Deepwater Horizon Oil Spill (DWHOS)
Water Column Technical Working Group

NRDA Offshore Deep Meso- and Bathypelagic Fish Sampling Plan
September 2011

Sampling Vessel: NOAA Ship *Pisces*

September 2, 2011

Prepared by:

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Reviewed by:

NOAA: John Quinlan (NOAA)

Louisiana: Amanda Vincent (LDEQ)

William Graeber, Amy Piko, Jeffrey Simms (Cardno ENTRIX), and Joyce Miley (BP) on the behalf of BP

Proposed Cruise Dates

September 7 – 27, 2011

Leg 1: 7 – 16 September

Leg 2: 19 – 29 September

(Sept 17 & 18 are shore days)

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 contaminated water, spending time on/in contaminated sediments, taking up contaminants through body surfaces, passing contaminated water over respiratory structures, and ingesting water, oil droplets, contaminated biota, and particulates contaminated with oil 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. 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.

Invertebrates and fish in the north-eastern Gulf of Mexico, which include early life history stages of fish and invertebrates, as well as smaller invertebrate holo-plankton, gelatinous zooplankton and fish of various size classes, are among those biota exposed to the released oil and spill-related chemicals. 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 cumulative summary of fluorescence measurements between 1000 and 1500m, indicating a possible southwestward transport of the oil and some locations where plankton may have been exposed in deepwater (laboratory analyses to establish whether or not these measurements are linked to MC252 oil have not yet been analyzed).

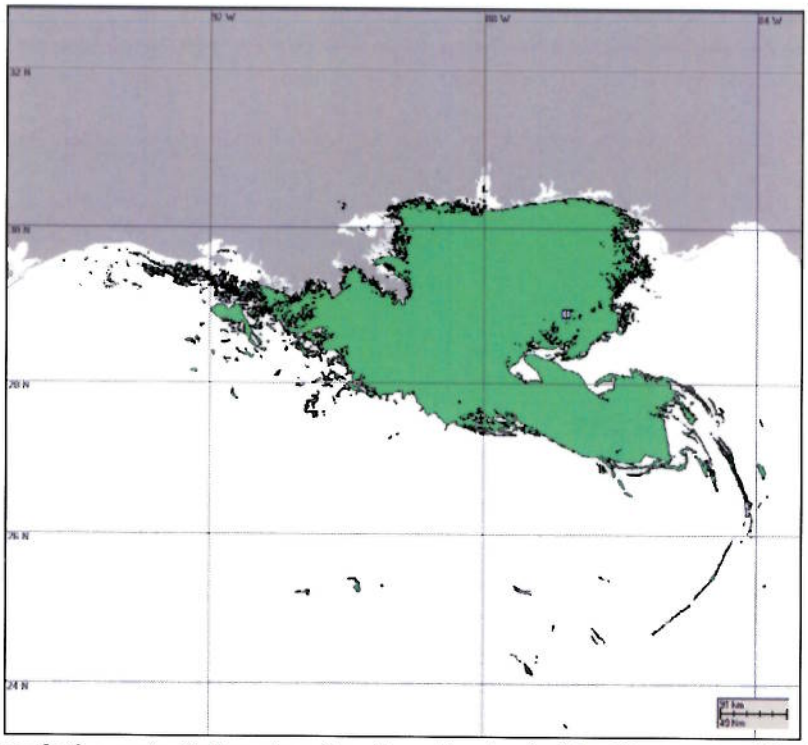

Figure 1. Cumulative potential surface floating oil extent of the Deepwater Horizon oil spill. (Figure derived from compositing April, May, June, and July 2010 radar shape files available on

the NOAA ERMA website. Note that radar images with noted anomalies were not included in composite.)

