MAR-ECO

CENSUS OF MARINE LIFE

http://www.mar-eco.no NEWSLETTER 2/2003

Diving into the depths of the Charlie-Gibbs Fracture Zone

MIR is being launched.

The Charlie-Gibbs Fracture Zone extends about 2000 km (from about 18 to 43°W) along an axis that cuts across the mid-Atlantic ridge at about 52°N or between the northern tip of Newfoundland and the southern tip of Ireland.

In June 2003, MAR-ECO scientists were the first human beings to ever explore the deepest fracture zone associated with the mid-Atlantic Ridge; the Charlie-Gibbs Fracture Zone. Aboard the Russian manned MIR submersibles, the scientist descended to 4500m …

ELINOR BARTLE

June 2003, MAR-ECO leadership, supported by funds from NOAA Ocean Exploration Initiative and the A.P. Sloan Foundation were able to organise a unique opportunity for MAR-ECO scientists aboard the Russian manned submersibles, MIR I & II. The MIR submersibles can dive to about 6000 m and enabled these scientists to be the first human beings to ever explore this deep ocean zone, which is around 4500 m at its deepest point. The support vessel for the MIR submersibles was the Russian RV, Akademic Mistislav Keldysh, which is owned by the Russian Academy and operated by the P.P. Shirshov Institute of Oceanology in Moscow.

Each of the June double dives involved four scientists; one Russian and one American in each of the submersibles. At each dive site, the two subs performed near-bottom visual/video transects and collected samples. In addition, both subs observed and documented pelagic organisms during their transit downward and upward. Videotapes were recorded continuously throughout dives. Dive parameters and other observations were also recorded manually in dive logs.

The goal of the expedition was to observe and document the megafauna of the deep pelagic, near bottom and bottom communities. Therefore the scientists used what bathymetric data is available about the region to select two contrasting dive zones. The first included some of the roughest topography the bathymetric data indicated. The second was a flatter area, bounded by what looked like an escarpment, on paper at least.

A sea cucumber surrounded by "marine snow" - the aggregations of biological debris that sift slowly down from the upper layers of the ocean.

Life through a MIR window

The scientists appreciated the great contrast between the life forms seen and the landscape in the two dives, although the two locations were only separated by a distance of around 15 nautical miles. In general, however, they were surprised by how much life, in fact, was present at these great depths. Another very interesting observation was the presence of so much "marine snow". Marine snow is the name given to the aggregations of biological debris that sift slowly down from the upper layers of the ocean. Sadly, the researchers also noted the presence of plastic trash in some of the holes or depressions in this area.

The scientist were surprised by how much life, in fact, was present at these great depths.

Dive 1, June 11, went to a rough area – the roughest the scientists could find according to the available bathymetry data. Veteran of many deep-water cruises, Vecchione stated that it would be impossible to trawl this area, and that direct observation was the only way to see the life forms present. The scientists were able to photo or video document many different creatures. They saw at least six different types of fish, including many juveniles. The video enabled them to capture the swimming/walking behaviour of an orange anglerfish. They documented many invertebrate organisms that will provide fodder for months of analysis by invertebrate experts, as well as being able to collect a number of samples.

Dive 2, June 13, covered a much flatter region. There were ripple marks aligned in a N/S direction in the fluffy sediment material on the bottom attesting to regular water movement patterns. Vecchione reported that the subs actually drifted quite quickly when the motors were completely stopped. In addition there was a great deal of evidence of bio-perturbations of the sea-floor caused by creatures burrowing into the sediments. While there was relatively little fauna in the sediments, any rock surfaces that emerged were covered in invertebrate communities, to the point that in some places the scientists described them as sponge gardens.

MAR-ECO's deep-sea explorers

A diverse team of scientific specialists were assembled to participate in the expedition. The team included Mike Vecchione as its chief scientist. Vecchione is a world-renowned cephalopod specialist based in Washington D.C., where he heads the National Systematics Laboratory of the NOAA National Marine Fisheries Service (NMFS). His particular interests in the MAR-ECO Project are the virtually unknown cephalopods living below 1000 m.

Other scientists included Raymon R. Wilson Jr., who is a fish biologist working at California State University, Long Beach, California. The three scientists Andrey Gebruk, Georgii Vinogradov and Elena Krylova came from P.P. Shirshov Institute of Oceanology in Moscow. Elena Krylova is a benthos specialist, while Vinogradov is a planktologist, i.e. studying small mid-water animals. Gebruk is a specialist on epibenthos (bottom-living fauna), especially sea cucumbers.

The final US team member was John Nicolas from NMFS, Northeast Fisheries Science Center in Woods Hole. Nicolas came along to observe and record whales during the cruise period. His observations will serve the MAR-ECO mammals component, which is investigating whether mammals are particularly concentrated in the mid-Atlantic Ridge area.

