UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA Marine and Aviation Operations
Marine Operations Center
439 W. York Street
Norfolk, VA 23510-1114

MAY 24 2011

MEMORANDUM FOR: Lieutenant Commander Stephen Meador, NOAA
Commanding Officer, NOAA Ship *Nancy Foster*

FROM: Captain David A. Score, NOAA
Commanding Officer, NOAA Marine Operations Center—Atlantic

SUBJECT: Project Instruction for NF-11-04
Atlantic Deep-Water Canyons

Attached is the final Project Instruction for NF-11-04 Atlantic Deep-Water Canyons, which is scheduled aboard NOAA Ship *Nancy Foster* during the period of 4 June-17 June 2011. Acknowledge receipt of these instructions via e-mail to **OpsMgr.MOA@noaa.gov** at Marine Operations Center—Atlantic.

Attachment

cc:
MOA1

Final Cruise Instructions

NF-11-4-NC, Norfolk Canyon

Date Submitted:	23 May 2011
Platform:	NOAA Ship *Nancy Foster*
Cruise Number:	NF-11-04
Project Title:	Atlantic Deep-Water Canyons
Cruise Dates:	4-17 June 2011 (Project Days)

Prepared by: ___ _____ Dated: ___23 May 2011_____

Steve W. Ross
Co-Chief Scientist
UNCW, Center for Marine Science, 5600 Marvin Moss Ln., Wilmington, NC 28409, 910-962-2346, email: rosss@uncw.edu

Prepared by: __ Sandra Brooke ____ Dated: ____23 May 2011_____

Sandra D. Brooke
Co-Chief Scientist
Oregon Inst. Marine Biology, 63466 Boat Basin Rd., Charleston, OR 97420, email: sandra.brooke@marine-conservation.org

Approved by: _____ CAPT/NOAA Dated: 5/24/11

Captain David A. Score, NOAA
Commanding Officer
Marine Operations Center - Atlantic

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I. **Overview**

Submarine canyons are dominant features of the outer continental shelf and slope of the US East coast from Cape Hatteras to the Gulf of Maine (Fig. 1). Cutting deeply into the bottom and linking the shelf to the deep sea, these conduits funnel anthropogenic pollutants, organic carbon, and sediments from shallow to deeper waters. Large canyons (e.g., Norfolk, Baltimore, Washington, Hudson) occur at regular intervals along the shelf-slope interface (Fig. 1). The geology of these features has been well studied; however, despite their high productivity, biological data are limited (particularly deeper than 200 m). Much of the biological data available for these canyons is represented by unpublished reports, unanalyzed data sets, and anecdotal observations. The canyons between Cape Hatteras and Cape Cod are the subject of potential oil exploration, intensive fisheries, and are possible National Marine Sanctuary candidates, and yet these are even less well known than those further north.

One of the first activities preceding intense multidisciplinary sampling is to obtain detailed bathymetric maps of our major target Mid-Atlantic canyons, which will help guide future sampling activities. Such multibeam sonar mapping will be the primary activity during this *Nancy Foster* cruise. Some multibeam surveys have already been conducted in the study area (Fig. 2), and we will prioritize those areas that have not yet been mapped (e.g., Baltimore Canyon, Fig. 2) or that need improved resolution over existing data (e.g., Norfolk Canyon area, Fig. 2). Additional cruise activities will include CTD and water sampling (using CTD with niskin rosette), search for and retrieval of a benthic lander, and potential deployment of a new benthic lander (Fig. 3). Education and outreach activities will also be incorporated into the cruise, using NOAA, NC Museum of Natural Science, and other personnel and internet sites. This cruise represents a collaborative effort between the Bureau of Ocean Energy Management Research and Enforcement (BOEMRE, the major funding source), Continental Shelf Associates (CSA, the BOEMRE contractor) and its partners, NOAA Office of Ocean Exploration and Research (OER, provider of ship time), and the US Geological Survey (USGS). This cruise represents the first field activity in this new project.

