

Deepwater Horizon Oil Spill (DWHOS)

NRDA Offshore Deep Meso- and Bathypelagic Fish Sampling Plan

NOAA R/V *Pisces*

Water Column and Fish Technical Working Group

November 30, 2010

Prepared by: Deborah French McCay, Melanie Schroeder & Eileen Graham (ASA), and Dan Hahn (NOAA)

Proposed Cruise Dates

R/V *Pisces* – December 1 - 20, 2010

Background/Justification

Conceptual Model – Water Column Organisms

The trustees have developed a preliminary conceptual model of the DWH release, potential pathways and routes of exposure, and potential receptors. This preliminary model has informed the trustees' decision to pursue the studies outlined in the work plan. By signing this work plan and agreeing to fund the work outlined, BP is not endorsing the model articulated in the work plan.

Release and Pathway

Oil released from the broken well head both dispersed at depth and rose through nearly a mile of water column. The composition of the released gas-liquid mixture changed over time and space as the result of dilution, changes in pressure, dissolution, and addition of other constituents such as dispersants, methanol, and anti-foaming additives. Of oil that made it to the water surface, some entrained water forming mousse, was dispersed into the water column naturally and by application of dispersants, and some was removed mechanically or by in situ burning. Floating oil, oil droplets and dissolved components were transported large distances at various levels of the water column. Oil also picked up sediments, and other particulate material, some of which became neutrally or slightly negative buoyant, sinking to various depths. The oil dispersed at the wellhead (both via turbulence or by injection of dispersants) was transported by currents that varied in time and space, yielding a complex pathway of subsurface oil contamination that affected abyssal, bathypelagic, and mesopelagic waters of the offshore Gulf of Mexico.

Routes of Exposure

Fish and invertebrates in the water column are exposed to contaminants by swimming through the water column, passing contaminated water over respiratory structures, and ingesting water and oil droplets as part of feeding. Additionally, sensitive life stages of pelagic fish and invertebrates come in direct contact with floating oil that covers and is mixed into the neuston layer (upper ~0.5m) where many embryos and larvae develop. Other neustonic organisms exposed to surface oil include many

small invertebrates important to the food web. In the water column, organisms are also exposed to suspended oil droplets, which can foul appendages or other body surfaces, or be consumed. Water column organisms have also been exposed to dispersants dissolved in water, on oil droplets and adsorbed to suspended particulate matter. Water column organisms were also exposed to dissolved and water-borne chemical additives such as methanol and anti-foaming agents.

Nektonic organisms throughout the water column of deep offshore slope areas were potentially exposed, including the deeper depth strata where sub-surface oil has been observed (i.e. 1000-1300m). Figure 1 shows the approximate extent of oil observed on the water surface, which indicates areas of surface waters potentially affected. Figure 2 shows a modeled distribution of subsurface oil for a 30,000 bbl/day release from the well from 3 June to 15 July, sampled on 2 August. Currents used for the simulation are based on the real-time data obtained from Acoustic Doppler Current Profilers (ADCPs) in the area. This simulation result indicates the southwestward transport of the oil and locations where plankton may have been exposed.

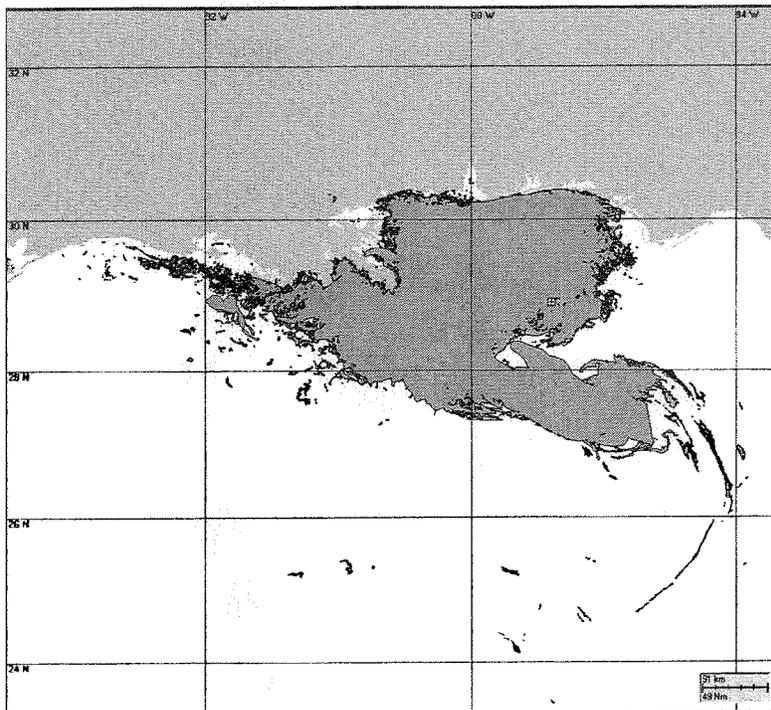


Figure 1. Cumulative potential surface floating oil extent of the Deepwater Horizon oil spill. (Figure derived from compositing April, May, June, and July 2010 radar shape files available on the NOAA ERMA website. Note that radar images with noted anomalies were not included in composite.)

