

Addendum: Collection of Data to Determine Impacts of the Deepwater
Horizon Mississippi Canyon 252 Incident on Endangered and Protected
Marine Mammals in the Northern Gulf of Mexico

This addendum is for collection of additional data on marine mammals and
their prey in the Mississippi and DeSoto canyons area – 8 October to 23
November 2010

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Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Each party reserves its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan. The field work described in this plan was completed prior to the plan being signed.

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. This cruise will be conducted under Marine Mammal Protection Act Research Permit #779-1633-00 issued to the Southeast Fisheries Science Center (SEFSC).

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.

Jessica White 1/21/11
Department of Commerce Trustee Representative Date
FOR ROLAND GUIDRY

[Signature] 2/22/11
Louisiana Trustee Representative Date

[Signature] Jan 6, 2011
BP Representative Date

This Work Plan is an addendum to the Work Plan that included a cruise aboard the Gordon Gunter during June-August, 2010. Eighteen sea days were lost from the prior survey due to re-tasking of the Gordon Gunter. The previous study plan also included vessel expenses to recover and re-deploy acoustic moorings deployed during the summer cruise. Therefore, \$607,000 previously allocated under the original work plan will be used to cover operational expenses (e.g., scientific staff expenses, travel, and equipment). Additional funding in the amount of \$993,900 will be required to fund sea days aboard the NOAA ship Gordon Gunter.

I. Natural Resources Being Addressed

The primary prey species of sperm whales and other deep-diving marine mammals are deepwater squids and mesopelagic fish that occupy water depths between 400-800m. Subsurface oil and dispersants from the DWH MC 252 spill and response (hereafter referred to as MC 252 oil) may have direct impacts on this prey community. MC 252 oil may cause habitat degradation, which could cause a shift in the spatial distribution of these mobile predators to areas with lower prey densities. Such a distribution shift could have impacts on survival and productivity of marine mammal populations.

Surveys in the Mississippi Canyon/DeSoto Canyon region of the north-central Gulf of Mexico conducted during summer 2009 and February/March 2010 by the Southeast Fisheries Science Center (SEFSC) could provide information on both the occurrence of sperm whales and other marine mammals and the species composition and distribution of potential mesopelagic prey prior to the spill. These studies included trawl sampling and collection of scientific echosounder data to quantify the abundance of mesopelagic fish and squids within likely feeding depths of sperm whales. In the February/March 2010 study prior to the MC252 oil spill, 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). In addition, tissue samples (skin and blubber) were collected from sperm whales. These samples provide information on the concentrations of pollutants in prey tissues prior to the discharge of MC 252 oil.

Bryde's whales are the only resident baleen whale occupying the northern Gulf of Mexico. A small population of 40 or fewer animals is known to occupy waters between the 200m and 400m isobaths on the outer edge of the western Florida continental shelf (Waring et al., 2009). SEFSC has collected data on the distribution of this population during the last decade in multiple seasons and has a limited number of biopsy samples that have been used to examine the genetic structure of the population (SEFSC, unpublished data; sighting locations can be viewed at: <http://seamap.env.duke.edu/species>). In addition, two biopsy samples were collected during the summer 2010 survey completed under the work plan that is supplemented by this addendum. Those samples were retained for later analysis. Additionally, five passive acoustic moorings were deployed in historical Bryde's whale habitat during that cruise to provide longer-term monitoring of their occurrence and spatial distribution. The

planned effort during the summer survey on Bryde's whales was cut short by required vessel maintenance repairs resulting in only four survey days in the habitat and encounters with two Bryde's whales.

The proposed study for October and November 2010 is intended to address two aspects of assessing potential injury to oceanic marine mammals from MC 252 oil. First, midwater (fishing depths 400-800m) trawling will be conducted to document the mesopelagic prey community. This effort should provide data that are comparable to data collected just prior to the spill. Second, the study will examine the spatial distribution and habitat of Bryde's whales and collect biopsy samples for future analysis.

