Ocean Survey Vessel BOLD
Survey Report

Validation of Seafloor Sediment Maps
In Cape Cod Bay

June 18 – June 25, 2010

Photo: Bob Boeri (MA Coastal Zone Management) tends cable as a bottom camera is retrieved from a drop.

Prepared By:
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U.S. Environmental Protection Agency - Region 1

With:
Massachusetts Coastal Zone Management
Matt Liebman, EPA Region 1

GENERAL

Project title	Habitat Mapping in Massachusetts Coastal Waters
Survey title	Validation of Seafloor Sediment Maps in Massachusetts Bay and Cape Cod Bay
Survey vessel	OSV BOLD
Vessel requested by	Todd Callaghan
Organization	Massachusetts Office of Coastal Zone Management (CZM)
EPA Work Assignment Manager	N/A
Organization	
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EPA Funding/Contract Number	N/A
Organization	
Comments	The first 7 days of this survey were dedicated to habitat map validation. The final portion was dedicated to SSS data collection at a disposal site. OSV Bold crew did an outstanding job of supporting both efforts, and should be commended for their flexibility in altering ship operations to pick up additional crew with a small boat transfer on 6/23.

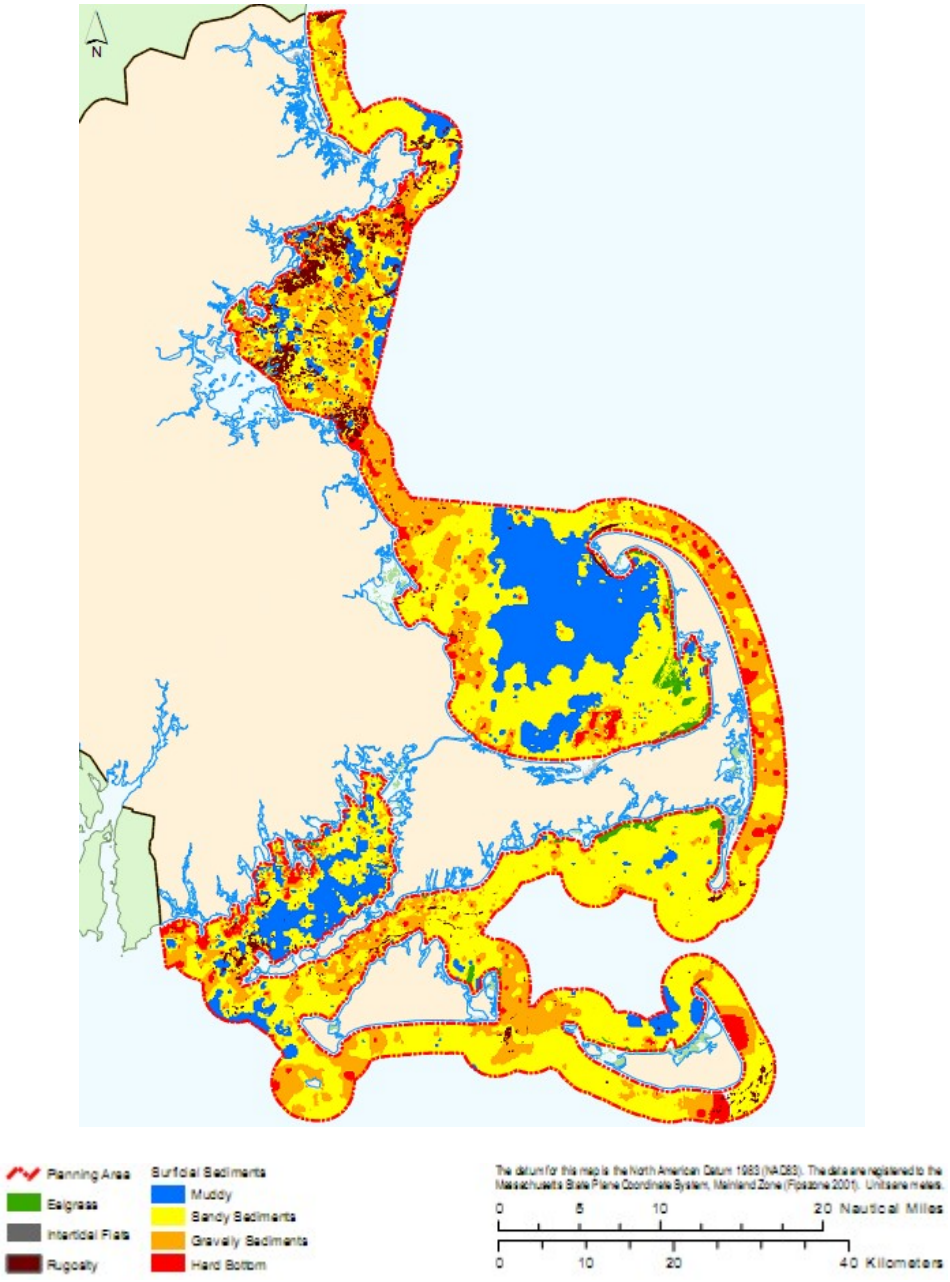
2.0 SCHEDULE OF OPERATIONS

Mobilization Date	Friday, June 18, 2009
Location	U.S. Coast Guard Station, Commercial St., Boston, MA
Departure Date	Friday, June 18, 2010
Survey Duration (Days)	8 days
Allowable Weather/Breakdown Days	No survey time was lost due to weather or breakdown.
(Actual) Survey Duration (Days)	7.5
Demobilization Date	Friday, June 25, 2010
Location	U.S. Coast Guard Station, Commercial St., Boston, MA

3.0 BACKGROUND INFORMATION

The 2008 Massachusetts Oceans Act required the development of an integrated ocean management plan. One of the Commonwealth's priority tasks for implementing the ocean management plan is to categorize and map the various marine habitats in Commonwealth waters. The Massachusetts Office of Coastal Zone Management (CZM) and the U.S. Geological Survey (USGS) Woods Hole

