NZ IPY-CAML Voyage 2008

3 - 5 MAR Seamounts and open water

John Mitchell

Now we are out of the inner Ross Sea the focus of the voyage has changed to sampling seamounts (underwater mountains) and the abyss (seafloor in the deep ocean 2000–4000 m). We're surveying a series of seamounts, concentrating on the Scott complex around Scott Island north of the Ross Sea, at about 68 ºS, 180º followed by the Admiralty chain further to the west. Even further west are the Balleny Islands and associated seamounts, which will not be visited this trip as they have already been sampled during previous *Tangaroa* voyages. The composition of the fauna has gradually changed and reduced in quantity (but not quality) as we have moved north and is now 'transitional' i.e., is a mixture containing fauna typical of both the Ross Sea and the Southern Ocean.

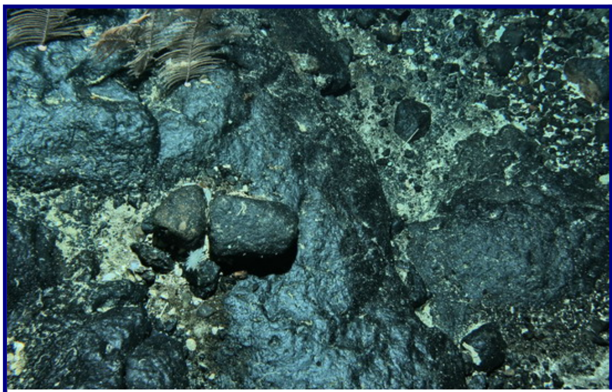


Fig. 1. DTIS image from Scott Seamount showing a seafloor lava flow and glacial 'drop stones' (stones carried by glaciers and icebergs and dropped to the seafloor upon melting).

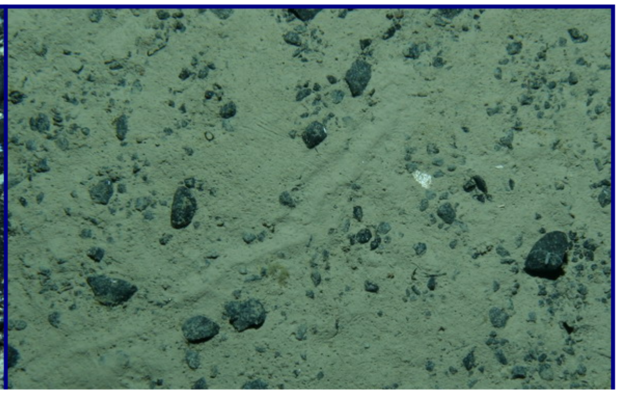


Fig. 2. DTIS image of the seabed at a depth of 3325 m, showing a predominantly muddy seabed with numerous drop stones and animal tracks. (Photos 1 & 2: Dave Bowden/DTIS)

Running closely in parallel to our sampling programme is an extensive outreach programme which includes educational blogs for both New Zealand and International web sites, and the filming of the voyage with the aim of producing a documentary of our scientific journey. Max Quinn (Natural History NZ), assisted by Stacey Mulgrew (MFish), can be seen at all times of the day and night capturing the voyage activities on film or interviewing us.

Fig. 3. Filmmaker Max at work, filming a trawl station and the recovery of the DTIS camera. (Photos 3 & 4: John Mitchell)

Fig. 4. The documentary team filming *Tangaroa*, working in heavy ice.

SCIENCE REPORT

Denizens of the deep: daggertooth and stareater:
(Andrew Stewart – Museum of New Zealand, Te Papa Tongarewa)

We have caught two striking but very different predatory fishes in the midwater trawl net this week: the formidable daggertooth and the stareater.

At 71°S, the half-grown, 50 cm long daggertooth specimen (Fig. 5 & 6) is one of the southernmost daggertooth specimens ever caught. The unusual forward-curved teeth in the upper jaw of this species help it to immobilise its prey. When the daggertooth clamps down on its prey (usually small fish) it then pulls backwards and the teeth cut deep into its victim, often severing the spine and paralysing it. Because this specimen is in such good condition, we were able to record not only the iridescent body colour, but also the brilliant sapphire blue of the eye. Sadly, these colours fade rapidly on death and are not visible in museum collections.