A. Cruise Period: 30-31 May 2011 Transit and 4-17 June 2011 Project Days

B. Operating Area (see Figures): Region off Virginia, Maryland, and Delaware, including Norfolk, Washington, Accomac, and Baltimore canyons and the areas surrounding them in water depths of approximately 150-1000 m (see Figures).

C. Summary of Objectives

1. Conduct multibeam sonar mapping of selected Middle Atlantic Bight deep water canyons and surrounding areas and process data at sea to the extent possible
2. Conduct CTD casts in support of the multibeam mapping and to generate hydrographic profiles. Niskin bottle arrays will collect water samples for aragonite saturation and particulate organic matter (POM) analyses. Water samples will not be collected on every CDT cast
3. Attempt retrieval of Cape Lookout benthic lander (in route to and/or from study area)
4. Deploy one new benthic lander in mid-axis of Norfolk Canyon (Baltimore Canyon as alternate)
5. Conduct limited education and outreach activities (internet postings, essays)

D. Participating Institutions

Univ. of North Carolina at Wilmington (UNCW)
Oregon Inst. of Marine Biology (OIMB)

National Oceanographic and Atmospheric Administration (NOAA) Office of Ocean Exploration and Research (OER)
Bureau of Ocean Energy Management (BOEMRE)
US Geological Survey (USGS)
NC Museum of Natural Sciences (NCMNS)
Univ. of Washington (UW)
College of Charleston (CC)
Univ. of Rhode Island (URI)

E. Personnel (Science Party – tentative pending berthing confirmation)

Dr. Steve W. Ross (m, USA)	Chief Scientist	UNCW	rosss@uncw.edu
Dr. Sandra Brooke (f, USA)	co-Chief Scientist	OIMB	sandra.brooke@marine-conservation.org
Brendan Reser (m, USA)	Data/web	NOAA	Brendan.Reser@noaa.gov
Dr. Rod Mather (m, UK)	Scientist	URI	rodmather@mail.uri.edu
Dr. Daniel Brothers (m, USA)	Scientist-mapping	USGS	dbrothers@usgs.gov
Dr. Jason Chaytor (m, Aust)	Scientist-mapping	USGS	jchaytor@usgs.gov
Megan Prescott (f, USA)	Student	UW	mcprez@u.washington.edu
Veronica Holton (f, USA)	Student	CC	vrholton@g.cofc.edu
Caitlin Casar (f, USA)	Student/tech	USGS	CASARC07@students.ecu.edu

WATCH SCHEDULE (Tentative and subject to change)

Vessel meal times: Breakfast = 0700-0800, Lunch = 1100-1200, Dinner = 1630-1730

F. Administrative

1. Points of Contact: Dr. Steve W. Ross, Chief Scientist, UNCW, Center for Marine Science, 5600 Marvin Moss Ln., Wilmington, NC 28409, office 910-962-2346, cell 910-620-0786, email: rosss@uncw.edu

Dr. Sandra D. Brooke, co-Chief Scientist, Oregon Inst. Marine Biology, 63466 Boat Basin Rd., Charleston, OR 97420, email: sandra.brooke@marine-conservation.org

Proposed watches:
Day (0800 – 1600): S.W. Ross, B. Reser, J. Chaytor
Evening (1600 – 2400): S. Brooke, R. Mather, D. Brothers
Night (2400 – 0800): M. Prescott, V. Holton, C. Casar

2. Diplomatic Clearances – None required
3. Licenses and Permits – None required

II. **Operations**

A. Cruise Plan Itinerary

We plan to steam directly from Charleston to the northernmost area to be mapped (Baltimore Canyon), with a brief stop off Cape Lookout, NC to retrieve a benthic lander. If constructed in time, we plan to deploy a new benthic lander in either Baltimore or Norfolk canyon (location is tentative pending additional information therefore does not appear in schedule). This activity should only require about 2-3 hrs or less. CTD casts and associated water sampling are not scheduled below as these are generally dictated by the layout of multibeam survey lines which will be done by the ship's survey technicians in consultation with PIs. Water sampling at different

depths will occur on selected CTD-niskin array deployments. All work days will be 24 hr operations and transits will be minimized. Although we will attempt to keep to the schedule below, weather, changing priorities, unexpected developments, and gear issues may dictate schedule changes which will be addressed by the co-Chief scientists in consultation with the Commanding Officer and other investigators. As much lead time as possible will be provided in the event of such changes.