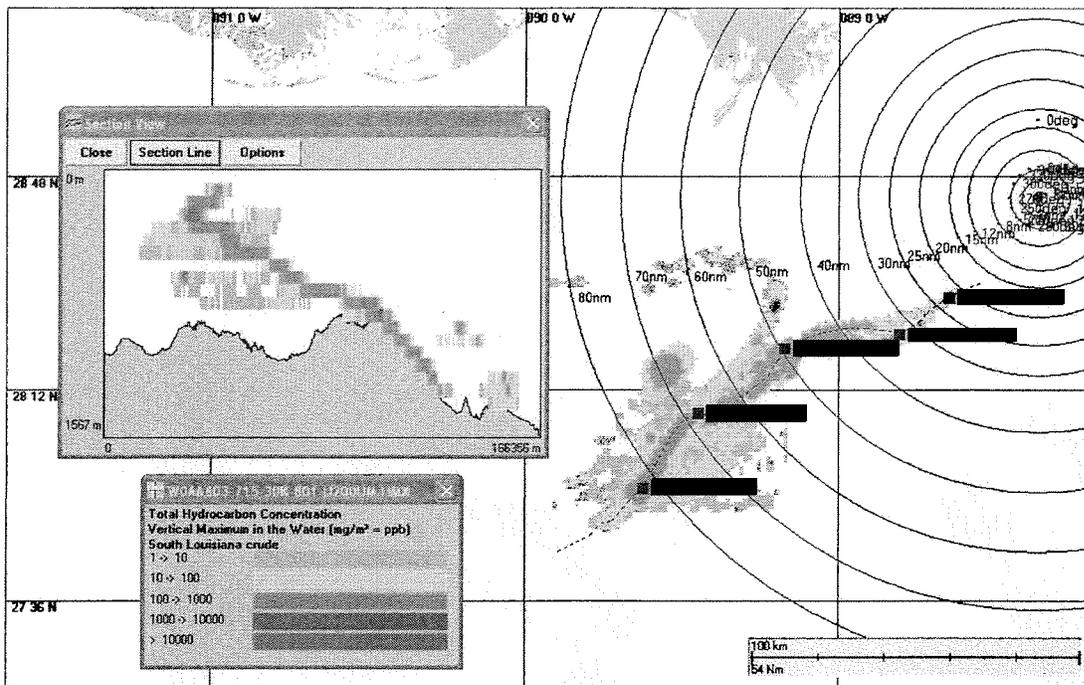


Figure 2. Modeled distribution of subsurface oil droplets from a 30,000 bbl/day release from the well from 3 June to 15 July, model output on 2 August for a preliminary model run.

Objectives and Approach: Deepwater Fish Sampling Plan

Herein, the deepwater fish and invertebrate winter sampling plan, to be performed on the R/V *Pisces* (Attachment 1), is described. This plan is being conducted along with other surveys to evaluate the composition, distribution, and densities of juvenile and adult fish and larger invertebrates in the offshore Gulf of Mexico waters potentially affected by the Deepwater Horizon Oil Spill (DWHOS) and in surrounding areas. In this plan, deepwater communities (deep mesopelagic and bathypelagic, i.e., between 700m and 1400m) are targeted. This plan is not intended to investigate deep water benthic communities. This plan has been developed by the DWHOS NRDA Water Column Technical Working Group in close coordination with members of the Fish Technical Working Group.

Background

The existing data that describe deepwater fish and invertebrate distributions in potentially affected offshore slope areas (i.e. >200m) are less extensive than data available for the shelf (i.e. <200m), but there are historical datasets for midwater nektonic communities in offshore slope areas of the northern Gulf of Mexico. The University of South Florida carried out midwater tows with a small trawl net at one deepwater station off the Florida coast in the late 1980's and 1990's (Sutton, 2005). In the 1990's some of the tows conducted were deeper than 800m. NOAA NMFS has conducted two recent midwater trawl surveys investigating marine mammal prey species in slope waters (February/March 2010 and fall 2010). The depth range targeted was approximately 400-600m. Several mesopelagic fish and invertebrate species were collected during these surveys. In the February/March 2010 study conducted prior to the Deepwater Horizon release, samples of mesopelagic fish and squids were preserved for genetic

identification of squids, stable isotope analysis (an indicator of trophic level), and contaminant analysis (persistent pollutants and PAHs).

The Gulf SERPANT project funded by MMS has been conducting midwater and benthic ROV transect surveys near and around offshore oil rigs since 2006 including the Deepwater Horizon. This ROV survey data contains information primarily on gelatinous midwater and abyssal species, but nekton is also often recorded. This survey method yields information on species composition, depth stratification, and diversity and provides for an index as catch-per-unit-effort.

Finally there are deep (>800m) benthic trawl datasets which contain information on bathypelagic species. These include MMS's *Northern Gulf of Mexico continental slope habitats and benthic ecology study* (Rowe and Kennicutt, 2009) having data from 1999-2001, and from the NOAA NMFS Fall Small Pelagics Survey (2002-2004, 2006-present) at some deeper stations along the shelf break.

