

Chris Viney boards the  
RV Franklin with CSIRO's  
'reader of the sea'.

## By George

The shutter of my CSIRO Hasselblad opened with the expensive thud of a Volvo door closing. The sound disturbed the able seaman guiding onto the RV Franklin a measuring device retrieved from deep in the Southern Ocean, one kilometre below.

But Dr George Cresswell, hard at work in the 'wet lab', ignored the camera's tell-tale thud. Watching him filling sample bottles one after another, I asked whether the process of experimentation ever became monotonous.

'Yes, it's repetitive,' he said. 'Our measuring routines are all much the same, and most of the time, oceanography's pretty dry stuff.'

But this man had just plotted the course of a 1000-tonne ship to coincide with the track of a satellite. Earlier, he'd gazed with delight at a young colleague's zooplankton haul.

'There's some wicked little things in there,' the PhD student had said. 'There certainly are!' Cresswell agreed. 'Really... wicked!'

Oceanography, dry stuff? I don't think so. Nor, of course, does Cresswell, who has a passion for his work, and perhaps more importantly, a rare ability to share it.

Cresswell's career began with a Bachelor of Science degree at the University of Western Australia, followed by two years with the Australian Antarctic Division. From the sub-zero temperatures at Mawson Base, he travelled almost as far north as possible, to study the aurora borealis at the University of Alaska. He completed his post-doctorate studies at the University of Calgary, before returning to Australia and CSIRO, where he has worked since the late 1960s.

Cresswell specialises in the study of currents, the great saltwater rivers that flow through the seas and oceans of our region. How does the Leeuwin Current affect the lives of Western Australians? What drives the eddies of the East Australian current? How do currents crossing the continental shelf influence water quality close to the coast? How do

currents affect the life cycles of marine creatures? Questions such as these are the focus of his life's work.

By gathering data from different depths at points plotted across a current, Cresswell builds a picture of what happens when water bodies mix. It's a three-dimensional picture, because water is not only moving along the horizontal plane. Upwellings of cold, nutrient-rich water can have a profound impact on oceanic life because they are vital link in the marine food chain.

Explaining the basics of Cresswell's field of study isn't easy, yet it's a duty he embraces with enthusiasm. 'I enjoy sharing the results of my work with people who have a non-scientific interest in the ocean: such as blue-water yacht-racers, cruising skippers and professional fishers,' he said.

Cresswell's charts of the East Australian Current and its impact on the Sydney-Hobart Yacht Race fleet have been an important feature of pre-race briefings for several years. As well as being



valuable aids to navigation, the charts are visually impressive. The satellite images, with their coloured swirls of warm and cool eddies, give the current a dramatic presence, and the CSIRO's Sydney-Hobart posters, based on Cresswell's observations, grace many yachts' walls.

Conveying the enormous scale of ocean currents can also be a difficult task. 'I sometimes liken it to standing on a bridge looking down into a fast-flowing river,' he said. 'The careful observer sees waves, ripples, eddies, a whole system of moving, interacting water, determined by

the topography of the river bed and the shape of the banks. So it is with ocean currents, but we need to stand a little further away.'

In some cases, as far away as space. Exciting observations of currents have been made from the Synthetic Aperture Radar on board ERS-1, a satellite operated by the European Space Agency. The radar can detect surface patterning from the internal waves formed at the interface of current layers, or show the wake left when massive underwater waves break across sea-mounts beneath the surface.

## Samples from the deep

While the big picture may be seen from space, close-up observations are even more important. The key instrument used to take measurements in deep water is called a CTD (C for conductivity, or salinity; T for temperature; and D for depth).

Lowered slowly while the ship holds station above, the CTD also measures oxygen and fluorescence (an indicator of the presence of microscopic algae and phytoplankton in the water) sending data 30 times per second along a conducting cable to the ship's operations room. It also samples water at pre-determined depths, sealing the specimens in electronically-triggered tubes.

On a recent voyage along the Great Australian Bight and into the Leeuwin Current off Western Australia, Cresswell positioned the RV Franklin along the swath cut by the ERS-1 radar. He then sampled ocean water at different depths to relate the view from space to detailed observations of the current.

Many benefits flow from Cresswell's ability to 'read' the ocean. For example, studies of the Leeuwin Current have helped fisheries managers and the industry understand the links between the current and larval rock lobster distribution. Information on currents and eddies has also helped search and rescue organisations plan more efficient operations.