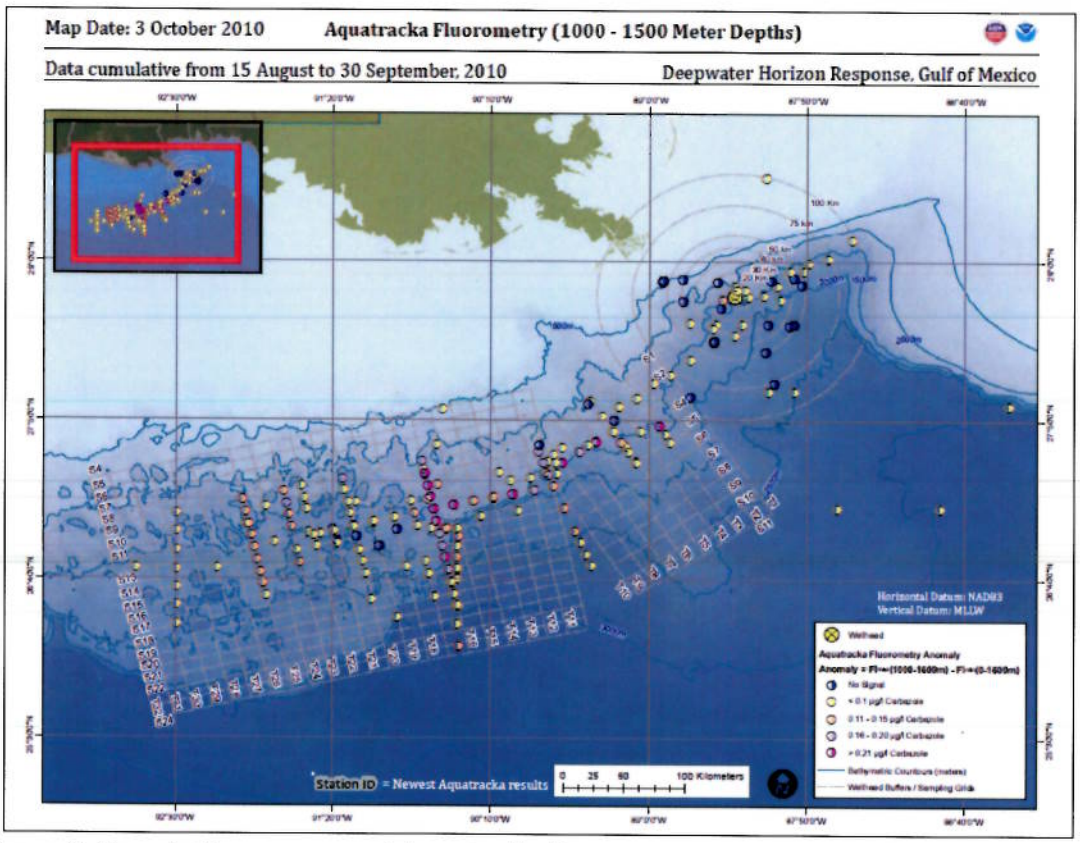

Figure 2. Cumulative summary of Aquatracka fluorescence measurements between 1000 and 1500m, 15 August to 30 September 2010.

Summary of Historical Data

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). Historical datasets for midwater nektonic communities in offshore slope areas of the northern Gulf of Mexico are limited. 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 SERPENT 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* summer 2011 sampling plan is an effort to address these data needs.

The need for and design of potential sampling in other years to provide additional quantitative information and to document the deep meso- and bathypelagic community composition and abundance remains to be determined. Previous to this plan, the NOAA Ship *Pisces* conducted a cruise from December 1-20, 2010, from March 22 – April 11, 2011, and from June 21 – July 14, 2011.

The primary objective is to collect fish and invertebrate samples using a midwater trawl net. The primary intended use of the resulting data is to fill existing data gaps on community characteristics to better inform biological inputs to models (e.g. SIMAP and COSIM) and other potential injury assessments. Sampling and analysis protocols have been developed for offshore stations in the 700m - 1400m depth range. In addition to trawling, the shipboard acoustics system will be running and collecting water column data for the entire cruise track. Also, if time permits (including during transits between stations and while transiting into and out of port), additional acoustic surveys near the wellhead area will be conducted (Attachment 7). 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.

Objectives and Approach: Deepwater Fish Sampling Plan

Herein, the deepwater fish and invertebrate summer sampling plan, to be performed on the NOAA Ship *Pisces* (Attachment 2), 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 coordination with members of the Fish Technical Working Group and the marine mammal TWG to ensure maximum comparability between sampling data sets collected by the different TWG efforts.

This plan will be implemented consistent with existing trustee regulations and policies. All applicable state and federal permits must be obtained prior to conducting work.

Attachments 13 and 14 provide SOPs for the protection and conservation of marine mammals and any species listed under the Endangered Species Act as appropriate for the vessel and sampling equipment operations to be conducted on this cruise. Marine mammal mitigation measures will be taken before and

during deployments of all gear types. Working in shifts, there will be two visual observers using big eye binoculars and two acoustic monitors using a towed acoustic array to monitor for the presence of marine mammals and listed species. Attachment 13 describes the specific mitigating procedures that will be taken and actions to be taken should species of concern be observed.