The post-spill composition and density of pelagic fish and invertebrate species in the vicinity of areas potentially affected by the MC252 Deepwater Horizon incident have not been quantified in detail, especially in the deepwater areas surrounding the release site. Many of the species and families that exist at such depths are known to vertically migrate (diel migration), for example the myctophids. However, vertically stratified sample data, investigating day/night shifts in abundance, for juvenile and adult fish and invertebrates in the water column is sparse. The R/V *Pisces* winter 2010 sampling plan is an effort to address these data needs.

Subsequent sampling, repeating the overall approach, in other seasons and years may be conducted to provide additional quantitative information and to document the deep meso- and bathypelagic community composition and abundance.

The primary objective is to collect fish and invertebrate samples using a High Speed Midwater Rope Trawl (HSMRT). Sampling and analysis protocols have been developed for offshore stations in the 700m -1400m depth range. Stations to be occupied correspond to locations sampled during the 2010 SEAMAP Offshore Fall survey on the R/V *Gordon Gunter*. In addition to trawling, the shipboard acoustics system will be running and collecting water column data for the entire cruise track. In this way, the occurrence, abundance, biomass, and daily vertical migration of juvenile and adult deepwater meso- and bathypelagic species within the study area can be assessed. Past and future potential cruises in the region have and will sample various life stages of fish and invertebrates in the deep meso- and bathypelagic. Plankton data has been collected at depth using a small mesh 1-m Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS). Potential future cruises will collect depth discrete samples of juveniles and small adult fish and invertebrates with a 10-m larger mesh MOCNESS. The midwater trawl gear used in this proposed cruise will select for larger juveniles and adults, thus filling in this life stage data gap.

Methodology

Cruise Plan and Sampling Stations

The R/V *Pisces* will depart Pascagoula, MS on December 1, 2010 to primarily conduct deep midwater trawl sampling at offshore stations. The 20-day cruise is scheduled to come back into port on December 20, 2010. Other sampling activities are planned in conjunction with the midwater trawl including CTD vertical profiling (conductivity, temperature, salinity, depth) and acoustic data from the shipboard EK60 system.

The Deepwater Horizon Incident encompassed an area that extended seaward of the standard SEAMAP operation area, off the coasts of Louisiana, Mississippi, Alabama (Figure 1). This resulted in the inclusion of 31 additional stations in water exceeding 200m in depth off the coast of Louisiana, Mississippi, Alabama, and Florida during the fall *Gordon Gunter* SEAMAP cruise (August 24-September 30, 2010)(Figure 3). In this work plan, a subset of the additional deepwater stations added to the 2010 fall SEAMAP survey are targeted for midwater trawl sampling.

The standard SEAMAP plankton sampling grid extends from the Texas shelf to the Florida west coast shelf. (The latest SEAMAP survey extended the grid to cover all of the west Florida shelf.) The 30 by 30 nautical mile survey grid runs from the coast out to the 200m isobath. Sampling stations are located at the mid-point of each grid cell. The positions of the additional stations for the fall *Gordon Gunter* SEAMAP cruise were determined by extending the standard 30nmile fall SEAMAP sampling grid into the offshore waters in the vicinity of the spill site. More details on SEAMAP protocols and the annual SEAMAP environmental and biological atlas reports may be found at: http://www.gsmfc.org/default.php?p=sm_ov.htm#:content@8:links@4.

Routine SEAMAP neuston and bongo deployments (to 200m), as well as 1-m MOCNESS tows (to 130m), were conducted at the 31 additional Deepwater Horizon Incident-specific stations during the fall SEAMAP survey aboard the *Gordon Gunter*. Comparable 1-m MOCNESS data (to 1500m) were also collected during the fall 2010 cruises of the R/V *Walton Smith* which occupied a subset of these stations.

These efforts have contributed to a growing volume of deepwater depth-discrete plankton data in this region. To characterize the juvenile and adult deep meso- and bathypelagic assemblage of the region, the trawl net will be deployed at the same subset of stations occupied by the R/V *Walton Smith* cruises 1 & 3 and will target the 1000-1500m depth range (Figure 4, Table 1). This array of 15 stations was selected for its geographic expanse across the region of interest and its high degree of overlap with the stations sampled in the marine mammal survey (Figure 5). The Entrix/NOAA cooperative cruises aboard the M/V *Nick Skansi* (fall 2010) also sampled a subset of the deepwater stations in Figure 4 with a small mesh 1-m MOCNESS (down to 1500m). The *Nick Skansi* stations were spread out between where the *Walton Smith* sampled. It is predicted that due to weather and travel time, the R/V *Pisces* will only be able to occupy 15 stations for the December Cruise. As such, this estimate is conservative; more stations in the grid can be picked up (weather and time dependent). Stations sampled with the 1m MOCNESS by the *Nick Skansi* will be selected and added to the cruise plan as needed.

