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

NRDA Spring 2011 Water Column Processes Cruise Plan

Sampling Vessel: M/V *Walton Smith*

Originally Submitted: April 12, 2011
Revised: December 12, 2012

Prepared by:
Deborah French-McCay (ASA), Malinda Sutor (LSU), Eileen Graham (ASA) on behalf of the Trustees
Reviewed by:
NOAA: Dan Hahn, John Quinlan (NOAA), Jamie Holmes (Stratus Consulting)
Louisiana: Amanda Vincent (LDEQ)
BP: William Graeber and Jeffrey Simms (Cardno ENTRIX) on behalf of BP

Cruise Dates
April 19 – May 28, 2011

Leg 1: April 19-May 1 (12 days)
Leg 2: May 3-May 15 (12 days)
Leg 3: May 17-May 28 (11 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 meso-pelagic 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 conducted).

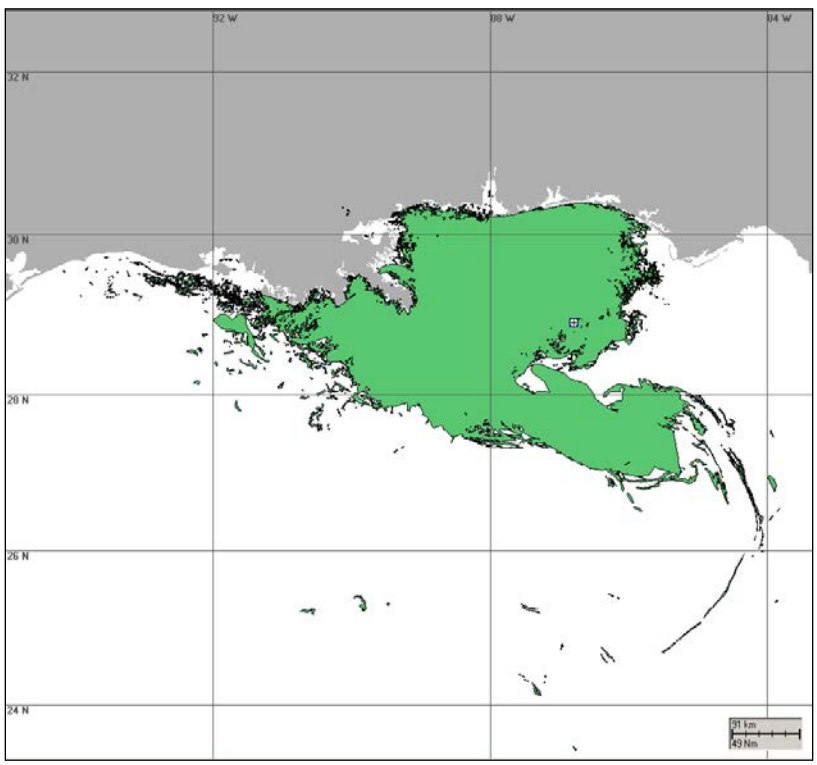

Figure 1. Cumulative potential surface floating oil extent of the Deepwater Horizon oil spill. (Figure derived from compositing April, May, June, and July 2010 radar shape files available on the NOAA ERMA website. Note that radar images with noted anomalies were not included in composite.)

