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

NRDA Summer 2011 Plankton Imaging Sampling Cruise Plan

Sampling Vessel: R/V *McArthur II*

June 16, 2011

Prepared by:
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Reviewed by:
Dan Hahn, on behalf of NOAA
Amanda Vincent, on behalf of Louisiana
William Graeber, Amy Piko, Jeffrey Simms, Julie Keister, Mark Benfield (Cardno ENTRIX) and Joyce Miley (BP) on the behalf of BP.

Proposed Cruise Dates
Leg 1: June 12 – 30, 2011
Leg 2: July 18 – 31, 2011
Leg 3: August 21 – September 2, 2011

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 nor is BP endorsing the full geographic extent of sampling or the rationale provided for it.

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, flocculated 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 meso-pelagic waters of the offshore Gulf of Mexico.

<u>Routes of Exposure</u>
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.

Plankton in the northeastern Gulf of Mexico, which include early life history stages of fish and invertebrates, as well as smaller invertebrate holo-plankton and gelatinous zooplankton, are among those biota exposed to the released oil and spill-related chemicals. Planktonic 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 using radar data, which indicates some areas potentially affected by floating oil. 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 conducted).

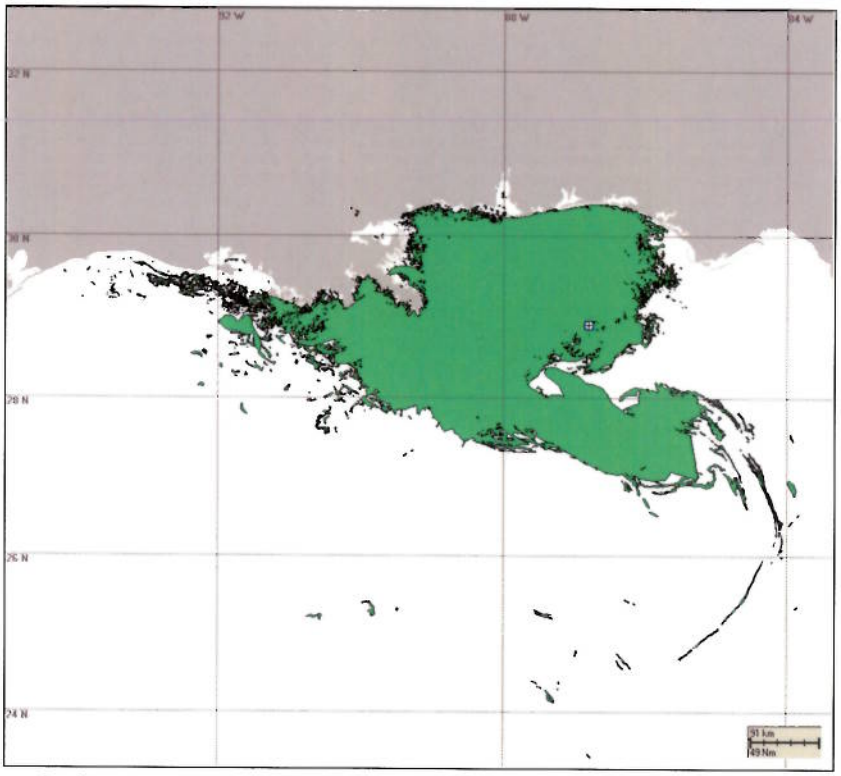

Figure 1. Cumulative potential surface floating oil extent of the Deepwater Horizon oil spill. (Figure derived from compositing April, May, June, and July 2010 radar shape files available on the NOAA ERMA website. Note that radar images with noted anomalies were not included in composite.)

