Mountains in the Sea

Exploring the New England Seamount Chain

Final Report

2003-2006

Award Number: NA03 OAR4600116

EXPLORE

TABLE OF CONTENTS

I. OVERVIEW 4
II. SUMMARY 4
1. Abstract 4
2. Purpose of Project: 5
2a. Describe issue that was addressed 5
2b. Describe/list the project objectives 5
3. Approach: 5
3a.1 - Multibeam Mapping 5
3a.2 - Map The Distribution Of Octocorals And Assess Overall Biodiversity Of Seamounts 7
3a.3 - Taxonomic And Reproductive Studies Of Octocorals 8
3a.4 - Colonization Dynamics Of Deep Sea Corals 9
3a.5 - Seamount Coral Genetics 10
3a.6 - Deep-Sea Fishes 10
3a.7 - Education And Outreach 11
3b. Describe how the project was organized and managed 11
3c. Describe how data was organized, processed, and archived 12
4. Findings: 12
4a.1 Multibeam Mapping 12
4a.2 - Map The Distribution Of Octocorals And Assess Overall Biodiversity Of Seamounts 12
Detailed observations of several of the octocoral species and their associates have been made from the Alvin and ROV video. 12
4a.3 - Taxonomic And Reproductive Studies Of Octocorals 13
4a.4 - Colonization Dynamics Of Deep Sea Corals 13
4a.5 - Seamount Coral Genetics 14
4a.6 - Deep-Sea Fishes 15
4a.7 Education and Outreach 16
4b - Inventory of activities (number of submersible dives, CTD, net tows, etc.) 17
4c - Inventory of samples collected 17
4d - Describe/list resulting publications, Web sites, presentations, etc. 17
4e - Location and status of data archive and/or sample storage 20
III. Evaluation: 21
1. Accomplishments 21
2. Expenditures: 21
2a. Describe original planned expenditures 21
2b. Describe actual expenditures 21
2c. Explain special problems, differences between planned and actual expenditures 21
3. Next Steps: 21
3a. Planned or expected reports (professional papers, presentations, etc.) 21
3b. Brief description of need for additional work, if any (next project phase, new research questions, unaccomplished work, etc.) 22

APPENDIX ONE -CRUISE PARTICIPANTS 23
2003 EXPEDITION- R/V Atlantis 23
2004 Cruise Participants – NOAA Ship Ronald H. Brown 24
APPENDIX TWO - SPECIMENS, SAMPLE LOCATIONS AND DISPOSITION 25
2003 Mountains in the Sea Data Collection Summary 25
2004 Mountains in the Sea Data Collection Summary 42

I. OVERVIEW

Grant Number (If applicable): NA03 OAR4600116

Amount of funding from Ocean Exploration: $380,000

Project Title: Mountains in the Sea: Exploring the New England Seamount Chain

Area of Operation (if applicable): New England Seamounts

Principle Investigator (name, address, contact information): Ivar G. Babb; NURC-UConn, 1080 Shennecossett Rd. Groton, CT 06340; babb@uconn.edu; 860-405-9121

Participating Institutions: University of Connecticut, University of Maine, Woods Hole Oceanographic Institution, University of Louisiana-Lafayette, Florida Atlantic University

Award Period: From _May, 2003_____ To __May, 2006_____(two year award with one year no cost extension)

Period Covered by this Report: From _May, 2003____ To _May, 2006__ (ref: Final Report)

II. SUMMARY

1. Abstract

Mountains in the Sea (MIS) represented the first exploration of these seamounts by an interdisciplinary team of scientists, educators, artists, hydgrographers and media representatives. Over the course of the two year project the team conducted a cruise on the RV *Atlantis* using the *Alvin* submersible and a second cruise the following year using the NOAA Ship *Ronald H. Brown* and the Institute for Exploration's *Hercules* and *Argus* remotely operated vehicles. Previous work on this line of extinct volcanoes running from the southern side of Georges Bank midway across the western Atlantic was limited to work by geologists using various geophysical methods including observations from the Alvin submersible during a series of dives in 1974. Exploratory trawl surveys of Bear Seamount conducted by NOAA's Marine Fisheries Service have also been on-going.

A snapshot of these expeditions includes: diving on five seamounts, collecting extensive multibeam data of much of the northern New England Seamount Chain, collecting over 100 coral samples, collecting dozens of other invertebrates, recording and identifying dozens of fish species, collecting thousands of digital still images and frame captures, and developing a comprehensive education component closely tied to the expeditions.

The two years of investigation have produced an outstanding data set that includes the identification of new species, acquisition of enough multibeam data to develop a reasonably comprehensive atlas of the northern New England seamount chain, collected adequate deep sea coral samples to begin to understand the relationships between the various taxa from various seamounts, and have gathered significant data on coral growth and mapped intra- and inter-seamount coral distributions.

2. Purpose of Project:

2a. Describe issue that was addressed

This research addressed many aspects of seamount ecosystems with a particular focus on deep sea coral and fish communities.

2b. Describe/list the project objectives

1. Map the distribution of the octocorals and assess the overall diversity of organisms living in the coral communities of the New England seamount chain.
2. Determine the reproductive state and potential larval strategies of seamount octocorals.
3. Investigate the colonization dynamics of dense coral aggregations.
4. Determine whether seamount octocorals are genetically isolated between seamounts and from continental slope species.
5. Determine the relationship of demersal nekton to the landscape features with and without corals.
6. Assess physical impact of bottom trawling on octocoral communities and seamount biodiversity.
7. Develop educational materials and opportunities associated with the Mountains in the Sea exploration

3. Approach:

3a.1 - Multibeam Mapping

Project Leads: Ivar G. Babb, Kevin Joy, NURC, University of Connecticut, Nicholas Forfinski, NOAA, Allen Gontz, University of Maine

Producing maps of the seamounts targeted for exploratory dives was the first objective of this expedition. The New England seamounts form a southeast trending chain of underwater peaks, running from Bear seamount (200 miles from Woods Hole, MA) for another 700 miles to Nashville seamount. In year one we focused on three seamounts: Manning, Kelvin and Bear, mapping them with the R/V Atlantis' Seabeam 2112 12KHz swath bathymetric sonar system. The NOAA ship Ronald H. Brown has the same multibeam system, which facilitated the integration of data sets from 2003 and 2004.

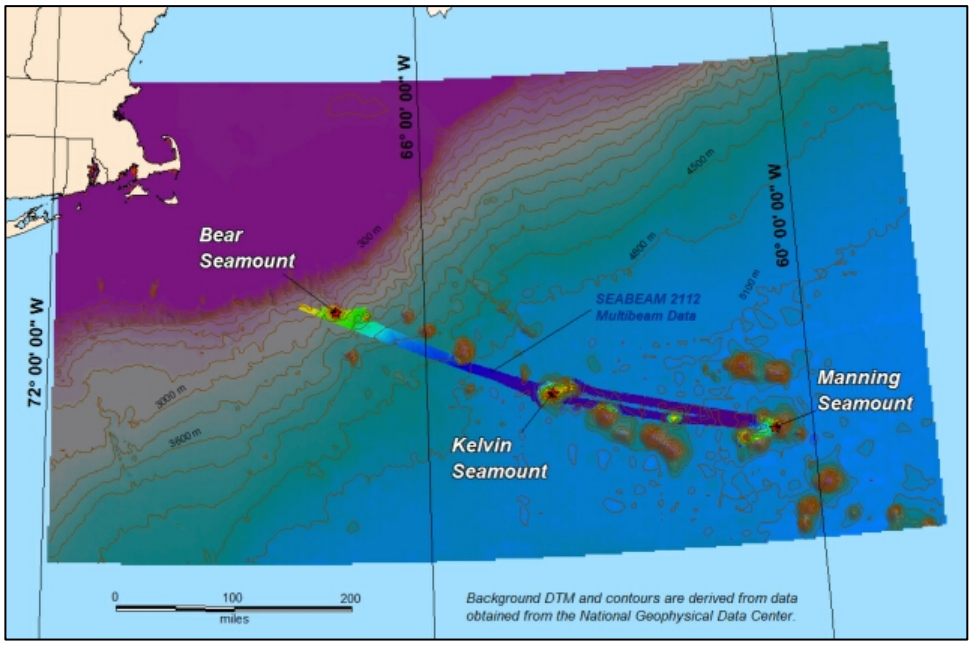

Figure 1. Map showing 2003 multibeam mapping efforts from the R/V Atlantis

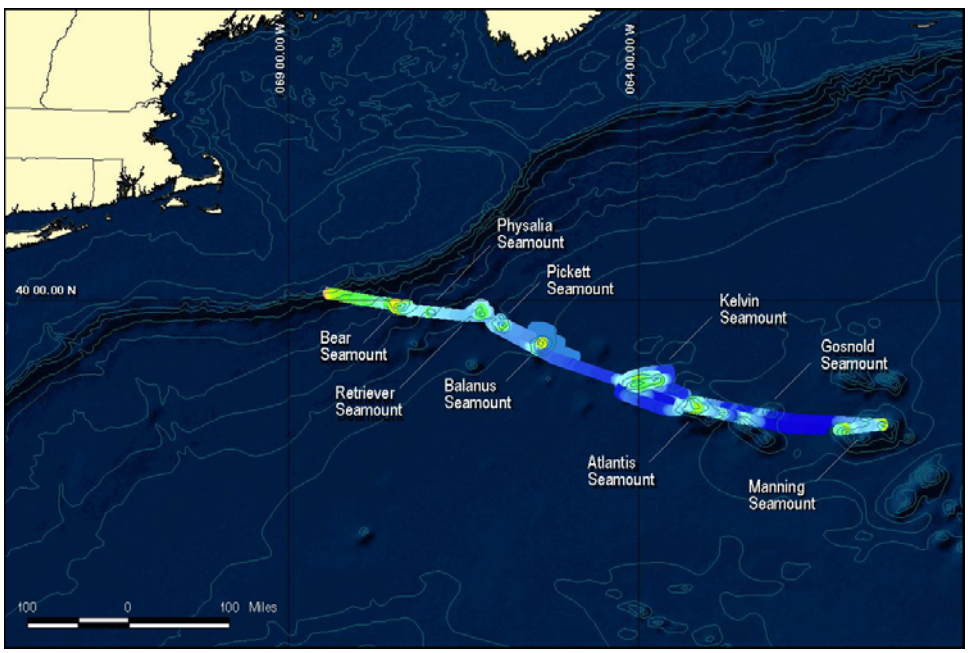

Figure 2. Map showing 2004 multibeam mapping efforts from the Ronald H. Brown

For 2004 the mapping efforts intended to fill in as many data “holes” from 2003 as possible, as well as mapping new seamounts. The overall mapping track began at the edge of the continental shelf south of Georges Bank as we entered deep water, which highlighted more rugged topography than anticipated from existing bathymetry as we proceeded to Bear seamount. After diving on Bear seamount we transited to Manning seamount, attempting to map Physalia, Retriever, Balanus and some of Gosnold and Sheldrake seamounts en route. We dove on one of the five peaks of Manning seamount, then filled in a data gap between other peaks on Manning. The mapping transect then ran from Manning back to Kelvin. We were able to map additional areas south of Kelvin to Atlantis seamount while repairs were

being made to the ROV after making its first dive to 3900 meters in preparation for diving on the Titanic on the next OE mission. From Kelvin, we mapped north to Balanus, Pickett and Retriever seamounts.

3a.2 - Map The Distribution Of Octocorals And Assess Overall Biodiversity Of Seamounts

Project Leads: Les Watling, Jon Moore, Peter Auster

The *Alvin* submersible a good platform for the initial exploration of the New England Seamount Chain, providing researchers with first hand look at the topography, substrates and distribution of organisms on these rugged features. The submersible also provided good imaging capabilities with 3-chip cameras and digital still images. The submersible was also an excellent platform for the collection of the coral and other samples.

The ROVs *Hercules* and *Argus* proved to be excellent platforms to record the distribution and abundance of deep sea corals as well as the other organisms inhabiting the seamounts. The two-vehicle configuration, with the *Argus* hovering 20-30 meters over the *Hercules* ROV proved to be a perfect tool for mapping small-scale coral distribution. The 2400 watts of HMI lighting and High Definition TV camera on *Argus* provided an outstanding perspective of the small-scale topography that the larger *Hercules* vehicle used to maneuver to investigate and collect samples. The High Definition video and digital still cameras have provided massive data sets that are currently being analyzed and reviewed to add to the species lists from each of the seamounts.

Preliminary photographic surveying and selective sampling during this expedition has once again expanded our knowledge of the animals living on these seamounts. Most of the over 910 specimens collected from the seamounts will either reside in PI's laboratories or be deposited in the Smithsonian's National Museum of Natural History and the Peabody Museum of Natural History at Yale University. Year one collected 59 coral specimens, representing 24 species. Our preliminary collection estimates for year two indicate at least 27 octocoral species, 8 black coral species, 2 stony coral species, 7 species of sponges, 15 species of polychaete worms, 16 crustaceans, 5 molluscs, 4 species of brittle stars, 1 sea star, 4 anemones and several other invertebrates live on these seamounts. Analysis of these voucher specimens and photographic evidence will take some time, but will considerably expand this list of species even further.

In addition, our team custom-built two insulated "bioboxes" for the *Hercules* ROV to store specimens at ambient water temperature throughout the dives, especially as the vehicle was recovered from the warmer Gulf Stream waters.

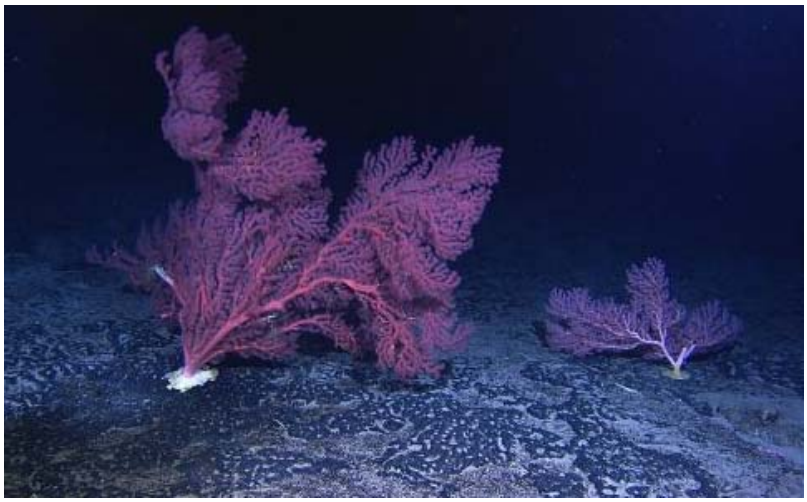

Figure 3. Large Paragorgia colonies on basalt substrate

All octocorals collected were also examined for associated invertebrates. These were removed and preserved separately. One associate, the polynoid polychaete *Gorgoniapolynoe caeciliae*, which lives in tunnels made by the modified sclerites of the primnoid, *Candidella imbricata*, was reproductive and so was preserved so that the gonadal structures could be examined on return to the laboratory. In another case, we found pregnant females of a deep sea version of a snapping shrimp living amongst the branches of the various *chrysogorgiid* species that occur on these seamounts.

In addition to adding to the species list, the corals that were collected also served to address other mission objectives. The live corals were kept at ambient temperatures and examined for preliminary classification, polyp morphology and behavior, and reproductive state. A video-microscope provided close-up record of the coral colonies. Skeletal and tissue samples were preserved for morphological analyses.