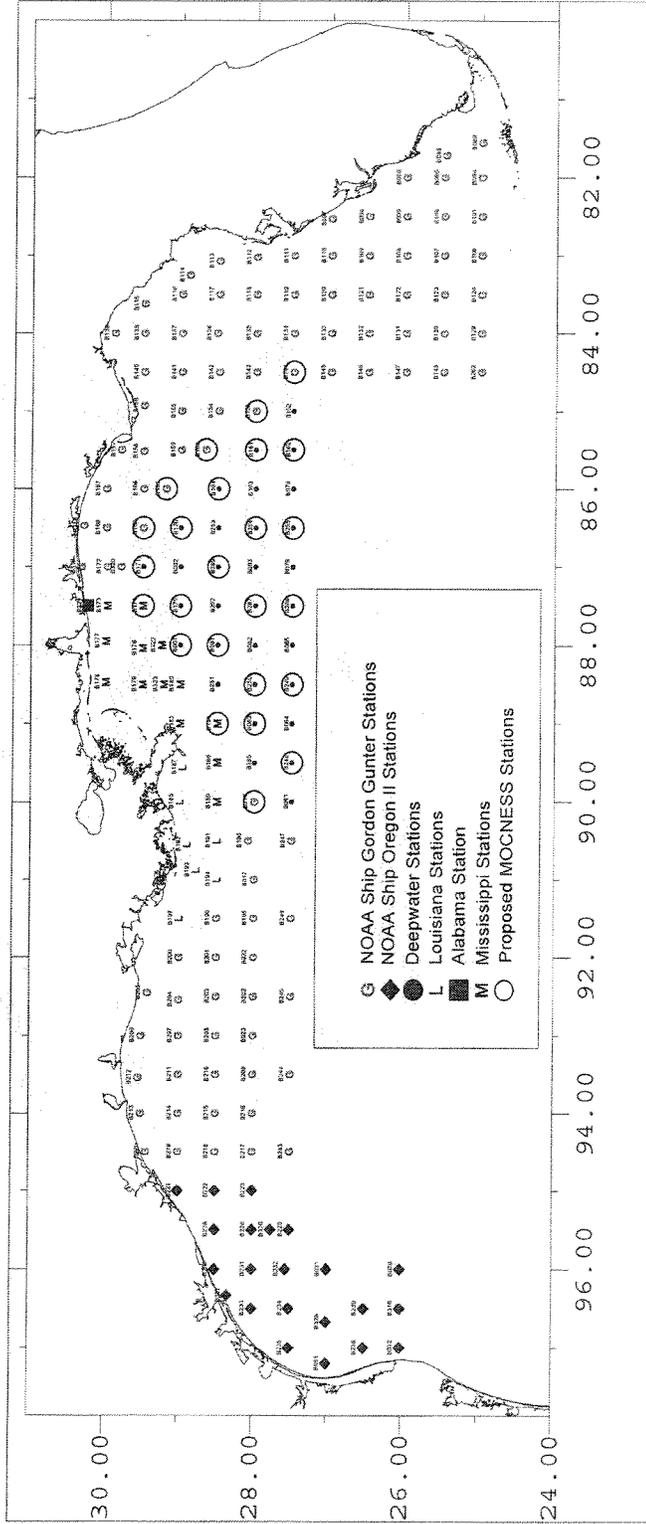


Figure 3. Fall plankton SEAMAP stations and additional deepwater stations to cover some of the area in the vicinity of the DWHOS. Symbols represent various ships/state SEAMAP partners and additional MOCNESS sampling sites. Note: stations planned for the fall R/V Gordon Gunter cruise are marked as a red G (G NOAA Ship Gordon Gunter Stations) and a black dot (• Deepwater Stations). Stations with a black circle around them were planned with the MOCNESS (top 130m).