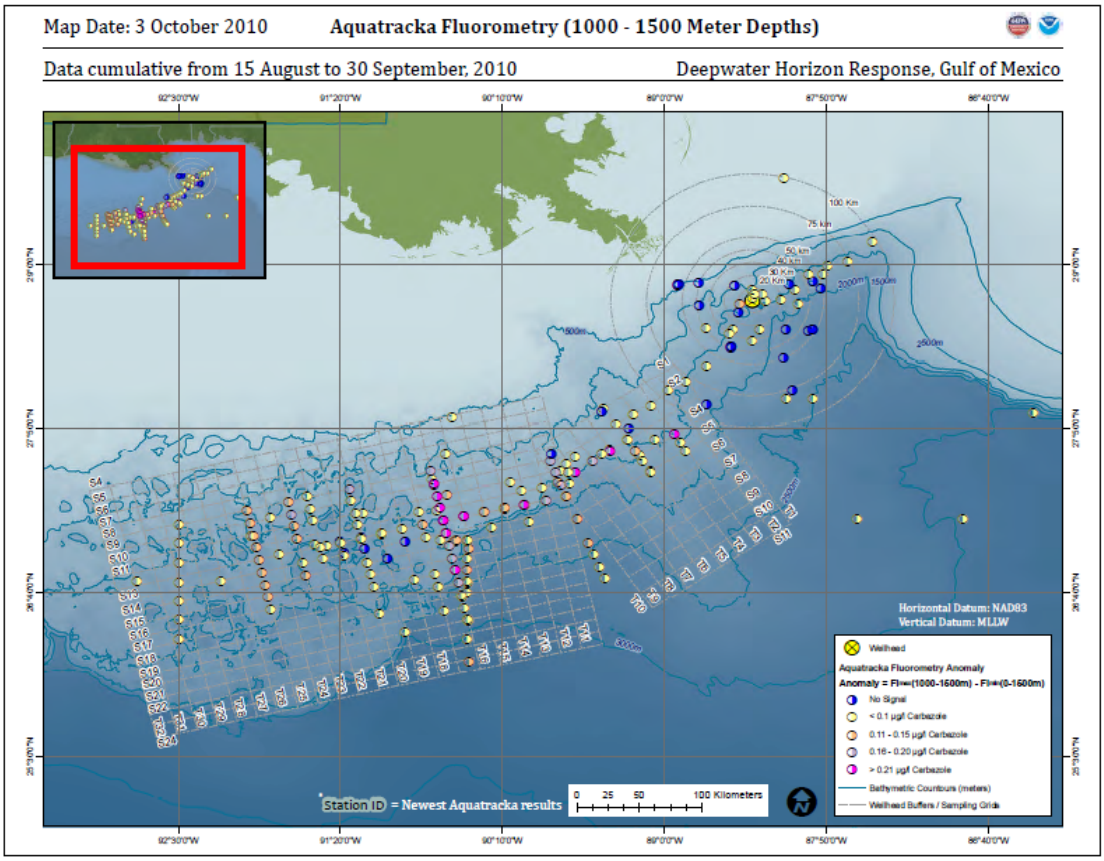

Figure 2. Cumulative summary of Aquatracka fluorescence measurements between 1000 and 1500m, 15 August to 30 September 2010.

Objectives and Approach

This plan, also called the *Walton Smith* 4 plan, is part of a series of cruises scheduled for the spring of 2011 to evaluate the distribution, densities, movements and trophic transfer rates of plankton and particulate organic matter in Gulf of Mexico waters potentially affected by the Deepwater Horizon Oil Spill (DWHOS) and in surrounding areas. Plankton in the upper 200 m 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; see also annual SEAMAP environmental and biological atlas reports at: http://www.gsmfc.org/default.php?p=sm_ov.htm#:content@12:links@13.). The overall NRDA plankton sampling plan is designed to take advantage of this historical data set by continuing and extending the NMFS SEAMAP program into deep water areas where the spill took place.

A series of cruises in the fall of 2010 (aboard *Walton Smith* and *Nick Skansi*), the winter of 2011 (on *Nick Skansi* and *Meg Skansi*), and the spring of 2011 (on *Nick Skansi* and *Meg Skansi*) targeted 30-46 deepwater stations in the northeastern Gulf of Mexico. Stations to be sampled as part of this cruise plan correspond to some of the locations sampled during the 2011 winter and spring 1-m^2 and 10-m^2 MOCNESS cruises (which correspond to those sampled on the 2010-2011 SEAMAP Plankton survey cruises). The objectives of this work include the determination of important rate constants (bacterial production, primary production, respiration, microzooplankton grazing) that could be used in food web evaluations and/or models. The sampling during this cruise will also produce data useful for gear comparisons (optics, acoustics, and net collections), as well as provide detailed estimates of the vertical distribution of plankton.