II. Study Purpose and Objectives

The objective of this study is to collect data that should help assess the potential impacts of MC 252 oil on oceanic populations of marine mammals (see Appendix I) in the northern Gulf of Mexico. The study has three primary objectives:

- 1) Collect field data on the abundance, spatial distribution, and habitat of Bryde's whales in the northeastern Gulf.
- 2) Obtain samples from Bryde's whales for future analysis to be conducted under a separate Plan.
- 3) Evaluate potential impacts of the MC252 events on the prey of sperm whales and other oceanic marine mammals.

To address these objectives, we will conduct the following specific activities:

- Conduct a systematic trawl and scientific echosounder survey of midwater zooplankton, fish and squids in the region.
- Visual and acoustic surveying to collect data on the abundance, spatial distribution, and habitat of Bryde's whales.
- Collect tissue samples from Bryde's whales and other marine mammals for future analysis to be conducted pursuant to a separate workplan.
- Recover passive acoustic moorings deployed during June-August 2010 and re-deploy some units to monitor marine mammal occurrence in the region through the fall and winter of 2010.

III. Study Methods and Sampling

The survey will be conducted aboard the NOAA ship *Gordon Gunter* during 8 October to 23 November, 2010. The survey will be conducted in two legs of approximately 20 days. The first leg will conduct “double zig-zag” surveys in the historical Bryde’s whale habitat between the 200 and 400 m isobaths in the northeastern Gulf of Mexico (Figure 1). The second leg will be conducted in the central Gulf of Mexico in waters between the 1,000m isobaths and approximately the 2,800m isobaths. During this leg, mid-water trawling will be conducted at fixed stations along a zig-zag trackline (Figure 1). Bottom mounted acoustic recording units that were deployed during summer 2010 will be recovered and redeployed opportunistically throughout the cruise.

Bryde’s whale surveys: During the first leg, the historical habitat of Bryde’s whales will be surveyed (Figure 1). Combined visual and passive acoustic line transect surveys will be conducted to locate Bryde’s whales and document the presence of other oceanic marine mammals within the region. Visual surveys will be conducted by a team of three observers stationed on the vessel’s flying bridge (elevation 13.7m above water level) during daylight hours, and will consist of two observers using 25x150 “bigeye” binoculars and a central observer/data recorder following standard methods employed by the SEFSC (e.g., Mullin and Fulling, 2004) and requirements for Distance line transect sampling (Buckland et al., 2001). Data will be recorded using a data acquisition program that will operate on a laptop and will record ancillary habitat and sighting condition data along with position and sighting information. Survey speed will typically be 10 knots, but may vary with sea conditions. Visual survey effort will likely be suspended during high sea states (generally sea state > 5 on the Beaufort scale and/or swell heights > 6 feet), poor visibility conditions (e.g., fog, haze, rain), or when there is lightning in the area.

Passive acoustic monitoring will be conducted simultaneously with the visual observations. Acoustic monitoring will be conducted using a towed acoustic array or the deployment of sonobuoys. The array will be interfaced with a suite of electronics inside the ship, and scientists will monitor the array when it is in tow. Signal processing equipment, recording equipment, and data collection computers, will be stationed in the dry lab. The passive acoustic team will record marine mammal vocalizations into a digital archive and record the location, bearing, and species identification of acoustic contacts.

Small boat photography and biopsy sample collection: A 7-m rigid hull inflatable boat will be deployed from the *Gunter* when Bryde’s whale groups are encountered. Photographic data will be collected on close approaches. The small boat will collect small tissue biopsy samples that include a small plug of skin and blubber. Sample collection and storage procedures will be the same as those used during the summer 2010 survey for direct comparison. Biopsy samples will also be collected from bow-riding delphinids using the same methods employed during the summer 2010 study.