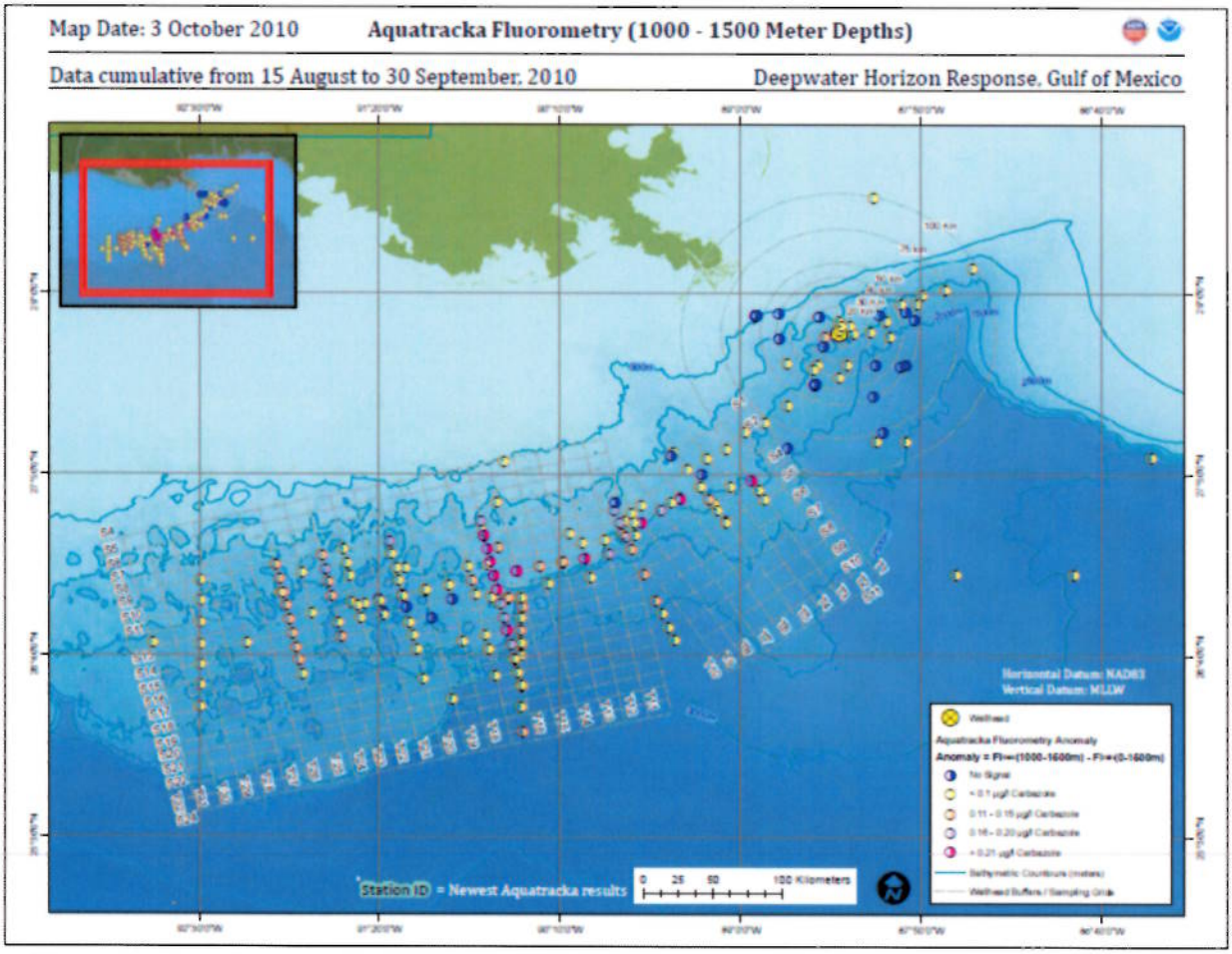

Figure 2. Cumulative summary of Aquatracka fluorescence measurements between 1000 and 1500m, 15 August to 30 September 2010.