Fig. 5. Andrew Stewart holding a freshly caught daggertooth and close-up of its jaw (Photos: Richard O'Driscoll)

Fig. 6. Daggertooth set up for specimen photography (Photo: Peter Marriott)

The stareater is another midwater predator. Smaller and more fragile than the daggerfish it is believed to capture its prey by luring small fishes into striking range with its red luminous chin barbel. The delicate fins and skin on this specimen were abraded by the net, but all important key features remained. These include the row of light organs along the belly (seen as black dots on Fig. 7); the mouth with its long, slender, curved teeth; and the lure. This 21 cm long specimen is about as big as this species gets. Scientists are unsure as to exactly how many species of stareater there are.

Fig. 7. Stareater showing the sharp curved teeth and red luminous lure (Photo: Peter Marriott)

Linking DTIS and specimen images yields new insights
(David Bowden – NIWA, and Stefano Schiaparelli – Italian National Antarctic Museum)

Images of invertebrates captured by NIWA's Deep Towed Imaging System can help with the identification of specimens collected by physical sampling methods. Used in conjunction with specimen images, they can also reveal a whole lot more about the communities that live on the seafloor.

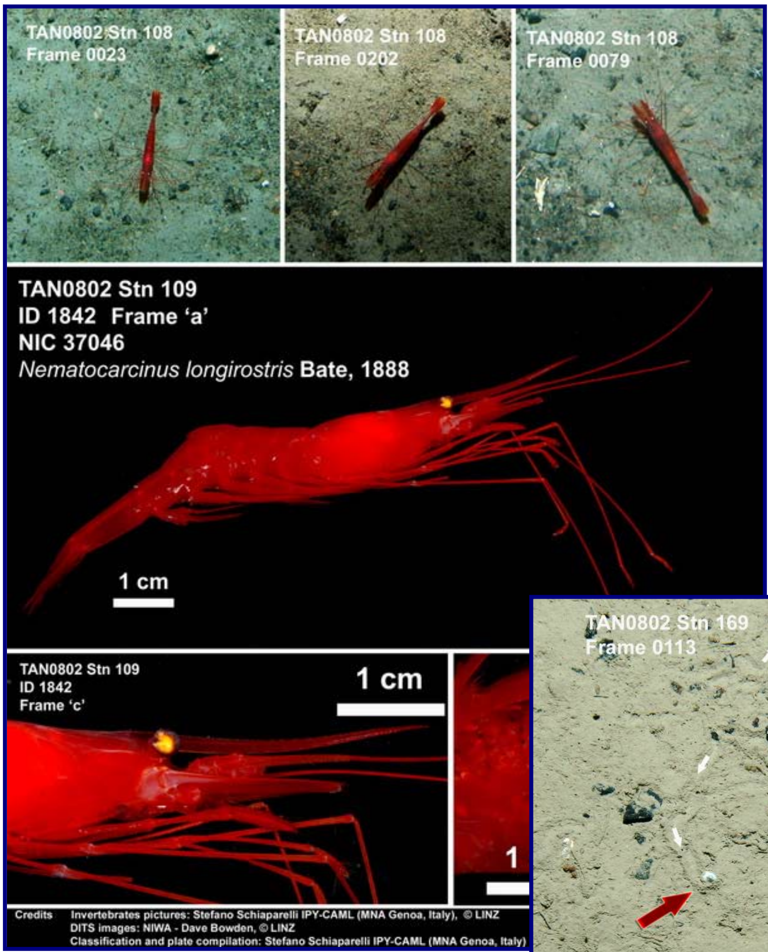
For marine biologists, scientific field expeditions provide a great opportunity to study freshly caught specimens while they retain their natural colouration and form. Biological material collected during a voyage is preserved, usually in formalin or ethanol, for later identification of known species and naming of those not previously described. In most cases the colours of the organisms fade rapidly after fixing them in these chemicals. For invertebrate groups such as anemones that lack skeletal structures, even their 3-D structure and morphology may be unclear once they are hauled up on deck. Consequently, fresh caught and preserved specimens may bear little resemblance to their live appearance, and give little indication of how the animals are organised on the seabed.

Onboard *Tangaroa*, we routinely photograph live specimens under controlled conditions in the laboratory. These images record consistent standards of detail required for accurate taxonomic identification. These images are also used to confirm the identity of organisms captured on film during seabed video transects with the deepwater camera system.