Coastal and Marine Science Center are currently engaged in a Seafloor Mapping Cooperative to map seafloor habitat in Massachusetts coastal waters (http://www.mass.gov/czm/seafloor/index.htm). Surficial sediment maps were created using USGS SEABED point data to produce very small scale sediment maps for the Massachusetts ocean management plan (see figure below). These maps, which represent very rough approximations of seabed character, are being revised (early 2010) to produce larger-scale maps informed by high resolution bathymetry, sidescan sonar, and geologic interpretation. These new and more refined seabed maps will be used in conjunction with other data to reflect “potential habitat,” areas of homogenous structural and lithologic seafloor character (physiographic features and their surficial geology).



4.0 ENVIRONMENTAL MANAGEMENT QUESTIONS ASKED AND ANSWERED BY THE PROJECT

The environmental management questions being answered by this work include:

- Are the sediment types in each of the mapped physiographic zones in the MCZM map correct?
- Are there unique sediment grain sizes associated with each physiographic zone?
- Are physiographic zones predictive of infaunal assemblages or individual infaunal species?
- Can 6 to 15 million cubic yards (CY) of unconsolidated dredged material be used to cap several of the historically disposed waste container concentrations in the former IWS?

The goals of the survey are listed below. All of the goals were accomplished.

- Collect sediment samples in soft sediment areas to validate the sediment maps, using a Ted Young-modified grab.
- Collect infauna from a subset of the sediment samples to further characterize the sediment types.
- Use underwater drop-camera to validate the sediment maps where sediment grabs are unsuccessful (e.g., in gravel, cobble, boulder, and/or ledge areas).
- Use sidescan sonar to document and characterize dumping activities at the MBDS.

5.0 SUMMARY OF SCIENTIFIC ACTIVITIES AND OBSERVATIONS

ACTIVITY LOG SUMMARY

6/17 – *Ship in port at USCG*.

CS, Matt Liebman, Jillian Allen, Marco Rivera and Gordon Hamilton visit ship docked at CG. Gordon Hamilton and CS begin setup of GPS and computer in wetland. Nobeltec waypoints for stations 1-100 and SSS grid loaded onto DAC and bridge computers. Setup completed by **1300** and science crew departs.