The scientists reported that everything went pretty well in both dives, which took about 12 hours, with eight hours of bottom time each. They underlined, however, the need for better, more detailed bathymetry so that dives could be planned to better optimise the observation and sampling opportunities. They recommended that on future dives, the subs divide tasks so that one undertakes the transect work (filming and counting), while the other is responsible for sampling. In addition, there were some difficulties safely transporting samples, particularly fragile ones, back to the ship. Wilson suggested using covered sample baskets, to avoid possible sedimentation or washing away problems.

The MIR expedition – an appetizer

After the intense experiences of voyaging to these great unexplored depths, the team takes back a wealth of information that will keep MAR-ECO scientists at their respective research centres busy for many months. The MIR expedition has whetted our appetites for the continuing MAR-ECO explorations to come.

What are we looking for?

Mapping of species composition and distribution patterns, identification of trophic interrelationships and modelling of food web patterns, and analyses of life history strategies - these are the three main tasks of MAR-ECO.

MAR-ECO has 10 science components, i.e. inter-related elements dealing with zooplankton, pelagic and demersal nekton, genetics, mammals and birds etc.


G.O. Sars

Life in the deep northern mid-Atlantic

Light drives photosynthesis and primary production. However, light penetration in the ocean waters decreases exponentially with depth, and researchers will investigate how energy is conveyed to the largely unstudied but diverse community of zooplankton living in the deeper waters.

Deep-sea fishes are widely distributed across the Atlantic. With different shapes and sizes, they have fascinating life histories and ecological adaptations. Few may have life history features that are compatible with sustained high exploitation rates. Much more information about deep-sea species is needed before researchers can provide sound advice to the management of deep-sea fisheries resources. Specific questions include: Do the members of a given species inhabit different habitats at different ages? Do fish seek out specific topographical features? What kinds of communities exist in areas of soft or hard bottoms? Are there latitudinal differences? Researchers will focus on reproductive biology and ecology, growth studies, and mortality estimation. Data from previous international research cruises in this area will be mined.

We know very little about the species living in the blue ocean waters. Moving with the great ocean currents, aggregating around topographic and hydrographic features such as seamounts, ocean ridges and ocean fronts; who is there and who is eating what? How are oceanic species affected by seamounts and ocean ridges? How do they interact with the resident populations of these features? What are the feeding patterns of the different species? How much daily vertical migration is there? Who are the players in an oceanic food web? How does this differ from a coastal water food web? Do these patterns change with latitude along the mid-Atlantic Ridge? Are these populations merely extensions of those found in the waters over the continental slopes?

Measurements of genetic diversity can estimate deep-sea fish population identity and distributions. Are the populations in different parts of the mid-Atlantic Ridge distinct? Are they inter-related via "stepping stone" migration patterns? How do climate and current patterns influence diversity and dispersal patterns? Do thermal boundaries, such as the sub-polar front, restrict gene flow?

Mammal and seabird researchers plan to conduct visual surveys of the large-scale migration patterns of cetaceans and sea birds during the MAR-ECO cruises. They are studying to what extent distribution patterns are related to the mid-Atlantic Ridge. How does their distribution relate to hydrographic features in this area, such as the sub-polar front, and are the presence of groups of cetaceans and flocks of sea birds inter-related and tied to areas of high densities of other pelagic nekton and zooplankton?

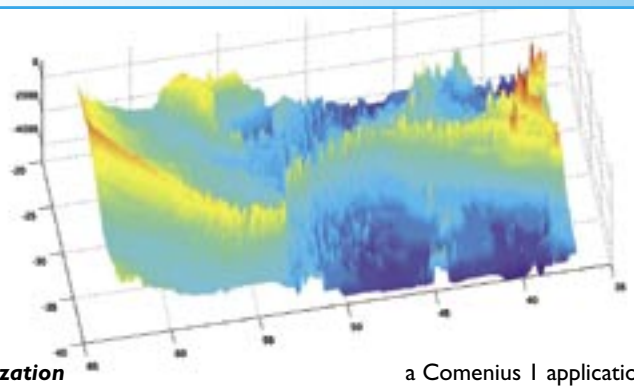
Technology: Rising to deep-sea challenges

The choice of appropriate tools (technologies), procedures and strategies can make the difference between the success and failure of a research expedition. MAR-ECO will use the new Norwegian research vessel G.O.Sars for a two-month cruise during the summer of 2004. She is equipped with the latest generation of modern technology for marine studies - both biological, geological and oceanographic.

