

Welcome to the first edition of *current directions* the new quarterly newsletter of the Strategic Research Fund for the Marine Environment or SRFME as it's known.

SRFME aims to enhance the capability and capacity for marine science in Western Australia and to facilitate strong and enduring collaboration among marine researchers in WA.

Already SRFME has made some significant investments in the development of marine science in WA. SRFME, in conjunction with four WA universities, has awarded 15 full or top-up PhD scholarships, two SRFME collaborative projects and one SRFME state linkage project. CSIRO has expanded its capability in WA from one marine scientist to 14 since the start of SRFME, and expects to have a full complement of 18 scientists and a total of 24 staff in place by mid 2003. Already there are some interesting findings from the unique and under-researched waters of Western Australia.

I hope you enjoy reading *current directions* and find its content useful and informative. I also encourage readers to take a look at the SRFME web site for updates on funding opportunities and research outcomes as well some interesting news involving marine science.

Dr John Keesing  
SRFME Research Director

## WHAT IS SRFME?

The Strategic Research Fund for the Marine Environment (SRFME) is a \$20 million, six year joint venture between CSIRO and the Western Australian Government. The research fund aims to enhance the capability and capacity of marine science in areas of strategic interest to the WA government. SRFME will invest in a number of large integrated marine science projects to be conducted by CSIRO, in collaboration with state and federal agencies, and in PhD scholarship projects. Importantly the research funded by SRFME will be strategic as opposed to applied or tactical research aimed at a particular single industry or management objective (which is more appropriately funded by other sources). It will therefore serve the long-term needs of Western Australia across a range of user groups from fisheries to ecosystem management.

The State Government Agencies involved in SRFME are: the Department of the Premier and Cabinet; Department of Conservation and Land Management; Department of Fisheries WA; Department of Environment, Water & Catchment Protection and the Department of Industry and Resources. For more information on SRFME, please contact the Research Director, Dr John Keesing on (08) 9222 8887 at Office of Science and Innovation, Depart. of the Premier & Cabinet, Level 2, 197 St George's Terrace Perth WA 6000.

## CMR MOVES TO FLOREAT

CSIRO Marine Research moved to Floreat in August 2002 ending 26 years of marine research at the Marmion site. The relocation is consistent with CSIRO efforts to consolidate its research activities in environment and life sciences in WA at the Floreat site. It presents an opportunity for a relatively small group of marine researchers from a range of disciplines to interact closely and collaborate with other scientists from the same discipline areas working in land, air and freshwater systems. The new address for CSIRO Marine Research is Underwood Avenue, Floreat Park, WA 6014, Private Bag No. 5 Wembley WA 6913.

## SRFME HEADS SOUTH

The southwest coast between Bunbury and Geographe Bay is becoming an area of focus for SRFME with CSIRO researchers beginning ecological, biogeochemical and remote sensing validation research there in March. The area has had some scientifically interesting occurrences recently with a large marlin being washed up in Busselton and six Gray's beaked whales beaching themselves in Geographe Bay resulting in a dramatic rescue bid by CALM.

> SRFME Research Director John Keesing assists in the Busselton whale rescue



## NEWS FROM THE FIELD

SRFME has three core research projects: 1) Biophysical Oceanography off Western Australia; 2) Integrated Modelling for Western Australian Marine Environmental Management; and 3) Coastal Ecosystem and Biodiversity Management for Western Australia. This first edition of *current directions* outlines the research focus of the first project.

### Biophysical oceanography off Western Australia

#### *Understanding the ebb and flow in Western Australia's oceans*

El Niño is known to affect the strength of Western Australia's Leeuwin Current and the landings of western rock lobster, pilchards and scallops, but the link between ocean physics and these fisheries remains unexplained.

This is one of the questions that SRFME's Biophysical Oceanographic Research Project is aiming to tease out. According to CSIRO's Tony Koslow, who leads the research, the missing link is thought to be biological oceanography — the food web throughout the water column and its relationship with ocean currents — which has never before been comprehensively examined across the continental shelf off Western Australia.

"We think climate is driving the lower trophic levels in the food web — the phytoplankton and zooplankton," says Koslow. "The focus of the research

program is to describe and model these links between ocean physics, chemistry, phytoplankton production and zooplankton and to see how these forces affect the fisheries and other biological processes.

"SRFME is providing a very exciting opportunity to build a multidisciplinary team to examine these linkages. This includes bringing together collaborators from the University of Western Australia, Murdoch University and Curtin University."