6/18 – *Ship in port at USCG*.

Science crew boards by **0800**.

CS spoke to Gordon Kinsman (USCG security) about permission to leave a vehicle parked onsite.

Science meeting at **0930**. Collect gratuitous service agreement forms from non-EPA staff and student liability forms. Go over introductions, team structure, shifts, overall mission and goals, etc.

Safety meeting at **1000**. Briefing by 3rd mate Doug Moore. Demonstration and practice donning Gumby suits and using fire extinguishers at muster area.

Science lab meeting at **1100**. Go over sampling protocols, note taking, SOPs, etc.
Depart dock at approximately **1230**.
Arrive at first station and perform first drop at **1420**.
Begin 24-hour operations.

6/19 – *24 hour operations underway (sediment grabs and camera drops)*

6/20 – *24 hour operations underway (sediment grabs and camera drops)*
Transit to area outside of state waters for MSD discharge at **0115**.
MSD discharge complete and resume science operations at **0530**.
Problems with camera beginning at **1830**. Stop using camera to troubleshoot. Changing camera power supply resolves camera problems. Begin successful camera drops again at **2300**. (Note: after speaking with ship's electrician, suspect problems with camera were related to "dirty" power from the ship's generators causing problems with the camera power supply. For remainder of survey, marine UPS used before camera power supply to provide cleaner power. No further problems developed with camera.)

6/21 – *24 hour operations underway (sediment grabs and camera drops)*
Complete station 100 at **1100**
Attempted new camera deployment setup beginning at station 101 by using a block rig to guide data cable. Test of block rig setup unsuccessful, removed block setup and resumed original method of deployment (hand deployment of cable).
Transit to area outside of state waters for MSD discharge at **2200**.

6/22 – *24 hour operations underway (sediment grabs and camera drops)*
MSD discharge complete and resume science operations at **0230**.
Complete station 150 at **2010**.

6/23 – *24 hour operations underway (sediment grabs and camera drops)*
Suspend science operations at **1720** for small boat ops.
Small boat (the Willard) deployed and sent to Plymouth Harbor to pickup additional science crew. Matt Liebman, Steve Wolf, and Marco Rivera come onboard by EPA small boat transfer at **1930**.
Resume science operations at **2100**.
Marco Rivera begins shooting video for EPA outreach materials at **2100.**
Complete station 200 at **2345**.
Ship transits to Mass Bay disposal site to prepare for SSS survey. MSD discharge during transit, outside of state waters.

6/24 – *24 hour operations underway (SSS operations)*
CTD cast at industrial waste site (IWS), SSS grid area at **0500**.
Begin SSS operations at NW corner of grid at **0600**
Bridge in communications with 2 tugs in the area monitoring security of LNG infrastructure nearby
SSS shiv stuck, stop operations to free shiv at **1820**.

6/25 – *SSS operations underway*
Complete SSS grid at **0415**
Arrive at USCG dock at **0900**