This particular effort is being developed as a cooperative program, but is ultimately Trustee-led as required by the Oil Pollution Act of 1990 (OPA) regulations. As such, these cruises will be led at sea by a Trustee-appointed Chief Scientist who serves as a Trustee representative. This Chief Scientist will work to ensure that cruise objectives are met and that time at sea is utilized efficiently for collecting information pertinent to the investigation. When not on duty, the Chief Scientist will designate a Watch Lead. This Watch Lead will also be a Trustee representative. The Chief Scientist may be supported on-board by a senior scientist appointed by the Responsible Parties. This senior scientist is to consult with the Chief Scientist on logistical and scientific matters, but ultimate decision making authority rests with the Chief Scientist. The Chief Scientist will also consult as needed with shore-side Trustee support (*i.e.*, Drs. French McCay, Hahn, and Quinlan).

The Captain and Chief Scientist will confer regarding the operational plan and schedule, and any changes to the plan or schedule that are required due to logistics, breakdowns or weather concerns. The Chief Scientist will be responsible for notifying the designated NOAA and RP leads regarding schedule changes, so that each lead may notify staff and adjust their respective staff mobilization schedules, as needed.

Methodology

Cruise Plan and Sampling Stations

The NOAA Ship *Pisces* will depart Pascagoula, MS on September 7, 2011 to primarily conduct deep midwater trawl sampling at offshore stations. Other sampling activities are planned in conjunction with the midwater trawl including CTD vertical profiling (conductivity, temperature, salinity, depth), acoustic data from the shipboard EK60 system, and acoustic sensor array (including imaging sonar) vertical profiling (time permitting).

Due to the locations where oil exposure may have occurred (Figures 1 and 2 show some of the areas where contaminants have been observed), there is a need to sample additional stations beyond the shelf region off the coast of Louisiana, Mississippi, Alabama, and Florida, including sampling locations routinely sampled by the SEAMAP program. The standard SEAMAP plankton sampling grid extends from the Texas shelf all the way to the Florida west coast shelf. The grid runs from the coast out to the 200 m bathymetric contour in the shelf waters of the gulf. Grid cells are 30 x 30 NM, with sampling stations located at the mid-point of each grid cell. For more detail on SEAMAP protocols, the annual SEAMAP environmental and biological atlas reports are found at: http://www.gsmfc.org/default.php?p=sm_ov.htm#:content@12:links@13.

In biological sampling plans implemented in the fall of 2010, winter 2011, and spring 2011 additional stations were added to the SEAMAP grid to help fill the data gap for sampling in the offshore areas near the spill (Figure 3, black dots). The extent of the offshore sampling grid is based on knowledge that currents and animal movements disperse water column biota widely in the northeastern Gulf of Mexico. In this work plan, a subset of the additional 46 deepwater stations added to the 2010 fall SEAMAP survey are targeted for midwater trawl sampling. As many of the deepwater stations as can be feasibly sampled in the ship-time available will be targeted. It is predicted that due to weather and travel time, the NOAA Ship *Pisces* will only be able to occupy 16 stations for the September Cruise (Figure 3, red dots). As such, this estimate is conservative; more stations in the grid can be picked up (B250, B185, B061, B065; weather and time dependent). In December 2010, midwater trawls were conducted at 11 of the deepwater

stations (Figure 3, red squares; gear loss prevented completion of all the intended sampling stations). In March of 2011, midwater trawls were conducted at 10 of the deepwater stations (Figure 3, red triangles; gear loss prevented completion of all the intended sampling stations). In June-July of 2011, midwater trawls were conducted at 10 of the deepwater stations (Figure 3, red circles).

These efforts have contributed to a growing volume of deepwater depth-discrete plankton and small nekton data in this region, which will better inform potential injury assessments. 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 previous midwater trawl cruises on the *Pisces* (December 2010, March-April 2011, and June-July 2011) and will target the 700 – 1400m depth range (stations for September 2011 are in Figure 3, red dots and Table 1). This array of 16 stations was selected for its geographic expanse across the region of interest and potentially exposed to MC252 oil, overlap with NRDA plankton sampling effort, and its high degree of overlap with the area sampled by the 2010 fall marine mammal survey (mid-water trawls 400-600m)(Figure 3, maroon dots). The stations to be sampled for the September survey correspond to those targeted in March-April and June-July 2011. This station array differs from the December 2010 cruise on the *Pisces*, in that station B250 located at 28° 00'00 N, 88° 30'00 W was removed due to potential gear hazards. In addition, three stations (B016, B246, B247) targeted in December 2010 were shallower than 700m and not actually sampled. This effort was reallocated in the March 2011 plan and this plan to deeper stations south of the well (i.e., B252, B082, B064, SW-5). Station SW-7 was also been added to the array because of increased days at sea for the spring and summer cruises. The September 2011 cruise stations will be sampled from the northeast to the southwest, subject to weather and logistical constraints (such as a need to return to port) that might dictate a more efficient sampling order.

