NZ IPY-CAML Voyage 2008

WEEK 1 SCIENCE REPORT: Still in transit

The start of week one was taken up by the completion of the gear mobilisation for the voyage followed by a project/voyage launch function on the *Tangaroa* attended by Prime Minister Helen Clark, Cabinet Ministers Winston Peters (live link from Scott Base, Antarctica), David Parker and Pete Hodgson, the Ambassadors of Italy and United States, Professor Michael Stoddart of CAML, along with the numerous other invited guests and associated media.

At the completion of mobilisation on the 31st January the vessel departed for gear trials in the Cook Strait. Once these trials were completed the *Tangaroa* set sail for the Ross Sea.

By the end of week one the vessel had travelled over 900 nautical miles and is still transiting towards the ice front estimated to be at approximately 67°S.

INTRODUCTION (extract from Voyage Plan)

In May 2007 the Prime Minister announced new government funding for a New Zealand Census of Antarctic Marine Life (CAML) biodiversity studies in the Southern Ocean and Ross Sea Region as part of the governments Ocean Survey 20/20 (OS2020) programme and the International Polar Year (IPY) activities. The overall Project includes two phases a) data collection voyage and b) data analysis and reporting.

For some years, the Ministry of Fisheries (MFish), the Ministry of Foreign Affairs and Trade (MFAT), Antarctica NZ, NIWA, LINZ, DOC and the fishing industry have been working collaboratively in different ways to improve our knowledge of the biodiversity and ecosystems of the Ross Sea region through Ocean Survey 20/20 or through core agency activities. Vessel-based and shore-based research programmes to sample marine biodiversity, to assess toothfish stocks, to map the sea-bed and to investigate ecosystem structure and function, have been carried out through the MFish Biodiversity Research Programme (BioRoss), the LINZ Hydrographic Programme, the MFish Antarctic Research Programme and research projects funded through FRST.

The recognition of International Polar Year (IPY) throughout the globe from March 2007 to March 2009 has provided the impetus for a large international effort to conduct collaborative research both in Antarctica and the Arctic, spanning two summer seasons in both regions. New Zealand is participating in a range of both terrestrial and marine projects for IPY that are important, not only nationally, but also in the international science arena.

The Census of Antarctic Marine Life (CAML) is a major multi-national IPY Programme that New Zealand's project is part of. This project forms a particularly important component of the international CAML Programme, as it will not only be part of the circum-polar national surveys, but will provide an opportunity to compare fauna and ecosystems from opposite sides of the globe including the two most significant shelf areas in Antarctica-the Ross Sea and the Weddell Sea.

On a global scale, the international CAML Programme plans to investigate the biodiversity and evolutionary history of Antarctic waters, including genetic sampling of selected fauna at

sea as well as obtain relevant baseline physical and biological data that will contribute to high profile environmental issues, particularly climate change and its effects on the Southern Ocean. Comparisons with similar datasets being collected in the Arctic during IPY will contribute towards global integration of the results.

New Zealand's IPY-CAML project incorporates this 50 day *R.V. Tangaroa* voyage to the Ross Sea region from 30th January – 21st March 2008, and 3 years of post-voyage analysis of the data collected. The project will contribute to a wide range of international and national initiatives that are linked to the international CAML programme and to other New Zealand interests in the Ross Sea region. The project will collect relevant ecosystem data that are important to the future management of the Ross Sea toothfish fishery under CCAMLR and bioregionalisation initiatives under CCAMLR and the Antarctic Treaty.

SCIENCE THEMES

As the voyage progresses and data are successfully collected each of the main research groups on board will contribute to the weekly science report, using information collected during the voyage. As we are still in transit mode this week's contribution is from the two main groups collecting underway data: Fisheries acoustics and the Pelagic group.

Fisheries Acoustics

Fisheries acoustics data are being collected continuously during the CAML-IPY voyage, including on the transit to and from the Ross Sea. The fisheries acoustic system we are using consists of a Simrad ER60 echosounder with 4 transducers mounted on the hull of the vessel. These transducers all operate at different frequencies: 12, 38, 70, and 120 kHz. The 70 kHz transducer was mounted on Tangaroa by divers immediately prior to this voyage.

