

# Unseen diversity

Microorganisms – bacteria, fungi, protozoa, algae and viruses – are fundamental to the existence of 'higher' lifeforms, yet tend to be overlooked in debates about biological diversity. Microbes are thought to make up about a quarter of Earth's biomass. It is estimated that there are hundreds of thousands of species of microbes in the world, but only about 40 000 have been cultured or identified.

Microorganisms are responsible for almost all the nutrient and many of the mineral transformations in soils. For example, in the carbon cycle, they decompose organic matter and transform cellulose, hemicellulose, other polysaccharides, hydrocarbons and lignin. They facilitate nitrogen fixation and the decomposition of animal and plant proteins and amino acids.

Pollutants such as oil, pesticides and sewage can be decomposed by soil and aquatic microbes. Their use to control pests in agriculture is likely to expand as more is learnt about them.

Antibiotics are the best known examples of medical benefits derived from microorganisms, and they are also used to produce fine chemicals, agrochemicals, single-cell protein for animal feedstuffs, and in the treatment of effluent and waste.

Planktonic algae in the Earth's oceans fix more than half of the world's carbon. A reduction in algal growth in the oceans would therefore have a profound effect on higher organisms in the food chain.

Soils and water contain a diversity of microorganisms, some of which can reverse the effects of pollutants by biological control of invading organisms or decomposition of chemicals. But in cases of large-scale sewage pollution, microbial activities may become so intense that their waste products reach toxic levels and oxygen becomes limited. This can lead to losses of some groups of microorganisms.

*This information is from an article by Dr Margaret Roper of the Division of Plant Industry: 'Biological diversity of microorganisms: an Australian perspective', Pacific Conservation Biology 1: 21-28, 1993.*



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# Study in

## Research into the effects of prawn trawling is a priority for managers of the Great Barrier Reef.

The effect of fishing on a prawn being caught in a trawl net is predictable: the prawn ends up on somebody's barbie. The effect of fishing on the area being trawled is less certain, and is becoming a matter of great concern to fisheries worldwide.

In Australia, the Great Barrier Reef Marine Park Authority regulates activities that exploit the reef's natural resources. In 1989 the authority convened a workshop to discuss research into the effects of fishing.

The workshop decided research into the effects of prawn-trawling was a priority. A five-year study by CSIRO's Division of Fisheries and the Queensland Department of Primary Industries has since begun.

Protecting important areas of fish habitat to safeguard marine fish stocks is also an important goal of the Federal Government's marine conservation program Ocean Rescue 2000. This 10-year program, begun in 1991, aims to gather information and develop long-term plans for the sustainable use of Australia's marine environments.

It includes preparation of a State of the Marine Environment Report; expansion of the existing system of marine parks and reserves; a conservation plan for Australia's marine areas; a national marine education program a national marine information system and a marine and coastal community network.

Harvesting fish by commercial or recreational fishing changes ecosystems. The degree of change is largely determined by the species that is exploited, the role the target species play in the particular ecosystem and by the impact of the gear on the ecosystem.

Researchers involved in the prawn trawling study have some thorny

questions to consider. They include:

- What are the predictable effects of fishing?
- How will the animal being fished be affected?
- Will its population decline in the long-term?
- How will animals that prey on the target species be affected?
- How will the animals caught along with the target species be affected?
- Does throwing away non-target species affect bird, shark and dolphin populations?
- Which species will benefit from, and which will suffer from, changes to the seabed?
- Does the seabed return to its previous state and if so, how long does it take?
- How far down the food chain will effects be felt?

The study is comparing areas closed to prawn trawling with areas open to trawling.

In the region between the coast and the outer Barrier Reef it will compare closed areas in a far-northern section of the Great Barrier Reef Marine Park called the Green Zone with open areas to the north and south. The aim is to find out what effect closing the Green Zone to fishing in the late 1980s has had on the seabed and the animal and plant communities. Experimentally-trawled and untrawled inter-reef areas will also be compared in one of the largest field experiments ever undertaken.

The first stage of the program involved describing the study areas. The description, completed in May 1992, details the fish, benthos (bottom-dwelling plants and animals), paenid prawns and sediments at 86 stations within the study areas. Further work on the sample plots will begin in 1994.





## g the effects of fishing

Prawn trawling also has an impact on the seabirds of the Great Barrier Reef. In Moreton Bay, the pied and little pied cormorants and the crested terns largely depend on the non-commercial species discarded after trawling.

The largest crested tern colony in the world is on Wellesly Island in the Gulf of Carpentaria. Historical records suggest that the numbers increased after trawling began in the area. Do the birds in the Great Barrier Reef also feed on the by-catch of fish and prawn trawlers? If so, which species and how dependent are they on this food source?

To find out, the Division of Fisheries scientists are studying seabirds near Lizard Island and north to the Green Zone, including remote Raine Island, which has large breeding colonies. The study is timed to cover both the open and closed prawn trawling seasons.

The uneaten food and pellets the birds regurgitate at their nests when alarmed are collected and analysed. Many of the hard parts in the pellets can be identified, and the durable otoliths (ear bones) can be 'read' like trees to ascertain the age of its former owner.

The size of bird populations in temperate zones is thought to be dependent on the amount of food available, because in other respects their environment does not change dram-

atically. In the Shetland Islands for example, seabird populations fell and millions died when fishing in the region virtually stopped. No one knows whether the size of tropical seabird populations is similarly coupled with food availability. If trawling stopped and the discards were no longer available, would their populations decreased? If trawling closures coincide with the breeding season, would thousands of nestlings die of starvation?

Turtles are also affected by trawling. In separate studies, scientists from both the Division of Fisheries and the Queensland Department of Primary Industries are trying to determine how many turtles are caught in prawn trawls in northern Australia including the reef.

The turtles may be more numerous in some areas than others, or more vulnerable at certain times of the year. With such information, management agencies such as the Great Barrier Reef Marine Park Authority will be able to make decisions that minimise the effects of fishing on turtles.

*This information is from an article by Vivienne Mawson from CSIRO's Division of Fisheries.*

**The white-capped noddy-tern. Scientists are studying breeding colonies of sea bird species such as this to see how they are affected by prawn trawling.**



## Managing the reef

Future strategies for conserving biological diversity will challenge traditional forms of resource-management. An ecosystem approach, already adopted to manage the Great Barrier Reef Marine Park, is likely to extend beyond Australia's protected areas.

The Great Barrier Reef is an example of an ecological system whose overall management is coordinated by one body: the Great Barrier Reef Marine Park Authority.

Chairman of the authority, Graeme Kelleher, says the Great Barrier Reef is the only large marine ecosystem in the world deliberately managed according to the principles of ecologically sustainable development. He says the management of large marine areas on an integrated basis, with primary responsibility resting on one agency, is the best way to achieve ecological sustainability.

'Otherwise, the energy of managers and users would be wasted in conflict between different sector groups, and issues would rarely receive the attention they deserve,' Kelleher says.

'A single agency is best equipped to reach the best possible balance of the sometime competing ecological, economic and social considerations, provided its charter is explicitly to achieve ecologically sustainable development.'

The Great Barrier Reef Marine Park, established in 1975, is the world's largest marine protected area. The reef is the largest system of corals and associated plants and animals in the world, and is home to about 1 500 species of fish; 400 species of corals; 4 000 species of molluscs; 500 species of seaweed; 215 species of birds; 16 species of seasnakes; six breeding species of turtles; and some of the largest populations of dugong in the world.

*Bryony Bennett*