Deepwater Horizon Oil Spill Natural Resource Damage Assessment

Draft Restoration Plan for the Gulf of Mexico

Attachments to Online Comments for the *Draft Programmatic Damage Assessment and Restoration Plan (PDARP) and Programmatic Environmental Impact Statement (PEIS)*

December 2015
www.gulfspillrestoration.noaa.gov

Appendix A. Original Copies of Correspondence Received on the *Draft Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS)*

October 13, 2015

David G. Westerholm
Director, Office of Response and Restoration
National Oceanic and Atmospheric Administration
1305 East-West Highway
Silver Spring, MD 20910

Samuel D. Rauch III
Deputy Assistant Administrator for National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1305 East-West Highway
Silver Spring, MD 20910

Re: Comment period extension request for Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement (Draft PDARP/PEIS)

Dear Mr. Westerholm and Mr. Rauch:

On behalf of the undersigned organizations, we are writing in response to the BP *Deepwater Horizon* Natural Resource Damage Trustee Council's (Trustees) publication of the draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement (draft PDARP/PEIS). **Given the scope and great importance of this issue, we respectfully request an extension of the public comment period from 60 days to 75 days.**

The draft PDARP/PEIS and accompanying draft consent decree published by the U.S. Department of Justice contain critical information for restoring the Gulf of Mexico in the wake of the BP *Deepwater Horizon* oil disaster. The details of the draft PDARP/PEIS concern all citizens of the Gulf region, as well as millions of Americans who benefit from the Gulf's natural bounty. The culture and economy of the Gulf depend on the health of the ecosystem, as do the wildlife that thrives there. These documents will guide Gulf restoration for decades to come, and as such, will have a substantial impact on proper analysis of future restoration projects and will significantly impact the public's ability to engage effectively in ensuring sustainability of our fisheries, wildlife populations, coastal and marine environments, and the local economies that depend on them.

A disaster of this magnitude requires an approach to restoration that is ecosystemwide, comprehensive, integrated, long-term and fully addresses injuries based on a series of ecologically balanced restoration alternatives and actions that collectively contribute to recovery from the coast to offshore, deep-sea environment and related human services. **We commend the Trustees for their extensive work leading to the publication of the draft PDARP/PEIS; however, a 60-day public comment period is an insufficient amount of time for affected members of the public and scientific community to comment on the decree.** Though we share the desire for expeditious restoration, it should not preclude allowing all stakeholders adequate time to comment on this critically important issue. Thank you for your consideration.

Sincerely,

Environmental Defense Fund
Gulf Restoration Network
National Audubon Society
National Wildlife Federation
Ocean Conservancy

Meredith Amend

From: Regalado, Nanciann <nanciann_regalado@fws.gov>
Sent: Saturday, October 31, 2015 10:18 PM
To: Meredith Amend
Subject: Fwd: Use BP Dollars to Restore the Gulf Coast

---------- Forwarded message ----------
From: **Raleigh Hoke** <raleigh.hoke@gmail.com>
Date: Fri, Oct 16, 2015 at 5:58 PM
Subject: Use BP Dollars to Restore the Gulf Coast
To: Nanciann_regalado@fws.gov

I'm writing to urge you to spend every dollar of the BP settlement on effective restoration of the Gulf's coast and communities.

The Gulf region is an amazing natural and cultural treasure, and a key economic driver for the nation. Yet, 5 years since the BP disaster and 10 years since Hurricanes Katrina and Rita, the Gulf's communities and wildlife continue to suffer from the impacts of coastal wetland loss and BP's oil.

Plans have been developed to restore coastal lines of defense and protect the Gulf's communities, but these plans have yet to be fully funded and implemented. The threat to the people of the Gulf Coast is real and urgent.

That's why it is essential that we spend the BP restoration dollars on funding actual restoration. Already, politicians are talking about using BP restoration dollars on wasteful projects like a beachfront convention center, a minor league baseball stadium and other unnecessary infrastructure. Please do the right thing and spend these precious funds on effective restoration, not pork-barrel politics.

Sincerely,

Raleigh Hoke
2009 st. claude
new orleans, LA 70116
5737951916

--
DWH ATTORNEY WORK PRODUCT / ATTORNEY-CLIENT COMMUNICATIONS

Nanciann Regalado

October 27, 2015

NOAA/DWH Trustee Council
Trustee Representative Craig O'Connor
Chief of Natural Resources Section and Special Counsel for Natural Resources
NOAA Office of the General Counsel
263 13th Avenue South
St. Petersburg, FL 33701

I am writing to ask your help concerning the $18.7 billion settlement that BP must pay to make things right after the largest oil spill in U.S. history.

I ask the Council to please earmark a good portion of these funds for long-term monitoring in the Gulf of Mexico so that everything that is done is grounded in solid science and meaningful research. It is imperative to do all we can to help sick dolphins and disintegrating corals. Corals and sponges can take centuries to grow into a vibrant underwater habitat, and when an area is destroyed, it may never recover. These living structures provide shelter and a place to eat, breed and raise young to thousands of fish and other sea creatures.

It has been five years since BP's oil disaster first hit the Gulf. And the lasting effects of oil continue to affect wetlands, beaches, and wildlife habitat across the Gulf. The iconic species of bottlenose dolphins are dying and sick with symptoms that many scientists believe were caused by oil exposure. Lori Schwake, one of the leading experts on dolphins in the southern U.S., speaking about bottlenose dolphins in the Gulf said, "I've never seen such a high prevalence of very sick animals."

A recent comprehensive scientific study showed the most alarming observation is the increase in deaths of bottlenose dolphins. Since the BP blowout in April 2010 that spewed almost five million barrels of oil into Gulf waters, scientists have documented the deaths and strandings of over 1250 dolphins. The NOAA directly linked the alarming spike in dolphin deaths to the BP spill.

And in a recent study in the peer-reviewed online journal PLOS ONE, a team of 22 scientists documented even more evidence connecting dolphin deaths to exposure to petroleum products, observable through lesions on their lungs and adrenal glands after oil and fumes entered their blowholes.

One study found that in areas most impacted by the BP oil disaster, bottlenose dolphins are dying at four times the normal rate. The study reports findings of dolphins with missing teeth, lung disease, and abnormal hormone levels. Pneumonia, liver disease and a pregnant female carrying a dead fetus were also documented.

I urgently ask the Council to direct a significant portion of the money from the BP settlement towards long-term monitoring and research to continue to track the health and recovery of dolphins, corals, and other sea life still suffering from the 2010 spill. There is still a lot of work to do in the Gulf on behalf of the many myriad animals like the dolphin who call the ocean home.

In addition to restoring the Gulf of Mexico ecosystem to what it was at the time of the disaster, restoration efforts must address the ecosystem degradation that has been unfolding in the Gulf for decades before the spill, and help return the Gulf to its rightful place as a natural treasure.

The whole Gulf ecosystem, including the deep waters and inland marshes, as well as jobs, way of life and communities depend upon it.

Thank you for your consideration.

Yours truly, J. Capozzelli 315 West 90th Street

RECEIVED
NOV 02 2015
NOAA-GCSE
ST. PETERSBURG, FL

NEW YORK NY 100
31 OCT 2015 PM 6 L

NOAA/DWH Trustee Council/
Trustee Rep. Craig O'Connor
Chief of Natural Resources Section
Special Counsel for Natural Resources
NOAA Office of the General Counsel
263 13th Avenue South
St. Petersburg, FL 33701

November 2, 2015

U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, Georgia 30345

Enclosed are my personal comments about the Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Draft Environmental Impact Statement (DEIS).

In general, I believe that Alternative A, the preferred alternative, is the best alternative for implementation of the Restoration Plan. However, I have several comments about changes to the document and emphasis on restoration.

1) **Page 2-2, Executive Summary,** the DEIS and Restoration Plan states that "... some lighter oil compounds evaporated from the slicks, exposing air-breathing organisms like marine mammals and sea turtles to noxious fumes at the sea surface." I recommend adding "humans" to marine mammals and sea turtles since people also breathed the noxious fumes from the oil spill at the sea surface.

2) **Page 2-8, 2.3.1 Release of Oil and Natural Gas,** the DEIS and Restoration Plan states "At that ratio, at least 7.7 billion standard cubic feet of natural gas was released from the well." Since the release of natural gas, which is essentially methane, and which is an extremely potent greenhouse gas (about 20-105 times more potent than CO2 (see below from www.global-warming-forecasts.com/methane-carbon-dioxide.php), the Trustees should require mitigation in Alternative A for the loss of this massive amount of methane. Additional mitigation will allow for adaptive management and protection of ecosystems on a more vast scale than the current proposal calls for in the DEIS.

Methane and Carbon Dioxide – CH4 and CO2

105 times. Level of heat trapping potency that methane is greater than carbon dioxide over a 20-year time frame according to NASA research.
"But [Robert Howarth, a professor of ecology and environmental biology at Cornell University] and company took things even further, incorporating data from Drew T. Shindell at NASA's Goddard Institute for Space Studies, who published a study in 2009 in the journal *Science* that suggested that the interaction of methane with certain atmospheric aerosols might well amplify the global warming potential of methane, rendering it up to 105 times more potent than carbon dioxide in the 20-year time frame. Although the 100-year time horizon is more commonly used by climate scientists, Mr. Howarth relies on the shorter time-horizon, which would greatly intensify the impact of leaking methane on climate. Combining that with the novel methane leakage estimates at various points along the production and transmission life cycles,

he and his co-authors were able to push the climate impact, per unit of energy, of unconventional natural gas industry well beyond that of the perennial environmental and climate demon, coal." (Tom Zeller Jr., "Methane Losses Stir Debate on Natural Gas," *The New York Times*, April 12, 2011

72 times. Methane has a global warming potential 72 times greater than carbon dioxide over a 20 year period. Compared with carbon dioxide, methane has a high global warming potential of 72 (calculated over a period of 20 years) or 25 (for a time period of 100 years). (Intergovernmental Panel on Climate Change - IPCC - "Climate Change 2007: The Physical Science Basis - Summary for Policymakers," Fourth Assessment Report -FAR, Working Group 1, Chapter 2, IPCC Secretariat, Geneva, Switzerland, February 2007, p. 212)

72 times. Over a 20-year period, one pound of methane traps as much heat as at least 72 lbs. of CO2. "Methane is a far more powerful greenhouse gas than carbon dioxide, though it doesn't last nearly as long in the atmosphere. Still, over a 20-year period, one pound of it traps as much heat as at least 72 pounds of carbon dioxide. Its potency declines, but even after a century, it is at least 25 times as powerful as carbon dioxide. When burned, natural gas emits half the carbon dioxide of coal, but methane leakage eviscerates this advantage because of its heat-trapping power." (Anthony R. Ingraffea, "Gangplank to a Warm Future," *The New York Times*, July 8, 2013)

72 times. Over 20 years, emission of 1 ton of methane has the same climatic impact as the emission of 72 tons of carbon dioxide. "After Carbon Dioxide, Methane is the next most important GHG [greenhouse gas], because it has high capacity to absorb infrared radiation and is relatively abundant. [T]he observed lifetime of methane, in today's atmosphere, is on average 12 years. Methane has a GWP [global warming potential] of 72 over a 20 year period, meaning that over this time period, the emission of 1 ton of methane will have the same climate impact as the emission of 72 tons of carbon dioxide, or in other words methane is 72 times stronger than carbon dioxide. When looking at a 100 year period of time, however, the emission of 1 ton of methane has the same climate impact as the emission of 25 tons of carbon dioxide." Energy + Environment Foundation, info@eeocw.org, *Global Warming Potentials,* Energy + Environment OpenCourseWare, Washington, DC, 2008, p. 3)

64 times. Number of times more potent that methane is compared to carbon dioxide as a heat-trapping gas. "For the same volume, methane is 64 times more potent as a heat-trapping gas than carbon dioxide, and there is a lot of it." Methane compared to carbon dioxide. (Ian Hoffman, Staff Writer, "Global warming could trigger methane release," *The Oakland Tribune*, Oakland, California, August 29, 2006 reporting findings in T. M. Hill, J. P.

Kennett, D. L. Valentine, Z. Yang, C. M. Reddy, R. K. Nelson, R. J. Behl, C. Robert, and L. Beaufort, "Climatically driven emissions of hydrocarbons from marine sediments during deglaciation," published online before print August 30, 2006, doi: 10.1073/pnas.0601304103 and published in print *Proceedings of the National Academy of Sciences* PNAS September 12, 2006 vol. 103 no. 37 13570-13574 pp. 13570–13574)

40 times. Methane releases are 40 times more potent in terms of warming than CO2. "As catastrophic as all this is, [Kevin Schaefer [kevin.schaefer@nsidc.org], a scientist at the National Snow and Ice Data Center (NSIDC) in Boulder, Colorado] acknowledges his study underestimates what is likely to happen. The model does not measure methane releases, which are 40 times as potent in terms of warming as carbon. Methane could have a big impact on temperatures in the short term, he says. 'There would be a lot of methane emissions. We're working on estimating those right now,' he said. The model also does not include emissions from the large region of underwater permafrost. *IPS* previously reported that an estimated eight million tonnes of methane emissions are bubbling to the surface from the shallow East Siberian Arctic shelf every year. If just one percent of the Arctic undersea methane (also called methane hydrates) reaches the atmosphere, it could quadruple the amount of methane currently in the atmosphere, Vladimir Romanovsky of the University of Alaska in Fairbanks previously told *IPS*." (Stephen Leahy, "Permafrost Melt Soon Irreversible Without Major Fossil Fuel Cuts," *IPS,* Uxbridge, Canada, February 17, 2011 reporting findings in Kevin Schaefer, Tingjun Zhang, Lori Bruhwiler, Andrew P. Barrett, Amount and timing of permafrost carbon release in response to climate warming, *Tellus B*, 2011; DOI: 10.1111/j.1600-0889.2011.00527.x, article first published online on February 15, 2011)

30 times. Number of times more potent methane is than CO2 in terms of heat-trapping potential. "Methane is a greenhouse gas more than 30 times more potent than carbon dioxide." How does methane compare to carbon dioxide? ("*Methane Releases From Arctic Shelf May Be Much Larger and Faster Than Anticipated,*" Press Release 10-036, National Science Foundation, March 4, 2010)

25 times. Methane GWP potency compared to carbon dioxide over a 100 year period. "Methane is a relatively potent greenhouse gas. Compared with carbon dioxide, it has a high global warming potential of 72 (calculated over a period of 20 years) or 25 (for a time period of 100 years). (Intergovernmental Panel on Climate Change - IPCC - "Climate Change 2007: The Physical Science Basis - Summary for Policymakers," Fourth Assessment Report, Working Group 1, Chapter 2, IPCC Secretariat, Geneva, Switzerland, February 2007, p. 212)

23 times. Methane has about 23 times the global warming potential of carbon dioxide when it is released into the atmosphere. "Methane (CH4) . . . is the simplest hydrocarbon, and is the primary component of the natural gas that we burn for energy. Methane is also an important greenhouse gas, it has about 23 times the global warming potential of carbon dioxide when it is released into the atmosphere. There are many sources of methane. Some methane comes from human activities, for example, landfills, rice cultivation, and ruminant farm animals (like cows) are all large methane sources. Other large methane sources, like the ocean and wetlands, are natural." (Monica Heintz, University of California, Santa Barbara, "Methane in the Ocean," *Ocean Explorer,* ," National Oceanic and Atmospheric Administration, Washington, DC, revised August 25, 2010)

21 times. Methane is about 21 times more powerful at warming the atmosphere than carbon dioxide. "Methane (CH4) is a principal component of natural gas. It is also formed and released to the atmosphere by biological processes occurring in anaerobic environments. Once in the atmosphere, methane absorbs terrestrial infrared radiation that would otherwise escape to space. This property can contribute to the warming of the atmosphere, which is why methane is a greenhouse gas. Methane is about 21 times more powerful at warming the atmosphere than carbon dioxide (CO2) by weight. . . Methane's chemical lifetime in the atmosphere is approximately 12 years. Methane's relatively short atmospheric lifetime, coupled with its potency as a greenhouse gas, makes it a candidate for mitigating global warming over the near-term (i.e., next 25 years or so)." (U.S. EPA, *Science - Greenhouse Gas Properties,* Climate Change Division – 202-343-9990, Office of Atmospheric Programs, U.S. Environmental Protection Agency, Washington, DC, June 22, 2010)

20 Times. Global warming potential of methane compared to carbon dioxide. "In the ongoing debate over global warming, climatologists usually peg carbon dioxide as the most dangerous of the atmosphere's heat-trapping gases. But methane, a greenhouse gas 20 times more potent than carbon dioxide, might be even more problematic. According to Tessa Hill, a geologist at the University of California, Davis, more methane is released into the atmosphere from ocean deposits during periods of warming than previously thought. This expelled methane increases temperatures and releases more methane, creating a positive feedback loop." (Elizabeth Svoboda, "Global Warming Feedback Loop Caused by Methane, Scientists Say," *National Geographic News*, August 29, 2006 reporting findings in Tessa M. Hill - tmhill@ucdavis.edu, J. P. Kennett, D. L. Valentine, Z. Yang, C. M. Reddy, R. K. Nelson, R. J. Behl, C. Robert, and L. Beaufort, "Climatically driven emissions of hydrocarbons from marine sediments during deglaciation," published online before print August 30, 2006, doi: 10.1073/pnas.0601304103 and published in print *Proceedings of the National Academy of Sciences*, PNAS vol. 103 no. 37 13570-13574, September 12, 2006, pp. 13570–13574)

3) **Page 3-3, Executive Summary,** under the "human stressors" should be listed subsidence because excessive withdrawal of water and oil/gas has caused significant subsidence in parts of coastal Texas and Louisiana.

4) **Pages 3-11 and 3-13, 3.4 The Northern Gulf Ecosystem: An Interconnected Fabric,** the DEIS and Restoration Plan states "The resources and habitats ... are linked through physical processes and biological relationships ... including: The transport of nutrients, sediments, and organic matter between nearshore and offshore habitats and between surface waters and the sea bottom." It would be appropriate to add marine organisms and their reproductive elements since eggs, sperm, and larvae follow the same transport path as nutrients, sediments, and organic matter and become organic matter after they die.

5) **Pages 5-34 through 5-37, 5.5.4 Restoration Type: Nutrient Reduction (Nonpoint Type),** I became aware of the hypoxia problem in the Gulf of Mexico (GOM) from the Mississippi River in 1985. For the past 30 years federal agencies and others have not addressed this issue in a comprehensive, serious, and expeditious manner. Now there is hypoxia off the coast of Texas.

What is needed with this DEIS and Restoration Plan is a concerted effort by all federal, state, and local agencies and individuals to prepare and implement a long-term plan, with specific goals to reduce nutrient levels and maintain freshwater instream flows and inflows into bays, estuaries, and the GOM in the watersheds that feed into the Mississippi River and watersheds in Texas where hypoxia events occur. We all need to compromise but get serious. The time for research, talking, and arguing is over. Let's get going!

6) **Pages 5-58 through 5-65, 5.5.10 Restoration Type: Sea Turtles,** I support proposals to restore sea turtle populations and habitats. It is very important to stress enforcement of turtle excluder device (TED) and other required mitigation measures (long-lines) for those who fish because unfortunately a few cheaters can kill many sea turtles.

I strongly encourage money be set aside for enforcement of sea turtle regulations. Enforcement money is needed for all restoration types in this DEIS and Restoration Plan because there are people who break the law and take advantage of restoration efforts to kill, destroy, damage, degrade, and profit from protected organisms and habitats of the coast.

The level of enforcement and compliance for coastal protection is not sufficient oftentimes to ensure long-term and maintenance of natural ecological processes, values, and benefits. More resources are needed (money, people, equipment) for enforcement and compliance for the long-term. For instance, the R/V Manta, attached to the Flower Garden Banks National Marine Sanctuary has been limited in its operations due to a lack of money. A fund to provide money to long-term enforcement, monitoring, and compliance would help provide protection in perpetuity.

7) **Pages 5-72 through 5-76, 5.5.12 Restoration Type: Birds,** there are a number of areas that should be considered for bird habitat acquisition and restoration on the coast of Texas. Some of these areas include:

1. Katy Prairie, in western Harris County and eastern Waller County, particularly adding to and adjoining existing conservation lands that have been protected by the Katy Prairie Conservancy that include coastal prairies and prairie pothole wetlands.

2. Eastern Chenier Plain, from Interstate (I) 45 east to the Texas – Louisiana border, includes coastal prairies and marshes in Anahuac National Wildlife Refuge, McFaddin National Wildlife Refuge, Texas Point National Wildlife Refuge, J.D. Murphree Wildlife Management Area, and Sea Rim State Park.

3. Western Chenier Plain, from I-45 west to the end of Matagorda County, includes coastal prairies, marshes, and the important Columbia Bottomlands habitat in Brazoria National Wildlife Refuge, San Bernard National Wildlife Refuge, Big Boggy National Wildlife Refuge, Galveston Island State Park, and Scenic Galveston lands on Galveston Bay.

4. Trinity River Floodplain and its Delta, includes bottomland hardwood forested wetlands for the Trinity River National Wildlife Refuge.

5. Farther inland but still mostly in or near the coastal zone, Sam Houston National Forest and Big Thicket National Preserve, include upland, slope, and bottomland hardwood forests and wetlands of the San Jacinto and Trinity Rivers.

It is particularly important that nesting colonies of birds be protected and perpetuated. It is also very important that migratory birds from the Central and Mississippi Flyways be protected with acquisition in the Columbia Bottomlands area of the lower Brazos, San Bernard, and Colorado Rivers. This ensures that resting and feeding areas (along with native habitats for waterfowl and wading birds) are protected.

8) **Pages 5-77 through 5-81, 5.5.13 restoration Type: Mesophotic and Deep Benthic Communities,** I am in favor of a greater number of dollars being spent on the protection of these marine communities. In particular, the Flower Garden Banks National Marine Sanctuary **(see also Page 5-107)** needs additional funding for the use of the R/V Manta, for research activities, for enforcement visits, for lionfish reduction programs.

There is also a need for expansion of and additional protection for a number of important marine areas across the GOM called "topographical highs" or as a group called, "Islands in the Stream". These areas are very important biologically and ecologically and potentially are at risk from oil spills. These areas should be included in marine protected areas (some which should be no-take marine reserves) so that these natural resources are protected in perpetuity and so fish stocks can rebuild in numbers and size quickly. I find protection of these natural areas much more important to fund than temporary "rigs to reefs" areas.

9) **Pages 6-36 through 6-39, 6.4.1.5 Protect and Conserve Marine, Coastal, Estuarine, and Riparian Habitats**, this "restoration approach" is one of the key approaches that would be funded with DEIS and Restoration Plan funds. The protection of important riparian habitats like Columbia Bottomlands (San Bernard and Brazoria National Wildlife Refuges) and Trinity River National Wildlife Refuge ensure that bottomland hardwood and riparian woodlands are acquired and protected for birds, forested wetlands, and clean water.

Protection of marine areas like the Flower Garden Banks National Marine Sanctuary and the "Islands in the Stream" topographic highs in the GOM ensure that a healthy GOM will exist from east to west and from top to bottom.

It is also particularly important to acquire lands behind existing shorelines, beaches, dunes, marshes, and other coastal features so that sea level rise habitat adjustments can occur and human structures are minimally affected.

10) **Pages 6-137 through 6-141, 6.14.1 Impacts of Restoration Approaches on GHG Emissions,** I am disappointed in the level of climate change adaptation that this DEIS and Restoration Plan proposes. We need to be much more aggressive or many of the protected local, state, and federal lands will be degraded or destroyed by sea level rise and other climate change effects.

I strongly encourage the Trustees to prepare and include in this DEIS and Restoration Plan, a climate change ecological resilience and resistance plan (CCERRP). This CCERRP would assess the biological and ecological elements in the GOM and the effects that climate change has had and will have on them. The CCERRP would assist plants, animals, and ecosystems in adapting to climate change and would require monitoring of changes and mitigation measure effectiveness. The CCERRP would be based on:

1. Protection of the existing functioning ecosystems on the GOM.

2. Reduction of stressors on the ecosystems on the GOM.

3. Restoration of natural functioning ecological processes on the GOM.

4. Use natural recovery on the GOM, in most instances.

5. Acquisition of buffers and corridors to expand and ensure connectivity of ecosystems on the GOM.

6. Intervention to manipulate (manage) ecosystems on the GOM only as a last resort.

7. Reduce greenhouse gas emissions on the GOM.

11) **Pages 7-1 through 7-29, 7. Governance,** one of the most important governance items that should be implemented with this DEIS and Restoration Plan is the use of audits to determine that proper spending for projects occurs. Audits will also determine if funded projects are successfully completed and provide the results anticipated. The results of these audits must be made available to the public in a timely manner so that people can see how and whether their funds are being successfully spent.

I appreciate this opportunity to comment. Thank you.

Sincerely, Brandt Mannchen

Brandt Mannchen
5431 Carew
Houston, Texas 77096
713-664-5962
brandtshnfbt@juno.com

Fwd: Get your hands out of these coffers

1 message

GulfSpill Comments - NOAA Service Account <gulfspill.comments@noaa.gov> Tue, Dec 1, 2015 at 8:53 AM
To: Jamey Redding - NOAA Affiliate <jamey.redding@noaa.gov>

Here's a non-form letter.

---------- Forwarded message ----------
From: audrey ross <webmaster@oceanconservancy.org>
Date: Fri, Nov 20, 2015 at 9:18 AM
Subject: Get your hands out of these coffers
To: Deepwater Horizon Trustees <gulfspill.comments@noaa.gov>

Nov 20, 2015

Deepwater Horizon Trustees

Dear Trustees,

Pathetic, greedy, lickers of political boots and sundry corporate trash. the loathing I feel towards you should not expressed in public.

May your progeny be forced to live in the toxic waste you leave behind

Thank you (ha-ha) again for your time and your dedication to restoring the Gulf of Mexico.

Sincerely,

audrey ross

AZ 85712-3335
audreymross@msn.com

Jamey Redding - NOAA Affiliate <jamey.redding@noaa.gov>

Fwd: Protect Open Ocean Funding

2 messages

GulfSpill Comments - NOAA Service Account <gulfspill.comments@noaa.gov> Tue, Dec 1, 2015 at 8:54 AM
To: Jamey Redding - NOAA Affiliate <jamey.redding@noaa.gov>

Jamey - here's the language we got in many emails.

---------- Forwarded message ----------
From: **Helen Schafer** <webmaster@oceanconservancy.org>
Date: Fri, Nov 20, 2015 at 8:28 AM
Subject: Protect Open Ocean Funding
To: Deepwater Horizon Trustees <gulfspill.comments@noaa.gov>

Nov 20, 2015

Deepwater Horizon Trustees

Dear Trustees,

Thank you for the opportunity to comment on the Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS). This plan provides a strong vision and rationale for undertaking an ecosystem approach to restoration of the Gulf of Mexico following the BP oil disaster. I commend the Trustees on the massive undertaking to collect and synthesize the wide range of impacts to the Gulf environment, and on your commitment to monitoring and adaptive management.

I am also pleased to see $1.24 billion dedicated to restoring the open ocean, where the disaster occurred and where impacts continue to this day. However, I am concerned that the open ocean fund will also have to cover all federal trustee administrative and preliminary planning activities across restoration areas. Administrative and planning costs are important and necessary, but taking all federal administrative costs from the open ocean funding is inappropriate.

In addition, four of the early restoration projects to address lost recreational use have been reclassified as open ocean projects. These projects include roadway and trail enhancements and the purchase of boat ferries, totaling more than $22 million. None of these projects occur in the open ocean and none fit the consent decree's definition of open ocean. I believe that allocating any open ocean funds to recreational use projects, past or present, sets a bad precedent that will allow Trustees to pull from this account for restoration activities that do not primarily benefit ocean resources. I believe these projects are better suited for the region-wide or state-based allocations in the states where the projects occur.

Thank you again for your time and your dedication to restoring the Gulf of Mexico.

Sincerely,

Helen Schafer

NJ 08889
bill.helen@outlook.com

Jamey Redding - NOAA Affiliate <jamey.redding@noaa.gov> Tue, Dec 1, 2015 at 8:54 AM
To: GulfSpill Comments - NOAA Service Account <gulfspill.comments@noaa.gov>

Thanks Courtney. You don't have to forward all of them. I will go in a get a count soon. Just wanted to make sure I had one to add to PEPC.

[Quoted text hidden]

--

Jamey Redding
Marine Resource Specialist
ERT Contractor
NOAA Office of Habitat Conservation - Restoration Center
1315 East-West Highway
Silver Spring MD 20815

Phone: 301-427-8646
Email: jamey.redding@noaa.gov

GALVESTON
PARK BOARD OF TRUSTEES

601 Tremont – P. O. Box 1080
Galveston Island, Texas 77550
(Phone) 409-797-5000
(Toll Free) 1-888-GAL-ISLE
(Fax) 409-762-8911
www.galvestonparkboard.org

December 4, 2015

U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

Dear NRDA Trustees:

The Galveston Island Park Board of Trustees ("Park Board") appreciates the opportunity to submit comments about the proposed Consent Decree for the Deepwater Horizon (DWH) oil spill and the draft Programmatic Damage Assessment and Restoration Plan. It is clear that significant thought and effort have gone into developing these documents that are critical in determining how funds from the oil spill will be allocated and used within the Gulf region. After reviewing the proposed documents, the Galveston Island Park Board of Trustees believes that some revisions and clarifications to them could make the project application and implementation process more clear, objective, transparent, and effective in restoring the Gulf of Mexico.

The Park Board encourages all parties involved in making project funding decisions to emphasize the importance of barrier islands to the economy and environment, and to consider their vulnerability to coastal hazards including oil spills. Texas beaches are the second most popular tourist destination in the state, contributing enormous economic benefits to the state and the nation. However, Galveston Island and other barrier islands in the Gulf of Mexico are most vulnerable to the impacts of oil spills and the first line of defense against coastal storms. In addition to the impacts of the DWH oil spill, Galveston Island is still recovering from Hurricane Ike in 2008 that caused $29 billion in property damage and $142 billion in economic damage. As a result, the Park Board strongly believes that protective barrier islands such as Galveston Island should be made the top priority in the evaluation and award process for DWH-related project funding applications.

We also feel strongly that Texas should receive funding to "provide and enhance recreational opportunities," which the draft plan has allocated to the other four Gulf States affected by the DWH oil spill but not to Texas. Like most barrier islands, Galveston has a relatively small population, with roughly 40,000 citizens supporting more than six million tourists annually. Providing quality recreational opportunities to millions of tourists helps to create connections between visitors and the Gulf, educating them and influencing their behavior toward this important natural asset. It is through the generation of recreational fees that the

GALVESTON
PARK BOARD OF TRUSTEES

601 Tremont – P. O. Box 1080
Galveston Island, Texas 77550
(Phone) 409-797-5000
(Toll Free) 1-888-GAL-ISLE
(Fax) 409-762-8911
www.galvestonparkboard.org

Galveston Park Board maintains facilities, manages the impacts of visitation and funds conservation efforts. Therefore, funding to "provide and enhance recreational opportunities" is essential to effectively manage visitation, leverage economic impact and ensure the upkeep, maintenance and preservation of important environmental assets. The lack of facilitated recreational opportunities can be an impediment to the creation of on-going revenue streams which will sustain conservation efforts after initial recovery funds have been invested.

We also believe that the approach to paying for the administrative costs associated with administering the Deepwater Horizon-related funding should be clarified and reconsidered. The Galveston Park Board believes administrative costs should not be covered from the "open ocean" funding. We maintain that funds allocated for the open ocean should be used for projects and activities directly related to the open ocean since it took the direct impact of the unprecedented amount of oil and dispersants that were released as a result of the DWH spill.

In addition, the proposed governance structure seems unwieldy and likely to create silos. It seems to go against the stated intention of approaching Gulf restoration on a landscape-wide, regional basis. Therefore, we recommend that consideration be given to revising the governance structure to encourage a more Gulf-wide approach.

Finally, we believe that transparency in the project selection process will help ensure the funds available from this unique, unprecedented event are used for projects that benefit the areas most impacted by the oil spill and that provide the most benefit for the Gulf of Mexico as a whole.
Thank you for considering these comments and suggestions from the Galveston Island Park Board of Trustees.

Sincerely,

Kelly de Schaun
Executive Director
Galveston Island Park Board of Trustees

GulfSpill Comments - NOAA Service Account <gulfspill.comments@noaa.gov>

More details needed on restoration implementation and coordination

1 message

Ben Spector <NationalWildlifeFederation@nwf.org>
Reply-To: Ben Spector <spectorb@nwf.org>
To: Deepwater Horizon NRDA Trustees <gulfspill.comments@noaa.gov>

Wed, Dec 2, 2015 at 4:20 PM

Dec 2, 2015

Deepwater Horizon NRDA Trustees

Dear NRDA Trustees,

Thank you for your efforts to assemble this draft Programmatic Damage Assessment and Restoration Plan (PDARP), and for the opportunity to comment. The release of the Draft PDARP and the Consent Decree represents a critical milestone on the road to restoration, and I am eager to see funding flow for project implementation.

I commend the Trustees for recommending a comprehensive, ecosystem-scale approach to restoration. I also support the PDARP's emphasis on restoration of wetlands, coastal, and nearshore habitats, which benefit a large variety of wildlife species and provide essential ecological services.

However, I am concerned by the lack of details in the draft PDARP regarding the content of the Standard Operating Procedures (SOPs). Given that the procedures and practices set forth in the SOPs will guide implementation and coordination of restoration activities across the Gulf for many years to come, transparency at this juncture is critical. I strongly urge the Trustees to provide an opportunity for public comment on the SOPs before they are finalized.

Sincerely,

Mr. Ben Spector
123 Capitol Square Pl SW.
Washington, DC 20024
spectorb@nwf.org

GulfSpill Comments - NOAA Service Account <gulfspill.comments@noaa.gov>

Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan

Gerry Ahrens <takeaction@edf.org> Wed, Dec 2, 2015 at 3:04 PM
Reply-To: Gerry Ahrens <mustang.shelby2@yahoo.com>
To: Deepwater Horizon Natural Resource Damage Assessment Trustees <gulfspill.comments@noaa.gov>

Dec 2, 2015

Deepwater Horizon Natural Resource Damage Assessment Trustees

Dear Natural Resource Damage Assessment Trustees,

Thank you for your efforts to assemble this draft Programmatic Damage Assessment and Restoration Plan (PDARP), and for the opportunity to comment. The release of the Draft PDARP and the Consent Decree represents a critical milestone on the road to restoration, and I am eager to see funding flow for project implementation.

I commend the Trustees for recommending a comprehensive, ecosystem-scale approach to restoration. I also support the PDARP's emphasis on restoration of wetlands, coastal, and nearshore habitats, which benefit a large variety of wildlife species and provide essential ecological services. Specifically, I am pleased with the Council's consideration of diversions as a restoration tool. Diversions are a cornerstone in the State of Louisiana's Coastal Master Plan, and I am glad that the NRDA process will incorporate this science-based, widely supported Plan.

However, I am concerned by the lack of details in the draft PDARP regarding the content of the Standard Operating Procedures (SOPs). Given that the procedures and practices set forth in the SOPs will guide implementation and coordination of restoration activities across the Gulf for many years to come, transparency at this juncture is critical. I strongly urge the Trustees to provide an opportunity for public comment on the SOPs before they are finalized.

Thank you for your consideration of this request,

Ms. Gerry Ahrens
890 Rough Edge Rd Lot 14
Ruston, LA 71270-3092
(318) 243-7749
mustang.shelby2@yahoo.com

Comments on Chapters 4 and 5 of the Deepwater Horizon Oil Spill: Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement (Hereinafter referred to as Draft)

By
Charles W. Caillouet, Jr., Ph.D.
Marine Fisheries Scientist-Conservation Volunteer
Montgomery, Texas

3 December 2015

1. **Among the following literature citations below, add those that were not already cited and discussed in the Draft to Sections 4.8.7 (References) and 5.11 (References), and (within Chapters 4 and 5) discuss the relevance of each publication and presentation to the damage assessment and restoration of Gulf of Mexico (GoM) sea turtle populations:**

BEVAN, E., WIBBELS, T., NAJERA, B.M.Z., MARTINEZ, M.A.C., MARTINEZ, L.A.S., REYES, D.J.L., HERNANDEZ, M.H., GAMEZ, D.G., PENA, L.J., AND BURCHFIELD, P.M. 2014. *In situ* nest and hatchling survival at Rancho Nuevo, the primary nesting beach of the Kemp's ridley sea turtle, *Lepidochelys kempii*. Herpetological Conservation and Biology 9:563–577. http://www.herpconbio.org/Volume_9/Issue_3/Bevan_etal_2014.pdf

BJORNDAL, K.A., BOWEN, B.W., CHALOUPKA, M., CROWDER, L.B., HEPPELL, S.S., JONES, C.M., LUTCAVAGE, M.E., POLICANSKY, D., SOLOW, A.R., AND WITHERINGTON, B.E. 2011. Better science needed for restoration in the Gulf of Mexico. Science 331:537–538. https://www.sciencemag.org/content/331/6017/537.full

BJORNDAL, K.A., BOWEN, B.W., CHALOUPKA, M., CROWDER, L.B., HEPPELL, S.S., JONES, C.M., LUTCAVAGE, M.E., SOLOW, A.R., AND WITHERINGTON, B.E. 2010. Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance. Washington, DC: The National Academy Press, 162 pp. http://dels.nas.edu/Report/Assessment-Turtle-Status/12889

BJORNDAL, K.A., PARSONS, J., MUSTIN, W., AND BOLTEN, A. B. 2014. Variation in age and size at sexual maturity in Kemp's ridley sea turtles. Endangered Species Research 25:57–67. http://www.int-res.com/articles/esr2014/25/n025p057.pdf

CAILLOUET, C.W., JR. 2006. Guest editorial: revision of the Kemp's ridley recovery plan. Marine Turtle Newsletter 114:2–5. http://www.seaturtle.org/mtn/archives/mtn114/mtn114p2.shtml

CAILLOUET, C.W., JR. 2010. Editorial: demographic modeling & threats analysis in the draft 2nd revision of the bi-national recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). Marine Turtle Newsletter 128:1–6. http://www.seaturtle.org/mtn/archives/mtn128/mtn128p1.shtml

Caillouet, C.W., Jr. 2011. Guest editorial: Did the BP-Deepwater Horizon-Macondo oil spill change the age structure of the Kemp's ridley population? Marine Turtle Newsletter 130:1–2. http://www.seaturtle.org/mtn/archives/mtn130/mtn130p1.shtml

Caillouet, C.W., Jr. 2014. Interruption of the Kemp's ridley population's pre-2010 exponential growth in the Gulf of Mexico and its aftermath: one hypothesis. Marine Turtle Newsletter 143:1–7. http://www.seaturtle.org/mtn/archives/mtn143/mtn143-1.shtml

Caillouet, C.W., Jr., Gallaway, B.J., and Landry, A.M., Jr. 2015a. Cause and call for modification of the bi-national recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*) - second revision. Marine Turtle Newsletter 145:1–4. http://www.seaturtle.org/mtn/archives/mtn145/mtn145-1.shtml

Caillouet, C.W., Jr., Shaver, D.J., and Landry, A.M., Jr. 2015b. Kemp's ridley sea turtle (*Lepidochelys kempii*) head-start and reintroduction to Padre Island National Seashore, Texas. Herpetological Conservation and Biology 10(Symposium):309–377. http://www.herpconbio.org/Volume_10/Symposium/Caillouet_etal_2015.pdf

Committee on Sea Turtle Conservation (CSTC). 1990. Decline of the Sea Turtles: Causes and Prevention. Washington, DC: National Research Council, National Academy Press, 259 pp. http://www.nap.edu/catalog/1536/decline-of-the-sea-turtles-causes-and-prevention

Condrey, R. and Fuller, D. 1992. The US shrimp fishery. In: Glantz, M.H. (Ed.). Climate Variability, Climate Change, and Fisheries. Cambridge: Cambridge University Press, pp. 89–119.

Coyne, M. and Landry, A.M., Jr. 2007. Population sex ratio and its impact on population models. In: Plotkin, P.T. (Ed.). Biology and Conservation of Ridley Sea Turtles. Baltimore: Johns Hopkins University Press, pp. 191–211.

Crowder, L., and Heppell, S. 2011. The decline and rise of a sea turtle: how Kemp's ridleys are recovering in the Gulf of Mexico. Solutions 2:67−73. http://www.thesolutionsjournal.com/node/859

Epperly, S.P. 2003. Fisheries-related mortality and turtle excluder devices (TEDs). In: Lutz, P.L., Musick, J.A., and Wyneken, J. (Eds.). The Biology of Sea Turtles Vol. II. Boca Raton: CRC Press, pp. 339–353.

Finkbeiner, E.M., Wallace, B.P., Moore, J.E., Lewison, R.L., Crowder, L.B., and Read, A.J. 2011. Cumulative estimates of sea turtle bycatch and mortality in USA fisheries between 1990 and 2007. Biological Conservation 144:2719–2727. http://micheli.stanford.edu/pdf/Cumulative%20estimates%20of%20sea%20turtle%20bycatch%20and%20mortality%20in%20U.S.A.%20fisheries%20between%201990-2007.pdf

GALLAWAY, B.J. AND CAILLOUET, C.W., JR. 2014. The 2013 Kemp's ridley stock assessment: shrimp trawls and oil spills. In: Texas Sea Grant Program. Second International Kemp's Ridley Sea Turtle Symposium. College Station: Texas A&M University TAMU-SG-14-101, p. 10. http://texasseagrant.org/assets/uploads/resources/14-101_SIKRSTS_program.pdf

GALLAWAY, B.J. AND GAZEY, W.J. 2014. The 2014 Kemp's ridley stock assessment: reduced nesting or reduced nesters? In: Texas Sea Grant Program. Second International Kemp's Ridley Sea Turtle Symposium. College Station: Texas A&M University TAMU-SG-14-101, p. 11. http://texasseagrant.org/assets/uploads/resources/14-101_SIKRSTS_program.pdf

GALLAWAY, B.J. AND GAZEY, W.J. 2015. The 2014 Kemp's ridley stock assessment: reduced nesting or reduced nesters? In: Texas A&M Sea Grant Program. Second International Kemp's Ridley Sea Turtle Symposium. College Station: Texas A&M University TAMU-SG-15-101, p. 33. http://texasseagrant.org/assets/uploads/resources/15-101_Monitoring_Status_program.pdf

GALLAWAY, B.J., GAZEY, W.J., CAILLOUET, C.W., Jr., RABORN, S.W., PLOTKIN, P.T., AND KEMP'S RIDLEY STOCK ASSESSMENT WORKSHOP PARTICIPANTS. 2014. Presented in the Session on Conservation, Management and Policy, 34th Annual Symposium on Sea Turtle Biology and Conservation, 10-17 April 2014, New Orleans.

GALLAWAY, B.J., GAZEY, W.J., CAILLOUET, C.W., Jr., PLOTKIN, P.T., SHAVER, D.J., ABREU GROBOIS, F. A., AMOS, A.F., BURCHFIELD, P.M., CARTHY, R,R., CASTRO MARTÍNEZ, M.A., COLE, J.G., COLEMAN, A.T., COOK, M., DIMARCO, S., EPPERLY, S.P., FUJIWARA, M., GOMEZ GAMEZ, D., GRAHAM, G. L., GRIFFIN, W.L., ILLESCAS MARTÍNEZ, F., LAMONT, M.M., LEWISON, R.L., LOHMANN, K.L., NANCE, J.M., PITCHFORD, J., PUTMAN, N.F., RABORN, S.W., RESTER, J.K., RUDLOE, J.J., SARTI MARTÍNEZ, L., SCHEXNAYDER, M., SCHMID, J.R., SLAY, C., TUCKER, A.D., TUMLIN, M., WIBBELS, T., and ZAPATA NÁJERA, B.M. in press. Development of a Kemp's Ridley sea turtle stock assessment model. Gulf of Mexico Science. (contact: Dr. Pamela Plotkin, Director, Texas Sea Grant Program and Texas A&M University, College Station, TX).

HEPPELL, S.S. 1997. On the importance of eggs. Marine Turtle Newsletter 76:6–8.

HEPPELL, S.S. 2014. The fragility of recovery: implications of the dramatic reduction of the Kemp's ridley population growth rate since 2010. In: Texas A&M Sea Grant Program. Second International Kemp's Ridley Sea Turtle Symposium. College Station: Texas A&M University TAMU-SG-14-101, p. 9.
http://texasseagrant.org/assets/uploads/resources/14-101_SIKRSTS_program.pdf

HEPPELL, S.S. 2014. Data and models indicate dramatic changes in Kemp's ridley growth rate. Presented in the Session on Sea Turtle Biology and Conservation in the Gulf of Mexico, 34th Annual Symposium on Sea Turtle Biology and Conservation, 10-17 April 2014, New Orleans.

HEPPELL, S.S. 2015. The fragility of recovery: implications of the dramatic reduction of the Kemp's ridley population growth rate since 2010. In: Texas A&M Sea Grant Program. Second International Kemp's Ridley Sea Turtle Symposium. College Station: Texas A&M University TAMU-SG-15-101, p. 25.

http://texasseagrant.org/assets/uploads/resources/15-101_Monitoring_Status_program.pdf

HEPPELL, S.S., BURCHFIELD, P.M., AND PEÑA, L.J. 2007. Kemp's ridley recovery: how far have we come, and where are we headed? In: Plotkin, P.T. (Ed.). Biology and Conservation of Ridley Sea Turtles. Baltimore: Johns Hopkins University Press, pp. 325–335.

HEPPELL, S.S., CROUSE, D.T., CROWDER, L.B., EPPERLY, S.P., GABRIEL, W., HENWOOD, T., MÁRQUEZ, R., AND THOMPSON, N.B. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp's ridley sea turtles. Chelonian Conservation & Biology 4:767–773.

JENKINS, L.D. 2012. Reducing sea turtle bycatch in trawl nets: a history of NMFS turtle excluder device (TED) research. Marine Fisheries Review 74:26–44. http://spo.nmfs.noaa.gov/mfr742/mfr7423.pdf

LEWISON, R., WALLACE, B., ALFARO-SHIGUETO, J., MANGEL, J.C., MAXWELL, S.M., AND HAZEN, E.L. 2013. Fisheries bycatch of marine turtles: lessons learned from decades of research and conservation. In: Wyneken, J., Lohmann, K.J., and Musick, J.A. (Eds.). The Biology of Sea Turtles Volume III. Boca Raton: CRC Press, pp. 329–351.

LUTCAVAGE, M.E., P.L. LUTZ, G. BOSSART & D.M. HUDSON. 1995. Physiologic and clinicopathologic effects of crude oil on loggerhead sea turtles. Archives of Environmental Contamination and Toxicology 28:417-422. http://link.springer.com/article/10.1007%2FBF00211622

LUTZ, P. L., AND LUTCAVAGE, M. 1989. The effects of petroleum on sea turtles; applicability to Kemp's ridley. In: Caillouet, C.W., Jr. and Landry, A.M., Jr. (Eds.). Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Galveston: Texas A&M University TAMU-SG-89-105, pp. 52-54. http://texasseagrant.org/assets/uploads/publications/1989/89-105%202.pdf

MARQUEZ-M., R. 1994. Synopsis of biological data on the Kemp's Ridley turtle, *Lepidochelys kempi* (Garman, 1880). NOAA Technical Memorandum NMFS-SEFSC-343, 91 pp. http://www.sefsc.noaa.gov/turtles/TM_343_Marquez_M_1994.pdf

MÁRQUEZ M., R. 2001. Status and distribution of the Kemp's Ridley turtle, *Lepidochelys kempii*, in the wider Caribbean region. In: Eckert, K.L. and Abreu Grobois, F.A. (Eds.). Marine Turtle Conservation in the Wider Caribbean Region: A Dialogue for Effective Regional Management. St. Croix: Wider Caribbean Sea Turtle Conservation Network, World Wildlife Fund, International Union for Conservation of Nature/Marine Turtle Specialist Group, and United Nations Environment Programme, pp. 46–51. http://www.widecast.org/Resources/Docs/Biology_Kemps_DR_Proc.pdf

MÁRQUEZ-M., R., BURCHFIELD, P.M., DÍAZ-F., J., SÁNCHEZ-P., M., CARRASCO-A., M., JIMÉNEZ-Q., C., LEO-P., A., BRAVO-G., R., AND PEÑA-V., J. 2005. Status of the Kemp's ridley sea turtle, *Lepidochelys kempii*. Chelonian Conservation and Biology 4:761–766.

MÁRQUEZ M., R., RÍOS OLMEDA, D., SÁNCHEZ P., J.M., AND DÍAZ, J. 1989. Mexico's contribution to Kemp's ridley sea turtle recovery. In: Caillouet, C.W., Jr. and Landry, A.M., Jr. (Eds.). Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Galveston: Texas A&M University TAMU-SG-89-105, pp. 4–6. http://texasseagrant.org/assets/uploads/publications/1989/89-105%202.pdf

MÁRQUEZ-MILLÁN, R., DEL CARMEN JIMÉNEZ-QUIROZ, J., PEÑAFLORES-SALAZAR, C., and DÍAZ-Flores, J. 2014. Programa Nacional de Investigación de Tortugas Marinas. In: Márquez-Millán, R. and Garduño-Dionate, M. (Compilers). Tortugas Marinas. Mexico, D.F.: Instituto Nacional de Pesca 50 Anniversario 1962-2012, pp. 13–47. http://www.inapesca.gob.mx/portal/documentos/publicaciones/LIBROS/Tortugas-Marinas-x1a.pdf

NANCE, J.M., CAILLOUET, C.W., Jr., AND HART, R.A. 2010. Size-composition of annual landings in the white shrimp, *Litopenaeus setiferus*, fishery of the northern Gulf of Mexico, 1960–2006: its trend and relationships with other fishery-dependent variables. Marine Fisheries Review 72:1–13. http://spo.nmfs.noaa.gov/mfr722/mfr7221.pdf

NFWF. 2009. Business Plan for Sea Turtle Conservation. Washington, DC: National Fish and Wildlife Foundation, 39 pp. http://www.nfwf.org/seaturtles/Documents/Sea_Turtles_Biz_Plan.pdf

NMFS AND USFWS. 2015. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation. Silver Spring and Albuquerque: NMFS Office of Protected Resources and USFWS Southwest Region, 63 pp. http://www.nmfs.noaa.gov/pr/listing/final_july_2015_kemp_s_5_year_review.pdf

NMFS, USFWS, AND SEMARNAT. 2011. Bi-national recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). Second Revision. Silver Spring, MD: National Marine Fisheries Service, 156 pp. http://www.nmfs.noaa.gov/pr/pdfs/recovery/kempsridley_revision2.pdf

NOAA. 2014. ENDANGERED SPECIES ACT – SECTION 7 CONSULTATION BIOLOGICAL OPINION. http://sero.nmfs.noaa.gov/protected_resources/sea_turtles/documents/shrimp_biological_opinion_2014.pdf

PUTMAN, N.F., MANSFIELD, K.L., HE, R., SHAVER, D.J., AND VERLEY. P. 2013. Predicting the distribution of oceanic-stage Kemp's ridley sea turtles. Biological Letters 9:20130345. http://rsbl.royalsocietypublishing.org/content/9/5/20130345

PUTMAN, N.F., SCOTT, R., VERLEY, P., MARSH, R., AND HAYS, G.C. 2012. Natal site and offshore swimming influence fitness and long-distance ocean transport in young sea turtles. Marine Biology 159:2117–2126. http://link.springer.com/article/10.1007/s00227-012-1995-5?no-access=true

PUTMAN, N.F., SHAY, T.J., AND LOHMANN, K.J. 2010. Is the geographic distribution of nesting in the Kemp's ridley sea turtle shaped by the migratory needs of offspring? Integrative and Comparative Biology 50:305–314. http://icb.oxfordjournals.org/content/50/3/305.full

ROWE, C.L. 2008. "The calamity of so long life": life histories, contaminants, and potential emerging threats to long-lived vertebrates. BioScience 58:623–631. http://bioscience.oxfordjournals.org/content/58/7/623.full.pdf+html

ROWE, J., MCCAY, D.F., and WHITTIER, N. 2007. Estimation of natural resource damages for 23 Florida cases using physical fates and biological modeling. In: Proceedings of the Annual International Conference on Soils, Sediments, Water and Energy 12(Article 34):335-345. http://scholarworks.umass.edu/soilsproceedings/vol12/iss1/34 http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1062&context=soilsproceedings

SEMINOFF, J.A. AND SHANKER, K. 2008. Marine turtles and IUCN red listing: a review of the process, the pitfalls, and novel assessment approaches. Journal of Experimental Marine Biology and Ecology 356:52–68. http://www.sciencedirect.com/science/article/pii/S002209810700576X

SHAVER, D.J. AND CAILLOUET, C.W., Jr. 2015. Reintroduction of Kemp's ridley (*Lepidochelys kempii*) sea turtle to Padre Island National Seashore, Texas and its connection to head-starting. Herpetological Conservation and Biology 10(Symposium):378–435. http://herpconbio.org/Volume_10/Symposium/Shaver_Caillouet_2015.pdf

SHAVER, D.J., HART, K.M., FUJISAKI, I., RUBIO, C., SARTAIN, A.R., PEÑA, J., BURCHFIELD, P.M., GOMEZ Gamez, D., AND ORTIZ, J. 2013. Foraging area fidelity for Kemp's ridleys in the Gulf of Mexico. Ecology and Evolution 3:2002–2012. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3728941/

TEWG (TURTLE EXPERT WORKING GROUP). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409, 96 pp. http://www.nmfs.noaa.gov/pr/pdfs/species/tewg1998.pdf

TEWG (TURTLE EXPERT WORKING GROUP). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444, 115 pp. http://www.nmfs.noaa.gov/pr/pdfs/species/tewg2000.pdf

USFWS. 2015. Gulf Coast Vulnerability Assessment Mangrove, Tidal Emergent Marsh, Barrier Islands, and Oyster Reef. Watson, A., and Ashby, S. (Principal Investigators). http://gulfcoastprairielcc.org/media/28945/finalgcva_xsummary_v5.pdf http://gulfcoastprairielcc.org/media/28946/gcva_11022015_final.pdf

USFWS AND NMFS. 1992. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). St. Petersburg, FL: National Marine Fisheries Service, 47 pp.
WIBBELS, T. 2007. Sex determination and sex ratio in ridley turtles. In: Plotkin, P.T. (Ed.).

