

**“We’re stewards of the oceans  
yet we know less about them  
than about the moon”**

Dr Charlotte Severne  
Chief Scientist – Oceans

*New Zealand manages exploitation of its marine resources in a way that maintains the environmental health of the oceans and meets the needs of all stakeholders*

# Food for life

Two very different scientific voyages on board NIWA's research vessel *Tangaroa* – to the sub-Antarctic Southern Ocean and to the sub-tropical waters off the northern tip of the country – have led to greater understanding of ocean nutrients that play a critical role in determining the productivity of fisheries in New Zealand's Exclusive Economic Zone (EEZ).

Research scientists voyaged some 1000 kilometres south in the depths of winter 2007, weathering very rough seas, to measure levels of nitrate, phosphate, and trace elements such as iron. These nutrients comprise a rich soup on which optimal phytoplankton growth depends. Phytoplankton are microscopic plants which form the base of the food chain.

The three-week voyage – the first to the sub-Antarctic by *Tangaroa* in mid-winter – was timed to coincide with the annual 'resetting' of the ocean. The winter winds churn the seas and more uniformly cold waters mix better, bringing plant nutrients up from the depths, ultimately

determining the productivity of the EEZ in the coming season. The cycle is completed in spring and summer when the upper layer of the ocean warms and phytoplankton use the nutrients via photosynthesis.

Dr Philip Boyd, NIWA principal scientist, says it is the first time that any scientists have observed the Southern Ocean system being 'topped up'. They were able to make interesting links between ocean circulation and the ratio of the concentrations of nutrients and trace elements, and collect data to improve models of the ocean.

Unlike the nutrient-rich Southern Ocean, the much warmer, sub-tropical waters north of New Zealand have been called an "ocean desert" because of low phytoplankton stocks and vanishingly low levels of plant nutrients.

NIWA scientists led by Dr Cliff Law voyaged to the edge of the EEZ, several hundred kilometres north of the Three Kings Islands, to measure in detail this region's nutrient sources.

For the first time in northern New Zealand waters, the team observed a bloom of a nitrogen-fixing phytoplankton, *Trichodesmium*. *Trichodesmium* is a primitive microscopic cyanobacterium that can extract nitrogen from the atmosphere – much like nitrogen-fixing legumes do in the soil – enriching the subtropical waters and making them more productive.

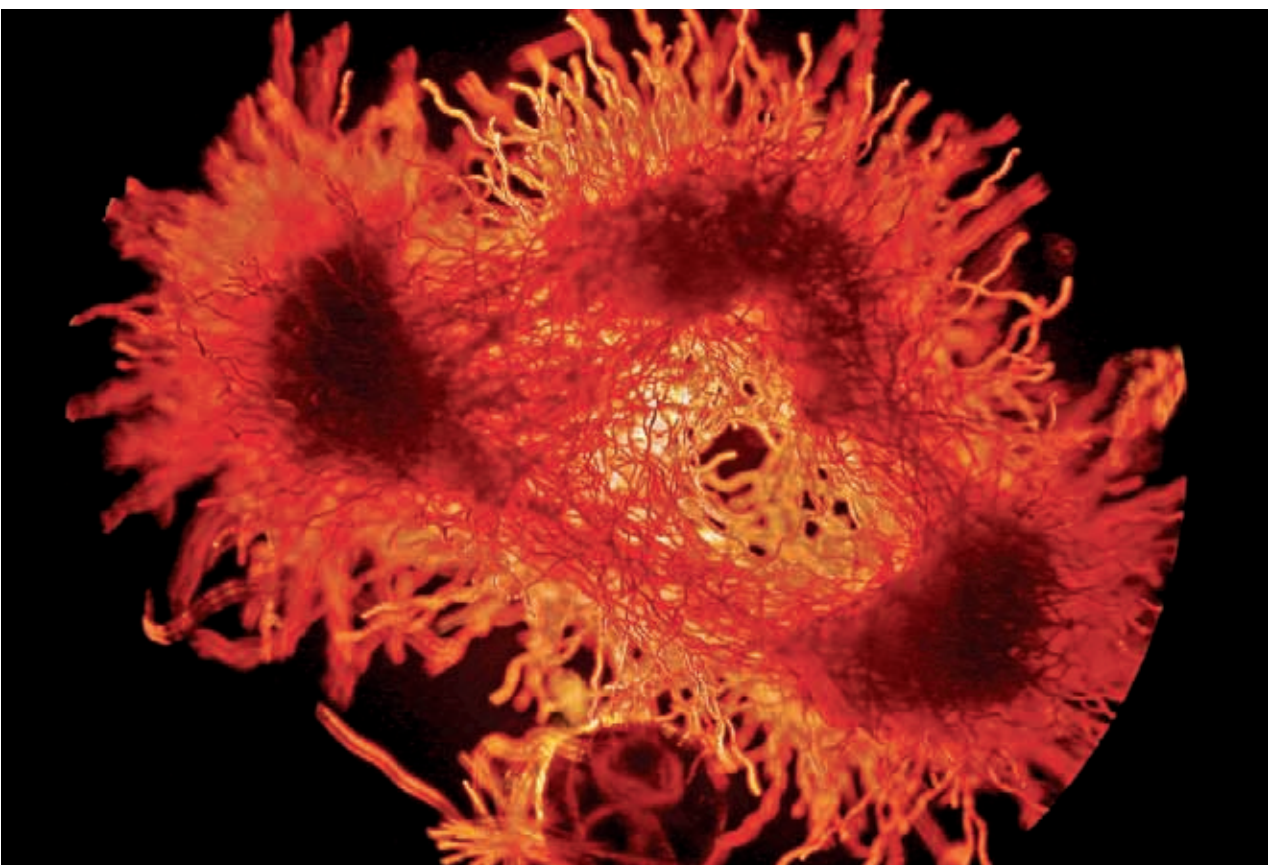
"We're not sure how often these blooms occur but if they become more frequent because of climate change then that can increase the productivity of these northern sub-tropical waters," says Dr Boyd.

#### FUNDER:

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- Australian National University
- Plymouth Marine Laboratory
- University of Otago



*The nitrogen-fixing phytoplankton, Trichodesmium, found for the first time in New Zealand waters, during a NIWA voyage on RV Tangaroa. It acts much like nitrogen-fixing legumes do in the soil – enriching the water. "It's very desirable to know what drives the productivity of the different water masses in our Exclusive Economic Zone because that has significant knock-on effects right up the food chain and into the economy," says NIWA Principal Scientist Dr Philip Boyd.*