ERRATA SHEET
for

Proposed Data Collection Plan to Assess Injury to Florida Manatees from the Deepwater Horizon Oil Spill, June 9, 2010

- The title of this plan is corrected to "Proposed Data Collection Plan to Assess Injury to Florida Manatees from the Deep<u>water</u> Horizon Oil Spill"

- The cover to this plan bears the date of 06-07-*2011*; the correct date is 06-07-*2010.*

06-07-2011

Deepwater Horizon/Mississippi Canyon 252
Pre-Assessment and Data Collection Plan – Marine Mammal and Turtle Workgroup

APPROVED:

Approval of this work plan is for the purpose 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

Department of Commerce Trustee Representative: 6/9/10 Date

BP Representative: June 7, 2010 Date

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Proposed Data Collection Plan to Assess Injury to Florida Manatees from the Deep Horizon Oil Spill

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Point of Contact AL, MS, LA (TBA in separate collaborative proposal)

I. Natural Resources Being Addressed

The Florida manatee (*Trichechus manatus latirostris*) is listed as endangered under the federal Endangered Species Act and the state Imperiled Species List; it is also listed as depleted under the federal Marine Mammal Protection Act.

Distribution and Habitat: The Florida manatee inhabits the coastal waters, estuaries, and freshwater river systems of Florida. Manatees could be most susceptible to contaminant exposure if the oil enters estuaries, river mouths, and intracoastal waters inshore of barrier islands, particularly where there are seagrass beds upon which manatee forage. Much of the Big Bend coast (Wakulla through Pasco Counties) lacks an intracoastal waterway so manatees and seagrass beds are not protected from approaching oil by barrier islands in this region. During winter (November/December to February/March), manatees thermoregulate during cold weather by seeking shelter at a limited number of warm-water sites (e.g., natural springs, power plants) or areas in the southern two-thirds of Florida (Irvine 1983; Reynolds and Wilcox 1994; USFWS 2001; Laist and Reynolds 2005a,b). During the warm season when water temperatures exceed 20°C (March/April through October/November), manatees disperse throughout Florida waters and some migrate to neighboring states (Lefebvre et al. 2001). On the Gulf of Mexico coast, that includes northwestern Florida, Alabama, Mississippi, and Louisiana, with some individuals having traveled as far west as Texas (Powell and Rathbun 1984; Rathbun et al. 1990; Fertl et al. 2005).

Diving and Surfacing Behavior: Manatees spend the vast majority of their time in very shallow waters close to shore, so these are the areas in most need of protection. Manatees are mostly found in depths of about 3 m or less. As aquatic mammals, manatees surface to breathe every few minutes (rate depending on activity). This places their nostrils just at the surface, making them vulnerable to inhalation of volatile hydrocarbons; surfacing could also expose the animals' skin, eyes, nares and mucous membranes of the oral cavity to oil compounds in and on the water surface. Because manatees often rest or forage on the bottom, their skin could also be exposed to dispersants, tar balls and other forms of oil that settled to the bottom. In addition to direct effects of oil on the animal's skin, it could be ingested by other manatees during social interactions that often involve tactile oral contact (Hartman 1979).

Foraging Behavior and Ecology: Manatees may be most vulnerable to the effects of oil during foraging. Manatees are generalist herbivores that feed on a large variety of marine and freshwater vegetation (Smith 1993). Seagrass is a staple of their diet in shallow estuarine and

marine areas. In addition to benthic foraging, manatees also feed on floating, emergent, and bank vegetation in brackish or freshwater systems. This includes feeding on drift seagrass that floats at the surface. Therefore, manatees in oil-contaminated areas could ingest oil compounds while foraging at the surface or on the bottom where they may encounter and eat tar balls and other forms of the oil that have settled to the bottom. Manatees in estuarine or marine environments regularly seek freshwater sources to drink, such as creeks or industrial outfalls (Lefebvre et al. 2001). Indirect adverse effects of oil on manatee populations could occur through harm to seagrass beds, resulting in reduced quantity and quality of forage resources (FDEP et al. 1997) and potential impacts on vital rates such as reproduction and survival (Preen and Marsh 1995).

