Mississippi Canyon 252 Incident

Approval of this work plan is for the purposes of obtaining data on the movements and fate of whale sharks in the vicinity of the Deepwater Horizon/ Mississippi Canyon 252 Oil Spill (MC252 Spill) for the Natural Resource Damage Assessment (NRDA). Parties each reserve its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

Unless otherwise agreed upon by the Trustees and BP, all chemical analytical samples will be sent to TDI Brooks Lab.

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 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 ENTRIX. Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Quality Assurance Project Plan, after which time the validated/QA/QC'd data shall be made available to all trustees and ENTRIX. Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Quality Assurance Project 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. 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 ENTRIX.

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.

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APPROVED:

Jennifer Bayca
NOAA Trustee Representative:

August 3 2010
Date

FOR ROLAND GUIDRY
Louisiana Trustee Representative:

AUGUST 14, 2010
Date

Joyce Melancon
BP Representative:

August 3 2010
Date

Investigative plan to monitor and assess the potential for impacts of the *Deepwater Horizon* oil spill on whale sharks in the northern Gulf of Mexico using satellite tag technology

Prepared by

MC 252 NRDA Fish Technical Working Group

Eric Hoffmayer[1] and Sean Powers[2,3]

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For the

Mississippi Canyon 252 Incident Natural Resource Trustees

Version 2.0

Date August 2, 2010

Summary

This document presents a plan for monitoring the movements and inferring the short term fate (up to 6 months) of whale sharks currently in the north-central Gulf of Mexico. The plan is intended for use, to the extent feasible, both before and after oil from the MC252 Spill reaches actual or potential habitats. The collection of data on whale shark movement and fate outlined in this plan is a pre-assessment phase activity within the NRDA process for the MC 252 Spill. The data collection described in this plan targets ephemeral data---data that is anticipated to change or disappear within a relatively short period time even while the spill is ongoing. 15 C.F.R. §990.43.

I. **Approach and rationale.** This section describes the overall purpose and need for documenting movement and fate of whale sharks in relation to the MS 252 Spill.

II. **Data needs and sources.** This section provides an overview of the types of data that may be a useful complement to this plan.

III. Health and Safety procedures

IV. **Investigative and Sampling Strategy.** This section describes the approach to be used in investigating whale shark movements and determining fate of whale sharks that may be exposed to oil or dispersants as well as those that may not be exposed in offshore environments.

V. Project Management and Reporting

I. Approach and Rationale

The Gulf of Mexico (GOM) provides essential habitat for many shark and ray species, including the whale shark, *Rhincodon typus* (Hoffmayer et al., 2006). The oil spill resulting from the explosion of the Deepwater Horizon platform in the northern GOM is located in whale shark essential fish habitat (NOAA, 2010; Hoffmayer et al., 2005) and may be posing a threat to this species in the region. Whale shark abundance in the northern GOM increases during summer, from mid-May to mid-September (Burks et al., 2006; Hoffmayer et al., 2005). In addition, the area of the spill is in whale shark feeding habitat. From 2003 to 2009, over 300 whale shark sightings were reported to the Gulf Coast Research Laboratory's northern GOM whale shark sightings survey (Hoffmayer, unpublished data). Over a third of these sightings are within the area impacted by the MC 252 incident (Figure 1). Given the amount of time whale sharks spend at/near the surface of the water and the fact that they aggregate in large numbers to feed (Hoffmayer et al., 2007), there is potential for harm or death to individuals from direct exposure to and contamination from the spill (via oiling or clogging of their gills), as well as from depletion of prey, or consumption of oil-contaminated prey. Based on recent reports of whale sharks sighted within four miles the wellhead (MC252) from NOAA/NRDA aerial surveys , it is clear that they are not completely avoiding oil-impacted areas. Whale sharks need to be tagged so that their ephemeral movements in relation to oil-impacted areas can be documented.