3 June - In port, Charleston, SC. Science crew arrives in late afternoon and loads gear and baggage onto the NOAA Vessel *Nancy Foster*.

Schedule below will be refined as we reconfigure survey boxes and obtain more data on length of time to map study areas.

4 June - Vessel departs Charleston around 1000 hr and steams northeast to the Cape Lookout benthic lander site (approx. **34° 12.70' N, 75° 52.31' W, 435 m**). This run may take at least 22 hrs to cover the 230 nmi. Science crew organizes/stows gear on the way. Depending on timing and logistics, first science crew meetings on board will be "soon" after we are underway. We should arrive on station the morning of next day.

5 June – Upon arrival, we will spend a few hours attempting to locate and retrieve the benthic lander (Fig. 3) via acoustic releases. Transducer to communicate with releases will be deployed over the side (no special mounting required) as the ship holds station or slowly drifts over target areas. We anticipate spending no more than 4-5 hrs in this activity, after which, we will continue the steam north to the first mapping target box at Baltimore Canyon (see Fig. 2, Box 1) at approximately **38° 10.00' N, 73° 42.92' W.** This area is about 260 nmi from the benthic lander recovery site, requiring ~25 hour transit.

6 June – Arrive at Baltimore Canyon site probably before noon. Begin multibeam sonar mapping Box 1 with CTD drops as needed.

7 June – Same as above, same area.

8 June – Same as above, same area.

9 June – Same as above, same area. At some point after the target area is mapped, we will conduct a CTD transect of 8-10 stations down the axis of the canyon to profile the water column and to collect water samples at various depths (CTD transect I). As an option, several single line transects across canyon may be made using high energy sonar (12khz) to obtain a bottom and sub-bottom profile.

10 June – Same as above, same area. After completed, steam south to begin mapping in Box 2 (Fig. 2) in the Norfolk and Washington canyon areas. During the steam between mapping boxes, we may be able to map a strip of area between the boxes to overlap with existing data.

11 June – Same as above.

12 June – Same as above.

13 June – Same as above.

14 June – Same as above. At some point after the target area is mapped, we will conduct a CTD transect of 8-10 stations down the axis of the canyon to profile the water column and to collect water samples at various depths (CTD transect II). As an option, several single line transects across canyon may be made using high energy sonar (12khz) to obtain a bottom and sub-bottom profile. After Box 2 is completed, if time allows, the ship will move north to map Wilmington Canyon, the Optional Box (Fig. 2).

15 June – Same area and methods as above. Stop mapping operations in the early afternoon and begin the steam for Charleston, SC (~445 nmi depending on survey end point). Time of steam to port depends on departure point & weather, but should take about 45 hrs at 10 kn. Science crew packs gear and cleans vessel.

16 June – Steaming to Charleston with possible stop of 3-4 hrs off Cape Lookout (see above) to locate lander, if not retrieved on outbound trip.

17 June - Arrive Charleston, SC by 1200 hr. Crew cleans vessel & gear, packs gear for transport, moves all gear off vessel & departs as soon as possible.

B. Staging and destaging – Charleston, SC (both)

C. Operations to be conducted

Multibeam sonar mapping in predetermined areas (see Fig. 2): This will be the main activity and will occupy most of the cruise time. In case of failure of the multibeam system, one recourse will be CTD transects and time-series of vertical CTD deployments with associated water sampling. We may also conduct single beam sonar transects across canyons (lower priority).

CTD casts conducted as needed to support multibeam sonar, collection of hydrographic data and collection of water samples from the Niskin bottles. Water samples will <u>not</u> be collected on every CTD cast.