Life History Considerations: Spring and summer are peak periods for manatee calving and mating (O'Shea and Hartley 1995, Rathbun et al. 1995, Reid et al. 1995). Manatees have a slow reproductive rate with a calving interval of 2-5 years and 1-2 years of maternal dependence (Reynolds and Powell, 2002). Knowledge of the effects of oil on manatees is limited, and effects of oil exposure on manatee reproduction and development can only be hypothesized.

II. Purpose/Objectives

1. To estimate abundance and assess distribution of Florida manatees in areas affected by and adjacent to the Deepwater Horizon oil spill (before, during and after impact).

2. To conduct an aerial assessment of impacted areas to document locations of marine mammals in fouled areas, locate fouled, distresses or dead animals, and to inform manatee rescue efforts.

Two types of aerial surveys (stratified random sampling surveys [Williams et al. 2002] and response surveys) will be conducted in manatee habitats affected by the oil spill and in manatee habitats adjacent to the affected areas. Information collected during the surveys will help us assess the number of manatees that are in, and around areas, that have been impacted by oil, and their distribution within the affected area (document exposure). A second survey type, (response survey) with a separate mission, will be conducted to help inform rescue efforts in the affected area.

III. Methods

Equipment and Protocols

Surveys will be flown in a fashion similar to historical manatee surveys in the area of operation. One experienced manatee observer will be present, and seated on the right side of the aircraft with the window open (if possible). Ideally, we would have two observers per plane in order to be able to evaluate the observer effect on detectability; but because of logistical constraints we may not be able to include two observers in each survey. Fortunately, it is still possible to estimate abundance of manatees with just one observer. By adding an additional observer in each plane we may be able to increase the accuracy of the estimates; therefore, we plan on including an additional observer whenever possible. No surveys (in which the mission is to count manatees) will be flown in winds greater than 15 kts with gusts no greater than 25 kts or in rainy or foggy conditions. Observers will record the start and end times of the survey, aircraft track line (with GPS), wind speed and direction, sea state (beaufort scale), turbidity and any sightings of manatees (and other marine wildlife such as dolphins and sea turtles) including the number of calves and adults.

Survey Type 1--Stratified Random Sampling Survey to Estimate Abundance and Distribution

There are some obstacles to obtaining reliable inference from manatee survey data. Unlike marine mammals that inhabit large, open-water areas, manatees often reside in narrow, irregularly shaped bodies of water (e.g., man-made canals, rivers, creeks) that are difficult or impossible to survey using standard methods like distance sampling (Barlow, 1995; Calambokidas and Barlow, 2004). In addition, the difficultly of detecting manatees (heterogeneous detection) during a survey can lead to biased results. Because of the limitations inherent in surveying manatees, a stratified random sample survey has been developed to estimate abundance and distribution of this species, and will be implemented here as part of the Deepwater Horizon oil spill response.

Pre-Impact (<72 hrs before oil impact) and Post-Impact Phases

We will conduct one reconnaissance survey (during each phase) of the region which may become impacted by oil (i.e., within the boundaries of uncertainty projected by NOAA, http://response.restoration.noaa.gov/book_shelf/2098_TMF24-2010-05-30-2100.pdf) to determine if manatees are present. This survey will entail following a predefined flight line that will include plots that are randomly selected according to the design outlined below. Each selected plot will be circled three times. If no manatees are present we will continue to monitor the situation by conducting reconnaissance surveys every week for a maximum of four weeks (per budget) for implementation of this work plan (if potential of oil exposure beyond one month is anticipated within Florida, this work plan may be extended). If more than one manatee is present in the region, we will implement one stratified random sampling survey that incorporates stratified random sampling and occupancy estimation to determine abundance and distribution in that region.