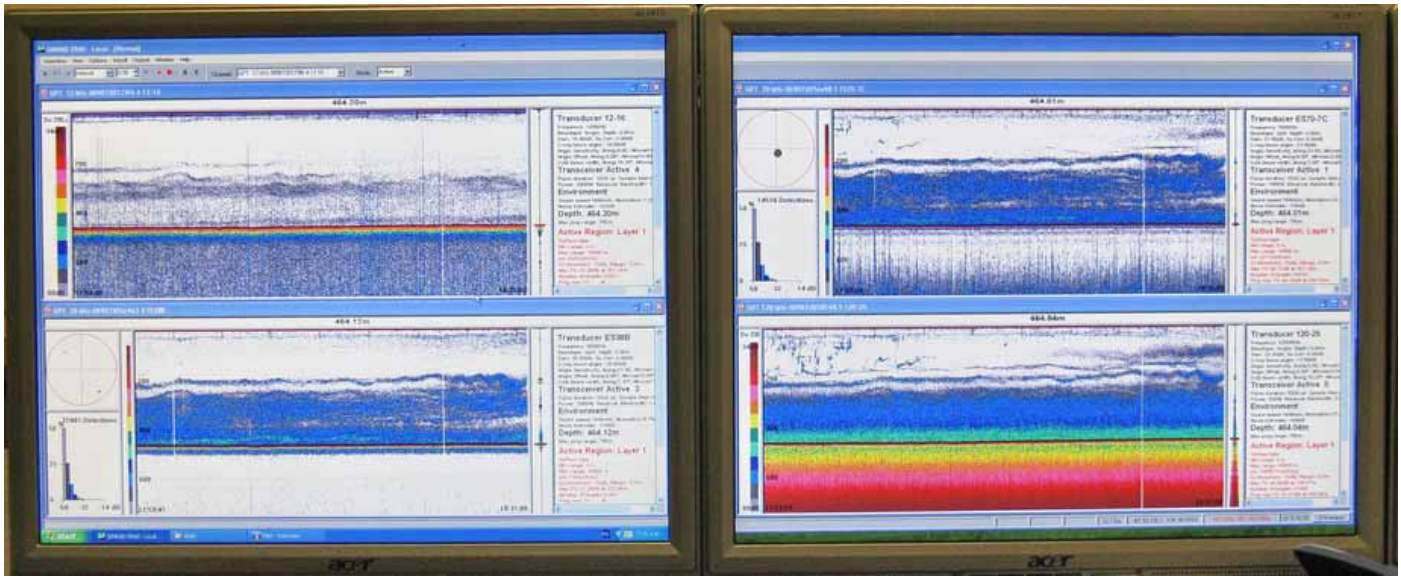

Fig. 1 Monitor display showing returns from the 4 transducers being used to identify acoustic marks.

Having multiple frequencies increases our ability to distinguish between different types of organisms (mark identification). Different animals exhibit different acoustic scattering properties at different frequencies (called the 'frequency response'). For example, we know that krill and other zooplankton are a much stronger scatterer at high frequencies (e.g., 120 kHz), while some small fish like myctophids have strongest scattering at 12 kHz, because their swimbladders resonate at this frequency. Large fish like rattails have similar scattering properties across a range of frequencies. We will use the frequency response information to guide us in the identification of acoustic marks seen in the Ross Sea. Target identity will be confirmed by trawling using the fine-mesh mesopelagic trawl.