Biology and Conservation of Ridley Sea Turtles. Baltimore: Johns Hopkins University Press, pp. 167–189. http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_kempsridley.pdf

WIBBELS, T. AND BEVAN, E. 2015. New riddle in the Kemp's ridley saga. In: Mast, R.B., Hutchinson, B.J., and Villega, P.E. (Eds.). State of the World's Sea Turtles Volume X. Ross: Oceanic Society, pp. 15-17. http://seaturtlestatus.org/sites/swot/files/report/SWOT10_p14-17_New%20Riddle%20in%20Kemps_spread.pdf

WITHERINGTON, B., HIRAMA, S., AND HARDY, R. 2012. Young sea turtles of the pelagic *Sargassum*-dominated drift community: habitat use, population density, and threats. Marine Ecology Progress Series 463:1–22. http://www.researchgate.net/publication/270087545_Young_sea_turtles_of_the_pelagic_Sargassum-dominated_drift_community_Habitat_use_population_density_and_threats

WITZELL, W.N., SALGADO-QUINTERO, A., AND GARDUÑO-DIONTE, M. 2005. Reproductive parameters of the Kemp's ridley sea turtle (*Lepidochelys kempii*) at Rancho Nuevo, Tamaulipas, Mexico. Chelonian Conservation & Biology 4:781–787.

YANINEK, K.D. 1995. Turtle excluder device regulations: laws sea turtles can live with. North Carolina Central Law Journal 21:256–299.

2. **On page 4-25, it is stated: "Sections 4.8 (Sea Turtles) and 4.9 (Marine Mammals) describe the Trustees' assessment of injury to these highly charismatic organisms, which are protected by the Endangered Species Act and the Marine Mammal Protection Act. The sea turtle assessment relied on extensive observations of oiled turtles to develop opinions regarding sea turtle injuries, as supplemented by veterinary assessments of captured turtles and a laboratory study of surrogate freshwater turtles. The marine mammal assessment synthesized data from NRDA field studies, stranded carcasses collected by the Southeast Marine Mammal Stranding Network, historical data on marine mammal populations, NRDA toxicity testing studies, and the published literature."**

To supplement the approaches applied to assess injury to sea turtles, the Trustees should also synthesize sea turtle data from NRDA field studies, stranded carcasses collected by the NMFS SEFSC Sea Turtle Stranding and Salvage Network, historical data on sea turtle populations, and the published literature (including literature listed under item 1 above). In other words, data existed from which these approaches could have been applied, just as they were applied to the marine mammals; they should work as well for sea turtles. If the Trustees actually applied them to sea turtles, then the statement on page 4-25 (item 2 above) should be corrected accordingly.

3. **On page 4-169 it is stated: "Assessing production foregone allows for a more thorough representation of spill-related injuries to water column organisms than would be captured by calculating what is lost by the direct kill alone. Results of the production foregone model are measured in biomass, which can be used to address biological concerns and can be informative when considering restoration needs."**

Although the Trustees applied this approach to fishes, they should also apply forgone production modeling to sea turtles for which growth and survival have been estimated and modeled (see Rowe et al. 2007 in literature listed under item 1 above). This would supplement the other approaches that were applied to sea turtles. Rowe et al. (2007) noted that foregone production modeling **"…is not a direct method of increasing sea turtle production. Therefore, scaling was performed to estimate the number of hatchlings needed to compensate for the sea turtle injuries."** This is especially relevant because increasing annual hatchling production on nesting beaches in Tamaulipas and Veracruz, Mexico as well as in Texas, is the most immediate restoration action that can be taken to restore exponential growth toward recovery of the Kemp's ridley population (see http://www.galvnews.com/opinion/guest_columns/article_68a51fea-6186-11e5-82f1-03855703a74a.html). Restoration and enhancement of annual hatchling production and releases from nesting beaches have long been demonstrated as effective means of restoring sea turtle population growth, especially for Kemp's ridley (see literature listed under item 1 above).

4. **As stated on page 4-516: "Inherent challenges to studying highly mobile marine animals (i.e., they are typically located in remote areas that are difficult for researchers to access, they are difficult to find and capture at sea, and certain life stages spend most of their time below the surface) further restricted the Trustees' survey efforts. For these reasons, the Trustees used expert opinion, surface oiling maps, and statistical approaches to apply the directly observed adverse effects of oil exposure to turtles in areas and at times that could not be surveyed. This produced estimates of the total number of sea turtles that were injured within the entire footprint and period of the DWH oil spill." On page 4-519, it was stated that "Turtles frequently become accidentally entangled, ensnared, and hooked in fishing gear, including in trawls, nets, traps/pots, and on hook and line, and many of these interactions are fatal (Lewison et al. 2013)."**

In retrospect, bottom trawling with shrimp trawls would have been an effective method for sampling abundance of neritic life stages of sea turtles that spend most of their time submerged, and especially for sampling abundance of large subadult and adult females that have the highest reproductive value compared to all other life stages. This was a missed opportunity. It could have provided valuable data on abundance of large subadult and adult female sea turtles, especially Kemp's ridleys, during and following the oil spill. This was a possible reason why large subadult and adult female sea turtles failed to be detected within areas inside and outside (to the west and east) the expanding spill footprint. Not only could the oil spill have killed large subadult and adult Kemp's ridley, but it could have been a barrier to migration of these turtles to western GoM nesting beaches. The cold winter of 2009-2010 could have delayed their migration to the nesting beaches; the nesting season in 2010 was delayed. See literature authored by Gallaway and other under item 1 above. This should be discussed in a revision of the Draft.

5. **The injury assessment results for the female portion of the Kemp's ridley (*Lepidochelys kempii*) population are woefully inadequate for purposes of informing this species'**

restoration planning so that restoration can address the nature, degree, and extent of the injuries (see references under item 1 above).

According to Gulf Coast Vulnerability Assessment conducted by USFWS (2015), **“Of the species assessed, Kemp’s ridley sea turtle is thought to be the most vulnerable species across the Gulf Coast. Experts identified its main threat as loss of nesting habitat to sea level rise, erosion, and urbanization.”** This implies that Kemp’s ridley is considered to be a highly important index species for detecting environmental impacts and trends. In addition, its nesting beaches are habitats that are important to it survival and recovery, because they are annual sources of hatchling releases (i.e., additions to the population). This should be discussed in a revision of the Draft.

6. **The 4.8.1 Introduction in the Draft stated: “Given the extensive nature of the DWH oil spill, it is key to understand how different life stages are distributed, and how different species of sea turtles use habitats in these different areas, in order to assess impacts of the DWH oil spill. Consequently, the Trustees assessed injury to sea turtles by species and life stage.”**

However, on pages 4-516 and 4-517, GoM sea turtle species were combined to present numbers of large juvenile and adults killed by the DWH oil spill, as well as to present numbers of hatchlings injured by the DWH oil spill. All GoM sea turtle species, life stages, and sexes would not be expected to have been impacted in identical ways by the 2010 DWH oil spill (see Caillouet 2014, under item 1 above). Demographic, stock assessment, and regression models have shown that the female portion of the Kemp’s ridley population suffered a major setback which began sometime between the ends of the nesting seasons in 2009 and 2010, and that this population’s pre-2010 exponential growth (NMFS et al. 2011) has not resumed since then (see literature cited under item 1 above; see also Section 4.8.4.7 and Figure 4.8-15). The only life stages that could have influenced the documented annual numbers of Kemp’s ridley nests on nesting beaches in Texas and Mexico in years 2010-2014 were adult females and large subadult females (i.e., those that matured and joined the adult life stage before or during each nesting season in years 2010-2014; see Caillouet 2014 under item 1 above). Only adult female sea turtles lay clutches of eggs (i.e., nests). Before the oil spill, growth in the female Kemp’s ridley population, especially exponential growth, provided strong evidence that additions to the population through annual hatchling releases over the years had overwhelmed all losses due to anthropogenic and natural mortality for 2.5 decades (see Caillouet 2010 under item 1 above). NMFS predicted that Kemp’s ridley would meet downlisting criteria by 2011. This should be discussed in the

7. **Section 4.8.2.1 stated acknowledged that: “This extensive oiling contaminated vital foraging, migratory, and breeding habitats at the surface, in the water column, and on the ocean bottom throughout the northern Gulf of Mexico for Kemp’s ridleys, loggerheads, green turtles, hawksbills, and leatherbacks, across geographic areas used by different life stages. In fact, DWH oil contaminated areas designated as “Critical Habitat” under the ESA for loggerhead sea turtles in the northern Gulf of Mexico. The pervasive and prolonged nature of the DWH spill, particularly at the air-water interface where all sea turtles must go to breathe, made exposure to oil inescapable for**

many sea turtles, and caused significant injuries to sea turtle populations in the northern Gulf of Mexico." In the Figure 4.8-4 legend, it was stated that "Boat-based efforts during the DWH oil spill focused on offshore areas that are inhabited by small juvenile sea turtles. Photos: (top left) Trustees searched convergence areas, which accumulate floating material, typically *Sargassum* and associated fauna, including sea turtles, as well as DWH oil; (top right) responders performed boat-based operations in offshore areas to rescue small juvenile sea turtles that inhabited convergence areas affected by the oil;(bottom) a heavily oiled, small juvenile Kemp's ridley turtle rescued during the spill." On page 4-534 is was stated: "It is important to note that the turtles documented during rescue operations—especially the number of oiled, dead turtles—underestimate the actual magnitude and degree of oil exposure that affected sea turtles during the DWH oil spill. The underestimation was due to several factors that hindered the ability of field crews to document live and dead turtles during the rescue efforts. Foremost was the vast expanse of the search area and distance from shore, which limited the proportion of the spill area that could be physically searched for small turtles, which are only visible from vessels. Disappearance of carcasses due to sinking of remains, scavenging, and rapid decomposition rates in summer temperatures limited the recovery of dead turtles as did the difficulty of seeing motionless, oiled small turtles among surface material and oil. In addition, rescue crews were restricted from working early in the spill period, during inclement weather, around the wellhead, and in more distant areas due to logistical constraints and safety concerns." On page 4–539 it is stated that: "Given the many complexities of response operations and translocation of nests during the DWH oil spill, very little sampling was done during the actual nesting season in 2010. Studies of nesting females, eggs, and hatchlings in subsequent years primarily focused on Kemp's ridleys in Texas and were aimed at detection of ongoing exposure and effects. None of these studies yielded evidence of exposure to DWH oil; however, the limited scale of sampling, uncertainty about application of methods to sea turtles, and the variability in exposure probability among animals that forage in different areas may have prevented detection of possible oil exposure of nesting female sea turtles (Hooper & Schmitt 2015)."

Absence of evidence should not have been taken as evidence of absence. The northern GoM includes well known foraging areas for large subadult and adult Kemp's ridleys, and these life stages are known to migrate through northern GoM corridors on their way to western GoM nesting beaches. Any large subadult and adult Kemp's that encountered DWH oil at the surface likely would have been killed or debilitated by inhaling fumes of the volatile components of DWH oil, by ingesting DWH oil, or both. Typically, large subadult and adult Kemp's ridleys occur farther offshore than smaller neritic life stages, and they are not typically associated with Sargassum. The proportion that large subadult and adult female Kemp's ridleys represent within the female population is small compared to younger life stages, but the large subadult and adult females have much greater reproductive value than the younger life stages (Seminoff and Shanker 2008; Bjorndal et al. 2011; Crowder and Heppell 2011; NMFS et al. 2011; NMFS and USFWS 2015). In addition, any large subadult and adult female Kemp's ridley that may have been killed or debilitated by the DWH oil, dispersants (e.g., COREXIT), or burning of the DWH oil at sea would have been less likely to strand dead or alive along the coast of the northern GoM because of their greater distances from the coast. In other words, numbers of documented deaths and injuries of large subadult and adult female Kemp's ridleys during the DWH oil spill probably were very low compared to numbers actually killed or debilitated by DWH oil, and their deaths or debilitation no doubt would have reduced nesting in 2010. Numbers of nests dropped in 2010 and have remained much lower than expected ever since (see NMFS et al. 2011; NMFS and USFWS 2015) in Texas and Mexico. The drop was documented in Tamaulipas, Veracruz, and Texas. What else could have killed or debilitated large numbers of subadult and adult female Kemp's ridleys in 2010, if not the DWH oil and actions taken to mitigate its impacts on sea turtles? See the published sources under item 1 above. The draft assessment should at least include a discussion of various hypotheses put forward to date to explain the drop in nests throughout the western GoM, and cite the relevant literature listed under item 1 above.

Lutz and Lutcavage (1989) should be cited and mentioned in in the damage assessment (see citation under item 1 above).

Also the quote above from page 4–539 should be revised to clarify exactly what was meant by **"…response operations and translocation of nests during the DWH oil spill…"** If this passage referred specifically to response operations relating to sea turtles, it should be stated as such, because **"response operations"** dealt with many factors and biota. If **"translocation of nests"** related to Kemp's ridley, it should be stated as such, because translocation of clutches to protective corrals and polystyrene boxes containing beach sand is standard practice on Kemp's ridley nesting beaches in Tamaulipas, Veracruz, and Texas. However, if **"translocation of nests"** referred instead to the translocation of clutches of sea turtle clutches (https://pub-dwhdatadiver.orr.noaa.gov/dwh-ar-documents/894/DWH-AR0021308.pdf) from west Florida to east Florida nesting beaches during the oil spill, it should be stated as such. Translocation of sea turtle clutches from west Florida to east Florida beaches during the DWH oil spill should not be given as a reason that **"…very little sampling was done during the actual nesting season in 2010."** The fact that very little sampling was done during the actual nesting season in 2010, especially that of Kemp's ridley, could well be the major reason why data are lacking concerning impacts on large subadult and adult Kemp's ridley on the northern Gulf of Mexico foraging grounds. Since shrimp trawling has been designated the most important anthropogenic cause of mortality in neritic life stages of sea turtles at sea since 1990 (http://www.nap.edu/catalog/1536/decline-of-the-sea-turtles-causes-and-prevention), it would have been prudent to sample northern GoM foraging areas for large subadult and adult Kemp's ridley sea turtles with bottom trawls during the nesting season in 2010? In 2010, were there no strandings of large subadult and adult Kemp's ridleys documented along the northern GoM coast (Florida through Texas) before, during, and following the DWH oil spill? See Gallaway et al. (2013). A summary of annual numbers of strandings of large subadult and adult female and male Kemp's ridleys in each year 2009-2014, should be included in a revision of the Draft, and compared to strandings of smaller, neritic life stages of Kemp's ridleys. For 2010 only, these strandings should be grouped into two temporal categories, "pre-spill" and "from beginning of the spill onward". Comparisons should also be made of carapace length distributions of the annual strandings of all neritic stage Kemp's ridleys, for years 2009-2014, with 2010 partitioned into the two categories above. This should determine the proportion of strandings made up of large subadults and adults (by sex) in each year 2009-2014, and evaluate how this proportion may have changed over years 2009-2015. It should also determine whether the proportion changed between "pre-spill" and "from beginning of the spill onward in 2010). Methods and results of these analyses should be included in a revision of the Draft.

8. **Also revealing is the following statement in Section 4.8.4.3: "In a separate study, changes in chemical markers in carapacial scutes (i.e., the keratinized covering of turtles' shells) of nesting adult Kemp's ridleys suggested that turtles in 2011 and 2012 foraged in different locations than areas used by turtles in 2010 prior to the DWH spill (Hooper & Schmitt 2015). Although the cause(s) of these observations is unknown at this time, a persistent effect on turtle foraging areas and/or prey availability or quality related to the DWH oil spill cannot be ruled out. Furthermore, because sea turtles tend to use the same foraging areas across years (e.g., Shaver et al. 2013), it is plausible that turtles that foraged in or traveled through the DWH oil spill footprint were exposed to oil."**

The Kemp's ridleys in mentioned in these studies were those that were examined after being found in the areas surveyed. These studies did not rule out the probability that significant numbers of large subadult and adult females were killed or debilitated by DWH oil during their migration toward western GoM nesting beaches in 2010, or prevented or delayed from migrating by DWH oil. Energy stores are required for their migration to nesting beaches and production of eggs; if the turtles were undernourished due to reduction of abundance of prey by the DWH oil spill, they may not have been able to migrate, produce eggs, or both. An examination and discussion of most if not all the sources listed under item 1 above should be included in a revision of Draft Section 4.8, since those sources provided numerous hypotheses regarding factors including the DWH oil spill and responses to it that could have contributed to the setback in the Kemp's ridley female population, evidenced by the substantial drops in nests on beaches in Tamaulipas, Veracruz, and Texas in 2010, which appears to have had lasting effects on nesting. Also, a control group of 18 adult Kemp's ridleys exists at Cayman Turtle Farm Inc., Grand Cayman Island, BWI, from which carapacial scute samples can be taken for analysis of chemical markers, and comparison with those mentioned above. All of this should be discussed in a revision of the Draft.

9. **The DWH oil spill footprint and the 50 m depth contour should be added to Figure 4.8-10 should depict**

The legend of Figure 4.8-10 states that **"Trustees flew aerial surveys to document locations of sea turtles within the DWH oil spill footprint. Triangles indicate all sightings of Kemp's ridleys (blue; n=287 turtles) and loggerheads (orange; n=529 turtles) along all survey transect lines flown systematically from April through September 2010."**

The DWH oil spill footprint should be added to Figure 4.8-10. Also, adult Kemp's ridleys are not abundant seaward of the 50 m contour, so the 50 m contour should also be added to Figure 4.8-10.

10. **Section 4.8 stated "Although DWH oil was unlikely to have had an impact on Kemp's ridley nesting abundance in 2010, it is likely DWH oil contributed to some unquantified extent to the observed reduction in projected nesting after 2010."**

This begs the question; “What caused the unprecedented and unpredicted substantial drop in numbers of nests in Tamaulipas, Veracruz, and Texas in 2010?” Whatever it was also remains unquantified, but it obviously had a GoM-wide detrimental impact on large subadult and adult female Kemp’s ridleys in 2010. Sources under item 1 above discuss a number of possible causes, which should all be discussed in Section 4.8.4.7 which states that: **“DWH oil did not arrive on the continental shelf of the northern Gulf of Mexico until late May or early June 2010. By that time, adult Kemp’s ridley turtles that were going to breed in 2010 would likely have already departed the northern Gulf for their breeding and nesting areas in the western Gulf.”** This is conjecture. Trustees should provide evidence that large subadult and adult Kemp’s ridleys that were going to breed in 2010 departed the northern GoM prior to late May or early June in 2010. A comparison of the time sequencing of Kemp’s ridley nesting in Texas, Tamaulipas, and Veracruz during 2010 and the previous 10 years should be made. If the start of nesting was delayed in 2010 (e.g., by the cold winter of 2009-2010) as compared to the preceding 10 years, this would suggest that would-be nesters did not migrate from the northern GoM to western GoM nesting beaches before the DWH oil spill as suggested in the Draft. For years 2000-2010, data on daily Kemp’s ridley nest counts probably exist for nesting beaches in Texas, Tamaulipas, and Veracruz. The time-sequence patterns of Kemp’s ridley nest numbers at these three States in each year 2000-2010 should be examined and compared. For each year and State, I suggest that the cumulative number of daily Kemp’s ridley nests over each of the 11 nesting seasons be calculated and graphed and the graphs compared. It should be possible to determine from such graphs whether nesting was delayed in 2010 compared to the previous 10 years. If nesting was not delayed in 2010, that might be taken as circumstantial evidence that Kemp’s ridley female adults and large subadults left the northern GoM foraging grounds before the DWH oil could have affected them in 2010. If nesting was delayed in 2010, this could be taken as circumstantial evidence that something delayed migration to nesting beaches in 2010, leaving the turtles vulnerable to impacts by the DWH oil spill. One thing for certain is that the annual nest counts in Texas, Tamaulipas, and Veracruz were much lower in 2010 than in 2009! The magnitude of the drop in annual nests in Tamaulipas (where most nesting occurs), between the ends of the 2009 and 2010 nesting seasons, was unprecedented as compared to annual nests in years 1966-2009. More than 4 decades of successful conservation efforts in the GoM were incapable of preventing this setback, or restoring exponential growth of the Kemp’s ridley female population. All of this should be discussed in a revision of the Draft.

11. **Section 4.6.3.2.2 (River Water Releases) stated: “With oil approaching the shoreline, salinity control structures at nine separate locations in Louisiana (Davis Pond, Caernarvon, Bayou Lamoque, West Pointe a la Hache, Violet Siphon, White Ditch, Naomi Siphon, Ostrica Lock, and Bohemia) were opened as part of a series of response actions intended to reduce the movement of oil into sensitive marsh and shoreline areas. The largest two of these structures allowed river water to flow into Barataria Bay and Black Bay/Breton Sound. The Caernarvon structure was opened on April 23, 2010, and remained open through the first two weeks of August at or near maximum capacity (approximately 8,000 cubic feet per second) (see Figure 4.6-13 for Caernarvon flow history) (Rouhani & Oehrig 2015b)…..”**

The winter of 2009-2010 was cold and wet (http://www.ncdc.noaa.gov/extremeevents/specialreports/2009-2010-Cold-Season.pdf https://sites.google.com/site/whythe2009winterissocold/), and the deliberate releases of river water mentioned in Section 4.6.3.2.2, as well as colder Mississippi River water outflow (http://onlinelibrary.wiley.com/doi/10.1002/2014JC010498/full), may have delayed migration of large subadult and adult female Kemp's ridley from the northern GoM in 2010, thereby allowing them to be impacted by DWH oil (under item 1 above, see Caillouet 2010, 2011, 2014; Gallaway et al. 2013, 2014, in press; Gallaway and Gazey 2014, 2015). This should be discussed in a revision of the Draft.

Dear Sir:

Thank you for the opportunity to comment on the Deepwater Horizon Draft PDARP/ PEIS. As the Aerial Dispersant Group Supervisor for the Deepwater Horizon release I was intimately involved in the operational decisions. Also, I initiated within our group a science team to continually determine if our dispersant application was effective and what impacts our dispersant spraying was having on biota in the underlying water column. We wanted to be sure we were doing the very best we could to reduce environmental damage that was being caused by the spill. The important result of that scientific effort was the publishing of the data in the OSAT Ecotoxicity Addendum (OSAT 2011) that showed that no harm to the water column test species was occurring.

I could not find any quantification of the environmental benefits of surface dispersant application. Only the harm caused by dispersant application was discussed. This would lead one to question why dispersants were approved for use. It is important to include a discussion of net environmental benefits so that government officials and the general public can better understand why dispersants were used. The removal and biodegradation of an estimated 15,000,000 gallons of Macondo crude oil by aerial application of dispersant (over 10% of the total released) had a significant benefit to offshore mammals, turtles, and birds and an even greater benefit to the shoreline habitat. This benefit was realized by using less than 10% of the aerial dispersant capability that could have been applied.

Even though the purpose of the report is to ascertain environmental damages, I recommend that a full analysis of the overall environmental impact of aerial dispersant operations be added to the report. This will assist future FOSCs, RRT members, government officials and the general public in understanding the benefits of using dispersants and may enable faster approval and acceptance of this valuable response tool.

Throughout the document there are many instances where dispersant impacts are discussed, but the specific manner of application, i.e., subsea injection or surface application, is not identified. The two response techniques are quite different in application and results. For instance, the dispersed oil plume is often discussed without noting that this is a subsea plume resulting from the subsea injection of dispersants. It was shown by both fluorometry and water sampling that the surface application of dispersants led to dispersed oil entering the water column and within hours being diluted to background levels. Surface application did not create any measureable long lasting plumes. Aerial application applies a low dosage of dispersant over a very wide area measured in square miles; whereas subsea injection deposits dispersants continuously at one single spot (the 7 in pipe riser) in the ocean. Appropriate text be added to clearly indicate the results or statements that apply to subsea dispersant operations and those associated with surface application.

Comments on specific sections or paragraphs of the Deepwater Horizon Draft PDARP/ PEIS are attached. If you have any questions concerning any of my comments, I will be glad to discuss them at your convenience.

Sincerely,

Charles A. Huber

C. A. Huber, Inc.
5 Captain’s Court
Williamsburg, VA 23185
Phone: 757 253-98875
Email: CharlesAHuber@verizon.net

Comments on Deepwater Horizon Draft PDARP/PEIS

(preliminary damage and restoration plan/preliminary environmental impact statement)

1. Page 2-10 Incident Overview

   A sentence should be added to the end of section 2.3.2 which states the other main purposes for using dispersants:

   - to remove oil from surface waters to reduce harmful impacts to offshore marine mammals, turtles and birds that may become oiled when they surface to breathe or when they land or dive on or through the oil slick, and

   - to reduce VOCs near the relief well vessels to protect workers on these ships from the inhalation hazards posed by evaporation of the oil spill.

> **2.3.2 Dispersants**
>
> Dispersants are chemicals that reduce the tension between oil and water, leading to the formation of oil droplets that are more readily dispersed within the water column (Waring et al. 2015). A main purpose of using dispersants is to enhance the rate at which bacteria degrade the oil in order to prevent oil slicks from fouling sensitive shoreline habitats.

2. Page 4-30

   The word "dispersants" highlighted below should be modified to "subsea injected dispersants." Surface applied dispersants did not ravel through the deep sea but were quickly dispersed to background levels within the top 10 meters of the water column.

> The spatial extent of oil exposure and response activities was immense (Figure 4.2-3). Oil, dispersants, and drilling mud introduced in response to the oil spill traveled through the deep sea—some of which was deposited on the sea floor. The estimated 7.7 billion standard cubic feet (scf) of natural gas (based

3. Page 4-31

   The statement made below should clearly indicate that the "dirty blizzard" of oil marine snow was not caused by the use of aerially applied dispersants. The testing of water samples and fluorometry showed that aerially dispersed oil was quickly (in a matter of hours) diluted to background levels, and these applications were applied over large areas of the ocean measured in square miles.

> consumed by microbes. The microbes, as well as oily particulate matter and burn residues near the sea surface, sank to the sea floor in a so-called "dirty blizzard" of oily marine snow particles that was deposited on the sea floor as brown flocculent material ("floc").

4. Figure 4.2-3

Replace “dropped chemical dispersant” with “quantitatively sprayed dispersant.” Aerial application of dispersant is calibrated to each spray aircraft, the nozzles they use, and their application speed and altitude to ensure that precise dosages and droplet sizes are produced.

Figure 4.2-3. The cumulative DWH oil footprint covered a large swath of the northern Gulf of Mexico. Most surface slicks traveled toward shore, intersecting at least 2,100 kilometers (1,300 miles) of shoreline; and some slicks followed currents to the southeast. A deep-sea plume migrated more than 400 kilometers (250 miles) southwest of the well (Payne & Driskell 2015a). In response to the surface slicks, more than 400 flights dropped chemical dispersant, and more than 400 fires were set to burn off surface oil. These data are all discussed in greater detail throughout this section.

5. Page 4-33

To the highlighted word “dispersant,” add “injected at the well head” to clarify that the dispersant entrained in deep-sea plumes and entrained in plumes that rose through the water were the results of subsea injection of dispersants, and not aerial application of dispersants. This addition will help readers better understand that the dispersant plumes came from subsea injection, and not from aerial or vessel application.

- DWH oil, dispersants, and drilling mud were spread throughout the environment. For example, oil and synthetic-based drilling mud were deposited on the sea floor. Additionally, oil and dispersant were both entrained in deep-sea plumes and entrained in plumes that rose through the water column, formed surface slicks, and were transported throughout the northern Gulf of Mexico.

6. Page 4-37

Recommend removing the highlighted area below and adding a new sentence at the end of the paragraph which states: “The surfactants used in Corexit EC9500A dispersant are some of the safest available and are also used in baby shampoo and facial creams as well as dishwashing liquids.” This would provide a better description of surfactants for reader understanding. (See table below)

4.2.2.3 Dispersants

Dispersants are chemical mixtures that reduce the surface tension between oil and water, leading to the formation of oil droplets that more readily disperse in the water column (NRC 2005). Generally, dispersants contain surfactants (similar to dishwashing detergent) and solvents that together promote the formation of small oil droplets when added to oil and water.

Comparison of Corexit 9500 Ingredients with Levels in Medications, Cosmetics or Household Products

Corexit Ingredients			Percent of Ingredient in FDA-Approved Medication Categories[1] Cosmetics or Household Products									
CAS # and Chemical Name[2]	Common Name	Percent in Corexit (w/w)[3]	Oral Medicines	Solutions for Inhalation	IV Medicines	Nasal Sprays	Eye Medicine	Ear Medi-cine	Medicated Skin Gel or Lotion	Medicated Shampoo	Cosmetics[4]	Other
57-55-6 1,2-Propanediol	Propylene glycol	1 - 5%	Up to 92%	Up to 25%	Up to 82%	Up to 20%	Up to 10%	Up to 95%	Up to 98%	Up to 3.5%		
64742-47-8 Distillates (petroleum) hydrotreated light		10–30%										<95%[5]
Emulsifiers												
577-11-7 Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)	Docusate sodium	Total Percent of Emulsi-fiers[6] in Corexit 10–30%	Up to 0.11%						Up to 3%	Up to 2%	Up to 5%	
1338-43-8 Sorbitan, mono-(9Z)-9-octadecenoate	Sorbitan oleate; Sorbitan monooleate		Up to 15%						Up to 7%		Up to 25%	
9005-65-6 Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	Polysorbate 80		Up to 12.6%		Up to 12.5%	Up to 10%	Up to 4%	Up to 5%	Up to 9.4%		Up to 25%	
9005-70-3 Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs	Polyoxyethylene sorbitan trioleate, Polysorbate 85										> 50%	
29911-28-2 2-Propanol, 1-(2-butoxy-1-methylethoxy)-	Di-propylene glycol-n-butyl ether											2.5 – 10%[7]

[1]Information obtained from FDA website http://www.accessdata.fda.gov/scripts/cder/iig/index.cfm
[2]Information obtained from EPA website http://www.epa.gov/bpspill/dispersants-qanda.html
[3]Information obtained from Corexit 9500 MSDS
[4]Maximum recommended concentration; Information obtained from the Cosmetic Ingredient Review board: http://www.cir-safety.org/staff_files/PublicationsListDec2009.pdf
[5]Information obtained from Goo Gone product label and MSDS http://www.magicamerican.com/media/154654/goo%20gone.pdf
[6]Listed as "organic sulfonic acid salt" on Corexit 9500 MSDS
[7]Information obtained from Lysol Bathroom Cleaner, 4 in 1, Island Breeze pump spray MSDS http://www.rbnainfo.com/MSDS/US/Lysol-Brand-Bathroom-Cleaner-Complete-Clean-Trigger-US-English.pdf

7. Page 4-38

At the end of the first sentence add, "… entrained in the water column and then are removed from the environment by naturally occurring microbes which biodegrade the dispersed oil." This would give a better understanding to readers of the end result of dispersing the oil. The dispersed oil does not sink nor stay indefinitely in water column.

> Dispersants are sometimes used in oil spill response as a means to break oil slicks into small droplets that can then become entrained in the water column. This process reduces the amount of floating oil available to reach shorelines, but increases the amount of small oil droplets to which underwater biota may be exposed.

8. Page 4-38

In the paragraph below it should also be stated that reducing the amount of surface oil reduces harmful impacts to offshore marine mammals, turtles and birds that may become oiled when they surface to breathe or when they land or dive on or through the oil slick. Additionally, surface dispersant application also provides safety to workers on vessels at the spill site by reducing the inhalation exposure to Volatile Organic Chemicals (VOCs) from the oil slick.

> Dispersants are sometimes used in oil spill response as a means to break oil slicks into small droplets that can then become entrained in the water column. This process reduces the amount of floating oil available to reach shorelines, but increases the amount of small oil droplets to which underwater biota may be exposed.

9. Page 4-39

The statement below about surface application of dispersants gives the impression that aerial application of dispersants increased biological damage by increasing oil concentrations in the upper water column. It should be stated that although surface application of dispersants temporarily increased dispersed oil concentrations in the upper area of the water column, it was shown that this temporary increase was at concentrations that did not have any harmful impact on biological species habiting this area based on measured chemical concentrations and results of toxicity tests with field collected samples. This fact was shown in the following reference which published the results of toxicity studies of the aerial dispersant operations.

OSAT Ecotoxicity Addendum (OSAT 2011). "*Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Ecotoxicity Addendum*." Operational Science Advisory Team. Gulf Coast Incident Management Team, Deepwater Horizon MC252, July 8, 2011

Throughout this document use of the word "dissolved" referring to dispersed oil should be removed. Dispersed oil does not dissolve. Dissolving indicates that the dispersed oil would become inseparable from water and lose its identity. In fact, dispersed oil droplets of approximately the width of a human hair become neutrally buoyant and remain in the water column until they are biodegraded within a matter of days.

> The surface application of dispersants increased exposure of near surface biota to oil that re-entered the water column and further dissolved (Section 4.2.5.3). The sub-sea application of dispersants at the wellhead helped keep some oil in the deep sea where it was entrained within the deep-sea plume and further dissolved (Section 4.2.3.2).

10. Page 4-39

I question whether the highlighted wording below is a proven fact. The dispersant in the surface oil could also have been the result of subsea injection at the well head. I don't think there is any way to determine how the dispersant became a part of the surface oil slick. Additionally, the paragraph does not give any indication of the concentration of the dispersant in the oil slicks nor any indication that this concentration was harmful in any way.

With the small amount of dispersant that was applied in each aerial spray pass, and the effectiveness of the dispersant on the Macondo crude oil, the dispersant should not have stayed in the oil slick for a considerable period of time and at any substantial concentration.

Furthermore, it has been shown that dispersant applied to a surface slick will disperse the oil when wave energy is supplied within 3-5 days. It has also been shown that waves as small as 0.5 to 1.0 ft. are sufficient to disperse oil slicks and that rarely are there days in the Gulf of Mexico when waves of this size are not seen. (See reference below). Hence, dispersant applied to a surface slick would have been activated by wave energy before being transferred throughout the GOM.

> fate of the DWH oil: dispersant chemicals applied at the wellhead either deposited on the sea floor or became entrained within deep-sea plumes, and dispersant chemicals applied at the sea surface were transported throughout the northern Gulf of Mexico with surface oil slicks.

Reference: US Minerals Management Service (MMS). 2006. Calm seas application of dispersants. Prepared by SL Ross Environmental Research Ltd., A. Lewis Oil Spill Consultancy, and MAR Inc. Final Report. September. 45 pp.

11. Page 4-40

After the highlighted area below, add, "from subsea injection." This will help readers understand where the dispersant came from and that it was not from surface application by aircraft or vessels.

> **4.2.3 Exposure in the Deep Sea and Sea Floor**
>
> **Key Points**
>
> - Oil and dispersant-derived chemicals remained in the deep sea and were transported laterally within a deep-sea plume that extended more than 250 miles (400 kilometers) southwest of the well and persisted for at least five months after the spill ended. Some evidence indicates vestiges of the plume persisted for nearly 1 year after the spill ended.

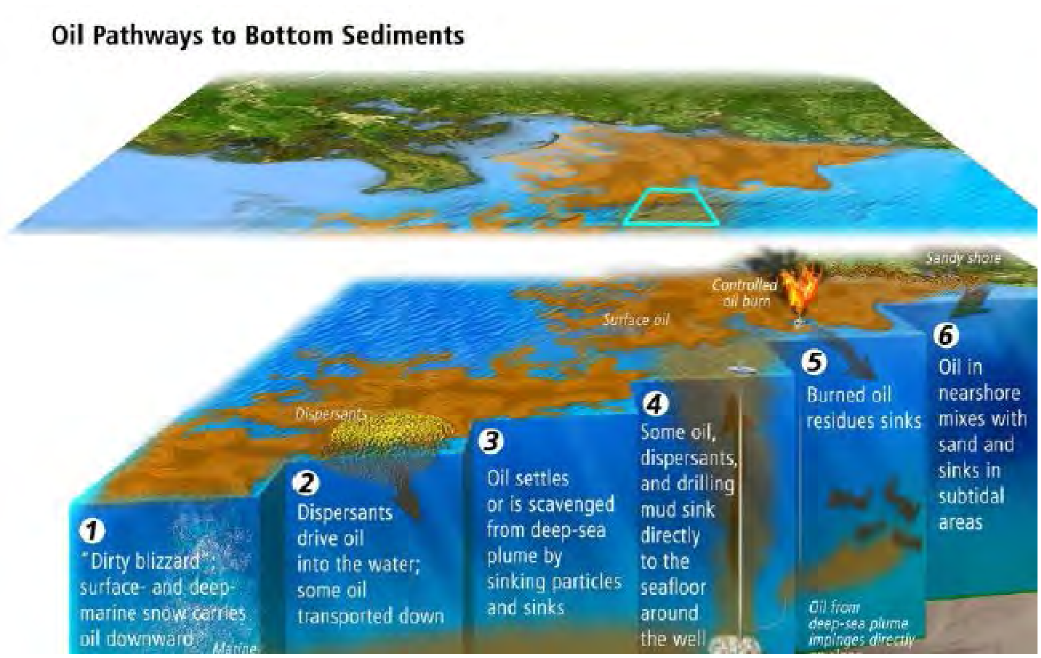
12. Page 4-40

Precede the word "dispersants" with "subsea injected" in the statement below to make clear that the dispersant did not come from the surface application of dispersant, but only from subsea injection.

> During and for months following the *Deepwater Horizon* incident, the deep sea and sea floor resources of the northern Gulf of Mexico were exposed to oil, dispersants, and synthetic-based drilling mud. These substances had either 1) remained and moved within the deep sea or 2) moved to the sea surface and

13. Page 4-41

Remove item #2 shown below. Fluorometry showed that within hours of surface application there was only background concentrations of dispersed oil. Item #2 should be eliminated as it is hard to even imagine dispersed oil particles the width of a human hair falling and lighter than water falling 5,000 ft to the sea floor. If there is evidence of surface applied dispersant or dispersed oil sinking to the sea floor or forming a deep sub-sea plume, that evidence should be referenced.



14. Page 4-53 Exposure at Sea Surface

The statement below indicates that the dispersed oil in the upper water column was harmful to biota in that area when, in fact, the research showed that this was not the case. This fact should be included in the statement below or as a separate key point to emphasize the benefits of using dispersants (See reference below). Additionally, there are no data showing that dispersants from surface application reached even 30 feet below the water surface. This paragraph should be changed to more accurately reflect the transport of dispersants in the water column.

> OSAT Ecotoxicity Addendum (OSAT 2011). "*Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Ecotoxicity Addendum*." Operational Science Advisory Team. Gulf Coast Incident Management Team, Deepwater Horizon MC252,

> - Turbulence at the sea surface and use of chemical dispersants drove some surface oil back into the upper water column. This exposed the diverse biota living in near-surface habitats (less than 65 feet deep) to dissolved and particulate oil and to dispersant-derived chemicals.

15. Page 4-53

It should be stated in this key point that responders on the relief well vessels, skimming vessels and ISB vessels were also exposed to the VOCs of the oil slicks and that this posed health issues.

> - The air above surface oil contained elevated concentrations of volatile compounds that were evaporating from the surface oil. Small droplets (aerosols) also formed and traveled long distances through the air. Air-breathing animals were exposed to both evaporated compounds and aerosols.

16. Page 4-54

To the first highlighted statement below, add that, "removing oil from the surface waters protects marine mammals, turtles and birds from being oiled." Sargassum rafts, which form offshore floating habitats, are also protected from being oiled. Applying dispersants is not done not just to protect sensitive shoreline habitat.

Second, the dispersed oil from the surface application of dispersants <u>does not sink</u>. Small dispersed oil droplets entering the water column are neutrally buoyant or rise to the surface. The DOSS or dispersant chemicals that were detected in deep sea samples were most probably from the subsea injection of dispersant rather than from surface application. With the minor amount of dispersant per area that was applied via aerial application over the vast primary operating area of 18,000 sqmi or more makes it extremely unlikely that the dispersants found in deep sea samples were from surface application.

> Over 1 million gallons of dispersant were sprayed directly on the sea surface (OSAT-1 (2010); see Figure 4.2-4) in attempts to disperse the oil into the water and to reduce the overall amount available to reach the coastlines. Chemicals within the dispersant, particularly the surfactant DOSS, both persisted within undispersed oil on the sea surface and sank with dispersed oil into the waters below. DOSS and other dispersant chemicals were detected in samples of floc from the deep-sea floor collected 6 months after the spill (White et al. 2014) and at trace levels in some stranded oils that had reached shore (Stout 2015g). The latter observation indicates some dispersant was transported to shore as a residue in coalesced oil slicks.

17. Page 4-62

It should be stated that aerial dispersant operations dispersed an estimated 15,000,000 gallons of oil or slightly more that 10% of the oil released. Stating that "some" floating oil was sprayed is extremely inaccurate. The aerial application was a substantial effort and is the largest aerial dispersant operation ever performed with over 1200 dispersant sorties safely conducted. (See Aerial Dispersant Group After Action Report).

> **4.2.5.4 Exposure to Dissolved and Particulate Oil in Surface Water**
> Wave action and turbulence within the upper water column naturally disperses and entrains droplets of oil into the upper water column. Lighter oil constituents can dissolve directly from the surface slick and form droplets entrained into the upper water column. The buoyancy of these droplets will dictate whether or when they resurface, with smaller droplets remaining submerged. Some natural entrainment of the floating DWH oil occurred across the northern Gulf of Mexico where floating oil existed. Also, as discussed previously, planes and vessels sprayed some floating oil with 1,070,000 gallons of chemical dispersants that were intended to break-up the oil slicks into smaller droplets that would then disperse or become entrained in the water column.

18. Page 4-63

The section below should indicate that research showed that the toxicity to biota in the upper water column was minimal and returned to background levels within hours of dispersant application based on field monitoring using fluorescence, field collected chemistry data, and laboratory toxicity studies with field collected samples. General statements like the one below give a picture that the dispersant application was not effective and was harmful, when exactly the opposite is true. (See earlier references to OSAT results)

> Both wave action and chemical dispersion drove oil back below the sea surface. This dispersion exposed upper water column biota, including plankton, fish, and invertebrates, to dispersed oil droplets, chemicals that dissolved from the oil, and dispersant chemicals (Hemmer et al. (2011); Section 4.3: Toxicity; Section 4.4: Water Column).

19. Page 4-63

The statement highlighted below should be deleted as it has not been proven that this actually occurred. The amount of dispersed oil that was placed into the water column by the surface application of dispersants was a very small amount, was quickly diluted to background levels and was spread over more than an 18,000 sqmi operating area. Thus, it is not likely that surface dispersant application substantially added to the observed reaction. Unless the researcher can confirm his statements with supportable data, the statement should not be made.

> Stout & Passow 2015). This process was likely enhanced in areas where dispersants were applied to the surface, as bacteria preferentially acted upon the dispersed oil. Some

20. Page 4-82

Precede the highlighted word "dispersant" with "subsea injected" to indicate the source of the dispersant application.

Providing information on the concentration of the dispersant will lead to clearer understanding of potential impacts.

Table 4.2-2. Inventory of pathways, exposures, and resources in different habitat zones. Details available in subsequent draft PDARP/PEIS sections indicated.

Habitat	Transport Pathways	Contaminants	Resource Groups	Chapter 4 Sections
Deep-Sea, Slope, and Shelf	Direct fallout around wellhead	oil, dispersant, and drilling mud in sediment	benthic sediments and biota	4.2.3
	Direct deposition due to impingement of deep-sea plume particulate due to bathymetry	oil with or without dispersant in sediment		
	Sinking marine oil snow originating at/near sea surface or within deep-sea plume	oil-containing flocculent with or without dispersant in sediment		

The same comment applies to the highlighted word below to indicate that the dispersant referenced was from subsea injection. This will help readers understand the source of the dispersant and that similar impacts are not associated with surface dispersant application.

Rising Plume	Ascending buoyant oil and (limited) gas plume	dissolved and particulate oil with or without dispersant in water column	column and biota	4.2.4

21. Page 4-82

It would be helpful to indicate the concentration of dispersants associated in these areas to provide better understanding of the potential environmental impacts.

<table>
<tr><td rowspan="2">Surface and Near-surface</td><td>Floating oil slick, sheen, mousse</td><td>floating oil with or without dispersant</td><td rowspan="2">surface water and biota</td><td rowspan="2">4.2.5</td></tr>
<tr><td>Uppermost water column (less than 10 meters below surface)</td><td>dissolved and entrained particulate oil with or without dispersant in water column</td></tr>
</table>

This also is true for the other areas where dispersants are listed in Table 4.2-2.

22. Page 4-99

The identification of dispersant as “nail polish remover” in the statement below should be removed. The solvent in nail polish remover is acetone (Cutex nail polish remover MSDS) a highly flammable solvent, which is not representative of the solvents used in oil dispersants. This reference should be revised to something more closely associated with the solvents used in dispersants as shown in the following tables of dispersant components.

> Chemical oil dispersants are mixtures of solvents (like nail polish remover), surfactants (like soaps), and other additives that are applied to oil slicks in order to break up the slick and mix the oil into the water

Comparison of Corexit 9500 Ingredients with Levels in Medications, Cosmetics or Household Products

Corexit Ingredients			Percent of Ingredient in FDA-Approved Medication Categories[1] Cosmetics or Household Products									
CAS # and Chemical Name[2]	Common Name	Percent in Corexit (w/w)[3]	Oral Medicines	Solutions for Inhalation	IV Medicines	Nasal Sprays	Eye Medicine	Ear Medicine	Medicated Skin Gel or Lotion	Medicated Shampoo	Cosmetics[4]	Other
57-55-6 1,2-Propanediol	Propylene glycol	1 - 5%	Up to 92%	Up to 25%	Up to 82%	Up to 20%	Up to 10%	Up to 95%	Up to 98%	Up to 3.5%		
64742-47-8 Distillates (petroleum), hydrotreated light		10–30%										<95%[5]
	Emulsifiers											
577-11-7 Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)	Docusate sodium	Total Percent of Emulsifiers[6] in Corexit 10–30%	Up to 0.11%						Up to 3%	Up to 2%	Up to 5%	
1338-43-8 Sorbitan, mono-(9Z)-9-octadecenoate	Sorbitan oleate, Sorbitan monooleate		Up to 15%						Up to 7%		Up to 25%	
9005-65-6 Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.	Polysorbate 80		Up to 12.6%		Up to 12.6%	Up to 10%	Up to 4%	Up to 5%	Up to 9.4%		Up to 25%	
9005-70-3 Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.	Polyoxyethylene sorbitan trioleate Polysorbate 85										> 50%	
29911-28-2 2-Propanol, 1-(2-butoxy-1-methylethoxy)	Di-propylene glycol-n-butyl ether											2.5 – 10%[7]

[1]Information obtained from FDA website http://www.accessdata.fda.gov/scripts/cder/iig/index.cfm
[2]Information obtained from EPA website http://www.epa.gov/bpspill/dispersants-qanda.html
[3]Information obtained from Corexit 9500 MSDS
[4]Maximum recommended concentration. Information obtained from the Cosmetic Ingredient Review board: http://www.cir-safety.org/staff_files/PublicationsListDec2009.pdf
[5]Information obtained from Goo Gone product label and MSDS http://www.magicamerican.com/media/154854/goo%20gone.pdf
[6]Listed as "organic sulfonic acid salt" on Corexit 9500 MSDS
[7]Information obtained from Lysol Bathroom Cleaner, 4 in 1, Island Breeze pump spray MSDS http://www.rbnainfo.com/MSDS/US/Lysol-Brand-Bathroom-Cleaner-Complete-Clean-Trigger-US-English.pdf

The table below outlines the same ingredient list for our COREXIT dispersants as provided to the EPA.

CAS #	Name	Common Day-to-Day Use Examples
1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate	Skin cream, body shampoo, emulsifier in juice
9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly (oxy-1,2-ethanediyl) derivs.	Baby bath, mouth wash, face lotion, emulsifier in food
9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly (oxy-1,2-ethanediyl) derivs	Body/Face lotion, tanning lotions
577-11-7	* Butanedioic acid, 2-sulfo-, 1,4-bis (2-ethylhexyl) ester, sodium salt (1:1)	Wetting agent in cosmetic products, gelatin, beverages
29911-28-2	Propanol, 1-(2-butoxy-1-methylethoxy)	Household cleaning products
64742-47-8	Distillates (petroleum), hydrotreated light	Air freshener, cleaner
111-76-2	** Ethanol, 2-butoxy	Cleaners

* Contains 2-Propanediol ** This chemical component (Ethanol, 2-butoxy-) is NOT included in the composition of COREXIT® 9500

23. Page 4-99

In the statement below reports that the Trustee's evaluated the toxicity of different types of exposures to aquatic resources of different oil-water mixtures. However, there is no reference to the fact that the toxicity research conducted and reported in the OSAT reference previously identified showed no observable impacts more than background samples. This should be included here.

This section also did not discuss the fact that surface applied dispersants were very effective on Macondo crude, the oil plus dispersant was no more toxic than the oil itself and the amount (concentration) of dispersed oil in the water column quickly diluted to background levels. The standard LC50s, i.e., for continuous exposures for 48 to 96 hours result in greater impacts than what biota in the ocean are exposed and are not really comparable to field exposures. This statement has been confirmed by the CROSERF research (Cooperative Aquatic Toxicity Testing of Dispersed Oil and the "Chemical response to Oil Spills: Ecological Effects Research Forum (CROSERF)" report which stated "that constant exposure testing does not realistically assess the risk to marine or coastal organisms when rapid dilution is possible."

Additionally, the Trustees discussion did not evaluate the net environmental benefits of using dispersants, nor discuss the reduced environmental impacts to offshore marine mammals, turtles, and birds and the reduced damage to shoreline habitat. It is necessary to evaluate the total environmental impacts of the application of dispersants to understand the why dispersants were used and the resulting benefits.

> column (Section 4.2, Natural Resource Exposure). Although dispersants are used to reduce the amount of thick, floating oil that can reach sensitive shoreline habitats, adding dispersants can increase the toxicity of oil to aquatic organisms by mixing more of it into the water column (NRC 2005). The Trustees' toxicity evaluation considered these different types of exposures to aquatic resources by evaluating the toxicity of different oil-water mixtures, as well as the toxicity of oil with added chemical dispersants

24. Page 4-102

The toxicity testing program discussed below only evaluated the negative impacts of dispersed oil. The analysis should also compare the environmental impacts of using dispersants versus not using dispersants. The dispersing of an estimated 15,000,000 gallons of oil through the aerial dispersant application should have resulted in a substantial net environmental benefit. This benefit should be evaluated and stated.

> The Trustees designed their toxicity testing program to investigate the nature and extent of different types of adverse impacts to a variety of organisms based on observed, measured, and modeled exposure to oil and dispersant. The testing program was designed to address different types of exposures to DWH oil (e.g., exposure to weathered oil, to dispersed oil, to oil-water mixtures, to surface slicks, and to sediments), different environmental variables that can influence toxicity (primarily UV light), different test species, different life stages, and a series of different lethal and sublethal effects endpoints (Figure 4.3-5). To address the role of weathering on toxicity, a range of weathered DWH oils were used in laboratory tests (Box 2). Through this comprehensive toxicity testing program, the Trustees created a body of information that greatly expands on the scientific literature available prior to the spill and provides an unprecedentedly large, coherent dataset from which conclusions about injury could be drawn.

25. Page 4-114

The "Dispersant Toxicity" section did not state the lengths of time the LC20 and LC50 values were conducted. This is critical as standard times of 48- 96 hours far exceed field exposures times. Water column species were only exposed to elevated dispersed oil levels for a matter of hours before dilution to background levels. (See CROSERF reference in comment 23 above).