3a.3 - Taxonomic And Reproductive Studies Of Octocorals

Project Leads: Kevin Eckelbarger & Anne Simpson, University of Maine

We collected tissue samples from fifty-nine octocorals specimens in eight different families. This material is being used to: (1) describe the reproductive morphology of octocorals from the New England Seamounts; (2) examine classical morphological characters (such as sclerite type) in combination with reproductive characters (including cell ultrastructure) to identify deep-dwelling octocorals species.

Prior to the Mountains in the Sea expedition, little was known about the timing of gametogenesis in deep-water octocorals. We were pleased to discover that nearly half of the colonies we examined contained eggs in various stages of development. Live sperm and developing embryos were also observed in several colonies. The presence of embryos in coral tissues suggests that brooding may be one reproductive strategy employed by some deep-dwelling octocorals.

Figure 4. Cross sectional view of polyps and eggs in *Paragorgia sp* colony.

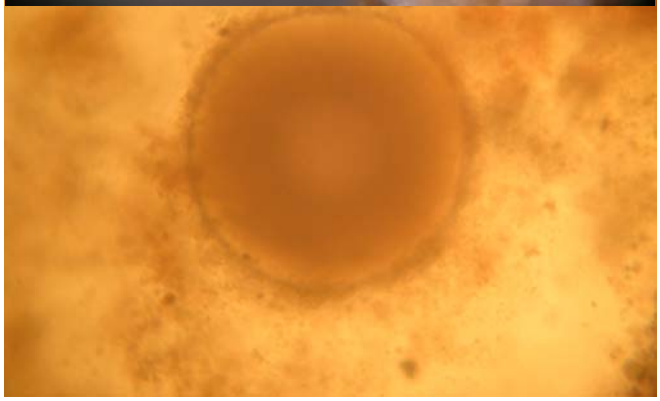

Figure 5. Egg from *Acanella sp*.

3a.4 - Colonization Dynamics Of Deep Sea Corals

Project Leads: Lauren S. Mullineaux and Susan W. Mills, Woods Hole Oceanographic Institution

The main goal of our group is to investigate the colonization dynamics of deep-sea corals inhabiting the New England Seamount Chain. To do this, we are measuring the size distributions of two target species, *Paragorgia* sp. and *Lepidisis* sp., and aging selected specimens using ^{210}Pb dating techniques. We initiated complementary recruitment studies by deploying settlement blocks in 2003 using the Alvin submersible. One half of the blocks were recovered in 2004 on the second year of the Mountains in the Sea expedition, and we were fortunate to receive additional OE support to continue our seamount exploration in 2005, which provided an opportunity to recover the remaining recruitment blocks. We also are using seafloor images (the forward-looking video and down-looking 'pixelfly' digital still images) to determine whether coral species typically settle in patches, and whether individual species associate with particular topographic features or flow regimes.

Much of our effort was focused on Manning Seamount. The recruitment blocks were deployed here based upon discussions with our collaborator, Jess Adkins. In 2004 we retrieved 10 basalt recruitment blocks, 5 from a site directly underneath a *Paragorgia* sp. colony, and 5 from a nearby site lacking corals. In the same general area, we sized *Paragorgia* sp. colonies by orienting the video camera normal to the fan and using the laser dots (10 cm separation) for scale. Two of the specimens were collected and frozen for ^{210}Pb dating. We searched for new colonies (i.e., a few polyps in size) by positioning the video camera close to the rocky substrate. Such colonies appear to be rare, but we did find some on this and subsequent dives. We developed a technique for measuring the height of the whip coral *Lepidisis* sp. This technique involved imaging the colony, and then measuring the position (in X, Y and Z coordinates) of the base and terminal end. This linear distance will be adjusted with estimates of the helical coiling and the overall curvature of the colony. We continued this measurement strategy for the remainder of the cruise. On all dives following Dive 4, we also attempted to use the pixelfly images for quantitative surveying.

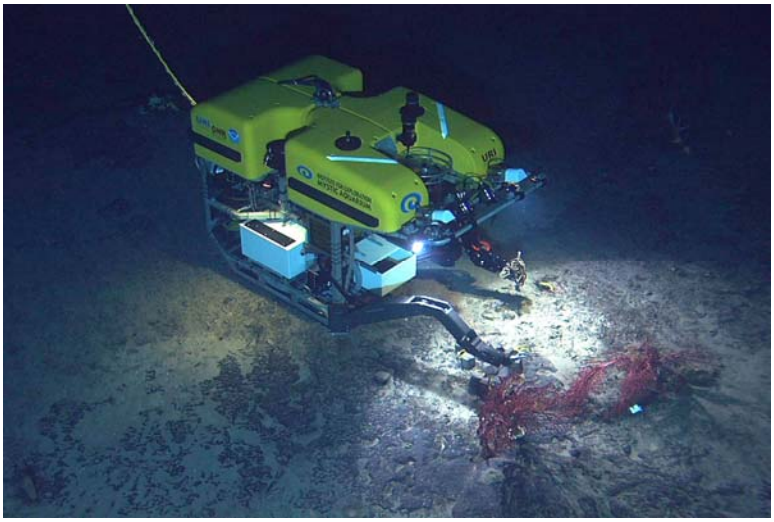

Figure 6. Recovering the basalt recruitment block experiment that was deployed by the DSV *Alvin* submersible in 2003 with the *Hercules* ROV.

3a.5 - Seamount Coral Genetics

Project Leads: Scott C. France, University of Louisiana at Lafayette

Small branches from all corals collected were preserved for DNA analysis in 95% non-denatured ethanol and by freezing. Where sufficient material was available, additional replicate samples were preserved in 2004 in different grades of ethanol (100% vs. 95%, and pure vs. denatured) to test the storage conditions on long-term preservation of coral DNA. DNA was extracted in the lab at UL Lafayette from 166 octocoral colonies, 17 black coral colonies and 2 zoanthids. Most octocorals were sequenced for the mitochondrial *msh1* gene, and selected colonies were sequenced for other mitochondrial genes, e.g., *cox1, cox2, nad2*. Black corals have been sequenced at two mitochondrial non-coding regions and *cox1*, and selected colonies have been sequenced at several nuclear loci. Sequencing analyses continue on these specimens, as well as additional colonies collected in 2005, as we survey for phylogenetically-informative variation at different taxonomic levels.

Figure 5. Sampling small coral colony with *Hercules* manipulator

3a.6 - Deep-Sea Fishes

Project Leads: Peter Auster, University of Connecticut, Jon Moore, Florida Atlantic University

We used video and still imagery acquired from Alvin, Hercules, Argus, ABE and Towcam to collect data on distribution, relative abundance, habitat associations, and foraging behaviors of fishes associated with elements of seamount landscapes. (Imagery from ABE and Towcam, as well as video from some Alvin dives, was collected during a collaborative NSF funded cruise led by Jess Adkins from CalTech). A variety of habitat and behavior classification approaches were used to develop data sets for analyses related to the major objectives.

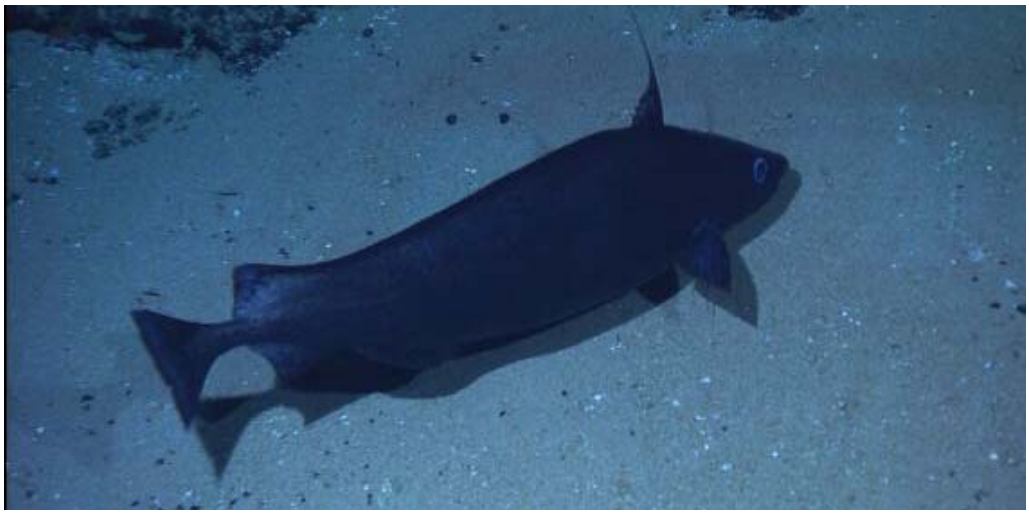

Figure 7. Antimora over sandy portion of seamount.

3a.7 - Education And Outreach

Project Leads: Diana Payne & Ivar Babb, University of Connecticut

The education plan for the Mountains in the Sea (MIS) cruise built upon the successful educational model developed, in part by the education team on the MIS expedition for the OE Deep East expedition in 2001. The following educational objectives were established for the two-year project and realized through pre, during and post-cruise activities.

- Develop products (e.g., lesson plans, promotional materials) to support outreach and grade 5-12 education related to the expedition,
- Coordinate regional teacher professional development workshops before the expedition,
- Select teachers to participate in the expeditions as part of a teacher-research experience, in which they worked with the researchers, helped prepare daily web log to be featured on the www.oceanexplorer.noaa.gov web site and participated in surveys to gather pedagogical data vis a vis the effectiveness of these activities.
- Develop CD-ROM/DVD educational/multimedia products to be distributed to educators at various forums.

3b. Describe how the project was organized and managed

The project was designed as a multidisciplinary effort wherein leading experts in deep sea corals, seamounts, deep sea fishes and marine science education were contacted regarding their interest in exploring the New England Seamount chain. The principals on the project each developed their complementary science program for the proposal. The project was administered by the NOAA Undersea Research Center at the University of Connecticut, with Ivar Babb as the Principal Investigator. Dr. Les Watling was named the Chief Scientist on the expeditions. Planning meetings/conference calls were held prior to each expedition to: 1) ensure that the appropriate technologies were available on the underwater dive systems to meet the research needs, 2) discuss dive sites, sampling protocols and priorities, and 3) discuss other cruise logistics and outreach opportunities.

3c. Describe how data was organized, processed, and archived

The National Undersea Research Program has collaborated with Ocean Exploration in the development of an Expedition Information System (EIS) designed for data management at sea. NURC personnel participated on the Mountains in the Sea cruise and had the opportunity to pilot a runtime version of the EIS. The project was unusually complex involving seven principal investigators and entailing a number of dives, transits, and multibeam surveys during the at sea missions. Alvin submersible and ROV operations were conducted at each of the targeted seamounts, resulting in a wealth of data and multimedia to manage. The EIS was heavily utilized during the second year expedition, which provided opportunities to identify the strong suits and limitations of a system that is currently a work-in-progress.

Biological samples were processed based upon the research protocols required by each PI. A detailed record of samples was developed for each dive by Dr. Jon Moore and is provided below. Data collected on individual components of this project will remain with the Principal Investigators.
DNA sequences of corals sampled for genetic analyses have been submitted to the NCBI GenBank database, and additional sequences will be deposited as publications are prepared.

Figure 8. Paragorgia on basalt/sand substrate

4. Findings:

4a.1 Multibeam Mapping

The results of this two-year mapping effort were immediate and long-lasting. The multibeaming effort provided the real-time, at-sea images of the topography of the seamounts that was critical to the dive planning efforts of both years expeditions using the human occupied submersible and ROVs. Images of the multibeam maps were integrated into both dive systems navigation system to provide a real time guide for the pilots and scientists. The longer term value of the maps and images has been for outreach and education as well as provided to other researchers to guide their efforts to better understand seamounts. All data has been submitted to the NOAA Office of Ocean Exploration. A total of approximately XXX square miles was mapped by the R/V Atlantis in 2003 and another 800 square miles were mapped with the Ronald H. Brown in 2004.

4a.2 - Map The Distribution Of Octocorals And Assess Overall Biodiversity Of Seamounts

Detailed observations of several of the octocoral species and their associates have been made from the Alvin and ROV video. Octocorals were found on all seamounts examined, from the deepest dive on Kelvin (3879 m) to the summits. An unknown chrysogorgiid and an unknown primnoid were the only two species found at that deep station. In general, chrysogorgiids, isidids, coralliids, and acanthogorgiids were found on the seamount slopes and paragorgiids at or near the summits. Coralliids were especially common on slope areas where the substratum consisted of cemented basaltic debris. A complete distribution pattern for all octocoral species encountered will be presented in a publication to follow. Results of MDS analysis of octocoral abundances were plotted by 100 m depth interval. There was a

large cluster of samples which included those from 1600 to 2100 m, while the 1400 and 1500 m intervals showed the greatest variability. While the presence-absence and 4th root transformed abundance MDS results were similar, using the semi-quantitative data provided better discrimination amongst the depth layers. Only the 1700 to 2100 m and 2200 to 2400 m depth groups were reasonably distinct.

There is also an east-west distributional pattern involving some of the octocoral species. For example, the genus *Acanthogorgia* is not found from the central New England seamounts and eastward, whereas the species, *Acanella eburnea* is not found at the western end of the chain. As the follow-on data from our 2005 expedition to Corner Rise and some of the easternmost NE seamounts are analyzed, we will get a better view of this pattern. And lastly, there are several species that we found that are known from the Pacific Ocean, or who have sister taxa in the Pacific. One of these, *Metallogorgia melanotrichos*, appears to harbor the same brittle star associate in both ocean basins.

4a.3 - Taxonomic And Reproductive Studies Of Octocorals

Voucher specimens of approximately 32 octocoral species in 26 genera were recovered. These include members of the Acanthogorgiidae, Anthothelidae, Paragorgiidae, Chrysogorgiidae, Primnoidae, and Isididae, among others. Of these, many are new to science, especially those in the Chrysogorgiidae and Isididae. Four new chrysogorgiids have been described in a paper in press. Complete descriptions involve detailed studies of the polyps and their sclerites, usually with scanning electron microscopy (SEM), so progress is slow.

All specimens collected had some part or all of the polyp fixed for histological and transmission electron microscopy (TEM). On return to the lab all pieces of tissue were embedded and are currently being cut for microscopical examination. One species, *Metallogorgia melanotrichos*, has been examined in detail. While sexes appear to be separate in this species for the most part, some hermaphroditic colonies have been found. The reproductive morphology work is the part of the thesis of a Ph.D. student, so this work is ongoing.

4a.4 - Colonization Dynamics Of Deep Sea Corals

For direct quantification of recruitment, we recovered half of the colonization blocks after ten months, in May 2004, and the remainder in August 2005, 25 months after deployment. Few invertebrates and no corals had settled after ten months, but we did collect a single tiny coral recruit on one block during the 2-year experiment. This suggests that our original supposition was correct – coral colonization on seamounts is a slow process, even within an existing coral community – and that the community would recover slowly, if at all, from disturbance.

For our colony measurements we focused our analyses on two species groups, bubblegum coral (*Paragorgia* sp.) and whip bamboo corals (*Keratoisis* spp.). *Paragorgia* is found in low abundance throughout the seamounts; the only dense population found to date is on the summit of Manning Seamount, where the settlement blocks were placed. Using an initial analysis of video images, we found that most of the colonies were either fairly large (>30 cm) or tiny (less than 10 cm), suggesting either that settlement might be discontinuous or that mortality of new recruits is very high. Subsequent analysis of this same population using transects of down-looking pixel-fly images resulted in detection of many colonies in the 10-30 cm size range that were missed in the video study. We conclude that there is no evidence for an extensive recruitment hiatus in this species and strongly recommend the use of high-resolution digital still images for quantifying these coral populations.