Our aim is to be able to use DTIS video transects to assess the diversity of benthic (bottom-dwelling) organisms and estimate species abundances with minimum impact on the seabed. If we can do this reliably, we will be able to reduce our dependance on more destructive sampling tools, such as trawls and sleds. Another bonus from using a sampling tool like the DTIS is to learn about the spatial relationships and structural organisation of organisms on the seabed. To achieve this, we use sled and trawl sample data to 'ground-truth' the identifications made from photographic transects. By photographing captured specimens in the lab and linking these to images of the undisturbed seabed taken by DTIS, we're developing a reference library of benthic fauna. This library allows us to first assess the match between what's seen in the photographic transects and what's caught by the trawls and sleds.

Further analysis of the video and still images will then allow us to calculate accurate abundances for conspicuous species and to describe a range of ecological factors that could not be determined from the trawl and sled samples alone. This includes studying the direct links between physical aspects of the seabed (e.g. substrate type) and the patterns of animal distribution seen on camera.

In the first example here (Fig. 8), consecutive deployments of the DTIS and the bottom trawl enable species-level identification of the shrimp *Nematocarcinus longirostrus* seen in DTIS images. The next example (Fig. 9) illustrates how *in situ* images of organisms on the seabed can improve ecological understanding. The literature on deep-sea lepetellid gastropods (a type of limpet) reports that all known species are sedentary and live on hard substrates . However, in the DTIS images, ground-truthed by trawl-caught specimens (Fig. 9), the limpets can be seen clearly grazing on soft mud and from the tracks that they have left, it appears that they actively avoid rocks.



There is far more detail captured in the images we are taking than we can analyse during the voyage, but these examples demonstrate how the combination of seabed images and detailed specimen images can yield new insights into the ecology of the Ross Sea benthic fauna.

Fig. 8. Laboratory images of live specimens caught from sleds or trawls (bottom) allow accurate ground-truthing of specimens visible in seabed images (top) (Photos: Dave Bowden/DTIS – top; Stefano Schiaparelli, bottom).

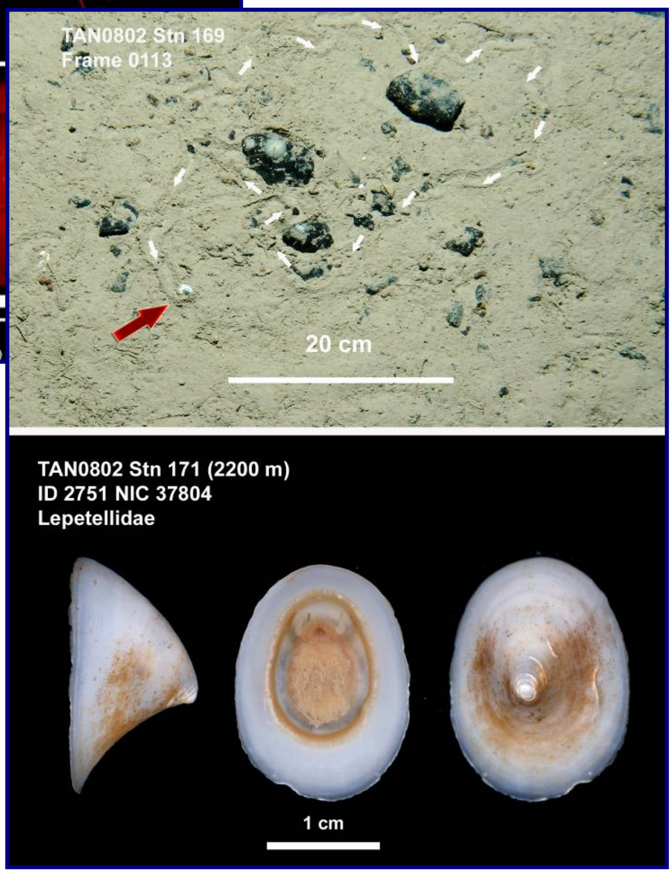


Fig. 9. Top: Deep-sea limpet (red arrow) at 2250 m depth grazing on soft mud. White arrows show its track across the mud (Photo: Dave Bowden/DTIS). Bottom: Laboratory images of limpet specimens (Photo: Stefano Schiaparelli).