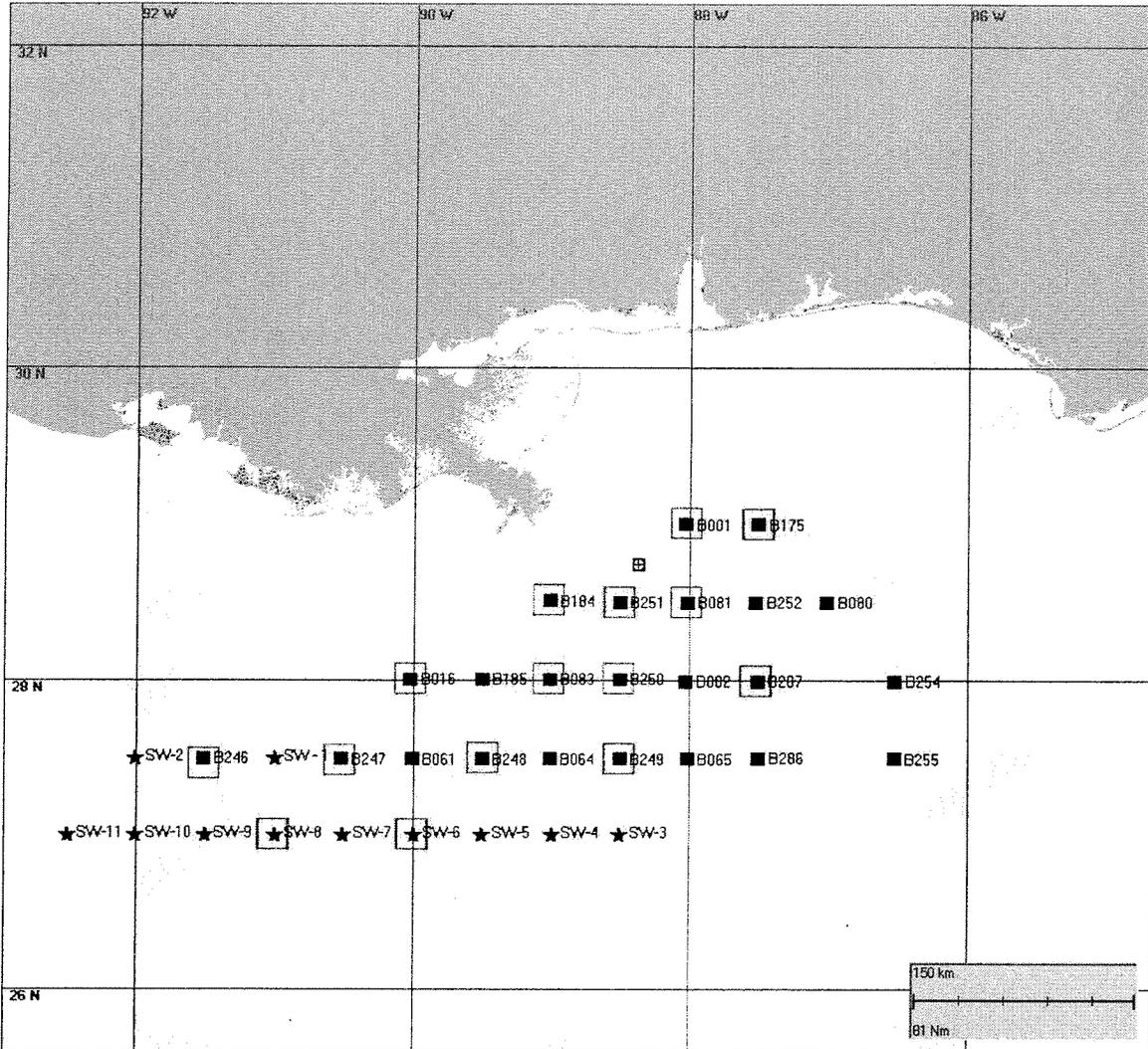


Figure 4. All deepwater stations, extended SEAMAP grid, sampled by the *Gordon Gunter* Fall SEAMAP survey (solid black squares) and additional offshore stations to the SW (stars). SW stations (stars) were added by extending the SEAMAP grid (30nm x 30nm) to the south to obtain more sample coverage in offshore areas relevant to the DWHOS. The fifteen deep midwater trawl stations to be sampled by the *R/V Pisces* are outlined by blue squares.

Table 1. Coordinates of deepwater stations to be sampled during the R/V *Pisces* Cruise.

Station Number	Longitude	Latitude
B001	[REDACTED]	[REDACTED]
B184	[REDACTED]	[REDACTED]
B081	[REDACTED]	[REDACTED]
B016	[REDACTED]	[REDACTED]
B083	[REDACTED]	[REDACTED]
B250	[REDACTED]	[REDACTED]
B246	[REDACTED]	[REDACTED]
B247	[REDACTED]	[REDACTED]
B248	[REDACTED]	[REDACTED]
B249	[REDACTED]	[REDACTED]
B287	[REDACTED]	[REDACTED]
B175	[REDACTED]	[REDACTED]
B251	[REDACTED]	[REDACTED]
SW-8	[REDACTED]	[REDACTED]
SW-6	[REDACTED]	[REDACTED]

The DWHOS NRDA Marine Mammals Technical Working Group is sampling an array of stations in the region of interest with the same midwater trawl gear (HSMRT) aboard the R/V *Gordon Gunter* (Fall 2010) (Figure 5). This effort is targeting composition of marine mammal prey species (i.e. squid) in the 400-600m depth range. This study investigates fish and invertebrates found near and above the deep scattering layer (DSL). The composition of nekton in this depth stratum (400-600m) is different from what has been observed in deeper areas of the GOM (700-1400m). For more details please see the DWHOS NRDA workplan titled "Collection of Data to Determine Impacts of the Deepwater Horizon Mississippi Canyon 252 Incident on Endangered and Protected Marine Mammals in the Northern Gulf of Mexico." Sampling stations for the marine mammal cruise overlap the R/V *Pisces* stations. These two data sets will be complementary in that two depth strata in the same region are being sampled.