The stratified random sampling survey will entail: 1.) Stratifying the survey region into two strata (stratum 1 will consist of known manatee habitat [known manatee habitat are areas were manatees have been reported by aerial or other observers, tracked through radio or satellite telemetry, or where carcasses have been recovered], and stratum 2 will consist of habitat less likely to have manatees but may be utilized occasionally. Habitat deemed unlikely (unlikely habitats are areas that are too deep or too shallow) to be occupied by manatees will be excluded from the survey); 2.) Dividing the area into plots 1.0 mi x 0.5 mi in area; 3.) Randomly selecting plots to be sampled using a random number generator; and 4.) Surveying selected plots during a single sampling event using repeated counts (Royle and Dorazio 2008). Three consecutive repeated counts (each count will take approximately 2 to 3 minutes) will be obtained at each plot by a single plane and will be used to estimate the total abundance of each stratum. Occupancy estimation techniques, for example, Royle and Dorazio (2008), will be used to estimate the probability that at least one manatee was present given that no manatee were observed during the three consecutive passes. Environmental information including sea state, water turbidity, glare, and air temperature will be recorded at each plot at the end of the three consecutive passes and used as covariates in the model.

Impact Phase (Oil in or very near region of concern)

Once oil is in the region of concern we will implement one stratified random sampling survey to determine abundance and distribution in the region (per protocols listed above in pre-impact phase).

Survey Type 2--Response Surveys to Assist Rescue Operations

Impact Phase (Oil in or very near region of concern)

In addition to the stratified random sampling surveys, we will also conduct another type of aerial survey (as stated in the purpose/objectives) to document and map manatees (and other wildlife species such as sea turtles and dolphins) in the impacted areas; locate fouled, distressed or dead marine animals; assist rescue/stranding responses; photograph fouled, distressed or dead marine animals and impacted areas; and collect relevant environmental information (e.g., presence and type of oil) along flight track and at sightings ; and disseminate information (e.g., data, photos) to the appropriate parties regarding distribution and counts of manatees and other wildlife species, oil extent within survey areas, and potential impacts.. Most importantly, these surveys will be flown to assist and inform manatee rescue efforts. These surveys will be ad hoc and will focus solely on the impacted areas and areas surrounding the impacted waters. The aircraft will circle areas where sightings of marine wildlife may occur to help direct rescuers to distressed animals, and to photograph marine mammals (near shore and in estuaries) and other points of interest, and collect environmental information (sea state, water turbidity, glare, air temperature, oil presence and type). Observers will report all relevant information to appropriate parties.

IV. Expected Florida Budget and Requested Resources

We project that the cost of the survey in Florida using multi-engine aircraft or helicopter will be:

	# of Aircraft*	# of hrs/survey	Cost/hour	Total # of Surveys*	Cost

Survey Type					
Reconnaissance	2	8	$700	6	$67,200
Plot Sampling	4	8	$700	2	$44,800
Response (impact phase)	**1**	**8**	**$700**	**30**	**$168,000**
Sub-total					$280,000
	# of staff hrs	**Cost/hr**			**Cost**
Salary (GIS staff)	80	$25			$2,000
Salary (aerial observers)	432	$25			$10,800
	# of days	**Cost/day**	**Per diem/day**		
Lodging	40	$120	$36		$6,240
Supplies					$200
Fuel					$500
Data Analyses	75	$100			$7,500
Sub-total					$27,240
TOTAL					**$307,240**

We project that the cost of the project in Florida using a single-engine aircraft will be:

	# of Aircraft*	**# of hrs/survey**	**Cost/hr**	**# of Surveys ***	**Cost**

Survey Type					
Reconnaissance	2	8	$250	6	$24,000
Plot Sampling	6	8	$250	2	$24,000
Response (impact phase)	1	8	$250	30 (1 month)	$60,000
Sub-total					$108,000
	# of staff hrs	**Cost/hr**			**Cost**
Salary (GIS staff)	80	$25			$2,000
Salary (aerial observers)	432	$25			$10,800
	# of days	**Cost/day**	**Per diem/day**		
Lodging	40 (approx. month)	$120	$36		$6,240
Supplies					$200
Fuel					$500
Data Analyses	75	$100			$7,500
Sub-total					$27,240
TOTAL					**$135,240**

* Budget is based on an impacted region the approximate span of approximately three counties and a one month response. Number of aircraft and surveys is subject to change based on the extent and the length time of the impact. Number of reconnaissance surveys is based on an estimate of up to 6 surveys.