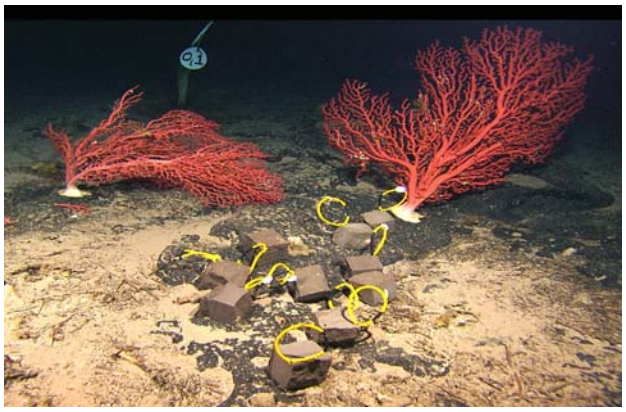

Figure 9. Settlement blocks on Manning summit, near *Paragorgia* colonies, May 2004

The bamboo corals, so-called because their skeleton resembles a piece of bamboo, are widely distributed along the seamount chain. Preliminary measurements indicate that there is no gap in their size range, but molecular evidence from our colleague Scott France indicates that there are at least four species present, complicating interpretation of the data. We plan to analyze skeletons of several individuals of known species using ^{210}Pb dating to determine ages of the colonies and to calculate growth rates. We can then use the growth rates to estimate ages of colonies we have imaged but not collected. We also intend to use the dating method to determine ages of the *Paragorgia* colonies we have collected. Furthermore, we are experimenting with a method of measuring bamboo colonies using stereo pairs of digital images. If it proves to be feasible, it would be a quicker and more accurate way to measure coral sizes than any of our current methods.

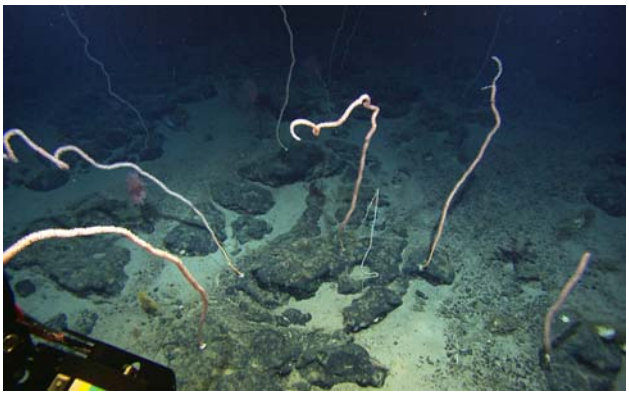

Figure 10. Whip bamboo corals on Balanus Seamount, May 2004

4a.5 - Seamount Coral Genetics

Our preliminary results from four groups of taxa (Chrysogorgiidae, Isididae, Paragorgiidae, *Paramuricea*/*Acanthogorgia*) have helped us delimit the extent of species diversity across the seamounts to the continental slope, but also suggest that even the most variable mitochondrial genes (*msh1* in octocorals) may not be able to distinguish all octocoral species. Nonetheless the genetic data reveal, for example, that we have collected at least 3 species of *Paragorgia* from the seamounts, where none had previously been reported, and at least 5 species of bamboo corals (Isididae). Phylogenetic analyses of the bamboo coral sequences were used to show that colony-branching pattern is not a good character to identify species from videos. A complete taxonomic study of the North Atlantic bamboo corals is ongoing (collaboration with Les Watling). DNA sequences also supported the description of 4 new species of *Iridogorgia* corals (described by Watling), and the hypothesis that morphologically-distinctive chrysogorgiid colonies were a "juvenile" stage of the common *Metallogorgia* rather

than a new species. Initial studies of biogeographic patterns have focused on octocorals in the genus *Paramuricea*. Analyses of DNA sequences from 42 *Paramuricea* colonies from Retriever, Balanus, Kelvin, Manning and Muir Seamounts, and the northeast US continental slope (Oceanographer Canyon, Gulf of Maine), reveal four *msh1* haplotypes and suggests that there may be morphologically-cryptic species variation among the seamount octocorals. *msh1* type C was found on all five seamounts where *Paramuricea* was sampled, type B from 3 seamounts, and type D (which is numerically the rarest) from only Kelvin and Balanus seamounts. Only type A is found on the continental slope, although this haplotype was also sampled on Kelvin. Thus, haplotypes B, C, and D are isolated from the continental slope (although we recognize sampling effort is relatively low), and type C is most widespread (and is the only type seen in the 4 samples analyzed from the off-chain Muir Seamount). We have yet observed no *msh1* sequence variation among 27 colonies of *Metallogorgia* collected from three western NES, Manning and Muir seamounts.

4a.6 - Deep-Sea Fishes

Analysis of imagery revealed the presence of 36 fish taxa from 24 families based on video records from *Alvin*, *Hercules*, ABE, and camera sled imagery. While previous studies have shown there are 591 species of deepwater fishes in the northwest Atlantic Ocean that occur at depths greater than 200 m, the zoogeography of this region as a whole has not been resolved to the level where we can predict patterns of distribution and diversity at the scale of particular landscape types such as seamounts. Given that most icthyofaunal surveys beyond continental shelf waters have been conducted using various types of towed nets over widely separated sampling stations, understanding the actual distribution of many deepwater taxa remains elusive. Our work is unique in that it can place individual fishes within their environmental context. Interestingly, faunal lists of fishes developed from video surveys on each seamount suggest that some species may use seamounts as “stepping stones” for dispersal across ocean basins.

Based on observations of variations in habitat features within seamount landscapes, and general patterns in the associations of fishes with such features, we used the video transects to develop a landscape classification scheme to classify patterns of habitat use in deepwater fishes. The classification scheme includes geologic, biologic, and flow regime as habitat attributes.

Figure 8. Roundnose grenadier in a head-down swimming posture

Preliminary analysis suggests that seamount fishes can be divided into four groups: (1) generalists that occur in all habitat types, (2) those that occur primarily in basalt habitats, that includes species associated with corals, (3) those that occur in fine-grained sediment habitats, and (4) those that appear to be specialized in living along the ecotone (edges) of hard substrate and sediment. Due to issues related to classification of fish location and small numbers of most taxa, we have only been able to quantitatively demonstrate differences in fish community structure between basalt and fine-grained sediments. However, a separate analysis of the relatively abundant false boarfish

(*Neocyttus helgae*) demonstrates that this species exhibits strong associations with octocorals (primarily fan morphotypes) as well as depression features in basalt pavements. This species also appears to exhibit behaviors consistent with territorial defense, a unique behavior not previously observed in a deep sea fish species. We have also quantified patterns in foraging behaviors of deep-sea fishes and assessed the range of behavioral plasticity of behaviors within taxa.

Some species exhibited a wide range of foraging behaviors in seamount landscapes when contrasted with the same species or cogener on continental margins or in the mesopelagic. There is a range of hypothetical mechanisms related to flow and seafloor topography that have been advanced to explain why fish aggregate over abrupt topographic features like seamounts (e.g., topographic blockage of descending zooplankton, counter-upwelling depth retention, enhanced horizontal flux of prey). Each of these mechanisms require the exhibition of a particular set of behaviors by fishes. The purpose of this part of our work is to show that some species are highly plastic in their foraging behaviors and can take advantage of a wide range of landscape and flow conditions over seamounts and in submarine canyons. Such behavioral plasticity can be correlated with patterns of distribution and abundance of species across seamount landscapes (e.g., wide ranging species have more plasticity in foraging behaviors and can take advantage of a wider range of local conditions).

Analysis of data collected from a subsequent expedition in 2005 (Deep Atlantic Stepping Stones) to the eastern New England Seamount chain and the Corner Rise Seamount Complex will be added to existing data to generate papers which comprehensively focus on deep sea fishes associated with western North Atlantic seamounts.

4a.7 Education and Outreach

Pre-cruise activities

A total of 17 mission specific lesson plans were developed by OE to support the Mountains in the Sea 2003 and 2004 expeditions. Six Professional Development Institutes (PDI) were conducted at various locations in the New England region (Woods Hole Oceanographic Institution, Project Oceanology, New England Aquarium, Mystic Aquarium, the Gulf of Maine Research Institution). A total of sixty six educators attended the teacher workshops. Two educators were selected to join the science teams aboard the RV Atlantis and another two for the NOAA ship Ronald H. Brown expeditions.

At-sea activities

Scientists and students were requested to fill out surveys prior to their interaction with the educators and at the end of the cruise. The entire science team assisted OE Web Coordinators in obtaining quality images and video clips to tell the Mountains in the Sea 2004 story. During the 2003 expedition a live conversation from the Alvin submersible to a Connecticut school of one of the teachers on board was implemented. During the 2004 expedition five live Web casts were broadcast on the www.explorethesea.com Web site using the satellite technology that had been installed on the Ronald H. Brown by IFE.

Post-cruise

A Mountains in the Sea DVD has been produced and distributed to over 200 educators at local, regional and national conferences via workshops and presentations. The DVD includes video clips of the technologies used and organisms observed during the two expeditions as well as the five educational Webcasts produced in 2004. The data collected from the 2003 and 2004 surveys were analyzed and added to additional data on teacher-research experiences and presented and published in the proceedings of Oceans 2005.

4b - Inventory of activities (number of submersible dives, CTD, net tows, etc.)

Expedition Statistics	2003 Alvin HOV	2004 Hercules/Argus ROVs
Number of dives	7	12
Bottom time	25.5 hours	173 hours
DVCam tapes (2 hours each)	56	182
DVDs (duplicated from DVCAMs for 5 CoPIs)	280	910
HD highlight tapes 8		48
Square miles mapped	~600	800
Coral samples collected	59	145
Coral species collected/identified	24	30
Fish species identified		33
Digital data (frame grabs, digital stills, nav data)	8 GB	440 GB

4c - Inventory of samples collected

Appendix Two provides summaries of the samples collected during the 2003 and 2004 expeditions as compiled by Dr. Jon Moore. The summaries include the taxa collected, the location of the stations from which samples were collected and the disposition of the samples. It should be noted that the sample locations, particularly for the 2003 *Alvin* mission are not accurate, given the navigation system on the submersible did not use a long base line network required to improve submersible navigation.

4d - Describe/list resulting publications, Web sites, presentations, etc.

Scholarly Publications:

Auster, P.J. In press. Linking deepwater corals and fish populations. Bulletin of Marine Science.

Auster, P.J., B. Hecker, K. Heinonen, J. Moore, and J. Janssen. In preparation. Species composition and foraging related behaviors of deep-water fishes from submarine canyons and seamounts in the northwest Atlantic. To be submitted to Environmental Biology of Fishes.

Eckelbarger, K.J., L. Watling & H. Fournier. 2005. Reproductive biology of the deep-sea polychaete, *Gorgoniapolynoe caeciliae* (Polynoidae), a commensal species associated with octocorals. Journal of the Marine Biological Association of the United Kingdom 85: 1425-1433.

France, S.C. 2007. Genetic analysis of bamboo corals (Cnidaria: Octocorallia: Isididae): does lack of colony branching distinguish *Lepidisis* from *Keratoisis*? Bulletin of Marine Science in press.

France, S.C. and M.R. Brugler. In preparation. Distribution and abundance of black corals (Antipatharia) in relation to depth and topography on the New England Seamounts (western North Atlantic). To be submitted to Deep-Sea Research.

McFadden, C.S., S.C. France, J.A. Sanchez & P. Alderslade. 2006. A molecular phylogenetic analysis of the Octocorallia (Cnidaria: Anthozoa) based on mitochondrial protein-coding sequences (*ND2, msh1*). *Molecular Phylogenetics and Evolution*, doi: 10.1016/j.ympev.2006.06.010

Moore, J., P. Auster, B. Hecker, K. Heinonen and D. Callini. In preparation. The false boarfish *Neocyttus helgae* in the western North Atlantic. To be submitted to Journal of Fish Biology.

Watling, L. in press. A review of the genus *Iridogorgia* (Octocorallia: Chrysogorgiidae) and its relatives, chiefly from the North Atlantic Ocean. Journal of the Marine Biological Association of the United Kingdom.

Other Publications:

ICES. 2006. Report of the working group on deep water ecology (WGDEC). International Council for Exploration of the Seas, Advisory Committee on Ecosystems, ICES CM 2006/ACE:04. Ref. LRC.

ICES. 2006. Report of the working group on deep water ecology (WGDEC). International Council for Exploration of the Seas, Advisory Committee on Ecosystems, ICES CM 2006/ACE:04. Ref. LRC.

ICES. 2005. Report of the working group on deep water ecology (WGDEC). International Council for Exploration of the Seas, Advisory Committee on Ecosystems, ICES CM 2005/ACE:02. Ref. E,G.

ICES. 2004. Report of the study group on cold-water corals (SGCOR). International Council for Exploration of the Seas, Advisory Committee on Ecosystems, ICES CM 2004/ACE:07 Ref. E.

L.S. Mullineaux and S.W. Mills, 2005. Coral gardens in the dark depths. Oceanus 42:6 11. http://www.whoi.edu/oceanus/viewArticle.do?id=3801

Reed, R.S., Payne, D., Babb, I.G. 2005. Advancing Collaboration: Analysis of the Effectiveness of Research and Education Partnerships at Sea using Real-Time Technology and Professional Development. Proceedings, Oceans 2005

Meeting Presentation and Abstracts:

Auster, P. Deepwater corals: their role as fish habitat and impacts from fishing activities. Congressional briefing on deep sea coral conservation issues. Rayburn House Office Building 2 February 2006.

Auster, P. Deep Coral Habitats and Mapping Special Areas. MIT Sea Grant GIS 2006 Conference on Geographic Information Systems and Ocean Mapping in Support of Fisheries Research and Management. Boston, MA, April 2006.

Auster, P. J., K. Heinonen, and J. A. Moore. The Distribution of Fishes Over Seamount Landscapes in the Western North Atlantic Ocean. Oral presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Auster, P. J. Linking Deepwater Corals and Fish Populations. Oral presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Auster, P.J., B. Hecker, K.B. Heinonen, and J. Moore. A preliminary analysis of patterns in the diversity of fishes on seamounts and in submarine canyons (NW Atlantic): what questions emerge? Poster presentation at: Deep Sea Fisheries: Ecology, Economics and Conservation. Symposium on Fisheries, Oceanography and Society. Ocean Life Institute, Woods Hole Oceanographic Institution, Woods Hole, MA. 2005.

Brugler, M.R. and S.C. France. Low Sequence Variability within Anthozoan Mitochondrial Genomes: Are Antipatharian Noncoding Regions the Exception? Oral presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Brugler, M.R. and S.C. France. " Have We Discovered a “Fountain of Variation?” An Analysis of Non-Coding Regions within the Black Coral (Cnidaria: Anthozoa) Mitochondrial Genome " Society for the Study of Evolution Annual Meeting, Stony Brook, New York, June 2006.

France, S.C. and M.R. Brugler. "Deep-sea bamboo corals break rank: Mitochondrial gene order is not conserved among octocorals (Cnidaria, Anthozoa, Octocorallia, Isididae)" Society for the Study of Evolution Annual Meeting, Stony Brook, New York, June 2006.