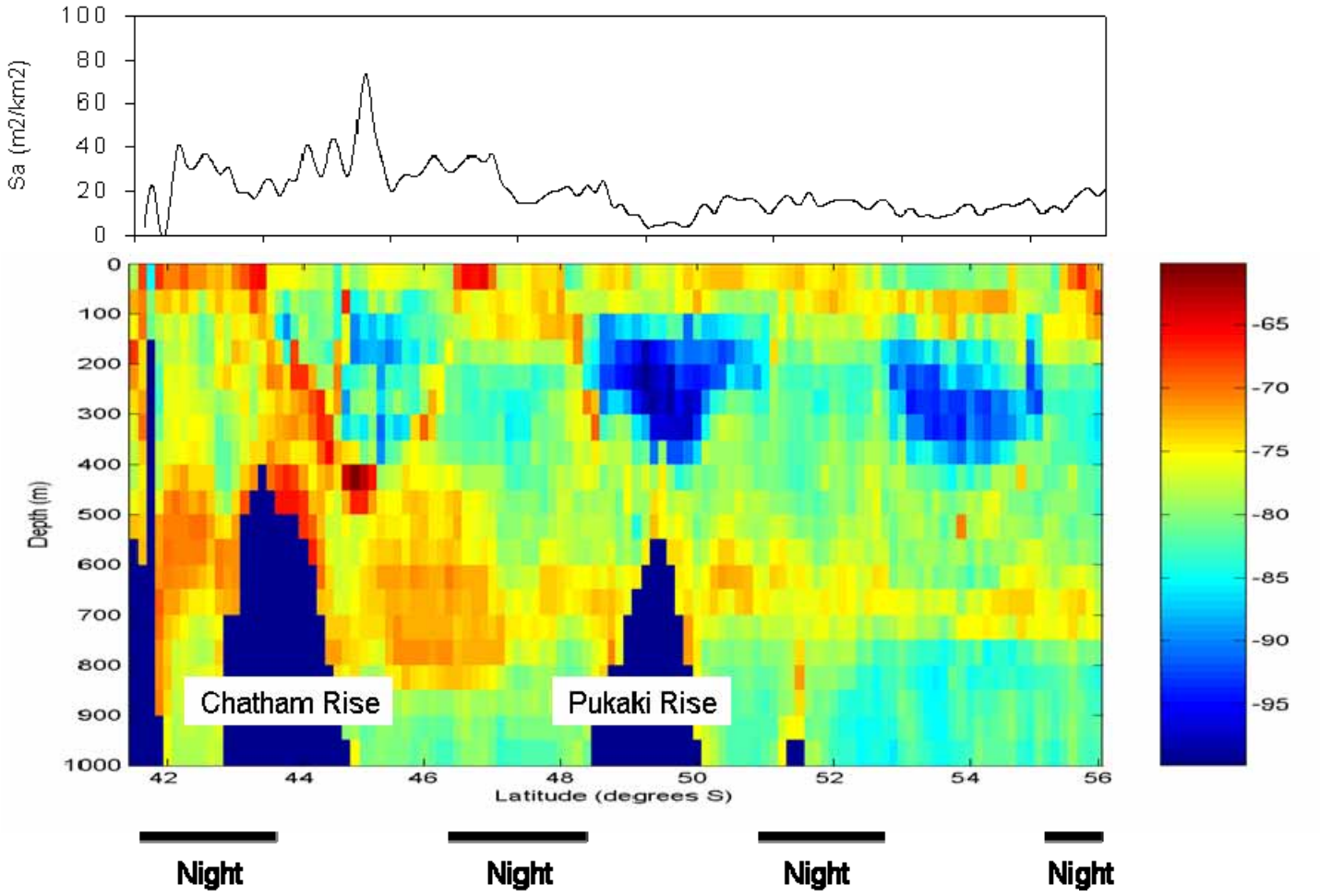

Fig. 2. Fisheries acoustic data collected on 38 kHz echosounder from leaving Wellington on 31 January to 04:00 NZST on 4 February. Each ‘pixel’ or cell in the lower (colour) panel is 10 n. miles long by 50 m deep. Colour gives the average acoustic backscatter in each cell (red = strong, blue = weak). Clear diurnal patterns can be observed in the depth distribution of mesopelagic fish layers. The upper plot gives the total acoustic backscatter (Sa) along the line. This peaks over the southern Chatham Rise, with relatively low backscatter observed south of the Pukaki Rise.

Pelagic (Plankton) Group

Since leaving Wellington calibration samples for the new underway optics system have been collected three times a day and the Continuous Plankton Recorder (CPR) has been towed throughout the transit south. Water samples were collected in the Sub Antarctic Front for the first of eight on board acidification experiments. These are testing the impact of increased atmospheric CO_2 on marine organisms by artificially lowering the pH of the seawater. This lowering of pH is what is predicted to occur as the CO_2 levels increase due to global warming. We have also collected samples at 55°S as part of the International Census of Marine Microbes (ICOMM) programme which is collecting samples over a latitudinal gradient on several transects around the Antarctic. Samples for this programme will also be collected at 60°, 65°, 70° and 75°S weather and ice conditions permitting.

Fig. 3. Julie Hall preparing the CPR for deployment.