The 1994 extension of Australia's Exclusive Economic Zone doubled the area of the country, giving us jurisdiction over waters 370 km from the coastline. In 25 years, the economic potential of Australia's ocean region could be between \$50 and \$85 billion. An improved knowledge of this region is vital to sustainably manage these marine resources.

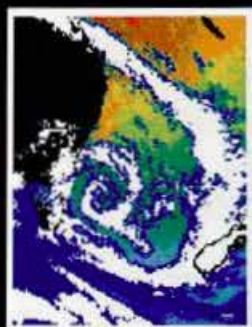
CSIRO is also helping other countries to better understand their own marine waters, through a number of collaborative oceanography studies with other ASEAN nations. This work has economic and environmental benefits.

'I enjoy working with scientists from our Asian neighbours, on their own research vessels or ours,' Cresswell said. 'Australia has a strong background in science, and in the Franklin, we have a first-class oceanographic facility. It's important and rewarding to share the knowledge.'

For his lifelong dedication to marine research, Cresswell has been called the 'grandfather of Australian oceanography'. This doesn't bother him at all. 'Not long ago, someone else dubbed me "father of the Leeuwin Current",' he said. 'I seem to have aged a generation rather quickly.'

## 1993 Sydney to Hobart Yacht Race

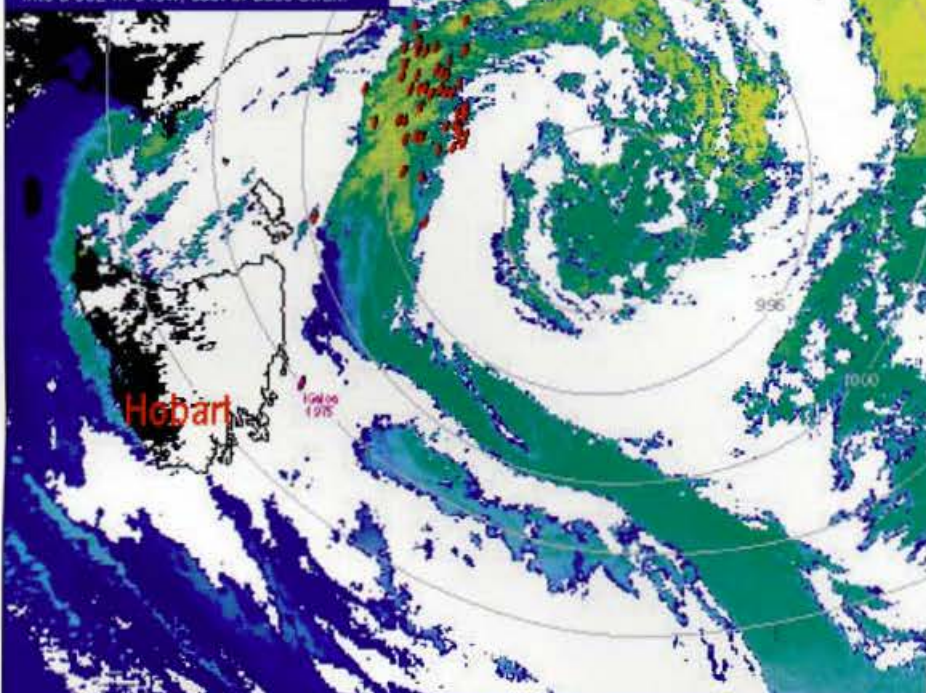
Late afternoon, December 28: the worst ever combination of wind and current?



The East Australian Current flowed southward at 3 knots into storm winds of 50 knots.

The current amplified and steepened waves that were already high, causing 67 of 104 yachts to retire. The fleet was east of Bass Strait at the time of this image.

The inset shows the stream of warm tropical air moving south-east from Queensland to New Zealand. It then crosses over the Tasman Sea and spirals into a 992 hPa low, east of Bass Strait.



The heat radiated from the Earth and sea can be detected by satellite and processed to yield surface temperatures. In this satellite image, the temperatures have been assigned colours ranging from red (hot) through the spectrum to blue (cold). Clouds are white. The positions of the yachts are marked in red. After the same lapsed time in 1975, the record-setting yacht, Kialoa, was almost to Hobart. The sea-level atmospheric pressure isobars are marked as light grey lines.