France, S.C. Genetic Analysis of Bamboo Corals: does lack of branching distinguish Lepidisis from Keratoisis? Oral presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

France, S.C. "Patterns of mitochondrial DNA sequence variation in deep-sea octocorals." 10th Deep-Sea Biology Symposium, Oregon Institute of Marine Biology, Coos Bay, Oregon, August 2003.

France, S.C. “Not all deep-sea whips are created equal: Genetic analysis of bamboo corals (Octocorallia, Isididae).” 11th International Deep-Sea Biology Symposium, Southampton, U.K., July 2006.

France, S.C. and M.R. Brugler. “Distribution and abundance of black corals (Antipatharia) in relation to depth and topography on the New England Seamounts (Northwest Atlantic).” 11th International Deep-Sea Biology Symposium, Southampton, U.K., July 2006.

France, S.C., Watling, L. E., Auster, P. J., Babb, I. G., Moore, J. A., Mullineaux, L. S., Adkins, J. F., Shank, T. M., and Waller, R. G. “Observations of Deep-water Coral Communities on the New England and Corner Rise Seamount Chains (Western North Atlantic)”11th International Deep-Sea Biology Symposium, Southampton, U.K., July 2006.

France, S.C. and M.R. Brugler. Distribution and Abundance of Black Corals (Antipatharia) in Relation to Depth and Topography on the New England Seamounts (Northwest Atlantic). Poster presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Mills, S. and L. Mullineaux. Sizes and distributions of octocorals *Keratoisis* sp. and *Paragorgia* sp. on the New England Seamount Chain: Implications for Colonization

Dynamics. Poster presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Moore, J. A, P. J. Auster, and K. Heinonen. Emerging patterns of small-scale and large-scale distributions of fishes associated with western North Atlantic seamounts. Poster presentation at AGU Ocean Sciences Meeting, Honolulu, HI 2006.

Reed, R.S., Payne, D., Babb, I.G. 2005. Advancing Collaboration: Analysis of the Effectiveness of Research and Education Partnerships at Sea using Real-Time Technology and Professional Development. Oceans 2005

Simpson, A., L. Watling and K. Eckelberger. Reproductive Morphology of Two Deep-water Octocorals, *Paramuricea placomus* (Plexauridae) and *Metallogorgia melanotrichos* (Chrysogorgiidae). Poster presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Watling, L. and A. Simpson. Distribution and Abunadance of Gorgonian Octocorals on the New England Seamounts in Relation to Depth and Substrate. Poster presentation at 3rd International Symposium on Deep-Sea Corals Science and Management, Miami, FL, November 2005.

Invited seminars

Babb, I. G. "The Mountains in the Sea – Exploring the New England Sea Mount Chain" Massachusetts Coastal Zone Management, May, 2004.

France, S.C. "A Virtual Tour of the Deep-Sea Coral Communities of the New England Seamounts" Museum of Natural Science, Louisiana State University, 11 November 2005.

France, S.C. "A Virtual Tour of the New England Seamounts" Department of Biology, University of Louisiana at Lafayette, 20 January 2005.

Web Pages and Products

Ocean Explorer Website:

http://www.oceanexplorer.noaa.gov/explorations/04mountains/welcome.html

Dive & Discover (Medusa) websites:

http://oceanexplorer.noaa.gov/explorations/explorations.html
http://www.divediscover.whoi.edu/expedition7/index.html

I.G. Babb and D. Payne. 2005. "The Mountains in the Sea – Exploring the New England Seamount Chain" Education and Outreach DVD

4e. Location and status of data archive and/or sample storage

The Chief Scientist received the original video tapes and copies of the videotapes from the 2003 and 2004 expeditions are maintained in the NURC-UConn's climate controlled video archive. Copies of the videotapes were burned onto DVD-R for Co-PI's to save costs. Individual PI's maintain their samples to complete their analyses. Additional voucher specimens and samples were distributed to either the Smithsonian or the Yale Peabody Museums as indicated in Appendix Two.

III. Evaluation:

1. Accomplishments – Explain special problems, differences between scheduled and accomplished work

This was a successful project that met all of the proposed objectives. Despite having two different research vessels and different dive platforms (Human Occupied Submersible and Remotely Operated Vehicle) we were able to meet or exceed our sample requirements. As mentioned above, the research vessels both carried similar multibeam sonar systems, that produced similar data sets. In addition, having two systems allowed for an interesting comparison of the efficacy and role of these systems in deep sea exploration.

2. Expenditures:

2a. Describe original planned expenditures

The original budget allocated expenditures for salaries, fringes, supplies, travel, contractuals and indirect costs. The majority of expenditures were for subawards to Co-PI's to support their research.

2b. Describe actual expenditures

Expenditures were on target with the proposed scope of work with the small exception detailed below.

2c. Explain special problems, differences between planned and actual expenditures

Final budget detail for the project is as follows: 2.5% ($7,451) of the direct costs were rebudgeted from the contractual category to the salary/fringe category and .5% ($1523) was rebudgeted from the contractual category to the travel category. Under expanded authority, these were internal transfers.

3. Next Steps:

3a. Planned or expected reports (professional papers, presentations, etc.)

Tissues collected for genetic analyses are currently being used by three Ph.D. graduate students for their dissertation research. The analyses will lead to peer-reviewed publications on systematics, taxonomy and biogeography of the deep-sea corals from a genetic perspective.

3b. Brief description of need for additional work, if any (next project phase, new research questions, unaccomplished work, etc.)

The Mountains in the Sea project lead to the submission of a follow up proposal, Deep Atlantic Stepping Stones, that successfully continued the research and education collaborations to explore the Corner Rise Seamounts, the younger, more easterly chain of seamounts in the Atlantic. . A subsequent proposal to address issues related to the southern biogeographic boundaries of coral-dominated communities is currently in review. A search continues for additional genetic markers that will allow for increased resolution of deep-sea corals at finer taxonomic scales. The tissues collected during this project will be used in other funded projects, e.g., NSF-sponsored Cnidaria Tree of Life, to continue this search.

Prepared By: _____ 10-23-06
Signature of Principal Investigator Date

APPENDIX ONE -CRUISE PARTICIPANTS

2003 EXPEDITION- R/V Atlantis

#	Last Name	First Name	Role	Affiliation
1	Watling	Les	PI	University of Maine
2	Babb	Ivar	Co-PI	University of Connecticut
3	Auster	Peter	Co-PI	University of Connecticut
4	France	Scott	Co-PI	College of Charleston
5	Moore	Jon	Co-PI	Florida Atlantic University
6	Simpson	Anne	Graduate Assistant	University of Maine
7	Grannis	Betsy	Graduate Assistant	University of Maine
8	Brugler	Mercer	Graduate Assistant	College of Charleston
9	Forest	David	Graduate Assistant	University of Maine
10	Payne	Diana	Education Coordinator	University of Connecticut
11	Ryan	Mellissa	Education Coordinator	College of Exploration
12	Frisketti	Pat	Educator	Hamden High School
13	Crosby	Maya	Educator	Lincoln Academy, ME
14	Martinez	Catalina	OE Coordinator	NOAA Office of Exploration
15	Tolson	John Paul	OE Data Manager	NOAA Office of Exploration
16	Rear	Laura	OE Web Coordinator	NOAA Office of Exploration
17	Brush	M.J.	Scientific Illustrator	
18	Haberstroh	Joseph	Media	Newsday
19	Malakoff	David	Media3	Science Magazine
20	Strychar	Kevin	Canadian collaborator	University of Connecticut
21	Forfinski	Nick	Hydrographer	NOAA
Others	Mullineaux	Lauren	Co-PI	Woods Hole Oceanographic Inst.
not on ship	Mills	Susan	Technician	Woods Hole Oceanographic Inst.

2004 Cruise Participants – NOAA Ship Ronald H. Brown

#	Last Name	First Name	Role	Affiliation
	Science POB			
1	Watling	Les	PI	University of Maine
2	Babb	Ivar	Co-PI	University of Connecticut
3	Auster	Peter	Co-PI	University of Connecticut
4	France	Scott	Co-PI	College of Charleston
5	Moore	Jon	Co-PI	Florida Atlantic University
6	Mullineaux	Lauren	Co-PI	Woods Hole Oceanographic Inst.
7	Gibbons	Ruth	Co-PI	Smithsonian Institution
8	Mills	Susan	Technician	Woods Hole Oceanographic Inst.
9	Simpson	Anne	Graduate Assistant	University of Maine
10	Brugler	Mercer	Graduate Assistant	College of Charleston
11	Heinonen	Kari	Graduate Assistant	University of Connecticut
12	Payne	Diana	Education Coordinator	University of Connecticut
13	Olds	Mary	Undergraduate	Florida Atlantic University
14	Lance Arnold		Educator	Tolland High School
15	Mary Grady		Educator	UMass Boston
	OE POB			
16	Martinez	Catalina	OE Coordinator	NOAA Office of Exploration
17	McKee	Mike	OE Data Manager	NURC-UConn
18			OE Web Coordinator	NOAA Office of Exploration
	IFE/OPS POB			
20	Coleman	Dwight	Navigation	Institute for Exploration
21	Newman	Jim	Argus pilot	Institute for Exploration
22	Gregory	Todd	Herc pilot	University of Rhode Island
23	LoValvo	Dave	Herc pilot	Eastern Oceanics
24	Orvosh	Tom	Herc pilot	University of Rhode Island
25	Wright	Dave	Argus pilot	IFE subcontractor
26	Bingham	Brian	Navigation	WHOI/DSL
27	Doros	Brian	Video	Institute for Exploration
28	Bunton	John	Video	IFE subcontractor
29	Howland	John	Data	WHOI/DSL
30	TBD		Network administrator	TBD
31	DeRoche	Mark	Deck operations	IFE subcontractor
32	Durbin	Mike	Satellite	EDS

APPENDIX TWO - SPECIMENS, SAMPLE LOCATIONS AND DISPOSITION

2003 Mountains in the Sea Data Collection Summary

NOTE CAVEAT REGARDING SAMPLE LOCATIONS ABOVE. NAVIGATION SYSTEM USED COULD HAVE RESULTED IN INACCURACIES

Alvin dive #3901

13 July 2003, Manning Seamount,
Les Watling, Scott France and Phil Forte (pilot)

Dive and Sample Locations

	time (GMT)	depth	X	Y	Lat-long
Sta.101-1	14:55:07	1734	1444	1468	38° 15.793'N 60° 33.010' W
Sta.101-2	14:58:52	1734	1444	1466	38° 15.792'N 60° 33.010' W
Sta.101-3	15:14:08	1734	1444	1466	38° 15.792'N 60° 33.010' W
Sta.101-4	15:14:53	1734	1444	1466	38° 15.792'N 60° 33.010' W
Sta.101-5	15:15:38	1734	1444	1466	38° 15.792'N 60° 33.010' W
Sta.102-1	15:57:27	1718	1496	1482	38° 15.801'N 60° 32.975' W
Sta.103-1	16:29:14	1675	1520	1493	38° 15.807'N 60° 32.958' W
Sta.104-1	17:20:50	1522	1689	1600	38° 15.865'N 60° 32.843' W
Sta.105-1	18:00:14	1510	1693	1644	38° 15.888'N 60° 32.840' W
Sta.105-2	18:01:55	1510	1691	1645	38° 15.889'N 60° 32.841' W
Sta.105-3	18:09:11	1510	1691	1645	38° 15.889'N 60° 32.841' W
Sta.105-4	18:10:10	1510	1691	1645	38° 15.889'N 60° 32.841' W
Sta.106-1	18:41:16	1496	1733	1655	38° 15.895'N 60° 32.812' W
Sta.107-1	18:41:13	1483	1733	1654	38° 15.895'N 60° 32.812' W
Sta.108-1	19:06:34	1451	1889	1550	38° 15.838'N 60° 32.705' W

Voucher recipients

Destination of specimens are USNM = Smithsonian, YPM = Yale Peabody Museum, JAM = Jon Moore, SLR = Susan Richardson, LM = Lauren Mullineaux, TS = Tim Shank, LW = Les Watling, RW = Rhian Waller

Specimen treatments

F/e = formalin fixation then ethanol storage, froz = frozen in –70 freezer, 95 etoh = 95% ethanol fixation, 70 etoh = 70% ethanol fixation, menthol = use of menthol to relax coral polyps before fixation

Species collected

Sta.101-1
1 Metallogorgia colony – f/e colony to YPM, f/e menthol relaxed sample to YPM
1 Asteronyx in branches of Metallogorgia – froz arm to TS, f/e rest to YPM

Sta.101-2
1 Metallogorgia colony – colony to LW?
1 Asteronyx in branches of Metallogorgia – froz arm to TS, f/e rest to YPM

Sta.101-3
1 Paramuricia colony – to LW?
1 Asteronyx – froz whole specimen to TS
1 anemone on Paramuricia branch – to Daphne Fautin?
1 ophiuroid sp.2 – froz arm to TS, f/e rest to YPM

Sta.101-4
1 Lepidisis colony – f/e colony to YPM

Sta.101-5
1 Lepidisis colony – colony to LW, f/e menthol relaxed sample to YPM

Sta.101 (don't know which of the above these dropped off of)
2 ophiuroid sp.2 – froz both to TS
1 pycnogonid – f/e to YPM

Sta.102-1
1 Iridogorgia colony – f/e colony to YPM, f/e menthol relaxed sample to YPM

Sta.103-1
1 Lepidisis colony – colony to LW, f/e menthol relaxed sample to YPM

Sta.104-1
1 Hymenaster cf. pellucida seastar – f/e to USNM
1 Munidopsis sp.1 – 1 f/e to YPM

Sta.105-1
1 live Lophelia colony – 2 froz samples to RW, 1 f/e sample to RW, f/e portion colony to YPM, f/e portion colony to USNM
1 bucket dead Lophelia skeletons with attached animals – f/e YPM
2 Eunice polychaetes in tubes in Lophelia – 1 f/e YPM, 1 f/e USNM
3 polychaete sp.3 from Lophelia – 1 froz TS, 1 f/e YPM, 1 f/e USNM
7 crinoid sp.2 from Lophelia - 3 froz TS, 2 f/e YPM, 2 f/e USNM
17 ophiuroid sp.2 from Lophelia - 9 froz TS, 4 f/e YPM, 4 f/e USNM
1 Acanthogorgia colony attached to Lophelia – f/e colony to YPM
2 nemertean worms – f/e YPM
3 smooth salmon gooseneck barnacles – f/e YPM
1 vial small misc polychaetes – f/e YPM

Sta.105-2
1 Keratoisis colony (very gracile branching form) - colony to LW?, f/e menthol relaxed sample to YPM

Sta.105-3
1 Acanthogorgia colony – f/e piece to YPM, f/e menthol relaxed sample to YPM
2 smooth salmon gooseneck barnacles – f/e to YPM

Sta. 105-4
1 Acanthogorgia colony from just above Lophelia – possibly mixed in with sta.105-3

Sta.105 (don't know which of the above these dropped off of)

1 large live snail (5 spiral cords and crossing axial ribs) – 95 etoh USNM
2 Munidopsis sp.1 – 1 froz TS, 1 f/e USNM
1 Munidopsis sp.2 – 1 f/e YPM
5 polynoid polychaete sp.A – 5 f/e USNM
1 polynoid sp.B – 1 f/e USNM
1 polynoid sp.C – 1 f/e USNM
2 euphrosinid polychaetes – 1 f/e YPM, 1 f/e USNM
12 misc ophiuroids – 12 f/e YPM
1 long thin eunicid polychaete – 1 f/e YPM
5 misc polynoids – 5 f/e YPM
2 crinoid sp.2 – 2 f/e YPM
4 live snails – 95 etoh USNM
2 live scallops – 95 etoh USNM
3 dead scallop shells – to YPM
1 sipunculan – f/e YPM
1 small live snail – 95 etoh USNM