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 14 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

Overview

A series of stations have been selected that are near plankton monitoring stations. Each station is to be occupied for approximately 72 hours. In that time the following operations will be conducted: day and night plankton surveys with multiple frequency acoustics, water sampling of biota and nutrients, image-forming optical systems (DAVPR and FlowCAM), and a 1-m^2 MOCNESS; along with CTD casts and on-board incubations to measure bacterial production, primary production and respiration, and microzooplankton grazing. The water collections for the incubations will be determined from the CTD profiles, focusing on key depths in the epipelagic zone as well as any observed peaks in Aquatracka fluorescence or relative lows in CDOM fluorescence at depth.

Sampling Stations

There are three cruise legs of 11-12 days duration totaling 35 days at sea. Each station involves 3 days of continuous sampling. Thus, allowing for transit time, 3 stations per leg of the cruise, or a total of 9 stations will be sampled. Stations are to be sampled in the order listed in Table 1.

The stations are located in these general areas: near the well-head; to the northeast of the well near locations where seafloor sediment traps have been placed in 2010-2011; to the southwest of the well-head in the area of the subsurface plume as indicated by sensors; and to the southeast of the well-head in an area that may not have been affected and so potentially serves as a reference area. Within these regions, stations have been selected (Figure 3 and Table 1) that are near previous or existing sediment traps and/or at previously-determined plankton monitoring stations (Figure 4).

Table 1. Coordinates of sampling stations, in priority order.

Leg #	General Location	SEAMAP Station	Longitude	Latitude	Water Depth (m)
1	NE of well*	Near B001	-88.02	29.16	1440
1	Near MC252 well**	Near B251	-88.42	28.71	1710
1	SW of well	B184	-89.00	28.50	806
2	SE of well	B081	-88.00	28.50	2235
2	SE of well	B082	-88.00	28.00	2428
2	E of well (slope)	B080	-87.00	28.50	2112
3	SW of well	B185	-89.50	28.00	977
3	SW of well	B061	-90.00	27.50	1137
3	SW of well	B247	-90.50	27.50	1046
(if time)	SW of well	B083	-89.00	28.00	1292
(if time)	SE of well	B249	-88.50	27.50	2112

*Seabed sediment trap deployment sites used by Christopher German (WHOI), GoMex2 and VK-RR1, are 17km N of B001 at 88° 01.13', 29°09.63'.

** Uta Passow (UCSB) and Vernon Asper (USM) deployed a moored time series trap in August 2010 at 28° 42.360'N, 88° 25.325'W (about 2.5 nmiles SW of the spill site).