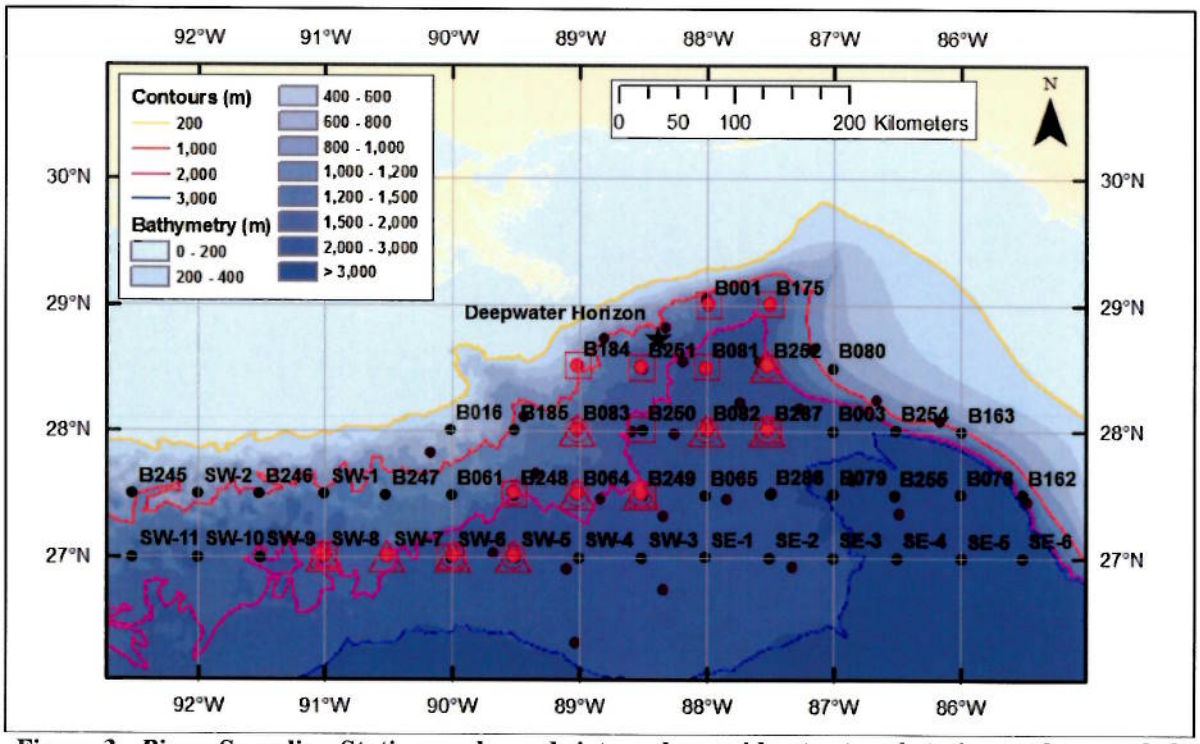

Figure 3. *Pisces* Sampling Stations - planned sixteen deep midwater trawl stations to be sampled during September 2011 (red dots), ten stations sampled in June-July 2011 (red circles), ten stations sampled in March-April 2011 (red triangles), eleven stations sampled in December 2010 (red squares), and all deepwater sampling stations targeted by the ongoing 1-m and 10-m MOCNESS

NRDA cruises (solid black dots). Maroon dots indicate stations sampled with the midwater trawl (400-600m) by the R/V *Gordon Gunter* Fall 2010.

Table 1. Coordinates of deepwater stations for the *Pisces* September 2011 Cruise. The last four stations (marked with a *) will only be sampled if there is sufficient ship time available after other (higher priority) stations are sampled.

