A vast proportion of life that dwells on the sea floor has never been seen by human eyes. This is a fascinating problem for marine scientists, but concerning for the marine managers who need to know what is living on the sea floor, and where it is located, so that communities which are unique or vulnerable to human activities can be protected.

Scientists working aboard the *Aurora Australis* during the 2007–08 Collaborative East Antarctic Marine Census voyage were determined to unlock the secrets of these ‘benthic’ (sea floor) communities in the George V Shelf region off East Antarctica. Using underwater video and still cameras, we collected 15 hours of video footage and 1800 still images of benthic animals living at depths ranging from 140 m to more than 2000 m. This imagery revealed a vast array of organisms and communities, including deep-sea corals, which are so unique and fragile that they were immediately protected as ‘Vulnerable Marine Ecosystems’ by the Commission for the Conservation of Antarctic Marine Living Resources (*Australian Antarctic Magazine* 15:19, 2008). We have since viewed and interpreted all of the footage to work out where different organisms live, and why they live there.
To do this we recorded the types of animals we could see in the footage and characteristics of the physical environment, such as the nature of the sea floor sediments (mud, sand, gravel, pebbles, cobbles, boulders), the sea floor relief (flat, low, moderate, high), and sea floor features such as iceberg scours, ridges and ripples. This process allowed us to build up a picture of what is living on the sea floor and the types of environments the animals live in.

A detailed bathymetry (depth) model and the sediment samples collected during the voyage also helped us to understand how the benthic communities related to the different environments within the study area. These datasets reveal that the George V Shelf is far more complex and rugged than was previously thought.

The expansion and flow of ice streams across the George V Shelf during past glaciations has created deep glacial basins extending to 1200 m. Shallow (200–250 m) outer shelf banks mark the edges of the expanded ice streams, and rugged nearshore depressions were created by the advance of smaller glaciers (below). The deep glacial basins have since been draped with thick, muddy sediments. The shallow banks, in contrast, are prone to erosion and iceberg scouring and generally have only a thin cover of sandy sediments.

The differences in depth and sediment type between the basins and banks creates distinct environments for the sea floor animals. We found that benthic communities varied according to water depth, the type of sediment and the sea floor relief. The deep basins with their thick sediments, for example, have high numbers of mobile animals that forage in the sediments for food, while the shallow banks have high numbers of stationary animals that attach to the hard substrates commonly found there (figure on page 13).

So far, this analysis has revealed the way in which sea bed communities are governed by environmental properties, but these communities represent only one layer of this marine ecosystem. Australian, Japanese and French researchers are currently analysing samples collected from the sea surface and the water column to look at the distribution of ‘pelagic’ communities. Our aim is to combine these datasets to gain an understanding of the entire marine ecosystem, from the sea surface and the water column to look at the distribution of ‘pelagic’ communities. By understanding where different communities in this ecosystem occur and the interactions between them, we will be able to better protect the biota on this Antarctic shelf.