And there is a very practical angle to the research, says Koslow. Management of marine resources and habitats requires an ability to distinguish between the effects of natural climate variability and climate change from human impacts. Applications extend to management of fisheries, marine protected areas and the impacts of human activities in the coastal zone.

Field work began in February 2002, with a pilot cruise off Perth to study the physical oceanography, phytoplankton, zooplankton and larval fish across the shelf. Three quarterly cruises (February, August and December 2001) and five monthly cruises (between March 2002 and January 2003) followed. The cruises covered the major pelagic (water column) habitats — coastal lagoon, inner and outer shelf, the shelf-slope break and the offshore water of the Leeuwin Current — along a 100 km transect that runs southwest from Two Rocks (north of Perth).

Observations along the transect are planned to continue to the end of 2004, supplemented by sea surface temperature and ocean colour satellite data, broad scale research cruises on the national facility vessel (the *Southern Surveyor*) and, potentially, a mooring on the shelf.



Deploying the Isaacs-Kidd midwater trawl from the stern of the W.A. Fisheries vessel *Naturaliste*.

## Ocean physics

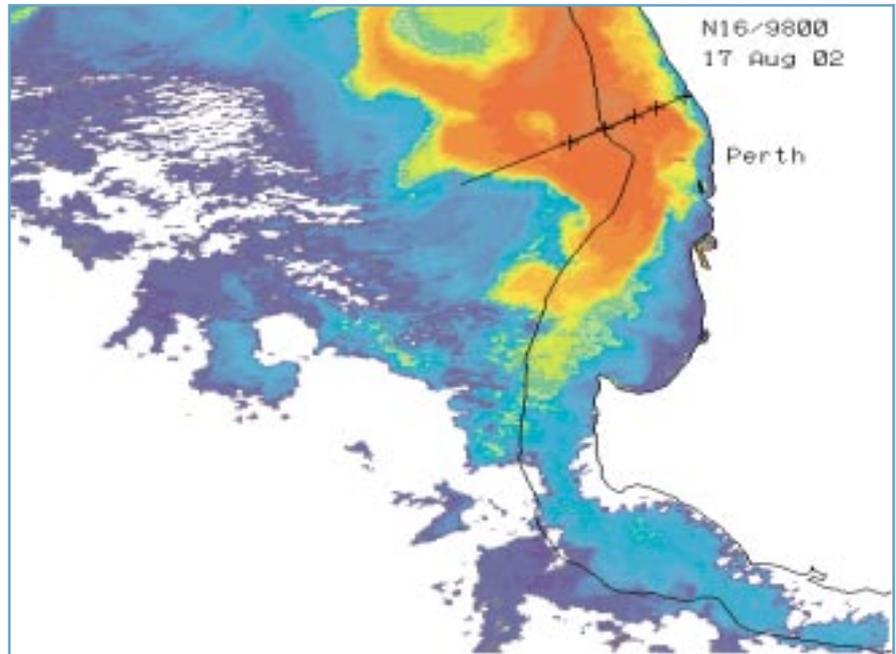
The waters off Western Australia are arguably more sensitive to climate variability than any other region in Australia, with the strength of the Leeuwin Current and Indonesian throughflow known to respond to the El Niño/Southern Oscillation (ENSO) cycle. Understanding the physical oceanography off Western Australia is therefore vital to unravelling the fisheries and ecosystem processes of the region.

CSIRO oceanographer Alan Pearce describes the goals of this research component: “We’re looking at the seasonal variability of the water properties across the continental shelf off Perth — the temperature, salinity, chlorophyll and nutrient profiles.

“In particular we’re trying to establish the role of the Leeuwin Current in modifying water properties at the edge of the shelf and its influence on the biological components — the phytoplankton and zooplankton — in our coastal waters.”

The scientists are mainly using CTD (conductivity, temperature and depth) profiles from the monthly cruises along the Two Rocks transect but are also using a surface thermo-salinograph to show smaller-scale horizontal changes across the shelf, and are making a major push into satellite remote sensing. “We’re using satellite images of sea surface temperature and chlorophyll to show the position and surface structure of the Leeuwin Current . . . and its effect on coastal water properties,” says Pearce.