Station Number	Longitude	Latitude
B001	88° 00'00	29° 00'00
B064	89° 00'00	27° 30'00
B081	88° 00'00	28° 30'00
B082	88° 00'00	28° 00'00
B083	89° 00'00	28° 00'00
B175	87° 30'00	29° 00'00
B184	89° 00'00	28° 30'00
B248	89° 30'00	27° 30'00
B249	88° 30'00	27° 30'00
B251	88° 30'00	28° 30'00
B252	87° 30'00	28° 30'00
B287	87° 30'00	28° 00'00
SW-5	89° 30'00	27° 00'00
SW-6	90° 00'00	27° 00'00
SW-7	90° 30'00	27° 00'00
SW-8	91° 00'00	27° 00'00
B250*	88° 30'00	28° 00'00
B185*	89° 30'00	28° 00'00
B061*	90° 00'00	27° 30'00
B065*	88° 00'00	27° 30'00

Sampling Procedures

Midwater Trawl: The midwater trawl net that will be used is similar in design to the Irish Midwater Herring Trawl (IMHT) used by NOAA NMFS Northeast Fisheries Science Center (NEFSC). Modifications of the original IMHT design include the use of polytron twine to create knotless webbing at the front of the net (to minimize drag) and a slight increase in taper throughout the body of the net. This net is a 4-seam midwater trawl designed for high tow speeds with minimal drag (tow speed 4 knots). The mesh size at the mouth of the net is 3.2m and gradually decreases down to 5cm at the last panel of webbing and codend. 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 Attachment 3.

Sampling will take place 24-hours a day. At each station there will be two daytime tows and two nighttime 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, in order to approximately center the sampling on noon and midnight, respectively. For the first tow the net will be deployed to a depth of 700m and slowly hauled up obliquely 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. Net depth will be determined using the vessel's third-wire system, which monitors depth in real time. The backup will be to use the trawl wire out/net depth relationships generated during the winter and spring *Pisces* cruises. Trawl wire out has been recorded from the wheelhouse during every tow, every ten minutes. These data are compared after each tow with net depth data determined during the tow using a time/depth recorder mounted on the trawl. Net depth vs. time has been plotted for every tow, and these plots are used by the *Pisces* crew to hit target depths as a function of wire out and ship's speed. Wire out versus time will continue to be recorded to assure target depth acquisition and fidelity. 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.

During net retrieval, the SeaBird TDR will be removed from the headrope. All available hands will be on the back deck, and will pick all organisms out of the net mesh as the net is retrieved. Picked specimens will be kept in buckets of cold water, as specimens from these depths are very fragile and degrade quickly. The cod-end catch will be deposited in a large plastic tote filled with cold water. Once in the *Pisces* wet lab, all buckets and totes will be sieved and combined into one large tray, with an adequate amount of cold water. Before any sorting is done a large label will be placed in the sample tray with the sample ID code in large print and a photo will be taken by a NRDA data manager. Once a photo is taken, the sample tray will be rough sorted into smaller, water-filled trays by major taxon (e.g., cephalopods, gelatinous zooplankton, pyrosomes, fishes by order). Organisms with positive IDs will be counted, weighed en masse, and entered into the Fisheries Scientific Computer System (FSCS, Attachment 4). Less obvious organisms will be identified to species or lowest possible taxon. All taxonomic identifications entered into the FSCS, whether to species or lowest possible taxon, are considered preliminary data and will be confirmed following data analysis procedures that will be described in a separate work plan.

After identification, counting/weighing, data entry and labeling, each abundant and/or large taxon will be bagged in perforated bags and kept in cold storage (45°F) until fixation. Perforated bags will be stored in a 5-gal bucket, one or more per tow (sample size dependent). Samples from more than one tow will not be stored in any single container. Smaller lots of identified taxa will be individually fixed in smaller jars. All specimens will be fixed in 10% (v/v) formalin/seawater solution (4% formaldehyde solution), buffered to neutral pH with sodium borate. The 5-gal buckets containing fixed samples will be kept in cold room until sample intake at dockside. 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.