Objectives and Approach

This plan is part of a series of cruises scheduled for the summer of 2011 intended to evaluate the distribution and densities of ichthyoplankton, other zooplankton and some phytoplankton (> ~50μm) in Gulf of Mexico waters potentially affected by the Deepwater Horizon Oil Spill (DWHOS) and in surrounding areas. Plankton in the upper 200m of the water column of the Gulf of Mexico off of Texas to Florida have been sampled by the NMFS/NOAA SEAMAP program over the past 25 years (Attachment 9). The overall NRDA plankton sampling plan takes advantage of this historical data set and plans for continuation and extension of the NMFS Southeast Fisheries Science Center (SEFSC) SEAMAP program into deep water areas where the spill took place.

The existing data that describe plankton distributions in potentially affected areas in the deep-water offshore are less extensive than data available for the shelf areas. First, the composition and density of plankton in the vicinity of the MC252 incident and the subsequent areas of impact have not been quantified in detail, especially in the deep-water areas surrounding the release site. Second, vertically stratified sampling in the upper water column is limited. Other data gaps include the underrepresentation of soft bodied organisms and marine snow in net-based surveys. Soft-bodied organisms and marine snow are thought to be important components of the offshore pelagic food web. A series of cruises in the fall of 2010 (aboard *Walton Smith* and *HOS Davis*) targeted these data gaps through the deployment of the color

digital-autonomous video plankton recorder (DAVPR). Comparative studies between plankton imaging systems and traditional net-based sampling techniques have been carried out by various investigators (i.e. Broughton and Lough, 2006). These studies have shown the advantages and limitations of imaging systems. For example fragile organisms and particles such as small gelatinous organisms and marine snow are easily identified and quantified using imaging systems, whereas these delicate groups are destroyed or damaged beyond recognition in net samples. On the other hand, net sampling provides specimens which may be examined in detail to confirm taxonomy. Thus, a combination of approaches is important to this or any plankton program.

This plan, the *McArthur II* plankton imaging sampling plan, describes the sampling effort for summer 2011. The primary activity of these cruises is to collect plankton image data using the In Situ Ichthyoplankton Imaging System (ISIIS) (Attachment 11). The objective of these ISIIS surveys is to assess the degree of patchiness at scales not resolved by sampling on the 30 nautical mile SEAMAP grid. Continuous, spatially-structured, along-track data will be collected with ISIIS, thus affording a level of analysis of spatial resolution much finer than that based solely on net sampling. The occurrence, abundance, biomass, and vertical distribution of plankton and marine snow in the Gulf of Mexico will be assessed. These data will help characterize the horizontal and vertical spatial scales of patchiness for zooplankton and ichthyoplankton distributions in the study area.

ISIIS uses a line scan camera system to continuously image a large, undisturbed sample volume (~140 L/sec) and can resolve mesoplankton (e.g. gelatinous organisms, zooplankton, and ichthyoplankton in the mm to several cm range). ISIIS differs from DAVPR, and VPRII in that it resolves larger organisms and samples a larger volume, thereby having the capacity to quantify relatively rare plankton such as larval fish. The data set from ISIIS will complement the current NRDA plankton imaging and net sampling effort. Because plankton are transported over wide areas, and populations are connected across the northern Gulf of Mexico, sampling plans need to be broad in geographic scope. The over-arching plankton plan is to conduct sampling in each season, utilizing several sampling methods (e.g. MOCNESS, bongo net, neuston net, and imaging systems). The duration of the program with respect to the number of years of monitoring is yet to be determined.

This particular effort is being developed as a cooperative program, but is ultimately Trustee-led as required by 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. They will discuss operational issues with the Responsible Party lead, as appropriate. 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.

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.

Attachment 8 provides 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.

Methodology

Sampling Stations

This cruise has three primary goals which will help to define the spatial distribution and abundance of planktonic organisms and assist in understanding the potential exposure of planktonic organisms to oil:

1.) Identify the broad to finescale vertical and spatial patchiness of mesoplankton from open water (pelagic) onto and across shelf environments,
2.) Identify the finescale horizontal patchiness of shallow mesoplankton within both open (pelagic) water and shelf environments, and
3.) Identify the finescale diel vertical distribution of mesoplankton in both open (pelagic) water and shelf environments.