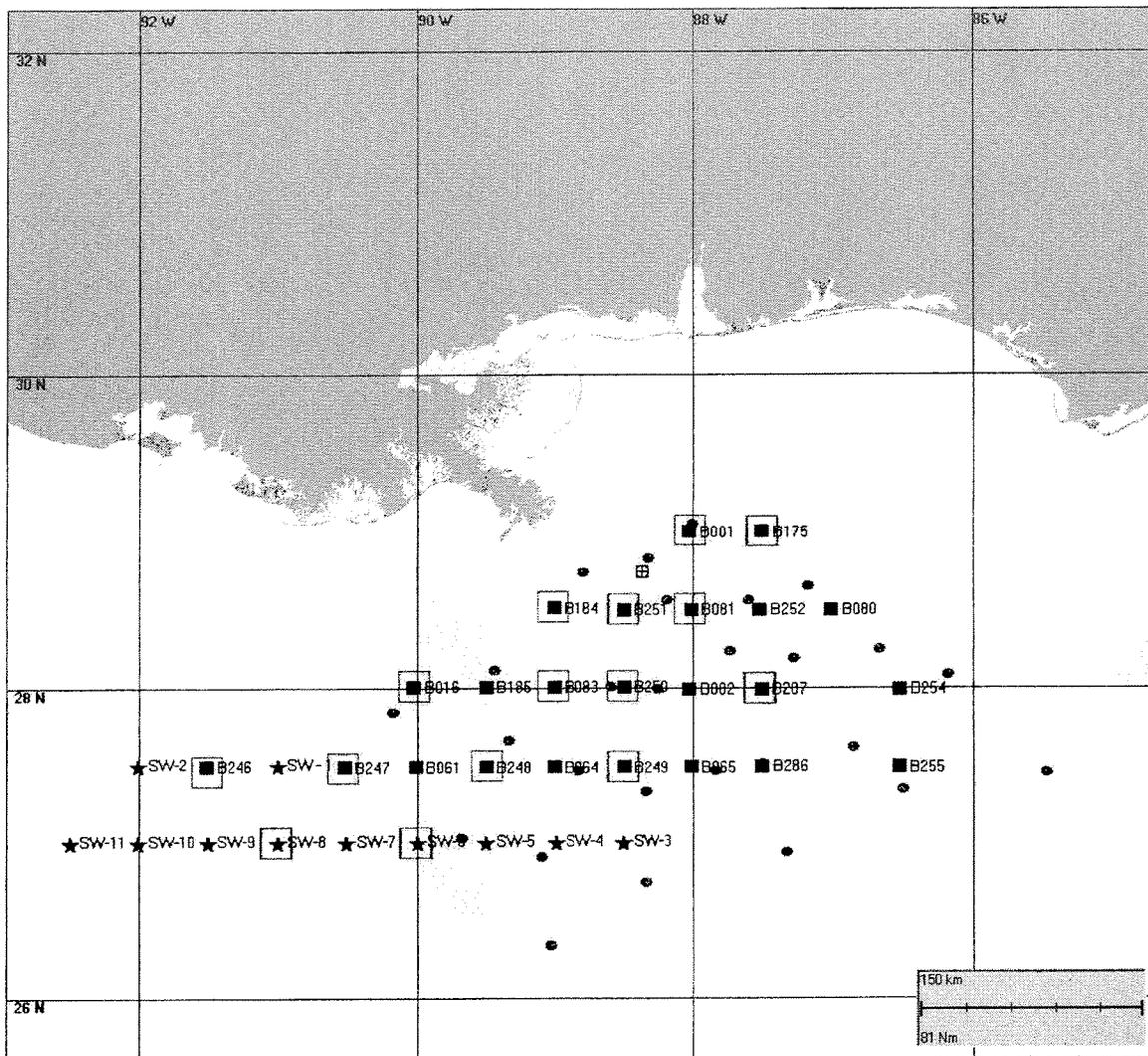


Figure 5. All deepwater stations, extended SEAMAP grid, sampled by the *Gordon Gunter Fall* SEAMAP survey (solid black squares) and additional offshore stations to the SW (stars). SW stations (stars) were added by extending the SEAMAP grid (30nm x 30nm) to the south to obtain more sample coverage in offshore areas. Fifteen deep midwater trawl stations to be sampled by the R/V *Pisces* are outlined by blue squares. Red circles indicate stations sampled with the midwater trawl (400-600m) by the R/V *Gordon Gunter Fall* 2010.

Sampling Procedures

High Speed Midwater Rope Trawl (HSMRT): The HSMRT is a commercial 4-seam midwater trawl designed for high tow speeds with minimal drag. This net is used by NMFS Northeast Fisheries Science Center (NEFSC) for standard midwater fishery surveys. The approximate mouth opening of the HSMRT is 13.3m vertical and 27.5m horizontal. The mesh size decreases along the body of the net from 6.5m down to 5.1cm at the last panel of webbing before the codend. The net will be outfitted with an aquarium style aluminum rigid codend (approximately 2.65 x 0.91 x 0.69 m) (see Attachment 11). This codend is designed to retain water when brought on board. This codend preserves the appendages and bodies of the specimens. Net mensuration sensors and data-loggers will be used to actively monitor the fishing depth of the net and record the layers fished for direct comparison with acoustic data collected during the trawls. Data from these sensors will also provide wing spread and mouth opening during the tow. This data will be used to calculate approximate net geometry. Net specifications and deployment procedures are given in Attachments 2 and 3.