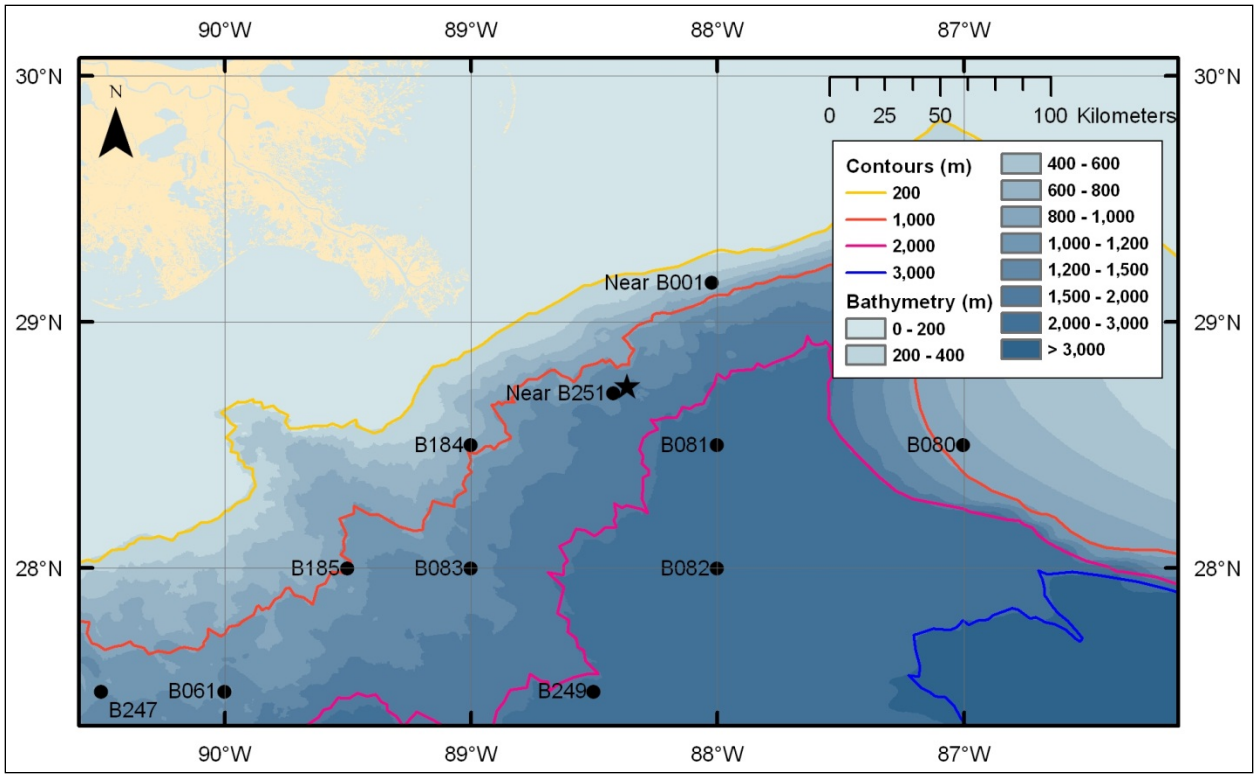

Figure 3. Stations to be sampled during the *Walton Smith* 4 Spring 2011 cruise (see Table 1 for details).