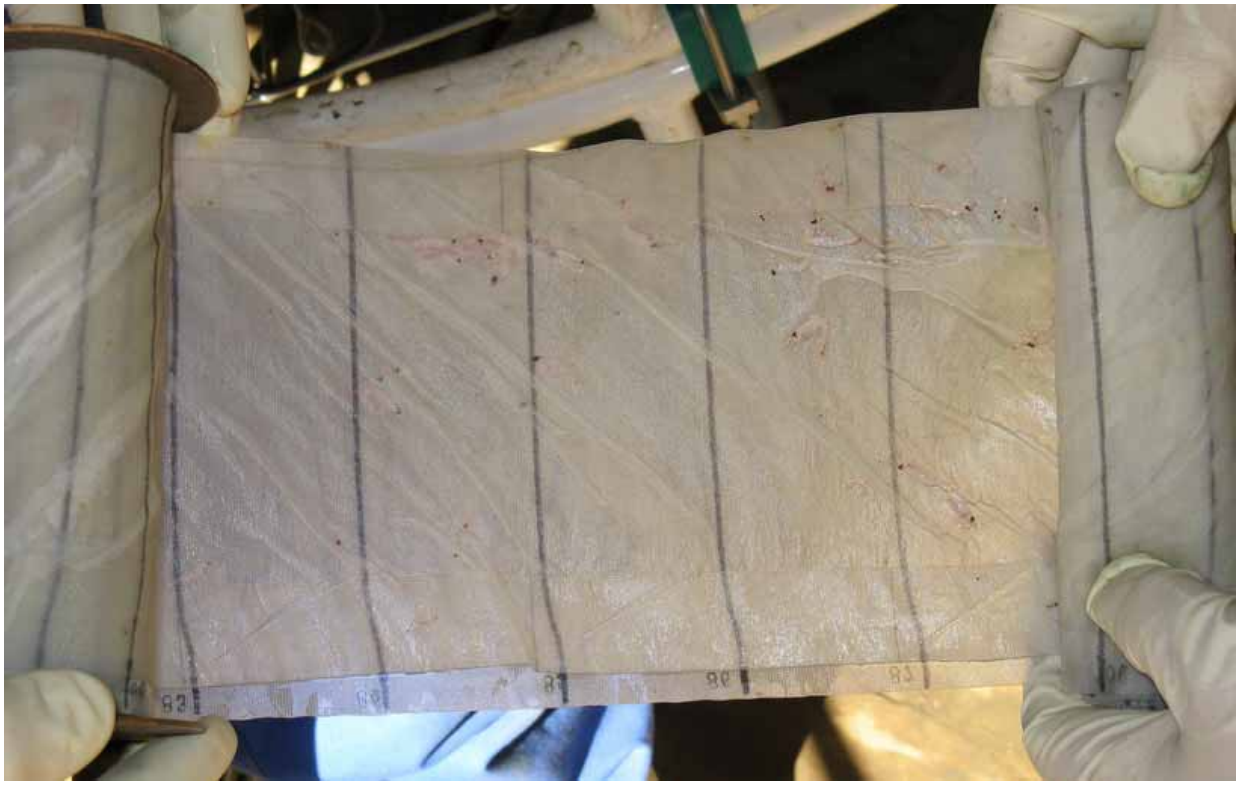

Fig. 4 Silk from the CPR after 450 nautical miles of towing, showing planktonic material captured on the mechanically advanced filter.

Other Activities

Argo Floats

Ten Argo floats are being deployed south of 60°S: nine for Scripps Institution of Oceanography and one for NIWA. Six of these had been deployed by the end of Week 1.

Argo is a programme aiming to have 3000 drifting, profiling floats deployed around all of the world's oceans. The floats are designed to drift at a fixed pressure (usually 1000 dbar) for ten days. After this period, the floats move to a profiling pressure (usually between 1000 and 2000 dbar) then rise, collecting profiles of pressure, temperature, and salinity data on their way to the surface. Once at the surface, the floats remain there for under a day, transmitting the data collected by satellite back via Argos (a French telecommunication system) and data are available in almost-real-time from one of several data centres. This also allows the satellite to determine their surface drift. They then sink again and repeat their mission. The floats have a nominal lifetime of five years, and will yield valuable information about large-scale ocean water property distributions and currents, including their variability over time scales from seasonal to the duration of the array. The profile data are freely available in near-real time for oceanographic and climate research.

This deployment will be a particularly valuable contribution to Argo since the Southern Ocean currently has poor float coverage and there are limited deployment opportunities.

Fig. 5. Argo float after deployment over the stern of the vessel, in its fully biodegradable packaging material. This ensures maximum protection for the float during deployment.

Fig. 6. Royal Southern Albatross. Our constant companions during the early part of the transit.