V. Data Management

Aerial survey data will be provided in electronic form (excel spreadsheets; GIS shapefiles; and electronic maps with locations of manatee sightings). We also will provide estimates of local abundance for each stratified random sample survey.

VI. Schedule

Manatees and other wildlife species (such as sea turtles and dolphins) that are fouled, distressed or dead will be reported immediately to appropriate parties.

A written summary of the survey and/or a map of manatee and other wildlife sightings will be provided to appropriate parties within 24 hours.

Within 90 days of data collection period a report of survey results will be submitted to appropriate parties.

REFERENCES

Barlow, J. 1995. The abundance of cetaceans in California waters. Part I: ship surveys in summer and fall 1991. Fishery Bulletin 93:1–14.

Beck, C. A., and N. B. Barros. 1991. The impact of debris on the Florida manatee. Marine Pollution Bulletin 22: 508-510.

Calambokidas, J., and J. Barlow. 2004. Abundance of blue and humpback whales in the eastern North Pacific estimated by capture–recapture and line-transect methods. Marine Mammal Science 20:63–85.

Deutsch, C. J., J. P. Reid, R. K. Bonde, D. E. Easton, H. I. Kochman, and T. J. O'Shea. 2003. Seasonal movements, migratory behavior and site fidelity of West Indian manatees along the Atlantic Coast of the United States. Wildlife Monographs 151:1-77.

Deutsch, C. J., H. H. Edwards, and M. E. Barlas. 2006. Florida manatee foraging behavior around a winter warm-water refuge. Final Report to the Wildlife Foundation of Florida. Grant No. CWT0405-12. FWC/FWRI file FCWT0405-12-F. 42 pp.

FDEP, NOAA, AND U.S. DOI. 1997. Damage Assessment and Restoration Plan/Environmental Assessment for the August 10, 1993 Tampa Bay Oil Spill. Volume 1 – Ecological Injuries. Final Report prepared by the Florida Department of Environmental Protection, the National Oceanic and Atmospheric Administration, and the U. S. Department of the Interior. 91 pp.

Fertl, D., A. J. Schiro, G. T. Regan, C. A. Beck, N. Adimey, L. Price-May, A. Amos, G. A. J. Worthy, and R. Crossland. 2005. Manatee occurrence in the Northern Gulf of Mexico, west of Florida. Gulf and Caribbean Research 17:69-74.

FWC. 2007. Florida manatee management plan, *Trichechus manatus latirostris*. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL. 267 pp.

Gannon, J. G., K. M. Scolardi, J. E. Reynolds, III, J. K. Koelsch, and T. J. Kessenich. 2007. Habitat selection by manatees in Sarasota Bay, Florida. Marine Mammal Science 23: 133-143.

Hartman, D. S. 1979. Ecology and behavior of the manatee (*Trichechus manatus*) in Florida. American Society of Mammalogists Special Publication No. 5.

Irvine, A. B. 1983. Manatee metabolism and its influence on distribution in Florida. Biological Conservation 25: 315-334.

Koelsch, J. K. 1997. The seasonal occurrence and ecology of Florida manatees (*Trichechus manatus latirostris*) in coastal waters near Sarasota, Florida. M.S. Thesis, University of South Florida, Tampa, Florida.

Laist, D. W., and J. E. Reynolds III. 2005a. Florida manatees, warm-water refuges, and an uncertain future. Coastal Management 33:279-295.

Laist, D. W., and J. E. Reynolds III. 2005b. Influence of power plants and other warm-water refuges on Florida manatees. Marine Mammal Science 21:739-764.