Studies reflecting actual field exposure would have substantially reduced the impacts of dispersant even more than the minimal effect the analysis states.

Box 7: Dispersant Toxicity

In addition to evaluating the toxicity of dispersant (Corexit 9500) in combination with oil in CEWAF tests, the Trustees performed bioassays with dispersant alone. Lethal effects concentrations for dispersant generally occurred in the parts-per-million (ppm, or mg/L) range of Corexit in water, whereas effects concentrations for TPAH50 were in the parts-per-billion (ppb, or µg/L) range (about 1,000 times lower).

For example, the left panel below shows the results of a test using larval mahi-mahi. In this test, the LC20 value was 25 ppm and the LC50 value for this test was 31 ppm. The right panel in the figure below shows the results of a bioassay in which abnormal development in oyster larvae was measured. In this test, the EC20 and EC50 concentrations were 5.3 and 5.7 ppm, respectively (Morris et al. 2015b).

26. Page 4-183

Since the first and second highlighted areas speak about dispersants, it would be helpful to confirm that, of the 92 samples analyzed ,"two had detectable levels of PAHs," and add immediately following " none contained dispersants," to clearly indicate this fact.

tissue (fillets) of whole fish or groups of small shellfish. Overall, PAHs and dispersants were found in low concentrations or below the limits of detection (Ylitalo et al. 2012). When detected, the concentrations were at least two orders of magnitude lower than the Food and Drug Administration (FDA) level of concern for human health risk (Ylitalo et al. 2012). Similar results were found from a study by Fitzgerald and Gohlke (2014), which tested the edible muscle tissue (fillets) of seven species of reef fish, including red snapper, red grouper, and tilefish, for PAHs, metals, and dispersants. Of the 92 samples analyzed, only two had detectable levels of PAHs and all were below the FDA level of concern (Fitzgerald & Gohlke 2014). Although these results may appear contrary to the ones discussed above, differences in the types

27. Page 4-245

The statement below, that floc occurred where dispersants were applied, does not appear supported by Figure 4.5-9 as there are 20 locations where no aerial dispersant application occurred, but where floc is found. Additionally, the greatest amount of floc occurred at the spill source site where aerial dispersant application was not allowed closer than 3 nm. Based upon these facts, the floc was not a result of surface dispersant application.

Another possible explanation of the dispersant found in floc, is that the dispersant was the result of the subsea injection of dispersant and that the floc assimilated the dispersant as it sank to the sea floor through the dispersed oil plume or was absorbed by the floc on the sea floor. The increased floc near the source site which is at the same location of the subsea dispersant injection further supports this theory. This possibility should be discussed as it is highly unlikely that aerial applied dispersant caused the floc due to the following:

- The swath widths of the application aircraft ranged from 60 to 150 ft which are very narrow areas when considering the vastness of the GOM
- Standard application dosages of 5 gpa to produce a surface spray thickness of 0.005 mm on the sea surface
- The resulting dispersed oil was shown to be diluted in the water column to background levels within approximately 3 hours.

Hence, it is unlikely the amount of dispersed oil could have caused floc.

Unless there is firm scientific evidence as to how the dispersant entered the floc that was sampled, the below statement should be removed as it is more speculation rather than fact and can lead to misinterpretation of dispersant impacts.

> The presence of floc on the sea floor corresponds well to areas beneath surface slicks and where dispersants were applied at the water surface (Figure 4.5-9). Chemical analysis also confirmed the
>
> **Figure 4.5-9.** Map overlaying surface dispersant application area, surface oiled area, and floc thickness (cm) found on the deep-sea sediments. Larger quantities of floc were generally observed on the sea floor beneath areas experiencing persistent surface oil and the application of dispersants (which were applied in areas of heavy surface oiling). Depth of floc also generally decreased with increasing distance from the wellhead.

28. Page 4-246

I recommend that the below comments be deleted as the aerial dispersant spray passes as shown below were not conducted over the Alabama Alps and Roughtongue reefs. The graphic below was prepared from the original SATLOC spray data from the aircraft and shows where all of the aerial spray sorties were conducted through July 13, 2010, i.e., just prior to dispersant termination on July 19th. As can be seen there were no spray missions over these reefs (i.e., see that where the blue lines cross there are no red spray runs.)

In the area of the Roughtongue Reef there were very few spray missions conducted as there was little oil in this area and the oil that was found was weathered and emulsified, and therefore not targeted for dispersant application because the dispersant would not be effective. After July 13 there was limited aerial applications through the end of the response.

If you would like I can conduct a more thorough review of the original aerial spray passes and identify those that were near the subject reefs and how close they came and how much was sprayed as I still have all of the original spray data.

I am not sure how the dispersant spray runs were evaluated; however I do know that the spray missions graphed on the below graph are not representative of the size of the actual swath width of the application. These lines had to be made considerably larger on the graph, because if the spray run was shown to scale it would not be too narrow to appear on the graph. This may have caused an incorrect analysis that spray runs were done over these reefs.

Additionally, aerial dispersants operations were shown not to disperse the oil more than 10 meters in depth before being diluted to background levels. These reefs are at depths of 80-90 meters, i.e., well below the extent of dispersed oil or dispersants in the water column.

> Mesophotic reefs, however, were exposed to oil and likely dispersants. For periods of weeks to months following the *Deepwater Horizon* oil spill, petroleum slicks and dispersant spray tracks were documented directly above Roughtongue and Alabama Alps Reefs, respectively. Waterborne dissolved hydrocarbon

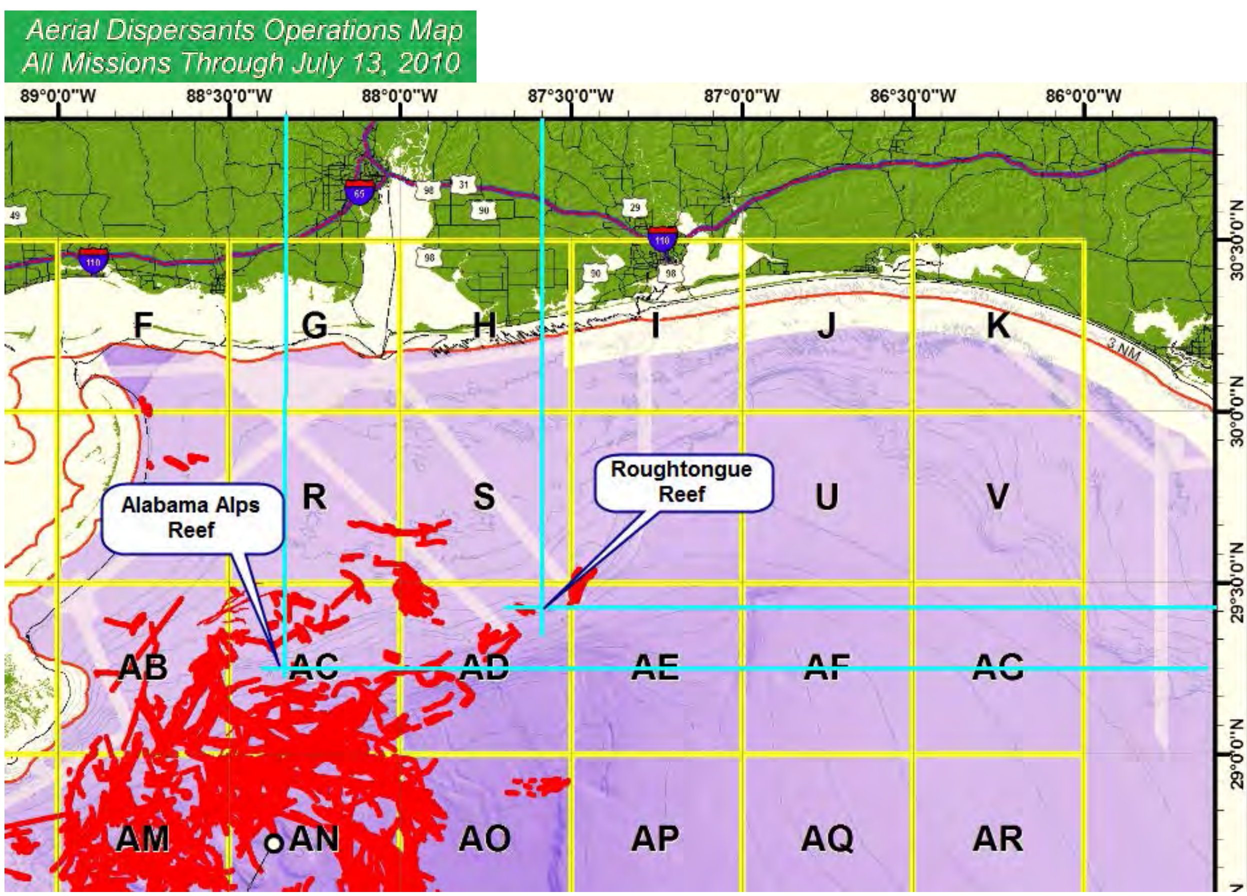


Table 1 Study site characteristics

Reef	Lat	Long	Distance (km)	Days under slick	Area (km^2)[a]	Reef base depth (m)
Alabama Alps	29.255	−88.339	57	39	0.126	88
Roughtongue	29.442	−87.579	109	19	0.082	78
Yellowtail	29.440	−87.575	109	19	0.038	68
Coral Trees	29.505	−85.146	231	3	0.324	94
Madison Swanson	29.187	−87.679	266	0	5.026	94

29. Page 4-246

The statement highlighted below indicates that bottom sediment contained dispersant that came from plume fallout. It should be noted that the plume came from the subsea injection of dispersant and was not associated with the surface application of dispersant. Surface application did not create any dispersed oil/dispersant plume as it was shown that concentrations of dispersed oil were diluted quickly (within several hours) to background levels. No concentrations of dispersed oil was detected lower than 10 m by SMART monitoring.

constituents settled out of the underwater plumes, or through the deposition of contaminated marine snow or floc. Many benthic animals ingest sediment routinely as part of their normal feeding behavior

affected bottom sediments. Oil and dispersant came to be located in marine sediments either through direct contact of oil droplets, dispersed oil, or dispersant alone with the sediment as the chemical

30. Page 4-263

I suggest that the highlighted area be changed to read "subsurface oil/subsea injected dispersant plume" to assist readers in understanding the source of the dispersant plume being referred to.

An additional zone of uncertain exposure and injury extends approximately 400 kilometers to the southwest of the wellhead. This area represents benthic habitat that likely was exposed to some degree by the subsurface oil/dispersant plume that migrated with ocean currents to the southwest and

31. Page 4-272

Give actual figures.

The statement below should be corrected as to the statement that dispersants were frequently used in this area and in significant quantities. The actual ….

> An additional footprint of approximately 3,300 square kilometers on the continental shelf north of the wellhead (see Figure 4.5-22 above) represents an area where oil persisted on the sea surface, dispersants were frequently applied in significant quantities, and increased amounts of flocculant material were observed atop benthic sediments. As noted above, the Trustees identified several

32. Page 4-544

No dispersant spray sorties were conducted over or near sargassum as that area was recognized as a valuable habitat, and the oil contained in the sargassum was not dispersible. It is recommended that "dispersant" be removed from the statement below, unless actual proof or evidence can be provided that dispersant was applied to sargassum and caused it to sink. The report should not speculate on potential impacts.

> **4.8.4.3 Potential Adverse Effects from Loss of Prey/Habitat**
> The Trustees documented evidence of potential impacts to sea turtle habitats. Exposure of *Sargassum* to oil and dispersant can cause it to sink to the ocean floor, thus removing essential habitat for oceanic juvenile sea turtles and numerous other organisms (see Section 4.4, Water Column; (Powers et al.

December 4, 2015

Natural Resource Damage Assessment and Restoration
Trustee Council
U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

> Re: Comments on the *Deepwater Horizon* Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement

Dear NRDA Trustee Council,

As organizations with a long history working throughout the Gulf Coast region, the National Wildlife Federation and our affiliates Texas Conservation Alliance, Louisiana Wildlife Federation, Mississippi Wildlife Federation, and Florida Wildlife Federation thank you for the opportunity to comment on the *Deepwater Horizon* oil spill draft Programmatic Damage Assessment and Restoration Plan (PDARP) and draft Programmatic Environmental Impact Statement (PEIS). On behalf of our 6 million members and supporters, we appreciate your continued efforts to restore public trust resources.

The National Wildlife Federation submits these thoughts for your consideration on behalf of our Gulf Restoration Program. These comments should be considered supplemental to those we have provided in our comment letters with our national partners and with the Restore the Mississippi River Delta Campaign.[1]

Without question, the release of the draft PDARP/PEIS represents a critical milestone on the road to restoration for the Gulf. Given the unprecedented scope and nature of the *Deepwater Horizon* disaster, we appreciate your efforts to undertake this damage

[1] See letter from NWF, Ocean Conservancy, Environmental Defense Fund, The Nature Conservancy, and National Audubon Society (Dec 4, 2015) and letter from Restore the Mississippi River Delta Campaign (Dec 4, 2015).

assessment and to produce a restoration plan befitting of the injuries incurred by Gulf ecosystems and communities, recognizing this was no minor task.

Overall, we believe that the draft PDARP/PEIS presented a very systematic analysis of estimated injury, and appropriately acknowledged the connectivity between habitats, resources, and ecosystem services in the Gulf of Mexico. We support the Trustees' preferred approach for "comprehensive, integrated ecosystem restoration," and applaud the heavy emphasis placed on restoring coastal and nearshore habitats given the critical role that they play for injured wildlife resources and overall system productivity. We are also pleased to see over 95% of restoration dollars allocated to restore the Gulf's urgent ecological injuries, rather than on recreational or public access projects.

After careful review of the documents, we believe there are a number of items that require additional clarification. In the comments that follow, we highlight these areas of ambiguity, and offer some suggestions to strengthen the implementation of this visionary restoration effort.

In the draft PDARP, the Trustee Council recognizes the need to update their existing Memoranda of Understanding (MOU) and to develop Standard Operating Procedures (SOP) for adoption and adherence by each of the Trustee Implementation Groups (TIGs). Many essential restoration planning and coordination details hinge on these documents. However, the expected content of the documents is not elaborated in the draft PDARP, making it impossible to provide meaningful comment on many aspects of the governance structure. Given that the procedures and practices articulated in the SOP will guide restoration activities across the Gulf for many years to come, this is a critical juncture for soliciting public feedback. <u>We therefore recommend that the PDARP commit to an additional public comment period to allow for needed public input regarding the MOUs and SOPs once they are drafted</u>. In the cases where individual TIGs elect to develop supplemental MOUs and SOPs, these documents also should be subject to public comment periods before being finalized.

As you know, Gulf of Mexico restoration will be occurring at an unprecedented scale and scope, involving a multitude of state and federal agencies and restoration programs. We believe that the decentralized decision-making structure proposed in the draft PDARP, with restoration plans developed and projects selected at the TIG level, will increase efficiency in decision-making and accelerate implementation of critical restoration efforts around the Gulf. <u>However, we also feel strongly that this structure necessitates proactive and formalized efforts to coordinate between TIGs and across other restoration programs (e.g., RESTORE and NFWF) to ensure that a Gulfwide perspective on restoration is not lost.</u>

More detail on the specific channels or processes that the Trustee Council will employ to promote coordination should be provided in the final PDARP, as well as in the SOP.

Additionally, we suggest the following as possible approaches to ensure regional coordination and informed-decision-making[2]:

- Full Trustee Council continues to meet on a frequent and defined basis (we recommend annually at minimum) as a forum for TIGs to proactively share restoration plans, best management practices, and consider how their intended activities fit into the larger restoration landscape. These meetings could also provide a space for communication of ongoing and planned activities to the public and to other Gulf of Mexico restoration programs, including the RESTORE Council and NFWF.
- Trustee Council completes biennial program reviews that examine whether projects are adequately coordinated and on track to meet goals.[3] These program reviews could also serve as a resource to inform and engage the public.
- Full Trustee Council develops an SOP that includes a set of high-level selection criteria for adoption across all restoration areas and by all TIGs. These criteria should include considerations such as level of scientific review, leveraging of other restoration dollars, and presence of a project in an existing comprehensive plan.
- TIGs prepare mandatory strategic restoration plans, built into project restoration plans where possible and updated as necessary to reflect changing conditions or evolving science. These strategic plans could assist in identification of opportunities to coordinate and leverage restoration efforts, and would compel TIGs to give thoughts to project sequencing and the order of injury restoration, accounting for recovery periods of injured resources.

We appreciate that one of the restoration plan's five goals is to "provide for monitoring, adaptive management, and administrative oversight to support restoration implementation." It is critical that all restoration projects are accompanied by monitoring and adaptive management plans to track and maximize project success. <u>We encourage the Trustee Council to strive for consistency in project tracking across the Gulf, including through the development of data collection and management protocols in the SOP.</u>[4] We note that in the PDARP, inconsistent metrics were used to describe injury to different resources (i.e., miles vs kilometers, metric tons vs. kilograms, etc.) Moving forward, this variability should be minimized where possible to facilitate efficient tracking and reporting of outcomes between restoration areas and across the broader Gulf landscape. Additionally, restoration plans should adequately account for climate change impacts, including sea-level

---

[2] For additional details on these and other suggestions on coordination, see letter from NWF, Ocean Conservancy, Environmental Defense Fund, The Nature Conservancy, and National Audubon Society (Dec 4, 2015) and letter from Restore the Mississippi River Delta Campaign (Dec 4, 2015).

[3] Note: The PDARP already directs the Trustee Council to undertake such reviews approximately every five years, but a biennial review may help to prevent missed coordination opportunities and would provide for more nimble adaptive management.

[4] PDARP/PEIS, pg 7-23

rise, storm surge, and other scientifically predictable impacts, to ensure restoration activities are designed to be resilient and sustainable.

The PDARP/PEIS does not describe the intended process for scientific review of restoration projects. We request that additional details on the scientific review process be provided in the Trustee Council SOP and circulated for public comment. In addition to any project vetting that may occur at the TIG level, we stress that some form of external science review at the Gulfwide scale is essential in order to ensure a coordinated approach to ecosystem restoration. We recommend the Trustee Council work with other restoration programs, including the RESTORE Council and NFWF, to establish an overarching Science Advisory Committee (SAC) to provide independent technical guidance on the use of best available science in the development, implementation and evaluation of ecosystem restoration across the Gulf. The SAC could help ensure that science is integrated into restoration decisions by providing input on restoration objectives, priorities, strategies, and performance metrics; evaluating progress toward restoration goals via monitoring and other adaptive management mechanisms; and identifying restoration gaps, conflicts and opportunities for coordination across TIGs and with other programs. The SAC could also help develop a scientific review process to be used by the TIGs to evaluate and select projects to ensure that the projects, as a collective whole, support comprehensive ecosystem restoration of the Gulf of Mexico. Science staff sitting at the full Trustee Council level could help to coordinate and connect the work of the TIGs to this independent SAC.

There are a number of other points in the PDARP/PEIS that we believe require additional explanation:

- We suggest that the Trustees clarify the relationships between the Restoration Management Portal, the DIVER interface, and the Gulfwide environmental data management system for which NOAA will receive $37 million from another portion of the BP settlement.
- We request additional information about the intended distribution of interest that will accumulate on the $7.1 billion. The draft PDARP states that interest earned on TIG subaccounts may be used "at the discretion of the TIGs for restoration within the jurisdiction of each TIG, including for restoration planning, operation, and administration, or other responsibilities described in the Council or TIG SOP."[5] This seems to be contradictory to the Consent Decree, which directs all interest earned on the $7.1 billion, along with the $232 million for unknown conditions, to the Adaptive Management and Unknown Conditions TIG NRDAR subaccount.[6] Clarification on this point would be helpful.
- The draft PDARP also provides for the Trustee Council to "designate dedicated support staff, as necessary, for conducting its business."[7] However, it does not

[5] PDARP, Section 7.6.1
[6] Consent Decree, Section 2.3.3 of Appendix 2
[7] PDARP, Section 7.2.1

specify the origin of the funding to stand up the Trustee Council's support staff and operations structure. We suggest this be clarified in the final PDARP.

Finally, as noted above, we applaud the commitment in the draft PDARP to restoring coastal and nearshore habitats. In particular, projects that protect or restore healthy estuaries along the Gulf Coast will pay dividends by benefitting innumerable wildlife species and increasing the overall resilience of coastal systems. Although the draft PDARP/PEIS does not contemplate specific projects, we encourage the Trustees to begin to identify promising projects/suites of projects to restore injured resources, so that restoration can begin in earnest once settlement dollars start to flow. We recommend prioritization of projects that address underlying system stressors (including sufficient freshwater flows into Gulf estuaries), and that benefit several categories of resources concurrently, thereby maximizing impact and progress toward restoration program goals. <u>In particular, we suggest the following projects/project types as ideal candidates for initial rounds of NRD dollars:</u>

- In Florida, the Caloosahatchee River (C-43) West Basin Storage Reservoir Project would improve the timing, quality, and quantity of freshwater flows to Caloosahatchee Estuary, which has suffered die-off of sea grasses and oysters due to unnatural fluctuations in salinity levels and nutrient pollution due to agricultural runoff. The Caloosahatchee River and Estuary are part of the larger Charlotte Harbor Estuary System, designated in 1995 as an "estuary of national significance."[8] The C-43 Reservoir project is authorized, making it a timely choice for NRD water quality funding. Farther up the Florida coast, completion of approved acreage additions to St. Marks National Wildlife Refuge would be another highly beneficial project with water quality funds.
- In Alabama, the "100-1000: Restore Coastal Alabama" partnership proposes to build 100 miles of intertidal oyster reefs, which will in turn protect and promote the growth of more than 1,000 acres of coastal marsh and seagrass. Mobile Bay has experienced a significant loss of oyster reefs, coastal marsh and seagrass beds. Yet the Bay has enormous potential for comprehensive ecological restoration—including replacement and enhancement of these lost habitats—due to the size of the estuary, historical distribution of oysters in the bay, high natural oyster-recruitment potential and warm water for fast growth. This project is an ideal candidate for NRD oyster funds.
- Straddling Mississippi and Alabama, the Grand Bay National Wildlife Refuge was established to protect one of the largest expanses of undisturbed pine savanna habitat in the Gulf Coastal Plain region. The marshes on the refuge provide wintering habitat for resident waterfowl and migratory birds and are extremely important to many recreational and commercial fish species, including speckled trout, red drum, and flounder. Strategic property acquisition and restoration within

[8] http://www.protectingourwater.org/watersheds/map/charlotte_harbor/

Grand Bay National Wildlife Refuge would be an excellent usage of funds for habitat projects on federally managed lands.

- In a drought-prone state like Texas, projects that restore or protect vital freshwater inflows to key estuaries, including Matagorda and Galveston Bays, would be an excellent use of water quality or habitat NRD funds. The assurance of adequate freshwater inflows is arguably the most critical long-term restoration need on the Texas coast. Because so much of the water that flows in Texas' rivers has already been permitted for withdrawal through perpetual water-use permits, affirmative measures, such as purchasing water rights from willing sellers, are needed to ensure that some of that previously permitted water is available for estuary inflows.

With thoughtful planning, strategic project selection, and proactive coordination, the Trustees have an opportunity to leave a lasting legacy for the Gulf of Mexico and its coasts. We look forward to working with you throughout the course of this restoration program, and again refer you to the letters we have submitted with our partners for additional comments. Thank you for the opportunity to comment.

Sincerely,

David Muth
Director, Gulf Restoration Program
National Wildlife Federation
3801 Canal Street, Suite 325
New Orleans, LA 70119

Janice Bezanson
Executive Director
Texas Conservation Alliance

Brad Young
Executive Director
Mississippi Wildlife Federation

Rebecca Triche
Executive Director
Louisiana Wildlife Federation

Manley K. Fuller
President
Florida Wildlife Federation

Comment Form

Park:	Federal Agencies - other than NPS	
Project:	DWH NRDA Programmatic Restoration	(ID: 60779)
Document:	Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement	(ID: 68459)

* indicates required fields

City: * New Orleans State/Province: * LA

Postal Code:* 70130

First Name: Bethany Middle Initial: C

Last Name: Kraft

Organization: Ocean Conservancy

☐ Member ☒ Official Representative

Address 1: 307 Tchoupitoulas St. #300

Address 2:

Country: U.S.A.

E-mail: bkraft@oceanconservancy.org

☐ Keep my contact information private

Comments or Requests:

Please see included documents
1) Official Comments
2) Correspondence
3) Executive Summary of "Charting the Gulf" Report

Gulf Restoration Center
307 Tchoupitoulas Street, Suite 300
New Orleans, LA 70130

Ocean Conservancy

504.208.5813 Telephone
504.267.8541 Facsimile
www.oceanconservancy.org

December 4, 2015

Cynthia K. Dohner
U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

Re: Ocean Conservancy's Comments on the *Deepwater Horizon* Oil Spill: Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement

Dear Ms. Dohner:

Ocean Conservancy[1] provides the following comments on the Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement (PDARP/PEIS) to restore natural resources, ecological and recreational use services injured or lost as a result of the BP *Deepwater Horizon* oil disaster.[2] We thank the Trustees for outlining a comprehensive approach to restoration necessary to address the scale and complexity of injuries to wildlife and habitats across the extent of the northern Gulf of Mexico ecosystem. The proposed restoration plan includes a number of approaches that will address stressors that could inhibit the recovery of impacted resources. The proposed plan also provides opportunities to improve the health of the ecosystem, perhaps even beyond the (relatively unknown) baseline conditions that existed prior to the disaster.

Ocean Conservancy recognizes and thanks the Trustees for the enormous amount of time and effort they have committed to the process of injury assessment and restoration planning. On balance we believe this draft PDARP/PEIS provides a strong vision and rationale for undertaking an ecosystem approach to restoration of the northern Gulf ecosystem following the BP oil disaster. Ocean Conservancy also appreciates the robust information provided in the injuries assessment, the well-crafted summary of injuries information, the details provided regarding the allocation of natural resource damage (NRD) payments and the overarching commitment to monitoring and adaptive management. However, we are concerned that the proposed governance structure for the administration of NRD funds and execution of restoration plans could undermine the Trustees' implementation of this comprehensive ecosystem approach, will be costly to administer and will make coordination across restoration areas difficult and cumbersome. Taken together, we believe that these challenges significantly outweigh the benefits of streamlined decision-making.

Ocean Conservancy provided a letter[3] to the National Oceanic and Atmospheric Administration (NOAA) in August 2015, outlining our recommendations for marine restoration to serve as a foundation for addressing the marine

[1] Ocean Conservancy is a nonprofit organization that educates and empowers citizens to take action on behalf of the ocean. From the Arctic to the Gulf of Mexico to the halls of Congress, Ocean Conservancy brings people together to find solutions for our water planet. Informed by science, our work guides policy and engages people in protecting the ocean and its wildlife for future generations.
[2] *Deepwater Horizon* Natural Resource Damage Trustees (2015). Deepwater Horizon *oil spill: Draft programmatic damage assessment and restoration plan and draft programmatic environmental impact statement*. Available at http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/
[3] *See* Letter from Ocean Conservancy to the National Oceanic and Atmospheric Administration (August 19, 2015).

ecosystem elements of comprehensive restoration in the Gulf region. We applaud the Trustees for addressing and adopting many of these recommendations in the draft PDARP/PEIS. This letter provides more details about our prior recommendations as well as recommendations for improvements to the draft PDARP/PEIS that are still needed.

This settlement with BP and the draft PDARP/PEIS mark an important milestone for Gulf communities who have been engaged and committed to providing input and guidance to the Trustees since 2010. We appreciate the opportunity to provide formal comments on this draft PDARP/PEIS.

Ocean Conservancy provides the following overall recommendations for the draft PDARP/PEIS (additional recommendations are outlined in the body of this letter):

- The Trustee Council must continue to play a role in reviewing, approving and/or revising restoration plans;
- The Trustee Council's standard operating procedures (SOPs) must be developed with public input, made available for public review and comment, and must be adopted and implemented across TIGs to ensure consistency;
- The Trustees should revise the definition of the term "open ocean" and ensure that the open ocean allocation cannot be accessed for activities that do not restore or enhance marine resources;
- Federal planning and administrative costs from the open ocean fund must be explicitly capped at $150 million;
- The Trustees must address the administrative burden as well as the barriers to coordination and public engagement that the current proposed governance structure will create; and
- The Trustees must ensure decisions for making claims on the allocation for unknown conditions and adaptive management are based on long-term monitoring data that documents and characterizes evidence of additional injury.

I. Governance

A "trust" is a legal relationship in which a person or entity (the "trustee") manages a property or resource for the benefit of another person or group. Trustees are legally bound to preserve the assets of the trust, allowing only judicious use of the assets and repairing the trust should it be harmed. The trustee must also manage the trust exclusively in the interests of the beneficiaries.[4] Based on these legal principles, the Oil Pollution Act of 1990 created a system by which the federal and state government trustees must restore natural resources following an oil spill and must do so in the best interest of their citizens, to whom these resources belong. The NRD Trustees owe legally binding duties to the public as beneficiaries. As such the Trustee Council at hand has a duty to use settlement funds in the most efficient, effective and transparent way possible. Though we recognize the potential benefit of streamlined decision-making at the state level, we are concerned that the creation of eight Trustee Implementation Groups with decentralized decision-making authority could result in inefficient use of funds, and that will undermine the Trustees' own stated goal of ecosystemwide restoration.

A. Trustee Council and Trustee Implementation Group structure and management

The draft PDARP/PEIS provides a description of the governance structure proposed to administer and allocate NRD monies[5] through the creation of eight Trustee Implementation Groups (TIGs), which are composed of a

[4] Turnipseed, M., Crowder, L. B., Sagarin, R. D., & Roady, S. E. (2009). Legal bedrock for rebuilding America's ocean ecosystems. *Science, 324*(5924), (citing Restatement (Third) of Trusts §2 (2003)).
[5] Draft PDARP/PEIS at page 7-4.

subset of Trustees. Under this proposal, the eight TIGs will take on all primary planning and decision-making responsibility.[6] In essence, the proposal creates eight Trustee Councils in addition to the existing Council. The subdivision of central decision-making authority will undermine the effectiveness of local and ecosystemwide restoration and the functionality of the restoration governance system as a whole. We recognize that some of the Trustees may wish to streamline decision-making and that, given purported difficulties in achieving consensus for funding early restoration projects in some areas, there is a reluctance to continue with a centralized model. However, the overall commitment to a coordinated, comprehensive approach outlined in the PDARP/PEIS requires a thoughtful governance approach based on what is best for the ecosystem, which does not recognize political boundaries. The hurdles to reaching consensus that may have been encountered during early restoration should be overcome easily now that funding is allocated by resource to specific political subdivisions.

In the event that the proposed structure moves forward, we are recommending areas to strengthen coordination, ensure consistency and accountability across TIGs, and address restoration needs at an ecosystem scale. We do believe, however, that the proposed structure sets a troubling precedent for future large NRDAs and potentially undermines the Trustees' own stated goals of a comprehensive, ecosystem approach.

B. Standard operating procedures (SOPs)

According to the draft PDARP/PEIS, the Trustee Council will establish standard operating procedures (SOPs) for administration, implementation and long-term management of restoration. We urge additional requirements for the SOPs, including clear guidance and requirements for the TIGs in how they develop, implement, and monitor restoration plans, engage the public and coordinate restoration activities both across restoration areas and with other restoration programs (e.g., RESTORE Act and NFWF). Below, we have outlined several concerns about the way the TIGs may operate, and have provided recommendations for developing standard operating procedures.

B.1 Decision-making and delegation of authority

The details regarding how this proposed governance structure will be implemented hinge upon standard operating procedures (SOPs) developed by the full Trustee Council and the proposed Trustee Implementation Groups (TIGs). The content of these SOPs has not been finalized, and the PDARP/PEIS does not require the SOPs to be made available to the public for review and comment. We understand that prior to this settlement there were legal justifications for the Trustees to operate in secrecy. However, this settlement removes any barriers to transparency and creates an opportunity for more information to be shared with the public and to increase the public's role in restoration planning going forward, including making meetings open to the public. Indeed, engaging the public in restoration planning is a hallmark of other credible regional restoration programs, and we would like to see the same level of commitment by the Trustees. We encourage the Trustee Council to ensure transparency and public engagement opportunities for the duration of NRD restoration, including a public comment period in response to the SOPs.

Additionally, consistency in administration, implementation and long-term management of restoration across the Gulf is important. We recommend that the Trustee Council develop one set of SOPs for adoption by all TIGs, and make them available for public review and comment. The SOPs developed by the Trustee Council must provide sufficient detail regarding the operation of the TIGs and the Council to assure the public that restoration will be closely coordinated and avoid random acts of restoration. Once finalized, each TIG should adopt and implement these SOPs, and any additional procedures established by a TIG for a particular restoration area should be consistent with and build on the Trustee Council SOPs.

[6] Draft PDARP/PEIS at page 7-4.

Summary of recommendations

- The Trustee Council SOPs must be adopted and implemented by each TIG;
- The Trustee Council must have express authority to approve, disapprove, partially approve or suggest revisions for all TIG restoration plans; and
- To the extent possible, meetings of the TIGs should be open to the public.

B.2 Funding, administrative procedures and project reporting

Ocean Conservancy believes the Trustee Council must have a meaningful role in administration, planning, implementation and long-term management of restoration. We are concerned that the proposed structure may result in excessive and inefficient use of funds and will undermine the goal of ecosystemwide restoration. Operating and coordinating the activities of nine Trustee Councils, rather than one, multiplies the functional administrative needs and substantially increases costs of the decision-making system. All four federal Trustees (DOI, NOAA, USDA and EPA) will sit on all eight TIGs, and each must be prepared to staff all eight TIGs, plus the primary Trustee Council, for the next decade and a half. How will the federal and state trustees cover the costs of maintaining the functionality of nine Trustee bodies, instead of one, for well over a decade? What will happen if and when the administrative costs exceed the amount allocated in the consent decree?

The federal Trustees have already incurred significant administrative expenses for early restoration planning they have conducted and for leadership, management and oversight of the Trustee Council.[7] For example, the claims submitted to BP in 2014 alone by EPA, DOI and NOAA for the administrative costs (staff time and travel) of coordination and oversight of restoration planning totaled approximately $35 million.[8] Multiplying those costs by nine provides some indication of the extraordinary cost of implementing this proposed governance structure—cost that will likely exceed the $150 million allocated to administrative oversight and comprehensive planning in the open ocean account. While we believe that federal Trustee participation in restoration planning and coordination is critical, we do not believe that the entire burden of costs for the federal Trustees to participate in this structure should be deducted from the open ocean account. The Trustees and the Department of Justice should explicitly cap the administrative costs from the open ocean allocation at $150 million, after which any additional costs must come from the state allocations in which the Trustees are operating.

The Trustees have identified a preferred restoration approach that will require extensive coordination and collaboration for successful implementation. We are concerned that, without dedicated staff to serve the Trustee Council, the Council's ability to provide the level of coordination and oversight envisioned by this restoration plan will be significantly impaired. Ocean Conservancy believes an independent, dedicated staff is the most efficient way to accomplish this effort. Therefore, the Trustee Council should, at a minimum, hire an executive director and a dedicated science coordinator to provide oversight, formalize planning, science and monitoring coordination across restoration areas and across other restoration programs (e.g., RESTORE Act and NFWF), and assist in identifying opportunities for collaboration and leveraging restoration funding. The Gulf Coast Ecosystem Restoration Council provides a good model of an appropriate and efficient staffing structure. We recognize that creating a staff component increases the initial administrative burden of the Council, but we believe that this is

[7] *See* Trustee Interim Partial Claims, available at: https://www.doi.gov/deepwaterhorizon/adminrecord

[8] 2014 EPA interim partial claim for DWH NRDA funding, available at: http://water.epa.gov/type/oceb/assessmonitor/upload/2014-EPA-Partial-Interim-Claim-for-Natural-Resource-Damage-Assessment-and-Restoration-Planning.pdf; NOAA fourth interim partial claim for assessment and restoration planning costs, available at: http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/NOAA_Fourth_Interim_Partial_Claim_for_Assessment_and_Restoration_Planning_Costs_10032014.pdf; and DOI third interim partial claim, available at: https://pub-dwhdatadiver.orr.noaa.gov/dwh-ar-documents/763/DWH-AR0205731.pdf

ultimately a more cost-effective approach that could actually result in cost-savings in the long-term, particularly if the Trustees rethink their proposed distributed governance approach.

Summary of recommendations

- Federal planning and administrative costs from the open ocean fund must be explicitly capped at $150 million, and any costs exceeding $150 million must be drawn from the state allocations in which the federal Trustees are operating;
- The Trustee Council must provide adequate staff capacity including but not limited to an executive director and science coordinator to fulfill their responsibilities in planning, implementing and monitoring restoration plans, programs and projects; and
- The Trustee Council must provide a detailed budget for administering the proposed governance structure that includes estimated costs for state and federal agency staff to participate in the TIGs.

B.3 Coordination and consultation opportunities among the Trustees

Chapter 5 of the draft PDARP/PEIS describes ecosystem injuries requiring an ecosystemwide response:

> *The injuries affected such a wide array of linked resources over such an enormous area that the effects of the* Deepwater Horizon *spill must be described as constituting an ecosystem-level injury. Just as the injuries cannot be understood in isolation, restoration efforts must also be considered and implemented from a broader perspective*.[9]

The ecosystem and injuries are repeatedly described as linked and interconnected:

> *The biota of the northern Gulf of Mexico ecosystem resides in an interconnected fabric of linked habitats*.[10]
>
> *Because of its physical and biological connectivity, the northern Gulf of Mexico ecosystem is a complex web, in which physical processes and biological interactions in one location may have an important impact on organisms in other locations*.[11]

As such, the chosen restoration type—Comprehensive Integrated Ecosystem Restoration—creates "an integrated portfolio" and "maximize[es] the potential synergies among the restoration types and approaches."[12] This preferred alternative is appropriate and laudable. It encompasses the complexities and interconnectedness of the Gulf's resources and seeks to address restoration in a holistic and all-inclusive manner. Yet, despite this well-founded and achievable aim, which will greatly enhance and improve the ecosystems, communities and economies of the Gulf, the draft PDARP/PEIS then establishes a governance structure based on political boundaries rather than a holistic ecosystem.

The management structure section (section 7.2) acknowledges that the "magnitude and geographic scale of the restoration in this draft PDARP/PEIS is far greater than in any other prior undertaking by natural resource trustees,"[13] but uses this fact as a rationalization for the creation of eight new Trustee bodies. It is exactly the magnitude and geographic scale of this restoration effort that requires a unified Trustee Council to ensure the funding achieves the chosen restoration type of "Comprehensive Integrated Ecosystem Restoration" using an

[9] Draft PDARP/PEIS at page 5-4.
[10] *Id*. at page 3-3.
[11] *Id*. at page 3-3.
[12] *Id*. at page 5-20.
[13] *Id*. at page 7-4.

"ecosystem-level approach."[14] The Trustees identify coordination and collaboration across stakeholders, states and resource agencies as critical to the successful implementation of the restoration approaches identified in draft plan. The draft PDARP/PEIS states:

> *Coordination among programs will promote successful implementation of this PDARP/PEIS and optimize ecosystem recovery within the Gulf. The Trustee Council may consider the restoration actions of these other programs and facilitate the TIGs in identifying synergies, leveraging opportunities, and evaluating cumulative effects, as well as reducing potential redundancy when selecting projects under this PDARP/PEIS.*[15]

Instead, we believe the Trustees **must** be required to establish a formal coordination structure that will facilitate the identification of cross-TIG and cross-program opportunities for collaboration and leveraging restoration funding for greatest impact. Additionally, the Trustees should consider ways to coordinate environmental review and permitting requirements across restoration programs. One approach the Trustees could take is to co-locate entities charged with managing protected and managed resources. This could streamline the review and permitting process and allow projects to move more quickly from planning to implementation. Coordination across restoration areas, programs and environmental review processes must be included in the SOPs.

The Trustee Council and TIGs could also facilitate coordination, consultation and cross resource planning by establishing advisory bodies which would provide objective, independent external review of restoration plans for technical merit and consistency with other restoration plans and overall restoration goals. [16] The Trustees should consider taking steps similar to those taken by the RESTORE Council to avoid conflicts of interest among external reviewers.

Summary of recommendations

- The Trustee Council and TIGs must establish formal coordination and consultation procedures for restoration approaches that cross restoration areas and programs, such as the RESTORE Act and NFWF, and facilitate opportunities to leverage financial resources across natural resource areas and programs;
- The Trustee Council must establish a process to ensure environmental compliance that could include co-locating entities charged with managing protected and managed resources and coordinating NEPA analysis and environmental compliance with the RESTORE Council; and
- The Trustee Council and TIGs should establish a process for independent external review of restoration plans.

B.4 Restoration planning

The draft PDARP/PEIS identifies multiple restoration approaches and types that seek to implement projects across the Gulf and in multiple states. The Trustees acknowledge that coordination and collaboration will be required to improve consistency across restoration projects and programs. The draft PDARP/PEIS addresses this specifically under the planning and implementation considerations for several restoration approaches including: dune and beach habitat restoration, water quality restoration, fish and invertebrate restoration, Gulf sturgeon restoration, oyster reef restoration, sea turtle restoration, marine mammal restoration, bird restoration, and mesophotic and deep benthic restoration.[17] The Trustees also state that where knowledge gaps will affect planning and

[14] Draft PDARP/PEIS at page 5-2.
[15] Draft PDARP/PEIS at page 7-15.
[16] Advisory bodies should be subject to the Federal Advisory Committee Act., 5 U.S.C. Appendix 2.
[17] Draft PDARP/PEIS at pages 5-27, 5-39, 5-43, 5-47, 5-56, 5-62, 5-70, 5-76, 5-80, and 5-368.

implementation for multiple resources, it would be "most efficient and consistent for the Trustees to address these knowledge gaps in a coordinated fashion by collecting data relevant to all of the resources that depend on those data and/or analyses."[18]

Ocean Conservancy urges the Trustees to develop strategic plans for resources where coordination across restoration areas is needed to ensure restoration goals are attained and potential conflicts among projects are avoided or minimized. Developing resource-specific strategic plans should guide the development of TIG restoration plans by establishing, where possible, clear outcomes that must be achieved for each resource. TIGs should then develop restoration plans that reflect resource-level priorities, and focus and sequence restoration activities to provide the most benefit to those resources and the restoration program. TIG restoration plans must include, at a minimum, the details of how projects will be sequenced or phased and how they contribute to achieving recovery objectives.

According to the draft PDARP/PEIS, TIGs will identify needs, objectives and scope, set priorities for targeted resource-level and/or cross-resource-level monitoring, and include monitoring and scientific support activities in restoration plans. The Trustee Council's SOPs need to include details about how the TIGs will use monitoring and scientific support to inform future restoration approaches and adaptive management. SOPs must also describe the process for coordinating resource-level and/or cross-resource-level restoration planning, monitoring and adaptive management plan development across TIGs. Coordination in restoration planning and monitoring could include sharing monitoring data aggregation and analysis responsibilities with each other, especially when restoration types overlap geographic areas, to assess the combined effects of restoration projects and to improve the efficiency and overall effectiveness of restoration evaluation.

Summary of recommendations

- The Trustee Council must develop resource-level strategic plans that identify key uncertainties and guide planning, monitoring, research and adaptive management for the resource across restoration areas;
- TIG restoration plans must include details about sequencing or phasing projects and how projects contribute to achieving objectives of the PDARP; and
- The Trustee Council's SOPs must define the process for sharing responsibilities and costs of monitoring across restoration areas and using monitoring data to inform project planning and implementation, especially when restoration types overlap geographic areas.

B.5 Public engagement and restoration tracking

While the Trustees outlined public review and comment procedures for restoration plans and included a commitment to public reporting, the creation and operation of nine Trustee Councils has troubling implications for public participation. For more than five years, Gulf communities have actively engaged in the recovery and restoration processes, attending dozens of meetings, reviewing restoration plans and providing public comments at each opportunity. For many members of the public, this has become increasingly difficult with multiple processes unfolding, a lack of coordination among them, insufficient time provided for review and comment, and barriers to language and literacy accessibility. Throughout, the public has consistently called for restoration of the Gulf ecosystem, understanding that the resources are interconnected. For example, people in Mississippi understand that improving water quality in Mississippi not only benefits living resources important to coastal

[18] Draft PDARP/PEIS at page 5-368.

residents, such as oysters, but also contributes to the health and recovery of these resources across the Gulf.[19] Establishing a process that requires the public to track and engage with nine restoration planning efforts creates unnecessary challenges and barriers to participation, especially among the most vulnerable populations. For example, the draft PDARP states:

> *The frequency of restoration plans may vary by TIG. Each TIG may specify a restoration plan frequency in its specific procedures or may choose for a flexible planning schedule that brings forward proposed projects individually or in groups.*[20]

This proposed process places a burden on the American public, and some may view this structure as an effort to decrease transparency and public participation. The Trustees must provide a consistent restoration planning process across TIGs that will not require enormous expenditures of time and treasure from the public to participate.

The Trustees should also communicate the outcomes of restoration by reporting the progress toward meeting restoration goals and objectives to the public and other interested entities every three years. This reporting will not only secure the integrity of this process but it will also build the public's trust in how funding allocations are dispersed. The Trustees should also provide meaningful opportunities for public input by establishing advisory committees that include resource managers, stakeholders and experts, as is common practice in other large-scale restoration efforts.[21] Finally, the Trustee Council, TIGs and advisory bodies are advising federal decisions and should be subject to the Federal Advisory Committee Act,[22] a federal law that provides transparency and accountability by making information about how they operate available to the public.

Summary of recommendations

- The Trustee Council should produce a report every three years that communicates the outcomes of restoration activities to the public; and
- The Trustee Council, TIGs and any associated committees or advisory bodies should be subject to the Federal Advisory Committee Act.

II. Injury to natural resources

Ocean Conservancy commends the Trustees for their detailed chapter on injury assessment. The clearly articulated information provided in Chapter 4 allows the public to understand and comment on the injury assessment fully for the first time. After five years of confidential injury assessment studies and the piecemeal release of science and research findings of the ecosystem impacts, we are now able to grasp the impact in numbers, mechanisms of injury and conclusions. The numbers of injured and lost animals are staggering. Throughout the different injury assessment sections of Chapter 4, the Trustees make the point that impacts will likely have an ecosystem-level effect on the northern Gulf of Mexico, and although these impacts were not

[19] Mississippi Department of Environmental Quality (2014), *Community conversations – Understanding the public's priorities for coastal restoration in Mississipp*i. Available at http://www.restore.ms/wp-content/uploads/2014/10/Community-Conversation-Report-Final-10.7.2014.pdf

[20] Draft PDARP/PEIS at page 7-13.

[21] For example, restoration and conservation efforts in the Everglades and Chesapeake Bay have established advisory bodies of stakeholders and experts.

[22] 5 U.S.C. Appendix 2. The Exxon-Valdez Trustee Council's Public Advisory Committee (PAC) was formed pursuant to the Federal Advisory Committee Act (FACA) to advise the Trustee Council on decisions relating to allocation of funds and the restoration and monitoring activities.

quantified, they are incredibly important. Ocean Conservancy supports a continued long-term monitoring and research effort that will enhance our understanding of the ecosystem effects of the BP oil disaster and the interactions across injured natural resources. This effort will provide information needed for restoration planners and resource managers to monitor recovery trajectories of affected species and habitats.

Each restoration project proposed and implemented by the Trustees is essentially an experiment. Projects that are monitored provide an opportunity to generate valuable information about whether projects are performing as expected. The understanding of poorly performing or unsuccessful projects provides an opportunity to refine restoration approaches and improve our understanding of how environmental factors affect the outcome of a project. Monitoring the outcome of restoration projects will also inform adaptive management of restoration and ultimately the successful recovery of injured natural resources.

Need for monitoring for certain resource types

The Trustees evaluated numerous natural resource categories for injury and identified the reasons why their assessment may be an underestimate of true injury. In many categories, it appears the Trustees were able to use existing and new data from field and lab studies to determine injury from the BP oil disaster. The following discussion of underestimated or unquantified injuries illustrates the need to conduct long-term monitoring of certain resources.

First, the assessment of birds (section 4.7), appears to show a more significant underestimate than others. The Trustees acknowledge that their approach to estimating colonial bird mortality results in a "gross underestimation of mortality to the important bird habitats."[23] Ocean Conservancy is concerned that the assessment approach and the subsequent underestimate of bird mortality sets a troubling precedent for the methodologies and appropriate amount of effort that should be applied to quantify bird mortality in future oil spills and for potentially underestimating the true cost of restoration. Unfortunately, five years have passed since the disaster, and baseline data or repeated estimates of parameters included in the "shoreline deposition model"[24] cannot be produced for the conditions present at the time of the disaster. The need to better quantify injury to birds underscores the need to bolster monitoring efforts of bird populations in the Gulf by targeting the highest-priority uncertainties that prevented the Trustees from making a more thorough estimate of mortality.

Second, there is uncertainty about the "current levels of human-caused mortality and serious injury for this [sperm whale] stock"[25] and bottlenose dolphin stocks.[26] These human interactions and stressors are potential population controls that could either interfere with recovery or bolster recovery efforts if reduced. Further research and monitoring efforts would fill important gaps in understanding how and where stressors are interacting with whale and dolphin populations, and how they can be addressed in restoration plans. Other whale species, such as Bryde's whales, occur in small populations in the Gulf which are "highly susceptible to stochastic, or unpredictable, processes and genetic effects that can reduce productivity and resiliency to perturbations […] the capability of the Bryde's whale population to recover from this injury is unknown."[27] Long-term monitoring is imperative to understanding the population status and trends of Bryde's whales and the environmental and human factors that are driving population trends.

[23] Draft PDARP/PEIS at page 4-488.
[24] *Id*. at page 4-485-487.
[25] *Id*. at page 4-590.
[26] *Id*. at page 4-588.
[27] *Id*. at page 4-631.

Third, a number of species in the Gulf are threatened or endangered, including four species of sea turtles impacted by the disaster. Chapter 4 states: "the complex and transient nature of the sea turtle population structure and the significant magnitude of the mortality resulting from the DWH oil spill will make complete recovery challenging."[28] Additional research could improve our understanding about populations, stressors, and where and how sea turtles use the Gulf of Mexico. Mitigating stressors on threatened and endangered species is an important part of their recovery from the BP oil disaster and other stressors.

Continuing monitoring and research initiated through the NRDA process will fill key gaps in information in areas of the Gulf where monitoring efforts have historically been limited. For example, numerous studies were initiated in the deep-sea environment as part of the injury assessment. The contamination of the deep-sea sediments in the innermost impact zone continues,[29] and the recovery trajectories for deep-sea organisms can extend for hundreds of years, making long-term monitoring and research of residual oil and the continued exposure of natural resources to BP oil imperative to understanding full injury. The surveys detailed in Table 4.5-1 are examples of efforts that begin to fill gaps in knowledge that were identified through Ocean Conservancy's survey of existing monitoring programs and priorities.[30]

The larger ecosystem implications of injury from the BP oil disaster "may or may not have been fully captured by the larger natural resource injury assessment. In other cases, as with deep-sea hardground habitats, the inhabitants and ecological functions are less well understood, and the larger ecosystem implications of observed injuries are also less well understood."[31] Therefore, further research to understand the natural resources and ecological functions in the Gulf of Mexico will better prepare us to quantify and understand injury for future disasters, whether oil related or otherwise. In addition, a deeper understanding of the Gulf ecosystem functions allows resource managers to better manage fisheries stocks and our interactions with Gulf ecology.

Summary of recommendations

- The Trustees should conduct long-term monitoring for species and resources that were either underestimated or unquantified; and
- The Trustees should conduct research and monitoring to better define stressors affecting injured species and design restoration approaches to mitigate stressors.

III. Ecosystem-level approach to restoration

Ocean Conservancy fully supports the Trustees' Preferred Alternative A: Comprehensive Integrated Ecosystem Restoration and applauds the Trustees for including restoration goals and approaches in the draft PDARP/PEIS that will provide the basis for planning, funding and implementing ecosystem-level restoration in the Gulf of Mexico. The draft PDARP/PEIS articulates the rationale for how these goals and the proposed restoration approaches will address the natural resource injuries and lost or reduced services. Together with the proposed monitoring and adaptive management processes, this framework appears to provide the programmatic vision necessary for successful and integrated long-term restoration of a large ecosystem. The key to realizing this vision

[28] Draft PDARP/PEIS at page 4-576.
[29] *Id.* at page 4-248.
[30] Love, M., Baldera, A., Robbins, C., Spies, R. B., & Allen, J. R. (2015). Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico. New Orleans, LA: Ocean Conservancy.
[31] Draft PDARP/PEIS at page 4-280.

will, of course, be how well restoration plans are developed and executed at both the Trustee Council/TIG-level and across restoration areas.

