Exploring new depths

Bryony Bennett

In 1800 the Royal Navy appointed Matthew Flinders captain of the tired vessel HMS Investigator and sent him to explore the southern coast of *Terra Australis*. The promotion held mixed blessings for Flinders. His career as a navigator, hydrographer and discoverer was to reach new heights, but his rotten luck with ships was to deepen.

During the next three years Flinders circumnavigated Australia, completing one of the most important exploratory surveys in the country's history. But the voyages finally wore out the Investigator so Flinders – after a false start on the Porpoise which was wrecked north of Sydney – took command of the Cumberland and set out for London with his charts and papers to request from the Admiralty a new vessel.

The Cumberland, however, leaked badly, so Flinders made for *Ile de France* (Mauritius). There he discovered that England and France were at war. After seven years as a prisoner, Flinders returned to England and spent a further three years writing *A Voyage to Terra Australis*. The first copy arrived at his bedside on 18 July 1814, the day before he died.

To help conserve the coastline that Flinders so brilliantly surveyed, a new wave of discovery is now taking place. This time it is Australia's seagrass meadows and reefs which are under scrutiny. These habitats reflect the changes wrought by human development in the 200 years since Flinders first sailed the 'South Seas'.

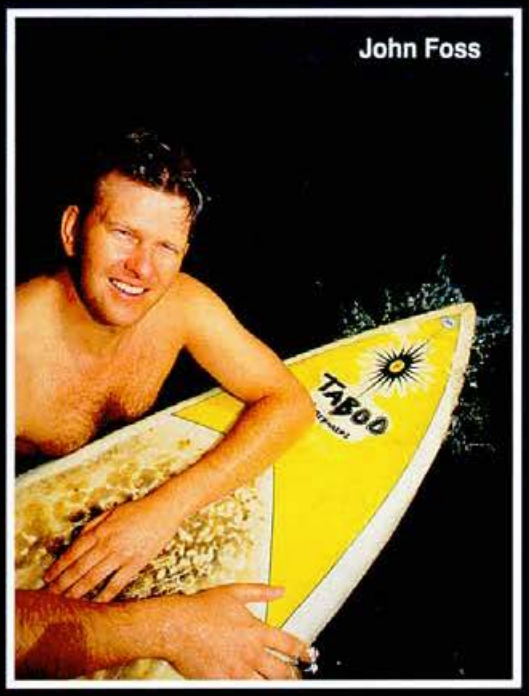
The Mapping of Australia's Underwater Features is a three-year project led by Dr Hugh Kirkman of CSIRO's Division of Fisheries at Marmion in Western Australia. It involves collecting and mapping information on Australia's seagrass and reef distribution, using – among other equipment – the South Australian Research and Development Institute's vessel Ngerin and a commercial fishing boat. Rather than being bound for the Admiralty, Kirkman's maps will become part of CAMRIS, the geographic information system (GIS) being established for Australia's coastal managers by the Division of Wildlife and Ecology (see story on page 21).

Kirkman says the location of marine nature reserves and national parks should be based on knowledge of the coast's underwater features. For example, reefs have many plants and animals of great scientific, aesthetic and commercial interest, while seagrasses are nursery areas for many fish and crustacea. But because the underwater features of Australia's inshore region have not been mapped, marine reserves are often selected on coastal features alone, with little consideration of what is underwater.

Seagrasses are endangered in areas of high coastal population because some of their habitats are prime sites for marinas and harbours. Near large cities, nutrients (treated sewage) dumped in the sea nourish epiphytes and phytoplankton which shade the seagrasses, causing them to die. Maps of vulnerable areas such as seagrass meadows can improve site selection for aquaculture, coastal reserves, developments and effluent outfalls, and also help decision-makers at times of oil spills or other pollution problems.

Two years into the mapping project, Kirkman and his team have collated existing information on Australia's seagrass distribution and completed maps at a scale of 1:1 million for CAMRIS. Now they are working on a more detailed map of underwater features off the Western Australian and South Australian coasts.

To achieve this level of detail, Kirkman uses existing information, satellite imagery, aerial photography and the Global Positioning System (GPS). Despite all the sophisticated technology though, fieldwork is still an essential part of modern-day exploration.



project's coordinator, Michael Legge-Wilkinson, says more than 1200 beaches will be represented.