If time and conditions allow, patchiness associated with Langmuir cell (wind generated) circulation will also be evaluated. The sampling design and transect layout is intended to meet the three primary objectives.

The sampling areas are to be located as follows: one transect to the west of the Mississippi Delta, and three transects to the east, one of which transits near the MC252 well site (see Figure 3). A combination of sampling protocols (see below) will be completed in each area.

1. **Cross-isobath long transects** – To address Objective 1, four (4) transects will be sampled approximately perpendicular to bathymetric contours traversing deepwater, slope and shelf environments within the sampling area. Transects are planned to be approximately 144 km (80 nm) in total length (corresponding to two 8-hr image collection times; 8 hours of recording being the hard drive capacity of the shipboard computers communicating with and recording ISIIS data). The standard spacing between SEAMAP plankton stations is 30 nm apart, therefore the two central transects will span across three grid nodes providing continuous plankton data between them. Sampling will be conducted on the inshore half of each transect initially, followed by sampling of the offshore portion – to minimize temporal aliasing (i.e., different times of day) of sampling within each of the various depth-related water masses sampled. Each transect portion will be sampled during the same time period (i.e., 0800-1600 hrs) to avoid any aliasing due to changes in vertical (e.g., light-linked) distributions and processes.

   ISIIS will be undulated between the surface (~ 1m) and a depth of 120 m (or within 10 m of the bottom if the water column is shallower than 120 m). This maximum depth is based on a review of existing hydrographic data and a consideration of the logistics of the cruise. A review of CTD cast data from ongoing cruises indicates that this sampling program will generally be capable of collecting data through the subsurface chlorophyll maximum as well as through most of the water column exhibiting the sharpest density gradients (i.e., ISIIS will sample through the majority of the thermocline).

   The typical time to descend to 120 m (or ascend) is ca. 6.7 min, corresponding to a vertical rate of change of 0.3 m/sec and a horizontal distance of 1.0 km (0.6 nm) –or- a total of 2 km for a full down/up towyo. Travel distance is half (1000 m) that for a 50 m depth towyo (i.e. the mean towyo depth over the shelf). Therefore, over the full 144 km transect, we anticipate

ca. 108 undulations (accounting downcast and upcast). Transects may be longer if data storage capability can be increased and if time allows.

2. **Star pattern horizontal sampling** - To address Objective 2, a series of short ~12km transects will be conducted during daylight hours in two areas (shelf and slope waters) (Figure 3). These short transects will be arranged in a 6-point star pattern (i.e., 2 overlapping triangles) to provide data on horizontal spatial scales in a variety of orientations (i.e., not only across bathymetric contours). ISIIS will survey at three narrow depth ranges (5-10 m, 15-20 m, and 60-70 m in deep enough water) or will otherwise target depths based on avoiding hazards, consideration of shallower water depths than the indicated targets depths, vertical maxima of plankton densities observed, or to be similar to prior ISIIS transects (i.e., on Legs 2 and 3 after establishing depth zones in Leg 1). The primary goal of this component is to develop higher-resolution measures of fine-scale horizontal patchiness than other sampling designs address.

3. **Diel vertical migration (DVM) sampling** – To address Objective 3 – at two (2) selected sites – one inshore and one offshore (see Figure 3), ISIIS will be deployed and towed along two short transects (~ 10 km long – and <1 km apart) repeatedly. Two of these DVM studies will start at ca. 4 hours before sunset and continuing for 4 hours after sunset (e.g. 1600-2400 hrs), two will be centered on the sunrise hour, thereby capturing both dawn and dusk DVM patterns (one each at the inshore and offshore sites). Offshore, ISIIS will be undulated from the surface to 100 m continually along this route – at the vertical rate of change rate (0.3 m/sec) there will be ca. 6 complete undulations per 10 km transect (for a total of 40 during the eight hour experiment – 24 pre-sunset (sunrise), 24 post-sunset (sunrise)). Twice the number of undulations will be completed in the shallow water environment, assuming a typical undulation depth of 50 m. If located in an area of strong currents (e.g., >25 cm/sec ~ 0.5 kt), we will deploy a surface drifter (with strobe light and radar reflector, drogued to 15 m) to allow transects to translate along with the current field to maximize sampling within the same water parcel during each 'experiment'.

