Secrets of

A study on the effects of prawn trawling has revealed a surprising diversity of seabed life off Queensland's north-east coast. The study will contribute to the management of multiple use areas in the Great Barrier Reef Marine Park. Katherine Johnson reports.

The Remote Operated Vehicle (ROV) whirs along the seabed off far northern Queensland, relaying digital images to the research vessel 40 metres above.

Up in the wheelhouse, three marine scientists are stationed at a video monitor. As one drives the ROV, another records the data on a computer. A third notes other parts of the marine ecosystem as they come into view.

The scientists are 50 kilometres offshore, in an area known as the lagoon. Most people consider unremarkable this deeper water between the coast and the Barrier Reef, but after five years of research in the area, the scientists know better. For them it's no surprise when diverse gardens of marine life – soft corals, sponges, sea-whips and fish – spring into view.

'This is the first time that much of the Great Barrier Reef's inter-reef habitat has been comprehensively studied,' says cruise leader Dr Roland Pitcher, of CSIRO Marine Research.

'Most attention in the past has focussed on the highly photogenic coral reefs. The waters between the reefs are so unexplored that for some areas we have had to draw up our own navigation charts.

'While the lagoon and inter-reef habitats are mainly bare, muddy or sandy areas, people are often surprised to hear that there are also algal and seagrass meadows, highly diverse sponge and coral garden patches and deeper hard coral reefs.'

Coral reefs make up about 6% of the 350 000km^2 Great Barrier Reef Marine Park (GBRMP). A further 70% consists of deeper waters between the reefs, and the lagoon. (Deep ocean waters outside the reefs account for the remaining 24%.)

Prawn trawling is the major fishing activity in the GBRMP. It occurs mostly in the lagoon and some inter-reef waters. Queensland's East Coast Prawn Trawl Fishery is the most important in the state, with an annual value of about $130 million. Some 800 trawlers are licensed to operate in the area. Many of them trawl in the Great Barrier Reef region.

Trawl grounds in the GBRMP cover 153 000 km^2, but the intensity of trawling varies. About 27% of the lagoon and inter-reef seabed is not trawled at all, and of the seabed that is trawled, most of the trawl effort is concentrated in less than 20% of the area. About 70% of the trawled grounds have been trawled less than one pass per year since the fishery became established in the late 1960s.

In 1989, a scientific workshop on the effects of fishing in the GBRMP recommended investigating the environmental effects of prawn trawling. A lack of information about the park's trawled areas was making management difficult.

The resulting study was conducted by CSIRO Marine Research and the Queens-

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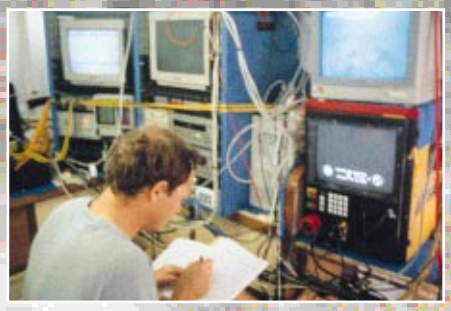
the lagoon



land Department of Primary Industries. It was the first to assess the environmental effects of prawn trawling in the tropics and the largest research project on the environmental effects of prawn trawling in the world.

Funding was provided by the Great Barrier Reef Marine Park Authority (GBRMPA), the Fisheries Research and Development Corporation, the Australian Fisheries Management Authority, CSIRO and QDPI. Support also came from the fishing industry.

The research took place in a 10 000 km^2 area of the far northern section of the park known as the Green Zone, which had been closed to trawling since 1985. Commercial trawling activities were simulated by conducting repeated trawls over an area of seabed. They showed that a single trawl had less impact than previously thought, but that there was a cumulative effect.

'Each pass of the trawl along the seabed removes about 5-25% of seabed life, while seven trawls over the same area of seabed remove about half of the seabed life, and 13 trawls remove 70-90% of seabed life,' says CSIRO program leader, Dr Ian Poiner. 'The research also showed that large sponges and flower-pot corals are susceptible to trawling, whereas species such as seawhips and gorgonians are more resistant,' he says.