In the meantime, Surfrider's 1800 or so members at 56 branches around the coast will continue their mission of 'Conservation, Activism, Research, Education'. For John Foss, that means working with SANE (Surfers Appreciating Natural Environment) to organise the first ever 'green' surfing contest at Victoria's Bells Beach where resource management and recycling will be promoted. Maybe he'll find time to catch a few real waves as well.

For Surfrider membership details contact: PO Box 444 Mermaid Beach, Qld 4218, (075) 35 0999, fax (075) 76 7157, toll free 016 78 5277.

Voyages of discovery

The mapping process is complex. Kirkman first selects satellite images of the coast, laminates them, and traces all the visible features below the waterline. Aerial photos help distinguish features near the shore. The next step is to see how the images compare with what's really there. This procedure is called 'ground truthing'.

Not every bay and headland along the coast is investigated; a group of representative areas is selected.

'I do this from experience and inspired guesswork,' Kirkman says. 'If you look at a map of Australia at a scale of 1:100 000 you'll bays repeated in shape many times in aspect exposure and the headlands at either end. I use this information to determine what is underwater.'

Kirkman leads survey teams of eight to 10 people made up of technicians, volunteer helpers and crew. So far they have explored deeper water off the islands of the Recherche near Esperance; the south coast from Albany to the cliffs of the Great Australian Bight; from the Head of the Bight to Elliston in SA; Kangaroo Island; and off the SA mainland from Gulf St Vincent to Victor Harbour.

At each dive site three pairs of divers, working from two inflatables and the mother boat, swim to the bottom, grab a handful of whatever is there and return to the surface. These are called 'bounce dives'. A mechanical 'grab' has been designed for areas too deep for diving.

The GPS position and substrate type is recorded at each location. Where there is vegetation, a sample is taken as a herbarium specimen. All this information is passed on to the 'mappers' after the cruise, who then add it to the satellite image, after which the information package is digitised for inclusion in CAMRIS.

Kirkman says he spends as much time preparing and completing the images as he does on the fieldwork. Sometimes there are more than 300 dives to put on outlines after one cruise.

Two cartographers from Coastal Information and Engineering Services, a unit of the WA Department of Transport, are helping with the mapping. In return, the department will add Kirkman's data to its Coastal Resource Atlas, a GIS designed to help manage oil spills. The WA departments of Land Administration and Environmental Protection and the SA Department of Environment and Heritage have provided relevant satellite images and enhancement support.

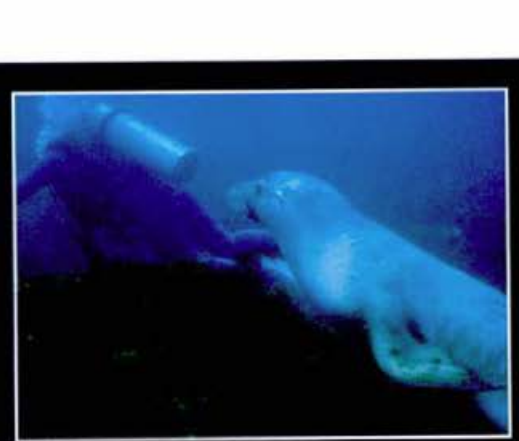
Exploration of the southern coast is planned to continue into Victorian waters. Information gathered by researchers in the other eastern states will also be collated. Kirkman says different methods will be needed to survey the turbid waters of the Kimberleys, Darwin and northern Australia. The final stage of the mapping project will involve collating available information on coastal macroalgae distribution in WA as a feasibility project for mapping macroalgae around Australia.

No doubt the full significance of Australia's 36 735-kilometre coastline eventually will be well-known and documented. As Kirkman continues his circumnavigation with a vigour akin to Flinders, perhaps we won't have too much longer to wait!

More about seagrasses

Kirkman H (1985) Community structure in seagrasses in southern western Australia. *Aquatic Botany* **21**: 363-375.

Kirkman H, Walker DI (1989) Chapter 5: Regional studies - Western Australian seagrasses. In: Larkum WD McComb AJ Shepherd SA (eds) *Seagrasses: a treatise on the biology of seagrasses with special reference to the Australasian region*: 157-181. Elsevier, North Holland.



Above right: Divers on the Ngerin prepare to sample underwater features off the South Australian coast.

Above: Sometimes the divers attract curious followers, such as this sea lion pictured at a reef off The Pages south of Victor Harbour.

Right: Seagrasses are nursery areas for many fish and crustacea. They are endangered near high coastal populations because some of their habitats are prime sites for marinas and harbours.

Far right: A CSIRO diver makes a video survey of filter feeders off the coast of Western Australia.