Midwater trawling and scientific echosounder survey: A systematic mesopelagic prey trawling survey will be conducted during the second leg of the cruise. This survey will be designed to characterize the vertical and horizontal distribution of prey biomass as characterized by multi-frequency analysis of scientific echosounder data. In addition, 20-25 mid-water trawl stations will be executed (Figure 1) at approximately 50 nautical mile intervals along the trackline. The spatial extent and resolution of trawl sampling is similar to that conducted during February-March 2010 (Figure 2). The trawl sampling encompasses habitats of sperm whales and other oceanic marine mammals along the 1,000m isobaths and extends offshore to encompass a loop current eddy that is currently occupying the north-central Gulf. These mesopelagic physical features may be areas of elevated productivity.

The SimRad EK60 scientific echosounder system will be used to collect data on acoustic backscatter in the water column associated with secondary productivity (e.g., zooplankton, small fish and squids). The Gordon Gunter has echosounders operating at 18 kHz, 38 kHz, 120 kHz and 200 kHz frequencies. The EK60 will be run continuously throughout the cruise with settings designed to quantify the relative biomass of mid-water fish and squids using the 18kHz and 38kHz frequencies.

The trawls will sample mesopelagic fish and squids at water depths from 400-800 m. Trawling will be conducted with a large-mouthed, high-speed mid-water rope trawl. 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 to echosounder data collected during the trawls. Water depths of 400-800m are the primary feeding layer for sperm whales (Jochens et al. 2008), and appear to contain a concentration of biomass below the vertically migrating scattering layer. Fish and squids will be identified to the lowest feasible taxonomic level on-board. Tissue samples and specimens will be stored as required for later analysis. Specific analyses will be conducted pursuant to a separate workplan.

Both the trawl sampling and active acoustics data that will be collected during this cruise will use similar methods to those conducted during Jan-Mar of 2010 to ensure comparability.

Acoustic moorings: Two types of bottom-mounted passive acoustic moorings were deployed in the survey region during summer 2010. The first type are MARUs (Marine Autonomous Recording Units, Cornell University) which are small self-contained units that record lower frequency marine mammal vocalizations. The second are larger HARPs (High frequency Acoustic Recording Packages, Scripps Institution of Oceanography) that record higher frequency vocalizations. These moorings record vocalizations from marine mammals and other sounds throughout a 110-day deployment cycle. The data can be analyzed to track changes in vocalization rates, as indicators of animal occurrence, through time. The moorings deployed during summer 2010 need to be recovered during the October-November time frame. In the case of the HARPs, the units can be refurbished at sea and re-deployed to provide an additional 110-day cycle of recording. HARP and MARU units near the primary survey area will be recovered and

re-deployed throughout the cruise. We anticipate the recovery and re-deployment of 3 HARP units and 18 MARUs (Figure 1).

Environmental and Water Sampling: Environmental data will be collected from the suite of instruments integrated into the vessel's Scientific Computing System (SCS), which will be in operation 24 hours/day. These systems conduct continuous sampling of surface waters including metrics such as sea surface temperature, salinity, and fluorescence. In addition, Conductivity Temperature Depth (CTD) profiler casts to depths of up to 800m will be made at each trawl station during the second leg. Expendable bathythermograph (XBT) casts will be made while underway during transit periods along the trackline at approximately 10 km intervals to collect vertical profiles of water temperature from the surface to 760m depth.

IV. Disposition of Samples and Collected Data

Data collected by NOAA/SEFSC during the cruise will be provided in raw format to the NRDA Data Management Team as soon as possible after the completion of the cruise. These data will include visual survey data, data on passive acoustic contacts from the towed array, sighting sheets, biopsy sheets, acoustic backscatter data, trawl catch and species composition data, and collected hydrographic data. Digital photographs will be logged and maintained following chain of custody procedures developed by the NRDA Data Management team. All analytical and non-analytical data associated with cooperatively funded work under this work plan will be provided simultaneously to BP/Entrix and the trustees within a reasonable timeframe.