Restore living marine resources

Ocean Conservancy applauds the Trustees for the overall approach to restoring marine resources and supports all the restoration approaches identified in the draft PDARP/PEIS. The Trustees recognize that restoration needs for the marine environment of the Gulf of Mexico are extensive. The draft PDARP/PEIS identifies key stressors and proposes a comprehensive suite of integrated and adaptive marine restoration activities to address those stressors. The Trustees have also determined that while some restoration activities can and should be implemented in the near term, there is a need to conduct more research to adequately design future restoration approaches. The focus on stress reduction, combined with the strong commitment for monitoring and science support to fill critical knowledge gaps, will allow restoration to begin immediately and evolve over time via the adaptive management framework. Overall, we are encouraged by the Trustees' programmatic approach to restoring marine resources and believe that, if implemented properly, it offers an excellent opportunity to fulfill the comprehensive and integrated vision laid out in the draft PDARP/PEIS.

Ocean Conservancy previously recommended three primary goals for funding restoration of the open ocean resources of the Gulf.[32] First, the Trustees should seek to understand population status and trends for key marine resources. The Trustees have clearly articulated their understanding that, for many of the Gulf's marine resources, describing population size, structure, movement and response to stressors is an essential first step to prescribing restoration projects or management changes targeted to improve their condition. We commend the Trustees for identifying the need to fill knowledge gaps before undertaking certain restoration and management actions, while designing and implementing projects that have been successful in the past.

Second, the Trustees should undertake activities to reduce known stressors, which is the primary strategy for the initial restoration approaches for living marine resource categories. Approaches like reducing incidental capture of injured resources in fishing operations, reducing injury from vessel strikes and reducing the impacts of marine noise have the potential to improve injured populations in the short term, and we support the reduction of known stressors as the initial approach to restoration. The monitoring, science support and adaptive management processes will be important for updating our understanding of additional stressors and restoration interventions that must provide, as discussed above, additional strategies and approaches to aid recovery.

The restoration approaches for fish and water column invertebrates, marine mammals, sea turtles, and mesophotic/deep benthic communities all appear adequate and appropriate to address a subsection of the known stressors on these populations based on the information provided. Yet, we think the public would benefit from more details about restoration approaches including assessments of project feasibility and/or expected project outcomes. We are concerned that the marine restoration approaches that rely heavily on voluntary behavior changes, enforcement, outreach and education to achieve stress reduction will face implementation challenges based on current conditions and practices in these fisheries. For instance, new bycatch reduction technology in commercial shrimp trawl nets has historically faced challenges with successful uptake by fishermen even after years of incremental advancements in technology. Another example is the restoration approach to

[32] See Letter from Ocean Conservancy to the National Oceanic and Atmospheric Administration (August 19, 2015).

address bottlenose dolphin injury, harm and mortality by reducing illegal feeding and harassment activities.[33] These types of approaches have traditionally involved outreach, education and enforcement activities that have proven less successful than desired, so it will be important to apply lessons learned in developing related activities going forward.[34] While substantial investments in these kinds of programs may provide the intended outcomes, the Trustees should consider alternative techniques for stress reduction of injured populations that may be more productive. Ocean Conservancy recommends that Trustees conduct feasibility analyses and/or consider implementing pilot projects that describe expected outcomes for the restoration approaches for, at a minimum, all marine categories. The Trustees should also continually explore additional restoration options, adding to the "toolbox" as we learn more about impacts and what types of projects are most successful.

The draft PDARP/PEIS allocates funding to restore living coastal and marine resources through multiple TIGs. This funding provides a unique opportunity to coordinate restoration approaches for these resources. To accomplish this, TIGs must plan their restoration approaches for these resources with consideration of and in the context of the approaches included in the other TIG's restoration plans. Ocean Conservancy recommends that the open ocean TIG develop strategic plans for marine resources to inform cross-resource planning and development of restoration approaches and monitoring across TIGs. Strategic plans should include a comprehensive narrative that describes an integrated suite of approaches as well as the role of science support, monitoring and adaptive management in ensuring comprehensive restoration. A useful example is an approach that expands both fisheries-dependent and fisheries-independent monitoring programs in the Gulf to aid in assessing population health, establishing science-based limits to catch and keeping fishing mortality within those prescribed limits.[35] Not only will these programs facilitate stress reduction of injured resources (i.e., keeping fishing mortality within limits), they will also inform future approaches to stress reduction via the adaptive management process (identifying bycatch hotspots, for example). Another example of a successful restoration approach targeted to inform future action is the currently proposed measurement of marine noise to improve knowledge and reduce impacts of anthropogenic sound on marine mammals.[36]

Third, the Trustees should implement appropriate projects to restore or protect analogous resources where injury simply cannot be directly remedied but actions taken would support recovery of the resource overall.[37] There are a handful of these restoration approaches for marine resources (two examples are increasing sea turtle and marine mammal survival through early detection and intervention of anthropogenic and natural threats, and enhancing sea turtle hatchling productivity), and we anticipate the monitoring and supporting science will uncover additional opportunities for successful restoration of analogous resources. Ocean Conservancy recommends that Trustees in the regionwide and open ocean TIGs develop detailed strategic plans for all living marine resource categories that spell out how these three important goals—filling data gaps, reducing known stressors and restoring analogous resources—will work together over time via the adaptive management framework. Strategic plans should also include measurable recovery goals for indicator species and resources representative of the spectrum of injuries in the marine environment. These plans, by their very nature, will be living documents, and we recommend formal review and update at least every five years.

Summary of recommendations

[33] Draft PDARP/PEIS at page 5-279.
[34] Cornish, V. (Ed.). (2015). *Gulf of Mexico marine mammal research and monitoring meeting: Summary report*. Bethesda, MD: Marine Mammal Commission.
[35] More recommendations for restoring fish resources can be found in §6.6 of: Ocean Conservancy. (2011). *Restoring the Gulf of Mexico: A framework for ecosystem restoration. New Orleans, LA: Author*.
[36] Draft PDARP/PEIS at page 5-294.
[37] NOTE: Ocean Conservancy referred to these as "compensatory restoration projects" in our letter to NOAA (Aug 19, 2015), but this phrase is used differently in the PDARP, so we have adapted our language to better articulate our point.

- Trustees should conduct a feasibility analysis and describe expected outcomes for the restoration approaches for all marine resources;
- Trustees in the regionwide and open ocean TIGs should coordinate to develop strategic plans for living marine resources to ensure cross-resource planning and monitoring;
- Strategic plans should articulate the process for using science and monitoring to inform the development of additional restoration approaches via the adaptive management process; and
- Trustee should update strategic plans at least every five years.

IV. Open ocean restoration area

Ocean Conservancy is pleased that $8.1 billion has been allocated toward NRD, and applauds the Trustees for proposing to earmark $1.24 billion for projects in the open ocean. The BP *Deepwater Horizon* oil disaster originated offshore, more than 40 miles off the Louisiana coast and 5,000 feet below the Gulf of Mexico's surface. Living marine resources, such as finfish, sea turtles, marine mammals, and seabirds, were exposed to oil and dispersants. The injury assessment and emerging information regarding impacts to natural resources continues to paint a troubling picture for the marine environment, underscoring the importance of restoration in the open ocean. Inclusion of the open ocean allocation in the settlement will allow for restoration and enhancement of not only the bays, marshes, and wetlands that were impacted by the BP oil disaster, but also restoration of the world-class fisheries and ocean habitats that are the backbone of the Gulf region's economy.

"Open ocean" definition

Ocean Conservancy has repeatedly recommended dedicated funds for restoration in the offshore waters of the Gulf of Mexico. However, we are disappointed with the broad definition and terms of funding for the open ocean allocation. The consent decree defines open ocean as "restoration activities for resources primarily in the ocean *and* Federal Trustee administrative and preliminary planning activities across Restoration Areas."[38] This definition will allow funds to be drawn from this account for projects and costs that do not address ocean resources, which is an unacceptable proposition considering the extent of damage detailed in the draft PDARP/PEIS for ocean resources and habitats.

The NRD Final Allocation table, found at Table 5.10-1 of the PDARP,[39] provides additional details on where the NRD money will be spent. Administrative oversight and comprehensive planning accounts for $150 million of the open ocean funding. As previously stated, Ocean Conservancy does not support funding dedicated for open ocean restoration being spent on overhead costs for other restoration areas, and we are concerned that the costly administration of the proposed governance structure will not provide adequate funding to develop and implement a comprehensive restoration plan for the open ocean resources. We urge the Trustees to revise the definition of open ocean to ensure the proper use of the funds in that allocation.

Recommendation

- Define "open ocean" to consist of restoration activities occurring in the ocean or activities that create, enhance, or improve marine resource management, scientific research, or monitoring of natural

[38] Consent Decree, Appendix 2 at §2.1.1 (emphasis added).
[39] Consent Decree at Appendix 2.1; Draft PDARP/PEIS at page 5-103.

resources in the ocean; and federal Trustee administrative activities, capped at $150 million, across restoration areas.

Allocations for recreation use projects

Four of the early restoration projects to address lost recreational use have been reclassified as open ocean projects.[40] These projects include nearly $7 million for roadway enhancements (i.e., bike and pedestrian lanes) at Davis Bayou in Mississippi, $545,000 for trail enhancement at Bon Secour National Wildlife Refuge in Alabama, more than $10 million for a "beach enhancement project which involves removing fragments of asphalt and road-based material that are scattered widely over the Fort Pickens, Santa Rosa, and Perdido Key areas of Gulf Islands National Seashore, in Florida,"[41] and more than $4 million for the "purchase of up to three pedestrian visitor ferries for use between the City of Pensacola, Pensacola Beach, and the Fort Pickens area of Gulf Islands National Seashore in Florida."[42] Ocean Conservancy does not support the reclassification of previously approved, land-based recreational projects. How are these projects—which do not occur in the open ocean and do not fit the definition—able to be reclassified and accounted for as open ocean projects?

The consent decree's definition of open ocean is: "Restoration activities for resources primarily in the ocean and Federal Trustee administrative and preliminary planning activities across Restoration Areas." While we acknowledge that these projects were part of early restoration and that no further funding from this account is allocated for recreational use activities, we believe that allocating *any* open ocean funds to recreational use projects, past or present, sets a precedent of allowing restoration activities that do not primarily benefit ocean resources to be paid from this account. Of the $832 million[43] allocated for early restoration, only $20 million has been allocated to restoring marine resources injured in this oil disaster.[44] Reclassifying these recreational use projects reduces the amount of funding available for restoration and enhancement of the offshore marine environment, where the disaster took place and where significant injuries to natural resources occurred. While these projects may be worthy of restoration funding from other allocations, they are not suitable for the open ocean allocation. We recommend that the Trustees consider a more appropriate allocation for these projects, either from the states in which the projects are implemented or from the regionwide allocations.

Recommendation

- Reclassify early restoration recreational use projects currently allocated to the open ocean fund to the regionwide allocation or to the states in which the projects are implemented.

V. Monitoring and adaptive management

The Trustees have specifically allocated funding for monitoring and adaptive management across restoration areas in the draft PDARP/PEIS. The Trustees reasonably recognize that restoration will occur over more than a decade and that the dynamic ecosystem of the Gulf of Mexico is likely to change over time. Each of the

[40] Bike & Ped Lane GUIS MS ($6,996,751), Bon Secour NWR Trail, AL ($545,110), Beach Enhancement G.I. National Seashore ($10,836,055), Gulf Islands National Seashore Ferry Project ($4,020,000). See Appendix 2 Table 2 of Consent Decree at http://www.justice.gov/enrd/file/780686/download

[41] Phase III Early Restoration Fact Sheet, Gulf Islands National Seashore Beach Enhancement Project, available at http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/BeachEnhancementFactsheet4.pdf

[42] Phase III Early Restoration Fact Sheet, Gulf Islands National Seashore Ferry Project, available at http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FerryFactsheet4.pdf

[43] On September 23, 2015, the Trustees approved Phase IV of early restoration bringing the total approved to be spent to $832 million from the $1 billion BP pledged for early restoration. See: http://www.sunherald.com/news/article37506207.html#storylink=cpy

[44] Early restoration included a bycatch-reduction project estimated to cost $20 million. See Consent Decree, Appendix 2, Table 2.

restoration areas identifies funding for monitoring and adaptive management, which will allow Trustees to track changing conditions, understand how ecosystem change is helping or hindering restoration, and make necessary adjustments to underperforming restoration approaches. This is commendable.

The data that has been developed as a result of the injury assessment, coupled with the data that will be developed through restoration and monitoring programs, will enable increased efficiency and more effective restoration actions while reducing resource-specific uncertainties.

Address gaps in species ecology and status through long-term monitoring

In prior recommendations to NOAA, we specifically highlighted the need to address data gaps and fundamental science for marine resources before designing the bulk of the restoration approaches.[45] For example, there are critical data gaps in our understanding of population-level status and trends in marine mammals, sea turtles and marine fish.[46] Ocean Conservancy agrees that information is a key first investment needed to "support restoration planning across a suite of projects that benefit the same resource,"[47] and we commend the Trustees for this approach to planning and implementation.

Further, the Trustees have acknowledged the need to evaluate progress of resource-level restoration including the need to improve understanding of food web dynamics and trophic connectivity, habitat mapping and collecting baseline data where information gaps exist to better assess the population or stock levels of resources for tracking collective restoration progress. The Trustees use examples such as the need to improve understanding of deep-sea coral communities as well as status and trends in sea turtles. Ocean Conservancy supports this approach to monitoring and urges the Trustees to apply them to all natural resource categories.

Ocean Conservancy has recently completed an analysis of monitoring priorities and gaps in monitoring coverage for species and habitats impacted by the BP oil disaster; some are identified in the PDARP as priorities for further study. Additionally, monitoring and research initiated through the NRDA process, if continued, have the potential to fill key gaps in information. For example, numerous studies were initiated in the deep-sea environment as part of the injury assessment. Historically, this area of the Gulf has received limited monitoring attention. The surveys detailed in Table 4.5-1 are examples of efforts that begin to fill gaps in knowledge that were identified through Ocean Conservancy's survey of existing monitoring programs and priorities.[48] We submit this assessment for the administrative record as a resource the Trustees can use to prioritize monitoring investments.

Use ecosystem indicators for assessing recovery and overall Gulf condition

Other regional restoration programs such as the Everglades restoration effort and the *Exxon Valdez* oil spill restoration program adopted a set of taxa, habitats and key services/natural processes to gauge the condition and function of an ecosystem recovering from an acute event or chronic stress. The use of ecosystem indicators is as much a tool for restoration and resource managers as it is for the public to understand how natural resources and processes are responding to restoration or to important changes and stressors in the environment. Given the finite amount of funding the Trustees will have for monitoring, we recommend the Trustees explore the benefits of indicator species, habitats and services for tracking recovery that are representative of injuries Gulf-wide. This

[45] See Letter from Ocean Conservancy to the National Oceanic and Atmospheric Administration (August 19, 2015).
[46] Love, M., Baldera, A., Robbins, C., Spies, R. B., & Allen, J. R. (2015). Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico. New Orleans, LA: Ocean Conservancy.
[47] Draft PDARP/PEIS at page 5-367.
[48] Love, M., Baldera, A., Robbins, C., Spies, R. B., & Allen, J. R. (2015). Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico. New Orleans, LA: Ocean Conservancy.

approach would be consistent with the Trustees' methodology for determining injury whereby a suite of representative species, communities and habitats were evaluated and the results of these studies were used to make conclusions about injuries not directly studied. Proxies of recovery could serve the dual purpose of prioritizing limited monitoring funding and communicating to the public the status of the ecosystem using a subset of injured resources.

Integrate and coordinate monitoring to be consistent with the Trustees' approach to restoration

The interconnected, ecosystem-level nature of injuries to natural resources across the Gulf, as described in the draft PDARP/PEIS, necessitates a monitoring approach that is integrated, coordinated and comprehensive and transcends political boundaries. To avoid duplication of monitoring effort among the eight restoration areas, the Trustees should establish a Gulf-wide monitoring advisory group to prioritize and coordinate monitoring activities at the resource and cross-resource levels and to evaluate the uncertainties recognized by the scientific community. This would be consistent with the approach other regional, non-Gulf restoration efforts[49] have taken to monitor resource status and trends at an ecosystem scale. The advisory group should consist of not only Trustee agency staff from each restoration area and but also non-Trustee experts and stakeholders that would view monitoring gaps and needs through an ecological lens and make recommendations to the Trustee Council or Trustee Implementation Groups.[50] The recommended monitoring activities would serve as the basis for integrated restoration plans and should be implemented with funding allocated for each restoration area.

Establish data collection standards

For the science-based adaptive management process to function as intended by the Trustees in the proposed framework, the process will need to rely on the integration of data and information standards. This standardized approach will require adherence to data collection, integration and management protocols by each of the TIGs for data to be efficiently used to track the collective progress of restoration activities. For example, there should be a requirement for data to be registered at time of collection and deposited once all accepted quality control procedures have been completed. Ecosystem processes are complex and data collected to track the dynamics of these processes, while simultaneously tracking impacts from restoration, are equally complex. Lack of adherence to institutionalized protocols and data standards will cripple the ability to comprehend ecosystem responses to restoration.

At the project level, it is vital that the Trustees and the other restoration programs adopt the same standards and metrics for quantifying restoration results. A common currency for collecting data across programs will enable all programs to compare and aggregate results, producing a measure of collective impact and demonstrating that these programs' actions are truly greater than the sum of their parts.

Establish data management, synthesis and communication in support of restoration

A key aspect of establishing this type of efficient data system is the development of a robust data management framework that supports the multiple scales of science and monitoring used to plan and track restoration. It has been well documented that the absence of a comprehensive data management and preservation infrastructure leads to the long-term loss of data. For example, Gulf Watch Alaska funded a data recovery project to compile information on the approximately 1,400 funded projects from the *Exxon Valdez* oil spill, only to recognize a large

[49] See as example: Puget Sound Partnership
[50] The advisory group must be subject to the Federal Advisory Committee Act, 5 U.S.C. Appendix 2.

number were inaccessible, with many datasets lost forever.[51] Data are often used to provide critical reference points for science and management issues years later, in ways that are not foreseen by the originators. For instance, they can be combined for use in new modeling approaches or address initially unrecognized questions that enable greater scientific understanding that would not have been possible or validated without those previously collected datasets. This continued use of data must be recognized and appreciated through the NRDA process, in coordination with all other restoration programs in the Gulf, emphasizing the need to plan the appropriate standards and archiving processes at the beginning of one of the greatest scientific endeavors of our time.

The Trustees have outlined a strong rationale for using monitoring data to inform decision-making for current projects and in selection of future restoration. Ocean Conservancy agrees with the Trustees in their recognition of data management as a key aspect of adaptive management. We urge the Trustees to establish data management and sharing that conforms to federal standards.[52] We support the web-based public portal to provide access to monitoring data and information. This web portal should serve not only as a source of data but also as a communication tool for the public and scientific community.

We believe the data management efforts of the Trustees must be tightly coordinated across restoration areas and other restoration programs (i.e., RESTORE Act and NFWF). The regional monitoring group described above would be in a strong position to facilitate coordination in consultation with dedicated Trustee staff (see Governance recommendations). The Trustees should leverage their efforts with those of other restoration programs to support the development of data infrastructure and to establish monitoring standards. These monitoring standards and protocols should be developed by the Trustee Council or the regionwide TIG but must be adopted uniformly by all TIGs. In the spirit of coordination and communication, the Trustees should also work with all Gulf restoration and research entities to hold an annual restoration symposium at which the results and the status of injured natural resource and broader Gulf ecosystem would be shared with the public. The annual Alaska Marine Science Symposium is one such model that could be adapted, or the existing Gulf of Mexico Research Institute (GoMRI) Oil Spill and Ecosystem Science Conference could be expanded to give the Trustee Council an opportunity to share the results of its work.[53] This level of coordination in data collection and information sharing will contribute significantly toward a comprehensive understanding of how natural resources, individually and and the Gulf ecosystem more broadly are recovering from the BP oil disaster or tolerating other stressors.

The *Deepwater Horizon* event remains a troubling disaster for the Gulf ecosystem, with the full degree of impacts still unfolding under the lens of scientific inquiry. The Trustees now have the ability to begin to not only restore the ecosystem from the detrimental impacts of that event but to propel our scientific understanding of the natural world that will better enable our sustainable existence within this complex system. This is an opportunity to expand the reach of our restoration and collective recovery investments, and to establish an enduring legacy of information infrastructure supporting scientific observation that will help address the current challenges of our time and those of future generations. Through this effort the Gulf may become a global model of environmental restoration through the integration of information on our global ecology.

Adaptive management

[51] Jones, M. B. (2015). Data preservation to enable synthesis and re-use. Presentation to National Academy of Sciences "Effective Approaches for Monitoring and Assessing Gulf of Mexico Restoration Activities" workshop.
[52] Exec. Order No. 13,642 (May 9, 2013), 78 Fed. Reg. 28,111 (May 14, 2013).
[53] 2014 Gulf of Mexico Oil Spill & Ecosystem Science Conference Report, available at http://2014.gulfofmexicoconference.org/wp-content/uploads/2014_GulfConferenceReport.pdf

Basing restoration decisions on project performance or new information about resource condition or ecosystem change can be challenging in the context of the technically and geopolitically complex restoration effort described in the draft PDARP/PEIS. Therefore, we commend the Trustees adaptive management approach for achieving recovery in a complex ecosystem. The project-level and cross-resource monitoring and adaptive management strategies predicting and/or measuring the influence of external factors—both stressors and drivers—are the key to understanding populations and improving intervention strategies, particularly where little baseline information is available. The nested structure of assessment from project-level to regionwide scales provides for the best opportunity to develop a supporting hierarchy of evidence for how the ecosystem is responding to current restoration actions. The draft PDARP/PEIS does a great job of outlining the needs for adaptive management particularly where current scientific understanding of the resource is limited or absent in the case of organisms, habitats and ecosystems that have been previously understudied.

Summary of recommendations

- The Trustees should identify and track the recovery of indicator species, habitats and services that are representative of injuries Gulf-wide;
- The Trustee Council should establish a Gulf-wide monitoring advisory group to prioritize and coordinate monitoring activities at the resource and cross-resource level and inform best practices and methodologies;
- The Trustee Council or the regionwide TIG must develop monitoring standards and protocols to be adopted by all TIGs;
- The Trustee Council must establish data management and sharing standards and protocols for all state and federal Trustees that conform to federal standards;
- The Trustees must coordinate, share and leverage their monitoring efforts across restoration areas and other restoration programs (i.e., RESTORE Act and NFWF) to support the development of centralized or collaborative data infrastructure; and
- The Trustees must coordinate with all Gulf restoration entities to establish an annual symposium of restoration and supporting science to further enhance communication and coordination.

VI. Unknown conditions and adaptive management allocation ($700 million reserve)

Ocean Conservancy greatly appreciates the inclusion of the reserve funding for unknown conditions in the settlement with BP. This reserve account is critically important to address restoration from injuries that are discovered or more fully understood subsequent to the settlement (e.g., latent, chronic, delayed manifestation in long-lived species). As the Trustees continue to learn more about the long-term impacts of the oil disaster, this account will provide the much-needed flexibility and adaptability to ensure restoration is supported with adequate capacity into the distant future. However, the consent decree does not outline a clear process for accessing that account. The consent decree states:

> *At any time between January 1, 2026 and the anniversary of the Effective Date in the assumed year 2032, the United States and all of the Gulf States may jointly demand payment of all or a part of the accrued and previously unpaid interest on the amount required* […][54]

According to the draft PDARP/PEIS, the funding set aside for addressing unknown conditions and adaptive management will be administered by a TIG comprised of all state and federal natural resource Trustees.

[54] Consent Decree, ¶ 21.a.

This TIG's function is separate from, but informed by, the continual monitoring and adaptive management that each of the above TIGs conduct as part of their overall restoration implementation responsibilities.[55]

Ocean Conservancy agrees that this allocation should be informed by evidence gathered across TIGs from monitoring. However, neither the consent decree nor the draft PDARP/PEIS includes any guidance on the scientific justification needed for the United States and all of the Gulf states to bring a joint demand of payment from this account to address lingering or new injuries. Further, this demand of payment may be brought prior to the completion end of the payment period, reducing or potentially depleting funds available to address new injuries or unknown conditions after the effective date of the finalized consent decree. We are concerned that the lack of guidance and criteria for properly accessing these funds could unintentionally incentivize a demand at an earlier date, thus shortchanging the potential for the full accrual of $700 million.

An undertaking this large is bound to encounter uncertainties, and, while Ocean Conservancy believes the Trustees have developed a sound vision for restoration, we continue to be concerned about how restoration approaches and strategies will be implemented. A number of the approaches included in the draft PDARP/PEIS have a degree of uncertainty, including "a limited scientific understanding of target resources, the use of novel approaches and/or techniques, restoration at large spatial scales and/or long time scales, and strong socioeconomic influence, among other factors."[56] Monitoring and adaptive management plans should be developed concurrent with implementation of the restoration approaches for each area, and the Trustees must ensure sufficient funding for these activities. Additionally, restoration plans must adequately account for climate change impacts and ensure restoration activities are designed to be resilient and sustainable with consideration of sea level rise, storm surge and other climate-related impacts that are predictable using best available science. Trustees should not, therefore, be able to access the funding allocated for unknown conditions and adaptive management to react to scenarios that were reasonably foreseeable in the planning process but that Trustee Implementation Groups failed to consider. Each TIG is allocated funding for monitoring and adaptive management and should budget appropriately for these activities rather than viewing the unknown conditions funds as a way to supplement the adaptive management process.

Evidence of additional injury required to access reserve account

The consent decree provides a broad definition for the use of funds from this account: "to address unknown injuries and/ or losses to Natural Resources" or "to adapt, enhance, supplement, or replace restoration projects or approaches initially selected by the Trustees."[57] Ocean Conservancy agrees that both addressing unknown injuries and adaptive management are critical to the long-term recovery of natural resources. The Trustees discuss the way that other ongoing scientific and monitoring activities in the Gulf could be leveraged to discover the existence of such currently unknown conditions, applying this information "to determine whether adjustments are needed to restoration at the project, resource, or cross-resource levels to ensure recovery of the resources from injury caused by the Deepwater Horizon incident."[58] Ocean Conservancy urges the Trustees to explicitly commit to this level of tracking at multiple scales and analysis of research and monitoring data. Further, the Trustees must develop a clear definition of unknown conditions and guidance for the type of documentation or evidence that will be needed to access the allocation for unknown conditions and adaptive management and avoid misuse of these funds.

[55] Draft PDARP/PEIS at page 7-10.
[56] Draft PDARP/PEIS at page 5-361.
[57] Consent Decree ¶ 21.
[58] Draft PDARP/PEIS at page 5-369.

Ocean Conservancy supports the Trustees' decision to initiate restoration now; however, the Trustees have indicated that for many resources, including fish and water column invertebrates, sea turtles, and birds, additional injuries likely occurred but were not quantified or were underestimated. Further, the Trustees indicate injuries to benthic communities are likely to adversely affect the marine food web. Chronic or new injuries and any population-level or food web impacts cannot be ruled out. Oil released into sensitive coastal and marine environments can persist for decades, and the resulting environmental impacts can last just as long or longer. Studies of the *Exxon Valdez* oil spill show that some oil remained in Prince William Sound two decades later, and some injured resources had not fully recovered.[59,60] Ocean Conservancy is concerned that without reasonable safeguards in place, this account could be zeroed out before the long-term impacts on natural resources are fully known. Therefore, the Trustees must conduct additional monitoring and supporting science needed to document and characterize injuries not accounted for in the draft PDARP/PEIS and to track recovery of injured resources. This monitoring data must be used to inform decisions for making claims on this account.

It is critical that the Trustees establish conditions and criteria that must be met before a demand for payment may be made from this account. For example, the Trustees should provide the following: 1) evidence of worsening or continuing injury and/or any unknown conditions that have interacted with these injuries to prevent a full recovery as of January 1, 2016; and 2) a summary of program successes and setbacks that includes an explanation of progress, or lack of progress, in achieving goals and the underlying reasons, as well as an articulation of the changes the Trustees will make to accelerate the recovery of injured resources and to improve the likelihood of restoration success going forward.

Summary of recommendations

- Trustees must demonstrate that they considered the impacts of climate change in their original project design and implementation as a condition for accessing this allocation to repair or replace projects;
- Trustees must ensure the funding allocated for unknown conditions and adaptive management is not used to supplement the adaptive management process of TIGs;
- The Trustees must provide more information about how Trustees will make determinations that conditions have presented a rationale for accessing this account;
- The Trustees must provide a definition for unknown condition; and
- The Trustees must ensure decisions for making claims on the allocation for unknown conditions and adaptive management are based on monitoring data that documents and characterizes currently unknown conditions.

VII. Conclusion

In summary, Ocean Conservancy supports the Trustees' commitment to an ecosystemwide approach to restoration that provides resources for the open ocean, coastal restoration, monitoring and adaptive management. However, we have serious concerns that the proposed distributed governance structure of the Trustee Council subdivides responsibility for achieving ecosystem restoration in a way that decreases accountability and threatens the Trustees' ability to coordinate, threatens the funding available for ecological

[59] *Exxon Valdez* Oil Spill Trustee Council. (2010), *Report on recent lingering oil studies*. Available at http://www.evostc.state.ak.us/Universal/documents/LingeringOilReport.pdf
[60] *Exxon Valdez* Oil Spill Trustee Council. (2014). Exxon Valdez *oil spill restoration plan update*. Available at http://www.evostc.state.ak.us/static/PDFs/2014IRSUpdate.pdf

restoration in the open ocean and places an unfair burden on the public by increasing the time and effort required to meaningfully engage and participate in restoration planning and implementation.

Making the best use of funds provided by the settlement for natural resource damages in the Gulf will depend on coordination, planning and careful setting of priorities for what is a significant—but nonetheless limited—amount of funding. The challenge and opportunity we now have is to leverage and allocate these funds to achieve maximum benefit for the ecosystem as a whole. In the end, restoration must not only result in benefits to individual resources or services but must collectively contribute to a healthier, more resilient Gulf ecosystem.

Thank you for your consideration of these comments as you move toward finalizing the PDARP/PEIS and the consent decree. Please contact me at 504.208.5814 or Ivy Fredrickson at 503.505.6575 with questions or to discuss these comments in more detail.

Sincerely,

Bethany Carl Kraft
Director, Gulf Restoration Program
Ocean Conservancy

Attachments:

Letter from Ocean Conservancy to the National Oceanic and Atmospheric Administration (August 19, 2015).

Love, M., Baldera, A., Robbins, C., Spies, R. B., & Allen, J. R. (2015). Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico. New Orleans, LA: Ocean Conservancy.

Gulf Restoration Center
307 Tchoupitoulas Street, Suite 300
New Orleans, LA 70130

Ocean Conservancy

504.208.5813 Telephone
504.267.8541 Facsimile
www.oceanconservancy.org

August 19, 2015

Chris Doley
Chief, Restoration Center
NOAA Fisheries, Office of Habitat Conservation
1315 East-West Highway SSMC3
14th Floor F/HC3
Silver Spring, MD 20910

Re: Ocean Conservancy marine restoration recommendations for inclusion in the Draft Assessment and Restoration Plan

Dear Mr. Doley:

Ocean Conservancy[1] would like to thank the National Oceanic and Atmospheric Administration (NOAA) for its leadership in the Deepwater Horizon Natural Resource Damage Assessment (NRDA) process, which undoubtedly played a crucial role in settling Natural Resource Damage (NRD) claims with BP. NRD funds are critically needed to address impacts from the BP Deepwater Horizon oil disaster and to make important investments toward comprehensive restoration of the Gulf ecosystem. We are especially pleased to see an allocation of $1.24 billion for "open ocean" projects, and we thank NOAA for its diligence and dedication to addressing impacts in the marine environment, where the blowout occurred.

It is our understanding that a draft consent decree outlining the terms of the U.S. Department of Justice settlement with BP, as well as a Draft Assessment and Restoration Plan (DARP), will be released in the coming weeks. In light of the approximately $1.24 billion in NRD monies for open ocean projects specified in the confidentiality order dated July 2, 2015, we offer the following recommendations for Trustee consideration in the finalization of the draft DARP.

Ocean Conservancy developed the following five key recommendations to serve as a foundation for addressing the marine ecosystem elements of comprehensive restoration in the Gulf region, with the understanding that in an ecosystem as large and dynamic as the Gulf of Mexico, projects restoring inland, coastal and marine systems must work together to achieve lasting ecological improvements.

1. **The Deepwater Horizon NRD claims are unprecedented in nature, requiring a creative and unprecedented approach to restoration of the Gulf of Mexico large marine ecosystem (LME).**

The Gulf of Mexico is the ninth-largest body of water in the world and an incredibly diverse ecosystem, supporting over 15,000 species. The Gulf is also heavily used by people. For example, it accounts for

[1] Ocean Conservancy is a nonprofit organization that educates and empowers citizens to take action on behalf of the ocean. From the Arctic to the Gulf of Mexico to the halls of Congress, Ocean Conservancy brings people together to find solutions for our water planet. Informed by science, our work guides policy and engages people in protecting the ocean and its wildlife for future generations.

about 30 percent of U.S. commercial fishery landings and 44 percent of U.S. recreational catch, 12 percent of domestic oil production and 25 percent of domestic natural gas production. Without a healthy Gulf, our coastal communities cannot thrive.

The discharge of 4.9 million barrels of oil and the massive use of chemical dispersants polluted water, air, seafloor and shorelines, killed a wide variety of coastal and marine wildlife, and caused enormous economic disruption and emotional stress for the people who live, work and recreate on the Gulf Coast. BP and other responsible parties also violated numerous state and federal laws, resulting in a number of settlements, including the pending $13.6 billion settlement in principle to resolve the Clean Water Act civil claims and Natural Resource Damage claims against BP, providing a once-in-a-lifetime opportunity to think—and act—comprehensively about restoring an ecosystem that is an economic engine and a natural treasure for the country.

The BP oil disaster occurred against a backdrop of decades of environmental stress, as well as the challenges of a changing climate. The Trustees have a unique opportunity to position the Gulf of Mexico to be able to sustain the region's recreational and economic needs in the coming decades by taking a creative and proactive approach to developing marine restoration options that not only address impacts of the oil disaster, but that also eliminate or reduce risk of future harm from other stressors that may interfere with the long-term health or recovery of injured resources.

Ocean Conservancy recommends adoption of the following elements of a creative, proactive approach to restoration of the open ocean:

A. **View the Gulf of Mexico as an ecosystem driver**
   Although we often think of the Gulf of Mexico as the passive recipient of consequential coastal activities (e.g., the Gulf of Mexico "dead zone"), it is a significant driver of our Gulf climate and our water-based economy. A better understanding of ocean conditions is critical to sustaining communities on the coast. Ocean acidification and shifts in species ranges in the Gulf are just two examples of changes we will likely see in the Gulf of Mexico in the coming decades, and both have important ramifications to our economy and way of life. Increasingly serious conversations about adaptation and community resiliency for the region must rely on accurate and timely delivery of information about changing conditions of the Gulf of Mexico itself in order to address and adapt to change. Without the data that tells us how and where the feeding, breeding, and essential habitat usage of reef fish, sea turtles or marine mammals are changing, for example, we will be ill-equipped to respond to these signals and make transitional economic and community decisions.

B. **Information is a key first investment**
   The BP oil disaster underscored where we lack baseline information in the Gulf that can be utilized to understand the health of the ecosystem and plan for restoration activities. In October, Ocean Conservancy will release an inventory and gap analysis of long-term monitoring and observations programs in the Gulf relevant to the Trustees' priority of tracking recovery of injured resources in an ever-changing ecosystem. The report tells a sobering story—although we have a lot of data in the Gulf, we lack an understanding of status and trends of marine resources from sea turtles to deep-sea corals, from marine mammals to seabirds, many of which were impacted by the oil disaster. For marine restoration to be successful, we must invest now in the science we need to better understand these impacted resources and their place in the ecosystem, so that we can better identify subsequent restoration projects. The Integrated

Ocean Observing System[2] provides an excellent conceptual framework for long-term monitoring of injured marine resources and tracking the ocean conditions that could affect their recovery.

Ocean Conservancy believes that investing NRD funds in research and observation as a means to better understand the Gulf ecosystem, thus enabling Trustees to make better decisions regarding where to invest additional restoration dollars is a critical first steps to a successful marine restoration endeavor.

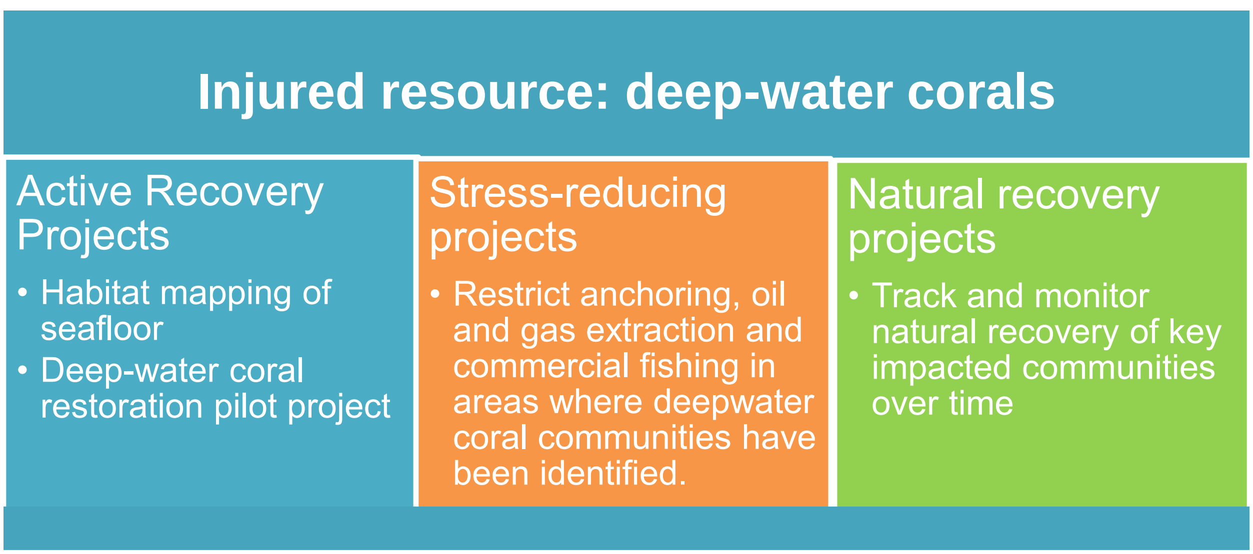
C. Integrated and adaptive marine restoration projects

Injured resources should be addressed through a suite of projects that:

- Account for how projects work in concert with each other to achieve recovery objectives.
- Account for future conditions, including anticipated impacts of climate change when developing restoration projects.
- Contain a range of project approaches, sequenced appropriately, including:
    - gathering essential information on impacted resources, stressors, drivers, and ecosystem function;
    - active recovery, where the project works directly and physically to addresses injury or an underlying issue;
    - stress reduction, where a project addresses injury by reducing or eliminating other sources of mortality; and
    - natural recovery options that monitor progress towards recovery in areas where no direct or indirect restoration options are deployed.

Figure 1. Examples of three kinds of restoration projects as applied to deep-water corals.

Given the unprecedented scope of the disaster and the lack of baseline information from which recovery can be based, this proactive approach increases the likelihood of success of marine restoration efforts.



[2] NOAA, Integrated Ocean Observing System (IOOS), Data Management and Communication (DMAC) System, available at: http://www.ioos.noaa.gov/data/dmac/welcome.html.

2. Establish the Gulf as a model for restoration of a large marine ecosystem

Establish a technology and innovation set aside within the open ocean NRD restoration program. Anticipated monies from the BP settlement offer an opportunity to do more than simply conduct business as usual. There are a number of transformational science and modeling concepts that, if adapted and applied, will dramatically advance not only what we know about the ecosystem but how we are able to use that information to manage the region's valuable natural capital. The right combination of addressing long-standing gaps in knowledge and investing in leaps forward in ecosystem understanding could set the Gulf up to be a model of innovation and implementation for other regions and countries to follow. This promise of implementing better, faster, cheaper ways of doing business will go unrealized, however, if we do not prioritize investing in new and innovative approaches.

Examples of innovation investments:

- Establishing and maintaining telemetry listening station infrastructure around the Gulf could allow researchers and resource management agencies to deploy acoustic tags on virtually any scale to gain essential of movement, migration, interaction, and survival information[3] of important marine species with a relatively small investment.
- Investing in integrated ecosystem assessment modeling and analytics could generate understanding of the relationship between species, processes, drivers, stressors, and the connectivity and relationships among and between the different parts of the marine environment.[4]
- Cataloging the genetic biodiversity of the Gulf—commonly called genetic barcoding —could provide a reference database for any and all species identification, and eliminate much of the time and expense of manual species identification while dramatically increasing accuracy.[5]

Institute a Gulf of Mexico LME advisory body to coordinate and cooperate on marine monitoring, management and project implementation in the offshore environment. Within NOAA alone, there are a number of offices and programs that work in the Gulf of Mexico and that number increases rapidly when you take into account other federal and state agencies, academic institutions, and private and nongovernmental interests who have a stake in the long-term health of the marine ecosystem. Establishing a working group to facilitate information sharing and collaboration within NOAA and with external stakeholders will encourage coordination, reduce duplication and likely lead to innovative problem-solving in the Gulf that will significantly advance NOAA's reach and ability to restore the ecosystem.

Set a new standard for adaptive management, transparency and inclusion. Efforts to address the complex restoration and conservation needs of a LME can benefit from a structured process for dealing with (significant) uncertainty, using new and emerging science and information to adjust course, and

---

[3] Hussey, N. E., Kessel, S. T., Aarestrup, K., Cooke, S. J., Cowley, P. D., Fisk, A. T., Harcourt, R. G., Holland, K. N., Iverson, S. J., Kocik, J. F., Mills Flemming, J. E., & Whoriskey, F. G. (2015). Aquatic animal telemetry: A panoramic window into the underwater world. *Science, 348*(6240), 1255642.

[4] Levin, P. S., Fogarty, M. J., Murawski, S. A., & Fluharty, D. (2009). Integrated ecosystem assessments: Developing the scientific basis for ecosystem-based management of the ocean. *PLoS Biol, 7*(1), e1000014.

[5] Burghart, S. E., Van Woudenberg, L., Daniels, C. A., Meyers, S. D., Peebles, E. B., & Breitbart, M. (2014). Disparity between planktonic fish egg and larval communities as indicated by DNA barcoding. *Mar Ecol Prog Ser, 503,* 195-204.

engaging the affected public in a transparent and meaningful way.[6] The Gulf of Mexico is a dynamic system, and the billions of dollars in restoration projects and programs will accelerate local and regional change—likely in unpredictable ways—accentuating the need for a structured and multi-jurisdictional process for decision-making that can evaluate new information and adjust actions accordingly.

Ensure that NOAA efforts are appropriately staffed for success over the 15-year lifespan of NRD spending. In order to take full advantage of the funds invested in coastal and marine restoration, these programs should be appropriately staffed, and it is unclear from the initial consent decree whether agency salary will be permissible in the NRD program. Regardless of the funding source, however, NOAA should view investments in personnel as essential opportunities to leverage available funds into successful programs.

3. Definition of "open ocean" in Consent Decree between BP and U.S. Department of Justice**.**

We recommend the following clarifying definition of "open ocean" and use of funds provision. This language has also been provided to the U.S. Department of Justice to inform their work to finalize a draft consent decree.

<u>Suggested definition of "Open Ocean"</u>
"Open Ocean" means the area seaward of the barrier islands in the Gulf of Mexico, including but not limited to the benthic and pelagic environments, species, and ecosystem services of the continental shelf, continental slope, and abyssal plain, as well as species inhabiting the open ocean that also spend part of their life cycle in state territorial waters or coastal environments of the Gulf of Mexico.

Open ocean funds must—

- *(a) be used to restore or enhance the condition of species, habitats, or ecosystems in the Open Ocean injured as a result of the Deepwater Horizon oil spill, or to replace or acquire the equivalent of injured resources, or to eliminate or reduce risk of future harm from other stressors that may interfere with the long-term health or recovery of injured resources;*
- *(b) enhance or improve the condition of natural resources of the Open Ocean; or*
- *(c) create, enhance or improve marine resource management, scientific research, or monitoring of natural resources of the Open Ocean.*

4. Science and monitoring is restoration in the Gulf of Mexico large marine ecosystem

In the terrestrial and coastal environment, restoration efforts are informed by an impressive body of information, but there are significant and wide-ranging gaps in baseline information in the marine environment that can hinder fully informed management of marine resources and services. In the past, information about the coastal and marine environments has been largely centered on our understanding of a single or localized issue—for example, the status of a single fish species, the coral communities in a solitary area of interest or the presence of whales at a certain time of year—and not on the systemic environmental conditions that are larger determinants of their survival. A primary challenge facing marine restoration efforts is bringing what we know about cause and effect in marine processes up to a level equivalent to their coastal counterparts and gaining a better understanding of how coastal and marine processes interact to drive Gulf function and conditions. Restoration of the

[6] Scarlett, L. (2013). Collaborative adaptive management: challenges and opportunities. *Ecology and Society, 18*(3), 26.

Gulf's marine populations, resources and communities will be secured by the combination of understanding population biology, status and trends, and characterizing threats and stressors, inclusive of their specific impact on populations. These two elements are critical in order to design successful restoration programs in the marine environment.

The *Exxon Valdez* restoration experience showed that targeted investments in marine research and monitoring shed crucial light on ecosystem health and led to new tools and better management decisions. The *Exxon Valdez* Trustee Council Restoration Program valued research and monitoring as a restoration type:

> "The [*Exxon Valdez* Oil Spill] Trustee Council recognized that there was little direct intervention that could be done, such as rearing and releasing seabirds… Recognizing that the sea cannot be protected through acquisitions, another strategy for long-term protection was adopted, using research and monitoring to increase knowledge of the injured species. The resulting knowledge was used to develop tools to support sound management decisions for the health of those populations and the people who depend on them."[7]

In order to be effective, a restoration program to restore the marine ecosystem must rest on a thorough assessment and understanding of that ecosystem, taking into account the effects of the BP oil disaster and long-term degradation, as well as a vision for what comprises a healthy and resilient Gulf of Mexico. While the BP disaster was unique and different from the *Exxon Valdez* disaster, NOAA and the other Trustees can learn from the experience of the *Exxon Valdez* Trustee Council by using NRD funds to make targeted investments in science. These investments can lead to a better understanding of stressors and drivers in the Gulf of Mexico and their impact on marine populations in order to aid recovery through management actions informed by science.

5. Recommendations for marine restoration goals and five-year investments

The restoration needs for the marine environment of the Gulf of Mexico are extensive. While the *Exxon Valdez* oil spill restoration efforts were not able to track the recovery of a number of species over time, they had enough information to set measurable recovery goals for a subset of resources that were representative of the spectrum of injuries. This is also likely the case in the Gulf, where tracking the status and recovery of every species injured by the BP oil disaster may prove to be unrealistic. A more practical approach might be to select a subset of species, habitats and sites to actively monitor and use as the basis for restoration, along with studying a suite of marine conditions and stressors that could influence their recovery.

Ocean Conservancy's recommended approach to describing a path to recovery is based on defining objectives that are measurable, and we recommend corresponding investments necessary in the first years of funding in order to achieve them. For many of the Gulf's marine resources, describing population size, structure, movement and response to stressors is an essential first step to prescribing restoration projects or management changes targeted to improve their condition. For much of the Gulf, we cannot conduct successful restoration in the absence of this information, and it is thus an essential component of a creative and unprecedented approach to recovery of a large marine ecosystem.

---

[7] *Exxon Valdez* Oil Spill Trustee Council, "The Trustee Council Restoration Program: Supporting a Leap in Knowledge," available at: http://www.evostc.state.ak.us/index.cfm?FA=projects.home.

To that end, Ocean Conservancy recommends three primary goals for funding restoration of the open ocean resources of the Gulf:

Goal 1: Understand population status and trends for key marine resources

Goal 2: Undertake activities to reduce known stressors

Goal 3: Implement appropriate compensatory restoration projects

We recommend these goals be included in the DARP so that projects can be appropriately sequenced by species group, tiered based on the current state of knowledge for that group, and integrated across species, thus identifying and taking advantage of project and program synergies that would not otherwise be possible under a siloed, resource-specific recovery perspective. The initial five-year investment recommendations are taken directly from research and management needs identified by NOAA endangered species recovery plans, Gulf of Mexico Fishery Management Council five-year research plans and similar documents.

Goal 1: Understand population status and trends for key marine resources		
Resource	**Recovery/ecosystem objective**	**5-year investments**
Marine mammals	Characterize population size, structure, health	High-resolution aerial imagery abundance surveys
		Foraging/reproductive output studies
		Genetics for analysis of population structure
		Conduct health assessments
	Understand environmental/ anthropogenic stressors and drivers	Fully fund the marine mammal stranding network
		Research on the effects of marine noise/contaminants on foraging, migration and reproduction
	Identify critical forage, breeding, and migration routes	Large-scale tagging program, acoustic monitoring, aerial surveys
		Acoustic monitoring
		Aerial surveys
Sea turtles	Characterize population size, structure, health	Identify important marine foraging, breeding, and inter-nesting habitats
		Monitor and assess female nesting and hatchling success trends
		Establish non-nesting metrics of populations size and health
	Understand environmental/ anthropogenic stressors and drivers	Increase observation of shrimp/reef-fish fishing activities
		Understand impacts of marine noise and oil and gas development on foraging and migration
	Identify critical forage, breeding, and migration routes	Establish monitoring sites in foraging areas, implement large-scale tagging program
Marine fish	Improve the accuracy and timeliness of assessments of fish and ecosystem health	Understand and characterize benthic habitats and their relationship to fish populations
		Increase fishery independent data collection via SEAMAP and others

		Improve timeliness of fishery dependent data collection
		Describe predator-prey relationships for key species groups
	Identify critical habitats and their relationship to fish populations	Map areas known or suspected to be essential fish habitat
		Characterize fish relationships to benthic habitat features
	Understand the relationship between environmental stressors and drivers and fish production	Develop and test tools and models (including model ensembles) that can identify important biotic and abiotic factors affecting fish production
Nearshore communities	Understand the connectivity between the coast and the deep sea	Describe how terrestrial and coastal inputs impact nearshore and offshore resources, habitats and water column
	Understand the connectivity between the deep sea and the coast	Describe how ocean processes drive coastal and terrestrial weather, climate, resource productivity, sea level rise and community resilience
Deep sea communities	Map and characterize deep sea communities	Locate and describe biotic/abiotic features
		Develop and refine methods for predicting additional locations of deep sea communities
	Understand environmental/ anthropogenic stressors and drivers	Describe fishing and exploration activities that overlap with known or suspected areas
		Assess sensitivity to disturbance and estimate recovery times, model a range of ocean acidification impacts
	Identify reproductive biology, connectivity between and among communities	Research on growth rates, reproduction, population sources and sinks

Goal 2: Undertake activities to address/reduce known harm, stressors for key marine resources

Resource	Recovery/ecosystem objective	5-year investments
Marine mammals	Mitigate impacts from fisheries interactions	Determine the top threats to marine mammals from fisheries and propose gear modifications or activity limitations, accordingly
	Mitigate impacts from marine noise	Define essential areas/times for breeding, foraging, migration and consult with other federal agencies on potential activity modifications
		Evaluate noise dampening techniques and technologies for large ships and tankers
	Mitigate impacts from marine pollution	Determine/estimate toxicity thresholds and consult with appropriate agencies to monitor water quality and enforce limits
Sea turtles	Reduce threats to nesting beaches	Identify and protect additional sea turtle nesting sites throughout the Gulf

		Developing nesting beach management plans that address future needs/threats
	Reduce threats from fisheries interactions	Expand the early NRDA turtle excluder device state implementation and enforcement to Louisiana
		Fully fund the sea turtle stranding network
Marine fish	Reduce threats from invasive species	Develop and implement lionfish monitoring and management plans
	Mitigate impacts from oil exposure	Develop and implement target-based fishery management with appropriate buffers for uncertainty of lethal effects (for reef and pelagic fish and their prey)
	Conserve and protect essential habitat areas	Identify and conserve habitat that is critical to important life-history stages of key fish species, protect from damage from bottom-tending activities
	Reduce threats from unsustainable fishing levels	Develop and implement management strategy evaluation models and other decision support tools
Nearshore communities	Mitigate impacts from coastal changes	Model potential impacts of terrestrial and coastal processes (including large-scale restoration projects) on nearshore resources
	Mitigate impacts from deep sea changes	Model potential impacts of sea level rise, ocean acidification, changes in resource productivity on coastal and terrestrial resilience (including communities)
Deep sea communities	Mitigate impacts of fishing	Evaluate effects of bottom-tending gear in areas known or suspected to contain deep-water communities
	Mitigate impacts from other disturbances	Evaluate and recommend appropriate buffers for oil and gas/mining activity around known and suspected deep sea communities

Goal 3: Implement appropriate compensatory activities

Resource	Recovery/ecosystem objective	5-year investments
Marine mammals	Population recovery from lethal and sub-lethal oil impacts	Fully fund the marine mammal stranding network
		Perform health assessments on key resident dolphin populations
		Protect essential sperm whale foraging habitat
	Understand processes that influence success	Develop and implement a comprehensive monitoring program to track recovery and how stressors and drivers interact to affect it
Sea turtles	Population recovery from lethal and sub-lethal oil impacts	Fully fund the sea turtle stranding network
		Protect coastal foraging areas and offshore sargassum habitats
	Understand processes that influence success	Develop and implement a comprehensive monitoring program to track recovery and how stressors and drivers interact to affect it

Marine fish	Population recovery from lethal and sublethal oil impacts	Protect key habitats and/or life history stages from the impacts of fishing
	Understand processes that influence success	Develop and refine models that incorporate environmental and social data into assessments of fish population health
Nearshore communities	Understand processes that influence success	Comprehensive oyster and submerged aquatic vegetation monitoring and improvement plans modeled with and tied to coastal restoration work
Deep sea communities	Population recovery from lethal and sublethal oil impacts	Detailed study of deep-water communities to identify reference sites and establish long-term monitoring of oiled and referenced areas
		Detailed report on deep-water community location and structure with recommendations on which sites to protect from what stressors to compensate for oiled areas
	Understand processes that influence success	Research biodiversity and ecosystem services of deep-water communities as well as the importance and distribution of functional groups

Conclusion

Achieving open ocean restoration that is greater than the sum of its individual projects will take smart planning, targeted monitoring, adaptive program management (recommendations for effective program administration can be found in the enclosed appendix) and a creative and unprecedented approach. Ocean Conservancy commends NOAA for its leadership on marine restoration to date, and we welcome the opportunity to discuss the above recommendations for a successful open ocean NRD program. The consent decree, if approved, represents a once-in-a-lifetime opportunity to establish the Gulf of Mexico as a model for implementing effective, adaptive and innovative restoration of a large marine ecosystem. We look forward to continued engagement with NOAA and the other Trustees in realizing this important goal. Please contact me at 504-208-5816 to discuss these recommendations in more detail or if you have questions.