Benthic lander search and retrieval: Off Cape Lookout, occurs during transit to and/or from the canyons study area.

Benthic lander deployment: occurs once in one canyon (TBD), if the lander is constructed in time. This lander and the one recovered above are of the same design and configuration (see Fig. 3).

D. Dive Plan – Not Applicable
E. Applicable Restrictions – None Known

III. **Equipment**

A. Equipment and capabilities provided by the ship

Differential GPS navigation and serial data output, NMEA format
Heading and water depth instruments with serial data output
Dynamic positioning (mostly used during lander operations)
Mid-depth multibeam echo sounder (Simrad EM1002, 95 kHz, 20- about1000 m)
Shallow water multibeam echo sounder (Reson 7125, 400 and 200 kHz, 500 m max)

Shallow/deep water single beam echo sounder (Knudsen Chirp 3200, 200 kHz and 12 kHz, 7000 m max)
Split beam echo sounder (Simrad EK60, 200, 120 and 38 kHz) – may not be used
Acoustic Doppler Current Profiler (ADCP, TRDI OS150, 150 kHz, 16-350 m)
HYPACK data acquisition and navigation software
Caris HIPS/SIPS for multibeam data processing
CTDs: SBE 911plus with 12 bottle, 1.71 L water sampling system; SBE 19 (2), SBE 17plus, SBE 36plus with PDIM
Additional CTD sensors: SBE 43 (DO), SBE 18 (pH), Seapoint turbidity meter, Benthos altimeter (200 kHz, < 100 m)
Freezer for water samples (normal temp range, not ultracold)
Science refrigerator
Hydro-winch for CTD
Deck cranes
Wet and dry lab spaces and storage space
Use of all science berths for science crew
Deck machinery for science gear deployment and recovery
A-frame
Email and internet services
Networked computer printers and plotter, Scientific Computing System (SCS)
PC based workstations
Crane support for all equipment during mobilization and demobilization
Uncontaminated Seawater System: SBE 38 (SS temperature), SBE 21 (TSG), SBE 45 (Micro TSG), Turner 10AU fluorometer
At least one functioning laboratory hood
RM Young weather suite (wind speed/direction, temperature, relative humidity and barometric pressure)
40” wide-screen video monitor in Dry Lab for presentations, navigation, or video/data

Also sufficient consumables, backup units, and on-site spares and technical support must be in place to assure that operational interruptions are minimal. All measurement instruments are expected to have current calibrations, and all pertinent calibration information shall be included in the data package. The ship is requested to provide technical expertise and assistance in the event of unexpected problems.

B. Equipment and capabilities provided by the scientists
All chemicals and containers
Any non-ship sampling devices
GIS, data computer, and hard drives
All software and computers associated with science data management

IV. **Hazardous Materials**

A. Policy and Compliance

The Chief Scientist is responsible for complying with MOCDOC 15, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the Chief Scientist.

The only chemical that we anticipate using is mercuric chloride for fixing water samples and deploying sediment traps on benthic lander.

Material will be stored on deck or in chemical locker in an appropriate container. When needed, these materials will be transferred to water-tight containers and diluted with DI water. Small spills can be wiped up with an absorbent material and disposed of in a proper receptacle. Quantities used will be small therefore large spills are not anticipated.

Safety goggles, gloves and protective clothing will be worn when handling the above listed materials. Appropriate protocols will be followed by all personnel handling these chemicals.

For all chemicals the first aid procedures are as follows:
Eyes: Immediately flush eyes with plenty of water for at least 15 minutes.
Skin: Immediately flush skin with plenty of water for at least 15 minutes.
Ingestion: Seek medical attention.
Inhalation: Remove to fresh air.
Additional information is found on the Material Safety Data Sheets (MSDS) for each chemical. The chief scientist has the MSDS for the above chemical, and this will be provided to the ship and will be available to the Science Party during the cruise.