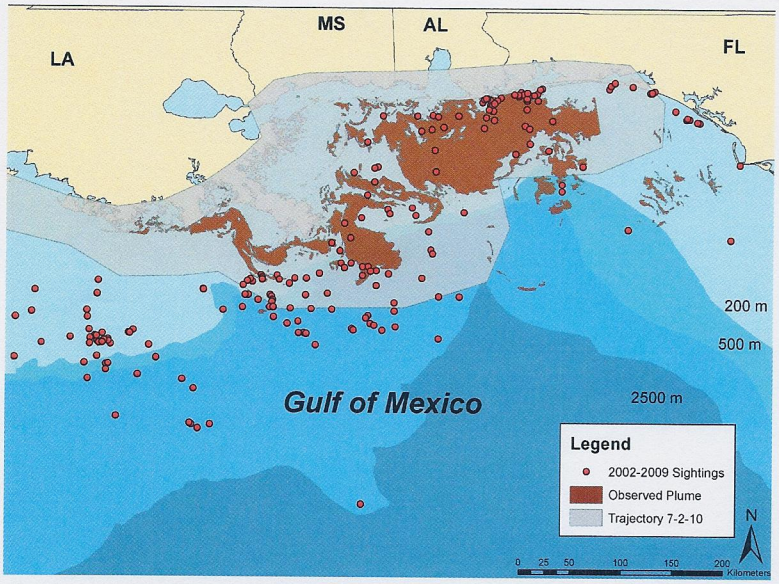

Figure 1. Map depicting historic (2003-2009) whale shark sighting's locations shown within the estimated boundaries of the MC 252 oil spill as of July 2, 2010.

II. Study Objectives and Data Needs

This workplan addresses two specific data needs/objectives: (1) document movements of whale sharks in the northern Gulf of Mexico including the time of occurrence in the spill area to evaluate the potential for exposure to oil or dispersants and (2) document the fate of whale sharks. By fate the plan documents disappearance or continued presence of whale sharks. The disappearance may be due to mortality, tag loss, or other artifacts. The purpose of this plan is to document disappearance; later assessment will be needed to link this disappearance to mortality.

III. Health and Safety

- **The team leader and field crew parties should have completed all applicable health and safety training as directed by NOAA or state agency oil spill policy.**

- **All field team members must complete the NOAA safety training and documentation requirements** as set forth in "Safety Requirements for All Personnel Working on NOAA-led NRDA teams for MS Canyon 252 Incident" (NOAA Safety Documentation Requirements.doc).

- **All field team members should read all of the documents in the Safety directory on the case's ftp site** [redacted] Exception: if site collection activities do not include use of a boat or helicopter, then familiarity with the safety documents for these vehicles is not required.

- **Each field team must submit a plan, not later than the night prior to going into the field.** This plan must specify:
  - The team leader;
  - Names of all team members;
  - The sampling location(s)-- please use the grid coordinates as shown in Maps 1 to 3 below;
  - What kind of sampling they are doing;
  - Expected arrival time at sampling area (daily);
  - Expected departure from sampling area (daily);
  - Team deployment date;
  - Team return date.

  This information may be reported in one of two ways:
  1. Fill out the Excel spreadsheet "Team Member Information Form – Excel.xls"[1] and send it to [redacted] Please use one tab for each team.
  2. If you cannot submit this spreadsheet electronically, you can call in and report the information using this number: [redacted]

[1] This file is available on the case's ftp site: [redacted]

- **Field teams must adhere to all procedures set forth in the MC252 Site Safety Plan** ("NRDA MC 252 Site Safety Plan_5.13.10.pdf"). [2]

- **If participating in a cruise or aerial operations:** Each cruise or aerial operation may have additional required health and safety procedures, that must be observed.

- Field teams interacting directly with whale sharks must adhere to Whale Shark Tagging Safety Procedures defined by Gulf Coast Research Laboratory and meet all NOAA/NMFS Highly Migratory Species Program permitting requirements.

IV. Investigative and Sampling Strategy

A. Field Research

Ewing Bank, a topographic feature in the northcentral GOM will be the primary target site to encounter whale sharks. This feature has been shown to be a large and predictable breeding site for whale sharks in the region. There have been over 19 reported sightings of 5-200 whale sharks at this location since 2007. The Primary Investigator has encountered 25-30 sharks at the same location in 2009, and over 100 sharks on 22 June 2010 (Hoffmayer, unpublished data). Vessels will be chartered from Grand Isle, Port Fourchon, and Cocodrie, Louisiana because of their close proximity to Ewing Bank. Whale sharks may also be encountered opportunistically off Louisiana, Mississippi, and Alabama, as sightings are reported.

