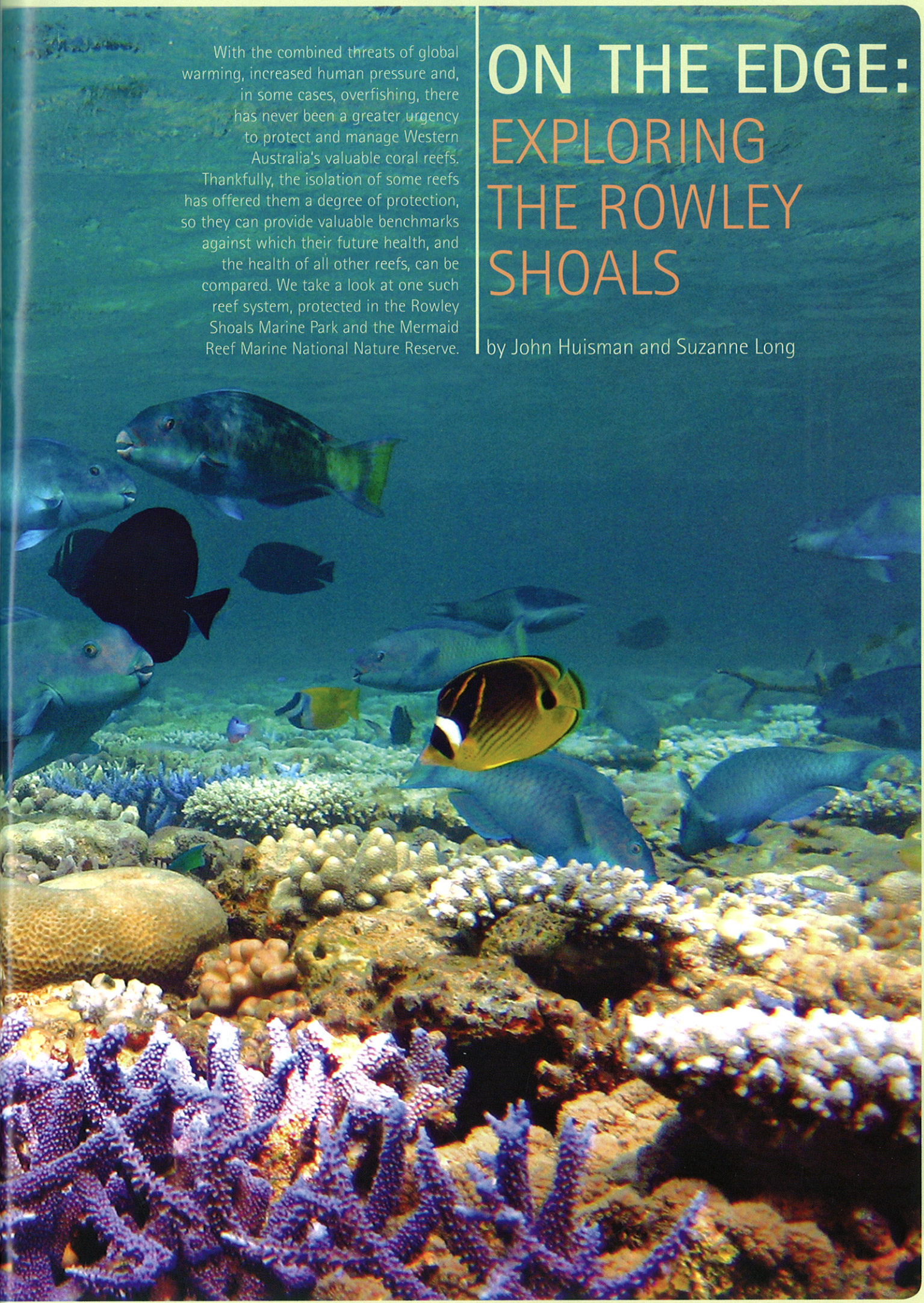
ON THE EDGE: EXPLORING THE ROWLEY SHOALS

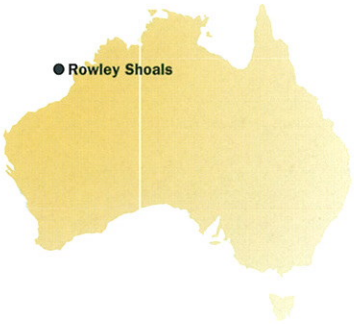
With the combined threats of global warming, increased human pressure and, in some cases, overfishing, there has never been a greater urgency to protect and manage Western Australia's valuable coral reefs. Thankfully, the isolation of some reefs has offered them a degree of protection, so they can provide valuable benchmarks against which their future health, and the health of all other reefs, can be compared. We take a look at one such reef system, protected in the Rowley Shoals Marine Park and the Mermaid Reef Marine National Nature Reserve.

