MAR-ECO LEG 2 CRUISE REPORT

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Goals

1. **Ichthyofaunal assessment using baited camera landers along and across the Mid-Atlantic Ridge (MAR)**
2. **Pelagic bioluminescence profiles on the MAR and Faraday seamount**
3. **Subpopulation dynamics of the armed grenadier, *Coryphaenoides armatus***
4. **Periodic bait release in the Charlie-Gibbs fracture zone**

1) Ichthyofaunal assessment using baited camera landers along and across the Mid-Atlantic Ridge (MAR): RObust BIOdiversity (ROBIO) lander

Technology:

The ROBIO is a free-fall lander equipped with a digital stills camera (Kongsberg Maritime, OE14-208), flash unit (Kongsberg Maritime, OE11-242), Sensortek current meter, rechargeable battery pack, and twin acoustic ballast release system (MORS AR and RT).

The ROBIO was deployed as a mooring consisting, from the top downwards, of a pick up buoy, Dhan buoy with flag, radio and strobe, 8 spherical syntactic foam floats (2 sets of 4 separated by 10m; CRP Marine), 2 glass spheres (Benthos), ROBIO frame, cross reference scale and 95Kg of ballast.

When deployed ROBIO descends to the sea floor at 36 $m.min^{-1}$. The ballast is suspended 2m below the frame of the lander anchoring the mooring, with the reference cross and bait (500g mackerel) attached. The reference scale is situated in the centre of the field of view (1m x 1m cross with 10cm graduated intervals) approximately 20-50cm above the seafloor (dependant on sinkage). Ribbons are attached to the end of each arm to indicate current direction. The camera was programmed to take digital photographs at 90-second intervals, with an average of 250 photos per deployment.

The current meter was programmed to measure depth, temperature, current speed and direction and conductivity at one minute intervals throughout the deployment.

On deployment completion the ROBIO was released from the ballast by acoustic command from a MORS deck unit via a transponder lowered into the water. The lander therefore returning to the surface by virtue of positive buoyancy.

Deployments:

The ROBIO lander was deployed at all 19 Super Stations (SS42–SS76). Images were not captured at SS42 due to camera programming problems, deployment 2 at SS44 captured images but due to intermittent autofocus failure the image capture sequence was not consistent. Therefore a total of 17 fully successful deployments were achieved at SS46–SS76. Capturing in excess of 4100 images, at depths ranging from 1012–3508m.

Preliminary results:
A total of 18 ichthyofaunal species were observed attending the bait, 13 in the Southern box, 11 in the South Eastern cluster of the Middle box and 15 in the North Western cluster. There are a total of 10 species common to both the Southern and Middle boxes.

Dominant species attending bait appear to be highly specific to depth strata, with *Antimora rostrata* and *Hydrolagus affinis* being the most common species at depths 1500-2500m in both the Southern and Middle boxes. Occurrences of *Etmopterus princeps* were more prevalent within this depth range in the Southern box. Consistent dominant species at depths exceeding 2500m are *Coryphaenoides armatus* and *Histiobranchus bathybius*.

Analysis:
Analysis of the ROBIO data will consist of a) image analysis; simple time series counts, length frequency determination, bait visitation by individuals, abundance estimate calculation, confirmation of species identification, behavioural observations, and b) collation and interpretation of current meter data.

Figure 1: a) *Antimora rostrata,* SS62, 1750m, b) *Hydrolagus affinis,* SS56, 1853m, c) *Etmopterus princeps,* SS44, 1658m, and d) *Coryphaenoides armatus* and *Histiobranchus bathybius,* SS64, 3460m.

2) Pelagic bioluminescence profiles on the MAR and Faraday seamount: Intensified Silicon Intensifier Target (ISIT) camera

Technology:
The ISIT camera was mounted in profile on the CTD profiler frame (University of Bergen), with a mesh screen, Barium LED and controller unit to interface camera and power, and to provide data storage. The mesh screen was located 60cm from the camera faceplate in the centre of the camera field of view. On descent through the water column the mesh screen stimulates bioluminescent events, which are recorded in monochrome on a 60-minute mini DV tape. The CTD was lowered at a rate of $0.8ms^{-1}$.