The scientists found that the effects of trawling depend not only on the amount of marine life removed, but also on the

Main picture and inset top: Gorgonians captured in the artificial light of the ROV. The light transforms the seabed, making visible reds and yellows not normally seen at depth. 'Reds, oranges and yellows, are the first to be lost when you go underwater,' Roland Pitcher says. 'By 20 metres or so, everything, even brightly coloured fish, becomes bluey green.

Inset from above: CSIRO Marine Research scientist Roland Pitcher makes notes from a video recorded by the ROV; A plate coral, one of the 1000 seabed species found in the study area, which indicated a high biological diversity; Predation experiments were conducted to determine how much of the bycatch from prawn trawling is consumed.

A means of mapping more territory

FOR marine scientists, Australia's 12 million square kilometre Exclusive Economic Zone represents a new frontier. Only 5% of its physical terrain (valleys, plains and mountains) and less than 2% of its marine habitat has been mapped.

Ocean mapping – surveying marine resources and their supporting habitats – is vital to sustainable ocean management, but with an ocean territory twice the size of Australia's landmass, where do you begin?

Scientists at CSIRO Marine Research believe the answer lies in a new 'rapid mapping' system for ocean habitats.

The system simultaneously deploys towed video cameras, side-scan sonar, seabed dredges and sediment samplers from a research vessel, enabling information on continental shelf seabed habitats to be rapidly collected. Remote-operated vehicles can then be used for more detailed habitat investigation.

A typical habitat description includes maps of bathymetry, topography, sediment type, biological productivity, vegetation and seabed fauna density, and type and abundance of fish communities. More than a dozen such site descriptions can be achieved in a day, and an area as large as 10 000 km^2 can be mapped in two to three weeks.

Using the system, CSIRO scientists have mapped 50 000 km^2 of Torres Strait, 15 000 km^2 of the Great Barrier Reef, 64 000 km^2 of the North West Shelf and 30 000 km^2 of the south-east Australian Continental Shelf.

ability of marine communities to recover between trawls, and also on the distribution and intensity of prawn trawling in relation to the distribution and abundance of seabed life.

'Recovery rates of seabed life are poorly known, but can be expected to range from one to 20 years depending on the species,' Poiner says. 'Continuing research in the area will monitor recovery and provide answers to this important question.'

Bycatch was also investigated in the study. In the far northern GBRMP, for every tonne of prawns retained, about 6-10 tonnes of other species are discarded. That's about 2 kg of discards per hectare annually on trawled grounds. Most of the discards were fish and crustaceans, which were eaten rapidly either by seabirds or small sharks and fish.

The study concluded that for most of the GBRMP, eliminating bycatch would have little impact on scavenging species. An exception is the crested tern, populations of which have doubled since trawling began in the late 1960s.

The research is of interest to fishers concerned about the possible impact of prawn trawling on fish populations. While adults and juveniles of recreationally and commercially important fish species were present in the study area, none of these fish were caught in the experimental prawn trawls.

Those involved in the management of trawling and concerned with its environmental effects in the region are considering the study.

Summaries of the report are available from Dr Phil Cadwallader, GBRMPA, PO Box 1379, Townsville QLD 4810, (07) 4750 0812.

Above left: The study found that populations of crested terns may have increased in response to the discarding of bycatch.

Above: A 'large' sponge collected during experimental trawling.

Top: A soft coral pictured next to the cable that links the ROV to the mother ship. Occasionally, the ROV uses a robotic arm to attach a specimen with an electronic tag. The tag number is then linked to the digital image and the size and location of the specimen automatically recorded. Scientists can later return to the specimen and take new photograph, thereby determining its rate of growth. This can help them to determine how quickly a species will regenerate after disturbance.

ABSTRACT

A five-year study of the environmental impact of prawn trawling in the Great Barrier Reef Marine Park has found a high degree of biological diversity on the seabed in deep waters between reefs, and between the Great Barrier Reef and the Queensland coast. The study found that each pass of a prawn trawl along the seabed removes 5-25% of seabed life and the species most vulnerable to disturbance are large sponges and flower-pot corals. Bycatch studies indicated that in most of the park's trawl grounds, discarding of bycatch is not having a serious impact on scavenging species. Experimental prawn trawls caught no commercially important fish species.

Keywords: **Prawn trawling; seabed; ocean mapping; wildlife surveys; Great Barrier Reef; biodiversity.**