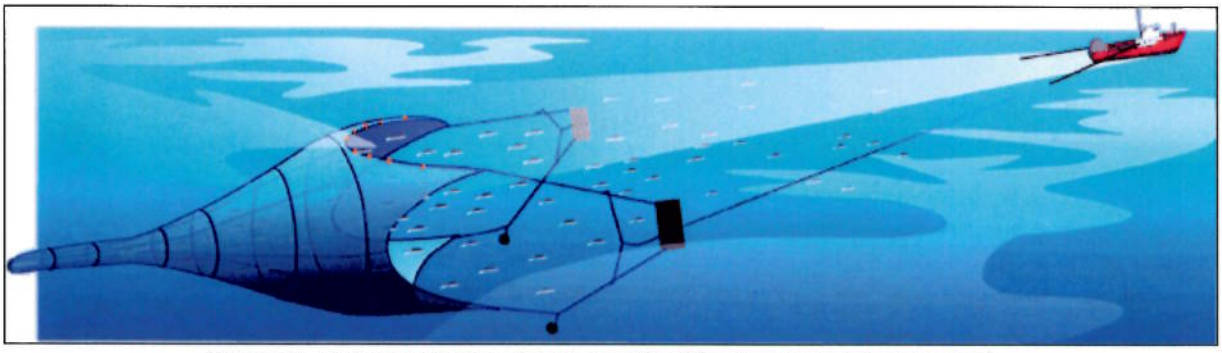

Figure 4. Schematic showing general midwater trawl deployment.

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 NOAA Ship *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 7. If time and cruise logistics allow, a set of transects will be run near the DWH well site operating the 18, 38, 70, 120, and 200 kHz transducers (see Attachment 7).

Raw acoustic data and sonar imaging data will be downloaded from the shipboard system or off of the appropriate sensors and onto an official NRDA hard drives and transported to the appropriate storage facility. The data will be controlled and managed by the trustees under project protocols, including Chain-of-Custody tracking of the hard drives. The hard drives will be kept in a secure facility in trustee custody. Future processing and analysis will occur at Dr. Kevin Boswell's laboratory at Florida International University (FIU). Processing, analysis, and reporting for all data types will be described and specified in separate work plans (currently under development).

Vertical Sonar Profiling: A DIDSON imaging sonar camera will be attached to the CTD rosette and deployed from the side of the vessel down to full ocean depth or the deepest depth sampled by CTD (see below). This sensor will be used to identify scattering sources of layers observed in fisheries echosounder data from survey vessel (Attachment 8). The DIDSON operates autonomously at 1.8 MHz and offers target size resolution between 2-5cm. The DIDSON has a 30° (horizontal) by 14° (vertical) field of view with an effective range of approximately 15m for nekton. This will provide additional data on size distribution and abundance, and has potential for identification purposes to general taxonomic groups for some fish species (i.e. family or genus). Data collected from the imaging sonar may then be used to better interpret the acoustic data from the shipboard scientific sonar system (e.g., Simrad EK 60s) and offer a quantitative estimate of in situ densities and length distributions for comparisons with direct capture in the midwater trawl net.

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

CTD casts will be performed at each station to the full water column depth for stations where the maximum net sampling depth is within 100 m of the sea floor (i.e., at stations with water depths < 1600 m). At stations with depths between 1600 and 2000 m, CTD casts will be performed to at least 1500 m and beyond to the greatest depth that is operationally appropriate. At stations with depths greater than 2000 m, CTD casts will be performed to at least 1500 m. The total depth of CTD casts may be decreased if there are time constraints that would potentially limit IMHT deployment at scheduled times.

In general, CTD casts should be conducted while the vessel is drifting. Because the midwater trawls are performed over a tow path, as opposed to at a single location, the objective is to characterize the water properties over the general area of the tow. The start and finish locations shall be recorded for both the down- and the up-cast of the CTD. Local conditions in sea state and operational areas will dictate if maintaining position with dynamic positioning (DP) is necessary. It should be recorded whether a cast was completed while drifting or under DP.

Data Management and Trustee Oversight
All profile, acoustic, and other electronic data (including photographs) will be saved to an on-board computer, and all data shall be migrated to a dedicated hard drive. The data will be controlled and managed by the trustees under project protocols, including Chain-of-Custody tracking of the hard drive. Data is generally organized by station and all electronic data files will be filed into this structure by NOAA NRDA data manager with the assistance of the operator/data logger. The hard drive will be duplicated in full immediately following the cruise, and the duplicate hard drives will be provided to (1) the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana, and to (2) Cardno ENTRIX on behalf of BP. The original hard drive shall be kept in a secure facility in trustee custody.

Under the direction of the Chief Scientist, a NOAA Data Manager on board each vessel will summarize sampling activities and scientific observations throughout the day and email a daily report to a designated list of recipients and NOAA NRDA (dwhnrdaWC@gmail.com) by midnight each day of the cruise.