Sta.106-1
1 Lepidisis sp.2 colony (highly branched Keratoisis-like, but with large Lepidisis-like polyps) – 1 f/e colony piece to YPM, f/e menthol relaxed sample to YPM

Sta.107-1
1 Paragorgia colony – f/e colony to YPM
3 ophiuroid sp.2 from Paragorgia – f/e but unaccounted for, may have gone to YPM
11 Asteronyx from Paragorgia – 8 froz TS, 2 f/e USNM, 1 f/e YPM
1 crinoid from Paragorgia – f/e to YPM
3 ophiuroid sp.1 from Paragorgia – 3 f/e USNM
1 crinoid sp.1 from Paragorgia – f/e USNM

Sta.108-1
20 red-eye amphipods – all 70 etoh to YPM
30+ mixed polychaetes – all f/e to USNM
1 small isopod – 70 etoh to YPM
1 caprellid amphipod - 70 etoh to YPM
1 copepod - 70 etoh to YPM
3 baby seastars (3 spp.) – f/e to USNM
4 snail shells with hermit crabs – 70 etoh to YPM
2 vials misc inverebrates – f/e to YPM
2 smooth salmon gooseneck barnacles – 70 etoh to YPM

Alvin dive #3902
14 July 2003, Manning Seamount,
Peter Auster, Jon Moore and Tony Tarantino (pilot)

Dive and Sample Locations

	time (GMT)	depth	X	Y	Lat-long
Sta.201-1	14:11:45	1364	64881	33165	
Sta.202-1	15:07:40	1337	64950	33370	38° 13.037'N 60° 30.683' W
Sta.203-1	15:24:25	1333	65025	33383	38° 13.046'N 60° 30.631' W
Sta.204-1	16:49:32	1340	64849	33534	38° 13.128'N 60° 30.751' W
Sta.205-1	16:58:02	1340	64821	33538	38° 13.130'N 60° 30.770' W
Sta.206-1	17:18:34	1342	64795	33543	38° 13.132'N 60° 30.789' W
Sta.206-2	17:14:22	1342	64795	33543	38° 13.132'N 60° 30.789' W
Sta.207-1	18:17:09	1375	64572	33591	38° 13.158'N 60° 30.941' W
Sta.208-1	18:25:10	1371	64580	33596	38° 13.161'N 60° 30.935' W
Sta.208-2	18:29:40	1372	64580	33596	38° 13.161'N 60° 30.935' W

Voucher recipients

Destination of specimens are USNM = Smithsonian, YPM = Yale Peabody Museum, JAM = Jon Moore, SLR = Susan Richardson, LM = Lauren Mullineaux, TS = Tim Shank, LW = Les Watling, RW = Rhian Waller

Specimen treatments

F/e = formalin fixation then ethanol storage, froz = frozen in –70 freezer, 95 etoh = 95% ethanol fixation, 70 etoh = 70% ethanol fixation, menthol = use of menthol to relax coral polyps before fixation

Samples collected

Sta.201-1
1 Bathypathes colony – f/e colony to YPM, f/e menthol relaxed sample to YPM

Sta.202-1
Deployed basalt settlement blocks

Sta.203-1
Deployed basalt settlement blocks

Sta.204-1
1 Bathypathes colony – f/e menthol relaxed sample to YPM

Sta.205-1
1 bottle brush antipatherian colony – f/e colony to YPM, f/e menthol relaxed sample to YPM

Sta.206-1
1 bushy orange antipatherian colony – f/e colony to YPM, 1 f/e colony piece to YPM, f/e menthol relaxed sample to YPM
1 pycnogonid assoc. with antipatherian – f/e to YPM

Sta.206-2

Suction sample at base of bushy orange antipatherian
1 vial fish otoliths – to JAM

Sta.207-1
Suction sample at base of sea pen
1 vial unsorted debris – to YPM
1 bag pteropod shells and debris – to JAM
1 vial dead snail shells – to YPM

Sta.208-1
1 Paragorgia colony with zonathids – colony to LW?, f/e menthol relaxed sample to YPM
2 Asteronyx on Paragorgia – to LW?

Sta.208-2
~30 fossil Desmophyllum cristigalli – to Jess Adkins
1 vial misc dead shells – to YPM
1 dead Lima-like shell – to YPM
1 bag misc fossil corals – to YPM
1 bag misc debris – to YPM
1 vial fish otoliths – to JAM
1 vial pteropod shells – to JAM

Alvin dive #3903
15 July 2003, Kelvin Seamount,
Les Watling, Anne Simpson and Bruce Strickrott (pilot)

Dive and sample locations

	time (GMT)	depth	X	Y	Lat-long
Sta.101-1	13:58:04	2061	4421	2460	38° 47.330'N 64° 07.948' W
Sta.101-2	14:11:06	2063	4417	2458	38° 47.329'N 64° 07.950' W
Sta.102-1	14:19:37	2060	4429	2444	38° 47.321'N 64° 07.942' W
Sta.103-1	14:41:09	2029	4481	2446	38° 47.332'N 64° 07.907' W
Sta.103-2	14:43:40	2029	4481	2446	38° 47.332'N 64° 07.907' W
Sta.104-1	14:51:26	2015	4502	2447	38° 47.322'N 64° 07.892' W
Sta.105-1	15:11:28	1986	4547	2459	38° 47.329'N 64° 07.861' W
Sta.106-1	15:30:46	1954	4591	2436	38° 47.317'N 64° 07.831' W
Sta.107-1	15:43:47	1948	4597	2426	38° 47.311'N 64° 07.826' W
Sta.XX	15:59:50	1917	4652	2409	38° 47.302'N 64° 07.788' W
Sta.108-1	16:21:23	1883	4690	2385	38° 47.289'N 64° 07.763' W
Sta.109-1	16:42:41	1823	4686	2407	38° 47.301'N 64° 07.765' W
Sta.110-1	16:56:00	1816	4696	2394	38° 47.294'N 64° 07.758' W
Sta.110-2	17:06:30	1816	4699	2394	38° 47.293'N 64° 07.756' W
Sta.111-1	17:45:21	1800	4831	2309	38° 47.248'N 64° 07.665' W

Voucher recipients

Destination of specimens are USNM = Smithsonian, YPM = Yale Peabody Museum, JAM = Jon Moore, SLR = Susan Richardson, LM = Lauren Mullineaux, TS = Tim Shank, LW = Les Watling, RW = Rhian Waller

Specimen treatments

F/e = formalin fixation then ethanol storage, froz = frozen in –70 freezer, 95 etoh = 95% ethanol fixation, 70 etoh = 70% ethanol fixation, menthol = use of menthol to relax coral polyps before fixation

Samples collected

Sta.101-1
1 pink primnoid (Candidella?) – f/e colony portion to YPM, f/e menthol relaxed sample to YPM
30 ophiuroid sp.2 (orange very spiny arms, 5 cuts in disc) from primnoid (Candidella) – 10 froz to TS, 10 f/e to YPM, 10 f/e to USNM
1 Macrobrachium shrimp, possibly from primnoid (Candidella) – 70 etoh to YPM
1 Munida galatheid – 70 etoh to YPM
1 smooth salmon gooseneck barnacle from primnoid – f/e to YPM
2 ophiuroids A (gray disc and spiny arms) – f/e to YPM
1 crinoid from primnoid – f/e to YPM
1 polynoid sp.A – f/e to YPM

Sta.101-2
1 pink primnoid (Candidella?) – f/e colony portion to YPM, f/e menthol relaxed sample to YPM, f/e menthol relaxed sample to USNM
17 ophiuroid sp.2 from primnoid – 6 froz to TS, 6 f/e to USNM, 5 f/e to YPM

2 polychaete worms on primnoid coral – f/e to YPM
2 ophiuroids A (gray disc and spiny arms) – f/e to USNM
1 ophiuroid (small disc, smooth long thin dark-armed) – f/e to USNM

Sta.102-1
~30 fossil Desmophyllum cristigalli – to Jess Adkins
1 bag fossil coral (non-Desmophyllum) – to YPM (not sta.108-1 as marked on bag)
10+ misc dead snail shells – to YPM
3 small Echinus – f/e to USNM
1 small shrimp – f/e to YPM

Sta.103-1
1 Metallogorgia classic parasol colony – colony to LW?, f/e menthol relaxed sample to YPM
1 Asteronyx – to LW?
1 crinoid – f/e to YPM
3 ophiuroid sp.2 – f/e to USNM

Sta.103-2
1 Paragorgia colony – colony to LW?, f/e menthol relaxed sample to YPM

Sta.104-1
1 Lepidisis colony – to LW?

Sta.105-1
1 Iridogorgia colony – colony to LW?, f/e menthol relaxed sample to YPM

Sta.106-1
1 Paragorgia colony with yellow zoanthids – colony to LW?

Sta.107-1
1 Metallogorgia small non-parasol colony (possibly young colony) – colony to LW?, f/e menthol relaxed sample to YPM
1 small Asteronyx – to LW?

Sta.XX (unrecorded slurper sample)
5 ophiuroid sp. D (oversize gray disc and thin smooth arms) – f/e to USNM
2 polyps stoloniferous octocoral on pebble – f/e to YPM
2 vials sand with forams – to SLR
1 bag basalt pebbles – to Matt Jackson
1 vial misc debris – to YPM

Sta.108-1
Anthomastis – f/e to YPM

Sta.109-1
1 pink primnoid (Candidella?) – colony to LW?
Many ophiuroids on primnoid – to LW?
7 sediment-covered zooanthids – f/e to YPM

Sta.110-1
1 bushy brown antipatherian - f/e colony to YPM, f/e menthol relaxed sample to YPM
6 ophiuroid sp.2 – f/e to YPM

Sta.110-2 (unrecorded slurper sample to only catch isopod)
1 Bathynomus? isopod – to LW?

Sta.111-1
1 Lepidisis – colony to LW?

Biobox (mixed material at bottom of box from unknown stations)
2 snail shells – to YPM
1 sediment-covered zoanthid (probably from sta.109-1) – f/e to YPM

Alvin dive #3904
16 July 2003, Kelvin Seamount,
Scott France, Ivar Babb and Phil Forte (pilot)

Dive and sample locations

	time (GMT)	Depth (m)	X	Y	Lat-long
Sta.201-1	13:51:43	2174	23398	10360	38° 51.600'N 63° 54.847' W
Sta.201-2	14:07:29	2172	23398	10360	38° 51.600'N 63° 54.847' W
Sta.201-3	14:09:14	2172	23398	10360	38° 51.600'N 63° 54.847' W
Sta.201-4	14:19:15	2172	23398	10360	38° 51.600'N 63° 54.847' W
Sta.201-5	14:20:00	2172	23398	10360	38° 51.600'N 63° 54.847' W
Sta.202-1	14:33:01	2158	23395	10351	38° 51.595'N 63° 54.849' W
Sta.202-2	14:40:32	2158	23395	10351	38° 51.595'N 63° 54.849' W
Sta.202-3	14:49:47	2158	23395	10351	38° 51.595'N 63° 54.849' W
Sta.203-1	16:05:24	2047	23400	10187	38° 51.506'N 63° 54.846' W
Sta.203-2	16:08:54	2047	23400	10187	38° 51.506'N 63° 54.846' W
Sta.203-3	16:09:54	2047	23400	10187	38° 51.506'N 63° 54.846' W
Sta.203-4	16:11:24	2047	23400	10187	38° 51.506'N 63° 54.846' W
Sta.203-5	16:13:39	2047	23400	10187	38° 51.506'N 63° 54.846' W
Sta.203-6	16:15:55	2047	23400	10187	38° 51.506'N 63° 54.846' W
Sta.204-1	16:38:57	2014	23349	10011	38° 51.411'N 63° 54.881' W
Sta.204-2	17:10:44	2014	23349	10011	38° 51.411'N 63° 54.881' W
Sta.204-3	17:04:43	2014	23349	10011	38° 51.411'N 63° 54.881' W
Sta.205-1	18:20:10	1923	22841	9525	38° 51.148'N 63° 55.232' W
Sta.206-1	18:30:41	1923	22837	9523	38° 51.147'N 63° 55.234' W
Sta.207-1	18:54:13	1902	22685	9402	38° 51.082'N 63° 55.339' W
Sta.208-1	19:20:30	1880	22543	9265	38° 51.008'N 63° 55.437' W
Sta.209-1	19:36:32	1859	22348	9236	38° 50.992'N 63° 55.572' W
Sta.209-2	19:39:32	1859	22348	9236	38° 50.992'N 63° 55.572' W
Sta.209-3	19:46:17	1859	22348	9236	38° 50.992'N 63° 55.572' W

Voucher recipients

Destination of specimens are USNM = Smithsonian, YPM = Yale Peabody Museum, JAM = Jon Moore, SLR = Susan Richardson, LM = Lauren Mullineaux, TS = Tim Shank, LW = Les Watling, RW = Rhian Waller

Specimen treatments

F/e = formalin fixation then ethanol storage, froz = frozen in –70 freezer, 95 etoh = 95% ethanol fixation, 70 etoh = 70% ethanol fixation, menthol = use of menthol to relax coral polyps before fixation

Samples collected

Sta.201-1 and Sta.202-3 (both scoop samples were taken in same bag and mixed togerther)
~80 fossil Desmophyllum cristigalli – to Jess Adkins
1 Munida valida galatheid with bopyrid isopod parasite – f/e to YPM
1 fossil tubular coral – to YPM
1 serpulid worm tube with serrated ridge – to YPM

fragments of hydrocoral skeleton – to YPM and USNM
1 small tunicate – f/e to YPM
2 small fossil Desmophyllum cristigalli – to USNM
1 large scaphopod shell

Sta.201-2
1 Metallogorgia colony – colony to LW?
1 Asteronyx on Metallogorgia – froz arm to TS

Sta.201-3
1 sparse bushy brown antipatherian – f/e colony to YPM, f/e menthol-relaxed sample to YPM

Sta.201-4
1 whip-like primnoid (Calyptrophora?) – colony to LW?, f/e menthol-relaxed sample to YPM
1 crinoid from primnoid – f/e to USNM

Sta.201-5 (this second whip grew from same base as previous, may be same colony)
1 whip-like primnoid (Calyptrophora?) – colony to LW?, f/e menthol-relaxed sample to YPM

Sta.202-1
1 Paragorgia with yellow zoanthids – colony to LW?, f/e menthol-relaxed sample to YPM
1 Asteronyx in Paragorgia – to LW?

Sta.202-2
1 Chrysogorgia – f/e colony to YPM

Sta.203-1
1 bushy brown antipatherian – to ?

Sta.203-2
1 Paramuricia – colony to LM or LW?, f/e menthol-relaxed sample to YPM

Sta.203-3
1 Metallogorgia – colony to LW?, f/e menthol-relaxed sample to YPM
1 Asteronyx from Metallogorgia – froz arm to TS

Sta.203-4
1 small bushy (actually pinnate) brown antipatherian – f/e colony to YPM

Sta.203-5
1 Iridogorgia – f/e menthol-relaxed sample to YPM

Sta.203-6
1 Paramuricia – to LW or LM?
1 Asteronyx on Paramuricia – to LW?