Rigorous documentation of new observations is thus critical, and researchers need to be able to to carry out visual inspection and systematic studies, for example along transects. Being able to collect simple samples is also of utmost importance for the success of the expedition. Both these tasks can be undertaken by Remotely Operated Vehicles (ROV) and Autonomous Underwater Vehicles (AUV) capable of operating at depth.

The G.O.Sars cruise involves three different data collecting approaches: on station, where the boat remains at a particular position while researchers collect data; continuous, where researchers collect data while the boat is in transit; and stationary, involving the use of buoys and independently anchored data collecting systems. All three approaches are necessary to get a 3D picture of the deep-sea eco-system, across depths, time and seasons.

NEWS



Visualization of the mid-Atlantic Ridge
MAR-ECO has compiled a high quality bathymetry of the mid-Atlantic Ridge between Iceland and the Azores. The illustration above shows a three dimensional visualization of the bathymetry, with the Azores and many subsurface seamounts to the right and the Reykjanes Ridge south of Iceland to the left.

Portugese RV D. Carlos I operating together with the G. O. Sars in 2004
A proposal has been submitted to Portugese authorities with the aim of having RV D. Carlos I to carry out hydrography, bathymetry and mammal-seabird studies together with RV G.O. Sars in 2004 .

Visiting scientist proposals
Cultural exchange agreements between several countries have been explored and proposals have been submitted to facilitate short-term exchange visits to work on MAR-ECO data and collections. One proposal is for two Portugese scientists to visit the Institute of Marine Research and Bergen Museum in the Autumn of 2004, and similarly two proposals for Russian visitors to Norway have been submitted to the Norwegian Research Council.

TV-documentary
The Norwegian Broadcasting Company, NRK, is planning to produce an international MAR-ECO TV-documentary.

School Network meeting
Representatives from schools in 11 countries have been invited to a meeting in Bergen 3-7 November 2003 to discuss preparations for submitting a Comenius 1 application to the EU. Numerous activities are planned; pupils will follow the project as it is progressing through the field and analysis phases, and there will be a web-based service including ship-to-shore communication when the RV G.O. Sars is at sea.

US-Norwegian collaboration
MAR-ECO is accepted as a concrete project under the collaborative agreement between the Norwegian Institute of Marine Research and the US National Marine Fisheries Service, and an action plan is now being written. A meeting of a US MAR-ECO consortium was held at the Virginia Institute of Marine Science in July 2003.

UK consortium
The MAR-ECO partners in the United Kingdom, lead by I.G. Priede, is preparing a consortium bid to the National Environment Research Council, aiming to conduct multi-year studies in the Charlie-Gibbs Fracture Zone and adjacent areas of the Sub-polar Front.

Fishing Industry Support
The Norwegian Fishing Vessel Owners Association and the Norwegian Fishermen's Association are helping MAR-ECO gather support for chartering a modern commercial longliner that can act as an additional "fish sampler" alongside RV G.O. Sars.

Proposals to support science projects
Many MAR-ECO partners have submitted proposals to funding agencies in order to enhance the support for various science and public outreach components. E.g. proposals are being considered by the Norwegian Research Council, the Nordic Council, and several private foundations and companies.

MAR-ECO, a field project of the Census of Marine Life

The Census of Marine Life (CoML) initiative, formalised in 1997, is an international research programme aiming at assessing and explaining the diversity, distribution and abundance of marine organisms throughout the world's oceans. It is a central objective of CoML that innovative research effort be focused on poorly known ecosystems and/or communities for which new information would be particularly important to enhance understanding. The vast oceanic areas off the continental shelves represent such poorly known areas, and the ecosystems of the mid-oceanic ridges and the mesopelagic zone are of particular interest.

Recognising this continued need for exploratory research in oceanic waters, Norway represented by the Institute of Marine Research and the University of Bergen offered to take the lead in developing a regional collaborative CoML pilot project focusing on macrofauna of the northern mid-Atlantic Ridge (MAR) from Iceland to the Azores.

The project was given the acronym **MAR-ECO,** and has the following overriding aims:

"To describe and understand the patterns of distribution, abundance and trophic relationships of the organisms inhabiting the mid-oceanic North Atlantic, and identify and model the ecological processes that cause variability in these patterns."

Contact:
Dr Odd Aksel Bergstad (PI MAR-ECO) Institute of Marine Research, Flødevigen Marine Research Station, N-4817 His, Norway +47-37059019 +47-37059001 oddaksel@imr.no

Dr Tone Falkenhaug (MAR-ECO Secretary), Institute of Marine Research, Flødevigen Marine Research Station, N-4817 His, Norway +47-37059020 +47-37059001, tonef@imr.no

Ms Elinor Bartle (Public Outreach contact), University of Bergen, +47-55583180, elinor.bartle@form.uib.no