By the end of the cruise, all documentation produced onboard, including COCs, field notes, sampling logs, sampling forms, photos, photo logs, ship logs, and GPS tracking shall be transferred to the NOAA NRDA Sample Intake Team following NRDA data management protocols. An identical copy of all documentation will be provided to LOSCO on behalf of the State of Louisiana, and to BP/Cardno ENTRIX at the end of the cruise. Attachment 9 contains additional details on the NRDA field sampler data management protocol.

Logistics

Vessel
Operations will be completed on the NOAA Ship *Pisces* (Attachment 2).

Personnel for NOAA Ship Pisces (15 Science Berths Available):
Dr. Tracey Sutton (VIMS, Chief Scientist; Lead Leg 1, Leg 1 only) – Deepwater Fish Taxonomy
Dr. Kevin Boswell (LSU) – Fisheries Acoustics
Dr. Jon Moore (FAU) – Fish Taxonomy/Ecology (Leg 2 only)
April Cook (VIMS, Lead Leg 2) – Fish Taxonomy
2 NRDA Data Managers
3 NRDA Field Samplers
Cardo ENTRIX Lead Scientist
Cardno ENTRIX Representative
4 Marine Mammals Observers
Paul Mercier – CSA Gear Specialist

NOAA Ship's Crew (commanding officer, mates, boatswain, engineer, deck hands)

NOAA Vessel Medical and Security Clearance Requirements
All cruise participants must fill out and are personally responsible for submission of the required NOAA medical and security clearance information included in Attachment 12. Instructions and appropriate parties to contact are indicated. Requirements for these clearances include a tuberculosis test, a FBI full background check, and fingerprinting. Medical and security forms must be submitted a **minimum** of two weeks prior to the cruise departure date.

Budgeting
The Parties acknowledge that this budget is an estimate, and that actual costs may prove to be higher. 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. The field survey costs, miscellaneous costs, and contractor costs indicated in Budget Chart # 1 below shall be reimbursed by BP upon receipt of written invoices submitted by the Trustees.

Budget Chart #1: Total Estimated Costs.

NOAA OMAO Costs	**Days**	**Day Rate**	**Total**
NOAA Pisces Ship Costs	25 (21 DAS, + 4 Staging/Destaging)		$665,931
NOAA NRDA Costs	Days	Day Rate	
NOAA Contractor Labor (days):			
Dr. Tracey Sutton (VIMS) and Dr John Moore (FAU)	25	2,000	$50,000
Dr. Kevin Boswell	25	2,000	$50,000
April Cook – Fish Taxonomist	23	2,000	$46,000
2 NRDA Data Managers	21	1,500	$63,000
3 NRDA Oceanographic Samplers	21	1,500	$94,500
2 Marine Mammal Observers	21	1,500	$63,000
2 Marine Mammal Acoustic Monitors	21	1,500	$63,000
NRDA Mobilization Costs:			
Equipment Shipping			$5,000
Misc Costs, Sample Handling			$13,000
DIDSON Equipment rental/insurance	25	500	$12,500
2 BP Representatives (Cardno Entrix)			Provided elsewhere
1 BP Representatives (CSA)			Provided elsewhere
TOTAL			$1,089,931

Budget Chart #2: Breakdown of NOAA OMAO Costs.

Item	**Operations = 21**	**Staging = 4**
Vessel Base Pay (17)	$55,383	$10,549
Wage Marine Overtime	$75,726	$9,980
Employer Surcharge - 31%	$17,169	$3,270
NOAA Corps Officer Salaries	$18,292	$3,484
NC Special Pay/Benefits	$8,060	$1,535
NOAA Overhead Rate (22.07%)	$15,127	$2,881
NOAA Line Office Overhead Rate (8.60%)	$5,894	$1,123
NOAA FMC Rate (0.0%)	$-	$-
GSA Rent Reimbursable Rate (9.00%)	$6,169	$1,175
Maintenance surcharge	$103,950	$-
Food/Supplies/Services	$84,966	$574
Fuel ($3.85/gal); 2400 gal/day	$194,040	$-
MOC Shoreside Support (112.3%) of WM and NOAA Corps Labor costs	$82,737	$15,759
Total:	$667,513	$50,331
Grand Total:		**$717,843**

Budget Chart #3: Approximate replacement costs for NOAA gear.