Sta.204-1
1 Corallium – frozen colony to YPM, f/e fragments to YPM
1 small anemone from Corallium – f/e to YPM

Sta.204-2
1 Paramuricia – colony to LM or LW?
1 Asteronyx on Paramuricia – to ?

Sta.204-3
1 dead coral skeleton – to JAM

1 hormanthiid anemone from coral skeleton – f/e menthol-relaxed to YPM
1 brisingid seastar from coral skeleton – f/e to YPM
2 commensal polychaetes from arms of brisingid – 2 f/e to USNM
2 hydroid colonies from coral skeleton – 1 f/e to YPM, 1 95 etoh to Leo Buss at YPM

Sta.205-1
1 Caryophyllia - f/e menthol-relaxed to YPM
1 yellow-eyed amphipods – 2 f/e to YPM
2 vial sand with forams – to SLR
1 polychaete worm – f/e to YPM

Sta.206-1
1 Paramuricia – colony to LM or LW?, f/e menthol-relaxed sample to YPM
1 Asteronyx – to LW?
9 ophiuroid sp.B – 6 f/e to USNM, 3 f/e to YPM
1 ophiuroid sp.C – f/e to USNM
4 ophiuroid sp.D – 2 f/e to USNM, 2 froz to TS
1 fan-like branching sponge – f/e to YPM

Sta.207-1
1 Corallium colony with live Desmophyllum growing on it – f/e menthol-relaxed sample to YPM
1 live Desmophyllum cristigalli from Corallium - f/e menthol-relaxed to YPM
1 large Echinus – f/e to YPM
1 small isopod – f/e to YPM
1 transparent-shelled snail – 95 etoh to USNM
3 misc worms – f/e to USNM

Sta.208-1
1 grapefruit sponge – 1 froz sample to TS, rest f/e to YPM

Sta.209-1
1 Lepidisis – to LW?

Sta.209-2
1 Corallium – small pieces f/e to YPM, large colony in freezer to YPM, f/e menthol-relaxed sample to YPM
3 polychaete worms from inside Corallium skeleton – 2 f/e to USNM, 1 f/e to YPM
1 white loose-mesh sponge on Corallium – f/e to YPM

Sta.209-3
1 dead coral skeleton – to JAM
several sponge fragments – f/e to YPM
1 bryozoan/hydroid colony – f/e to YPM
1 Isoactis anemone from sponge fragments – f/e to YPM

Biobox
5 crinoid sp.1 – 4 froz to TS, 1 f/e to USNM
6 ophiuroid sp.A – 3 froz to TS, 3 f/e to USNM
3 crinoids – 3 f/e to YPM
1 fuzzy snail – f/e to YPM
2 small Echinus – f/e to YPM
1 vial misc invertebrates – f/e to YPM
few misc ophiuroids – f/e to YPM
fragments of octocorals (Paramuricia, Chrysogorgia, Metallogorgia) – f/e to YPM
12 crinoids – 8 f/e to YPM, 4 f/e to USNM
fragments of Corallium – f/e to YPM

1 vial misc worms – f/e to YPM

Alvin dive #3905
17 July 2003, Bear Seamount,
Jon Moore, Anthony Berry (PIT) and Tony Tarantino (pilot)

Dive and sample locations

	time (GMT)	depth	X	Y	Lat-long
Sta.101-1	13:45	1780			15 m N of next station
Sta.102-1	14:09:42	1776	2909	3086	39° 53.668'N 67° 22.960' W
Sta.103-1	14:31:21	1773	2906	3052	39° 53.649'N 67° 22.962' W
Sta.103-2	14:38	1774	2903	3054	39° 53.650'N 67° 22.964' W
Sta.104-1	15:07	1745			39° 53.675'N 67° 23.024' W
Sta.105-1	15:42:57	1698	2708	3152	39° 53.703'N 67° 23.101' W
Sta.106-1	16:02:39	1690	2697	3152	39° 53.703'N 67° 23.109' W
Sta.107-1	16:06:57	1689	2694	3158	39° 53.707'N 67° 23.111' W
Sta.107-2	16:10:43	1688	2690	3156	39° 53.705'N 67° 23.114' W
Sta.108-1	16:18:33	1685	2688	3145	39° 53.700'N 67° 23.115' W
Sta.109-1	16:29:58	1681	2685	3140	39° 53.697'N 67° 23.117' W
Sta.110-1	16:47:00	1684	2692	3132	39° 53.693'N 67° 23.112' W
Sta.111-1	17:35:22	1674	2678	3139	39° 53.696'N 67° 23.122' W
Sta.111-2	17:39	1673	2678	3134	39° 53.694'N 67° 23.122' W
Sta.111-3	17:43:35	1673	2678	3134	39° 53.694'N 67° 23.122' W
Sta.111-4	17:45:59	1673	2679	3132	39° 53.693'N 67° 23.121' W
Sta.112-1	18:05	1670	2676	3130	39° 53.691'N 67° 23.123' W
Sta.113-1	18:20	1659	2666	3111	39° 53.681'N 67° 23.130' W
Sta.113-2	18:31	1659	2666	3107	39° 53.679'N 67° 23.130' W
Sta.113-3	18:29	1660	2668	3108	39° 53.680'N 67° 23.129' W

Voucher recipients

Destination of specimens are USNM = Smithsonian, YPM = Yale Peabody Museum, JAM = Jon Moore, SLR = Susan Richardson, LM = Lauren Mullineaux, TS = Tim Shank, LW = Les Watling, RW = Rhian Waller

Specimen treatments

F/e = formalin fixation then ethanol storage, froz = frozen in –70 freezer, 95 etoh = 95% ethanol fixation, 70 etoh = 70% ethanol fixation, menthol = use of menthol to relax coral polyps before fixation

Samples collected

Sta.101-1
1 Syringammina xenophyophore – 2 froz vials, f/e test
1 Liljeborgiid? or Idanella amphipod found under xeno – f/e to YPM
1 ophiuroid D found under xeno – f/e to YPM

Sta.102-1
1 Syringammina xenophyophore – 2 froz vials, f/e test
1 Liljeborgiid? or Idanella amphipod found under xeno – f/e to YPM
1 polychaete worm found under xeno – f/e to USNM

Sta.103-1 (slurp sample from sand)
1 orange anemone – f/e menthol-relaxed sample to USNM
2 live clams - 95 etoh to USNM
3 live snails - 95 etoh to USNM
2 polychaete worms – f/e to YPM
1 foram – to SLR

Sta.103-2
8 Anthomastis colonies on rock – f/e to YPM
agglutinated polychaete tubes attached to rock – f/e to YPM
2+ sponges attached to rock – f/e to YPM
1 Ophiomusium lymani brittlestar was lying next to rock – f/e to YPM

Sta.104-1
1 stalked crinoid (Ptilocrinus?) – f/e to YPM

Sta.105-1
1 Lepidisis – f/e menthol-relaxed sample to YPM
1 foliose white sponge – f/e to YPM
1 Farrea? sponge – f/e to YPM
1 yellow liver sponge – f/e to YPM
1 crinoid sp.1 – froz to TS
1 vial misc polychaetes – f/e to USNM
1 polynoid worm – f/e to YPM

Sta.106-1
1 Keratoisis – f/e menthol-relaxed sample to YPM

Sta.107-1
1 purple stoloniferous gorgonian (Clavulariidae?) – f/e colony to YPM, f/e menthol-relaxed sample to USNM

Sta.107-2
1 bushy antipatherian – f/e colony to YPM, f/e menthol-relaxed sample to YPM, f/e menthol-relaxed sample to USNM

Sta.108-1 (slurp from ledge)
1 polychaete worm – f/e to USNM
1 pogonophoran worm – f/e to YPM
1 amphipod – f/e to YPM
3 polychaetes – f/e to YPM
3 sipunculans – f/e to USNM
2 auger shells – 2 to YPM
1 small anemone – f/e to USNM
1 foram – to SLR
1 small brachiopod – f/e to YPM

Sta.109-1
1 skate egg case (cut open to find only egg yolk and white) – f/e to YPM

Sta.110-1
1 lyrate gorgonian (Narella?) – f/e colony fragment to YPM

Sta.111-1
3 sausage-shaped solitary tunicates – lost when biobox opened at surface

Sta.111-2
1 white sponge on rock – lost when biobox opened at surface

Sta.111-3
1 large urchin – lost when biobox opened at surface

Sta.111-4 (slurp sample)
1 Benthogone – f/e to YPM
1 mysid – f/e to YPM
1 sipunculan – f/e to YPM
1 Echinus – f/e to YPM
1 vial misc ivnertebrates – f/e to YPM

Sta.112-1
~40 Desmophyllum cristigalli – to Jess Adkins
8 sipunculans – 4 froz to TS, 2 f/e to USNM, 2 f/e to YPM
1 Caryophyllia skeleton – to YPM
1 red oligochaete? – f/e to YPM
1 white polychaete – f/e to YPM
6 misc ophiuroids – f/e to YPM
1 dead shell - to YPM
1 bag sieved scoop material – to YPM

Sta.113-1
2 Anthomastis on isid skeleton (small 2-polyp colony next to larger colony) – f/e menthol-relaxed sample f/e menthol-relaxed sample to YPM of polyp from larger colony to YPM
1 white potato chip sponge also attached to isid skeleton – f/e to YPM

Sta.113-2 (slurp from ledge)
1 mysid – f/e to YPM
1 vial small misc polychaetes – f/e to YPM
1 majid crab – f/e to YPM
1 Echinus – f/e to YPM
3 ophiuroids – f/e to YPM
3 small Desmophyllum cristigalli skeletons – to YPM
1 pink anemone – f/e to YPM

Sta.113-3
1 purple stoloniferous gorgonian (Clavulariidae?) – colony to LW?

Alvin dive #3906

18 July 2003, Bear Seamount,
Peter Auster, Mercer Brugler and Bruce Strickrott (pilot)

No specimens collected

Alvin dive #3907

18 July 2003, Bear Seamount,
Les Watling, Joe Haberstroh and Bruce Strickrott (pilot)

Dive and sample locations

	time (GMT)	depth	X	Y	Lat-long
Sta.301-1	19:53:41	1400	-440	1340	39° 52.724'N 67° 25.309' W

Voucher recipients

Destination of specimens are USNM = Smithsonian, YPM = Yale Peabody Museum, JAM = Jon Moore, SLR = Susan Richardson, LM = Lauren Mullineaux, TS = Tim Shank, LW = Les Watling, RW = Rhian Waller

Specimen treatments

F/e = formalin fixation then ethanol storage, froz = frozen in –70 freezer, 95 etoh = 95% ethanol fixation, 70 etoh = 70% ethanol fixation, menthol = use of menthol to relax coral polyps before fixation

Samples collected

Sta.301-1
1 Syringammina xenophyophore – 2 froz samples to SLR, rest f/e to SLR
2 vials forams – to SLR
1 worm tube on pebble – f/e to YPM
1 worm or amphipod tube from under xeno – f/e to YPM

2004 Mountains in the Sea Data Collection Summary

Dives one and two were dedicated to equipment testing, no specimens were collected.

Hercules dive #3

Bear Seamount, north slope

Dive started 06:48 GMT 11 May 2004, and ended 13:30 GMT 11 May 2004 when power and video was lost from Hercules. Haul back commenced at 13:30.

	time (GMT)	depth	Lat-long
Sta. BEA401	11:33	1559	39° 57.09'N 67° 24.59' W
Sta. BEA402	13:05	1564	39° 57.10'N 67° 24.60' W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. BEA401
BEA401-1 1 colony *Chrysogorgia* (big colony) – to SF, AS, LW
BEA401-2 1 colony *Metallogorgia*? (small colony) – to SF, LW
BEA401-3 1 *Macrobrachium* shrimp w/ purple eggs on *Chrysogorgia* BEA401-1 – to YPM
BEA401-4 1 *Asteroschema* brittle star on *Metallogorgia* BEA401-2 – to LW
BEA401-5 2 clumps of orange fish? eggs on *Metallogorgia* BEA401-2 – to MCZ
BEA401-6 *Ascothoracica* barnacle on *Metallogorgis* BEA401-2 – to LW

Sta. BEA402
BEA402-1 1 colony *Keratoisis* – SF, LW, AS
BEA402-2 1 *Hippasterias pharyngiana* seastar feeding on *Keratoisis* BEA402-11 – to LW
BEA402-3 1 small brittle star from sediment – to YPM
BEA402-4 forams from sediment – to YPM
BEA402-5 several small gastropod shells – to YPM

Hercules dive #4
Bear Seamount, southwest slope along radial ridge

Dive started 00:03 GMT 12 May 2004, and ended 17:07 GMT that day

	time (GMT)	depth	Lat-long
Sta. BEA501	04:46	1639	39° 52.8965' N 67° 28.4100' W
Sta. BEA502	05:30	1639	39° 52.8961' N 67° 28.4165' W
Sta. BEA503	05:53	1635	39° 52.88' N 67° 28.41' W
Sta. BEA504	06:35	1643	39° 52.901' N 67° 28.417' W
Sta. BEA505	10:39	1478	39° 53.0551' N 67° 28.3099' W
Sta. BEA506	12:37	1491	39° 53.017' N 67° 28.317' W
Sta. BEA507	14:44	1445	39° 53.063' N 67° 28.342' W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. BEA501
BEA501-1 1 colony *Lepidisis* – to SF, LW

Sta. BEA502
BEA502-1 1 colony chrysogorgiid – to SF, LW

Sta. BEA503
BEA503-1 1 colony *Metallogorgia* – to SF, LW
BEA503-2 2 *Asteroschema* attached to 506-1 – to LW, YPM

Sta. BEA504
BEA 504-1 1 colony *Leiopathes* bushy black coral – to SF, YPM, USNM

Sta. BEA505
BEA505-1 1 colony *Keratoisis* – to SF, LW, YPM, USNM
BEA505-2 2 crinoids attached to 505-1 – to YPM
BEA505-3 1 crinoid attached to 505-1 – to YPM

Sta. BEA506
BEA506-1 1 colony chrysogorgiid – to SF, LW
BEA506-2 1 *Asteroschema* attached to 506-1 – to LW

Sta. BEA507
BEA507-1 1 colony *Clavularia rudis* attached to old coral skeleton – to SF, LW
BEA507-2 1 crinoid attached to 507-1 – to YPM
BEA507-3 hydroids attached to coral skeleton that 507-1 was attached to – to YPM
BEA507-4 polynoid polychaete from old coral skeleton – to YPM

Sta. BEA5XX – material on bottom of bioboxes
BEA5XX-1 1 copepod that swam into suction sampler – to YPM
BEA5XX-2 2 polynoid polychaetes from bottom of biobox– to YPM

BEA5XX-3 1 doryvelid polychaete from bottom of biobox – to YPM
BEA5XX-1 1 amphipod from bottom of biobox – to YPM