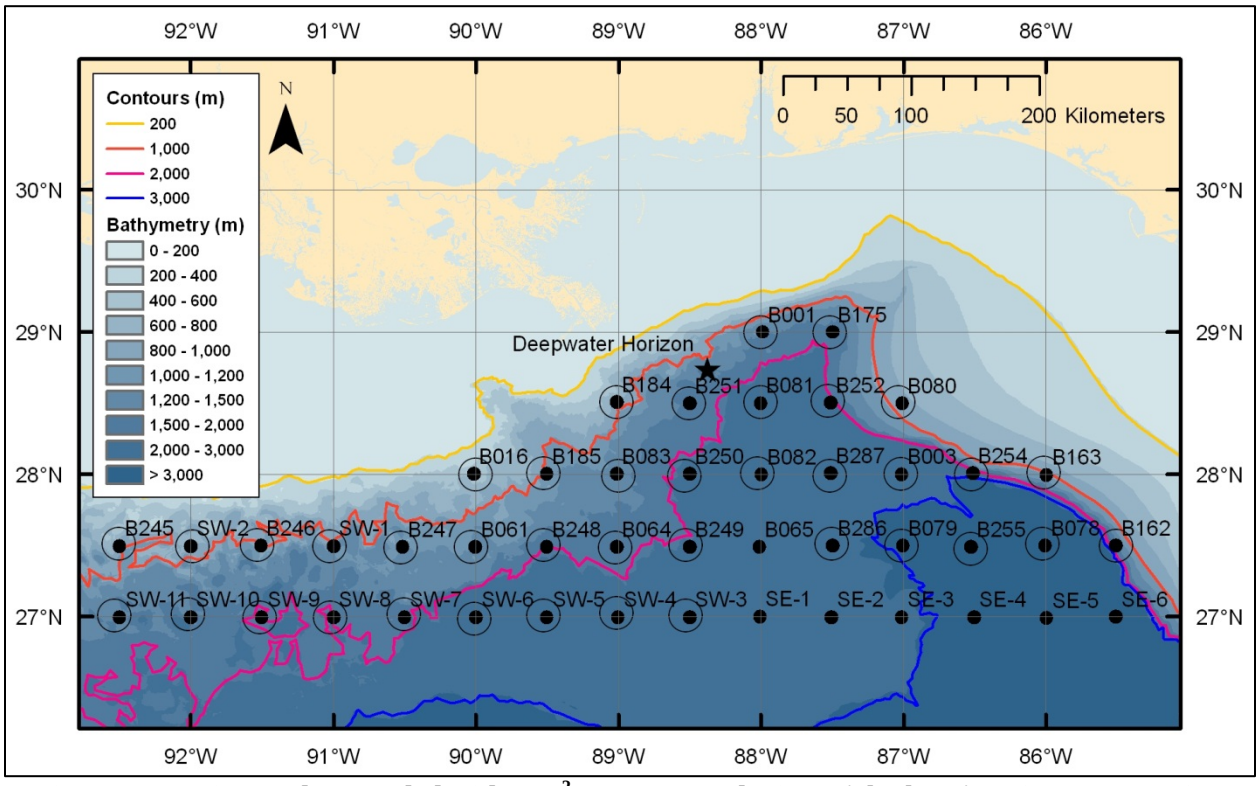

Figure 4. Stations to be sampled with 1-m^2 MOCNESS during *Nick Skansi* Spring 2011 Cruise (solid black circles). Open circles depict stations sampled during the MOC1 Winter 2011 survey.

Sampling Procedure at Each Station
Stations will be occupied for 72 hours to allow the following sampling activities to be conducted:

- 3 pairs of day and night MOCNESS tows (Deployments: 0-1500 m, 0-160 m, 0-2200 m, subject to water depth at the station; see Attachment 10);
- 3 pairs of day and night CTD/Rosette casts (including water sampling);
- 3 pairs of day and night vertical casts with the DAVPR; and
- Continual collection of acoustic data while on station.

The following ship-board sampling and measurements will take place:

- CTD profile collecting sensor data
- Collection of nutrient, DOC and TSS water samples (from CTD/Rosette water bottles) – Attachment 21
- Size-fractionated chlorophyll (from CTD/Rosette water bottles) – Attachment 15
- Live run of un-preserved water through FlowCAM to record data on phytoplankton, microzooplankton, and small particles (CTD/Rosette water bottles) – Attachment 15
- Collection of preserved whole water samples for phytoplankton/microzooplankton (CTD/Rosette) – Attachment 15
- MOCNESS tows and preservation of mesozooplankton samples – Attachments 10-11
- Neuston net tows and preservation of mesozooplankton samples – Attachment 23
- Measurement of primary production and respiration (light/dark bottle incubations with water from CTD/Rosette) – Attachments 19, 16
- Measurement of bacterial production (via radioactive lysine, water collected from CTD/Rosette) – Attachment 18
- Collection of samples for bacterial abundance (CTD/Rosette) – Attachment 18
- Measurement of microzooplankton (bulk community) grazing rate – Attachment 22
- *In situ* particle imaging using DAVPR – Attachment 13

CTD/Rosette: A Seabird CTD profiling package (which can be deployed to a depth of 6000 m) will be deployed with the following sensors to collect: dissolved oxygen, chlorophyll fluorometer, Aquatracka (Attachment 12), turbidity, transmissometer, salinity, temperature, and depth information. This package is mounted on a rosette outfitted with Niskin bottles.

CTD casts will be performed at each station to the full water column depth or a maximum of 2200 m. The total depth of CTD casts will be decreased if there are time constraints that limit MOCNESS deployment at scheduled times. CTD casts are to be conducted while the vessel is drifting. Because the MOCNESS tows 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 will be recorded for both the down- and the up-cast of the CTD.

Whole-water Plankton Sampling and Chlorophyll: Whole-water samples will be collected for quantitative enumeration of phytoplankton and microzooplanton at various times throughout the duration of the cruise (while underway, while towing MOCNESS, or during CTD deployment). Fresh whole water will be analyzed immediately in a FlowCAM (imaging microscope system). Additionally, two aliquots will be preserved in acid Lugol's and buffered formalin for later analysis. Size-fractioned chlorophyll samples also will be filtered onboard for later analysis. Methods and analyses are described in Attachment 15.

During CTD deployment, samples will be collected at the following water column features: the upper mixed layer (usually sampled at 10 m), the chlorophyll maximum, just below the chlorophyll maximum where the signal returns to a consistent reading, within any oxygen anomalies (peaks or valleys), and at

the discretion of the chief scientist, within, above, and/or below (number and depth of samples depending on bottle availability) any other signals of interest (e.g., Aquatracka).