by John Huisman and Suzanne Long



Lying some 300 kilometres west-north-west of Broome, on the edge of the continental shelf in deep, clear oceanic waters, are three atolls that comprise the Rowley Shoals. These atolls, often described as the best geological examples of shelf-edge reefs in Australian waters, are largely protected from most human impact due to their isolation, which has kept them among the most pristine in the world. But with increasing pressure from human activities, however well-intentioned, plus the threats from global warming and coral bleaching, the health of the atolls could be at risk. The Rowley Shoals are protected by State and Federal laws, but keeping them in good shape requires more than just legislation; it requires an intimate knowledge of the reefs and their inhabitants, ongoing management based on detailed scientific research, and vigilant surveillance to deter illegal activities.

With this in mind, a team of marine biologists from the Department of Environment and Conservation (DEC) and the Australian Institute of Marine Science (AIMS) visited the three atolls



in December 2007. This expedition represented a major collaboration between the two institutions, and was also the maiden voyage for the new AIMS research vessel, the RV *Solander*, a 35-metre high-tech vessel, built in Fremantle.

Discovery

The Rowley Shoals were named in 1818 by Lieutenant Phillip Parker King, who charted much of the north-western Australian coast. He named the atolls "in compliment to the discoverer of the westernmost (the Imperieuse [Reef])", Admiral Sir Josias Rowley (1765-1842). Rowley had encountered the most south-western of the atolls in HMS *Imperieuse* in 1800, and the reef bears the name of his ship. King, in the cutter *Mermaid*, visited Imperieuse Reef and fixed its position, then headed north-east and charted the position of the second reef, which he named Clerke Shoal (now Clerke Reef) after the whaler Captain Clerke, who first reported the reef some 10 years earlier. King named the most north-eastern reef Mermaid's Shoal, after his "little vessel" (as he described it). The small island at Imperieuse Reef was later named Cunningham Island in honour of Allan Cunningham, the botanist who accompanied King. The island at Clerke Reef is now known as Bedwell Island, for Frederick Bedwell, the master's mate aboard the *Mermaid*.

However, western mariners weren't the first to visit the shoals, as it is likely that fishermen from Indonesia had visited them from at least the mid-eighteenth century. The fishermen, who knew the shoals as *Pulau Pulo Dhaoh*, were collecting or hunting for trepang (holothurians or sea cucumbers), turtle shell, trochus shell and shark fin.

Management

Each atoll covers an area of about 80 to 90 square kilometres within the rim of the reef, including the lagoons, while the land areas are negligible. The reefs are about 30 kilometres apart and rise steeply from the ocean floor, the shallowest being Imperieuse Reef at 230 metres deep, becoming progressively deeper northward to Mermaid Reef, which sits in water 440 metres deep.

Imperieuse and Clerke reefs are protected in the Rowley Shoals Marine Park, which was gazetted in 1990 and then extended in 2004 to the limits of State waters, covering about 87,632 hectares. These reefs come under the jurisdiction of Western Australia because each has a permanent island. Bedwell Island is home to one of only two colonies of red-tailed tropicbirds in WA. Shearwaters, sea-eagles, terns, plovers and egrets also nest on Bedwell, and numerous migratory birds from Asia and even Siberia use the island as a resting site during their epic yearly flights.

