## Sewage pollution test

Shark attack is far from being the biggest risk associated with your next trip to the beach: at Sydney's beaches in particular, the greatest danger to swimmers until very recently was the household toilet — the beginning of a trail that led from an overworked sewage system to the discharge of inadequately treated sewage into the sea from ocean outfalls, from ocean outfalls towards swimming beaches... and, ultimately, to stomach upsets and eye and ear infections.

Extended outfalls — built to discharge sewage further out at sea — have improved the situation in Sydney, but water quality and sewage pollution must be constantly monitored to check the outfalls' performance. In other parts of Australia, even in sparsely populated areas, the situation is actually often worse because many places discharge sewage with little or no treatment.

Many disease-causing bacteria, viruses and protozoans find sewage a perfect environment for reproduction, and there are several ways of detecting their presence in sea water. Pollution-control officers collect sea-water samples from beaches in sensitive areas, especially those 'downstream' from sewage outfalls, and count the number of faecal coliform bacteria. If the count exceeds a set level, the beaches are closed until ocean currents have washed the pollution away.

Unfortunately, conventional monitoring of sewage pollution takes more than 24 hours, and can only be performed in a laboratory. Bacterial cultures have to be grown on agar plates to form recognisable colonies before they can be identified, and that means the microbiological information confirming the pollution is usually only available a day after the event... by which time the sewage could have affected thousands of swimmers.

Dr Simon Apte and Dr Graeme Batley, of the Centre for Advanced Analytical Chemistry at the CSIRO Division of Coal and Energy Technology, have developed a simple test for detecting faecal coliform bacteria in sea water that provides a useful 'early warning' — it takes just 60 minutes to produce a reliable indication not only of the presence of coliform bacteria, but also of the abundance of bacteria and hence the extent of pollution.

Oliver Strewe

**Conventional monitoring of sea water for pathogenic bacteria is a complex task requiring expensive equipment... and 24 hours in the laboratory. Scientists are developing a portable test kit that can give pollution-control officers results in just 60 minutes.**

Their test doesn't rely on identification of bacterial cultures; instead it operates by detecting an enzyme that occurs in coliform bacteria but not in marine bacteria. A measured water sample is added to a solution containing nutrients and an indicator chemical called methyl umbelliferone-ß-D-galactoside.

The mixture is then incubated at a controlled temperature, stimulating the bacteria to produce the distinctive galactose enzyme ß-galactosidase, which in turn 'cuts' the indicator molecules into two pieces. Fluorescence spectroscopy gives a measure of the amount of methyl umbelliferone cut up by the enzyme, which is proportional to the number of faecal coliform bacteria the sample contains. The technique's sensitivity means that it can rapidly detect small amounts of enzyme and, hence, small numbers of bacteria.

The test is undergoing field trials on Sydney beaches in conjunction with the Sydney Water Board and the New South Wales State Pollution Control Commission. Results to date are very promising, and Dr Apte and Dr Batley are working on a portable kit that will enable on-the-spot testing to be carried out at any nominated beach... in Australia or anywhere in the world where sewage pollution is a problem.

## A 24-hour watch

Orbiting 800 km above the Earth's surface, ERS-1 — the European Space Agency's first remote-sensing satellite — is adding a rich new layer of detail to what we know of our planet.

The first of a new generation of remote-sensing spacecraft, ERS-1 is devoted to gathering climatic and weather data critical to global environmental problems, and to improving weather forecasting through collecting information on global wind and wave movements.

It carries a state-of-the-art radar altimeter (accurate to within 10 cm) that will be used to measure wave heights, especially in polar regions where ground measurements are impossible.

The CSIRO has played an important role in designing the instruments ERS-1 carries, and scientists from several Divisions are involved in the satellite's investigations. Dr Ian Barton of the Division of Atmospheric Research co-designed ERS-1's Along-Track Scanning Radiometer (ATSC), an advanced infrared scanner that provides precise measurements of ocean surface temperatures — a prime indicator of greenhouse effect changes. Measurements of ocean temperature fluctuations in the South Pacific are vital to Australia, since they give an early warning of the El Niño events linked to severe droughts.

Australia and New Zealand have contributed 22 experiments to ERS-1's scientific activities and COSSA, the CSIRO Office of Space Science Applications, co-ordinated input from these countries. Dr Carl Nilsson of the Division of Oceanography now heads the research program.

He will be using ERS-1 to study the East Australian Current and aspects of the Southern Ocean; other Division of Oceanography researchers are looking at water-mass formation, heat fluxes in the Pacific and Indian Oceans, and continental-shelf circulation.

In addition, ERS-1 carries synthetic aperture radar (SAR), which can observe the Earth's surface at all times of the day or night, heedless of cloud or rain. Australia will receive SAR data at the Australian Centre for Remote Sensing ground station at Alice Springs, and at the TERSS facility in Hobart (see *Ecos* 68).