In addition to using Niskin bottles to take whole water samples, samples from the shipboard flow-through system (fixed intake below the hull of the ship 1 m deep) will be collected to evaluate plankton in the upper 1m of the water column (neuston). The flow-through water will be collected fresh and analyzed immediately in the FlowCAM (methods in Attachment 15).

Water Samples for Nutrients, TSS, DOC: From each Niskin water sampling bottle, water samples will be taken for filtered and unfiltered nutrients, total suspended particulates, dissolved organic carbon, and micronutrients (Attachment 21).

MOCNESS: Vertical distribution of plankton in portions of and the entire water column (with a safety margin near bottom, Attachment 24) will be measured by sampling in discrete depth intervals using a 1-m^2 Multiple Opening and Closing Net and Environmental Sensing System (MOCNESS). The MOCNESS (Attachment 10) will be towed obliquely through the water column. Depth strata for all MOCNESS sampling are in Attachment 10.

During the first 24 hours, the 1-m^2 MOCNESS will be deployed twice (1 day tow followed by 1 night tow) to a maximum depth of 1500 m (water depth allowing, see Attachment 10). Each 0-1500 m MOCNESS tow will be 4-5 hours in duration and timed to best capture the differences in diel distribution patterns, i.e., sampling will center on noon and midnight. During the second 24 hours on station, the 1-m^2 MOCNESS will be deployed to a maximum depth of 160m two times at each station (also 1 day tow followed by 1 night tow).

Over hours 48-72, the 1-m^2 MOCNESS will be deployed to a maximum depth of 2200 m (water depth allowing, see Attachment 10) two times at each station (1 day tow followed by 1 night tow). In these ~6-hour tows, strata sampled will focus on depths greater than 1000 m, up to 2200 m, to resolve vertical distributions in the deepest strata sampled previously, as well as below those depths.

All MOCNESS samples will be preserved immediately after recovering the nets per the description in Attachment 11. At the end of each leg, samples will be transported under NOAA NRDA Chain of Custody to Malinda Sutor's laboratory at Louisiana State University (LSU). All samples at the laboratory are to be stored in a secure facility. Samples will be processed as described in the NRDA Plankton Processing Plan (signed January 2012).

Neuston Net: In the top 1m of the water column ichthyo- and zooplankton will be sampled using a neuston net (0.950 mm mesh). Standard SEAMAP sampling protocols will be followed at each station – a 10 minute tow. The duration of a neuston tow will be shortened to no less than 5 min if high concentrations of jellyfish, ctenophores, *Sargassum*, floating weed and/or debris are present in the water. Preservation of the neuston samples will be in 10% buffered formalin. For a detailed description of the neuston net, SEAMAP protocols, and sample processing see Attachment 23.

At the end of each leg, samples are to be transported under NOAA NRDA Chain of Custody to Malinda Sutor's laboratory at Louisiana State University (LSU). All samples at the laboratory will be stored in a secure facility. Samples will be processed as described in the NRDA Plankton Processing Plan (signed January 2012).

Photosynthetic and Respiration Rate Measurements: Primary production and respiration will be measured using standard light/dark bottle protocols (Attachment 19). Water will be collected from the depth of the chlorophyll maximum and incubated on deck in a water bath. Oxygen concentrations will be

measured at the beginning and end of the incubation (Attachment 16) to determine the rates of primary production (light bottles) and respiration (dark bottles). Aliquots of water from the experimental bottles will be filtered for chlorophyll and preserved for FlowCAM analysis (See Attachment 15 for methods).

At the end of each leg, samples are to be transported under NOAA NRDA Chain of Custody to Malinda Sutor's laboratory at Louisiana State University (LSU). All samples at the laboratory will be stored in a secure facility. Samples will be processed under a separate workplan, currently under development.

Microbial Uptake Rate Measurements: To quantify the amount of bacterial biomass produced at stations sampled, Dr. Krista Longnecker (WHOI) will perform short-term incubation experiments using radioisotope-labeled organic compounds. The vessel is to be equipped with a radiation van for this purpose, and required reviews and certifications will be obtained (See Attachment 18). The methods used to quantify bacterial organic carbon assimilation in many different ecosystems are well established in the literature. They are based on using radioisotope-labeled compounds to quantify rates of DNA synthesis (using thymidine) or protein production (using leucine) by microorganisms. Both isotopes may be used to make these carbon uptake rate measurements.