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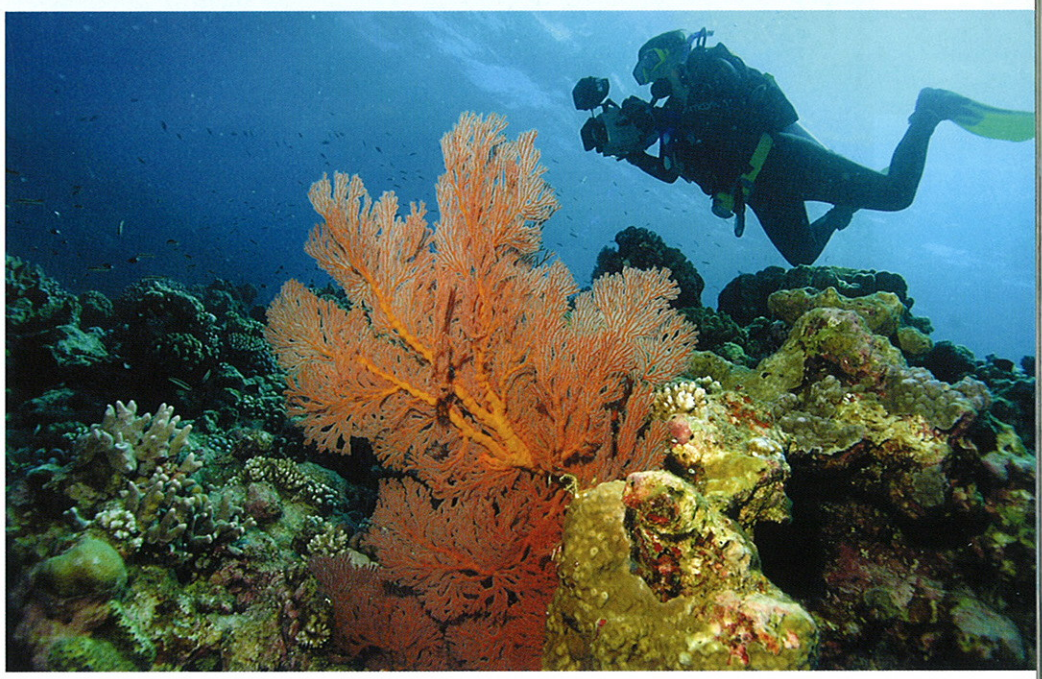
Main Healthy fish and coral communities in the sheltered lagoon of Clerke Reef.

Below A tender departs the new purpose-built AIMS research vessel *Solander*.
Photos – Suzanne Long/DEC

Below right Red-tailed tropicbird.
Photo – Huw Dilley/DEC

Above Coral bommie in Clerke Reef.
Photo – Suzanne Long/DEC



Right Suzanne Long working on a benthic community transect.
Photo – Eric Matson/AIMS

Mermaid Reef contains no permanent land above the high-water mark so lies in Commonwealth waters. It forms part of the Mermaid Reef Marine National Nature Reserve managed by the Department of the Environment, Water, Heritage and the Arts. The 53,984-hectare reserve was declared by the Australian Government in 1991 and is managed to preserve its ecological processes and systems and to protect it from the pressures associated with human use.

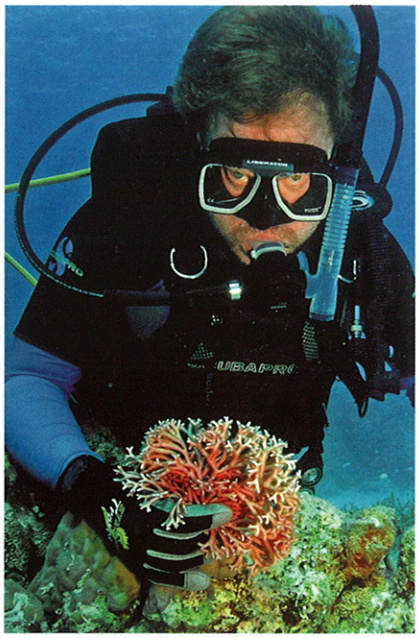
Although very remote, the Rowley Shoals are visited regularly by adventurous divers, fishers and sightseers. Fishing is not permitted anywhere within the Mermaid Reef Marine National Nature Reserve. In the Rowley Shoals Marine Park fishing is permitted only outside sanctuary zones. However, potato cod, Maori wrasse, coral trout, Queensland groper and all shellfish within 1.6 kilometres of the reefs are fully protected.