B. Radioactive Isotopes – None Used

C. Inventory

100% mercuric chloride solution, 50 ml & 5 g Falcon tubes

V. **Additional Projects**

A. Supplementary ("Piggyback") Projects - None
B. NOAA Fleet Ancillary Projects - None

VI. **Disposition of Data and Reports**

A. Data Responsibilities

All scientists participating will provide the Chief Scientist with a list of collections made or data taken for their respective objectives by the end of the cruise. Video and still photo data will be archived by the Chief Scientist. UNCW will archive all original hard copy station sheets with copies going to participating scientist as requested. Individual scientists will be responsible for their own sample analyses and reporting as required.

The Commanding Officer is responsible for all data collected for ancillary projects until those data have been transferred to the Chief Scientist. Data transfers will be documented

on NOAA Form 61-29. Reporting and sending copies of ancillary project data to NESDIS (ROSCOP form) is the responsibility of the program office sponsoring those projects.

The science party is responsible for the collection and organization of all data (other than shipboard digital data) relative to meeting the goals and objectives of their projects. This includes working with the appropriate ship's personnel, under direction of the Chief Scientist, to obtain relevant data collected by the Scientific Computer System (SCS), and compilation of metadata records associated with physical samples.

The following data products will be included in the cruise data package (recorded on appropriate media) delivered to Chief Scientist:

- Marine Operations Abstracts
- CTD data (on CD's or DVD's) and CTD data notebook, including CTD cast logs
- Salinity sample analysis floppy
- ADCP digital recordings
- All seismic sonar data on appropriate media
- Multibeam digital data (raw and processed), including bathymetry (x,y,z) data as well as backscatter (reflectivity) data on CD, DVD, or hard drive
- Marine weather observation logs
- Hard copy maps of multibeam surveys
- Calibration information for ship's salinometer and thermosalinograph
- SCS data tapes or CDs
- Cruise operations spreadsheet w/ actual speed/dates made good along trackline

B. Pre and Post Cruise Meeting

Pre-Cruise Meeting: Prior to or soon after departure, the co-Chief Scientists will conduct a meeting of the scientific party to train them in cruise procedures and inform them of cruise objectives. Safety and vessel protocols (e.g., meals, watches, etiquette, etc.) will be presented by the ship's Operations Officer.

A daily safety meeting will be held at 0750 on the bridge to review any observed safety issues. The ship's officers, department heads and the Chief Scientist will be in attendance.

Post-Cruise Meeting: Upon completion of the cruise, a meeting will normally be held at 0830 (unless prior alternate arrangements are made) and attended by the ship's officers and the Chief Scientists. Concerns regarding safety, efficiency, and suggestions for improvements for future cruises should be discussed. Minutes of the post-cruise meeting will be distributed to all participants by email, and to the Commanding Officer and Chief of Operations, Marine Operations Center.

C. Ship Operation Evaluation Report

Within seven days of the completion of the cruise, a Ship Operation Evaluation form is to be completed by the co-Chief Scientists. The preferred method of transmittal of this form is via email to OMAO.Customer.Satisfation@noaa.gov. If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Rd, Suite 500
Silver Spring, MD 20910

In addition to the ship operation evaluation report, the ship's Operations Officer will keep a log of project metrics, including operations expected and accomplished, and associated expenditures. This may require meeting with the Chief Scientists at the beginning of the project and periodically throughout to ensure accurate tracking. The log will be submitted to the Marine Operations Center, Atlantic following the completion of the project.

VII. **Miscellaneous**

A. Meals and Berthing

Meals and berthing are required for up to 9 scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after the termination of the cruise. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the cruise and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non NOAA or non Federal scientists aboard also have proper orders. It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

Required forms turned in to NOAA prior to cruise.

The NOAA Health Services Questionnaire (NHSQ, Revised: 08/08) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website at http://www.omao.noaa.gov/medical/NHSQ_Final_wi_Instructions_fill.pdf. The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The NHSQ should reach the Health Services Office no later than 4

weeks prior to the cruise to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the form, and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

The business day before departure, the Chief Scientist must provide a listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: name, address, relationship to member, and telephone number.