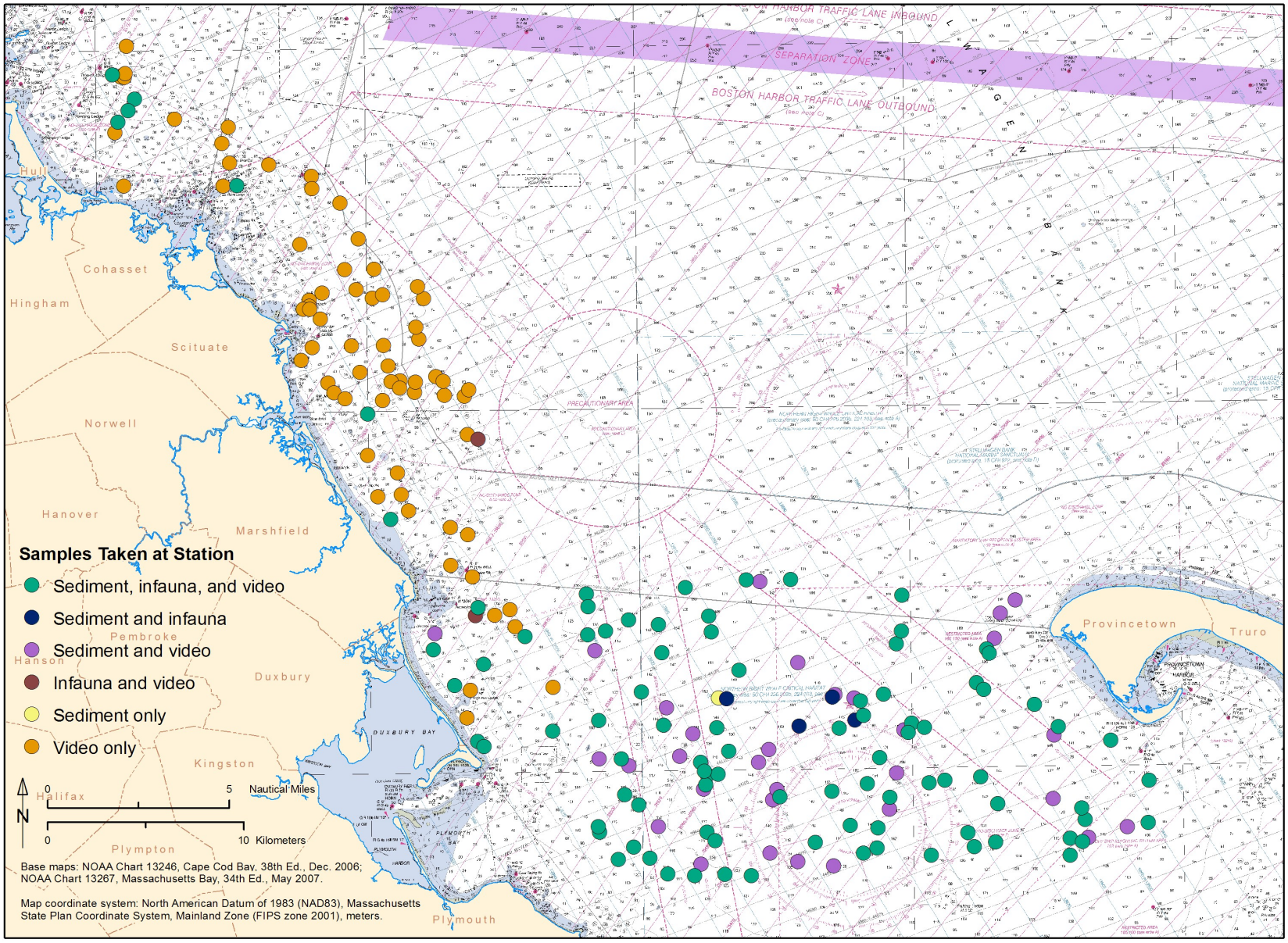
Equipment unloading at **1000**
Science crew departs. All science crew off ship by **~1200**

6.0 SUMMARY OF RESULTS COMPLETED DURING THE SURVEY

The figure below, "*OSV Bold Cruise Sampling Stations, June 18 – June 23, 2010*", shows the locations of stations occupied for seafloor map validation work. A total of 200 stations were completed with either sediment samples, infauna samples, camera drops, or some combination of all three (depending on bottom hardness and priority of stations for infaunal analysis). Stations were divided into priority tiers and completed in order of highest priority to ensure that the main survey goals would be met. Stations 1-100 were completed first as tier 1 (highest priority), followed by tier 2 stations 101-200.