All ISIIS sampling will be conducted in combination with acoustics (EK60 with 38, 120, and 200 kHz transducers) and an ADCP. A limited set of 1 m^2 MOCNESS tows will also be conducted to directly groundtruth acoustic and ISIIS observations. The MOCNESS sampling will cover the same depth range as the ISIIS sampling, and be co-located as close as possible in time and space.

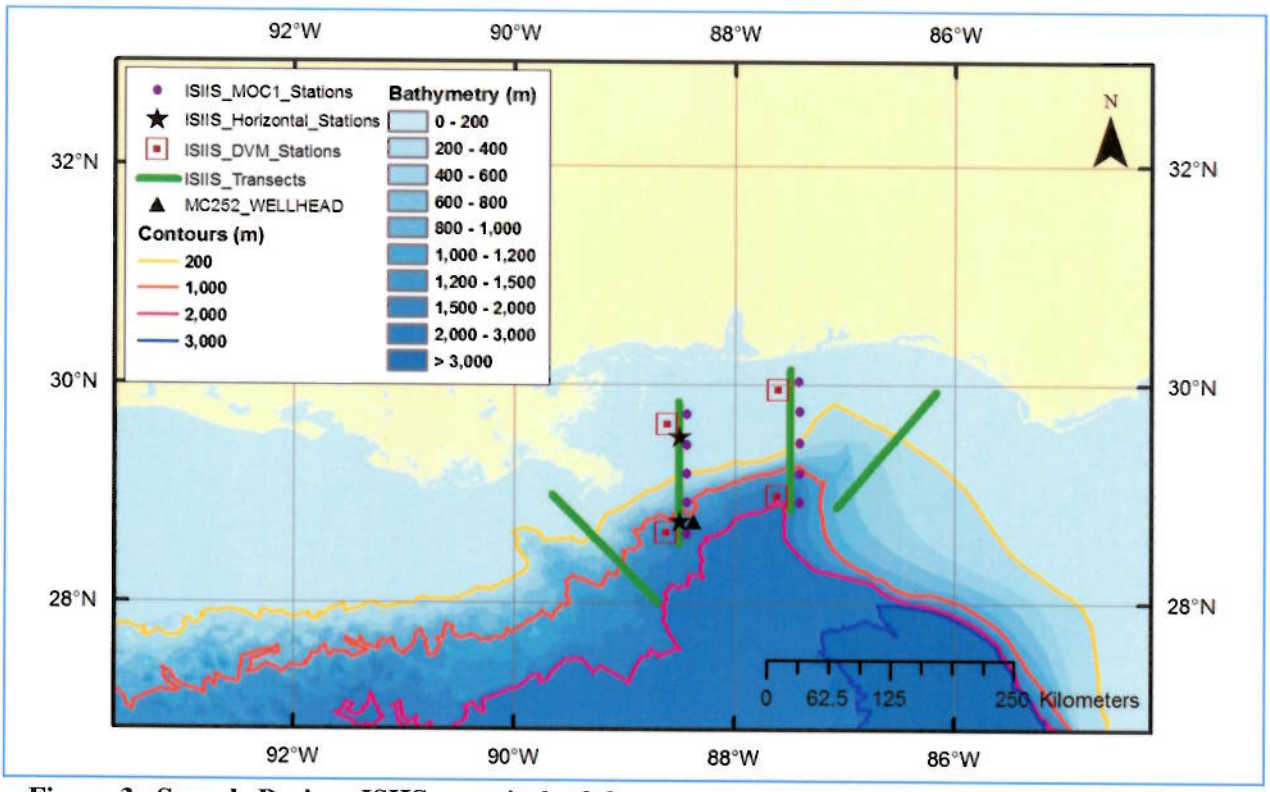

Figure 3. Sample Design: ISIIS cross isobath long transects (green lines) across shelf, slope and offshore habitats. Finescale horizontal sampling 'stars' (black stars) located in both shelf and offshore pelagic habitats (symbols are not to scale). Diel vertical migration (DVM) stations (dark red boxes) are positioned at two shelf and two offshore pelagic locations. (Note – planned DVM studies will be repeated at the DVM sites along Transect 2 (sunrise and sunset); the two DVM sites located along Transect 3 are alternates).MOCNESS stations (purple circles) are located along two ISIIS transects (5 per transect). Location of the DWH well is noted with the black triangle.

Sampling Procedures

ISIIS: In Situ Ichthyoplankton Imaging System (ISIIS) will be used to survey the distribution of plankton and marine snow (Dr. Robert Cowen, UMIAMI). See Attachment 11 for a description of the instrument, specifications, and deployment procedure. The ISIIS can be deployed off the side or the stern of the research vessel. It is equipped with fins that will guide it to the starboard side of the vessel, and out of the ship's wake; thus, stern deployment is possible. ISIIS undulates through the water column in a tow-yo or saw-tooth profile pattern. It is capable of reaching a depth of 200 m, so it can be towed from 0 m to a maximum depth of 200 m. See the above section "Sampling Stations" for the depth ranges to be targeted by ISIIS sampling. ISIIS is fitted with a suite of environmental sensors that record simultaneously with the imaging. These sensors include: temperature, conductivity (salinity), downwelled light (photosynthetically-active radiation, PAR), fluorometry, and dissolved oxygen. ISIIS deployment will require day and night operations.