C. Shipboard Safety

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. "Crocs" sandal style footwear is not permitted for any deck or small boat operations. Hard hats are also required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the NMAO Fleet IT Security Policy prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

1. Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
2. Installation of the latest critical operating system security patches.
3. No external public Internet Service Provider (ISP) connections.

Completion of these requirements prior to boarding the ship is preferable.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

The two foreign nationals participating in this cruise are permanent US residents and have green cards.

Appendices

1. Figures (Figures 1-3)
2. Station/Waypoint List (Coordinates in Latitude, Longitude: degree-minutes)

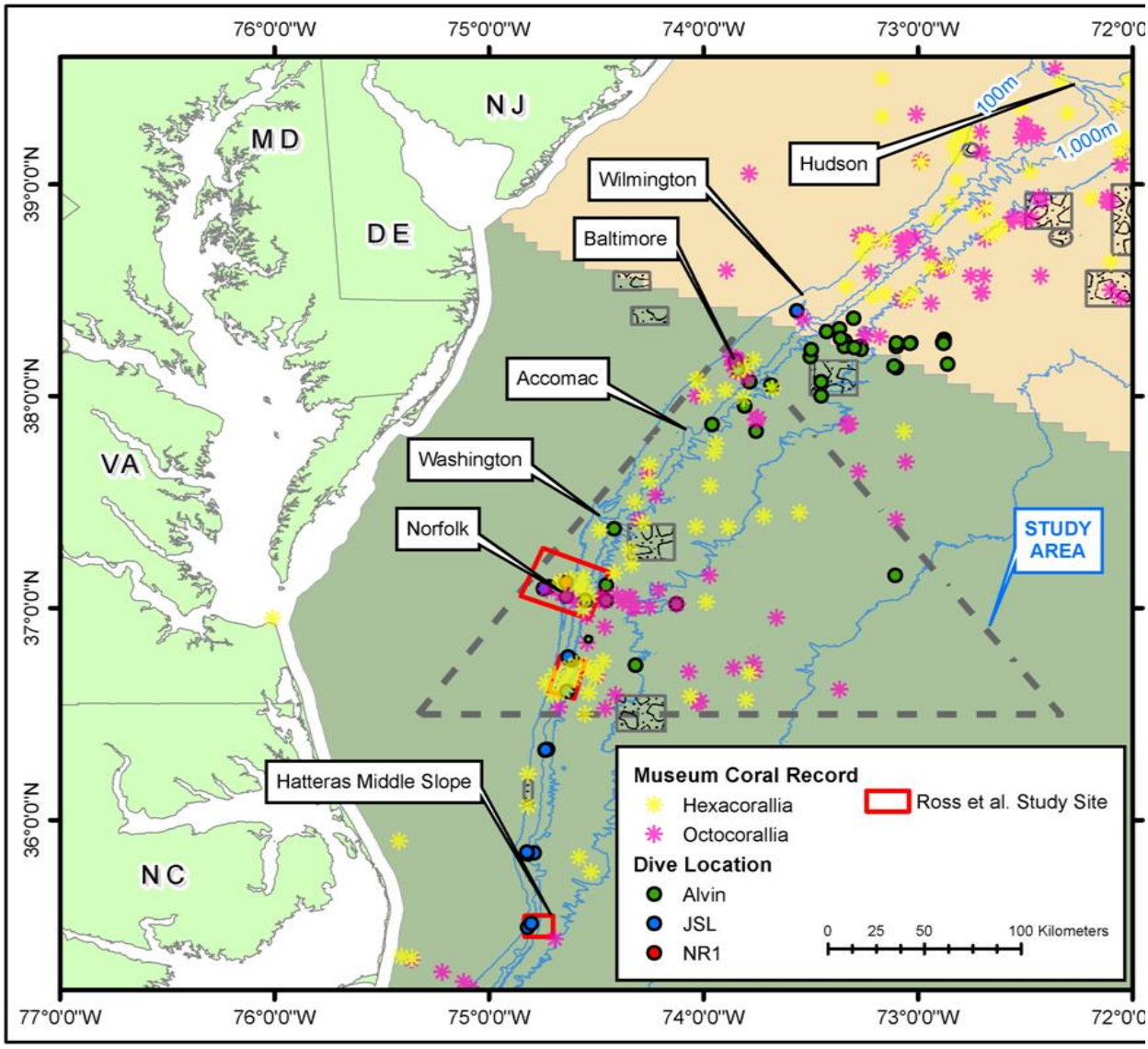

Figure 1. Major Mid-Atlantic Canyons. Target areas for this project are in and around Norfolk, Washington, Accomac and Baltimore canyons.