Sincerely,

Bethany Carl Kraft

Bethany Carl Kraft

Enclosure: Principles for Effective Restoration Program Administration, adapted from Ocean Conservancy Restoration Framework

CC: Cynthia Dohner
Carter Smith
George P. Bush
Toby Baker

Kyle Graham
Brian Wynne
Stephen Chustz
Robert Barham
Peggy Hatch
Gary Rikard
N. Gunter Guy, Jr.
Dr. Berry H. (Nick) Tew, Jr.
Mimi A. Drew
Nick Wiley
Ken Kopocis
Robert Bonnie
Craig O'Connor

Appendix: Principles for Effective Restoration Program Administration

Adapted from Ocean Conservancy Restoration Framework[8]

Sound Management

- Efficient, transparent, responsive management that is accountable to the public;
- Active, full participation by relevant federal entities and all Gulf states, individually and collectively, over time;
- A formal and recognized process that engages the public, including broad representation from the region's communities and stakeholders;
- Collaboration between the restoration planning phase of the open ocean restoration work and the broader restoration planning functions of the Gulf Coast Ecosystem Restoration Council, Gulf States, other Trustees, NFWF, etc. to ensure connectivity and continuity; and
- A comprehensive, science-based, ecosystem-focused restoration strategy—resting on a clear vision for a healthy Gulf ecosystem— supplemented by annual work plans, progress reports and periodic requests for project proposals.

Stable and Coordinated Funding

- Coordination of projects supported by funds allocated from various revenue sources (to ensure that projects are consistent, complementary and not duplicative);
- Endowment established to support permanently the research and monitoring needed to assess the health of the Gulf, evaluate the efficacy of restoration measures and facilitate adaptive management; and
- Funds set aside for innovations in technology and methodology.

Prudent Project Selection

- Established criteria clearly linking projects to specific, measurable, feasible objectives;
- Projects subject to independent scientific peer review in selection and evaluation processes;
- Projects coordinated and integrated within the framework of a comprehensive ecosystem restoration strategy; and
- Reevaluation of restoration priorities and activities as information on the extent and significance of injury to natural resources is obtained from the NRDA as well as other scientific sources.

---

[8] Ocean Conservancy (2011). *Restoring the Gulf of Mexico: A Framework for Ecosystem Restoration in the Gulf of Mexico*. New Orleans, LA. Available at: http://www.oceanconservancy.org/places/gulf-of-mexico/restoring-the-gulf-of-mexico.pdf

EXECUTIVE SUMMARY

We must continue to invest in the research and monitoring we need to better understand impacted resources and their role in the ecosystem.

In April 2010, the mobile drilling unit *Deepwater Horizon* exploded and sank in the northern Gulf of Mexico, discharging millions of barrels of crude oil and resulting in the unprecedented use of nearly two million gallons of chemical dispersant. The disaster impacted habitats, wildlife, fisheries and coastal communities. At the time of the BP *Deepwater Horizon* oil disaster, the scientific community was virtually unanimous on one point: Knowledge about how species and habitats in the Gulf would respond to oil and dispersant exposure, and the information needed to support their recovery, was woefully deficient (Graham et al., 2011; Norse & Amos, 2010; Peterson et al., 2012).

Given the magnitude of the oil disaster and the unparalleled resources targeted at restoration, Ocean Conservancy produced *Charting the Gulf: Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico* to better understand what information is available, where gaps exist and where we might focus our collective efforts to identify critical gaps in monitoring and observation (Table 1) in order to support a successful restoration initiative. These gaps, if left unfilled, could hinder our ability to understand if, how and why our natural resources are recovering from the BP oil disaster and responding to broader restoration efforts.

In order to build a foundation for ecosystem monitoring in the Gulf, Ocean Conservancy compiled an extensive inventory of existing and past natural resource monitoring efforts and conducted an expert-based assessment of long-term monitoring needs. This information was used to identify gaps in monitoring for species and habitats impacted by the BP oil disaster, but its applicability is much broader, given the wide range of coastal and marine restoration and management activities currently underway in the Gulf. Restoration programs such as the Gulf Coast Ecosystem Restoration Council or the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund can use the inventory to identify existing monitoring efforts related to their project evaluation and regional monitoring needs. By accessing and leveraging existing monitoring activities included in this inventory, restoration program managers will be able to track recovery of a target resource more efficiently and cost-effectively through reducing duplication and enhancing coordination.

Ocean Conservancy's analysis was conducted using 12 resource categories identified by the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA) Trustees (2012), plus one for the ecosystem drivers in the Gulf. These ecosystem drivers, such as freshwater inputs, size and location of low oxygen areas (known as “dead zones”), ocean temperature and chemistry, could explain why species or habitats are not responding to restoration efforts or recovering as expected. Knowledge of these drivers and other important parameters allows scientists to take the pulse of the Gulf and gives restoration decision-makers the wide-angle, ecosystem lens through which they can understand successes or setbacks and change course accordingly.

Just as a doctor cannot make a diagnosis and prescribe treatment without knowing anything about a patient's overall health and history, decision-makers cannot successfully restore the resources impacted by the BP oil disaster without understanding the overall health and history of the ecosystem. Monitoring is critically important in the aftermath of an ecosystemwide event like the BP oil disaster, because it helps scientists track the vital signs of the ecosystem and inform subsequent recovery actions. An integrated monitoring network will also help decision-makers anticipate emerging stressors in the ecosystem such as climate change.

For restoration to be successful, we must continue to invest in the research and monitoring we need to better understand impacted resources and their role in the ecosystem. Targeted and sustained investments in science shed crucial light on ecosystem health and lead to new tools and better management decisions.

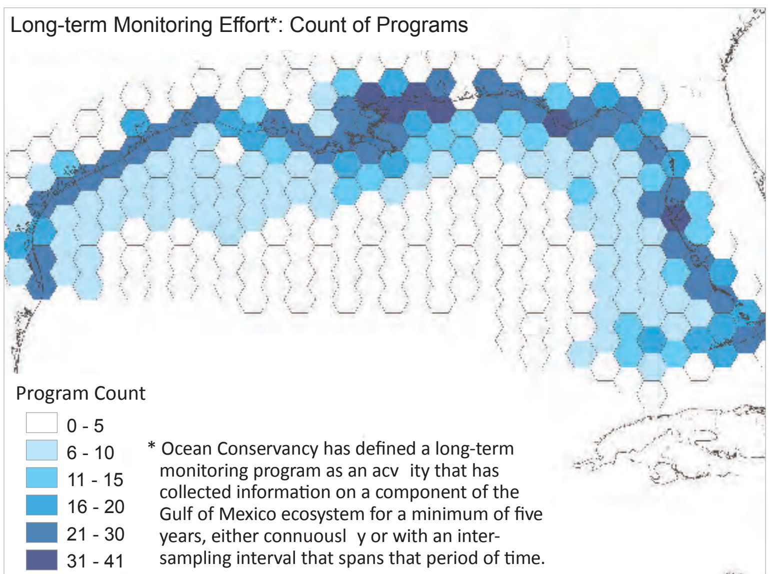


Figure 1: Coverage map of long-term monitoring efforts in the Gulf

The analysis reveals three overarching findings:

1. There are many existing monitoring efforts that restoration decision-makers can use to track the recovery of injured natural resources. Building on these existing efforts will improve consistency, efficiency and coordination.

2. There are gaps in monitoring and in our understanding of natural resources in the Gulf that must be addressed in order to effectively evaluate recovery and thus the success of restoration programs in the Gulf ecosystem.

3. As a group, the species and habitats in the offshore environment are monitored to a lesser degree than coastal or terrestrial species and habitats (Figure 1). Addressing the currently disjointed monitoring system and moving toward a Gulf-wide ecosystem monitoring network will provide a more efficient, integrated and accessible tool for ecosystem information.

Resource Category	Key Findings of Gap Analysis
Ecosystem Drivers	• Observing system mostly concentrated along coast or nearshore waters. • Ocean observing network is sparse or inoperav e with inadequate/unstable finding. • Observations are primarily limited to surface waters. • Need be er integration of drivers into status and trends assessments for species and habitats.
Deep-water Communities	• Limited long-term monitoring of impacted areas. • Monitoring is small-scale and isolated. • Almost no sustained monitoring of deep-water communies.
Water Column and Invertebrates	• No monitoring below 200 meters. • Methods and gear limit collection of smaller organisms. • No monitoring of gelatinous zooplankton.
Birds	• Little to no monitoring of pelagic species. • Existing monitoring targets distribution, abundance and density. • Limited monitoring of ecosystem drivers and stressors.
Marine Mammals	• Monitoring is fragmented. • Limited pelagic monitoring. • More monitoring needed for status and trends in many species.
Marine Fish	• More studies for adult pelagic species needed. • Limited sustained monitoring in pelagic waters. • Limited data on Gulf habitats.
Sea Turtles	• No long-term monitoring of male or juvenile turtles. • Observer coverage low or absent in Gulf fisheries. • Some nest monitoring is dependent on volunteer capacity.
Nearshore Sediments & Associated Resources	• No assessment of physiological, developmental or genetic response to oil. • Regionwide surveys not sustained. • Reliance on short-term intensive studies.
Oysters	• Mapping efforts not coordinated. • Gulf-wide metrics not standardized. • Oyster harvest activities are the most rigorously tracked.
Submerged Aquatic Vegetation	• All priority species are monitored. • Aerial surveys limited in range and frequency. • New programs provided opportunities to fill gaps.
Shallow- and Mid-water Corals	• Most monitoring is at national marine sanctuaries. • An integrated sentinel site program does not currently exist for monitoring climate change impacts. • No Gulf-wide efforts for regional trends and comparisons.
Shorelines	• Gaps in monitoring of shoreline stressors and ecological processes. • Monitoring of shoreline elevation and extent of coarse habitat is widespread.
Terrestrial Species	• Some species have Gulf-wide coverage; for others, only isolated monitoring exists. • Existing monitoring is focused on threatened/endangered species or harvestable species.

Table 1: Key findings of long-term monitoring gap analysis, by resource category.

December 4, 2015

From: Karla Klay
4919 Austin
Galveston, Texas 77551

To: Natural Resources Damage Assessment Trustees

Reference: Comments on the Draft Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS) for the Deepwater Horizon Oil Spill

Dear Trustees,

Thank you for the time, energy, and expense you have collectively invested in assessing damages to natural resources from the Deepwater Horizon Oil Spill/Explosion (BP Spill) occurring in the Gulf of Mexico in 2010, and for estimating the monetary cost of restoring public trust resources to their previous states. The Deepwater Horizon incident brought months of continuous gushing that released 134 million gallons of oil from the sea floor and into the three-dimensional pelagic environment of the ocean from the abyssal zone to the photic zone, flowing shoreward into many estuaries of national significance, floating onto over 1300 miles of beaches and shorelines, and evaporating into the air that marine mammals and sea turtles breathe, along with an additional 1.84 million gallons of dispersant applied throughout the water column and at the sea surface. The event is the most catastrophic manmade environmental disaster in the history of the United States. It is really hard to imagine that the assessment of the damages is complete or that the monetary value proposed to settle the public claims for natural resource damages is the total amount required to fully restore the public trust resources of the Gulf region, considering this restoration plan considers injuries to such a wide array of resources, including everything from brown pelicans to soft corals, sea turtles, marshes, oysters, sperm whales, 21 other species of marine mammals, and more (water column resources). Many species of animals (from sperm whales to small marsh periwinkles), plants (e.g., phytoplankton on smooth cord grass), and many other species that have yet to even be discovered were killed, injured, or impaired for life. This value cannot be truly estimated.

In reviewing the proposed restoration plan it seems that it is almost impossible to have comprehensively assessed the damage and accurately estimated the value of compensation required to restore the Gulf. The attempt is admirable and I realize that we as a nation must move forward on restoration after five years. As stated in the plan it will not be fruitful for the Gulf to have to wait 20 years or more for a complete assessment. Nevertheless, my comments here focus on the apparent insufficiency of a significant component of the plan: its consideration for the lives of the largest and most charismatic animals in the Gulf. These are the sperm whales and their toothed cousins (dolphins) and un-toothed cousins (baleen

whales). The amount of funding allocated for the restoration of marine mammals, and the restoration approaches considered for these species, seem paltry and insufficiently evaluated given the damages to marine mammals outlined in the injury assessment chapter, which are compounded in the context of previously depleted populations due to whaling and human impacts so severe that special federal legislation was passed to protect them (the Marine Mammal Protection Act). One pelagic species of marine mammal in the Gulf is protected under the Endangered Species Act, the sperm whale. Estimating damage to the sperm whale population and proposing methods of restoration for it and its habitat must certainly be challenging given how very little is known about sperm whale life history or physiology, or about rates of global recovery from whaling. More is known about the damage to bottlenose dolphin populations in the Barataria-Terrebonne estuaries, and the trustees' assumptions related to similar toxicity impacts affecting sperm whales and other species of marine mammals in the Gulf are reasonable.

The injury assessment states that 1,100 marine mammals were observed in the surface slick. Humans in the vicinity donned respirators and HAZMAT suits, and even they suffered adverse respiratory affects. The NRDA trustees have estimated tens of thousands of dolphins and whales were exposed in the described "contaminated prime marine mammal habitat in the estuarine, nearshore, and offshore waters of the northern Gulf of Mexico." It is known that marine mammals inhaled or aspirated liquid oil and this caused death in stranded dolphins. Other routes of exposure and evidence of injury are documented. 1,000 dolphins and whales were found stranded. The annual average of strandings increased four fold. The offshore and more pelagic species likely did not strand and no bodies were seen or recovered. How were the numbers of their mortalities or sublethal injuries estimated? It can only be surmised that the offshore and more pelagic species of whales and dolphins living in the "prime" marine mammal habitat affected by the spill also have lung disease, adrenal disease, and poor body condition from the extreme exposures resulting from the Deepwater Horizon event.

Data for strandings following DWH reflect the largest and longest lasting marine mammal unusual mortality event on record in the northern Gulf of Mexico. The injury assessment report states that dolphin and whale populations living offshore were generally less affected than bay, sound, and estuary dolphins. How can this be known? How was this data evaluated? These populations are smaller, congregate in the area affected by the spill, are dependent on the full spectrum of offshore water column habitats, and their bodies are much less likely to strand. The public is generally unaware that 22 species of marine mammals are found in the northern Gulf or that the Gulf hosts resident sperm whales; very few people have even heard of a Bryde's whale. The pelagic environment where most species of the impacted whales and dolphins live is far from shore, requiring a full day to reach in seas that are frequently unpredictable. Most people will never see this part of the Gulf. Despite this, the public holds whales in high regard and there is global pressure to protect all whales and dolphins from fisheries and harvesting, to release captive

killer whales, to stop the capture of whales and dolphins for aquariums, and to participate in whale watching. It is highly unlikely the NRDA trustees have evaluated this true value to the public of whales and dolphins.

Please consider the following requests for integration of additional restoration approaches into the proposed plan, revisions of proposed allocations of funds for restoration, and contingency for failure of the Trustees' proposed approaches for restoration of marine mammal populations:

A. **Establishment of a Gulf Sperm Whale/Pelagic Ecosystem National Marine Sanctuary of significant size**

This sanctuary will serve as a truly pelagic sanctuary for the remaining estimated 700 resident sperm whales in the Gulf of Mexico, providing safe haven for the Gulf's largest and most endangered marine mammal species, which is the most dependent on the full spectrum of depths and habitats in the offshore water column. Sperm whales rest at the surface, dive to and feed in depths over one mile, and are most frequently found associated with the interface between cold-core and warm-core eddies along the 1,000m isobath. There is very good data for sperm whale feeding and calving aggregations in the Gulf from the research conducted under the "Gulf Cet" program funded by the former Minerals Management Service (now BOEM). With data from Gulf Cet and the expertise of marine mammal researchers involved in this research it would be easy to establish appropriate boundaries for the Gulf Sperm Whale National Marine Sanctuary.

The Gulf is unique in that it hosts a resident population of sperm whales, which is considered strategically important in the global restoration of this species. It is not evident in the NRDA assessment and restoration plan that the impact of the spill on the global population of sperm whales has been calculated or addressed. It is important that this damage is calculated and added to the monetary valuation of the damage to sperm whales.

A Gulf Sperm Whale National Marine Sanctuary will protect many other species of marine mammals, billfish, tuna, and other species known to spawn in similar areas associated with features on the bottom, water column chemistry and currents, and eddy/gyre features. While such water column features can move slightly from season to season or year to year, it is possible to identify the areas in which they typically occur, offering the greatest protections to the species associated with them (see the attached map showing my proposal for an area that could be considered). It is vital that these areas be protected from human impacts and the formation of this marine protected area will also address all of the goals and methods listed in the restoration plan for marine mammals (see below). A large component of direct restoration for pelagic species will have to be a protected area for them specifically free of fishing, unnatural sound, and oil and gas exploration and development impacts. These species need a place free from the many

threats that exist in the Gulf of Mexico: potential future oil spills, unnatural sound, drilling, dead zones, pollution, ship strikes, etc.; a "no-human zone," no oil zone, and/or research only zone.

Scientific data exists to support establishing a truly pelagic sanctuary, and the sperm whale is the perfect "poster child" for such a sanctuary. This approach would turn what is now an exceptionally vague proposed restoration plan, incorporating limited tools, into something profound and meaningful for the pelagic environment that was damaged drastically by the DWH oil spill. Using the NMSA to designate a protected area would provide a mechanism through which all of the other proposed restoration strategies for marine mammals could be accomplished, giving back to the sperm whales what BP and oil exploration took away from them. As identified in the PDARP, several areas between the Mississippi Canyon and the DeSoto Canyon have known high densities of sperm whales likely because of localized and highly productive habitats. Setting aside an area for the protection of the sperm whale will have cascading impacts of improved protection and restoration for many pelagic species of fishes, cephalopods, and invertebrates.

B. **<u>The creation of the Sperm Whale and Pelagic Ecosystem Interpretive Center on-shore</u>**

A specialized, high tech facility provided for the interpretation to the public of sperm whale life histories and population dynamics, and of the pelagic environment generally, creates the capacity to educate the American public about the complex pelagic environment that very few people are ever able to directly witness. The offshore Gulf has fueled the economy through fisheries (tuna to anchovies), shipping, and oil and gas. People need to understand why, as well as what animals live there and how humans impact them. The depths of the Gulf are generally unknown to the public. The lives of sperms whales are extreme by any measure of comparison to other animals on earth and in the oceans. Sperm whales spend their lives regularly going where humans cannot, in an environment humans spend great amounts of money to minimally explore. Through interpretation of the story of the lives of sperm whales, people can gain an understanding of the abyssal zone, migrations of species through the water column (e.g., the deep scattering layer), migrations of dispersed males to Antarctica, and even more basic and essential principals such as the differences between the aphotic, mesophotic, and photic zones of the ocean, or the important roles sperm whales play for other species deep in the water column and connecting the surface and the deep ecosystems. This center should be located in a location or locations accessible to the greatest numbers of people in the Gulf of Mexico region, such as the metropolitan areas with the largest populations in Houston, New Orleans, and Tampa.

C. **<u>Design, development, and commissioning of the Gulf Sperm Whale and Pelagic Ecosystem research vessel, an offshore vessel dedicated to</u>**

<u>studying marine mammal population growth in the pelagic environment</u>

The study of the pelagic environment takes specialized talents and technologies, and is truly multidisciplinary. With the establishment of the Gulf Sperm Whale National Marine Sanctuary there must be a mechanism for the natural resource managers, researchers, and others to access the sanctuary and the pelagic environment of the northern Gulf. It will be necessary to invest substantial time in assessing the growth or decline of populations, health of the marine mammals (fecundity and mortality and dispersion), and learn further about the life histories of the sperm whales and other marine mammals in the Gulf. One cannot assess the recovery and restoration of the marine mammals and other pelagic species without consistent, long-term assured access to the pelagic environments of the Gulf.

<u>D. Review of the proposed monetary allocation by the NRDA of $144 million for the restoration of marine mammals.</u>

This allocation should be adjusted by adding an allocation of $70 million for the sole purpose of establishing and managing the Gulf Sperm Whale National Marine Sanctuary, and adding a $100 million endowment dedicated to sustained research, restoration, and adaptive management in the Gulf Sperm Whale National Marine Sanctuary, lasting at least the life time of an average sperm whale, bringing the total to $314 million in funds to restore the marine mammals of the northern Gulf.

Reassessment of the NRDA valuation of damages to sperm whales and other marine mammals is requested on the following grounds.

1. The sperm whale population is globally significant. These resident sperm whales raise their young in highly structured social groups. The males ultimately disperse and travel to Antarctica and throughout the world's oceans. A loss of a male sperm whale from DWH is a much bigger loss than just its loss to the Gulf. With already globally reduced populations, each male is essential to genetic diversity at global level. The same is the case with a female sperm whale because if one female becomes infertile the entire global population is impacted with reduced fecundity as a whole. If the sperm whales have similar problems as the bottlenose dolphins, scientists won't know if fecundity (or morbidity) has been affected until at least 2018.

2. Sperm whales can dive to depths more than twice as deep as the DWH wellhead, and therefore the oil and increased contaminant concentrations on the bottom surrounding the wellhead are affecting the habitats where they feed. Of all the species impacted by the DWH it will be the hardest to assess the impact on the sperm whales. The current draft restoration

plan does not appear to have considered or assessed the value of the feeding grounds of sperm whales, which is particularly problematic given their endangered status.

3. It is shocking to read the extremely low NRDA estimation of $144 million allocated to restore the populations of marine mammals in the Gulf of Mexico. Based on the material presented in the plan, almost 1.4 million lost cetacean years resulted from the spill, and the allocation provides only ~$104 per lost cetacean year. The numbers of individual marine mammals impacted is estimated in the tens of thousands of dolphins and whales, with one affected species, the sperm whale, being listed as endangered under the ESA, protected by the Marine Mammal Protection Act, and protected by the International Whaling Commission's global ban on harvest. Using the abundance estimate for sperm whales in the northern Gulf of Mexico provided in the introduction to the marine mammal injury assessment (page 4-590; 763 individuals), and the mortality estimate of 6% of the population of sperm whales killed as provided in table 4.9-6, about 46 sperm whales were directly killed by the spill (this figure would be more than doubled if the pre-spill abundance estimate of 1635 from tables 4.9-5 and 4.9-12 is accurate; the reason for this discrepancy in abundance estimates should be explained). A humpback whale in Australia is estimated to be valued at $1.25 million for the whale watching tourism industry. Using just that ecotourism value as a proxy for the value of a single sperm whale could yield a value for the loss of sperm whales alone of at least $57.5 million, which is over one third of the proposed marine mammal allocation but reflects a value for only one species of the 22 populations assessed. How was the value of a sperm whale calculated? Certainly the public would value the opportunity to see a sperm whale similarly to seeing a humpback whale, were the public more generally aware of this injury. How was the value of each sperm whale, dolphin, and other whale or dolphin species evaluated? A captive male killer whale has a reported value of $7 million dollars to an aquarium.

4. Given that $70 million is allocated to the states for the restoration of the inshore bottlenose dolphin populations (almost half of the total marine mammal allocation, disregarding the $19M allocated region-wide, some of which will almost certainly be spent inshore), the allocation for offshore species restoration seems exceptionally low. Additionally, it seems that there is not a reported value on the life of a bottle nosed dolphins when it seems easy to find out the value of them to wildlife watchers with dolphin watching occurring across Gulf estuaries and their ever present appearance in aquarium shows. These whales and dolphins, inshore and offshore (all species represented across the 22 populations assessed), will all have the same future problems with reduced fecundity and increased rates of mortality further hindering their recovery.

5. $540 million is allocated in the plan to address lost human uses of the Gulf of Mexico. There is absolutely no way that humans have lost more "uses" of the Gulf than sperm whales, bottlenose dolphins, and other species of whales/dolphins. Not one beach-goer or fisher lost his or her life breathing the fumes, became infertile from the toxins, or gave birth to a stillborn child. Marine mammals suffered all these effects. If humans lived in an area where contaminants were causing a 46% reduction in reproductive viability, the area would be declared a Superfund site and people would be removed. How will the trustees assure marine mammals live in an environment that is not toxic? Injury assessment identifies specific habitat areas where marine mammals congregate, but the restoration plan doesn't acknowledge this. It is very questionable that so much more is allocated for restoration of human uses across the same four states where only $144 million has been allocated for the species that are the apex predators and utilize all components of the three dimensional ocean from the offshore depths and surfaces to near shore estuaries.

6. The allocation for marine mammals did not consider what it will really take to restore the populations of marine mammals that were injured. How were the numbers / dollar values estimated by species or by individual. Tens of thousands of whales and dolphins are estimated to have been exposed to the oil toxic fumes. These species exchange almost all of their oxygen in their breaths at the water surface, thereby exposing their lungs and other internal organs to the highly toxic fumes at the surface more directly than any other species. It doesn't appear that even their commercial value has been estimated. Marine mammals values could be easily estimated to be much higher than assessed based on their very high commercial value from aquarium entertainment and education, wildlife watching, or even previous whaling values.

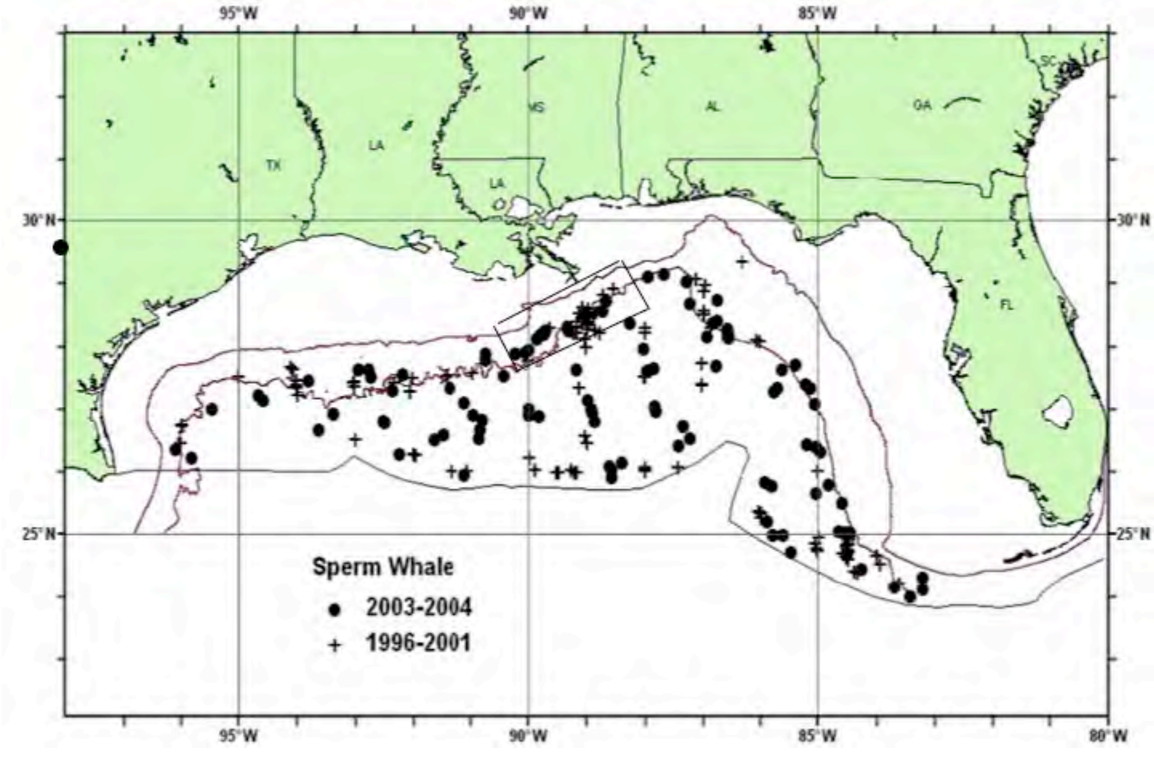
Lastly, the restoration plan for marine mammals appears to primarily address items that NOAA and NMFS are already required to address through management of fisheries and the public trust resources. No part to the plan appears to directly restore the populations of marine mammals impacted from the oil spill itself. The tools listed include collaborative partnerships with fishers to reduce their impacts and accidental takings (this is not an impact of the spill and does need to be done but, it is not likely to restore sperm whale populations numbers taking 29 years to restore).

Another listed tool is providing more funding to marine mammal stranding networks for researching causes of death, possible rehabilitation of dolphins, and necropsies. Most stranded whales and dolphins are near shore inhabitants and it is very unlikely much will be learned about the more pelagic populations. And it is

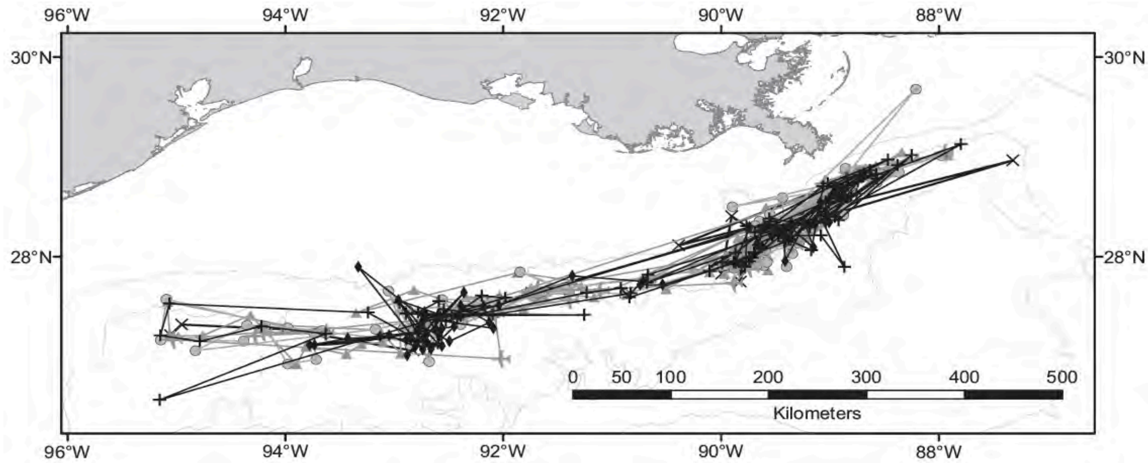
very unlikely a sperm whale might be rehabilitated and released back into the wild. There is not any disagreement that stranding networks are poorly funded and require more funding, but even a 7-fold increase in their funding will not restore populations of marine mammals. While this approach may contribute important information to understanding why (particularly coastal) marine mammals die, it is not a proactive restoration approach contributing to active restoration of populations impacted by the spill.

Were takings under the MMPA /Endangered species Act protections enforced under separate settlements or added to the value assessed for injury under the NRDA? If they are included in the NRDA assessment, the proposed allocation appears even more insufficient.

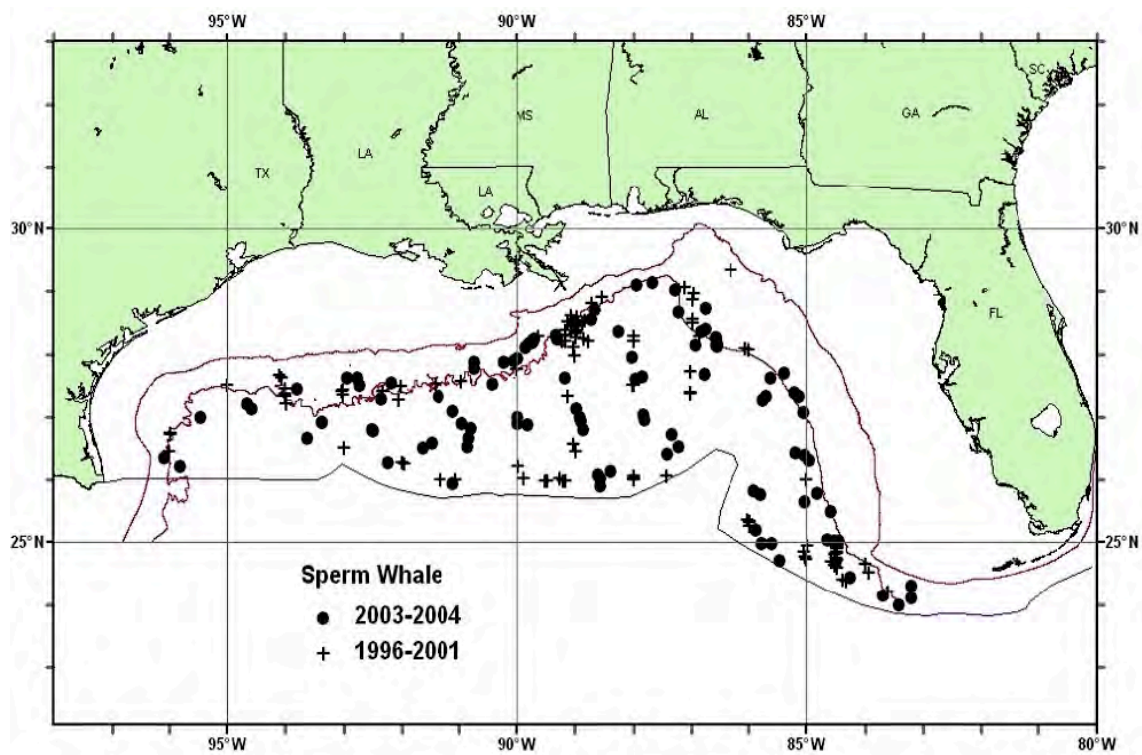
In summary, the proposed plan does not meet the Trustees' obligations to compensate the public for the loss of these resources by restoring marine mammal populations. The plan doesn't include any thing substantial toward active restoration of these populations and should incorporate the concepts identified above to provide more substantial refuge and protection to these populations on a more permanent basis, particularly in light of the uncertainty related to the recovery of the marine mammal populations affected by the spill.



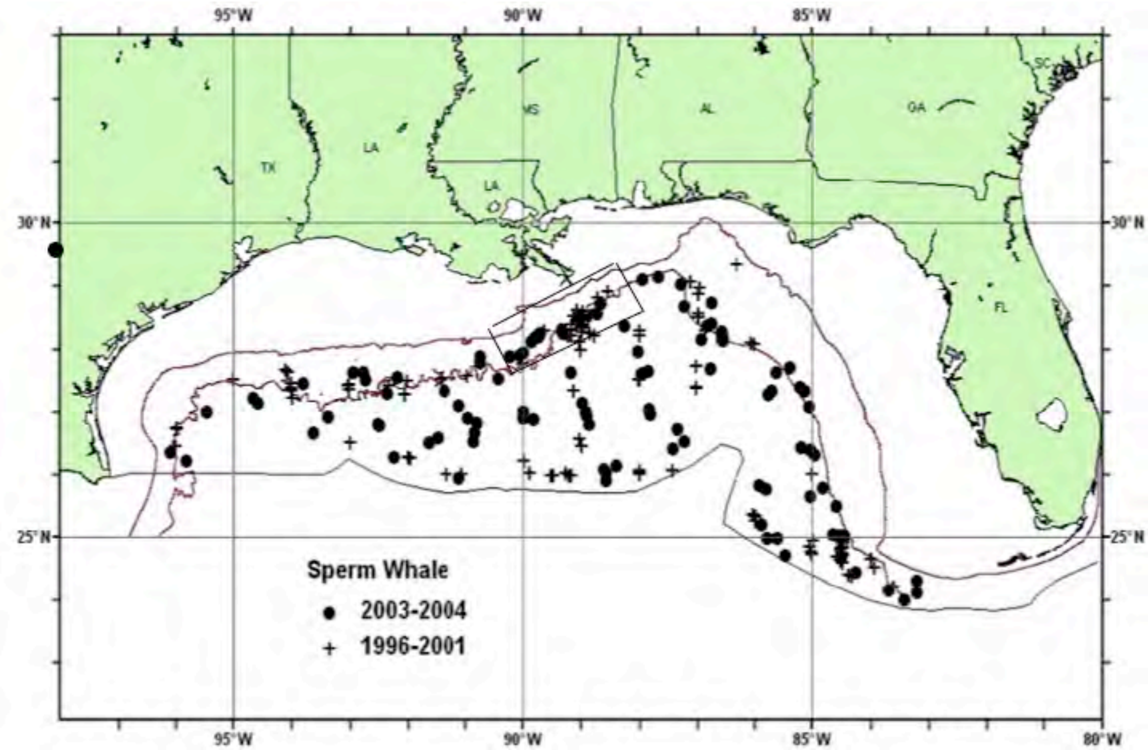
Proposed Gulf Sperm Whale National Marine Sanctuary is outlined in the box above. See attached summary document regarding sperm whale distribution and selection of the boxed area as the sanctuary.



Satellite tracks of seven sperm whales tagged July 3, 2002 and tracked for as long as early June, 2003 (two whales). For details see Ortega-Ortiz et al., 2012 from which this figure was taken.



Distribution of sperm whale sightings from SEFSC spring vessel surveys during 1996–2001 and from summer 2003 and spring 2004 surveys. All on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100-m (328-ft) and 1,000-m (3,281-ft) isobaths, and the southern line represents the U.S. EEZ.


Sperm Whale
2003-2004
1996-2001
95°W
90°W
85°W
80°W
30°N
25°N
TX
LA
MS
AL
GA
SC
FL

13.3.2.2 Sperm Whale

The sperm whale, medium gray above and light gray to white below, is the largest toothed whale and, indeed, the largest toothed creature on Earth. It is highly sexually dimorphic. Males average 15 m (49 ft) in length and a prodigious 36,000 kg or 36 metric tons (79,350 lbs), and females average 11 m (36 ft) and 20,000 kg or 20 metric tons (44,100 lbs). The maximum size of male sperm whales is around 20 m (66 ft), although due to last mid-century's intensive worldwide whaling, there are probably few of these giants around at present. The head of the male sperm whale grows disproportionately rapidly as they age. The male's head takes up about one-fifth to one-quarter of the body's length in young ones and up to one-third of the body's length in older males. It is obviously a secondary sexual characteristic, and males use the head for intrasex fighting and probably acoustic displays. The terrestrial analog might be deer stags with their antlers (the sperm whale male head) and roars (special male-only loud sounds that sperm whales emit). The head houses a giant structure of waxy oil—the spermaceti organ. The blowhole, placed differently from that of any other cetacean, is at the upper front of the mighty head, not along the mid-line but somewhat to the left, which results in a very distinctive, forward-tilted exhalation blow to the animal. Teeth are displayed in the lower jaw only and fit neatly into corresponding sockets in the upper jaw. The back has a dorsal ridge but no dorsal fin.

Sperm whales have a matriarchal society. Females and their female young tend to staying in one or adjacent groups for many years or for life. Males leave the group as they become sexually mature, at about age 10. The matriarchy, which tends to stay in tropical and subtropical waters, allows for related animals to help each other (e.g., take turns patrolling for danger to their nondiving neonates at the surface while others dive to depth). Indeed, deep diving for food (squid and fishes) seems to have driven the evolution towards high sociality in this species. Young males tend to stay together in groups of a dozen or so animals and travel to somewhat higher latitudes than the matriarchies they have left. As they mature—males do not seem to reach social maturity for re-inserting themselves briefly into matriarchies to mate until about age 25—older males tend to be alone (probably to avoid or minimize competition for access to females), and they travel to high near-Arctic and Antarctic latitudes to feed in very deep, productive waters. The general pattern of matriarchy, maturing males, older lone males, etc., has a close analog in the matriarchal systems of the largest land mammals—African and Asian elephants (*Loxodonta* sp. and *Elephas maximus*, respectively)—in what has been termed the collosal convergence of social/sexual strategies coupled with gigantism, long lives, and extended caregiving to young (Weilgart et al., 1996; Whitehead, 2003).

Figure 13.1. Sperm whales are the largest toothed whale and, indeed, the largest toothed creature on Earth. They are highly social, and all but older males are found in tight societies. There is a resident population in the northern Gulf of Mexico. Photo by Thomas A. Jefferson, with permission.

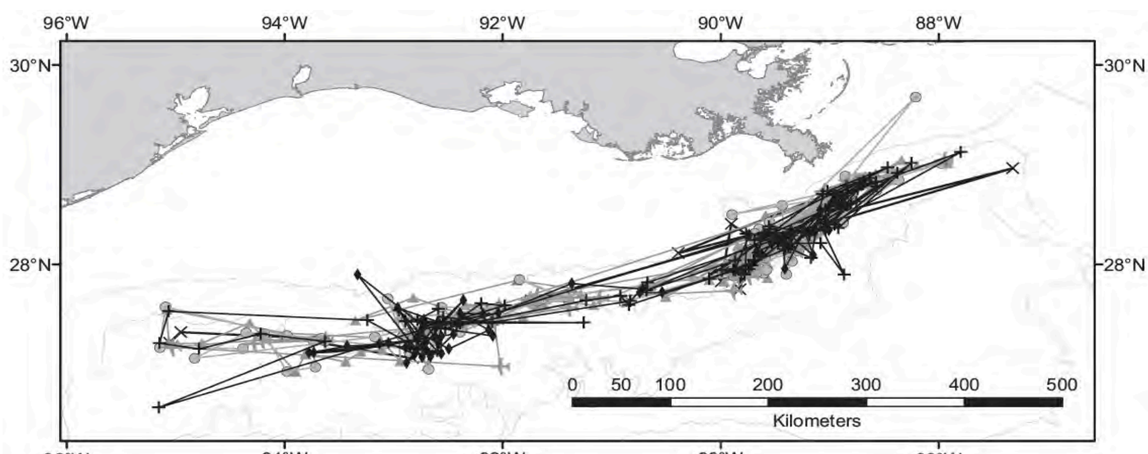


Figure 13.2. Satellite tracks of seven sperm whales tagged July 3, 2002 and tracked for as long as early June, 2003 (two whales). For details see Ortega-Ortiz et al., 2012 from which this figure was taken.

Sperm whales occur throughout the world's oceans but generally in waters deeper than about 500 m (1,640 ft) because of their habit of seeking largely deep-diving squid and fishes. Sperm whales in the Gulf are on average 1.5–2.0 m (4.9–6.6 ft) smaller than those found elsewhere (Richter et al., 2008; Jaquet and Gendron, 2009). This size difference was noted by whalers 150 years ago (Reeves et al,. 2011) and strongly suggests a different population from the sperm whales of the North Atlantic, a verification of which was provided by Engelhaupt et al.,

(2009) from genetic analysis. Mitochondrial DNA (inherited only from the mother) shows significant differences between Gulf sperm whales and sperm whales in other parts of the North Atlantic, while nuclear (bi-parentally inherited) DNA shows no difference. This indicates that females stay within the Gulf but that at least some males travel and breed in both the Gulf and North Atlantic. Indeed, recent satellite tracking of sperm whales showed that matriarchies stayed in waters about 200–3,499 m (656–11,480 ft) deep, generally in the area south and southwest of the Mississippi/Atchafalaya mouths, while males traveled south to Mexico's Campeche area, and one male left the Gulf but returned after about two months (Ortega-Ortiz et al., 2012).

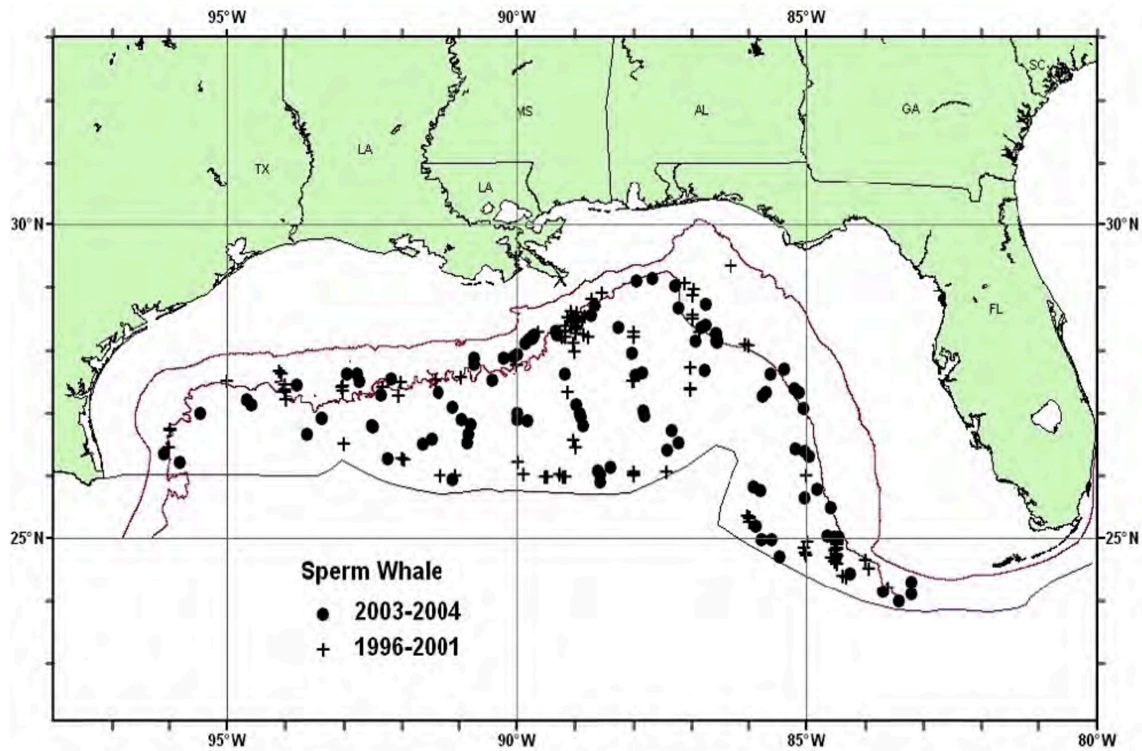


Figure 13.3. Distribution of sperm whale sightings from SEFSC spring vessel surveys during 1996–2001 and from summer 2003 and spring 2004 surveys. All on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100-m (328-ft) and 1,000-m (3,281-ft) isobaths, and the southern line represents the U.S. EEZ.

Typical group size of Gulf sperm whales in the north, which is almost always of presumed matriarchies, is 8–11 animals (Richter et al., 2008), often with calves less than 3–5 years old. This is smaller than groups (24–31) in the Pacific (Coakes and Whitehead, 2004), but similar to groups (about 6) in the adjacent Caribbean (Gero, 2005). Statistical lagged association rates (Whitehead, 2009) indicate that Gulf sperm whale groups are stable for longer (about 62 days) than in the Pacific (7–19 days) (Coakes and Whitehead, 2004) but similar (about 80 days) to another enclosed body of water, the Gulf of California (Jaquet and Gendron, 2009). It is possible that group sizes and association rates are ecologically related and that food or other ocean-basin physical/biological variables help to define social patterns (Richter et al., 2008).

Only recently have more accurate estimates of sperm whale numbers in the northern Gulf emerged. The latest estimate is about 1,665 (CV 0.20) animals (Mullin and Fulling, 2004; Table 13.5). Sperm whales overlap strongly with shipping lanes between New Orleans and Houston, industrial seismic activities, and deepwater oil/gas rigs (Azzara, 2012). They were the only large whale to be hunted in the Gulf (although apparently not into the twentieth century), and their population characteristics may still be influenced by this earlier depredation (Reeves et al., 2011). There is not enough precision to estimate population trends and current productivity rates.

Sperm whales also occur in the southern Gulf and were hunted there in the past (Reeves et al., 2011). Most sperm whales encountered during cruises in the south appear to be concentrated on the continental slope (Figure 13.10).

Table 13.1. Summary of Recent Abundance Estimate for Northern Gulf of Mexico Sperm Whales, Month, Year and Area Covered during Each Abundance Survey and Resulting Abundance Estimate (N_{best}) and CV

Month/Year	Area	N_{best}	CV
Jun–Aug 2003, Apr–Jun 2004	Oceanic waters	16,665	0.20

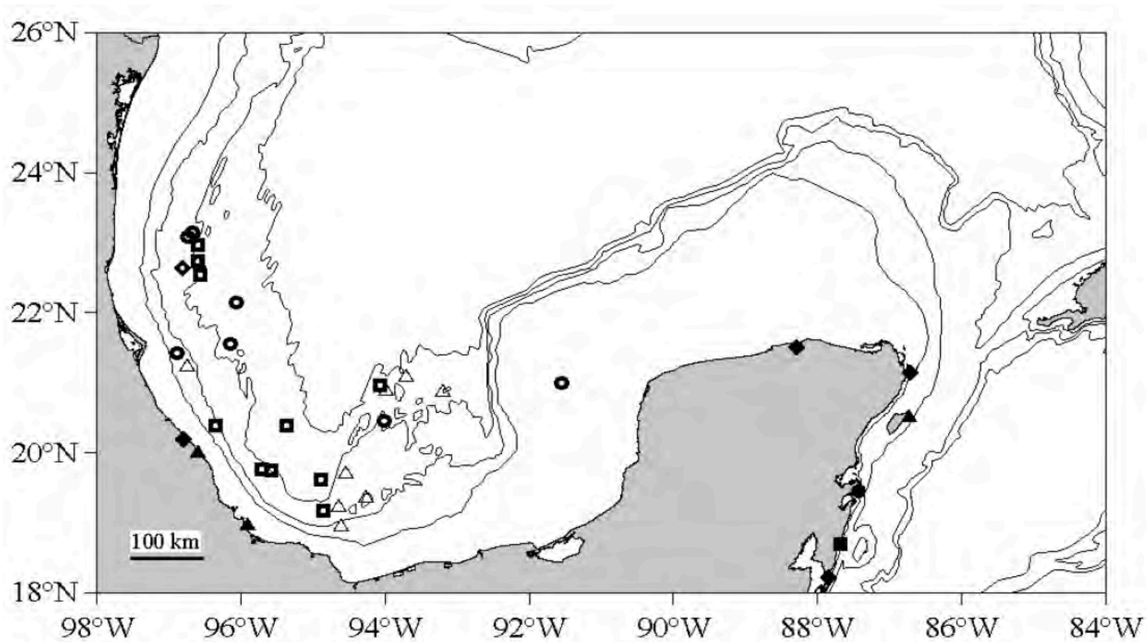


Figure 13.4. Records of sperm whales in the Mexican waters of the southern Gulf of Mexico and Caribbean. Display for distribution is as follows: solid symbol, strandings; hollow symbols, confirmed sightings; triangles, spring (Mar–May); squares, summer (Jun–Aug); circles, autumn (Sep–Nov); diamonds, winter (Dec–Feb); crosses, unknown dates. Thin contour lines show the 200-m, 1,000-m, 2,000-m, and 3,000-m (656- ft, 3,281-ft, 6,562-ft, and 9,843-ft) isobaths. From Ortega-Ortiz, 2002.