Lefebvre, L. W., M. Marmontel, J. P. Reid, G. B. Rathbun, and D. P. Domning. 2001. Status and biogeography of the West Indian manatee. Pages 425-474 *in* C. A. Woods and F. E. Sergile, editors. Biogeography of the West Indies: new patterns and perspectives. CRC Press LLC, Boca Raton, Florida, USA.

O'Shea, T. J., and W. C. Hartley. 1995. Reproduction and early age survival of manatees at Blue Spring, Upper St. Johns River, Florida. Pages 157-170 *in* T. J. O'Shea, B. B. Ackerman, and H. F. Percival, editors. Population biology of the Florida manatee. National Biological Service Information and Technology Report 1. Washington, D.C. 289pp.

Powell, J. A. and G. B. Rathbun. 1984. Distribution and abundance of manatees along the northern coast of the Gulf of Mexico. Northeast Gulf Science 7(1):1-28.

Preen, A. R., and H. Marsh. 1995. Response of dugongs to large-scale loss of seagrass from Hervey Bay, Queensland, Australia. Wildlife Research 22:507-519.

Rathbun, G. B., J. P. Reid, and G. Carowan. 1990, Distribution and movement patterns of manatees (*Trichechus manatus*) in northwestern peninsular Florida. Florida Marine Research Institute Publication Number 48: 1-33.

Rathbun, G. B., J. P. Reid, R. K. Bonde, and J. A. Powell. 1995. Reproduction in free-ranging Florida manatees. Pages 135-156 *in* T. J. O'Shea, B. B. Ackerman, and H. F. Percival, editors. Population biology of the Florida manatee. National Biological Service Information and Technology Report 1. Washington, D.C. 289pp.

Reep, R. L. and R. K. Bonde. 2006. The Florida Manatee: Biology And Conservation. Univ. Press of Florida, Gainesville, FL. 189 pp.

Reid, J. P., R. K. Bonde, and T. J. O'Shea. 1995. Reproduction and mortality of radio-tagged and recognizable manatees on the Atlantic Coast of Florida. Pages 171-191 *in* T. J. O'Shea, B. B. Ackerman and H. F. Percival, eds. Population biology of the Florida manatee (*Trichechus manatus latirostris*). National Biological Service, Information and Technology Report 1.

Reid, J. P., G. B. Rathbun, and J. R. Wilcox. 1991. Distribution patterns of individually identifiable West Indian manatees (*Trichechus manatus*) in Florida. Marine Mammal Science 7:180-190.

Reynolds, J. E., III, and J. R. Wilcox. 1994. Observations of Florida manatees (*Trichechus manatus latirostris*) around selected power plants in winter. Marine Mammal Science 10: 163-177.

Reynolds, J. E., III, and D. K. Odell. 1991. Manatees and dugongs. Facts on File, New York, New York, USA.

Reynolds JE and JA Powell 2002. Manatees. In: Encyclopedia of marine mammals (eds: Perrin WF, B Würsig, and JGM Thewissen). Academic Press, San Diego. pp 709-720.

Royle, J.A. & Dorazio, R.M. (2008) *Hierarchical Modeling and Inference in Ecology: The Analysis of Data from Populations, Metapopulations and Communities* Academic Press, San Diego, CA

Smith, K. N. 1993. Manatee habitat and human-related threats to seagrass in Florida: A review. Unpublished report. Florida Dept. of Environmental Protection, Tallahassee, FL. 38 pp.

USFWS. 2001. Florida manatee recovery plan, *Trichechus manatus latirostris*, Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia. 144pp. + appendices. http://northflorida.fws.gov/Manatee/manatees.htm

Weigle, B. L., I. E. Wright, M. Ross, and R. Flamm. 2001. Movements of radio-tagged manatees in Tampa Bay and along Florida's west coast, 1991-1996. Florida Marine Research Institute Technical Report TR-7. St. Petersburg, FL. 156 pp.

Williams, B.K., Nichols, J.D., & Conroy, M.J. (2002) *Analysis and management of animal populations*, Academic Press edn., San Diego, CA.