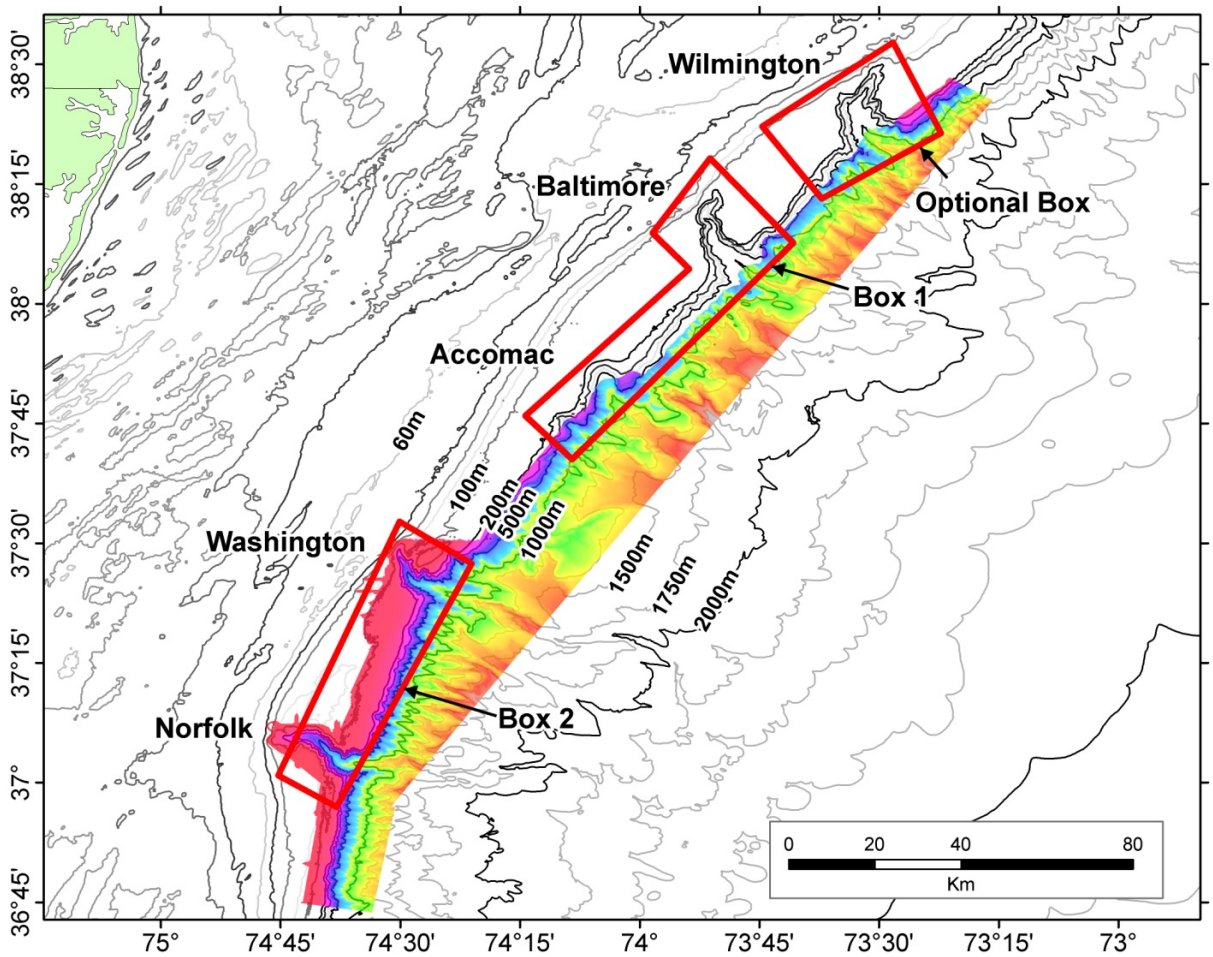

Figure 2. Major study area canyons and proposed priority multibeam mapping boxes. Existing multibeam sonar data represented by color shaded areas.

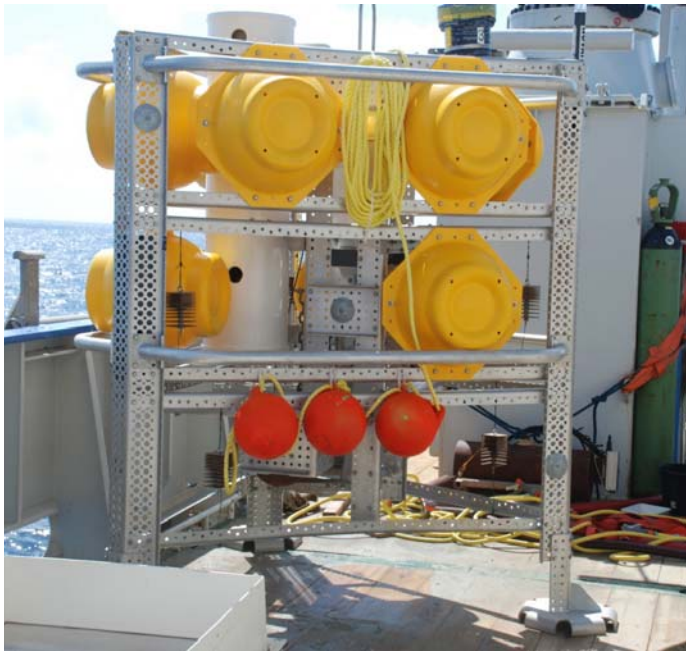

Figure 3. UNCW benthic lander. In air weight about 1000 lb without drop weight and about 1700 lb with drop weight; dimensions about 6 ft per side.

Station/Waypoint List (Coordinates in Latitude, Longitude: degree-minutes)
Multibeam polygons to be mapped and CTD stations associated with mapping are not included.

Cape Lookout Lander: 34° 12.696’ N, 75° 52.308’ W (435 m)

Norfolk Canyon Lander site: 37° 04.20’ N, 74° 39.18’ W