Gulf Restoration Center
307 Tchoupitoulas Street, Suite 300
New Orleans, LA 70130

Ocean Conservancy

504.208.5813 Telephone
504.267.8541 Facsimile
www.oceanconservancy.org

December 4, 2015

Cynthia K. Dohner
U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

Re: Ocean Conservancy's submission of *Charting the Gulf: Analyzing the Gaps in Long-Term Monitoring of the Gulf of Mexico* for consideration in finalizing the *Deepwater Horizon* Oil Spill: Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement

Dear Ms. Dohner:

Ocean Conservancy[1] submits *Charting the Gulf: Analyzing the Gaps in Long-Term Monitoring of the Gulf of Mexico* as an addendum to its public comments on the Draft Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS) to restore natural resources, ecological services and recreational use services injured or lost as a result of the BP Deepwater Horizon oil disaster.[2]

Charting the Gulf is the culmination of an assessment of monitoring needs and gaps in monitoring coverage for natural resources injured by the BP oil disaster. The findings are based on an extensive inventory of current and past ecosystem monitoring efforts combined with a comprehensive literature review and expert consultation on priorities for tracking the status of species, habitats and communities of concern. The report highlights aspects of a dynamic Gulf of Mexico that should also be priorities for monitoring because changes in key conditions can help explain why resources are not recovering or responding to restoration activities at a resource or cross-resource level.

We hope the report's findings, as well as the inventory of monitoring efforts documented throughout the Gulf, are useful to the Trustees as a framework for identifying data collection priorities needed to track resource status and trends in support of adaptive management and future restoration decisions.

The report is attached to this cover note, and the full inventory of programs can be downloaded here: http://www.oceanconservancy.org/places/gulf-of-mexico/gap-analysis.html.

If you believe it would be helpful to meet with you or your colleagues to discuss the report and its potential applicability in greater detail, we would be happy to do so.

---

[1] Ocean Conservancy is a non-profit organization that educates and empowers citizens to take action on behalf of the ocean. From the Arctic to the Gulf of Mexico to the halls of Congress, Ocean Conservancy brings people together to find solutions for our water planet. Informed by science, our work guides policy and engages people in protecting the ocean and its wildlife for future generations

[2] *Deepwater Horizon* Oil Spill: Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement, Natural Resource Damage Trustees (October 2015).

Sincerely,

Bethany Carl Kraft
Director, Gulf Restoration Program
Ocean Conservancy

Attachment: Love, M., Baldera, A., Robbins, C., Spies, R. B., & Allen, J. R. (2015). Executive Summary, Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico. New Orleans, LA: Ocean Conservancy.

Ocean Conservancy

CHARTING THE GULF

Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico

SPONSORS

Ocean Conservancy thanks the Walton Family Foundation for providing funding in support of *Charting the Gulf: Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico*.

Please see the Acknowledgments section (page 46) for the many people and institutions who contributed information, reviewed priorities, provided guidance or otherwise assisted with the development of this report. Individuals at the Gulf of Mexico Coastal Ocean Observing System, the National Centers for Environmental Information, Gulf of Mexico Alliance and the U.S. Fish and Wildlife Service were especially helpful in this effort.

SUGGESTED CITATION

Love, M., Baldera, A., Robbins, C., Spies, R. B. and Allen, J. R. (2015). *Charting the Gulf: Analyzing the gaps in long-term monitoring of the Gulf of Mexico.* New Orleans, LA: Ocean Conservancy.

ACCESS ONLINE

www.oceanconservancy.org/gapanalysis

If you have questions or comments, please contact the authors at
gulf@oceanconservancy.org

Charting the Gulf:

Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico

Matthew S. Love[1]
Alexis A. Baldera[1]
Christopher S. Robbins[1,*]
Robert B. Spies[2]
Jennifer R. Allen

[1]Ocean Conservancy
Gulf Restoration Center
307 Tchoupitoulas St, Suite 300
New Orleans, LA 70130

[2]Applied Marine Sciences
P.O. Box 315
Little River, CA 95456

*Corresponding author

DECEMBER 2015

Ocean Conservancy

CONTENTS

LITERATURE CITED

EXECUTIVE SUMMARY

We must continue to invest in the research and monitoring we need to better understand impacted resources and their role in the ecosystem.

In April 2010, the mobile drilling unit *Deepwater Horizon* exploded and sank in the northern Gulf of Mexico, discharging millions of barrels of crude oil and resulting in the unprecedented use of nearly two million gallons of chemical dispersant. The disaster impacted habitats, wildlife, fisheries and coastal communities. At the time of the BP *Deepwater Horizon* oil disaster, the scientific community was virtually unanimous on one point: Knowledge about how species and habitats in the Gulf would respond to oil and dispersant exposure, and the information needed to support their recovery, was woefully deficient (Graham et al., 2011; Norse & Amos, 2010; Peterson et al., 2012).

Given the magnitude of the oil disaster and the unparalleled resources targeted at restoration, Ocean Conservancy produced *Charting the Gulf: Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico* to better understand what information is available, where gaps exist and where we might focus our collective efforts to identify critical gaps in monitoring and observation (Table 1) in order to support a successful restoration initiative. These gaps, if left unfilled, could hinder our ability to understand if, how and why our natural resources are recovering from the BP oil disaster and responding to broader restoration efforts.

In order to build a foundation for ecosystem monitoring in the Gulf, Ocean Conservancy compiled an extensive inventory of existing and past natural resource monitoring efforts and conducted an expert-based assessment of long-term monitoring needs. This information was used to identify gaps in monitoring for species and habitats impacted by the BP oil disaster, but its applicability is much broader, given the wide range of coastal and marine restoration and management activities currently underway in the Gulf. Restoration programs such as the Gulf Coast Ecosystem Restoration Council or the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund can use the inventory to identify existing monitoring efforts related to their project evaluation and regional monitoring needs. By accessing and leveraging existing monitoring activities included in this inventory, restoration program managers will be able to track recovery of a target resource more efficiently and cost-effectively through reducing duplication and enhancing coordination.

Ocean Conservancy's analysis was conducted using 12 resource categories identified by the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA) Trustees (2012), plus one for the ecosystem drivers in the Gulf. These ecosystem drivers, such as freshwater inputs, size and location of low oxygen areas (known as "dead zones"), ocean temperature and chemistry, could explain why species or habitats are not responding to restoration efforts or recovering as expected. Knowledge of these drivers and other important parameters allows scientists to take the pulse of the Gulf and gives restoration decision-makers the wide-angle, ecosystem lens through which they can understand successes or setbacks and change course accordingly.

Just as a doctor cannot make a diagnosis and prescribe treatment without knowing anything about a patient's overall health and history, decision-makers cannot successfully restore the resources impacted by the BP oil disaster without understanding the overall health and history of the ecosystem. Monitoring is critically important in the aftermath of an ecosystemwide event like the BP oil disaster, because it helps scientists track the vital signs of the ecosystem and inform subsequent recovery actions. An integrated monitoring network will also help decision-makers anticipate emerging stressors in the ecosystem such as climate change.

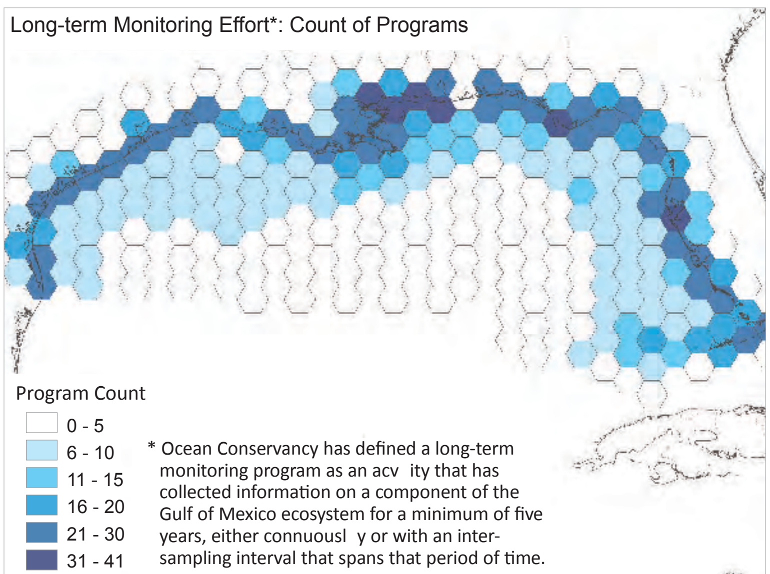


Figure 1: Coverage map of long-term monitoring efforts in the Gulf

The analysis reveals three overarching findings:

1. There are many existing monitoring efforts that restoration decision-makers can use to track the recovery of injured natural resources. Building on these existing efforts will improve consistency, efficiency and coordination.

2. There are gaps in monitoring and in our understanding of natural resources in the Gulf that must be addressed in order to effectively evaluate recovery and thus the success of restoration programs in the Gulf ecosystem.

3. As a group, the species and habitats in the offshore environment are monitored to a lesser degree than coastal or terrestrial species and habitats (Figure 1). Addressing the currently disjointed monitoring system and moving toward a Gulf-wide ecosystem monitoring network will provide a more efficient, integrated and accessible tool for ecosystem information.

For restoration to be successful, we must continue to invest in the research and monitoring we need to better understand impacted resources and their role in the ecosystem. Targeted and sustained investments in science shed crucial light on ecosystem health and lead to new tools and better management decisions.

Resource Category	Key Findings of Gap Analysis
Ecosystem Drivers	• Observing system mostly concentrated along coast or nearshore waters. • Ocean observing network is sparse or inoperav e with inadequate/unstable finding. • Observations are primarily limited to surface waters. • Need be er integration of drivers into status and trends assessments for species and habitats.
Deep-water Communities	• Limited long-term monitoring of impacted areas. • Monitoring is small-scale and isolated. • Almost no sustained monitoring of deep-water communies.
Water Column and Invertebrates	• No monitoring below 200 meters. • Methods and gear limit collection of smaller organisms. • No monitoring of gelatinous zooplankton.
Birds	• Little to no monitoring of pelagic species. • Existing monitoring targets distribution, abundance and density. • Limited monitoring of ecosystem drivers and stressors.
Marine Mammals	• Monitoring is fragmented. • Limited pelagic monitoring. • More monitoring needed for status and trends in many species.
Marine Fish	• More studies for adult pelagic species needed. • Limited sustained monitoring in pelagic waters. • Limited data on Gulf habitats.
Sea Turtles	• No long-term monitoring of male or juvenile turtles. • Observer coverage low or absent in Gulf fisheries. • Some nest monitoring is dependent on volunteer capacity.
Nearshore Sediments & Associated Resources	• No assessment of physiological, developmental or genetic response to oil. • Regionwide surveys not sustained. • Reliance on short-term intensive studies.
Oysters	• Mapping efforts not coordinated. • Gulf-wide metrics not standardized. • Oyster harvest activities are the most rigorously tracked.
Submerged Aquatic Vegetation	• All priority species are monitored. • Aerial surveys limited in range and frequency. • New programs provided opportunities to fill gaps.
Shallow- and Mid-water Corals	• Most monitoring is at national marine sanctuaries. • An integrated sentinel site program does not currently exist for monitoring climate change impacts. • No Gulf-wide efforts for regional trends and comparisons.
Shorelines	• Gaps in monitoring of shoreline stressors and ecological processes. • Monitoring of shoreline elevation and extent of coarse habitat is widespread.
Terrestrial Species	• Some species have Gulf-wide coverage; for others, only isolated monitoring exists. • Existing monitoring is focused on threatened/endangered species or harvestable species.

Table 1: Key findings of long-term monitoring gap analysis, by resource category.

INTRODUCTION

In April 2010, the mobile drilling unit *Deepwater Horizon* exploded and sank in the northern Gulf of Mexico, discharging millions of barrels of crude oil into Gulf waters and impacting habitats, wildlife and ecosystem services. Restoration from the BP oil disaster is underway and will continue for years, even decades. In addition to traditional restoration activities, long-term ecosystem monitoring is essential to understand if resources are recovering and how changes in the Gulf ecosystem are influencing their rate of recovery. Monitoring data will enable restoration planners to evaluate project effectiveness and adjust strategies for better outcomes. In addition, the government's ability to detect delayed or worsening oil disaster injuries – and its basis for accessing a reserve set aside by BP for further natural resource damages unknown at settlement – will hinge on information provided through a comprehensive and sustained monitoring effort (*In re: Oil Spill,* Confidentiality Order, E.D. La. July 2, 2015).

At the time of the BP oil disaster, the scientific community was virtually unanimous on one point: Knowledge about how species and habitats in the Gulf would respond to oil and dispersant exposure, and equally important, the information needed to support their recovery, was woefully deficient. The need for more complete information on the abundance and ecology of species led to the dedication of a portion of the oil disaster criminal and civil fines to Gulf ecosystem monitoring and research (Bjorndal et al., 2011).

In order to build a foundation for ecosystem recovery monitoring in the Gulf, Ocean Conservancy compiled an extensive inventory of existing and past natural resource monitoring efforts and conducted an expert-based assessment of long-term monitoring needs. This information was used to identify gaps in monitoring for species and habitats impacted by the BP oil disaster, but its applicability is much broader, given the wide range of coastal and marine restoration and management activities currently underway in the Gulf.

Sand dunes and sea oats, Florida Gulf Coast

Long-term ecosystem monitoring is essential to understand if resources are recovering and how changes in the Gulf ecosystem are influencing their rate of recovery.

The results of the inventory and analysis reveal three important overarching findings:

1. There are many existing monitoring efforts that restoration decision-makers can use to track the recovery of injured natural resources. Building on these existing efforts will improve consistency, efficiency and coordination.
2. There are gaps in monitoring and in our understanding of natural resources in the Gulf that must be addressed in order to effectively evaluate recovery and thus the success of restoration programs in the Gulf ecosystem.
3. As a group, the species and habitats in the offshore environment are monitored to a lesser degree than coastal or terrestrial species and habitats (Figure 1). Addressing the currently disjointed monitoring system and moving toward a Gulf-wide ecosystem monitoring network will provide a more efficient, integrated and accessible tool for ecosystem information.

Ocean Conservancy's analysis was conducted using 12 resource categories identified by the *Deepwater Horizon* Natural Resource Damage Assessment (NRDA) Trustees, plus one for ecosystem drivers. Like the monitoring needs discussed above, the inventory of monitoring efforts (Appendix D) has broader application. For example, restoration programs such as the Gulf Coast Ecosystem Restoration Council or the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund can use the inventory to identify existing monitoring efforts related to their project evaluation and regional monitoring needs. By accessing and leveraging existing monitoring activities included in the inventory, restoration managers will be able to track recovery of a target resource more efficiently and cost-effectively, reducing duplication and enhancing coordination.

The environmental impact of the BP oil disaster is significant and not yet fully understood. In addition to the immediate and devastating impacts of shorelines and wildlife coated in oil, the less visible, sublethal impacts of oil can slow the recovery of affected resources and services. In some cases, residual oil and injuries resulting from an oil disaster may persist or not be fully understood for years after the incident, and a full recovery from oil disaster injuries can take decades (Rice et al., 2007). Studies of the *Exxon Valdez* oil spill show that oil remains in Prince William Sound after more than 25 years, and some injured resources have not fully recovered. Using the *Exxon Valdez* oil spill as an analogue, a 25-year oil disaster recovery monitoring program is needed in the Gulf, particularly for an event as large and complex as the BP oil disaster.

Timely and accurate information on the status of injured populations, habitats and ecosystem services is essential for recovery planning, as is the understanding of how marine conditions affect rates of recovery. Decision-makers faced with making substantial investments in restoration need to know when to redirect resources or adjust strategies for better results if species or habitats are not showing signs of improvement. Under the Oil Pollution Act of 1990, the responsibility of restoring natural resources to their pre-oil spill condition and monitoring recovery rests exclusively with the *Deepwater Horizon* Trustees (15 CFR, Sec. 990.10). Therefore, the *Deepwater Horizon* Trustees overseeing the Natural Resource Damage Assessment and related restoration activities are in the best position to administer a long-term recovery monitoring program for resources injured by the BP oil disaster.

The Evolution of Monitoring in the Northern Gulf of Alaska Marine Ecosystem Following the *Exxon Valdez* Oil Spill

In the first few years after the 1989 *Exxon Valdez* oil spill, the state and federal government agencies took advantage of existing programs to track recovery of individual species. In some instances, they greatly expanded the existing sampling schemes in spatial or temporal intensity; in others, they added new programs where gaps existed. For the most part, these programs were designed to meet the individual agency mandates for specific species. For example, the Alaska Department of Fish and Game monitored many of the pink salmon spawning streams in the heart of the spill zone by measuring egg mortality and numbers of returning spawning adults (Bue, 1996; Sharr et al., 1995). In another example, the U.S. Fish and Wildlife Service designed a program just to monitor populations of sea otters (Garrott, 1993). While these programs were capable of detecting population changes, they could not explain unanticipated changes in populations or lack of recovery. As a result, when pink salmon populations took a downturn in Prince William Sound in 1991 and 1992, and the Pacific herring population crashed in 1993 and 1994, the restoration program had no ready answers for fishermen, who were expecting sharp improvements in fishing conditions, not downturns. The pressing question became, "Why aren't resources recovering as expected?" In order to get the answers to this question, a new phase of monitoring and research began in 1994, which went much further than individual agency mandates and instead emphasized an ecosystem approach and the need to understand ecological relationships between species and their environments (*Exxon Valdez* Oil Spill Trustee Council, 2003). In the instance of pink salmon recovery, the Sound Ecosystem Assessment Program and related efforts uncovered a whole web of relationships among oceanographic forcing factors, plankton production, salmon predators and hatchery fry release strategies that drove population fluctuations (Cooney et al., 2001) and helped restoration planners better understand the processes affecting recovery.

RESULTS AND LESSONS LEARNED

This chapter contains the results of Ocean Conservancy's analysis of long-term monitoring priorities and gaps for natural resources impacted by the BP oil disaster. This analysis is not intended to be a prescription for recovery monitoring, but it can be used as a reference document for planning and prioritizing activities under a broader restoration program.

Results of the Gap Analysis


Laughing gulls, Padre Island

The goal of this assessment is threefold:

1) identify the pool of long-term monitoring efforts applicable to BP oil disaster recovery monitoring;
2) identify priority long-term data collection or research activities needed to assess if natural resources are returning to their pre-oil disaster condition, and what is or is not driving their recovery; and
3) characterize the spatial, temporal and taxonomic gaps in monitoring coverage for each priority.

Analysis results are presented in 13 natural resource profiles, each containing the following elements:

- A short narrative summarizing the findings of the analysis;
- A table containing the long-term monitoring or research priorities and the types of gaps identified for each priority. (Note: The priorities included are summarized versions of those identified. The full priorities are listed in Appendix B);
- A set of bullets briefly explaining or elaborating on gaps presented in the table. (Note: Expanded descriptions of the gaps are included in Appendix C); and
- A map showing the approximate geographic coverage of long-term monitoring efforts, and a related timeline chart illustrating the duration of relevant programs. (Note: Some programs listed in the map legend or on the timeline chart might not be mapped. Program numbers on the map correspond to those in Appendix D.)

The Ecosystem Drivers profile is organized differently from the other 12 profiles. This section includes an overview of ecosystem drivers, a summary of existing programs and graphics unique to this category.

Process at a Glance

A review of relevant publications identified a suite of important resource-specific monitoring needs. These needs were reviewed for areas of overlap and synthesized to capture overarching monitoring priorities (see Appendix B). Experts were then asked to confirm the list of priorities for monitoring resource recovery and to add any priorities they thought were omitted. (See names of experts in Acknowledgments).

The recovery monitoring priorities for each of the 13 resource categories were cross-referenced with an inventory of principal long-term monitoring efforts in an attempt to match data collection activities with monitoring priorities. Matching a priority with a corresponding survey effort included an assessment of whether a survey, program or suite of programs could satisfy a given data collection priority in space and time or for relevant species. If a monitoring effort could not meet a data need, a gap was identified. More specifically, if a monitoring effort collects or collected the type of information identified by a monitoring priority across a relevant geographic footprint, during relevant times of the year (e.g., life history stages such as migration or spawning) or for relevant species, then it was labeled as meeting a monitoring need. See Appendix D for additional information on the long-term monitoring programs used in the analysis.

Interpreting the Gaps

The template in Table 2 is an example of the tables included for the 13 resource profiles, excluding Ecosystem Drivers, to demonstrate the monitoring or research priorities and corresponding gaps. (For additional information on how gaps are defined, see Appendix A.)

Species: Using Priority A in the table as an example, there is no gap under Species because the relevant species, Species X or Species Z in this case, are both found to be monitored under existing effort(s) in the inventory. If any priority species or areas were not found to be monitored, then there would be a full gap across this category. "N/A" is shown in the Species column for resource categories for which priority species were not identified.

Space: Again using Priority A, although some monitoring coverage exists for this natural resource category within the U.S. Gulf of Mexico, this coverage is incomplete, resulting in a partial gap for Space with respect to any priority areas/sites identified for the category.

Time: Coverage in Time for Priority A is characterized as a full gap because the identified monitoring efforts do not collect data during critical times of the year (or for important life stages) for the natural resources in this category.

GAP LEGEND: No gap / Partial gap / Full gap

MONITORING/RESEARCH PRIORITY	GAP			PRIORITY SPECIES OR AREA		
	SPECIES	SPACE	TIME	Species X (or area)	Species Y (or area)	Species Z (or area)
Priority A	No gap	Partial gap	Full gap	●		●
Priority B	Partial gap	Full gap	Full gap		●	
Priority C	Full gap	No gap	No gap	●	●	
Priority D	Full gap	Partial gap	Partial gap	●	●	●

Table 2: An example of how gap analysis results are presented in resource profiles.

Gaps in monitoring coverage across relevant species, time or space are based on an inventory of eligible principal programs (See Appendix A for definition of "eligible"). While the inventory is comprehensive, it is not exhaustive, so it is possible that relevant programs were omitted from the inventory. Programs not captured in the inventory and therefore excluded from the analysis could result in false-positives for gap identification. That is, gaps identified in the analysis are not gaps in reality, because there are programs in place to collect the data needed. Within the context of this analysis, gaps in monitoring coverage are based on an interpretation of monitoring needs and existing coverage, and should be considered proxies for the adequacy of coverage relative to each priority. They are not necessarily an indication of where monitoring should occur or the intensity or frequency with which monitoring should occur going forward. Determining where, when, what and how monitoring or research activities are carried out is the domain of experts working in close consultation with the *Deepwater Horizon* Trustees. Ultimately, these experts will need to consider many factors, including which gaps are important to fill and to what degree monitoring needs to be enhanced, in developing a monitoring program that is representative and statistically valid to assess the status and trends for a resource category, species or habitat. The geographic scope of the analysis and portrayal of gaps, unless otherwise noted, apply only to the coastal and marine environments of the United States.

Data Collected Under the Natural Resource Damage Assessment

This analysis excluded the studies and related data collection activities initiated under the *Deepwater Horizon* NRDA for injured natural resources. The primary reasons are that the injury studies generally did not meet the definition of an eligible long-term monitoring program (i.e., a minimum five-year data record), and the details of monitoring efforts were often not available to the public.

The studies initiated under NRDA undoubtedly generated unique and insightful data not available through any other program. Therefore, if not already doing so, the *Deepwater Horizon* Trustees should consider continuing or reinstating NRDA studies, or relevant elements, under a long-term *Deepwater Horizon* oil disaster monitoring program, particularly where gaps in coverage have been identified and non-NRDA monitoring efforts are not already in place. There is precedent for integrating data collection efforts initiated under NRDA into long-term recovery monitoring and research efforts, as was the case after the *Exxon Valdez* oil spill.

Gulf of Mexico: St Petersberg, FL

Natural Resource Profiles

The following Resource Profiles (pages 11-38) present gap analysis findings for 13 natural resource categories:

- Ecosystem drivers
- Deep-water communities
- Water column and invertebrates
- Birds
- Marine mammals
- Marine fish
- Sea turtles
- Nearshore sediments and associated resources
- Oysters
- Submerged aquatic vegetation
- Shallow- and mid-water corals
- Shorelines
- Terrestrial species

Ecosystem Drivers

If a resource is not responding to restoration actions, it may be due to natural forces or chronic stressors acting as a drag on recovery.

Summary

The Gulf of Mexico is a dynamic ecosystem influenced by natural forces and human activities, such as the BP oil disaster. The factors that drive changes in the broader Gulf ecosystem have important implications for restoration. For example, if a resource is not responding to restoration actions, it may be due to natural forces or chronic stressors acting as a drag on recovery. These prevailing environmental processes (physical, chemical and biological) help explain why fish populations might vary in abundance from year to year, how ongoing changes in ocean chemistry could impact species and how shifting species distributions can cause long-term impacts on fisheries. Ecosystem drivers ultimately influence the rate and degree of recovery of injured resources, so consideration of these critical processes is important to overall restoration success.

More than 200 discrete data collection efforts exist in the Gulf that can potentially provide data on the environmental parameters needed to track key ecosystem processes. While the large number of efforts might give the impression that these drivers are comprehensively monitored, it is important to recognize that gaps in coverage essential to understanding trends in Gulf conditions, and their effects on marine life, still remain. For instance, the network of ocean observation stations in the Gulf may at times be incomplete due to funding cuts or the geographic patchiness of stations, with the majority located closer to the coast than offshore. In addition, the low resolution of some data limits their precision and usefulness, particularly satellite-based observations of the sea surface for temperature, currents and salinity. While instruments provide valuable information on the marine environment, biological drivers cannot be effectively monitored wholly by ocean sensors alone, and thus on-the-water sampling is also needed. Finally, the disjointed nature of monitoring efforts makes it more difficult to locate and integrate oceanographic data into status and trends assessments for species and habitats injured by the BP oil disaster. These data will help better explain what ecosystem drivers might prevent some species from recovering, species such as bottlenose dolphins or oysters that in turn influence the ecosystem through their numbers as top predators or habitat engineers.

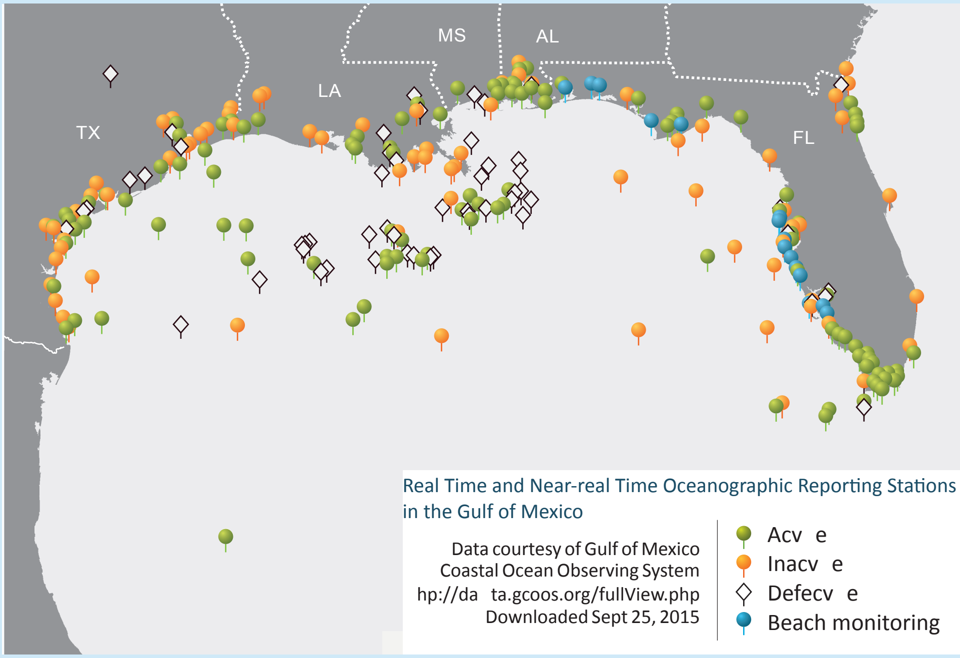
Measuring every ecologically important parameter is neither practical nor needed to understand changes in populations or habitats. The ecosystem drivers most likely to affect natural recovery should be monitored, as well as factored into recovery scenarios and restoration strategies.

What Ocean Conditions to Monitor?

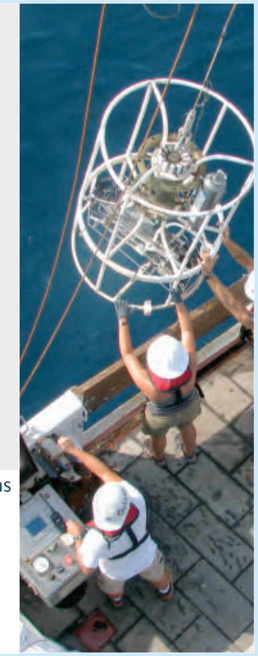
As restoration efforts scale up, the following parameters will be important to track at the appropriate scale, whether seasonally, annually or over many decades:

- Sea level across the Gulf, as well as currents, salinity, acidity (pH), dissolved oxygen and temperature with depth from nearshore to offshore waters
- The volume and concentrations of nutrients, sediment, organic matter and freshwater in the discharge of the Mississippi and other major rivers
- Primary production (e.g., carbon fixation, dissolved oxygen concentrations) on shelf and offshore
- Wind events across the continental shelf critical in transporting larvae or juvenile crabs, shrimp and fish into estuaries, and basin-scale ocean circulation, e.g., Loop Current and its eddies

Ecosystem Drivers



Real Time and Near-real Time Oceanographic Reporting Stations in the Gulf of Mexico



KEY LESSONS

- *Observing system is mostly concentrated along coast or nearshore waters.*
- *Ocean observing network is sparse or inoperative with inadequate or unstable funding.*
- *Observations are primarily limited to surface waters.*
- *Better integration of drivers data into status and trends assessments for species and habitats is needed.*

Monitoring Priorities and Example Programs for Ecosystem Drivers

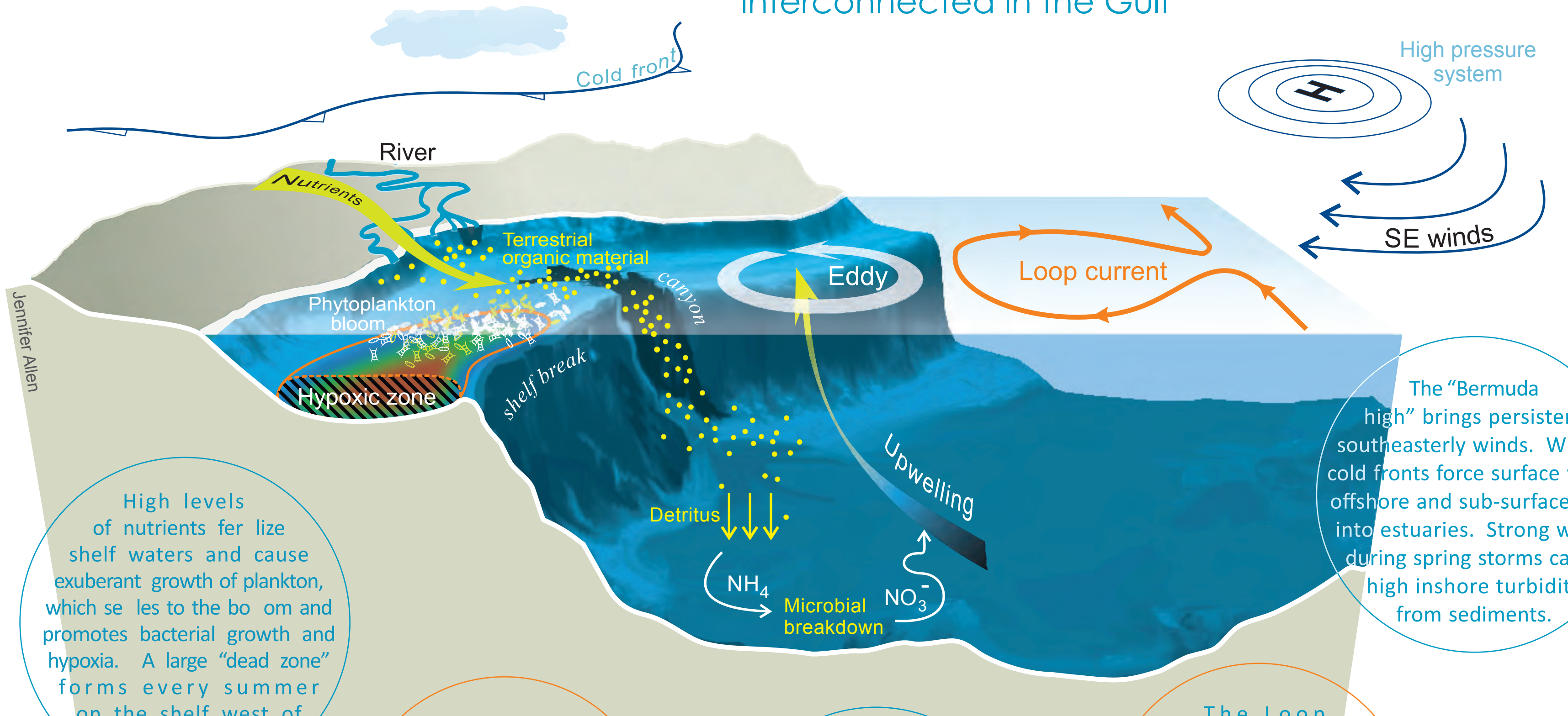
Monitoring Priority	Sampling Scale	No. of projects Current/Closed	Example Programs
Currents	Bay/estuary to oceanic	36 / 2	Ocean Surface Topography Mission/JASON-2, Univ. of S. Mississippi CODAR High Frequency Radar, Wave-Current-Surge Information System for Coastal LA
Temperature, pH, salinity, total suspended solids	Bay/estuary to coastal sea	98 / 14	EPA Env. Monit. Assessmt. Prog., Suwannee River Water Mgmt. District Water Resource Monit. Prog., LA Dept. of Env. Quality Ambient Surface Water Quality Monitoring
Bo om-water dissolved O_2	Coastal sea	2 / 1	LUMCON Hypoxia in the NGOM, Texas A&M Mechanisms Controlling Hypoxia Project
Dissolved O_2 point samples	Bay/estuary to oceanic	58 / 11	Florida Aquatic Preserve Program, Texas Coastal Ocean Observation Network
River discharge (fresh water)	Bay/estuary	3 / 0	USGS National Water Information System, ACOE Water Levels of Rivers and Lakes
Nutrients	Bay/estuary to oceanic	30 / 23	FL Dept. of Env. Protection Strategic Monitoring Program for TMDLs, EPA National Aquatic Resource Surveys National Coastal Assessment
Chlorophyll *a* or ocean color	Bay/estuary to oceanic	23 / 7	Mississippi Dept. of Env. Quality Coastal Assessment Program, NERR
Phytoplankton	Bay/estuary	3 / 0	Texas Observatory for Algal Succession Time-series, Mote Marine Lab Red Tide Program
Winds	Bay/estuary to oceanic	10 / 5	SeaWinds on QuickSCAT satellite, NOAA National Data Buoy Center
Sea level	Bay/estuary	10 / 0	NOAA National Water Level Observation Network

How Do Environmental Processes Affect Gulf Ecology?

	OCEANOGRAPHIC PROCESSES	EFFECTS ON SPECIES OR HABITATS (EXAMPLES)
Physical	• Speed and direction of water currents in the sea are largely driven by differences in salinity and temperature of seawater, creating varying seawater densities from place to place. Currents are also affected by atmospheric pressure gradients and the resulting winds. • Water temperature and salinity together determine water density, and they also influence physiological processes in marine organisms adapted to live within certain ranges of environmental condions. • Water turbulence affects light penetration, distribution of nutrients and ability of predatory fish to locate smaller prey (e.g., plankton).	• Large-scale eddies move land-based nutrients into the oceanic realm where they enable numerous marine mammals to thrive close to shore. • Large shifts in the temperatures or salinities of estuaries (too little or too much fresh water or salt water) can stress or kill plants and animals not adapted to rapidly changing conditions. • Inshore turbidity in the north central Gulf can be excessive, with prolonged strong spring winds suspending large quantities of sediments that can limit plankton production via shading.
Chemical	• Of the thousands of chemicals in seawater and sediments, the most important are: oxygen, carbon dioxide, nitrogen, silica and phosphorus-containing nutrients, iron, and various forms of dissolved organic carbon. These are all critical in sustaining marine life, but it is mainly nutrients, both natural and anthropogenic, and oxygen that are known to be most often limiting or in excess in the Gulf.	• The dead zone, an oxygen-depleted area that appears every summer in the northern Gulf, decreases suitable habitat for bottom dwellers such as brown shrimp and blue crabs, potentially affecting their contribution to Gulf fisheries and prey availability for sea turtles recovering from the BP oil disaster.
Biological	• Food inputs to the marine ecosystem come from: (1) primary producers (e.g., phytoplankton, seaweeds, and rooted plants such as seagrasses, mangroves and marsh plants), (2) chemoautotrophs (e.g., sulfur bacteria and methanotrophs), (3) bacterioplankton and other pros ts, and (4) imports of land-based particulate and dissolved carbon. This supply of organic ma er is consumed by animal respiration and excretion, disease, lost reproducv e output and predation by other species. Consumptive processes dictate the oceanic food webs, which depict how energy flows in the ocean among trophic levels and species, critical to driving recovery and to managing for sustained delivery of ecosystem services.	• A year of lower primary production due to high winds and turbid water would result in less food for various species of forage fish, potentially affecting recovery or leading to alternate ecosystem states.

Conceptual Diagram of Selected Ecosystem Drivers in the Gulf

Physics and biology are tightly interconnected in the Gulf



The "Bermuda high" brings persistent southeasterly winds. Winter cold fronts force surface water offshore and sub-surface flow into estuaries. Strong winds during spring storms cause high inshore turbidity from sediments.

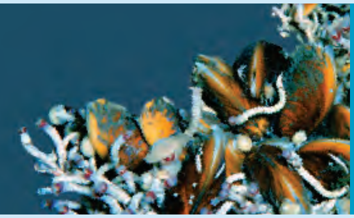
High levels of nutrients fer lize shelf waters and cause exuberant growth of plankton, which se les to the bo om and promotes bacterial growth and hypoxia. A large "dead zone" forms every summer on the shelf west of the Mississippi River.

Rivers bring terrestrial organic ma er and nutrients into the nearshore ocean. Organic material moves across the shelf and into canyons, carrying a rich food source to the deep-water organisms.

Microbial decomposi on at the depths of the ocean releases nutrients, which can be returned by upwelling to the sunlit zone. There they are available to photosynthe c plankton at the base of the food chain.

The Loop Current carries warm water into the Gulf and gives rise to both clockwise and counter-clockwise eddies. Counter-clockwise eddies cause upwelling of cold, nutrient-rich water from the deep.

Deep-water Communities



There is little long-term monitoring of these communities.

Summary

Deep-water communities* in the northern Gulf of Mexico were impacted by the BP oil disaster due to exposure to oil, gas and chemical dispersants. Although they are sensitive to threats from oil and gas industrial activities, there has been little long-term monitoring of these communities due to their remote location and the depths they occupy. Long-term monitoring is important for tracking their recovery and identifying appropriate restoration actions. There are full and partial gaps across all aspects of the monitoring priorities for this category due to the small-scale and opportunistic nature of identified monitoring efforts. The priorities for monitoring are to document the distribution and structure of oiled and unoiled deep-water communities, understand their role in the ecosystem, and track how they respond to disturbance. After the BP oil disaster, new research was initiated in the deep-water environment and some researchers were able to revisit sites studied prior to 2010. For example, the Ecosystem Impacts of Oil and Gas Inputs to the Gulf (ECOGIG) consortium, funded by the Gulf of Mexico Research Initiative, is one effort that will have five or more years of data as sites are revisited throughout 2015. The Natural Resource Damage Assessment will likely continue to generate monitoring data as restoration efforts are initiated and recovery progress is tracked. Building off new and past efforts, there is an opportunity to generate data that can be used for long-term trend analyses and to further our understanding of deep-water communities and how they respond to disturbance.

* In the 2012 NRDA status update, NOAA defines deep-water communities in the Gulf as those existing deeper than 200 feet. For our analysis we used this depth definition, although we further differenaäted between shallow- and mid-water corals by only considering those communities on the continental slope or deeper for the deep-water communities category.

Gaps Identified

GAP LEGEND: Full gap; Par al gap; No gap; N/A

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY AREAS: Contaminated deep-water seafloor communities
Monitor deep-water habitat use by mobile fauna	1	2	2	●
Map distribution/structure/condition of deep-water communities	1	3	4	●
Long-term monitoring of deep-water communities to understand vulnerability and recovery after disturbance	1	3	2	●
Monitor deep-sea microbial communities to understand fate and effect of dispersant compounds	1	2	2	●

EXPLANATION OF GAPS

1- Not applicable (no priority species identified).

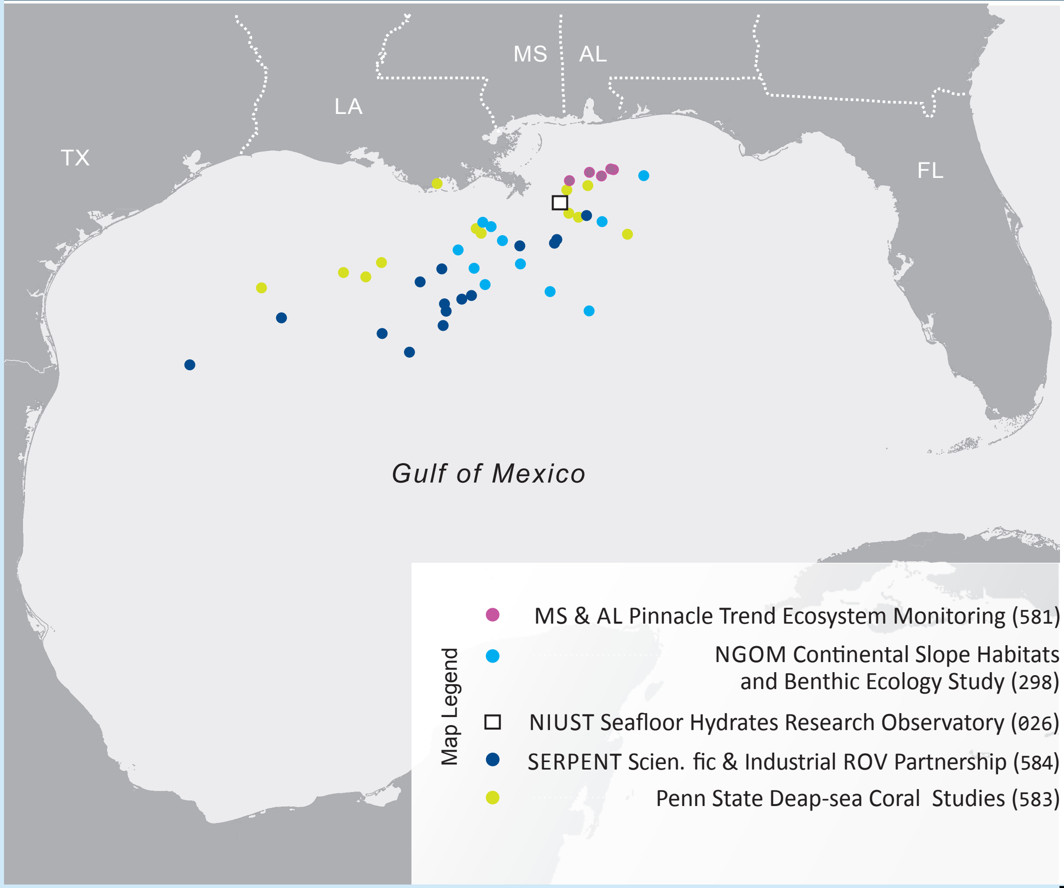
2- No sustained Gulf-wide effort addresses this priority.

3- Isolated efforts, no Gulf-wide coverage.

4- Monitoring efforts opportunistic and intermittent.

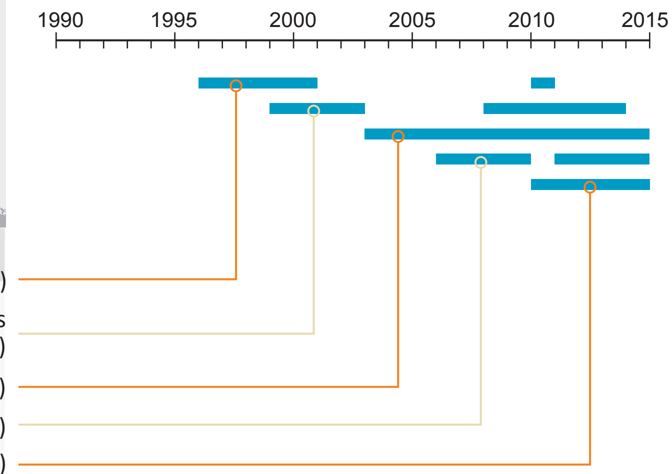
Deep-water Communities

Profile page 2



Existing Studies

DEEP-WATER COMMUNITIES
LONG-TERM MONITORING



KEY LESSONS

- *Limited long-term monitoring of impacted areas.*
- *Monitoring is small-scale and isolated.*
- *Almost no sustained monitoring of deep-water communities.*


Cold-water coral


Cold seep community

Water Column and Invertebrates

A better understanding of community composition of the deep pelagic zone is needed.

Summary

The epipelagic (surface to 200 meters deep) and mesopelagic (200 to 1,000 meters deep) ecosystems were exposed to a toxic mixture of oil and dispersant as they spewed from the Macondo wellhead at a depth of 1,500 meters, spreading horizontally and rising towards the Gulf surface.[1] The impacts in the pelagic sphere are challenging to document, because water masses and their fauna are in constant motion. That is, repeated measures at the same places and depths over time are actually sampling different organisms, unlike benthic ecosystems where organisms are stationary or move little. Therefore the gaps in knowledge of oil impacts in this environment reflect not only the inherent limits of monitoring, but also the lack of many long-term data sets from past monitoring. Current priorities in response to the BP oil disaster are to better understand community composition of the deep pelagic zones and to track changes in the distribution of zooplankton and other components of the food chain, including the many gelatinous water column feeders that inhabit the water column. The current network of monitoring efforts sample exclusively the upper 200 meters of the water column and is designed mainly to document fish egg and larval abundance in support of commercial and recreational fisheries management, leaving gaps in water column coverage and species. To track recovery of the full Gulf ecosystem and to assess risk from future changes, monitoring should target the status and dynamics of these communities, particularly the deep-water communities of which we know relatively little.

Gaps Identified

GAP LEGEND: Full gap (orange) · Par al gap (tan) · No gap (green)

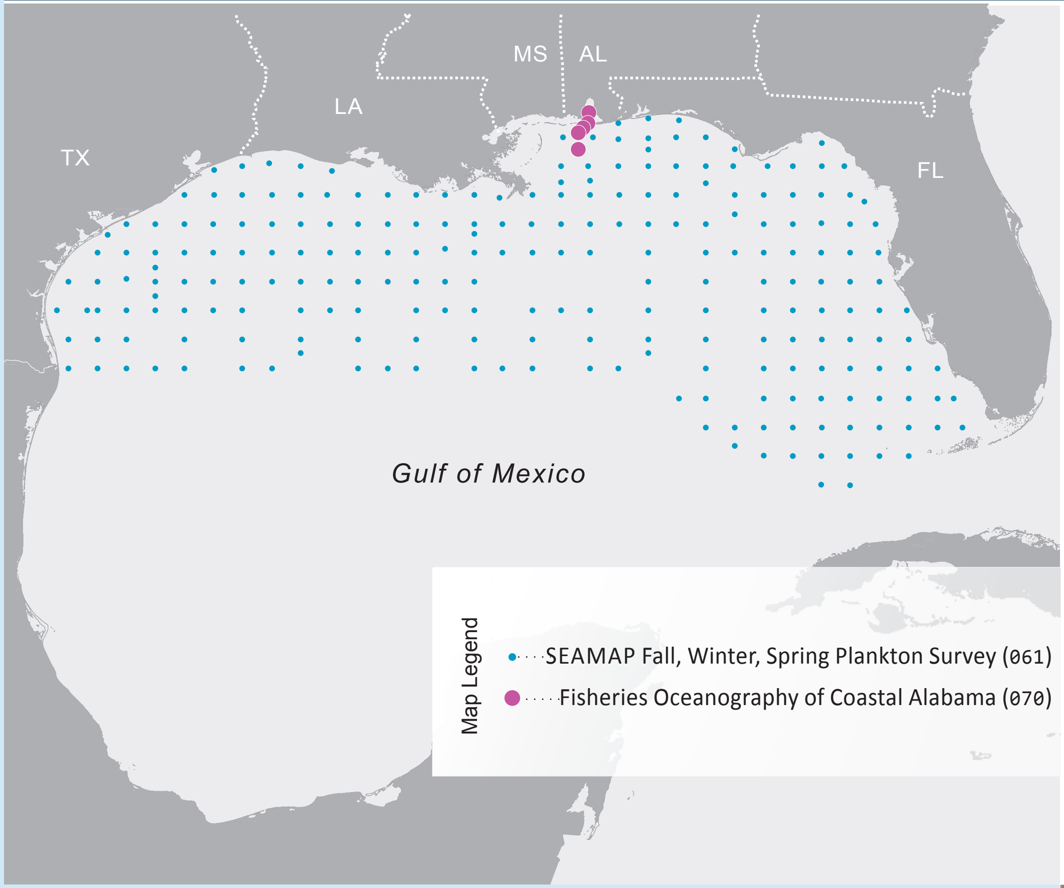
MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY SPECIES: Whole community	Copepods, chaeto-ganths, decapods, ostracods, amphipods	Mysids, copepods	Jellyfish, larvaceans, doliolids, salps, squid
Pelagic community composition at index sites near depth zone of well blowout	1	1	1	●			
Zooplankton densities in oil spill impact zone / changes in base of food chain as indicator of recovering fish populations	2	3	4		●		
Mysid and copepod species composition in suspected oiled areas / test for chronic hydrocarbon exposure as bio-indicator of residual oil and proxy for recovery of predator fish species	5	3	4			●	
Density of gelatinous zooplankton and water column feeders	6	6	6				●

EXPLANATION OF GAPS

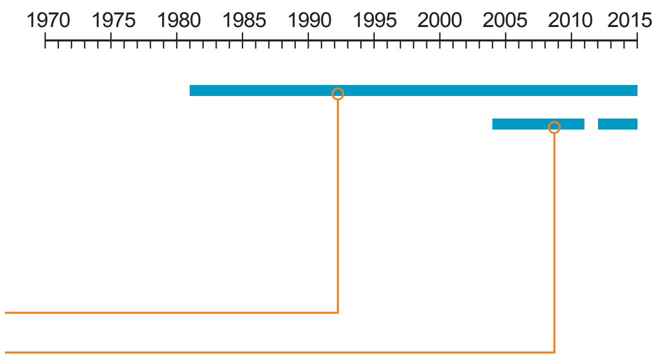
1- No mesopelagic/bathypelagic monitoring.
2- Copepods underrepresented due to gear limitations.
3- No sampling below 200 m depth.
4- Less sampling in summer and winter.
5- No testing of hydrocarbon exposure.
6- No sampling designed for delicate gelatinous organisms.

Water Column and Invertebrates

Profile page 2



Existing Studies




Blue crab larva


Moon jelly

KEY LESSONS

- *No monitoring below 200 meters.*
- *Methods/gear limit collection of smaller organisms.*
- *No monitoring of gelatinous zooplankton.*

Birds

There is a lack of integration and standardized monitoring protocols across the Gulf.

Summary

The BP oil disaster had significant impacts on birds in the Gulf of Mexico. Injuries from oil and dispersant exposure and habitat damage directly killed birds, affected long-term health and possibly caused loss of prey. The *Deepwater Horizon* Trustees estimate up to 84,500 total birds were killed as a result of the BP oil disaster, though some estimates are much higher. Long-term monitoring is needed to track the recovery of bird populations, as well as the habitats and ecosystem processes supporting impacted species. Numerous long-term monitoring efforts are occurring or have occurred around the Gulf coastline. Monitoring of pelagic birds, however, has been largely absent. Many of the existing monitoring efforts target individual species (e.g., mottled duck) or groups of birds (e.g., shorebirds) and allow for some analysis of species status and trends. One challenge for resource managers and a recurring finding in this review of monitoring priorities is a lack of integration and standardized monitoring protocols across the Gulf. In addition to determining abundance, density and distribution, there is a need to monitor influential ecosystem variables, spatial habitat use and species-specific stressors to better understand why and how bird populations are changing. Although a few monitoring programs are collecting this broader information, including the Monitoring Avian Productivity and Survivorship Program, these priorities have full or partial gaps due to the limited number of species and areas that are monitored. Recovery monitoring, with emphasis on expanding surveys to the pelagic environment and collecting data types beyond population parameters such as ecosystem drivers and stressors, will provide needed information to better understand Gulf-wide bird trends.