Sampling will take place 24-hours a day. At each station there will be two day time tows and two night time tows, each timed (to the extent possible) to best characterize diel distribution patterns of the organisms. Station sets will begin 1 hour after sunrise, and 1 hour after sunset. For the first tow the net will be deployed from 700m to the surface over the course of an hour (or possibly a shorter time period). The second tow will be deployed to a target depth of 1400m and slowly hauled up obliquely to 700m over a period of 1 hour. Once 700m is reached, the vessel will commence net haul back at a faster winch speed. The average catch from the set of shallower tows (700-0m) will be used as an indicator of biomass retained during set out and haul back of the deeper tows. This average biomass will be effectively subtracted from the 1400-700m catches. This will account for contamination that may occur during set out and haul back while the net is still potentially "fishing". After all four tows (2 daytime, 2 nighttime) are completed, the vessel will then transit to the next station getting there in time to repeat day-night sampling.

Once the net is on deck, the catch will be sorted into "rough" taxonomic groupings (i.e. decapods, mysids, mollusks, fish families). It is advantageous to rough sort the catch so that to the extent possible (without damaging samples), some of the bulk groupings can be processed for weight wet. All catch from all stations will be photographed thoroughly. Roughly sorted groupings will be immediately preserved in 10% buffered formalin, as specimens from these depths are very fragile and degrade quickly. All fish and invertebrates from each station will be kept and archived; nothing will be discarded. For more detail on shipboard specimen handling and preservation see Attachment 4. Later sample processing in the laboratory will involve further sorting, taxonomic identification, species counts, length/weight measurements, and correction for formalin effects. Existing correction factors for formalin weight, based on previous literature, will be applied. Detailed description of analyses to be conducted on samples will be specified in a separate workplan.

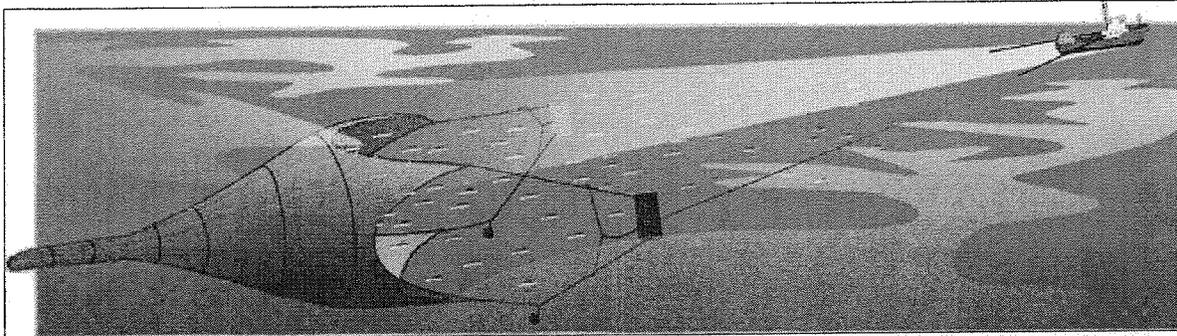


Figure 5. Schematic showing general midwater trawl deployment.

Acoustics: The SIMRAD EK60 scientific echosounder system will be used to collect data on acoustic backscatter in the water column. Much of this backscatter will be due to zooplankton, small fish, squids and other biota. The R/V *Pisces* has a suite of transducers operating at 18 kHz, 38 kHz, 120 kHz and 200 kHz frequencies. The EK60 will collect data continuously throughout the cruise with settings designed to quantify the relative biomass of midwater fish in the target depths using the 18kHz and 38kHz frequencies. For more detail regarding use of acoustics during the cruise see Attachment 5.

CTD: A Seabird CTD vertical profiling package will be deployed on station before each tow to full ocean depth to collect dissolved oxygen, salinity, temperature, conductivity, chlorophyll, CDOM (if available), and depth information.

Personnel for R/V *Pisces* (15 Science Berths Available):

Dr. Tracey Sutton and 4 Graduate Students (VIMS) – Deepwater Fish and Taxonomy

Dr. Kevin Boswell (LSU) – Acoustics/Fish

Michael Murphy (Dial Cordy) – NRDA Data Manager

John Nugent - NRDA Data Manager

Fred Marin (AIS Observing) – biologist, NRDA Data Manager and CTD Operator

Steve Graebe - Entrix Lead Scientist

Jennifer Leo – Entrix Representative

Juan Levesque - CSA Representative

Eddie Hughes - CSA Representative

Keith Bates - Gear Specialist (SEFSC)

Mark Grace – Fisheries Scientist (SEFSC)

NOAA Vessel Crew (commanding officer, mates, bosun, engineer, deck hands)

Vessel

Operations will be completed on the NOAA vessel R/V *Pisces*.

Estimated Costs:

NOAA OMAO Costs	Days	Day Rate	Total
NOAA Pisces Ship Costs (NOAA Core Lab, Operation, Mobilization, etc.)	24 (20 DAS, 4 Staging/Destaging)		\$ 640,000
NOAA NRDA Costs	Days	Day Rate	
NOAA Contractor Labor (days):			
Dr, Tracey Sutton/4 Graduate Students (VIMS)	█		\$ 40,000
Dr. Kevin Boswell (LSU)	█		\$ 26,500
2 NRDA Data Managers	█	█	\$ 66,000
1 NRDA Oceanographic Technician	█	█	\$ 33,000
NRDA Mobilization Costs			
Equipment Shipping			\$ 1,200
Misc Costs, Sample Handling			\$ 13,000
Equipment rental/insurance			\$15,000
BP Representatives (Cardno)			Provided elsewhere
BP Representatives (CSA)			\$99, 238
TOTAL			\$933,938

Days/Trips based on █
 Labor is estimated cost and hours
 Ships crew, Food, & Fuel estimates included in Ship Costs

Budgeting

The Parties acknowledge that this budget is an estimate, and that actual costs may prove to be higher due to a number of potential factors. As soon as factors are identified that may increase the estimated cost, BP will be notified and a change order describing the nature and cause for the increase cost in addition to a revised budget for BP's consideration and review.