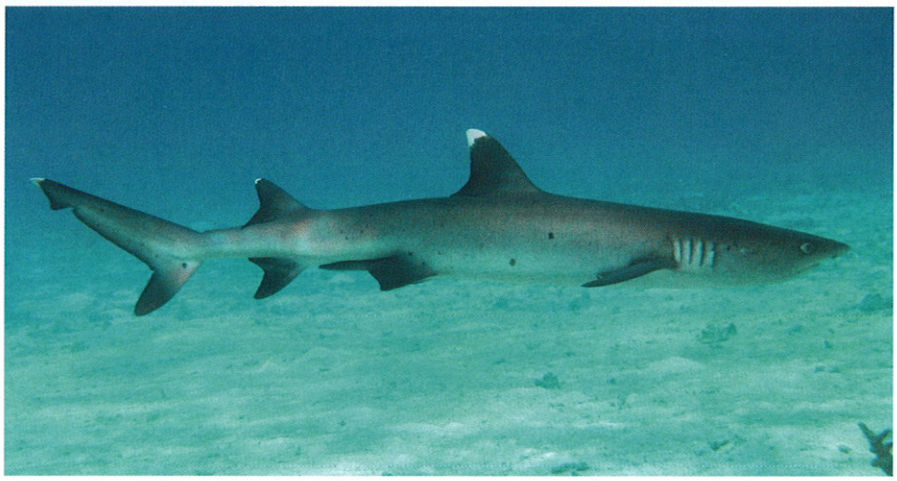
The collaborative expedition targeted several aspects of the reefs' biodiversity, with small teams of three to four biologists responsible for each. The survey aimed to collect data that could directly inform management of the Rowley Shoals Marine Park and the Mermaid Reef Marine National Nature Reserve. Together with results generated from earlier expeditions undertaken by the Western Australian Museum (see 'Life in isolated oases', *LANDSCOPE*, Winter 2007), this survey has dramatically increased our knowledge of the reefs' biology.

Bottom dwellers

Coral reef communities are highly dynamic ecosystems. This is reflected by periodic shifts of dominant species and relative cover of some key inhabitants of these communities: hard corals, soft corals and seaweeds. Dramatic changes are often caused by disturbance, such as domination of the reef by soft corals or seaweed following stress-related reductions in hard corals, or the loss of sensitive habitat-forming corals due to acute disturbances such as bleaching. Both these scenarios can cause significant detrimental flow-on effects to the ecosystem as a whole. Work to understand the responses of coral reef communities to different kinds of disturbance is essential for effective conservation management, particularly as the nature of such responses is often a good indicator of the health of the ecosystem.

This component of the expedition aimed to provide a snapshot of the





Above left Animals that are heavily fished elsewhere in the world, such as clams, are found in high numbers at the Rowley Shoals.
Photo – Shannon Armstrong/DEC

Above John Huisman examines the unusual red seaweed *Ganonema farinosum*.
Photo – Eric Matson/AIMS

Left Whitetip reef sharks (*Triaenodon obesus*) were regularly seen at all reefs.
Photo – Iain Field/Charles Darwin University

composition of the benthic communities (those that grow attached to underwater surfaces). Twenty-two long-term monitoring sites were revisited and three new sites established. At each, video footage was taken of five 50-metre transects. The footage will provide detailed information that can be used to monitor the health of the reefs. Soft corals were surveyed at 18 sites. Those encountered were identified (so far as possible in the field), most were photographed, and samples were taken of new observations for later taxonomic analysis. Spectacular sea fan gardens comprising both Pacific and Indian ocean species were found in the deeper waters. This survey was the first step towards understanding the importance of the ecological role played by soft corals on Western Australian reefs.

All seaweed species encountered at each site were photographed to form part of an identification guide to assist with the analysis of videos of benthic communities at the Rowley Shoals. The benthic team was led by Suzanne Long, who worked with DEC's Marine Science Program, with seaweed surveys by John Huisman from DEC's Western Australian Herbarium and soft coral surveys by Katharina Fabricius of AIMS. The team was supported by Eric Matson from AIMS and Steve Dutton from DEC.

Cucumbers and snails

High-value edible holothurians (sea cucumbers), trochus shells and giant clams perform important ecological functions and have been overfished on most Indo-Pacific reefs. At each site visited during the expedition, the 'slug team' traversed large distances by snorkel, counting and measuring the sea cucumbers and trochus. This will give a clear indication of the health of the populations and will be compared with similar studies undertaken at Scott Reef, further to the north.