Spotter planes will be used to help locate whale sharks and fishing vessels will serve as the tagging platform. To tag up to 40 whale sharks, up to 15 days at sea and 15 flights will be needed. Since 2006, at least 12 whale sharks have been successfully tagged with satellite tags in the northern GOM using the combined effort of charter vessels and planes.

B. Satellite Tags

Two types of satellite tags will be used: satellite position only tags (SPOT) and pop-up satellite archival tag (PSAT) to determine the spatial overlap between reported oil. Oil distribution and overlap with tagged animal position will be determined based on daily Incident Response Environmental Unit documentation of oiling extent. SPOT tags will provide real-time location data (+/- 150 to 1000 m) when the sharks are at the surface, and PSAT tags will provide archived data on movements and diving behavior in relation to water temperature and depth. PSAT tags can provide data useful in determining the fate of whale sharks (i.e. if they die and sink to the bottom), and help in estimating any mortality rates of

[2] This file is available on the case's ftp site: [redacted]

tagged whale sharks relative to their occurrence in the spill area. To document movements of whale sharks in the northern GOM, 60 satellite tags will be deployed (20 SPOT and 40 PSAT). Twenty whale sharks will receive both types of tags, and twenty sharks will receive PSAT tags only. Sharks will be tagged as they are spotted by the vessel. True randomness is not possible since we cannot determine the entire pool of animals available; however, if multiple animals are spotted the vessel will ensure adequate dispersion of sampling by selecting non-adjacent animals.

As whale sharks are encountered, they will be measured in total length, sexed, and an identification photograph will be taken. When possible, whale sharks will be tagged in the water using a 2 m pole spear (when no oil is present). The researcher, using snorkeling gear, will swim to within 0.5 m of the whale shark and implant the tag into the dorsal intramuscular region just below the first dorsal fin. A 1.25" titanium m-style anchor will be used to anchor the tags below the skin. Both the PSAT and SPOT tags will be tethered with 0.15 m and 1.7 m 1/16" diameter stainless steel cable, respectively. If oil is present, sharks will be tagged from the side of the fishing vessel using a 2.5 m tagging pole. After the satellite tags are deployed, a 5 gram tissue sample will be collected using a pole spear with a standard biopsy tip for genetic analyses.

Pop-up Satellite Archival Tags

Pop-up satellite archival tags record temperature and depth every 10 or 15 minutes, depending on the manufacturer, and a light level each day. The light levels are used to estimate a latitude and longitude. The duration of the tag is assigned by the researcher, and can range from one to 12 months. Once the tag reaches its assigned duration, it pops off the animal and floats to the surface. At that point, data is sent through a satellite and back to the researcher, and time series depth and temperature data, as well as raw geo-location estimates are provided. The tags are programmed to detach prematurely, if the animals spends more than five days at a constant depth (either at the surface or the bottom). So, if a shark dies and sinks to the bottom, the depth data recorded in the tag will trigger the premature release after five days. This will be evident in the time series data.

Pop-up satellite archival tags have been extremely useful in elucidating movements and environmental preferences (temperature and depth) of various marine organism, however, there has been about a 10-20 % tag failure rate associated with these tags. These failures have been attributed to various factors, including mechanical, electrical, programming, and animal behavioral. Most of these tag failures occur in deployments greater than six months. In deployment of over 25 PSAT tags over the past two years, the PI reports only two not reporting any data (92% success rate). The only two tags that didn't report were 8-month in duration.

C. Data Analysis

Both tags send data through the ARGOS satellite system, which can be accessed by the researcher. The SPOT tags will be sending daily location estimates (as long as the tag is at the surface, up to 80% of time for whale shark, E. Hoffmayer, unpublished data) which will be displayed on Google Ocean and the Gulf Coast Research Laboratory whale shark research website for the public to view the movements of the sharks. The PSAT data will be transmitted either at the set duration (6 months) or if the animal dies within that timeframe. Whether the shark is dead or alive will be assessed based on the location of transmission and the time series temperature and depth data, which is recorded every 15 minutes. The location data will need to be filtered using various steps to develop a reasonable movement track of the shark. Data collected from each of these tags will be analyzed spatially to better understand how much time was spent in the vicinity of the oil spill.