Approximate NOAA gear replacement costs	Cost
2 DIDSON battery bottles	$10,000

Safety Plans

BP's full operations and safety plans are attached as appendices. A HASP binder is provided to each vessel. In addition, the NOAA incident site safety plan (which all NOAA employees and contractors must sign prior to the cruise) is attached (Attachment 1). Vessels will adhere to current offshore vessel reporting regulations (Attachment 5). Vessels will report in daily using the attached situation report (Attachment 6).

Laboratory

Mid-water trawl samples will be transported under NOAA NRDA Chain of Custody to Dr. Tracey Sutton's laboratory at Virginia Institute of Marine Science (VIMS) College of William and Mary, VA where they will be stored in a secure facility. Later sample processing in lab will involve further sorting, taxonomic identification/verification, and species counts. Length/weight regressions will be generated for all major taxa, with correction for formalin effects (see Sutton and Hopkins, 1996). Detailed description of analyses to be conducted on samples will be specified in a separate workplan (currently under development). We expect thast the fall 2011 Meso- and Bathypelagic Fish (Pisces Midwater Fall 2011) samples are to be analyzed after several cruises prioritized before this cruise, i.e., the Pisces Midwater June 2011 (Summer), Meg Skansi MOC 10 Spring 2011, Pisces Midwater Dec 2010 (Winter), Pisces Midwater March 2011 (Spring), and Meg Skansi MOC 10 Summer 2011 cruise samples. Thus, we expect reporting of the Pisces Midwater Fall 2011to be provided in about 14 months.

Sample Retention

All materials associated with the collection or analysis of samples under these protocols or pursuant to any approved work plan, except those consumed as a consequence of the applicable sampling or analytical process, must be retained unless and until approval is given for their disposal in accordance with the retention requirements set forth in paragraph 14 of Pretrial Order # 1 (issued August 10, 2010) and any other applicable Court Orders governing tangible items that are or may be issued in MDL No. 2179 IN RE: Oil Spill by the Oil Rig "DEEPWATER HORIZON" (E.D. LA 2010). Such approval to dispose must be given in writing and by a person authorized to direct such action on behalf of the state or federal agency whose employees or contractors are in possession or control of such materials.

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 Cardno ENTRIX on 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 Cardno 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, after which time the validated/QA/QC'd data shall be made available simultaneously to all trustees and BP (or Cardno ENTRIX on behalf of BP). Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Analytical Quality Assurance Plan 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. The LADP shall not be released by the DMT, LOSCO, BP or Cardno 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 Cardno 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. NRDA_Ops_Safety_Plan_08DEC2010
Attachment 2 NOAA Research Vessel *Pisces* Brochure
Attachment 3. Mid Water Trawl Net Specifications
Attachment 4. Shipboard Meso- and Bathypelagic Specimen Processing
Attachment 5. SIMOPS Procedures for the NRDA Scientific Fleet
Attachment 6. DWH Vessel Daily SitRep.pdf
Attachment 7. Fisheries Acoustic Data Collection
Attachment 8. Vertical Sonar Image Collection
Attachment 9. NRDA_Field_Sampler_Data_Management_Protocol_10_23_2010
Attachment 10. MC252 HSSE Incident Reporting Final 02 May 10 rev 1
Attachment 11. Deep Tow Guidelines
Attachment 12A&B. NOAA Ship_Medical and Security Clearance Instructions and Forms
Attachment 13. Mid-water trawl sampling mitigation measures_summer&fall cruises
Attachment 14. Protected Species Interaction Prevention Procedures for No-impact Gear Types
Attachment 14A. NMFS Protocol for Dead Entangled Small Cetaceans
Attachment 14B. Sea Turtle Retrieval Resuscitation Protocols
Attachment 14C. Turtle Stranding Report Forms_STSSN
Attachment 14D. Vessel Strike Avoidance Guidance February 2008
Attachment 14E. 201106016_Final acoustic measures_NRDA BMPs.pdf

Deepwater Horizon Oil Spill (DWHOS)
Water Column Technical Working Group

NRDA Offshore Deep Meso- and Bathypelagic Fish Sampling Plan
September 2011

Sampling Vessel: NOAA Ship *Pisces*

Cruise Dates: September 7 – 27, 2011

Plan Date: September 2, 2011

Approvals

Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Each party reserves its rights to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

	Printed Name	Signature	Date
BP Approval	Lawrence Mahnor		Sept 23, 2011
Federal Trustee Approval	Jessica White For Lisa DiPinto	Jessica White	9/22/2011
Louisiana Approval	[illegible]	For Roland Guidry	10/31/2011