Deployments:
The ISIT camera was deployed at 14 stations (SS52-SS76, including SS53) at depths down to 3500m, capturing 14 hours of bioluminescence profiles. Single deployments were conducted in the Southern box (SS52), and one on the Faraday Seamount (SS53).

Preliminary results:
Initial results indicate a reduction of bioluminescent events with increasing depth at all stations. Some organisms are discernable and there is potential to classify to order level. In some profiles patchiness of events is evident intermittently throughout the profile.

Analysis:
Analysis of ISIT profiles will consist of image analysis; time series counts of bioluminescent events and shape and size classification of events. Analysis will commence in early 2005.

Figure 2: ISIT camera frames from a) SS62, and b) SS66.

3) Subpopulation dynamics of the armed grenadier, *Coryphaenoides armatus*: sample collection

Samples of white muscle and liver tissue were collected from a total of 133 individuals of *C.armatus* at 13 super stations (SS40, 42, 50, 52, 54, 56, 62, 64, 66, 68, 70, 72 & 74). Microsatellite and RNA analysis to determine the existence of sub-populations of *C.armatus* will be conducted in early 2005.

4) Periodic bait release in the Charlie-Gibbs fracture zone: Deep Ocean Benthic Observatory (DOBO)

Technology:
The Deep Ocean Benthic Observer (DOBO) is an autonomous lander vehicle designed to undergo long duration experiments at depth. Its titanium frame bears a battery unit, controller unit, 35mm stills camera (model M8S, Ocean Instrumentation, UK) and two strobe flash bulbs (200J each) slaved to the camera and illuminating a bait at the base of the lander.

Two Kodak E200 Ektachrome colour reversal films spliced together enable a maximum of 1400 images to be taken per deployment. Photographs are taken in a pre-determined sequence.

The DOBO bait consists of six mackerel carcasses sealed in individual plastic tubes. Bait tubes are tethered to an autosampler mechanism (KUM) programmed to release at 5-day intervals. This results in an identical bait presentation of one mackerel carcass every five days.

The camera and the autosampler are controlled by a low power 68000 based microcontroller, utilising software-controlled power reduction techniques.

The lander freefalls to the seafloor with the weight of two 60 kg steel ballast bars yoked to the lander with twin acoustic releases (AR 661 B2S-DDL and RT 661 B2S-DDL, Oceano France). Ballast is released by acoustic signal from the ship and the lander surfaces by virtue of positive buoyancy. Sixteen syntactic floats (TS2-6000, CRP Group, UK) on the frame, and two on the mooring line enable the lander to return to the surface where it is recovered. The DOBO mooring is equipped with a VHF radio beacon (RF-700A1, Novatech, Canada) and strobe (ST400-A, Novatech, Canada), both activated upon surfacing, and an orange flag to aid with location and recovery.

An upward looking 300KHz acoustic Doppler current profiler (ADCP) (Workhorse Sentinel WHS300-I-SP4, RD Instruments, USA) mounted at the top of the lander (2.4m above ground) records current velocity and direction in successive 3 m depth cells in the water column.

Deployment:
The DOBO lander was deployed at 52°42.209N, 35°14,794W (Super Station 71) on 18/6/04, to a depth of 3711m. It was retrieved on 26/7/04.

Preliminary results:
Camera, controller, and bait system and ADCP all functioned successfully. Approximately 1500 images were taken. Analysis of the scavenging faunal visitors and current regime will begin shortly.

Analysis:
Analysis of the DOBO data will consist of a) image analysis; simple time series counts, length frequency determination, bait visitation by individuals, abundance estimate calculation, confirmation of species identification, behavioural observations, and b) collation and interpretation of ADCP data.