During sample collection, biopsy samples will be split as required for different sample storage requirements. In particular, the skin from the sample will be stored in 20% DMSO and the blubber sample will be stored in Teflon vials at -80°C. The blubber sample will be split into parts if possible. All skin samples will be transferred to the SEFSC Marine Mammal Molecular Genetics Laboratory. The frozen blubber samples will be retained at the National Seafood Inspection Laboratory at Pascagoula, MS. Secure storage and chain of custody forms will be provided as needed to NRDA data management. Any analyses that may be conducted on these samples will be conducted under a separate work plan.

HARP raw acoustic data, and MARU data will be retained in raw form by the respective researchers and provided to the Trustees and BP as per existing contracts with Scripps Institution of Oceanography and Cornell University.

Tissue samples or whole specimens of mesopelagic fish and squids will be retained and stored for later analysis as provided in the sample storage and delivery plan that was developed in consultation with the appropriate analytical laboratory, BP/Entrix and the trustees (Trawl Sampling Protocol: GU-10-05, November 2, 2010).

Analysis of collected data on marine mammal distribution, acoustic backscatter of deep water prey, and the species composition of catches in mid-water trawls will be conducted by the Southeast Fisheries Science Center and provided to all parties.

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT), the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana and to BP (or ENTRIX 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 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 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. Also, the LADP shall not be released by the DMT, LOSCO, BP or ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and to BP (or ENTRIX on behalf of BP).

Literature Cited

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. 2001. Introduction to distance sampling: Estimating abundance of biological populations. Oxford University Press, 432 pp.

Jochens, A., Biggs D., Benoit-Bird K., Engelhaupt D., Gordon J., Hu C., Jaquet N., Johnson M., Leben R., Mate B., Miller P., Ortega-Ortiz J., Thode A., Tyack P., and Würsig B. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2008-006. 341 pp.

Mullin, K. D., and G. L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico, 1996 - 2001. *Marine Mammal Science* 20: 787-807.

Waring, G.T., Joesehpson, E., Fairfield, C.P., Foley, K.M. 2009. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2008. NOAA Technical Memorandum NMFS-NE-210.

VI. Project Budget

Activity	NOAA's Cost Estimates (\$K)
Salary and Benefits	
Labor 2 FTE for 6 months (130k)	
Travel (20k)	
Contractors (~270k)	450
Overtime (30k)	
Transportation	
Vehicle/Vessel Cost (small boat costs – \$15k)	18
Fuel (3k – small boat fuel)	
Other Services –fish and squid identification (20k).	20
Supplies – Expendable supplies	30
Days at Sea – NOAA Ship Gordon Gunter	993.9
Overhead ¹ (56% on FTE salary)	89
TOTAL	1,600.9

Operational expenses (Salary and Benefits, Transportation, Other Services, Supplies, and Overhead) listed above can be covered by funds allocated under the previous workplan. These include offsets for lost days at sea (~\$325k) and previously budgeted costs for FTE labor (\$138k), and charter days for acoustic mooring recovery (\$144k). Sample analysis costs for water samples, mesopelagic fish and squids, and marine mammal tissue samples are not included in this workplan.

Additional funding (\$993.9K) will be required to cover the cost for Days at Sea aboard the NOAA ship Gordon Gunter

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.

Appendix I. Gulf of Mexico Oceanic Marine Mammal Species

Sperm Whale
Bryde's Whale
Cuvier's Beaked Whale
Blainville's Beaked Whale
Gervais' Beaked Whale
Bottlenose Dolphin (Oceanic stock)
Atlantic Spotted Dolphin
Pantropical Spotted Dolphin
Striped Dolphin
Spinner Dolphin
Rough-toothed Dolphin
Clymene Dolphin
Killer Whale
False Killer Whale
Pygmy Killer Whale
Pygmy Sperm Whale
Dwarf Sperm Whale
Melon-headed Whale
Risso's Dolphin
Short-finned Pilot Whale

Figure 1. Survey plan for GU-10-05 to be conducted from 8 October – 23 November, 2010. Locations of HARPs and MARUs from the summer 2010 cruise in the Northern Gulf are shown. The concentric circles around the DWH site indicate distances of 10 and 20 nautical miles from the site.