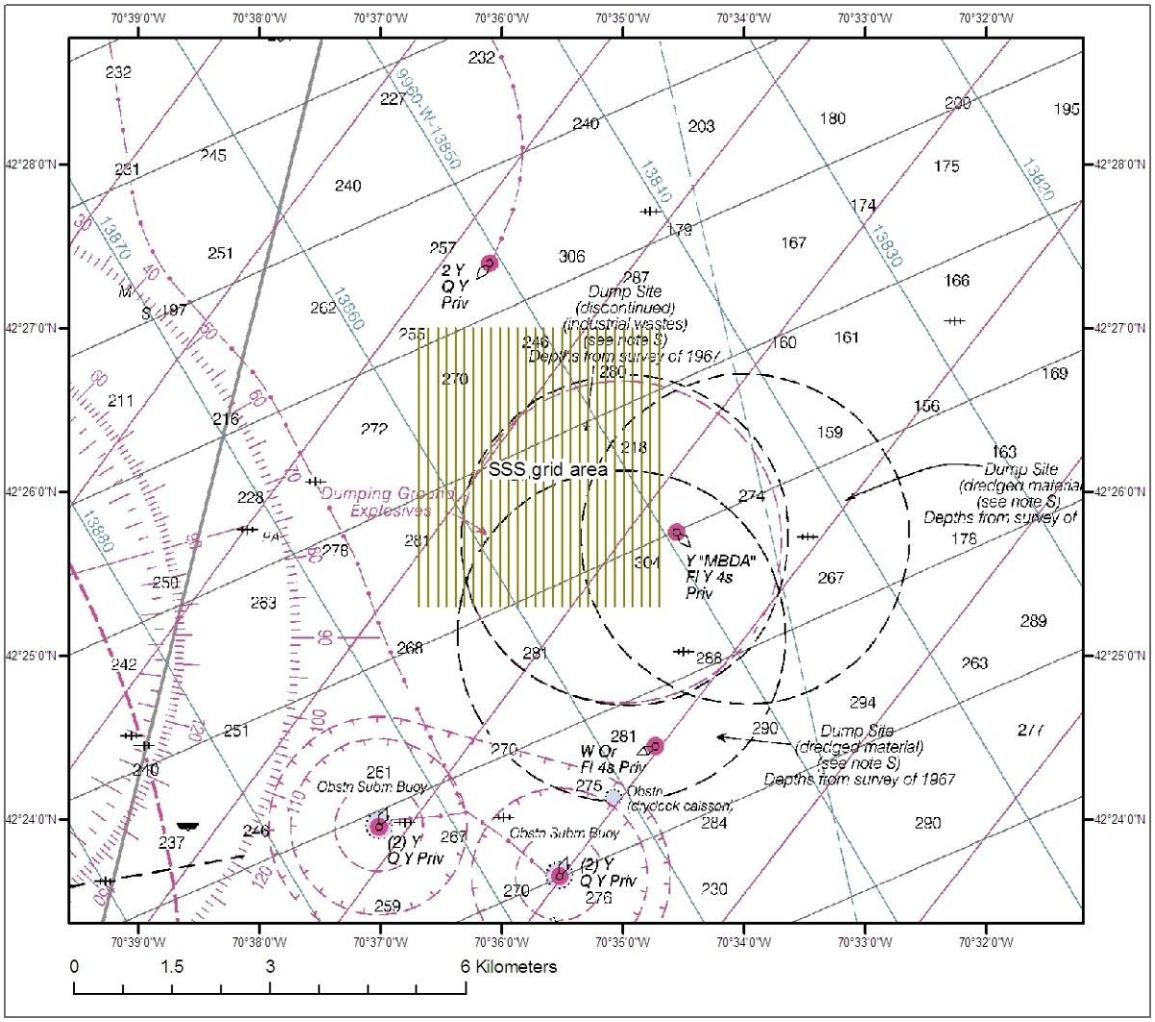
Field observations of sediment collected generally matched bottom types predicted by physiographic zone mapping. Grain size and infauna analysis is underway at an independent contractor. Analysis of video is being performed by the MA Division of Marine Fisheries (DMF). Results from the video will be used to determine seabed composition in areas where a grab sampler could not be used, notably ledge, boulder, and cobble bottoms. Together, the sediment grabs and video results will be used to statistically validate physiographic zone maps. Should results for certain physiographic zones not meet set accuracy thresholds, the data will be used to help refine the mapping methodology.