At the end of the cruise, samples will be transported under NOAA NRDA Chain of Custody to Krista Longnecker's laboratory at Woods Hole Oceanographic Institute (WHOI) to complete the processing. All samples at the laboratory will be stored in a secure facility. Details of the methods and protocols are in Attachment 17.

Microzooplankton Grazing Rate Measurements: The bulk community grazing rate will be measured using standard protocols for the dilution method described by Landry and Hassett (1982). Water will be collected from the depth of the chlorophyll maximum and used to create a dilution series to incubate on deck. At the end of the incubation time, aliquots of water from the experimental bottles will be filtered for chlorophyll and preserved for FlowCAM analysis. Changes in chlorophyll concentration and the abundance of microzooplankton grazers will be used to determine the bulk community grazing rate. Details are in Attachment 22.

At the end of each leg, samples are to be transported under NOAA NRDA Chain of Custody to Malinda Sutor's laboratory at Louisiana State University (LSU). All samples at the laboratory will be stored in a secure facility. Samples will be processed under a separate workplan, currently under development.

DAVPR: A color Digital-Autonomous Video Plankton Recorder (DAVPR) will be used to survey the distribution of plankton and marine snow. See Attachment 13 for a description of the instrument, specifications, and deployment procedure. The DAVPR will be deployed in a vertical cast to 1200 m (or to 100 m off the sea floor in shallower water locations). Each station will be sampled twice, once after each of the 0-1500 m MOCNESS tows. Data will be processed under a separate workplan, currently under development.

Acoustics: The *Walton Smith* will collect acoustic data using the ship's hull-mounted acoustic systems (75 and 300 kHz ADCPs) and pole mounted high-frequency acoustic instruments (2-frequency AWCP—420 and 775 kHz and a 1200 kHz ADCP to be calibrated with standard hydrophones). Data may be processed under a separate workplan.

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 ([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 to BP/Cardno ENTRIX at the end of the cruise. Attachment 8 contains additional details on the NRDA field sampler data management protocol.

Logistics

Vessel

Operations will be completed on the M/V *Walton Smith*, home ported at the University of Miami, Miami, FL.

Cruise Schedule

There will be three cruise legs of 11-12 days duration during the spring cruise totaling 35 days at sea over a 39-day period (April 19 to May 28, 2011). The *Walton Smith* will depart from Miami on April 14 and return to Miami on June 7, 2011. The scientific staff will join the cruise in Gulfport on April 19, and depart the vessel on May 28, 2011. The cruise schedule is as follows:

April 14	*Walton Smith* departs Miami
April 17	Arrive Gulfport
April 18	Load equipment for cruise
April 19	Depart Gulfport Leg 1
May 1	Arrive Gulfport
May 3	Depart Gulfport Leg 2
May 14	Arrive Gulfport
May 17	Depart Gulfport Leg 3
May 28	Arrive Gulfport and unload gear and scientific staff
June 7	*Walton Smith* returns to Miami

Personnel for M/V Walton Smith

This cruise requires 24 hour operations. The M/V *Walton Smith* has 12 berths for scientists.

NOAA Contractors:

Dr. Malinda Sutor (LSU), Chief Scientist
Dr. Krista Longnecker (WHOI), Scientist
Erik Quiroz (TAMU), Scientist
Alvaro Armas, Kate Lingoni, Shelly Chauvin, Danielle Edwards (LSU Technicians)
1 NRDA NOAA contractor (Sean Leathem)
2 NOAA Data Manager (Rylie Barron, Cody Fontenot)

Boat Crew from University of Miami (captain, mate, deck hands)

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.