Hercules dive #5
Manning Seamount, on summit, near dive 3902 site

Dive started 02:53 GMT 14 May 2004, and ended 19:21 GMT that day
Primary function was to collect settlement blocks left at two sites last summer

	time (GMT)	depth	Lat-long
Sta. MAN601	06:57	1337	38° 13.105' N 60° 30.662' W
Sta. MAN602	09:22	1332	*38° 13.1' N 60° 30.6' W
Sta. MAN603	11:00	1335	*38° 13.1' N 60° 30.6' W
Sta. MAN604	11:46	1336	*38° 13.0' N 60° 30.6' W
Sta. MAN605	12:37	1335	38° 13.026' N 60° 30.594' W
Sta. MAN606	12:47	1335	38° 13.0794' N 60° 30.5945' W
Sta. MAN607	13:29	1334	38° 13.0818' N 60° 30.5933' W
Sta. MAN608	13:46	1333	38° 13.0856' N 60° 30.5993' W
Sta. MAN609	14:07	1333	38° 13.0914' N 60° 30.6098' W
Sta. MAN610	14:20	1335	38° 13.0934' N 60° 30.6278' W
Sta. MAN611	14:30	1335	38° 13.0928' N 60° 30.6274' W
Sta. MAN612	14:58	1335	38° 13.1030' N 60° 30.6362' W
Sta. MAN613	15:23	1338	38° 13.1091' N 60° 30.6334' W
Sta. MAN614	15:30	1338	38° 13.1107' N 60° 30.6283' W
Sta. MAN615	15:44	1337	38° 13.1164' N 60° 30.6242' W
Sta. MAN616	16:05	1335	38° 13.1159' N 60° 30.6209' W
Sta. MAN617	16:35	1334	38° 13.1173' N 60° 30.6162' W
Sta. MAN618	16:42	1334	38° 13.1156' N 60° 30.6090' W
Sta. MAN619	16:51	1333	38° 13.1147' N 60° 30.6051' W
Sta. MAN620	16:57	1332	38° 13.1158' N 60° 30.5975' W
Sta. MAN621	17:10	1331	38° 13.1224' N 60° 30.5936' W
Sta. MAN622	17:33	1333	38° 13.1162' N 60° 30.5913' W
Sta. MAN623	17:40	1329	38° 13.1148' N 60° 30.5834' W

* approximate coordinates

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. MAN601 – collecting settlement blocks from 'forest'
MAN601-1 snails from off settlement blocks – to YPM

Sta. MAN602 – collecting settlement blocks from 'plains

Sta. MAN603 – measurement and collected small sample
MAN603-1 *Paragorgia*

Sta. MAN604
MAN604-1 *Paragorgia* – 2 frags to YPM

Sta. MAN605 - measurement and collected small sample
MAN605-1 *Paragorgia*

Sta. MAN606 - measurement and collected small sample
MAN606-1 *Paragorgia*

Sta. MAN607
MAN607-1 pink thin *Paragorgia*-like colony – frag to YPM
MAN607-2 crinoid attached to 607-1 – to YPM

Sta. MAN608 – measurement, but no collection

Sta. MAN609 – measurement, but no collection

Sta. MAN610 – measurement, but no collection

Sta. MAN611
MAN611-1 small *Paragorgia*
MAN611-2 hermit crab with purple eggs – to YPM
MAN611-3 nemertean worm – to YPM
MAN611-4 sponge on fossil coral – to YPM

Sta. MAN612 – measurement, but no collection

Sta. MAN613 – measurement, but no collection

Sta. MAN614 – measurement, but no collection

Sta. MAN615
MAN615-1 white *Paragorgia* – fragments to YPM

Sta. MAN616
MAN616-1 *Paragorgia* with *Asteroschema* brittlestar

Sta. MAN617 – measurement, but no collection

Sta. MAN618 – measurement, but no collection

Sta. MAN619 – measurement, but no collection

Sta. MAN620 – measurement, but no collection

Sta. MAN621
MAN621 –1 baby *Paragorgia* – to SF, LW

Sta. MAN622 – measurement, but no collection

Sta. MAN623 – measurement and collection of sample

Sta. MAN6XX– material on bottom of bioboxes
MAN6XX-1 2 crinoids (possibly from 611-1) – to YPM
MAN6XX-2 6 amphipods with red eyes from starboard biobox – to YPM
MAN6XX-3 6 pink nemertean worms from starboard biobox – to YPM
MAN6XX-4 2 red polynoid polychaetes from starboard biobox – to YPM
MAN6XX-5 1 snail from starboard biobox – to YPM 95 etoh

MAN6XX-6 2 brittle stars from starboard biobox – to YPM
MAN6XX-7 forams from starboard biobox – to SLR

Hercules dive #6
Manning Seamount, along radial ridge

Dive started 00:58 GMT 15 May 2004, and ended 10:48 GMT that day
Primary function was to collect octocorals and do fish transects

	time (GMT)	depth	Lat-long
Sta. MAN701	04:12	1887	38° 08.9780' N 61° 06.1147' W
Sta. MAN702	05:12	1884	38° 08.94' N 61° 06.13' W
Sta. MAN703	05:27	1867	38° 08.9263' N 61° 06.1376' W
Sta. MAN704	05:39	1863	38° 08.9327' N 61° 06.1281' W
Sta. MAN705	05:51	1849	38° 08.9229' N 61° 06.1248' W
Sta. MAN706	06:03	1847	38° 08.9264' N 61° 06.1295' W
Sta. MAN707	06:35	1826	38° 08.9184' N 61° 06.1056' W
Sta. MAN708	08:22	1718	38° 08.09' N 61° 06.965' W
Sta. MAN709	09:51	1688	38° 08.778' N 61° 06.920' W
Sta. MAN710	10:19	1668	38° 08.757' N 61° 06.896' W

* approximate coordinates

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. MAN701
MAN701-1 *Stauropathes* (open branching black coral)

Sta. MAN702
MAN702-1 *Paramuricea* with *Asteroschema* and anemone

Sta. MAN703
MAN703-1 *Metallogorgia*

Sta. MAN704
MAN704-1 *Paramuricea* – to YPM
MAN704-2 *Asteroschema* from MAN704-1 – to YPM

Sta. MAN705
MAN705-1 *Paramuricea* with *Asteroschema* (and another very small one)

Sta. MAN706
MAN706-1 *Metallogorgia*
MAN706-2 chrysogorgiid

Sta. MAN707
MAN707-1 *Lepidisis* whip with branched tip
MAN707-2 lyrate isid octocoral
MAN707-3 *Paramuricea* with 2 anemones and *Asteroschema* – to LW
MAN707-4 anemone on MAN707-3

Sta. MAN708
MAN708-1 *Metallogorgia* with 2 *Asteroschema*
MAN708-2 *Metallogorgia*
MAN708-3 *Candidella* – fragments to YPM
MAN708-4 *Gorgoniapolynoi* polychaete on MAN708-3 – to YPM
MAN708-5 *Lophelia pertusa* – to YPM
MAN708-6 orange polychaetes (with eggs) from *Candidella* and biobox – to YPM
MAN708-7 grapefruit sponge attached to dead *Lophelia* – to YPM
MAN708-8 phyllodocid polychaete – to YPM
MAN708-9 crinoid from *Candidella* – to YPM
MAN708-10 *Ophiacantha* – to YPM
MAN708-11 *Telestula*? attached to fossil coral – to YPM
MAN708-13 cladorhizid sponge on fossil coral – to YPM

Sta. MAN709
MAN709-1 lacy *Paragorgia* with yellow zonathids
MAN709-2 pink nemerteans from MAN709-1

Sta. MAN710
MAN710-1 *Metallogorgia*
MAN710-2 *Tanacetipathes* (bottle brush black coral) with 2 smooth galatheids
MAN710-3 2 smooth galatheids on MAN710-2

Sta. MAN7XX– material on bottom of bioboxes
MAN7XX-1 2 ophiuroids from forward biobox – to YPM
MAN7XX-2 aplacophoran from starboard biobox – to YPM
MAN7XX-3 8 brittlestars from starboard biobox – to YPM
MAN7XX-4 3 red eye (eusirid) amphipods from starboard biobox – to YPM
MAN7XX-5 polychaetes with pink spot from starboard biobox – to YPM
MAN7XX-6 polychaetes from starboard biobox – to YPM
MAN7XX-7 green nemertean – to YPM
MAN7XX-8 crinoid from starboard biobox – to YPM
MAN7XX-9 isopod from starboard biobox – to YPM
MAN7XX-10 amphipod from starboard biobox – to YPM
MAN7XX-11 polychaetes from starboard biobox – to YPM

Hercules dive #7
Manning Seamount, along radial ridge crest and top

Dive started 17:54 GMT 15 May 2004, and ended 10:15 GMT 16 May 2004
Primary function was to collect octocorals and do fish transects

	time (GMT)	depth	Lat-long
Sta. MAN801	21:33	1692	38° 08.843' N 61° 05.869' W
Sta. MAN802	22:13	1680	38° 08.837' N 61° 05.863' W
Sta. MAN803	22:27	1674	38° 08.829' N 61° 05.864' W
Sta. MAN804	23:40	1551	38° 08.7295' N 61° 05.138' W
Sta. MAN805	00:19	1537	38° 08.700' N 61° 05.761' W
Sta. MAN806	01:16	1481	38° 08.641' N 61° 05.645' W
Sta. MAN807	02:17	1469	38° 08.608' N 61° 05.538' W
Sta. MAN808	03:16	1458	38° 08.574' N 61° 05.485' W
Sta. MAN809	03:43	1454	38° 08.550' N 61° 05.473' W
Sta. MAN810	05:27	1448	*38° 08.5' N 61° 05.3' W
Sta. MAN811	06:50	1440	38° 08.4906' N 61° 05.2669' W
Sta. MAN812	07:19	1439	38° 08.4684' N 61° 05.2541' W
Sta. MAN813	08:20	1431	38° 08.4221' N 61° 05.2010' W

* approximate coordinates

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. MAN801
MAN801-1 *Metallogorgia*
MAN801-2 *Narella*

Sta. MAN802
MAN802-1 *Stichopathes* (orange whip black coral)

Sta. MAN803
MAN803-1 *Acanella*
MAN802-2 *Metallogorgia*

Sta. MAN804
MAN804-1 wispy *Isidella*? attached to *Lophelia pertusa* – fragments to YPM
MAN804-2 *Lophelia pertusa* – to YPM
MAN804-3 2 *Opiacantha* ophiuroids – to YPM
MAN804-4 *Asteroschema* from wispy *Isidella* – to YPM
MAN804-5 *Telestula* from wispy *Isidella* – to YPM
MAN804-6 slimy salmon sponge from *Isidella* – to YPM
MAN804-7 serpulid worms on *Lophelia* – to YPM
MAN804-8 pink smooth gooseneck barnacles – to YPM 70 etoh
MAN804-9 *Eunice* polychaete from *Lophelia* – to YPM
MAN804-10 terrebelid polychaetes and tubes from *Lophelia* – to YPM

Sta. MAN805
MAN805-1 *Metallogorgia* lost specimen

Sta. MAN806
MAN806-1 *Metallogorgia*
MAN806-2 *Metallogorgia*

Sta. MAN807
MAN807-1 *Keratoisis*
MAN807-2 crinoid on *Keratoisis* – to YPM

Sta. MAN808
MAN808-1 *Thouarella* – fragments to YPM
MAN808-2 polychaetes from *Thouarella* – 1 to YPM

Sta. MAN809
MAN809-1 *Paramuricea*

Sta. MAN810
MAN810-1 *Paramuricea*

Sta. MAN811
MAN811-1 *Metallogorgia*

Sta. MAN812
MAN812-1 *Paramuricea*
MAN812-2 *Paramuricea*
MAN812-3 unstalked crinoid – to YPM
MAN812-4 stalked crinoid

Sta. MAN813
MAN813-1 *Paramuricea*

Sta. MAN8XX– material on bottom of bioboxes
MAN8XX-1 4 polychaetes from forward biobox – to YPM
MAN8XX-2 4 red eye (eusirid) amphipods from forward biobox – to YPM
MAN8XX-3 new species lysionassidid amphipod from forward biobox – to YPM
MAN8XX-4 4 red eye (eusirid) amphipods from starboard biobox – to YPM
MAN8XX-5 amphipod from starboard biobox – to YPM
MAN8XX-6 snail from forward biobox – to USNM 95 etoh
MAN8XX-7 Ophiacantha from forward biobox – to YPM
MAN8XX-8 8 brittlestars from starboard biobox – to YPM
MAN8XX-9 crinoid from starboard biobox – to YPM
MAN8XX-10 snail from starboard biobox – to USNM 95 etoh
MAN8XX-11 polychaetes from starboard biobox – to YPM

Hercules Dive # 8
Deep Dive on southeast slope of Kelvin Seamount

Hercules dive #9
Kelvin Seamount, along top of plateau

Dive started 15:13 GMT 18 May 2004, and ended 23:25 GMT 18 May 2004
Primary function was to collect octocorals and do photo mosaic and fish transects

	time (GMT)	depth	Lat-long
Sta. KEL301	18:12	1773	38° 49.1981’ N 63° 57.5414’ W
Sta. KEL302	21:54	1720	38° 49.6381’ N 63° 57.9306’ W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. KEL301
KEL301-1 *Metallogorgia*
KEL301-2 chrysogorgiid
KEL301-3 *Metallogorgia*
KEL301-4 *Metallogorgia*
KEL301-5 *Paramuricea*
KEL301-6 *Swiftia*? red w/ alternating polyps
KEL301-7 fish egg clump off *Metallogorgia* (KEL301-1) - 70 etoh to YPM

Sta. KEL302
KEL302-1 *Paramuricea*
KEL302-2 *Acanthogorgia*

Sta. KEL3XX– material on bottom of bioboxes
KEL3XX-1 amphipods – to YPM
KEL3XX-2 aplocophoran – to YPM
KEL3XX-3 polychaetes – to YPM

Hercules dive #10
Kelvin Seamount, southwest ridge on western peak

Dive started 01:27 GMT 19 May 2004, and ended 21:55 GMT 19 May 2004
Primary functions were: collect octocorals, do fish transects, measure Lepidisis, and still photos

	time (GMT)	depth	Lat-long
Sta. KEL401	05:18	2417	38° 46.493' N 63° 57.926' W
Sta. KEL402	10:30	2310	38° 46.7305' N 63° 57.7797' W
Sta. KEL403	11:38	2311	38° 46.7457' N 63° 57.7696' W
Sta. KEL404	12:47	2308	38° 46.750' N 63° 57.781' W
Sta. KEL405	13:37	2310	38° 46.754' N 63° 57.775' W
Sta. KEL406	14:29	2331	38° 46.765' N 63° 57.745' W
Sta. KEL407	18:08	2253	38° 46.978' N 63° 57.767' W
Sta. KEL408	18:46	2252	38° 46.9804' N 63° 57.7641 W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. KEL401
KEL401-1 pink *Corallium* – fragments to YPM
KEL401-2 white *Corallium* – fragments to YPM

Sta. KEL402
KEL402-1 *Calyptrophora pillsburyae*? – fragments to YPM

Sta. KEL403
KEL403-1 *Iridogorgia* (open coil) fragments from colony that went into thruster
KEL403-2 *Iridogorgia* (open coil)
KEL403-3 pycnogonid

Sta. KEL404
KEL404-1 colonial zoanthid on dead *Isidella* skeleton

Sta. KEL405
KEL405-1 *Tanacetipathes* (bottlebrush black coral)

Sta. KEL406
KEL406-1 *Keratoisis*

Sta. KEL407
KEL407-1 pink *Corallium* – fragments to YPM
KEL407-2 *Chrysogorgia*
KEL407-3 polynoid scale worm off *Chrysogorgia* KEL407-2 – to YPM?
KEL407-4 corophid amphipod from tube attached to dead *Corallium* skeleton – to YPM
KEL407-5 hydroids on *Chrysogorgia* (KEL407-2) – 95 etoh to YPM (for Leo Buss)
KEL407-6 barnacles on *Chrysogorgia* (KEL407-2) – to YPM