1-m MOCNESS: To aid interpretation of ISIIS observations, a limited set of 1 m^2 MOCNESS tows will be conducted on a second vessel (*M/V Nick Skansi)* in order to collect biological samples during the same photoperiod and as close in time and space to ISIIS sampling as safely and logistically feasible. This activity will be coordinated between the Chief Scientists (Cowen and Pierson) of the vessels with

assistance from Trustee and RP shore-side support. In addition, within no more than 8 hours of ISIIS sampling runs along targeted transects (see Figure 3), MOCNESS samples (1 m^2 MOCNESS; 333 µm mesh nets) will be taken at five stations evenly spaced along two of the ISIIS cross isobath long transects. It is important that these 1 m^2 MOCNESS samples be collected in close temporal proximity to the ISIIS samples – as they will be used primarily for corroboration of density estimates provided by ISIIS. Further, these samples will provide larval fish (and other dominant zooplankton taxa) samples for ID verification purposes (i.e., to verify ISIIS fish IDs).

As these net tows are explicitly designed for comparison to ISIIS sampling, each tow will be sampled to a maximum depth (equal to the ISIIS depths at location) not to exceed 120 m. A total of five nets will be used for each tow: one open for descent (zero net) and 4 nets opened sequentially during retrieval with equal depth bins. For MOCNESS deployment and sample handling protocols see Attachments 12 and 13.

CTD: A Seabird CTD profiling package will be deployed at the beginning and end of each ISIIS and prior to each MOCNESS deployment to ~200 m or to ~10m above the seafloor (whichever is shallower) with the available sensors:, chlorophyll fluorometer,,, and salinity, temperature, and depth information (i.e., pressure). Water samples will be taken for chlorophyll analysis (Attachment 14) to characterize the pycnocline and chlorophyll maximum (i.e., samples will be taken above, below, and in the peak of the chlorophyll maximum).

In general, CTD casts should be conducted while the vessel is drifting. Because the plankton tows are performed over a tow path, as opposed to 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.