Baltimore Canyon Lander back-up site: 38° 08.58’ N, 73° 50.76’ W

CTD Baltimore Canyon transect:

B1	38° 12.48'	-73° 52.2'
B2	38° 11.7'	-73° 51.96'
B3	38° 10.92'	-73° 51.66'
B4	38° 10.14'	-73° 51.36'
B5	38° 9.36'	-73° 51.06'
B6	38° 8.58'	-73° 50.76'
B7	38° 7.8'	-73° 50.52'
B8	38° 7.14'	-73° 49.92'
B9	38° 6.6'	-73° 49.2'
B10	38° 6.0'	-73° 48.48'
B11	38° 5.4'	-73° 47.7'

CTD Norfolk Canyon transect:

N1	37° 5.94'	-74° 44.64'
N2	37° 5.76'	-74° 43.62'
N3	37° 5.58'	-74° 42.66'
N4	37° 5.46'	-74° 41.64'
N5	37° 5.34'	-74° 40.62'
N6	37° 4.86'	-74° 39.84'
N7	37° 4.2'	-74° 39.18'
N8	37° 3.6'	-74° 38.58'
N9	37° 2.94'	-74° 37.92'
N10	37° 2.28'	-74° 37.26'
N11	37° 2.28'	-74° 36.24'
N12	37° 2.28'	-74° 35.22'