OSV *Bold* Cruise Sampling Stations, June 18 - June 23, 2010



In addition to grab sampling and camera drops for map validation, a side scan sonar (SSS) survey was completed over the industrial waste site adjacent to the Massachusetts Bay Disposal Site. The figure below, “Side Scan Sonar Grid, Mass Bay Industrial Waste Site” shows the location of the survey grid. A total of 28 lines and approximately 15.5 km^2 were covered by the survey.

Side Scan Sonar Grid, Mass Bay Industrial Waste Site



Initial review of the SSS data indicate that all objectives of the survey were met. Approximately 95% of the survey area was covered, and only a small percentage was missed due to lobster pot snags. Having supporting information and data from previous surveys, such as the 1990s era surveys with ROVs confirming the locations of barrels and data on short dump locations from Jan and Feb 2010, helped scientists positively identify targets during data collection. It is expected that the SSS coverage will provide enough data to answer the primary environmental management question regarding capping of the barrel field.

The SSS survey:

- Identified the extent of the barrel field on both the north and western edges (and possibly the southern edge as well).
- Identified areas of short dumps from the January and February dumps by Burnham Associates.
- Confirmed that the location of barrel fields identified in the 1990s and in 2006 are unchanged.
- Identified shipwrecks that were previously identified in 2006.
- Identified probable concrete coffins which were identified in 2006.
- Likely distinguished between lobster pots (which exhibited more regular shapes with trawl lines) and barrels (with more irregular shapes and no trawl lines).
- Identified the Neptune LNG system suction anchors.
- Identified trenches possibly associated with the Neptune anchor system or pipeline.

In addition to the scientific survey work on board. A videographer (Marco Rivera) documented ship operations and interviewed science crew to produce outreach videos which will be posted online at www.epa.gov/ne/boldkids.

7.0 COMPLETION DATES, AND DISCUSSION OF PENDING ANALYSES

Sediment and infauna samples now being analyzed at Normandeau Associates, with the draft report containing the full infaunal and sediment analyses due November 21, 2010. DMF will complete the video analysis by the end of August, 2010. The data will initially be used to validate the aforementioned CZM-generated physiographic maps. The accuracy of each physiographic zone will be assessed; any zones that do meet standard will be investigated and remapped. We anticipate the initial accuracy assessment to be completed by January 31, 2011. Further analysis of infaunal assemblages is expected to be completed by February 28, 2011. In 2011, the data will be used to investigate correlations between sediment type and other potential habitat variable including rugosity, distance from shore, depth, bathymetric position index, and slope. All findings will be used to refine existing mapping and guide future mapping. Findings will also be reported to USGS to validate/refine physiographic zone mapping.

The IWS SSS data will be mosaicked next fiscal year and a final report will be available by June 2011. Dredged disposal observations in the side scan may be used to take enforcement action against Burnham associates for dumping at the wrong location in MBDS.

8.0 PROBLEMS ENCOUNTERED

We did not experience major problems during the survey. The ship's scientific equipment was in good working condition, and crew support for this survey was outstanding. Each of the crew should be congratulated for creating and

maintaining the Bold at such a high level of service and operation. Weather throughout the cruise was excellent, with warm temperatures, generally calm seas and wind, and very little rain.

Survey problems encountered included:

- The power supply to the drop camera (owned by state of MA) failed due to apparent “dirty” power being supplied by the ship’s generator. The cause of the problem was discussed with the ship’s electrician (Tim) and to prevent further failures, one of the ship’s marine uninterruptible power supplies (UPS) was used.
- On 6/26 CS was informed by the Master and vessel manager (Ken Potts) about a problem with the MSD discovered by engineers after completion of the cruise. On 6/25 while in port, there was a major failure of the MSD. Engineers investigated the problem and found the apparent cause was system fouling due to feminine hygiene products and other items clogging discharge lines and macerator pumps. Thanks to quick action by the crew, the problem was repaired and no time was lost from the planned open house (6/27) or from the following survey.