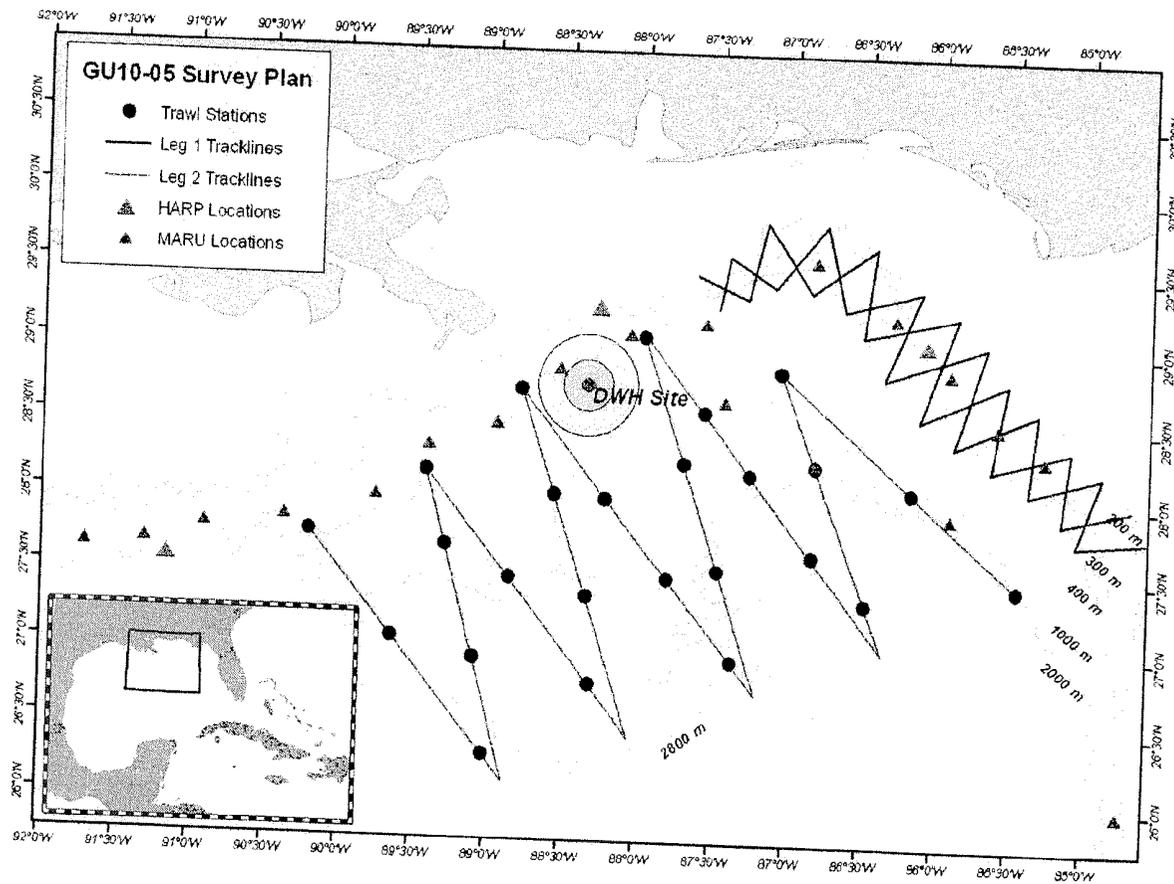


Figure 2. Midwater trawl stations sampled during January-March 2010 and proposed stations for the current study. Fishing depths for the January-March 2010 study ranged from 400-800m. The concentric circles around the DWH site indicate distances of 10 and 20 nautical miles from the site.