D. Expected Benefits

Satellite tagging of whale sharks will provide a reliable method to assess the behavioral aspects relative to the oil spill within an area of the northern GOM identified as whale shark essential feeding habitat. The use of SPOT and PSAT tags will allow the monitoring of whale shark movements in relation to the oil affect area, and may be useful in future estimation of any potential short-term mortality rate of whale sharks. However, this later analysis is not a component of this workplan and will be performed during any injury assessment.

V. Project Management and Reporting

To implement the plan, the NRDA Trustees will contract with Dr. Eric Hoffmayer, University of Southern Mississippi, to tag 20 whale sharks with two types of satellite tags for each whale shark, and 20 additional whale sharks with only one type of satellite tag for each whale shark. The current tag numbers are based on logistic considerations (i.e. delivery time for tags from the manufacturer and field logistics to locate and tag 40 sharks). Dr. Hoffmayer will provide cruise reports for each day of field operations to the MC 252 NRDA Fish Technical Working Group and NRDA Trustees. All field notes, data sheets or other records generated in conducting field work and data analysis should be compiled and sent to the MC 252 NRDA Fish Technical Working Group. Reports of estimated positions and movement tracks of whale sharks will be provided monthly. The reports will include raw (unfiltered positions) as well as filtered positions (noting filter values) for SPOT and PSAT tags. All data sheets and reports must be maintained in a manner that allows for complete and verifiable data retrieval for legal purposes. Unpublished data and published reports supporting Trustee analysis of data derived by this study will be made available to all parties.

Copies of all reports and correspondence should be sent to NOAA NRDA Fish TWG coordinator at the end of each week for the duration of the project.

VI. Logistic Needs and Implementation Timing

A. Estimated Cost

Budget

A. Salary and Fringe	
Hoffmayer (PI) [redacted]	$22,999
Technician	$20,421
B. Commodities	
SPOT tags 20@ $1,900	$38,000
PSAT tags 40@ $3,500	$140,000
Tethering materials	$ 3,000
Misc. Supplies	$ 1,000
C. Travel	
Lodging 30 nights @ $200/night	$ 6,000
Mileage 6000 mi @ $0.50/mile	$ 3,000
Per diem 2 x 30 days @ $40/day	$ 2,400
D. Other Costs	
Charter vessels 15 days @ $3,000/day	$45,000
Aerial Flight 15 @ $1,200/hr * 6 hr/day	$108,000
Sat Time SPOT tags 20 @ $1,500/tag	$30,000
Sat Time PSAT tags 40 @ $ 200/tag	$ 8,000
E. Facilities & Administrative Costs	
[redacted]	$172,269
F. Total Project Costs	**$510,089**

The Parties acknowledge that this budget is an estimate, and that actual costs may prove to be higher due to a number of potential factors. BP's commitment to fund the costs of this work includes any additional reasonable costs within the scope of this work plan that may arise because of any contingencies. The trustees will make a good faith effort to notify BP in advance of any such contingencies. All satellite tags (SPOT, PSAT) not used for this effort, and any retrieved during the study will be returned to BP or their representative.

B. Timing

The limiting step in this plan is acquiring the tags from the manufacturer. Estimated delivery is 30 days and field teams will be deployed as tags are made available. Continuance of field activities will be evaluated on October 1, 2010.

Literature Cited

Burks, C.M., W.D. Driggers, and K.D. Mullin. 2005. Abundance and distribution of whale sharks *(Rhincodon typus)*in the northern Gulf of Mexico. Bulletin of Marine Science 104:579-584.

Hoffmayer, E.R., J.S. Franks, W.B. Driggers, K.J. Oswald, and J.M.Quattro. 2007. Observations of a feeding aggregation of whale sharks, *Rhincodon typus*, in the north central Gulf of Mexico. Gulf and Caribbean Research 19(2): 69-73.

Hoffmayer, E.R., J.S. Franks, and J.P. Shelley. 2005. Recent observations of the whale shark (*Rhincodon typus*) in the northcentral Gulf of Mexico. Gulf and Caribbean Research 17: 117-120.

Hoffmayer, E.R., J.S. Franks, and J.P. Shelley. 2006. Whale sharks (*Rhincodon typus*) in the northcentral Gulf of Mexico: A rationale for research. Gulf and Caribbean Fisheries Institute, Proceedings 57: 255-262.

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