9.0 ACHIEVEMENT OF SURVEY OBJECTIVES

All objectives of the survey were met. Sea floor validation sampling and camera operations were successfully conducted at the 100 tier 1 (highest priority) stations as well as at an additional 100 tier 2 stations, for a total of 200 stations. Side Scan Sonar data were successfully collected over the IWS and barrels and dredge material disposal mounds were identified in the record.

10.0 PRELIMINARY ENVIRONMENTAL MANAGEMENT DECISIONS FROM THE SURVEY

The Massachusetts Ocean Management Plan includes explicit and implicit uses of seabed mapping data:

- Hard/complex bottom is a Special, Sensitive, or Unique Habitat (SSU) that presumptively excludes specified uses such as pipelines, cables, and sand and gravel extraction
- Seabed sediment is a cornerstone of habitat mapping and assessment, a stated goal of the Ocean Management Plan’s Science Framework (i.e. classify benthic and pelagic habitats)
- Habitat mapping has both direct and indirect implications for project review and siting

There were too many lobster pots in the MBDS and the IWS, despite the advisory against shellfishing in this area. EPA will follow up with the Massachusetts Lobsterman's association, FDA and NMFS regarding this issue.

The Division of Marine Fisheries is developing maps outlining more specific habitat areas for various life stages of managed fish species in Massachusetts. DMF is also examining the vulnerability of such habitats to a variety of uses. The information generated on the Bold cruise will help inform these projects. Importantly, the cruise offered an excellent opportunity to assess methodologies designed for a long-term focus on benthic and pelagic habitat monitoring; these assessments will be used to help make existing decisions regarding survey methodologies.

See also section 7.0

11.0 RECOMMENDATIONS FOR *OSV BOLD* IMPROVEMENTS

See section 8.0.

- Recommend a ship SOP be developed for use of a marine UPS whenever sensitive electronic equipment is used. For this survey, using a UPS from the beginning would have prevented camera power supply failure and lost time troubleshooting.
- Recommend signage in all science cabin heads (with clear instructions on what can/cannot be flushed into the MSD), trash receptacles in all heads, and inclusion of detailed instructions on the MSD system in the safety briefing.

12.0 CONTRACTOR SUPPORT EVALUATION (IF APPLICABLE): N/A

13.0 SCIENTIFIC PARTY

Name	Responsibility	Organization	Arrival-Departure
Marcel Belaval	EPA Chief Scientist (CS)	EPA	6/18 – 6/25
Bob Boeri	Principal Investigator (PI) / Watch Captain	MCZM	6/18 – 6/25
Dan Sampson	Principal Investigator (PI) / Watch Captain	MCZM	6/18 – 6/25
Alex Boeri	watch stander	MCZM	6/18 – 6/25
Chris Garby	watch stander	MCZM	6/18 – 6/25
Dave Janik	watch stander	MCZM	6/18 – 6/25
Emily Chambliss	watch stander	MCZM	6/18 – 6/25
Robin Lacey	watch stander	MCZM	6/18 – 6/25
Kathryn Glenn	watch stander	MCZM	6/18 – 6/25
Kathryn Ford	watch stander	MDMF	6/18 – 6/25
Steve Voss	watch stander	MDMF	6/18 – 6/25
Mark Rousseau	watch stander	MDMF	6/18 – 6/25
Sarah Connors	watch stander	EPA	6/18 – 6/25

Caroline Hayek	watch stander	EPA	6/18 – 6/25
Matt Liebman	watch captain (SSS)	EPA	6/23 – 6/25
Marco Rivera	videographer	EPA/Vistronix	6/23 – 6/25
Steve Wolf	watch stander (SSS)	USACE	6/23 – 6/25

14.0 FINAL REPORTING PLANS

Reporting on the seafloor validation efforts is expected. A report and/or possible journal article written jointly CZM and DMF will detail methods and materials. Results will be reported to USGS for inclusion in the usSEABED Open File Report, a database of east coast seabed sediment point data. Validation results, mapping, and infauna analysis will be reported internally to both CZM and DMF. These reports will guide future mapping work.

The IWS SSS data will be mosaicked next fiscal year and a final report will be available by June 2011.