Gaps Identified

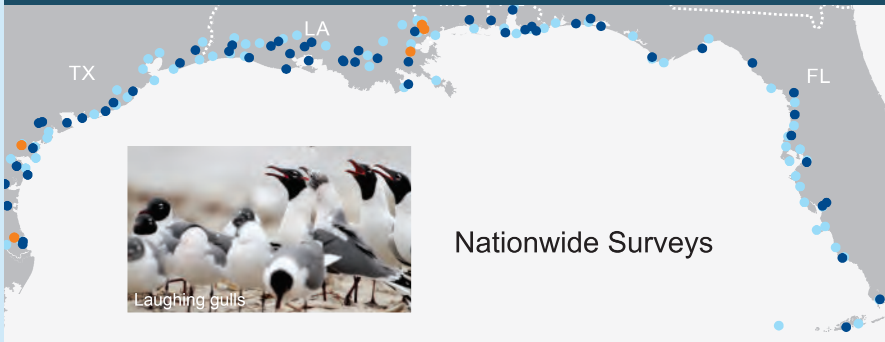
GAP LEGEND: Full gap (orange); Par al gap (beige); No gap (green)

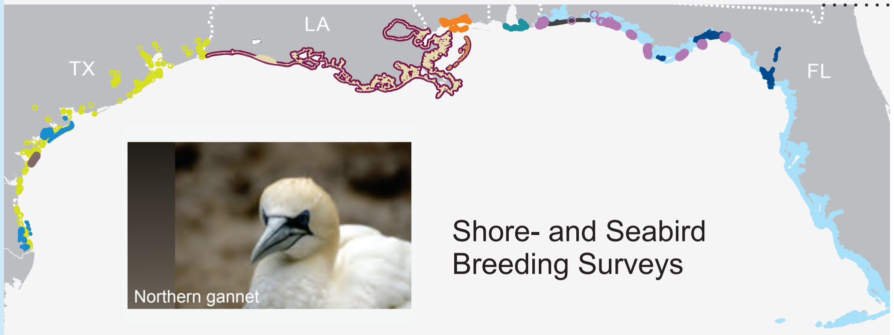
MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY SPECIES: Common loon, American white pelican, Brown pelican, Royal tern, Black skimmer, Laughing gull, Northern gannet
Spatial use of habitat types	1	1	1	●
Species-specific stressors, measures of health of individuals and populations	2	3	3	●
Abundance, density and distribution of populations affected by the BP oil disaster	2	4	5	●
Key ecosystem variables and system drivers, and their impacts on avian populations	2	3	5	●

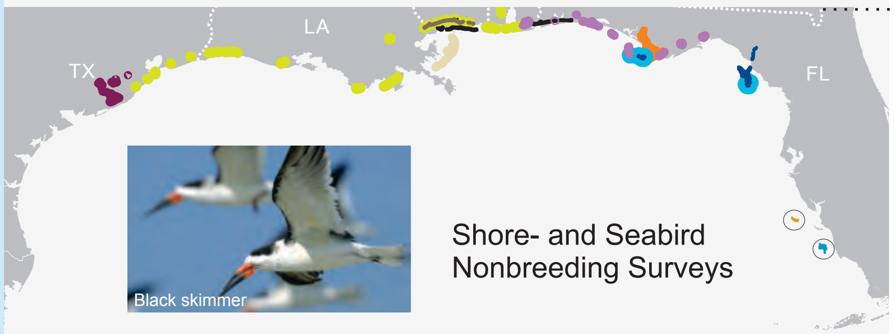
EXPLANATION OF GAPS

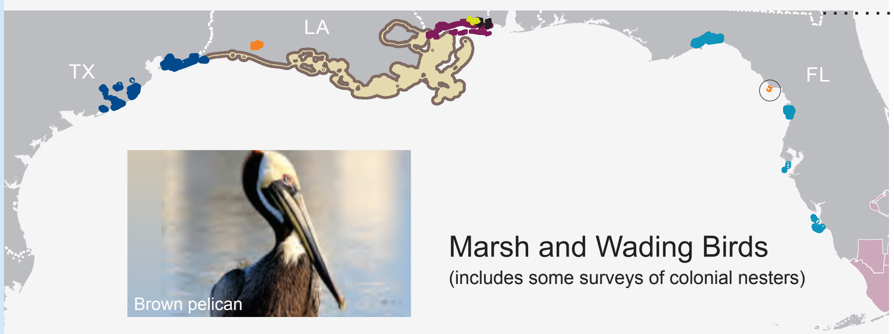
1- No monitoring efforts meet this priority.
2- Monitoring is absent for one or more priority species.
3- Very few monitoring efforts collect this type of information.
4- Monitoring is limited or absent altogether for some species.
5- Existing monitoring efforts meet this priority.

Birds





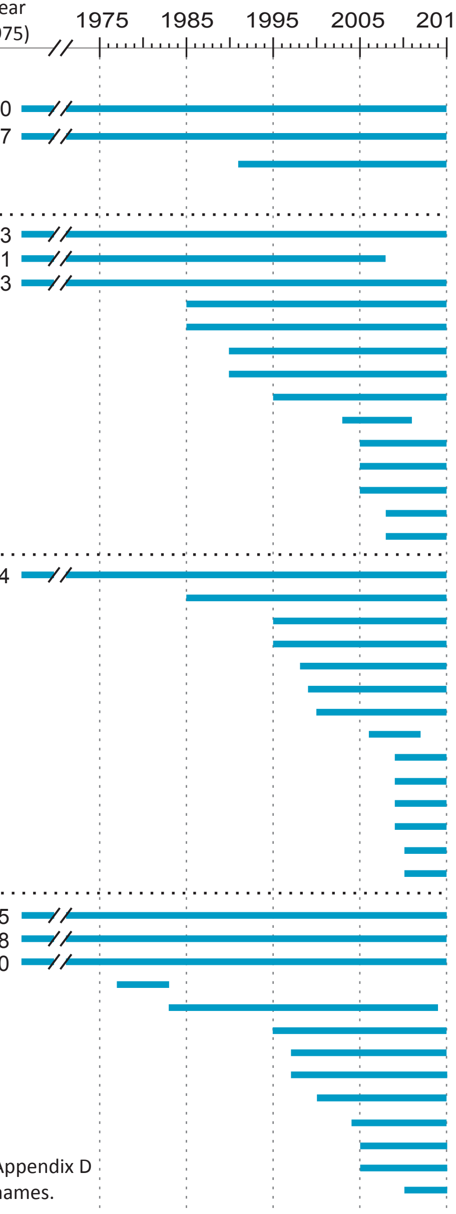




Existing Studies

BIRDS LONG-TERM MONITORING

Map symbol	Project ID*	Start Year (pre-1975)
	(890)	1900
	(885)	1967
	(787,812)	
	(764)	1953
	(768)	1971
	(726)	1973
	(733)	
	(790)	
	(715)	
	(750)	
	(821)	
with 715	(709)	
	(825)	
	(771)	
	(837)	
	(814)	
	(820)	
	(849)	1974
	(883)	
	(822)	
	(748)	
	(722)	
	(882)	
with 748	(749)	
	(806)	
	(835)	
	(838)	
with 835	(855)	
with 838	(880)	
	(030)	
	(819)	
	(843)	1955
with 843	(840)	1958
with 843	(847)	1960
	(784)	
	(772)	
	(884)	
	(765)	
	(839)	
with 843	(860)	
	(800)	
	(785,786)	
	(711)	
	(769)	



*Please see Appendix D for project names.

Marine Mammals

We knew very little about their status before the oil disaster.

Summary

Marine mammals inhabiting the pelagic and nearshore regions of the northern Gulf were impacted by the BP oil disaster. Yet we knew very little about their status before the oil disaster due to the remote habitats of the Gulf that many of these species occupy. Due to limited knowledge of the distribution and abundance of a majority of these species, as indicated by the variance in population estimates of stock assessments, defining recovery goals is challenging. Priority monitoring activities for recovery include the need to better define population status and understand conditions affecting population health. In most cases, current monitoring efforts for marine mammals do not adequately address the long-term recovery priorities identified in this analysis. Full gaps—or at minimum, partial gaps—characterize the level of existing coverage available to address recovery monitoring. The majority of research and monitoring efforts to date have been short-term observations to document diversity and distribution in the Gulf of Mexico. These studies have mainly assessed acute impacts from petroleum exploration and production, while the limited network of long-term monitoring programs relies heavily on aquariums or private marine mammal institutes. The fragmented and sporadic history of monitoring marine mammals limits the ability to track population status or recognize long-term trends. Therefore, investment in an integrated monitoring network to track species status, chronic oil exposure effects or other stressors slowing recovery should be established so managers and restoration officials can take necessary actions to facilitate recovery. Marine mammals have very long life spans. The effects of a major disaster like the BP oil disaster can be present in the population for many years.

Gaps Identified

GAP LEGEND: Full gap (orange); Par al gap (tan); No gap (green)

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	Bottlenose dolphin	Atlantic spotted dolphin	Bryde's whale	Sperm whale	Beaked whale	Pelagic delphinids
Strandings and animal health	1	1	1	●					
Abundance and distribution nearshore	2	3	4	●	●	●			
Abundance and distribution offshore	2	5	4				●	●	●
Stock structure	6	7	4	●		●	●		
Population demographics and reproduction	2	7	4	●					
Habitat use	8	8	8	●			●	●	
Bycatch and interactions, commercial and recreational fisheries	2	2	2	●					

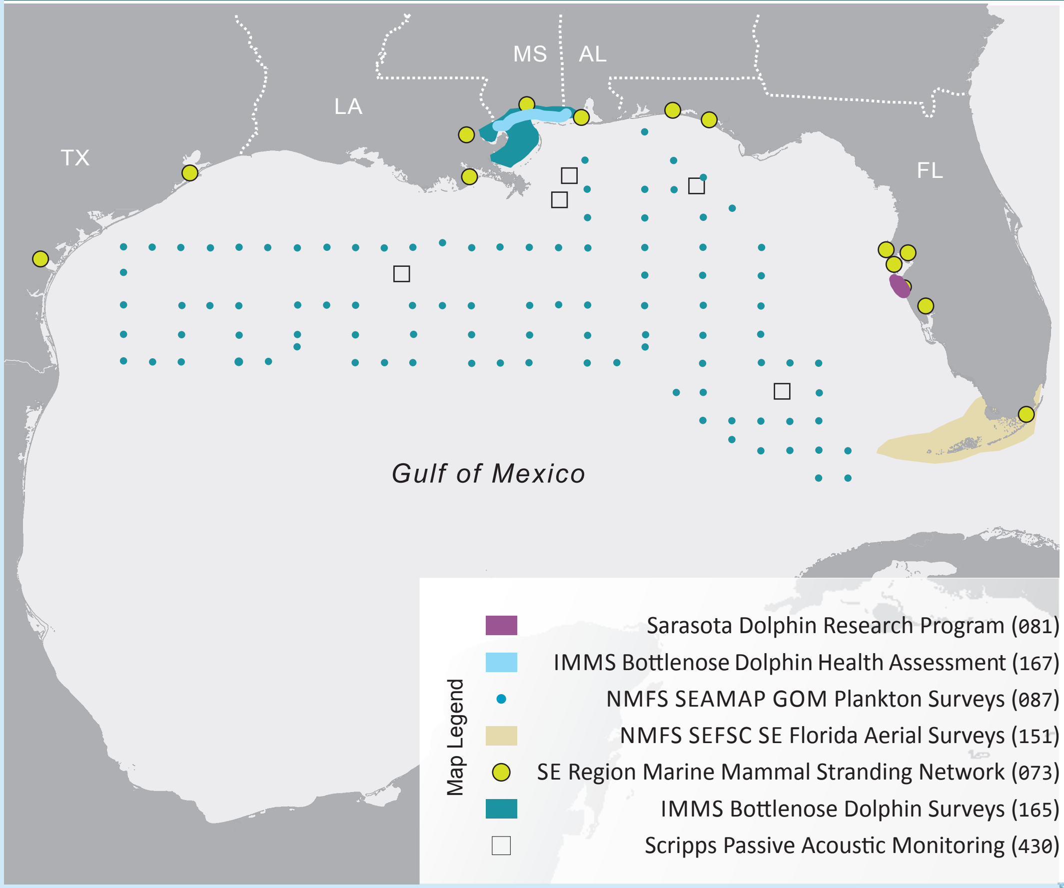
PRIORITY SPECIES

EXPLANATION OF GAPS

1- Monitoring exists but capacity limited; depends on volunteer response.
2- Monitoring occurs, but more is needed to better meet priority.
3- Monitoring occurring in isolated areas.
4- Existing survey(s) meet this priority.
5- Monitoring coverage is spatially dispersed.
6- Monitoring is not occurring for at least one priority species.
7- No Gulf-wide assessment to date.
8- No monitoring survey meets this priority.

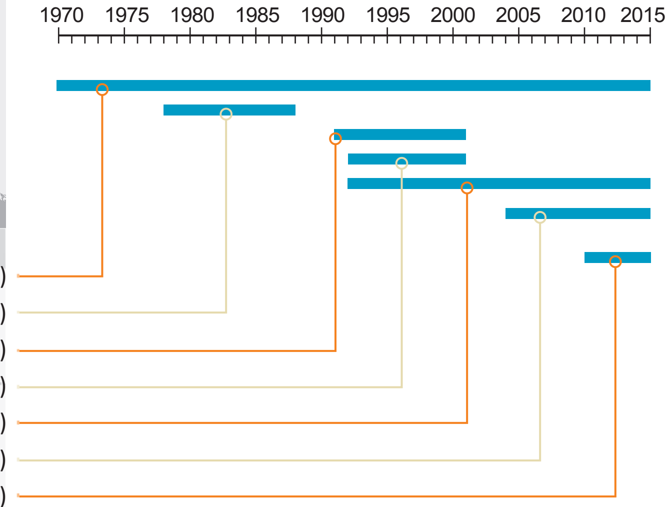
Marine Mammals

Profile page 2



Existing Studies

MARINE MAMMAL LONG-TERM MONITORING



KEY LESSONS

- *Monitoring is fragmented.*
- *Limited pelagic monitoring.*
- *More monitoring needed to determine status and trends in many species.*


Bottlenose dolphins

Marine Fish

Priorities can be fulfilled by enhancing or integrating existing monitoring programs.

Summary

Marine fish populations were impacted by the BP oil disaster due to exposure to pollutants and contaminated or lost habitat. The *Deepwater Horizon* Trustees estimate that between 2 and 5 trillion fish larvae were killed in the surface and subsurface zones during the disaster. This is in addition to early reports of shifting reef fish community structures and contaminated Atlantic bluefin tuna spawning grounds. Monitoring to track recovery should include documenting contaminant loads, life history development and shifts in community structure. To assess impacts to fish habitat while providing for better population assessments, a recovery monitoring program should address the need for high-resolution habitat maps and the ability to detect basic changes in the ecosystem that affect fish populations. Assessment of existing monitoring efforts indicates many partial gaps, especially in pelagic waters, where sampling adult life stages is challenging due to their high degree of mobility across vast areas of the ocean. Fishery-dependent data provide some information associated with these gaps, but due to high potential for bias derived from the way the data is collected, we were limited in how we assessed these data. Recovery monitoring priorities can be fulfilled by enhancing or integrating the many existing monitoring programs to track long-term trends from the BP oil disaster. For example, the species composition and abundance indices generated from fishery-independent and -dependent data are used to assess fish population health. The Southeast Area Monitoring and Assessment Program is a well-established fishery independent monitoring program that could be supplemented with validated fishery-dependent data from relevant commercial and recreational fisheries to support recovery monitoring goals and to provide an assessment of long-term trends.

Gaps Identified

GAP LEGEND: Full gap · Par al gap · No gap

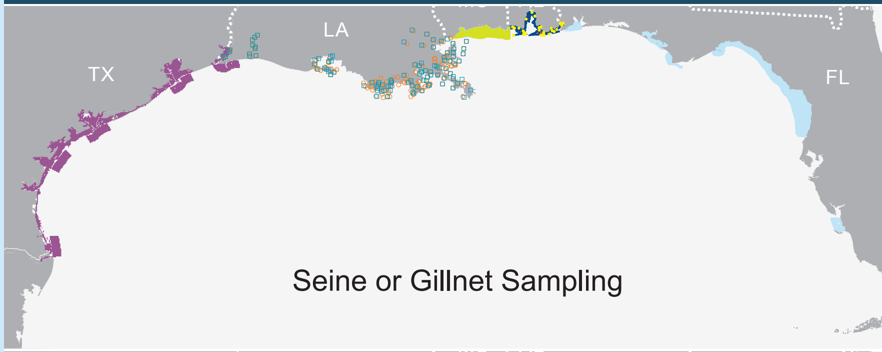
MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	Reef fish	Sciaenids	Mahi	Gulf menhaden	Flounders	Gulf killifish	Tunas	Amberjack	Swordfish	Cobia	Billfishes	Red snapper	Tripletail	Mackerel	Silversides	Anchovies	Reef,Corals,Oyster,SAV
Sampling for PAH exposure and toxicity effects	1	2	2	●	●	●	●	●	●											
Changes in migratory behavior and life history parameters	3	3	4							●	●	●	●	●	●	●	●			
Fishery-independent sampling nearshore and offshore	3	3	4	●		●	●			●				●				●	●	
Mapping impacted nursery grounds / benthic habitats	5	5	5																	●

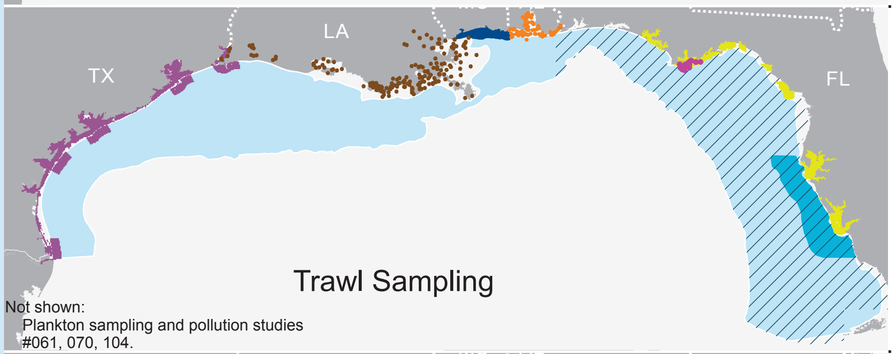
PRIORITY SPECIES

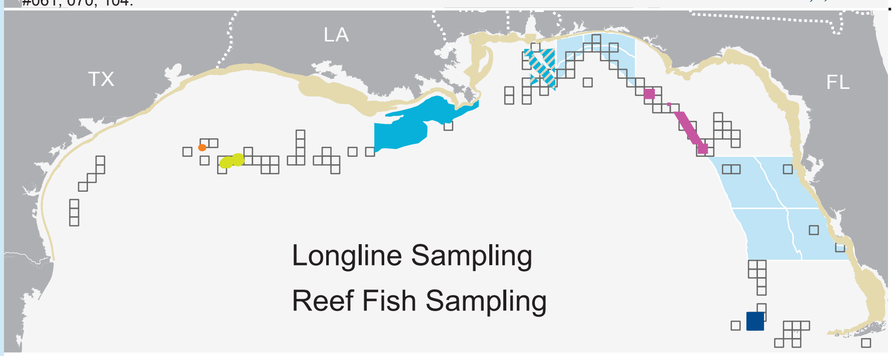
EXPLANATION OF GAPS

1- No monitoring of PAH levels in priority species.
2- Limited monitoring of coastal sharks in Alabama waters.
3- Relatively low fishery-independent effort in pelagic waters.
4- No pelagic icthyo-plankton surveys in summer or shrimp/groundfish surveys in spring/summer.
5- No sustained broad-scale habitat mapping.

Marine Fish





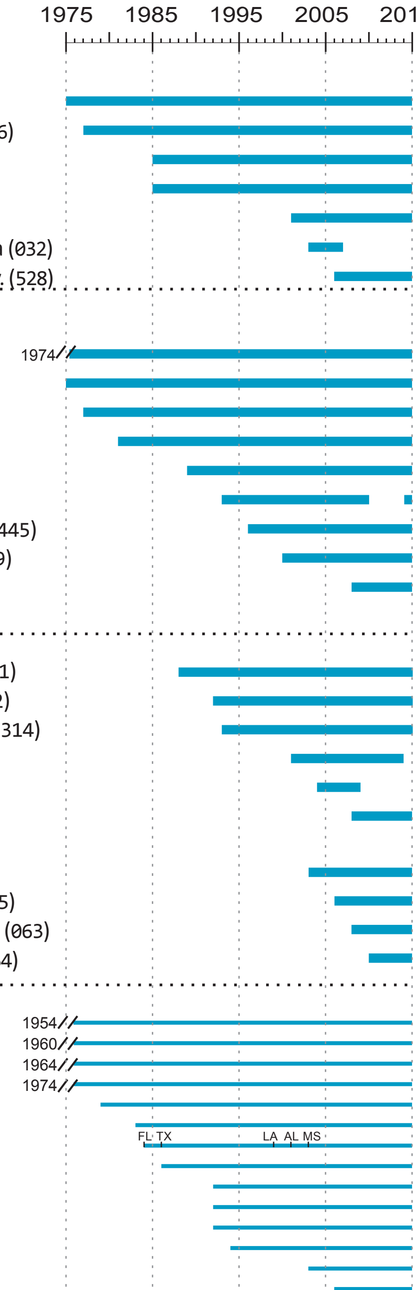


Fishery-dependent Sampling*

*Not mapped due to variability in area sampled.

Existing Studies

MARINE FISH LONG-TERM MONITORING



SEINE/GILLNET
- TPWD FIS (065)
- AMRD FAMP Shoreline Sampling (526)
- LDWF FIM Gillnet Sampling (441)
- LDWF FIM Seine Sampling (442)
- AMRD FAMP Gillnet Sampling (525)
- GOMS Shark Pupping & Nursery Area (032)
- MDMR IJF Coastal Finfish Gillnet Surv. (528)

TRAWL
- MDMR GCRL FIS (067/529)
- TPWD FIS (065)
- ADMR FAMP Trawls (524)
- SEAMAP GOM Trawl Survey (060)
- FWC Estuarine Surveys (069)
- FWC FIM Bai ish Surveys (519)
- LDWF Shellfish Monit. Prog. Trawls (445)
- ANERR Juvenile Fish Monitoring (129)
- FWC SEAMAP Groundfish (520)

REEF FISH
- E&W FGB Long-term Monitoring (131)
- SEAMAP GOM Reef Fish Survey (062)
- FGB Stetson Bank Coral Monitoring (314)
- NMFS NGOM MPA Surveys (315)
- NMFS Pulley Ridge Fish Survey (316)
- FWC - SEAMAP Reef Fish (522)

LONGLINE
- DISL FIS (124)
- DISL-UNF PAHs in Coastal Sharks (125)
- SEAMAP Insh. Bo om Longline Surv. (063)
- SEAMAP Ver cal Longline Survey (064)

FISHERY-DEPENDENT
- SEFSC Cooperav e Tagging Center (894)
- FL Annual Canvas Data Survey (898)
- Menhaden Captains Daily ... Assessmts (37)
- Marine Sport Harv. Prog. (Creel Surveys) (58)
- Marine Recr. Info. Program (MRIP) (56)
- Trip Interview Program (34)
- Dealer Trip Ticket Reports (50,54,53,51,52)
- GulfFIN Head Boat Port Sampling (57)
- Shrimp Observer Program (39)
- Gillnet Observer Program (41)
- Pelagic Longline Observer Program (897)
- Bo om Longline Observer Program (40)
- GulfFIN Biological Sampling (35)
- GOM Verc al Line Observer Prog. (42)

Sea Turtles

The status of males and developmental life stages is virtually unknown.

Summary

Floating oil and dispersant directly contaminated sea turtles as well as their habitat and food resources. The oil disaster occurred during the height of the nesting season in the Gulf of Mexico, so many nests were required to be relocated to a surrogate beach outside of the spill zone to protect sea turtles during disaster response. In order to gauge recovery from these types of impacts, recovery monitoring needs to assess the population conditions of affected species across the Gulf ecosystem and the multitude of factors influencing their return to pre-spill population levels. Long-term priorities for recovery monitoring include designing and funding more statistically valid surveys to expand the scope of data collected from the existing network of monitoring programs. A majority of the monitoring priorities are defined as partial or full gaps, such as the reliance of beach nesting surveys on volunteer capacity, which creates a partial gap in geographic and yearly coverage. Historically, population trends have been derived from the number of nesting females active each season. Therefore the status of adult males and early developmental life stages are virtually unknown, and is another important gap in knowledge. Implementing priority activities and addressing specific gaps in coverage to track progress toward long-term recovery targets, as well as to assess future risks to the species, should be enhanced by supplementing the current monitoring infrastructure. Enhancing the current fishery observer program, as was done through Natural Resource Damage Assessment Early Restoration, and expanding long-term, in-water monitoring surveys are specific activities that would address multiple recovery monitoring goals.

Gaps Identified

GAP LEGEND: Full gap (orange) · Par al gap (beige) · No gap (green)

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY SPECIES: Kemp's ridley	PRIORITY SPECIES: Loggerhead
Continue/expand evaluation at nesting beaches	1	2	2	●	
Monitor neophyte (first-time) nesters	1	3	3	●	
Assess reproduction and potential oil effects	6	6	6	●	●
Identify foraging, breeding, inter-nesting, migratory habitat	1	4	4	●	●
Monitor incidental take from U.S. and Mexico fisheries	1	5	5	●	●

EXPLANATION OF GAPS

1- Existing efforts observe all priority species.

2- Data primarily from volunteer surveys; may be limited by volunteer and staff resources.

3- Neophyte assessment is concentrated at 4 locations and effort varies during the nesting season.

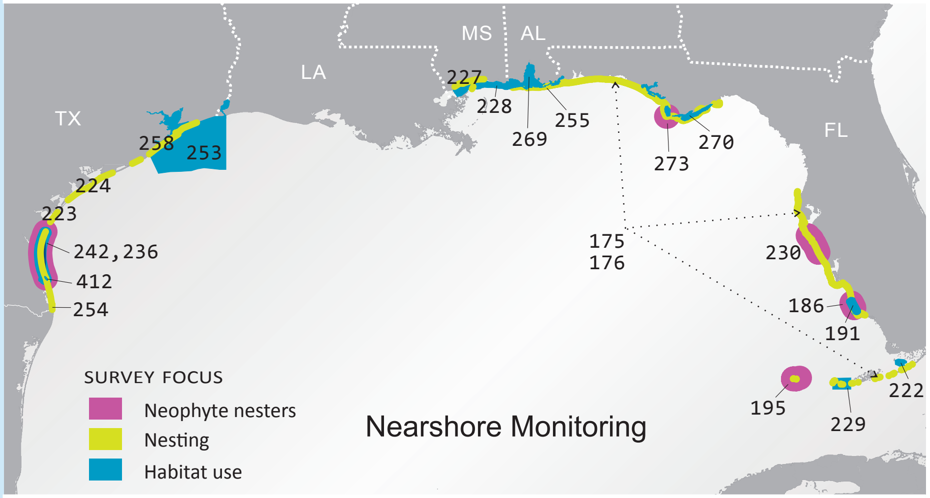
4- Habitat assessment is limited to females from 5 beaches and 7 in-water areas. There is less effort outside of nesting season for tracking habitat use.

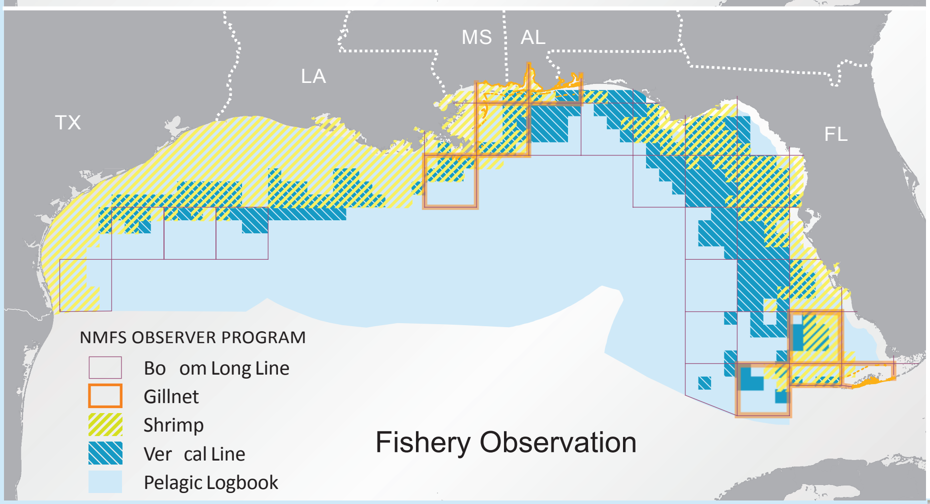
5- Very limited coverage of observers on fishing vessels.

6- No sustained toxicity assessment outside NRDA.

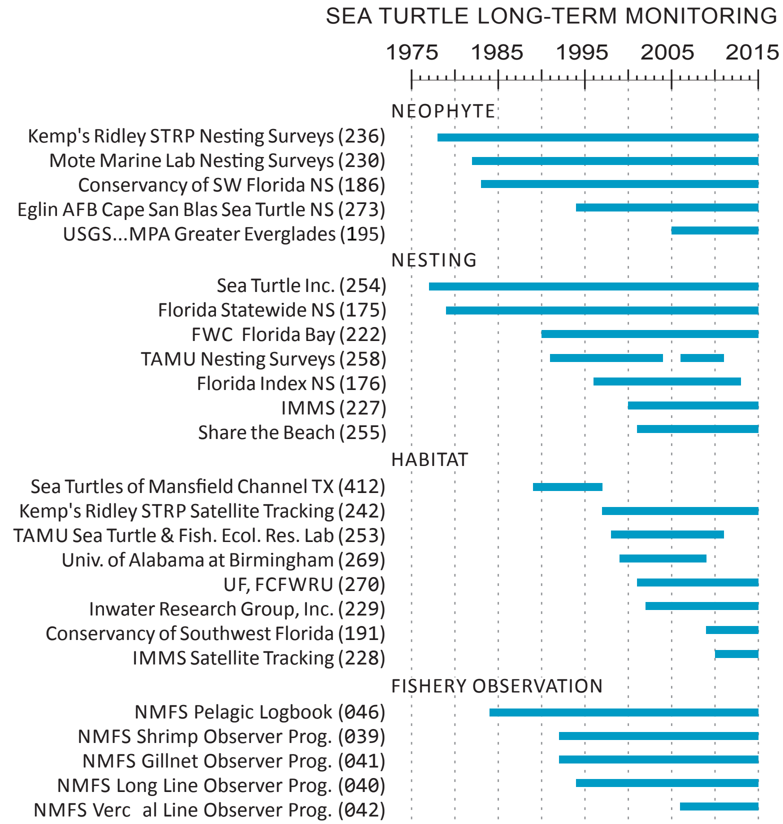
Sea Turtles

Profile page 2



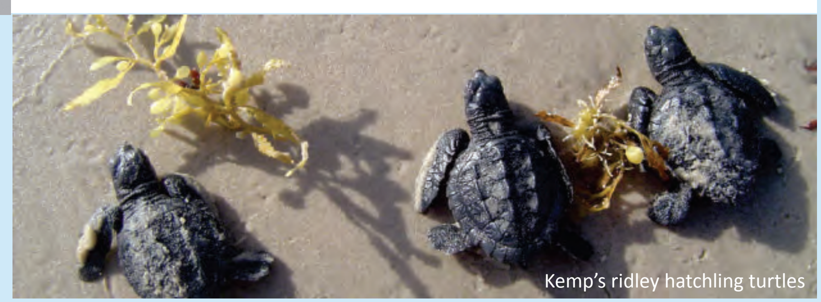


Existing Studies



KEY LESSONS

- *No monitoring of male or juvenile turtles.*
- *Few or no observers in Gulf fisheries.*
- *Some nest monitoring depends on volunteers.*


Kemp's ridley hatchling turtles

Nearshore Sediments & Associated Resources

Early monitoring efforts have not been converted into sustained programs for regionwide assessments.

Summary

The coastal submerged habitats and their benthic communities were exposed to BP oil in varying states of weathering, from dispersed oil droplets to dense, submerged tar mats. These habitats constitute a large area of the northern Gulf of Mexico affected by the BP oil disaster. The sampling techniques for tracking recovery of benthic and epibenthic communities involve analyzing finite samples or direct visual observations of small areas representative of the habitats and communities impacted by the BP oil disaster. Therefore, it is important that monitoring uses statistical survey designs that allow assessment of this large area based on data derived from finite, discrete samples. Monitoring priorities include measuring hydrocarbon concentrations in sediments and tissues of animals, benthic community responses to contamination, and the toxicological effects on marine life. Gaps in these priorities exist due to the lack of sustained, broad-scale monitoring efforts addressing these priorities. Significant investments in research and monitoring have been made to design valid sampling schemes and identify the indicators required to provide the scientific evidence to detect and track individual- and community-level responses. However, these earlier investments have not been utilized in sustained monitoring programs to understand the status and trends in contaminant exposure or the long-term impacts to these ecological communities.

Gaps Identified

GAP LEGEND: Full gap (orange) · Par al gap (tan) · No gap (green) · N/A (hatched)

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	Areas oiled by BP hydrocarbons	Nearshore benthic communities	Coastal fishes	White and brown shrimp	Blue crab
Monitor hydrocarbons in nearshore subtidal sediments with comparison to baseline data	1 (N/A)	2 (Partial gap)	2 (Partial gap)	●				
Monitor nearshore benthic/epibenthic species and develop multivariate assessment of community impacts of hydrocarbon exposure	3 (No gap)	3 (No gap)	4 (Partial gap)		●			
Monitor exposure of benthic organisms to PAH and oiled sediments with emphasis on divergent gene expression, developmental abnormalities and physiological responses	5 (Full gap)	5 (Full gap)	5 (Full gap)			●	●	●

PRIORITY SPECIES / SITE

EXPLANATION OF GAPS

1- Not applicable (no priority species identified).

2- Many programs have been scaled down or become inactive, sampling locations are sparse, and/or focus is intensive short-term only.

3- All macroinvertebrate species potentially sampled in major bays and estuaries.

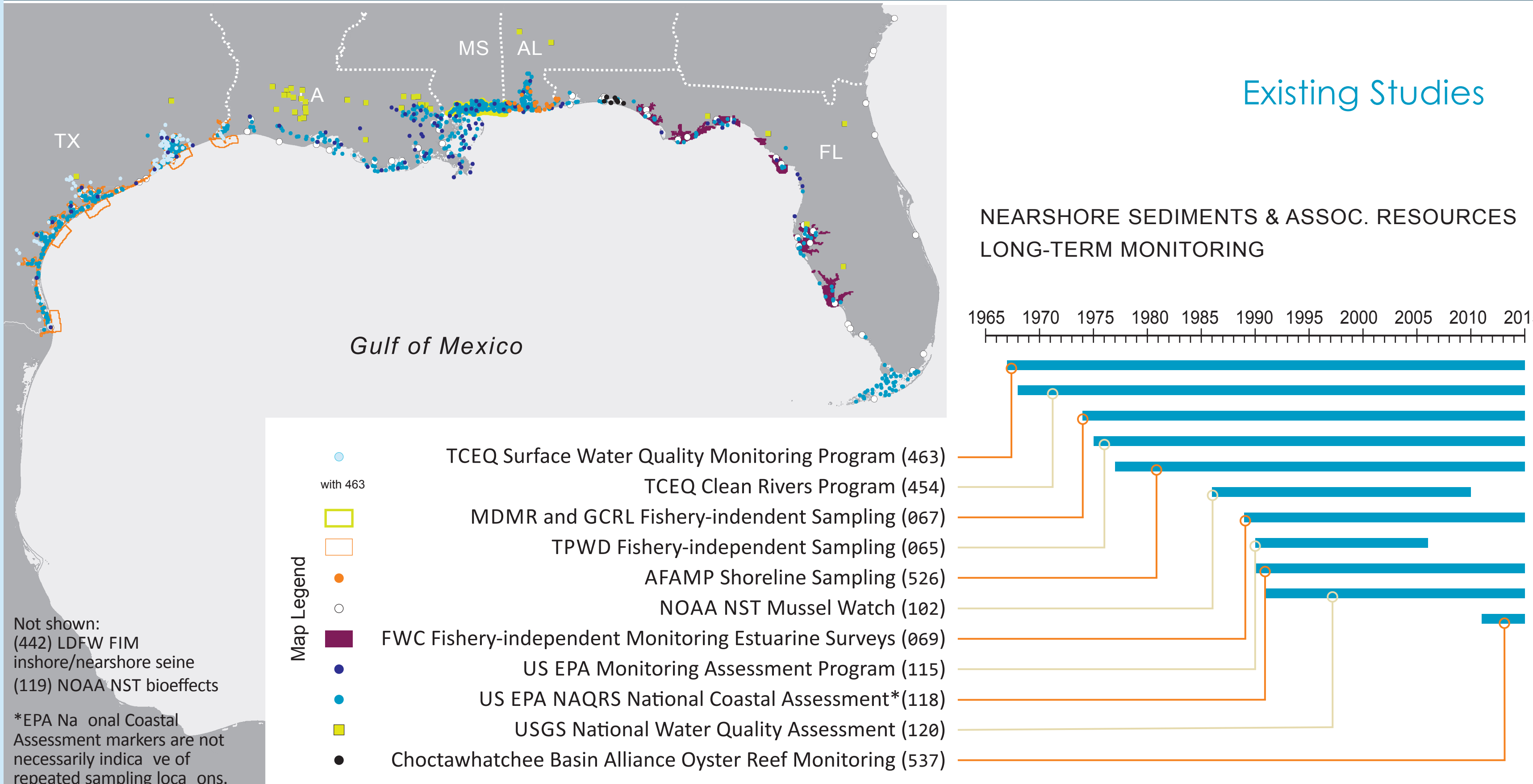
4- Resampling interval too long to assess acute impacts.

5- No toxicity monitoring.

Nearshore Sediments & Associated Resources

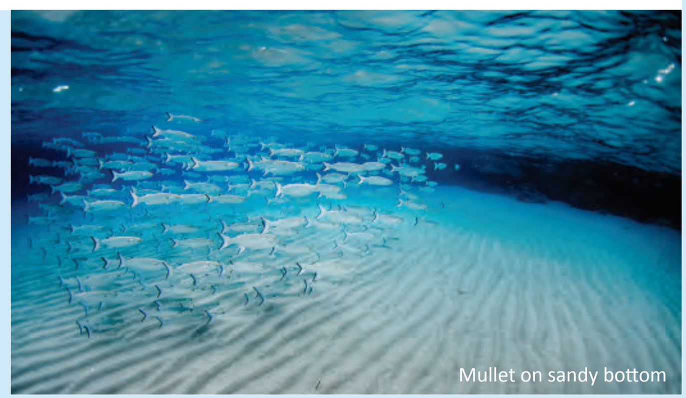
Profile page 2

Existing Studies



KEY LESSONS

- *No assessment of physiologic, developmental, or genetic response to oil.*
- *Regionwide surveys not sustained.*
- *Reliance on short-term, intensive studies.*


Mullet on sandy bottom

Oysters

Gaps exist due to a lack of a comprehensive mapping effort.

Summary

Gulf oysters, *Crassostrea virginica*, were impacted by exposure to oil and dispersant during the BP oil disaster and by fresh water released from salinity control structures in Louisiana to keep oil from reaching nearshore habitats. Oysters, which are commercially harvested in the Gulf of Mexico, have historically been monitored for fisheries management and human health concerns within each Gulf state. For example, the Department of Human Health in Louisiana has monitored oyster meat at 600 to 800 sampling stations coastwide for the presence of human pathogens since the 1980s. In addition to continuing to monitor oyster harvest activities, priorities for the long-term recovery monitoring of oysters include mapping reefs Gulf-wide, developing and implementing standard metrics (e.g., oyster abundance and spat density), and tracking oyster disease and environmental conditions. Gaps exist in oyster reef mapping efforts due to a lack of a coordinated, comprehensive mapping effort and outdated maps of oyster culture areas. Oyster disease monitoring is coordinated through the Oyster Sentinel online community, but due to the limited or voluntary nature of resources, this activity has been opportunistic and intermittent. Temperature and salinity are consistently measured in conjunction with oyster harvest and human pathogen monitoring; however, pH and dissolved oxygen are not, but are important parameters for tracking climate change effects. Further monitoring efforts that include standardized metrics and coordinated mapping efforts would greatly contribute to a more comprehensive picture of oyster communities. In addition, due to the long-term nature of many oyster monitoring programs, numerous opportunities to build from existing long-term data sets to inform and track restoration decisions can be leveraged.

Gaps Identified

GAP LEGEND: Full gap · Par al gap · No gap · N/A

MONITORING PRIORITY	Gap: Areas	Gap: Space	Gap: Time	PRIORITY AREAS: Oyster reefs impacted by the BP oil disaster, either through contamination or response efforts.
Map reef distribution Gulf-wide	1	2	3	●
Monitor reefs using standard metrics at historically sampled, injured, response and random sites	1	5	5	●
Monitor environmental conditions (temperature, O_2, salinity)	1	4	6	●
Monitor oyster disease	1	2	3	●
Monitor harvest	1	7	7	●

EXPLANATION OF GAPS

1- Not applicable (no priority species identified).

2- Monitoring exists, but is not comprehensive.

3- Monitoring opportunistic or intermittent.

4- Some metrics/conditions are not monitored.

5- No Gulf-wide or sustained standardized metrics.

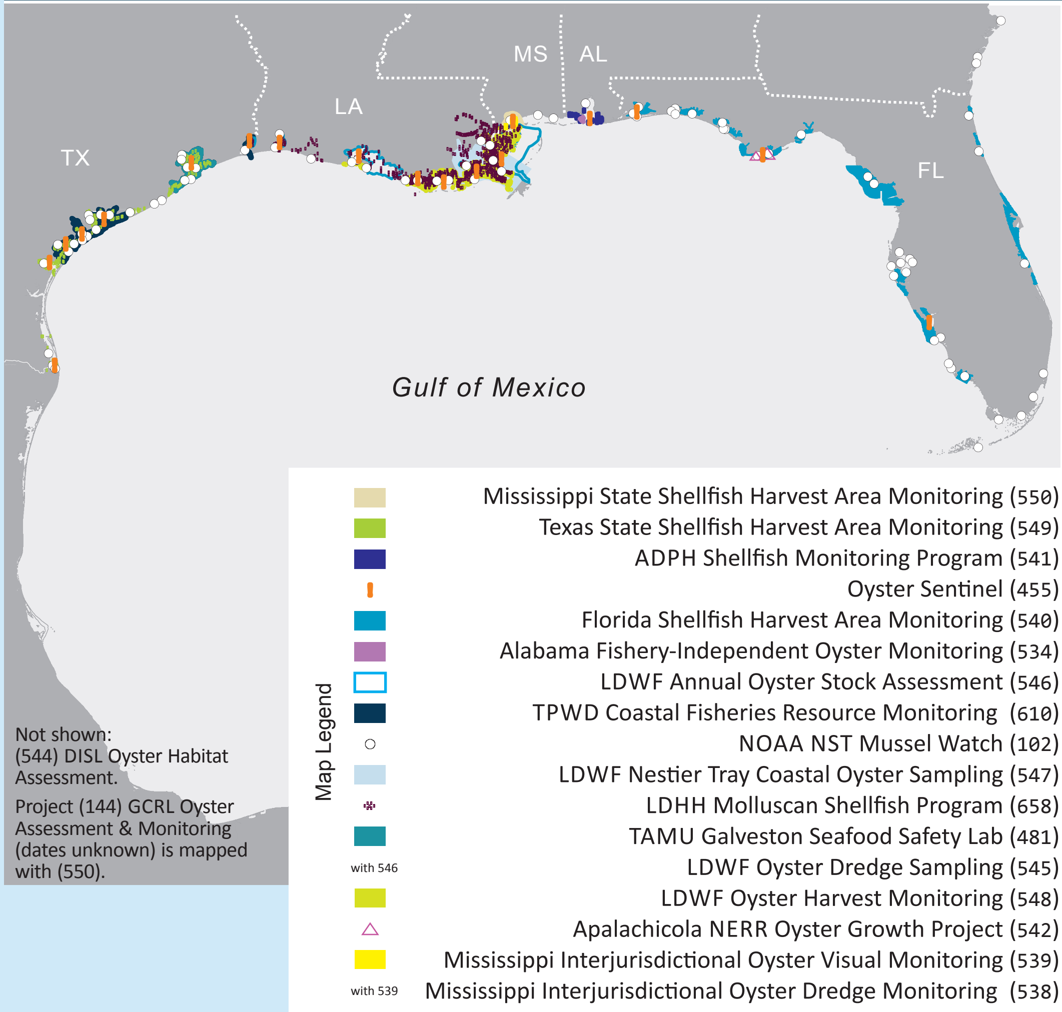
6- Monitoring at current efforts sufficient to track status and trends.

7- Oyster harvest monitored across Gulf.

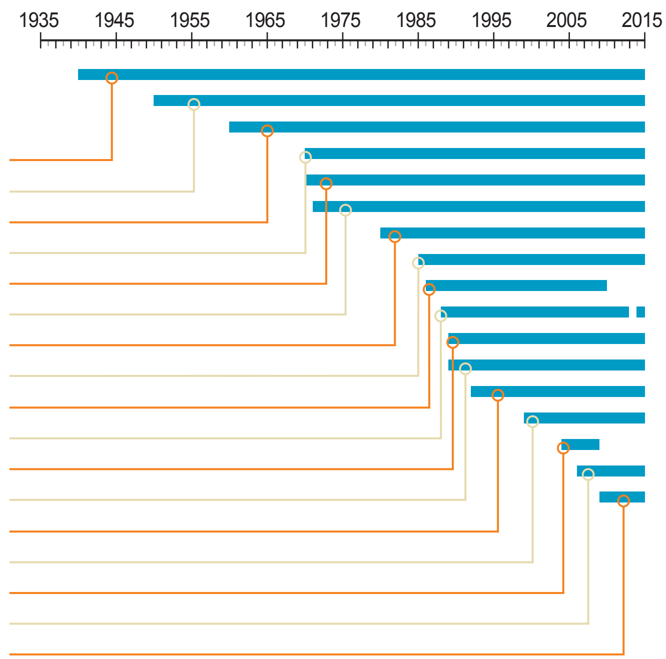
Oysters

Profile page 2

Existing Studies



OYSTERS LONG-TERM MONITORING



KEY LESSONS

- *Mapping efforts not coordinated.*
- *Gulf-wide metrics not standardized.*
- *Harvest activities are the most rigorously tracked.*

Submerged Aquatic Vegetation

In addition to broader geographic coverage, there is a need for more frequent aerial surveys.

Summary

The BP oil disaster affected submerged aquatic vegetation, or rooted vascular plants that grow up to the water surface but not above it, through exposure to oil and dispersants and physical damage during spill response. The impacts affected individual seagrasses, but also made seagrasses more susceptible to other disturbances.[2] Six priority species of seagrasses in the northern Gulf of Mexico were identified: *Halodule wrightii*, *Thalassia testudinum*, *Syringodium filiforme*, *Halophila engelmannii, Halophila decipiens* and *Ruppia maritima. The* priorities for submerged aquatic vegetation recovery monitoring are to 1) conduct aerial surveys to track bed extent, and 2) document percent cover and shoot density of submerged aquatic vegetation beds. Current gaps in seagrass percent cover and density monitoring occur along the coast of Texas and in key areas along Florida's coast, including the southwest, west central and Big Bend regions. The gaps in aerial surveys span the same areas of the Texas and Florida coasts, as well as the areas of Louisiana, Mississippi and Alabama where seagrasses exist. In addition to broader geographic coverage in recovery areas, such as Gulf Islands National Seashore, there is a need for more frequent aerial surveys. The National Park Service Inventory and Monitoring Program at Padre Island and Gulf Islands national seashores and the Texas Seagrass Monitoring Network are two examples of major existing sources of monitoring data that are not yet considered long-term, but could meet that threshold if continued for more than five years, and would provide valuable gap-filling information.

Gaps Identified

GAP LEGEND: Full gap (orange) · Par al gap (beige) · No gap (green)

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	*Halodule wrighi*	*Thalassia testudinumr*	*Syringodium filiforme*	*Halophila engelmannii*	*Halophila decipiens*	*Ruppia maritima*
Aerial surveys to detect changes in SAV coverage	1 (No gap)	2 (Partial gap)	3 (Partial gap)	●	●	●	●	●	●
Monitor seagrass percent cover and shoot density to track natural recovery from physical damage	1 (No gap)	2 (Partial gap)	4 (No gap)	●	●	●	●	●	●

PRIORITY SPECIES: columns 5–10 above.

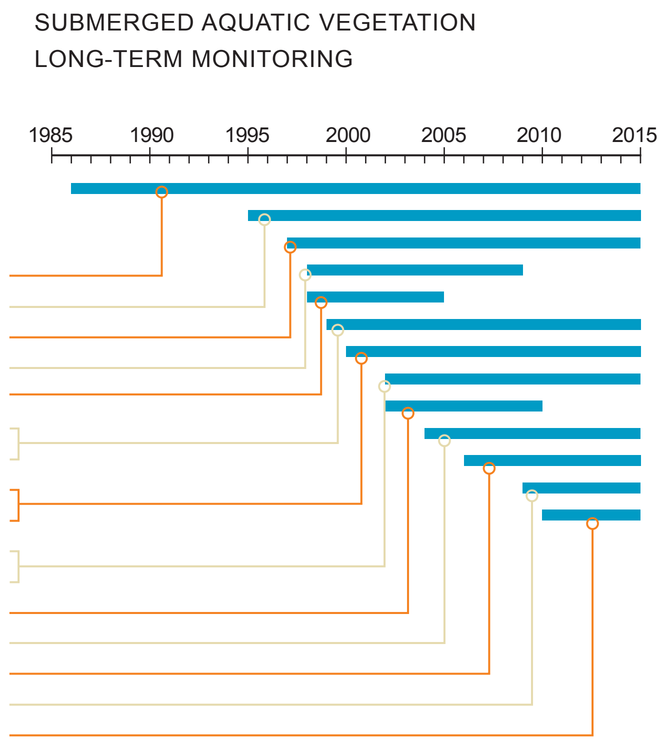
EXPLANATION OF GAPS

1- All priority species are monitored.
2- Key areas of the Gulf not monitored.
3- Monitoring frequency doesn't meet standard.
4- Existing surveys sufficient to track status and trends.

Submerged Aquatic Vegetation

Profile page 2

Existing Studies

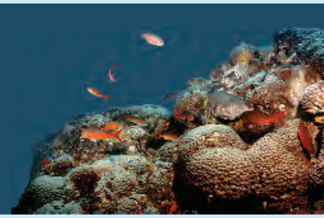


KEY LESSONS

- *All priority species are monitored.*
- *Aerial surveys are limited in range and frequency.*
- *New programs provide opportunities to fill gaps.*


Diverse green algae

Shallow- and Mid-water Corals



Monitoring efforts are not integrated in a manner to allow broad geographic comparability.

Summary

Monitoring of shallow- and mid-water corals should be modified or expanded to assess long-term impacts from exposure to hydrocarbons or chemical dispersants during the BP oil disaster. The monitoring priorities for shallow- and mid-water corals include developing high-resolution distribution maps of these ecosystems within the Gulf, monitoring marine conditions that affect recovery and establishing sentinel sites for elucidating long-term trends from global climate change. The current focus of long-term monitoring is primarily to track community status and species composition of coral reefs and associated fish communities. The majority of existing monitoring efforts are conducted in marine protected areas such as the national marine sanctuaries and habitat areas of particular concern, which are managed through fishing gear restrictions. These protected area programs are invaluable, as they help establish the record of baseline conditions in the face of catastrophic events like the BP oil disaster. These long-term data records can serve as reference conditions for documenting oil impacts of other reef communities throughout the Gulf of Mexico and can aid in tracking recovery. The existing long-term efforts address some monitoring priorities, but overall they are either not integrated in a manner that allows for broad geographic comparability, or they are limited in scope and not designed for tracking BP oil disaster recovery. In order to establish a scientifically defensible monitoring program for recovery tracking, significant additional investments need to be made to develop and expand the monitoring network that can not only inform recovery status but also begin to create a regionwide understanding of broadscale impacts from ecosystem drivers, such as climate change.