Field Survey Costs	Hrs/Days/Trips	Day/Hr Rate	Total
Vessel Costs	49	$12,527	$613,823
NOAA Labor (days):			
NOAA Chief Scientist (Sutor)	40	[redacted]	[redacted]
Krista Longnecker (WHOI)	40	[redacted]	[redacted]
Erik Quiroz (TAMU)	40	[redacted]	[redacted]
4 LSU Technicians	40 X 4	[redacted]	[redacted]
1 Plankton/Net handlers	40	[redacted]	[redacted]
2 Data Managers	40 X 2	[redacted]	[redacted]
Misc Costs Sample Handling	1	$10,000	$10,000
Microbial Uptake Sample Processing	1	$21,000	$21,000
Travel	1	$15,000	$15,000
TOTAL			**$1,219,823**

Days/Trips for labor based on 40 potential sampling or mobilization days. Labor costs are based on estimated cost and hours. The vessel costs include transit from and to Miami.

Safety Plans
BP's full operations and safety plans are attached as appendices (Attachments 1-6). A revised MOC 1 & MOC 10 Deep tow protocol to avoid and minimize risks of gear groundings is incorporated into this plan (Attachment 24). 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).

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).

Sample Retention

All materials associated with the collection or analysis of samples under these protocols or pursuant to any approved work plan, including any remains of samples and including remains of extracts created during or remaining after analytical testing, must be preserved and disposed of in accordance with the preservation and disposal requirements set forth in Pretrial Orders ("PTOs") # 1, # 30, #35, # 37, #39 and #43 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). Destructive analytical testing of oil, dispersant or sediment samples may only be conducted in accordance with PTO # 37, paragraph 11, and PTO # 39, paragraph 11. Circumstances and procedures governing preservation and disposal of sample materials by the trustees must be set forth in a written protocol that is approved by the state or federal agency whose employees or contractors are in possession or control of such materials and must comply with the provisions of PTOs # 1, # 30, # 35, 37, #39 and #43.

References

Landry, M.R. and Hassett, R.P., 1982. Estimating the grazing impact of marine micro-zooplankton. Marine Biology 67: 283-288.

Attachments

Attachment 1. NOAA-NRDA_MC_252_Site_Safety_Plan_5.13.10
Attachment 2. MC252 HSSE Incident Reporting Final 02 May 10 rev 1
Attachment 3. CSA-Davis HSE Plan Rev 005_Final
Attachment 4. Transfer of Personnel and Material at Sea 070510
Attachment 5. NRDA SIMOPS Procedures 040711
Attachment 6. DWH Vessel Daily SitRep
Attachment 7. FGWaltonSmith_ShipSpecs
Attachment 8. NRDA_Field_Sampler_Data_Management_Protocol_10_23_2010
Attachment 9. Summary SEAMAP Historical Data_2011Apr2
Attachment 10. MOC1_deployment_Protocols_2011Apr15a
Attachment 11. MOC1_Sampling_Handling_Protocol_2011Mar28
Attachment 12. Chelsea Aquatracka Fluorometer
Attachment 13. DAVPR-2011March
Attachment 14. Protected Spp Interaction Prevention Proc_No-impact sampling gear
Attachment 14A to E. Protected Spp - 5 annexes
Attachment 15. Sutor-Acoustics&WholeWaterSampling-2011Mar30.doc
Attachment 16. Dissolved oxygen measurement protocols_2011Apr10
Attachment 17. Microbial production analysis protocols_2011Apr10
Attachment 18. Longnecker_radioactiveMaterialDocumentation.2011.03.31
Attachment 19. Light-Dark Bottle Photosynthetic and Respiration protocols_2011Jun29
Attachment 20. MC252 Analytical QAP V2.2
Attachment 21. TSS-DOC-Nutrients-2010Oct23
Attachment 22. Microzooplankton community grazing protocols_2011Jun29
Attachment 23. Neuston Net Specifications and Deployment_2011Apr1
Attachment 24. MOC 1 & MOC 10 Deep tow protocol

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Water Column Technical Working Group

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Sampling Vessel: M/V *Walton Smith*

December 12, 2012

Approvals

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

BP Approval	Joyce Miley Printed Name	Joyce Miley Signature	12/20/12 Date
Federal Trustee Approval	Daniel Hahn Printed Name	[illegible] Signature	12/18/12 Date
Louisiana Approval	KAROLION DEBOSCHENE Printed Name	[illegible] Signature	1/14/13 Date