KEL407-7 forams and other animals on dead *Corallium* skeleton – to YPM

Sta. KEL408
KEL408-1 *Lepidisis*

Sta. KEL4XX– material on bottom of bioboxes
KEL4XX-1 amphipods – to YPM
KEL4XX-2 copepods – to YPM
KEL4XX-3 polynoid scale worms with big fleshy dorsal cirri from pink *Corallium*– to YPM
KEL4XX-4 polynoid scale worms with fuzzy setae from pink *Corallium* – to YPM
KEL4XX-5 polychaete from forward biobox – to YPM
KEL4XX-6 pink *Corallium* from forward biobox – to YPM
KEL4XX-7 polychaete from starboard biobox – to YPM
KEL4XX-8 nemertean from starboard biobox – to YPM
KEL4XX-9 brittlestar from starboard biobox – to YPM
KEL4XX-10 bryozoan – to YPM
KEL4XX-11 worm tubes – to YPM

Hercules dive #11
Kelvin Seamount, on eastern peak

Dive started 03:20 GMT 20 May 2004, and ended 21:00 GMT 20 May 2004
Primary functions were: collect octocorals, do fish transects, and measure corals

	time (GMT)	depth	Lat-long
Sta. KEL501	07:07	2078	38° 51.1730' N 63° 45.8583' W
Sta. KEL502	08:42	2054	38° 51.2167' N 63° 45.8507' W
Sta. KEL503	12:15	2001	38° 51.334' N 63° 46.126' W
Sta. KEL504	13:23	1994	38° 51.306' N 63° 46.155' W
Sta. KEL505	14:14	1996	38° 51.318' N 63° 46.154' W
Sta. KEL506	14:23	1996	38° 51.318' N 63° 46.154' W
Sta. KEL507	14:56	1991	38° 51.3266' N 63° 46.1747' W
Sta. KEL508	15:14	1990	38° 51.325' N 63° 46.170' W
Sta. KEL509	15:46	1993	38° 51.3069' N 63° 46.1825' W
Sta. KEL510	18:40	1959	38° 51.305' N 63° 46.352' W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. KEL501
KEL501-1 *Metallogorgia* – colony to USNM 70 etoh
KEL501-2 *Metallogorgia* – colony to YPM
KEL501-3 *Metallogorgia* – colony to USNM 70 etoh

Sta. KEL502
KEL502-1 *Iridogorgia* (tight coiling form) – fragments to YPM
KEL502-2 *Paramuricea*
KEL502-3 *Paramuricea*
KEL502-4 *Metallogorgia* – colony to USNM 70 etoh
KEL502-5 *Bathypalaemonella serratipalma* (shrimp) from *Iridogorgia* (KEL502-1) – to LW

Sta. KEL503
KEL503-1 *Candidella* with polychaete *Gorgoniapolynoe caecilae*
KEL503-2 *Iridogorgia* (open coiling form) – fragments to YPM
KEL503-3 *Stauropathes* – to YPM

Sta. KEL504
KEL504-1 *Paramuricea* – colony to USNM
KEL504-2 *Paramuricea*

Sta. KEL505
KEL505-1 *Metallogorgia* – colony to YPM

Sta. KEL506
KEL506-1 *Paramuricea*

Sta. KEL507
KEL507-1 *Paramuricea* – colony with rock at base to YPM

Sta. KEL508
KEL508-1 *Lepidisis* – sample of polyps to YPM, skeleton to LM

Sta. KEL509
KEL509-1 *Candidella*

Sta. KEL510
KEL510-1 *Candidella*
KEL510-2 *Clavularia rudis*

Sta. KEL5XX– material on bottom of bioboxes
KEL5XX-1 mysid from *Metallogorgia* in forward biobox – to YPM
KEL5XX-2 crinoids from forward biobox – to YPM
KEL5XX-3 amphipods from forward biobox – to YPM
KEL5XX-4 polychaetes from forward biobox – to YPM
KEL5XX-5 copepods from forward biobox – to YPM
KEL5XX-6 *Ophiacantha* brittlestar from starboard biobox (probably from *Candidella*) – to YPM
KEL5XX-7 *Candidella* fragments with commensal polychaetes (*Gorgoniapolynoe caecilae*), from starboard biobox – to YPM
KEL5XX-8 2 *Asteroschema* from starboard biobox (probably from *Metallogorgia*)– to YPM
KEL5XX-9 chaetognath from plankton – to YPM
KEL5XX-10 brittlestars from starboard biobox – to YPM
KEL5XX-11 amphipods from starboard biobox – to YPM
KEL5XX-12 mixed polychaetes from starboard biobox – to YPM
KEL5XX-13 orange polychaetes from starboard biobox – to YPM

Hercules dive #12
Balanus Seamount, south side of summit

Dive started 12:38 GMT 21 May 2004, and ended 10:00 GMT 22 May 2004
Primary functions were: collect octocorals, do fish transects, and explore

	time (GMT)	depth	Lat-long
Sta. BAL101	15:30	1912	39° 21.3039' N 65° 21.5179' W
Sta. BAL102	16:22	1903	39° 21.307' N 65° 21.558' W
Sta. BAL103	17:59	1865	39° 21.361' N 65° 21.575' W
Sta. BAL104	20:00	1792	39° 21.4117' N 65° 21.8902' W
Sta. BAL105	22:06	1777	39° 21.4614' N 65° 21.8404' W
Sta. BAL106	23:42	1766	39° 21.4977' N 65° 21.8229' W
Sta. BAL107	00:35	1769	39° 21.509' N 65° 21.815' W
Sta. BAL108	01:46	1762	39° 21.5397' N 65° 21.8143' W
Sta. BAL109	03:05	1753	39° 21.6304' N 65° 21.7957' W
Sta. BAL110	07:44	1562	39° 22.2963' N 65° 22.3084' W
Sta. BAL111	08:09	1560	39° 22.3011' N 65° 22.3146' W
Sta. BAL112	08:19	1556	39° 22.3108' N 65° 22.3414' W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson, Jess = Jess Adkins

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. BAL101
BAL101-1 *Metallogorgia* – colony to YPM
BAL101-2 *Metallogorgia* – colony to YPM
BAL101-3 large reddish crinoid – to YPM
BAL101-4 small tan crinoid – to YPM

Sta. BAL102
BAL102-1 big red *Paragorgia*

Sta. BAL103
BAL103-1 branched *Bathypathes* – 2 branches to YPM 95 etoh
BAL103-2 polynoid polychaetes from off *Bathypathes* (BAL103-1)

Sta. BAL104
BAL104-1 *Paramuricea*

Sta. BAL105
BAL105-1 *Paramuricea*
BAL105-2 *Acanthogorgia*
BAL105-3 spiny sponge – to YPM
BAL105-4 slimy salmon sponge – to YPM
BAL105-5 sponge fragments – to YPM
BAL105-6 hexactinellid base – to YPM
BAL105-7 fossil *Desmophyllum cristigalli* – to Jess

BAL105-8 3 snails from *Desmophyllum* (BAL105-7) – to USNM 95 etoh
BAL105-9 *Acanella* fragment – to SF
BAL105-10 hesionid polychaete from *Desmophyllum* (BAL105-7) – to YPM
BAL105-11 chitinous tube from *Desmophyllum* (BAL105-7) – to YPM
BAL105-12 brittlestar from *Desmophyllum* (BAL105-7) – to YPM

Sta. BAL106
BAL106-1 *Candidella*

Sta. BAL107
BAL107-1 *Metallogorgia* – colony to YPM
BAL107-2 *Metallogorgia* – colony to YPM
BAL107-3 *Metallogorgia* – colony to YPM

Sta. BAL108
BAL108-1 *Paramuricea*

Sta. BAL109
BAL109-1 *Paramuricea*

Sta. BAL110
BAL110-1 *Paramuricea*
BAL110-2 chrysogorgiid
BAL110-3 *Paramuricea*
BAL110-4 small tan crinoid from *Paramuricea* (BAL110-3) – to YPM
BAL110-5 darker crinoid from *Paramuricea* (BAL110-3) – to YPM

Sta. BAL111
BAL111-1 *Lepidisis* with 2 upper branches

Sta. BAL112
BAL112-1 *Paragorgia* with yellow zoanthids

Sta. BAL1XX– material on bottom of bioboxes
BAL1XX-1 red snail from forward biobox – to YPM
BAL1XX-2 amphipods from forward biobox – to YPM
BAL1XX-3 copepods from forward biobox – to YPM
BAL1XX-4 polychaetes from forward biobox – to YPM
BAL1XX-5 *Asteroschema* from forward biobox – to YPM
BAL1XX-6 crinoids from starboard biobox – to YPM
BAL1XX-7 2 amphipods from starboard biobox – to YPM
BAL1XX-8 polychaetes from starboard biobox – to YPM
BAL1XX-9 *Ophiacantha* from starboard biobox – to YPM
BAL1XX-10 fuzzy snail from starboard biobox – to USNM 95 etoh
BAL1XX-11 amphipods from starboard biobox – to YPM
BAL1XX-12 *Metallogorgia* fragments from starboard biobox – to YPM

Hercules dive #13
Retriever Seamount, south side of summit

Dive started 17:37 GMT 22 May 2004, and ended 15:30 GMT 23 May 2004
Primary functions were: deep dive, then shallower dive to collect octocorals, do fish transects, and explore

	time (GMT)	depth	Lat-long
Sta. RET101	23:33	3860	39° 45.0578' N 66° 14.9382' W
Sta. RET102	23:50	3855	39° 45.0754' N 66° 14.9408' W
Sta. RET103	00:56	3841	39° 45.1124' N 66° 14.9223' W
Sta. RET104	05:40	2045	39° 48.4343' N 66° 15.0036' W
Sta. RET105	06:20	2040	39° 48.4452' N 66° 14.9963' W
Sta. RET106	06:47	2035	39° 48.4489' N 66° 14.9999' W
Sta. RET107	07:11	2012	39° 48.4723' N 66° 14.9982' W
Sta. RET108	08:41	1984	39° 48.5454' N 66° 14.9883' W
Sta. RET109	09:13	1987	39° 48.5853' N 66° 14.9937' W
Sta. RET110	09:33	1984	39° 48.5383' N 66° 14.9891' W
Sta. RET111	09:53	1983	39° 48.5228' N 66° 14.9884' W
Sta. RET112	10:42	1990	39° 48.5422' N 66° 14.9766' W
Sta. RET113	11:24	1985	39° 48.5709' N 66° 14.9655' W
Sta. RET114	11:36	1982	39° 48.5808' N 66° 14.9675' W
Sta. RET115	11:48	1981	39° 48.5803' N 66° 14.9683' W
Sta. RET116	12:20	1981	39° 48.579' N 66° 14.953' W

Voucher recipients
Destination of specimens are YPM = Yale Peabody Museum, USNM = Smithsonian, MCZ = Museum of Comparative Zoology, SF = Scott France, LW = Les Watling, AS = Anne Simpson, LM = Lauren Mullineaux, JAM = Jon Moore, SLR = Susan Richardson, Jess = Jess Adkins

Specimen treatments
Most specimens formalin fixation, except those marked 95 etoh = 95% ethanol fixation or 70 etoh = 70% ethanol fixation

Sta. RET101
RET101-1 Chrysogorgiid

Sta. RET102
RET102-1 Primnoid

Sta. RET103
RET103-1 feathery black coral (lost when blew out of biobox)

Sta. RET104
RET104-1 *Metallogorgia* – colony to YPM
RET104-2 *Acanthogorgia*
RET104-3 *Acanthogorgia*
RET104-4 *Acanthogorgia*
RET104-5 *Taxipathes* (branching bottlebrush black coral) – to YPM
RET104-6 polynoid polychaete from *Acanthogorgia* – to YPM

Sta. RET105

RET105-1 *Paramuricea*
RET105-2 *Acanella* (small pinkish)

Sta. RET106
RET106-1 *Acanella* (larger browninsh) – fragment to YPM

Sta. RET107
RET107-1 *Metallogorgia* – colony to YPM

Sta. RET108
RET108-1 *Metallogorgia* – colony to YPM
RET108-2 new primnoid (*Candidella*-like) – fragment to YPM

Sta. RET109
RET109-1 *Metallogorgia* with side branch

Sta. RET110
RET110-1 *Paramuricea*
RET110-2 fossil *Desmophyllum cristigalli* – to Jess
RET110-3 spiky sponges on fossil *Desmophyllum cristigalli* (RET110-2) – to YPM
RET110-4 *Munidopsis* from fossil *Desmophyllum cristigalli* (RET110-2) – to YPM
RET110-5 small branched sponge on fossil *Desmophyllum cristigalli* (RET110-2) – to YPM
RET110-6 whiskered basket sponge on fossil *Desmophyllum cristigalli* (RET110-2) – to YPM
RET110-7 *Ophiacantha* on fossil *Desmophyllum cristigalli* (RET110-2) – to YPM
RET110-8 snails on fossil *Desmophyllum cristigalli* (RET110-2) – to YPM
RET110-9 stoloniferous sponge on fossil *Desmophyllum cristigalli* (RET110-2) – to YPM

Sta. RET111
RET111-1 *Paramuricea*

Sta. RET112
RET112-1 *Paragorgia*

Sta. RET113
RET113-1 *Paramuricea*

Sta. RET114
RET114-1 *Isidella*? on *Desmophyllum cristigalli*
RET114-2 verrucid barnacle on *Desmophyllum cristigalli* (RET114-6) to YPM
RET114-3 anemone on *Desmophyllum cristigalli* (RET114-6) to YPM
RET114-4 *Telestula*? on *Isidella*? (RET114-1) to YPM
RET114-5 sponge on *Isidella*? (RET114-1) to YPM
RET114-6 fossil *Desmophyllum cristigalli* – to Jess

Sta. RET115
RET115-1 *Paramuricea*

Sta. RET116
RET116-1 *Metallogorgia* – colony to YPM
RET116-2 *Acanthogorgia* on *Desmophyllum cristigalli*
RET116-3 *Anthothela*
RET116-4 *Plumapathes* (feathery black coral) – to YPM

Sta. RET1XX– material on bottom of bioboxes

RET1XX-1 orange-red polynoid polychaete from *Paramuricea* (RET115-1 or RET105-1) – to YPM
RET1XX-2 red snail from forward biobox – to YPM
RET1XX-3 hermit crab from forward biobox – to YPM
RET1XX-4 amphipods from forward biobox – to YPM
RET1XX-5 2 aplacophorans from forward biobox – to YPM
RET1XX-6 phyllodocid polychaete from forward biobox – to YPM
RET1XX-7 polychaetes from forward biobox – to YPM
RET1XX-8 glycerid polychaete from forward biobox – to YPM
RET1XX-9 *Asteroschema* from forward biobox – to YPM
RET1XX-10 brittle stars from starboard biobox – to YPM
RET1XX-11 *Asteroschema* from starboard biobox – to YPM
RET1XX-12 crinoids fragments from starboard biobox – to YPM
RET1XX-13 glycerid polychaete from starboard biobox – to YPM
RET1XX-14 hesionid polychaete from starboard biobox – to YPM
RET1XX-15 polychaetes from starboard biobox – to YPM
RET1XX-16 3 red snails from starboard biobox – to YPM 95 etoh
RET1XX-17 amphipods from starboard biobox – to YPM 70 etoh
RET1XX-18 *Acanthogorgia* on fossil twig – colony to YPM
RET1XX-19 *Acanthogorgia* – misc pieces and 2 small colonies to YPM
RET1XX-20 *Ophiacantha* brittle star from starboard biobox – to YPM

Unknown station: *Munida* galatheid – to SF