Since fishing of these species is prohibited at all three atolls of the Rowley Shoals, but permitted at Scott Reef by traditional Indonesian fishermen under a memorandum of understanding between the Australian and Indonesian governments, monitoring populations of these commercially important invertebrates will provide information about pristine population characteristics and give indications of illegal fishing. Although illegal fishing at the shoals is thought to be uncommon, a Taiwanese fishing vessel was apprehended at Mermaid Reef Marine National Nature Reserve in 1984 with a large quantity of clam meat. Apart from this incident, the extent and impacts of illegal fishing activity are unknown.

The slug team was led by Jamie Colquhoun of AIMS and included Kylie Cook of AIMS and DEC's Huw Dilley and Shannon Armstrong, supported by volunteer Phil van Dyk.

Right Yellow margined moray eel at Imperieuse Reef.
Photo – John Huisman

Below right Dive support vessel in the channel at Imperieuse Reef.
Photo – Suzanne Long/DEC

Shark tales

Sharks are under relentless pressure worldwide from overfishing, both legal and illegal. This is reflected in the dwindling populations in many areas, but arresting this decline is hampered by how little is known about many aspects of their biology, including home ranges, stock sizes and migration patterns. This information is essential if management strategies, such as establishing marine parks and reserves at scales appropriate to ensure the survival of sharks in reef systems, are to be implemented.

The abundant populations of reef sharks at the Rowley Shoals, primarily silvertip (*Carcharhinus albimarginatus*) and grey reef sharks (*C. amblyrhynchos*), provided a unique opportunity to gather baseline biological information on habitat use and migration over time that can be used to ensure protection and survival of these species. This aspect of the expedition, led by Iain Field of AIMS and Charles Darwin University and supported by Warren White from Wildlife Resources, first established an array of acoustic listening stations at the reefs. Then came the hard part—catching the sharks. This was done at night using baited barbless hooks, with the sharks then gently cajoled into a specially designed hammock.

The sharks were measured, small tissue samples taken for DNA analysis, and an acoustic transmitter tag attached to the dorsal fin before being returned to the water. Thirty-seven sharks were tagged across all three shoals. Data will be downloaded from the listening stations periodically during the next 18 months, which will track the movement of individual sharks across the reef atolls, showing patterns of reef attendance, habitat use and migrations between reefs.

The expedition found the coral reef communities of the Rowley Shoals were generally in an excellent condition. Maori wrasse, sharks and commercially important invertebrates such as trochus shells, trepang and clam species are abundant at the Rowley Shoals and are larger in size and inhabit a more diverse habitat range than populations to the north at the heavily fished Scott, Ashmore and Cartier reefs.

It doesn't end here

WA's remote coral atolls are among the most pristine in the world, but keeping them that way cannot be left to chance. If we are to guarantee these atolls are left for future generations to visit and enjoy, ongoing scientific research is imperative to document the reefs' inhabitants, understand the ecological processes governing the reefs, and monitor that all is well. This research then feeds directly into the second essential component of maintaining the reef health—management. By ensuring that visitor numbers are kept low, boat and diver impact is kept to a minimum, and any fishing is limited and wholly sustainable, we will hopefully ensure that the Rowley Shoals Marine Park and Mermaid Reef Marine National Nature Reserve remains in its pristine state. And we're not doing this just for ourselves. As coral reefs continue to degrade worldwide at an alarming rate, the Rowley Shoals are our chance to show the world that reef conservation is achievable. Through careful management we can establish and maintain the Rowley Shoals as regional and potentially global benchmarks for coral reef biodiversity conservation—a pristine wilderness, if not untouched, then untainted. Something we can all be proud of.

John Huisman is a research scientist, currently holding a joint position with the Western Australian Herbarium and Murdoch University. He is an international expert on seaweeds and can be contacted by email (john.huisman@dec.wa.gov.au).

Suzanne Long was, at the time of the expedition, a senior research scientist with DEC's Marine Science Program. She has since taken up a position at the Reef and Rainforest Research Centre in Cairns, Queensland, and can be contacted by email (suzanne.long@rrrc.org.au).

For more information on the Rowley Shoals and Scott Reef, see the article 'Life in isolated oases' by John Huisman and Sue Morrison in *LANDSCOPE* Winter 2007, and visit DEC's website (www.dec.wa.gov.au).

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