Acoustics: The SIMRAD EK60 scientific echosounder system will be used to collect data on acoustic backscatter in the water column. The R/V *McArthur II* has a suite of transducers operating at 12 kHz, 38 kHZ, 120 kHz and 200 kHz frequencies. Acoustic data will be collected throughout the cruise during all sampling. The purpose of the acoustic surveys is two-fold: (1) collection of bathymetry data to understand seafloor morphology and plan sampling depths, and (2) potential identification of backscatter anomalies in the water column that may indicate biota. For a further description of acoustic data collection including a deep water collection SOP, please see Attachment 10.

ADCP: While sampling, a 75kHz ADCP will be continuously collecting data. This ADCP is hull mounted. The ADCP measurements, in combination with CTD information, will provide measures of water column shear and stability.

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 sampling 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 duplicates of the hard drive 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 ([redacted]) 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 BP/Cardno ENTRIX at the end of the cruise.

Logistics

Vessel

Operations will be completed in three separate legs on the R/V *McArthur II*, currently operating out of Pascagoula, MS.

Personnel for R/V* McArthur II *(13 Science Berths Available):

NOAA Contractors:

- Dr. Robert Cowen, Chief Scientist
- 5 UMIAMI Technicians and Graduate Students
- 2 NOAA Data Managers (Dade Moeller)

Cardno ENTRIX Employees:

- 2 Representatives

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 increased cost in addition to a revised budget will be provided for BP's consideration and review.

Budget Chart #1-Cost includes all three legs of cruise.

Field Survey Costs	Hrs/Days/Trips	Day/Hr Rate	Total
NOAA Vessel Cost			$1,258,170
NOAA Contractor Costs:			
Science Team			
Dr. Robert Cowen and Technicians	[redacted]		105,000
Equipment Rental (ISIIS)	46 Days	$2,612/d	120,152
Travel			11,000
Indirect Cost [redacted] **MTDC)**			**63,791**
2 NRDA Data Managers	[redacted]	[redacted]	69,000
TOTAL			**$1,690,349**

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 4). Vessels will call into SIMOPS based on the current regulations (Attachment 5). Vessels will report in daily using the attached situation report (Attachment 6).

Laboratory
Samples will be transferred, and held under NOAA NRDA chain of custody. Electronic data will be held at Dr. Robert Cowen's laboratory at the University of Miami. MOCNESS samples will be processed in the laboratory of Dr. Robert K. Cowen. When sample processing is complete, all samples will be transferred (under NOAA NRDA chain of custody) to Dr. Malinda Sutor of the Department of Oceanography and Coastal Sciences of Louisiana State University for any further processing and storage. All samples will be stored in a secure facility. Samples will be processed in theses labs and data distributed as described in a separate workplan (currently under development).

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).

Attachments

Attachment 1. NRDA_Ops_Safety_Plan_08DEC2010
Attachment 2. MC252 HSSE Incident Reporting Final 02 May 10 rev 1
Attachment 3. NRDA SIMOPS Procedures 111710
Attachment 4. DWH Vessel Daily SitRep
Attachment 5. MC252 Analytical QAP V2.2 Final
Attachment 6. NRDA_Field_Sampler_Data_Management_Protocol_10_23_2010
Attachment 7. NOAA Ship Medical and Security Clearance (A&B)
Attachment 8. Protected Spp Interaction Prevention Procedures-for No-Impact Sampling Gear 2011Apr16
Attachment 9. Summary SEAMAP Historical Data_2011Apr2
Attachment 10. Acoustic Data Collection EK60-2011Apr15
Attachment 11. ISIIS instrument specifications
Attachment 12. MOC1_Sampling_Protocol
Attachment 13. MOC1_deployment_Protocol
Attachment 14. WholeWaterSampling&Chlorophyll
Attachment 15. Liquid Nitrogen Protocols

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Leg 1: June 12 – 30, 2011
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Plan Date: June 16, 2011

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	Lawrence K. Mahar Printed Name	 Signature	Jan 30, 2012 Date
Federal Trustee Approval	Lisa D. Pinto Printed Name	 Signature	6/27/11 Date
Louisiana Approval	RANDOLPH D. BRUSS CITEAU Printed Name	FOR ROLAND GUIDRY Signature	2/15/2012 Date