And there have already been some exciting findings. “The sea surface



**Satellite image showing the Leeuwin Current (in red) flowing southwards off Western Australia during the fourth cruise in August 2002. Temperature variability is being analysed along the black diagonal line, which extends twice as far offshore as the boat transect. The edge of the continental shelf is also shown in black.**

**In stark contrast to the west coasts of other continents, the waters off Western Australia are low in productivity in global terms. The major currents off Western Australia run from north to south, carrying warm, nutrient-poor water down the west Australian coast. The ocean currents off Africa and Chile run from south to north bringing cold, nutrient-rich waters that support highly productive fisheries.**

temperature images clearly show the Leeuwin Current meandering its way southwards along (and often onto) the outer continental shelf, with smaller-scale tongues of warm water penetrating across the shelf towards the coast, with clear implications for cross-shelf larval transport,” says Pearce.

## The biological connection

Early results of the biological research component include the summer observation that the highest levels of chlorophyll (phytoplankton) offshore occurred at depths of 100 metres.

Chari Pattiaratchi, Christine Hanson and Anya Waite, of the University of Western Australia, together with Peter Thompson and Tony Koslow, of CSIRO, made the discovery during a *Franklin* research cruise to examine the physical and biological oceanography along the coast of Western Australia in November 2000.

At other times of the year the SRFME cruises off Two Rocks have found this ‘chlorophyll maximum’ layer to be somewhat shallower and to vary considerably across the shelf.



**SRFME postgraduate fellows, Harriet Paterson and Woyteck Klonowski, setting up a microzooplankton grazing experiment at sea.**

Near-surface Western Australian waters were typically low in phytoplankton but, in a common twist for waters low in nutrients, generally contributed more to phytoplankton production than the deep, light-limited chlorophyll maximum layer.

CSIRO's Tony Koslow explains that while most of the phytoplankton production occurs in near-surface waters, phytoplankton levels remain low there because the phytoplankton predators — the microzooplankton — consume it as fast as it is produced.

"It's like a merry-go-round — spinning fast but not going anywhere," Koslow says. "Very little of this production is getting to the fish."

The sampling experiments are important in helping determine how meaningful the satellite observations of primary production in surface waters will be in this region, says Koslow.

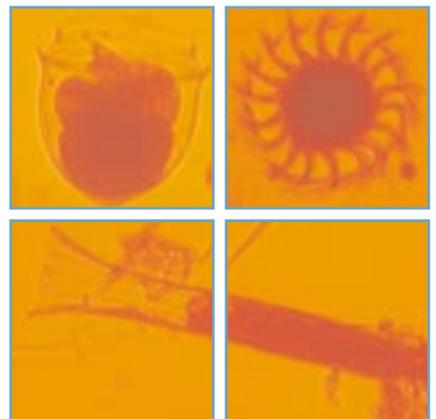
The research is also important for understanding why the biological

communities and their productivity differ as much as they do from nearshore to offshore habitats of south-western Western Australia.

Then there is the complication of diversity. Mesozooplankton (medium-sized plankton) are highly diverse off Western Australia, with more than 100 species of copepods. CSIRO's Joanna Strzelecki is examining the mesozooplankton community across the continental shelf and slope: the species assemblages, their seasonal cycle, their grazing impact on both the phytoplankton and microzooplankton, and their productivity.

SRFME is also using high-frequency acoustics to measure the fine-scale distribution of zooplankton and higher trophic levels, including fish, through the water column. In an exciting development, CSIRO's Nick Mortimer, together with the CSIRO Marine Research acoustics group in Hobart, is using a newly-developed six-frequency instrument called TAPS (Tracor Acoustic Profiling System). SRFME postgraduate fellow Chris van Etten, of Curtin University, is using the acoustic systems to examine how features such as offshore canyons and Langmuir circulation may serve to aggregate plankton as prey for higher trophic levels, including fish larvae and the pygmy blue whales observed feeding off Rottnest and other canyons along the coast.

And, in research that brings all the components together, SRFME postgraduate fellow Barbara Muhlig has joined the project to examine larval fish assemblages and their ecology across the shelf. Together with Senior Lecturer Lynnath Beckley, of Murdoch University, and Tony Koslow, Muhlig will endeavour to apply the project's considerable physical and biological data to the key question with which the project began: to understand the links between climate and fishery recruitment off Western Australia.



**Until about 15 years ago, the role of microzooplankton in fueling marine food webs was poorly appreciated. SRFME postgraduate fellow Harriet Paterson, of the University of Western Australia, is characterizing the microzooplankton community onshore and offshore and assessing its grazing impact on phytoplankton. No one in Australia has expertise in identifying these organisms, so in April Harriet will travel to Guelph University, in Canada, to learn the essentials of microzooplankton taxonomy.**