The Parties acknowledge that this budget is an estimate, and that actual costs may prove to be higher due to a number of potential factors. BP's commitment to fund the costs of this work includes any additional reasonable costs within the scope of this work plan that may arise. The trustees will make a good faith effort to notify BP in advance of any such increased costs.

Safety Plans

BP's full operations and safety plan is attached along with incident reporting form, SIMOPS protocols, and transfer protocols. In addition, the NOAA incident site safety plan (which all NOAA employees and contractors must sign prior to the cruise) is attached.

Transfer of the shared electronic media in the onboard equipment to each of the party's hardware for retention and use.

Upon return to port, the vessel Operations Manager shall produce identical copies of the raw and processed electronic media generated during the cruise and deliver one of those copies each to NOAA (or its QA contractor), to the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana, and to ENTRIX.. The Entrix data transfer protocol specifies 2 copies be delivered to ENTRIX, one archival and one working copy.

Laboratory and Data Processing

Official NRDA chain of custody procedures will be followed for any transfer of samples from ship to laboratory. Specimen sample and electronic data intake will be coordinated through standard NRDA field operations and transported/shipped to the appropriate laboratory or storage facility.

Specimen samples will be processed, analyzed, and archived at Dr. Tracey Sutton's laboratory at Virginia Institute of Marine Science (VIMS) College of William and Mary, VA. Raw acoustic data will be downloaded from the shipboard system onto an official NRDA hard drives and transported to the appropriate storage facility. Future processing and analysis will occur at Dr. Kevin Boswell's laboratory at Louisiana State University (LSU). Processing, analysis, and reporting for all data types will be described and specified in separate work plans and budget. All other electronic data including station logs (containing station metadata), scanned field data sheets, shipboard GPS files, and CTD data will be offloaded to official NRDA hard drives and transported to the appropriate storage facility. This data will be uploaded to the appropriate online NRDA data repository and catalogued.

Distribution of Laboratory Results

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT), the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana and to BP (or ENTRIX behalf of BP). The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure FTP drop box maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO and to BP (or ENTRIX on behalf of BP). Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Analytical Quality Assurance Plan (AQAP), after which time the validated/QA/QC'd data shall be made available simultaneously to all trustees and BP (or ENTRIX on behalf of BP). Any questions raised on the validated/QA/QC results shall be handled per the procedures in the AQAP and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. In order to assure reliability of the consensus data and full review by the parties, no party shall publish consensus data until 7 days after such data has been made available to the parties. Also, the LADP shall not be released by the DMT, LOSCO, BP or ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and to BP (or ENTRIX on behalf of BP).

References

Rowe, G.T. and M.C. Kennicutt II, eds. 2009. Northern Gulf of Mexico continental slope habitats and benthic ecology study: Final report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2009-039. 456 pp.

Sutton, T.T. 2005. The bathypelagic fish assemblage of the Gulf of Mexico. The 85th Annual Meeting of the Amer. Soc. Ichthyologists and Herpetologists, Tampa.

Attachments:

- Attachment 1 NOAA Research Vessel *Pisces* Brochure
- Attachment 2. HSMRT – Net Specifications and Maintenance
- Attachment 3. HSMRT – Deployment Procedure
- Attachment 4. Shipboard Meso- and Bathypelagic Specimen Processing
- Attachment 5. Fisheries Acoustic Data Collection
- Attachment 6. NOAA-NRDA_MC_252_Site_Safety_Plan_5.13.10
- Attachment 7. NRDA_Field_Sampler_Data_Management_Protocol_10_23_2010
- Attachment 8. SIMOPS Procedures for the NRDA Scientific Fleet
- Attachment 9. MC252 HSE Incident Reporting Final 02 May 10 rev 1
- Attachment 10. NOAA Cruise_Instructions_NRDA_Pisces_Dec2010_FinalNov19
- Attachment 11. NMFS NEFSC_Aquarium Codend_rigging_deployment

Deepwater Horizon Oil Spill (DWHOS)

NRDA Offshore Deep Meso- and Bathypelagic Fish Sampling Plan

NOAA R/V Pisces

Water Column and Fish Technical Working Group

Cruise Dates: December 1-20, 2010

Plan Date: November 30, 2010

Approvals

Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Parties each reserve its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

BP Approval

Robin Bullock [Signature] 12/4/10
Printed Name Signature Date

Federal Trustee Approval

Jennifer Boyce [Signature] 12/2/10
Printed Name Signature Date

Louisiana Approval

KAROLICH DEBUSSCHERE [Signature] 1/20/11
Printed Name Signature Date