Gaps Identified

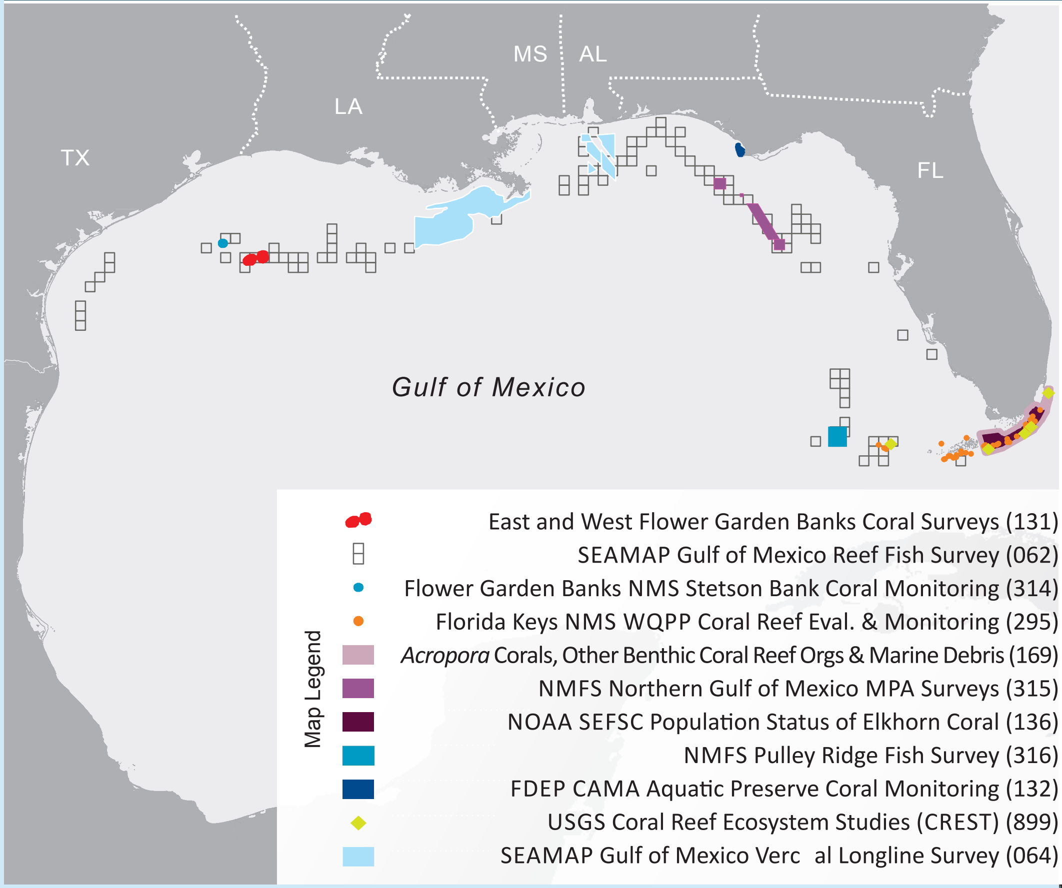
GAP LEGEND: Full gap; Par al gap; No gap; N/A

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY AREAS: Areas in oiled region of Gulf	PRIORITY AREAS: Flower Gdn Banks NMS, Madison–Swanson MPA, Dry Tortugas NP, Pulley Ridge HAPC
Quantify status and trends of Gulf corals	1	2	3	●	
High resolution mapping of coral and hard-bottom habitats	1	2	4	●	
Monitor community processes at existing restoration projects	1	2	5	●	
Full suite physical/chemical monitoring	1	6	6	●	
Sentinel site monitoring / climate change / ocean acidification	1	7	7		●

EXPLANATION OF GAPS

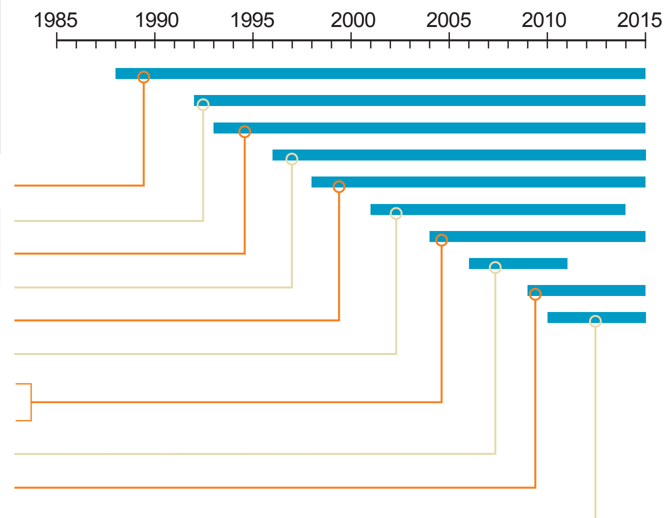
1- Not applicable (no priority species identified).
2- Majority of efforts are limited to the national marine sanctuaries.
3- Existing surveys meet this priority.
4- Monitoring efforts are opportunistic and intermittent.
5- Several long-term surveys have been terminated.
6- No sustained monitoring of full suite physical/chemical parameters.
7- An integrated sentinel program does not yet exist.

Shallow- and Mid-water Corals



Existing Studies

SHALLOW- AND MID-WATER CORALS
LONG-TERM MONITORING



KEY LESSONS

- *Most monitoring is at national marine sanctuaries.*
- *No integrated sentinel site program for monitoring climate change impacts.*
- *No Gulf-wide efforts for regional trends.*

Shorelines

Many monitoring programs capture how shoreline extent, elevation and habitat are changing, but not why.

Summary

Northern Gulf Coast shorelines were heavily impacted from oiling and the subsequent response during the BP oil disaster. The most heavily impacted shorelines, as indicated on Shoreline Cleanup and Assessment Team (SCAT) maps, were in Louisiana. In Mississippi, Alabama and Florida there was also heavy to moderate shoreline oiling, although to a lesser extent than Louisiana. Long-term recovery monitoring priorities include documenting and understanding changes in landforms and habitats, sediment biogeochemistry, and stressors that could impact rates of recovery. In addition, there is a need to monitor invertebrates as indicators of chronic exposure to oil-derived PAHs and other types of coastal pollution. There are varying levels of gaps depending on the information collected by existing monitoring efforts. For example, Landsat is a global remote sensing satellite program that captures data useful for creating coarse-resolution land cover information consistently and broadly; therefore, there are no gaps in habitat coverage monitoring. Other parameters such as shoreline elevation are generally monitored using LiDAR and Sediment Elevation Tables. However, gaps in this type of information exist, as some programs do not gather data on the physical forces causing changes in elevation such as sediment accretion or wave energy. Due to these gaps, many monitoring programs capture how shoreline extent, elevation and habitat are changing, but not why. Based on the findings of our analysis, monitoring the long-term recovery of shorelines would benefit greatly by widening the geographic coverage of monitoring and incorporating metrics to measure the processes behind changes in shoreline status.

Gaps Identified

GAP LEGEND: Full gap (orange); Par al gap (tan); No gap (green); N/A (hatched)

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY SPECIES/AREAS: Oiled/impacted areas from SCAT maps	Forested and herbaceous wetland vegetation spp.	Wetlands, uplands, ridges, barrier islands	Coquina clams
Monitor shoreline position and form	1	2	3	●			
Monitor vegetative communities	4	5	4		●		
Monitor spatial integrity of shoreline habitats	1	4	4			●	
Document changes in soil condition, specifically re: PAHs	1	6	4	●			
Monitor additional shoreline stressors that could impact recovery	1	5	4	●			
Monitor intertidal invertebrates as indicator of coastal pollution	7	5	7				●

EXPLANATION OF GAPS

1- Not applicable (no priority species identified).

2- Monitoring of elevation is occurring, but ecological process monitoring is lacking in some areas.

3- Monitoring does not capture all seasons.

4- Monitoring meets this priority.

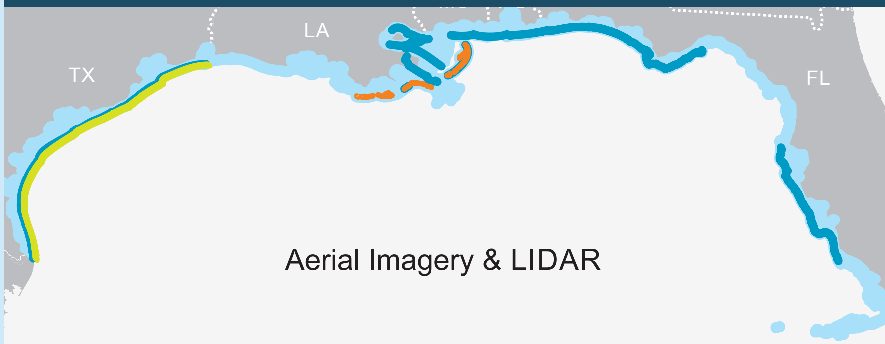
5- Monitoring is not Gulf-wide.

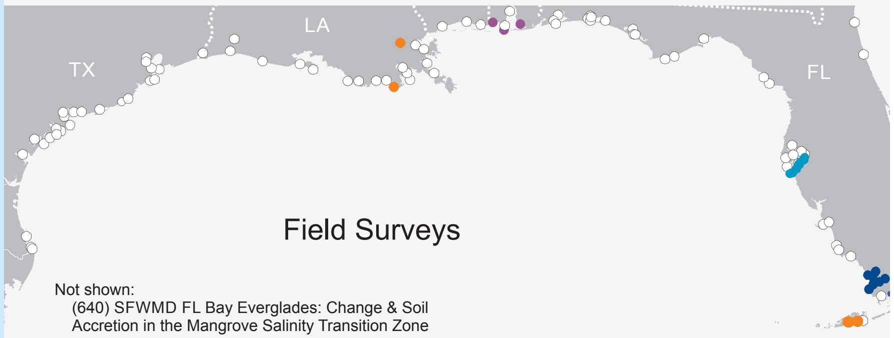
6- Monitoring does not capture PAH-related effects.

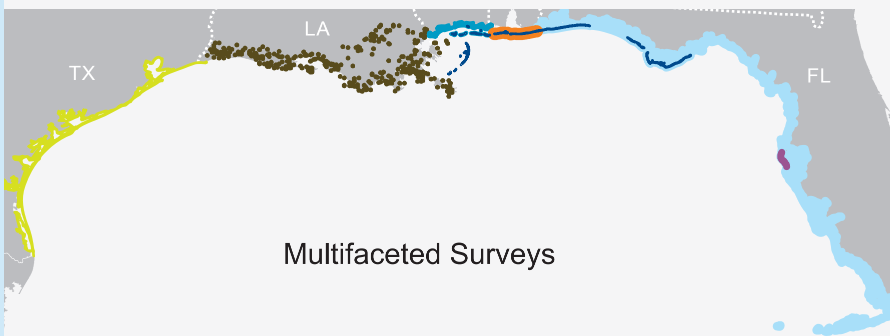
7- No sustained long-term monitoring is occurring.

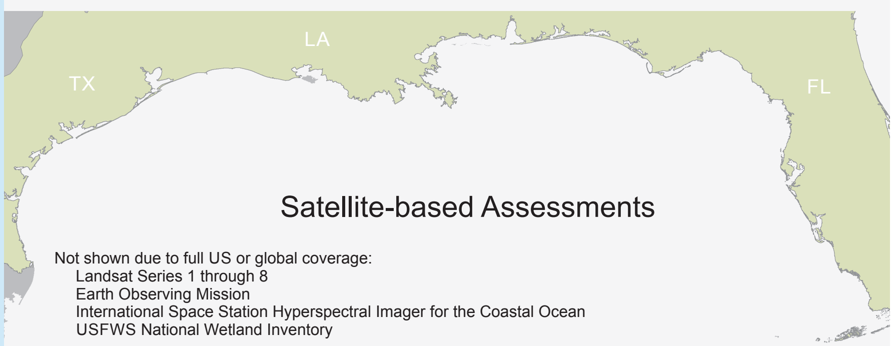
Shorelines

Profile page 2

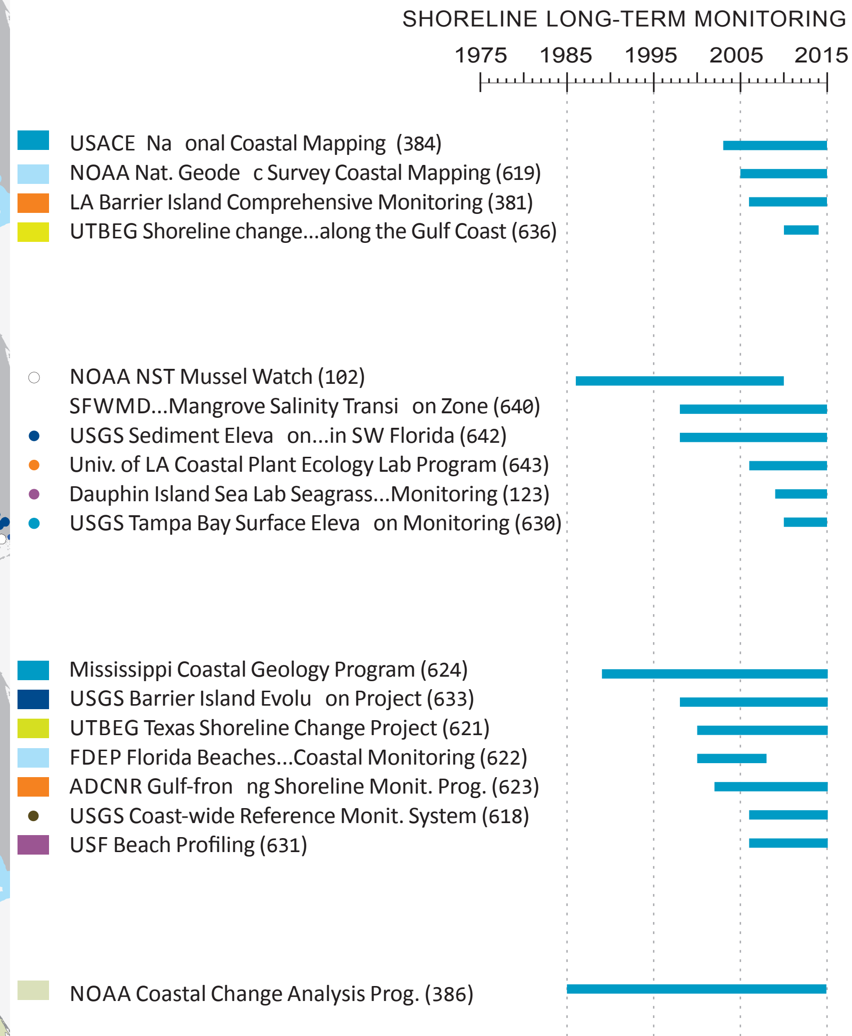






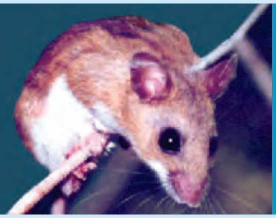


Existing Studies



Mangrove shoreline, Florida Keys

Terrestrial Species



Priorities include estimating population sizes, distribution and habitat impacts.

Summary

Terrestrial species in the northern Gulf of Mexico were impacted by the BP oil disaster either due to habitat disturbance from oil contamination or directly from response efforts. In addition, residual oil in nearshore habitat and restoration actions adjacent to dunes and upper marsh habitat should be closely monitored to identify and avoid any impacts to terrestrial species' habitats. Historically, monitoring of terrestrial species has focused on those species with a legal harvest such as the American alligator, as well as those species that are listed as endangered or threatened under state and federal law such as beach mice. Monitoring priorities for terrestrial species include estimating population sizes, distribution and habitat impacts to the diamondback terrapin, American alligator and beach mice species. In addition, monitoring of arthropods could provide important information to better understand community dynamics and trophic interactions in oiled marshes. Partial and full gaps were identified for these priorities due to limited seasonal or geographic sampling of terrestrial species, limited reporting to the public or insufficient data to understand population trends and seasonal fluctuations. For example, the diamondback terrapin has been monitored opportunistically in isolated areas, and overall efforts have not been sustained, repeated or consistent. Since the BP oil disaster, new monitoring efforts of terrestrial species have been initiated, such as those conducted by the Center for Coastal Studies at Texas A&M University-Corpus Christi to track diamondback terrapins along the central Texas coast, that if continued will provide an opportunity to fill gaps and build a foundation for long-term monitoring.

Gaps Identified

GAP LEGEND: Full gap (orange) · Par al gap (beige) · No gap (green)

MONITORING PRIORITY	Gap: Species	Gap: Space	Gap: Time	PRIORITY SPECIES: Beach mouse	American alligator	Diamondback terrapin	Insects & spiders
Demography, distribution and habitat use of injured species	1 (no gap)	2 (full gap)	3 (partial gap)	●	●	●	
Alligator populations and annual harvest	1 (no gap)	4 (no gap)	5 (partial gap)		●		
Status and trends of terrestrial arthropods in oiled marshes	6 (full gap)	6 (partial gap)	6 (full gap)				●

EXPLANATION OF GAPS

1- All priority species are monitored.

2- No distribution-wide efforts.

3- Sustained sampling is limited and important trends in seasonality are missing.

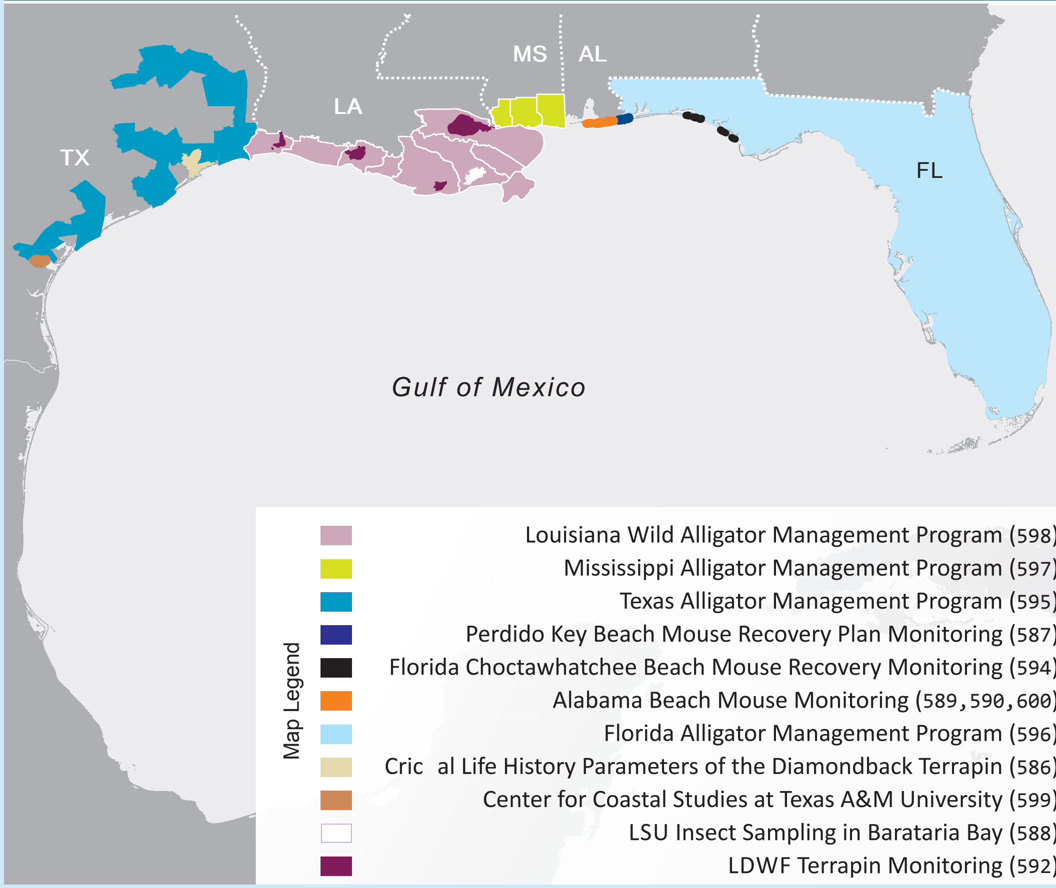
4- Alligators are monitored in all Gulf states.

5- Important trends in seasonality are missing for alligators.

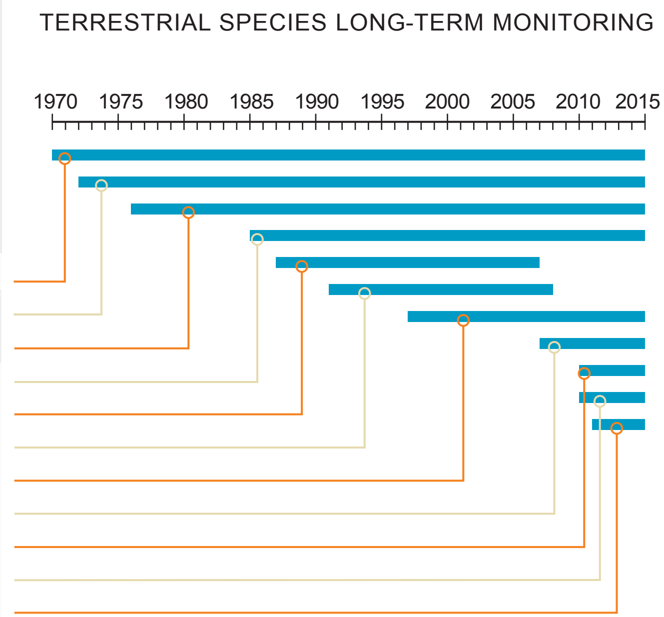
6- Isolated monitoring occurring in Louisiana.

Terrestrial Species

Profile page 2



Existing Studies



KEY LESSONS

- *Some species have Gulf-wide coverage; for others, only isolated monitoring exists.*
- *Focus is on threatened/endangered species.*


Diamondback terrapin

Overarching Lessons Learned

Throughout Ocean Conservancy's analysis of recovery monitoring efforts and needs, several overarching themes and cross-cutting monitoring priorities emerged. Instead of repeatedly describing these within multiple resource categories, they are discussed here as additional monitoring needs that should be integrated into long-term oil disaster recovery monitoring efforts.

Residual Oil Monitoring

Due to the wide geographic distribution of leaked oil, which could last decades in certain environments, tracking residual oil in the environment and its continuing impacts are key components of a broader recovery monitoring program (Carls et al., 2012). Exposure to lingering oil can result in chronic impacts such as genetic defects, compromised health (including effects on growth or reproduction) and even destabilized predator-prey relationships (Peterson et al., 2003). Because oil weathers most slowly when buried in sediments, remaining oil including poly-cyclic aromatic hydro-carbons are a concern for animals living in or near contaminated sediments. Monitoring benthic habitats is an identified priority for susceptible marine fish, nearshore sediments and associated resources and shorelines. However, residual oil impacts are not necessarily limited to these resource groups, so more extensive monitoring may be needed. In tracking residual oil and its potential effects, the following should be taken into account:

- The fate of the oil (i.e., where it went and what remains);
- The geochemical nature of the environment where the residual oil resides (e.g., buried in sediment on the sea bottom or on beaches and likely to be exposed by storms);
- The concentration of the oil (mainly in sediments of beaches, marshes and the sea bed), its chemical composition and degree of weathering;
- The accumulation of oil and its metabolites in key organisms that are still exposed and its potential toxicity; and
- The rate of oil degradation in various environments, specifically including redox and nutrient conditions that determine degradation rate.

Establishing Environmental Condition

Sufficient baseline information is not available for some habitats impacted by the BP oil disaster, such as deep-sea benthos, and this complicates efforts to accurately measure impact and recovery. In habitats showing signs of oil disaster injury for which there is insufficient data, gathering baseline information was consistently identified as a priority for monitoring. Alternatively, researchers can use reference areas to assess the degree of damage, infer recovery rates of injured habitats or consider appropriate actions that will aid recovery. For example, habitat mapping can document the distribution and condition of Gulf habitats, which is useful for identifying uninjured reference sites that contain comparable conditions to injured areas. Mapping and a broader baseline understanding are a priority for oyster reefs, shorelines, deep-water communities, shallow-water and mid-water corals, and hard-bottom marine fish habitats.

Monitoring and Research: A Symbiosis for Gulf Restoration

Monitoring is done to understand where, when and how ecological change is occurring, and research is carried out to learn what is possibly causing the change. Their goals are complementary, and there is a need for both, particularly when trying to understand how ecological systems and relationships interact in the Gulf in ways that affect restoration outcomes. Without research, the data that accumulate from monitoring only reveal changes in the coastal or marine environment but do not explain them. Long-term monitoring data are extremely useful in guiding research questions that ask the "how" of observed change; whereas research helps scientists to determine the "what" to monitor. One example takes place in the mesopelagic ecosystem of the deep Gulf (from 200 to 1,000 meters deep), an ecosystem that was directly and repeatedly exposed to BP oil and applied dispersant. Many species at these depths migrate to the surface layer of the ocean every night, but there are major species in this zone that have yet to be named, let alone understood for how they function or interrelate (Hopkins et al., 1994; Kaltenberg et al., 2007). Therefore, conducting basic research on the meso-pelagic organisms and their roles would help the scientific community to better understand how this ecosystem was injured.

Integrating and Coordinating Gulf-wide Efforts

Many Gulf monitoring efforts are uncoordinated, patchy, intermittent or even duplicative (NAS, 2014; NAS, 2015). It is common for monitoring efforts around the Gulf to use different monitoring protocols to track the same natural resource. These characteristics of monitoring make it difficult or impossible to make Gulf-wide comparisons of monitoring data or understand long-term trends in resource condition. Additionally, a disjointed network of monitoring within and across habitats or taxa makes it difficult to make inter-disciplinary connections. For example, information about how a recovering species' prey resources are changing could inform restoration managers' understanding of why a species is not recovering. Moving from a disjointed system to a coordinated monitoring paradigm in the Gulf would improve our understanding of recovery and ecosystem change.

Leveraging Existing Projects and Programs

Ocean Conservancy's assessment identifies monitoring priorities for which existing programs might be able to provide relevant data for tracking the recovery of resources injured by the BP oil disaster. See Table 3 for examples of monitoring efforts managed by agencies or academic institutions that represent sources of data for recovery monitoring. It is possible that the monitoring infrastructure already in place across the Gulf can address the gaps in coverage at critical times of the year, in critical locations or for priority species, provided the active programs are appropriately modified or expanded and receive the supplemental resources needed to accommodate the goals of restoration decision-makers to assess Gulf-wide recovery.

Using existing Gulf programs to monitor sea turtles impacted by the BP oil disaster

Ocean Conservancy's assessment identified a partial gap in space and time for the priority of monitoring incidental take of sea turtles from U.S. and Mexican commercial fisheries. Building off existing programs, the *Deepwater Horizon* Trustees' Sea Turtle Early Restoration Project is starting to address this gap in monitoring. The proposed project includes a 10-year enhancement of NOAA's long-standing observer program for documenting sea turtle bycatch in the shrimp trawl fishery, and a 10-year increase in law enforcement patrols to enforce the use of turtle excluder devices on shrimp vessels in Texas waters. The proposed restoration activities help address the gap by strength-ening the ability of fisheries managers and law enforcement officials to document – and ultimately deter and decrease – lethal interactions as a means of aiding the recovery of affected species.

Sea turtle tagged by NOAA SEFSC fishery observer program

Table 3: Examples of Existing Monitoring Efforts that Can Inform Injured Resource Recovery Monitoring

Survey Name	Target Resources	Sampling Location	Program Duration	Managing Entity
Southeast Area Monitoring and Assessment Program* Fall and Summer Shrimp/Groundfish Survey	Commercially and recreationally important fish and invertebrates (abundance, distribution, species length-frequency and environmental conditions)	U.S. waters, inshore to 50-60 fathoms offshore	1981 - current	A partnership of state, federal and regional agencies
North American Breeding Bird Survey	Breeding birds (point counts)	Throughout North America; multiple sites in Gulf of Mexico	1966 - current	U.S. Geological Survey and Canadian Wildlife Service
Scripps Passive Acoustic Monitoring for Marine Mammals	Marine mammals (detect presence and track changes in distribution by recording vocalizaons)	Northeastern Gulf of Mexico	2010 - current	Scripps Instut e of Oceanography Whale Acoustic Laboratory
Louisiana Wild Alligator Management Program	American alligator (nest density, population esma tes, harvest parameters, environmental conditions, mark and recapture of farm-released alligators)	Coastal Louisiana	1970 - current	Louisiana Department of Wildlife and Fisheries
Seagrass Integrated Mapping and Monitoring Program	Seagrasses (presence or absence, species composition, percent cover, abundance using the Braun-Blanquet scale and aerial imagery)	Florida coastline	1992 - current	Florida Fish and Wildlife Conservation Commission
Coastwide Reference and Monitoring System	Sediment (elevation, accretion, subsidence, salinity and type), marsh and forest vegetation (cover, species composition, relav e abundance, dominance, richness and height), and wetland characterization (land/water rao , duration and frequency of flooding)	Coastal Louisiana	2003 - current	Louisiana Coastal Protection and Restoration Authority and the U.S. Geological Survey
Fisheries Oceanography of Coastal Alabama	Zooplankton, icthyoplankton and environmental parameters (count, weight, taxa, biovolume, water, water temperature, depth, etc.)	Alabama nearshore area and connen tal shelf	2004 - 2015	Dauphin Island Sea Lab

* Administered by the Gulf States Marine Fisheries Commission with participation from the following agencies: Alabama Department of Conservation and Natural Resources, Marine Resources Division; Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute; Louisiana Department of Wildlife and Fisheries; Mississippi Department of Marine Resources; Gulf Coast Research Laboratory; Texas Parks and Wildlife Department; National Marine Fisheries Service, Southeast Fisheries Science Center; and the Gulf of Mexico Fishery Management Council.

TEXT REFERENCES

Bjorndal, K. A., Bowen, B. W., Chaloupka, M., Crowder, L. B., Heppell, S. S., Jones, C. M., Lutcavage, M. E., Policansky, D., Solow, A. R. & Witherington, B. E. (2011). Better science needed for restoration in the Gulf of Mexico. *Science*, *331*(6017), 537-538.

Bue, B. G., Sharr, S., Moffitt, S. D., & Craig, A. K. (1996). The effects of the *Exxon Valdez* oil spill on pink salmon embryos and pre-emergent fry. In S. D. Rice, R. B. Spies, D. A. Wolfe, & B. A. Wright (Eds.), *Proceedings of the* Exxon Valdez *oil spill symposium* (pp. 619-627). Bethesda, MD: American Fisheries Society.

Carls, M., Lindeberg, M., & Rice, J. (2012). *Long-term monitoring: Lingering oil - Extending the tracking of oil levels and weathering (PAH composition) in PWS through time* (Project No. 15120114-S). Research project funded by the *Exxon Valdez* Oil Spill Trustee Council for the period 2011-2016.

Cooney, R. T., Allen, J. R., Bishop, M. A., Eslinger, D. L., Kline, T., Norcross, B. L., McRoy, C. P., Milton, J., Olsen, J., Patrick, V., Paul, A. J., Salmon, D., Scheel, D., Thomas, G. L., Vaughan, S. L., & Willette, T. M. (2001). Ecosystem controls of pink salmon (*Oncorhynchus gorbuscha*) and Pacific herring (*Clupea pallasii*) populations in Prince William Sound, Alaska. *Fisheries Oceanography*, *10*(Suppl. 1), 1-13.

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill.* Retrieved from http://www.gulfspillrestoration.noaa.gov/wpcontent/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Exxon Valdez Oil Spill Trustee Council. (2003). *The Sound Ecosystem Assessment Program*. Retrieved from http://www.evostc.state.ak.us/index.cfm?FA=projects.SEA

Garrott, R. A., Eberhardt, L. L., & Burns, D. M. (1993). Mortality of sea otters in Prince William Sound following the *Exxon Valdez* oil spill. *Marine Mammal Science*, *9*(4), 343-359.

Graham, B., Reilly, W. K., Beinecke, F., Boesch, D. F., Garcia, T. D., Murray, C. A., & Ulmer, F. (2011). *Report to the President: National Commission on the BP* Deepwater Horizon *Oil Spill and Offshore Drilling* http://www.gpo.gov/fdsys/pkg/GPO-OILCOMMISSION/pdf/GPO-OIL COMMISSION.pdf

Hopkins, T. L., Flock, M. E., Gartner Jr., J. V., & Torres, J.J. (1994). Structure and trophic ecology of a low latitude midwater decapod and mysid assemblage. *Marine Ecological Progress Series, 109*, 143-156.

Kaltenberg, A. M., Briggs, D. C., & DiMarco, S. F. (2007). Deep scattering layers of the northern Gulf of Mexico observed with a shipboard 38-kHz acoustic Doppler current profiler. *Gulf of Mexico Science, 25*, 97-108.

*In re: Oil Spill by the Oil Rig "*Deepwater Horizon*" in the Gulf of Mexico on April 20, 2010*, MDL No. 2179 (E.D. La. July 2, 2015) (order granting confidentiality to settlement documents and discussions).

National Academy of Sciences. (2014). *The Gulf Research Program: A strategic vision.* Washington, DC: The National Academies Press.

National Academy of Sciences. (2015). *Opportunities for the Gulf Research Program: Monitoring ecosystem restoration and deep water environments.* Washington, DC: The National Academies Press.

Norse, E. A., & Amos, J. (2010). *Impacts, perception, and policy implications of the* Deepwater Horizon *oil and gas disaster.* Washington, DC: Environmental Law Institute.

Oil Pollution Act of 1990a. § 1006, 33 U.S.C. § 2706; Natural Resource Damage Assessments, 15 C.F.R. § 990.

Peterson, C. H., Anderson, S. S., Cherr, G. N., Ambrose, R. F., Anghera, S., Bay, S., Blum, M., Condon, R., Dean, T. A., Graham, W. M., Guzy, M., Hampton, S., Joye, S., Lambrinos, J., Mate, B., Meffert, D., Powers, S. P., Somasundaran, P., Spies, R. B., Taylor, C. M., Tjeerdema, R., & Adams, E. E. (2012). A tale of two spills: Novel science and policy implications of an emerging new oil spill model. *Bioscience, 62*(5), 461-469.

Peterson, C. H., Rice, S. D., Short, J. W., Esler, D., Bodkin, J. L., Ballachey, B. E., & Irons, D. B. (2003). Long-term ecosystem response to the *Exxon Valdez* oil spill. *Science, 302*, 2082-2086.

Rice, S. D., Short, J. W., Carls, M. G., Moles, A., & Spies, R. B. (2007). The *Exxon Valdez* oil spill. In R. B. Spies (Ed.), *Long-term ecological change in the northern Gulf of Alaska* (pp. 419-520). London, England: Elsevier Press.

Sharr, S., Peckham, C. J., Sharp, D. G., Peltz, L., Smith, J. L., Willette, T. M., Evans, D. G., & Bue, B. G. (1995). *Coded wire tag studies on Prince William Sound salmon 1989-1991.* Fish/Shellfish Study No. 3. *Exxon Valdez* Trustee Council Natural Resource Damage Assessment Final Report. Anchorage, AK: Alaska Department of Fish and Game.

RESOURCE PROFILE BIBLIOGRAPHY

Ecosystem Drivers

Gulf of Mexico Coastal Ocean Observing System. (2015). *GCOOS data portal*. Retrieved from http://data.gcoos.org/

Karnauskas, M., Schirripa, M. J., Craig, J. K., Cook, G. S., Kelble, C. R., Agar, J. J., Black, B. A., Enfield, D. B., Lindo-Atichati, D., Muhling, B. A., Purcell, K. M., Richards, P. M., Wang, C. (2015). Evidence of climate-driven ecosystem reorganization in the Gulf of Mexico. *Global Change Biology, 21*(7), 2554-2568.

Karnauskas, M., Schirripa, M. J., Kelble, C. R., Cook, G. S., & Craig, J. K. (2013). *Ecosystem status report for the Gulf of Mexico.* NOAA Technical Memorandum NMFS-SEFC-653. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Miami, FL: Southeast Fisheries Science Center.

Spies, R. B., Senner, S. E., & Robbins, C. S. (2015). An overview of the northern Gulf of Mexico ecosystem. *Gulf of Mexico Science, 33*, (in press).

Deep-water Communities

Fisher, C. R., Hsing, P.-Y., Kaiser, C. L., Yoerger, D. R., Roberts, H. H., Shedd, W. W., Cordes, E. E., Shank, T. M., Berlet, S. P., Saunders, M. G., Larcom, E. A., & Brooks, J. M. (2014). Footprint of *Deepwater Horizon* blowout impact to deep-water coral communities. *Proceedings of the National Academy of Sciences, 111*(32), 11744-11749.

White, H. K., Hsing, P.-Y., Cho, W., Shank, T. M., Cordes, E. E., Quattrini, A. M., Nelson, R. K., Camilli, R., Demopoulos, A. W. J., German, C. R., Brooks, J. M., Roberts, H., Shedd, W., Reddy, C. M., & Fisher, C. R. (2012). Impact of the *Deepwater Horizon* oil spill on deep-water coral community in the Gulf of Mexico. *Proceedings of the National Academy of Sciences, 109*(50), 20303-20308.

Water Column and Invertebrates

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill*. Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Birds

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill*. Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Deepwater Horizon Trustee Council. (2015). Deepwater Horizon *oil spill: Draft programmatic damage assessment and restoration plan and draft programmatic environmental impact statement*. Retrieved from http://www.justice.gov/enrd/file/780401/download

Haney, J. C., Geiger, H. J., & Short, J. W. (2014). Bird mortality from the *Deepwater Horizon* oil spill. I: Exposure probability in the offshore Gulf of Mexico. *Marine Ecological Progress Series, 513*, 225-237.

Haney, J. C., Geiger, H. J., & Short, J. (2014). Bird mortality from the *Deepwater Horizon* oil spill. II: Carcass sampling and exposure probability in the coastal Gulf of Mexico. *Marine Ecological Progress Series, 513*, 239-252.

Marine Mammals

Ackleh, A. S., Loup, G. E., Loup, J. W., Ma, B., Newcomb, J. J., Pal, N., Sidorovskaia, N. A., & Tiemann, C. (2012). Assessing the *Deepwater Horizon* oil spill impact on marine mammal population through acoustics: Endangered sperm whales. *Journal of Acoustical Society of America, 131*(3), 2306-2314.

Venn-Watson, S., Colegrove, K. M., Litz, J., Kinsel, M., Terio, K., Saliki, J., Fire, S., Carmichael, R., Chevis, C., Hatchett, W., Pitchford, J., Tumlin, M., Field, C., Smith, S., Ewing, R., Fauquier, D., Lovewell, G., Whitehead, H., Rotstein, D., McFee, W., Fougeres, E., & Rowles, T. (2015). Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the *Deepwater Horizon* oil spill. *PLoS ONE, 10*(5), e0126538.

Marine Fish

Atlantic Bluefin Tuna Status Review Team. (2011). *Status review report of Atlantic bluefin tuna* (Thunnus thynnus). Retrieved from http://www.nmfs.noaa.gov/stories/2011/05/docs/bft_srr_final.pdf

Deepwater Horizon Trustee Council. (2015). Deepwater Horizon *oil spill: Draft programmatic damage assessment and restoration plan and draft programmatic environmental impact statement.* Retrieved from http://www.justice.gov/enrd/file/780401/download

Incardona, J. P., Gardner, L. D., Linbo, T. L., Brown, T. L., Esbaugh, A. J., Mager, E. M., Stieglitz, J. D., French, B. L., Labenia, J. S., Laetz, C. A., Tagal, M., Sloan, C. A., Elizur, A., Benetti, D. D., Grosell, M., Block, B. A., & Scholz, N. L. (2014). *Deepwater Horizon* crude oil impacts the developing hearts of large predatory pelagic fish. *Proceedings of the National Academy of Sciences, 111*(15), E1510-1518.

Muhling, B. A., Roffer, M. A., Lamkin, J. T., Ingram Jr., G. W., Upton, M. A., Gawlikowski, G., Muller-Karger, F., Habtes, S., & Richards, W. J. (2012). Overlap between Atlantic bluefin tuna spawning grounds and observed *Deepwater Horizon* surface oil in the northern Gulf of Mexico. *Marine Pollution Bulletin, 64*(4), 679-687.

Sulak, K., Dixon, P., Randall, M., Price, M., & Nash, U. (2015). Quantitative declines in mesophotic reef fish abundance and shifts in community structure across the threshold of the *Deepwater Horizon* event: Temporal and spatial contrasts. Proceedings from a special session of the *2015 Gulf of Mexico Oil Spill & Ecosystem Science Conference: Monitoring Status and Trends of Long-lived Marine Vertebrates as a Measurable Indicator of Restoration and Long-term Health of the Gulf of Mexico Ecosystem*.

Sea Turtles

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill.* Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Deepwater Horizon Trustee Council. (2013). Deepwater Horizon *oil spill: Programmatic and phase III early restoration plan and draft early restoration programmatic environmental impact statement.* Retrieved from http://www.gulfspillrestoration.noaa.gov/restoration/early-restoration/phase-iii/phase-iii-archives-2/

Nearshore Sediment and Associated Resources

Operational Science Advisory Team *Deepwater Horizon* Unified Area Command. (2010). *Summary report for sub-sea and sub-surface oil and dispersant detection: Sampling and monitoring*. New Orleans, LA: U.S. Coast Guard.

Oysters

Deepwater Horizon Trustee Council. *(2012). Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill.* Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Submerged Aquatic Vegetation

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill.* Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Shallow- and Mid-water Corals

Goodbody-Gringley, G., Wetzel, D. L., Gillon, D., Pulster, E., Miller, A., & Ritchie, K. B. (2013). Toxicity of *Deepwater Horizon* source oil and the chemical dispersant, Corexit® 9500, to coral larvae. *PLoS ONE, 8*(1), e45574.

Shorelines

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill.* Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

Michel, J., Owens, E. H., Zengel, S., Graham, A., Nixon, Z., Allard, T., Holton, W., Reimer, P. D., Lamarche, A., White, M., Rutherford, N., Childs, C., Mauseth, G., Challenger, G., & Taylor, E. (2013). Extent and degree of shoreline oiling: *Deepwater Horizon* oil spill, Gulf of Mexico, USA. *PLoS ONE, 8*(6), e65087.

Terrestrial Species

Deepwater Horizon Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill.* Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

ACRONYMS

ADCNR	Alabama Department of Conservation and Natural Resources
ADPH	Alabama Department of Public Health
AFB	Air Force Base
AFAMP	Alabama Fisheries Assessment and Monitoring Program
AMRD	Alabama Marine Resources Division
ANERR	Apalachicola National Estuarine Research Reserve
CAMA	(Office of) Coastal and Aquatic Managed Areas
DISL	Dauphin Island Sea Lab
ECOGIG	Ecosystem Impacts of Oil and Gas Inputs to the Gulf
EPA	Environmental Protection Agency
FAMP	Fisheries Assessment and Monitoring Program
FCFWRU	Florida Cooperative Fish and Wildlife Research Unit
FDEP	Florida Department of Environmental Protection
FGB	Flower Garden Banks
FIM	Fishery-independent Monitoring
FIS	Fishery-independent Sampling or Fishery-independent Survey
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
GCRL	Gulf Coast Research Laboratory
GOM	Gulf of Mexico
GOMS	Gulf of Mexico States
GulfFIN	Gulf of Mexico Fisheries Information Network
HAPC	Habitat Area of Particular Concern
IJF	Interjurisdictional Fisheries
IMMS	Institute for Marine Mammal Studies
LDHH	Louisiana Department of Health and Hospitals
LDWF	Louisiana Department of Wildlife and Fisheries
MAPS	Monitoring Avian Productivity and Survivorship
MDMR	Mississippi Department of Marine Resources
MPA	Marine Protected Area
NAS	National Academy of Sciences
NERR	National Estuarine Research Reserve
NGOM	Northern Gulf of Mexico
NIUST	National Institute for Undersea Science and Technology
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NS	Nesting Survey(s)
NST	National Status and Trends
PAH	polyaromatic hydrocarbons
ROV	remotely operated vehicle
SEAMAP	Southeast Area Monitoring and Assessment Program
SEFSC	Southeast Fisheries Science Center
SERPENT	Scientific and Environmental ROV Partnership Using Existing Industrial Technology
SFWMD	South Florida Water Management District
STRP	Sea Turtle Recovery Project
TAMU	Texas A&M University
TCEQ	Texas Commission on Environmental Quality
TPWD	Texas Parks and Wildlife Department
USACE	United States Army Corps of Engineers
USF	University of South Florida
USGS	United States Geological Survey
UTBEG	University of Texas Bureau of Economic Geology
WQPP	Water Quality Protection Program

ACKNOWLEDGMENTS

Charting the Gulf: Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico would not have been possible without the assistance of many people and institutions. Ocean Conservancy gratefully acknowledges and thanks the following for sharing their knowledge and advice or otherwise assisting with the development and production of this analysis.

EXPERT REVIEW OF MONITORING PRIORITIES

Deepwater Communities

Charles Fisher, Pennsylvania State University; Paul Montagna, Texas A&M University at Corpus Christi; and Samantha Joye, University of Georgia at Athens.

Water Column and Invertebrates

Kendra Daly, University of South Florida; Charles H. “Pete” Peterson, University of North Carolina; and Robert R. Spies, Applied Marine Sciences.

Birds

Participants of the Gulf of Mexico Bird Monitoring SDM Working Group; and Iain Stenhouse, Biodiversity Research Institute.

Marine Mammals

Ruth H. Carmichael, University of South Alabama; and Vicki Cornish, Marine Mammal Commission.

Marine Fish

Barbara Block, Stanford University; Read Hendon, University of Southern Mississippi; Will Patterson, University of South Alabama; and Charles H. “Pete” Peterson, University of North Carolina.

Sea Turtles

Elizabeth Scott-Denton, National Oceanic and Atmospheric Administration; James Nance, National Oceanic and Atmospheric Administration; Pamela Plotkin, Texas Sea Grant; and Blair Witherington, University of Florida.

Nearshore Sediment and Assoc. Res.

Joris L. van der Ham, George Mason University; and Andrew Whitehead, University of California, Davis.

Oysters

Christine Shepard, The Nature Conservancy; Thomas M. Soniat, University of New Orleans; and LaDon Swann, Mississippi-Alabama Sea Grant Consortium.

Submerged Aquatic Vegetation

Kenneth L. Heck Jr., University of South Alabama.

Shallow- and Mid-water Corals

Chris Bergh, The Nature Conservancy; Jorge Brenner, The Nature Conservancy; Andrew David, National Oceanic and Atmospheric Administration; and Emma Hickerson, National Oceanic and Atmospheric Administration.

Shorelines

Natalie Peyronnin, Environmental Defense Fund; Ann Hijuelos, The Water Institute of the Gulf; and Alisha Renfro, National Wildlife Federation.

Terrestrial Species

Aaron Baxter, Center for Coastal Studies; Andrew Coleman, Birmingham Audubon Society; Joseph Butler, University of North Florida; and Christina Mohrman, Florida A&M University.

GENERAL

Becky Allee, National Oceanic and Atmospheric Administration; Robert Arnone, University of Southern Mississippi; Steve Ashby, Mississippi State University; Jeff Barger, Ocean Conservancy; Russ Beard, National Oceanic and Atmospheric Administration; Landry Bernard, U.S. Fish and Wildlife Service; Jerry Boatman, Marine Technology; Laura Bowie, Gulf of Mexico Alliance; Melissa Carle, National Oceanic and Atmospheric Administration; Cristina Carollo,

Texas A&M University at Corpus Christi; Cara Cooper, 3 Little Birds Consulting; Scott Cross, National Oceanic and Atmospheric Administration; Dick Crout, Naval Research Lab; Alyssa Dausman, Gulf Coast Ecosystem Restoration Council; Theresa Davenport, National Oceanic and Atmospheric Administration; Percy Donaghay, University of Southern Mississippi; Scott F. Eastman; Elizabeth Fetherston, Ocean Conservancy; Larissa Graham, Mississippi-Alabama Sea Grant Consortium; Monty Graham, University of Southern Mississippi; Rebecca Green, Bureau of Ocean Energy Management; Margarita Gregg, National Oceanic and Atmospheric Administration; Rachel Guillory, Ocean Conservancy; Christine Hale, Texas Sea Grant; Jessica Renee Henkel, Gulf Coast Ecosystem Restoration Council; Dale Honeycutt, Environmental Systems Research Institute; Laura Herren, Harbor Branch Oceanographic Institute; Robin Vaughn Hirshorn; Joe Jewell, Mississippi Department of Marine Resources; Bethany Carl Kraft, Ocean Conservancy; Robert Kröger, Covington Civil and Environmental; Margot Langan; Kara Lankford, Ocean Conservancy; Julien Lartigue, National Oceanic and Atmospheric Administration; Ed Laurent, Connecting Conservation; Adena Leibman, Office of Sen. Sheldon Whitehouse; Shannon McArthur, National Oceanic and Atmospheric Administration; Roger McManus, International Union for Conservation of Nature; Fabio Moretzsohn, Texas A&M University at Corpus Christi; Ryan Moyer, Florida Fish and Wildlife Conservation Commission; Charles H. "Pete" Peterson, University of North Carolina; Dave Reed, Florida Fish and Wildlife Conservation Commission; Angela Salis, National Oceanic and Atmospheric Administration; Steve Sempier, Mississippi-Alabama Sea Grant Consortium; Tracie Sempier, Mississippi-Alabama Sea Grant Consortium; Stanley Senner, National Audubon Society; Greg Steyer, U.S. Geological Survey; Andrew Shepard, University of South Florida, LaDon Swann, Mississippi-Alabama Sea Grant Consortium; Joe Swaykos, National Oceanic and Atmospheric Administration; Shelby Walker, National Oceanic and Atmospheric Administration; Stephanie Watson, U.S. Fish and Wildlife Service; Dona Weifenbach, Coastal Protection and Restoration Authority; Sue Wilder, U.S. Fish and Wildlife Service; Monica Wilson, Florida Sea Grant; Steven Wolfe, Wolfe Associates; and Fred Zeile, National Oceanic and Atmospheric Administration.

INVENTORY OF MONITORING PROGRAMS

A number of individuals provided assistance with identifying relevant monitoring programs or providing metadata or GIS data on specific programs, identified below by resource category. Although not listed individually, multiple agency staff at Louisiana Department of Wildlife and Fisheries provided information throughout this project.

Ecosystem Drivers

Mathieu Belbeoch, Joint World Meteorological Organization Intergovernmental Oceanographic Commission Technical Commission for Oceanography and Marine Meteorology Observing Platform Support Center; Sarah Bernhardt, Galveston Bay Estuary Program; Kori Blitch, Louisiana Department of Environmental Quality; Richard Bouchard, National Oceanic and Atmospheric Administration; Jessica Comeaux, Louisiana State University; Emily Cotton, Mississippi Department of Environmental Quality; Matt Dornback, National Oceanic and Atmospheric Administration; Gene Carl Feldman, National Aeronautics and Space Administration; Ann Jochens, U.S. Fish and Wildlife Service; Albert E. Hindrichs, Louisiana Department of Environmental Quality; Matt Howard, U.S. Fish and Wildlife Service; Stephan Howden, University of Southern Mississippi; Lei Hu, University of South Alabama; Barbara Kirkpatrick, U.S. Fish and Wildlife Service; Kate Kohler, Mote Marine Laboratory; Jan Kurtz, U.S. Environmental Protection Agency; Carol Lewis, U.S. Geological Survey; Skip Livingston, Florida State University; Larry Lloyd, Texas A&M University at Corpus Christi;

Mark Luther, University of South Florida; Clifford Merz, University of South Florida; David Moroni, National Aeronautics and Space Administration; Eduardo Patino, U.S. Geological Survey; W. David Polk, Florida Department of Health; Chris Simomiello, U.S. Fish and Wildlife Service; Will Veatch, U.S. Army Corp of Engineers; and Nan Walker, Louisiana State University.

Deep-water Communities

Mark Benfield, Louisiana State University; Robert Carney, Louisiana State University; Charles Fisher, Pennsylvania State University; Daniel Jones, Scientific and Environmental ROV Partnership using Existing Industrial Technology Project; Ian MacDonald, Florida State University; and Paul Montagna, Texas A&M University at Corpus Christi.

Water Column and Invertebrates

Renee Collini, Dauphin Island Sea Lab; Frank Hernandez, University of Southern Mississippi; and Lauren Levi, Apalachicola National Estuarine Research Reserve.

Birds

James Callicut, Mississippi Department of Wildlife; Robyn Cobb, U.S. Fish and Wildlife Service; Steve DeMaso, U.S. Fish and Wildlife Service; Melanie Driscoll, National Audubon Society; Jamie Feddersen, Florida Fish and Wildlife Conservation Commission; Peter Frederick, University of Florida; Jeffrey Gleason, U.S. Fish and Wildlife Service; Richard Gibbons, Houston Audubon; Amanda Hackney, Audubon Texas; Chris Haney, Defenders of Wildlife; Susan A. Heath, Gulf Coast Bird Observatory; Jon Hemming, U.S. Fish and Wildlife Service; Chuck Hunter, U.S. Fish and Wildlife Service; Diana Iriarte, Aransas National Wildlife Refuge, U.S. Fish and Wildlife Service; Erik Johnson, National Audubon Society; Kevin J. Kraai, Texas Parks and Wildlife Department; Edward J. Laurent, Texas Parks and Wildlife Department; Brent Ortego, Texas Parks and Wildlife Department; Keith Pardieck, U.S. Geological Survey; Eric C. Soehren, Wehle Land Conservation Center; Michael Rezsutek, Texas Parks and Wildlife Department; John Tirpak, U.S. Fish and Wildlife Service; Peter Tuttle, U.S. Fish and Wildlife Service; Dan Twedt, U.S. Geological Survey; Randy Wilson, U.S. Fish and Wildlife Service; Nick Winstead, Mississippi Department of Wildlife, Fisheries and Parks; and Mark Woodrey, Mississippi State University.

Marine Mammals

Robert Bonde, U.S. Geological Survey; Andrew Coleman, Birmingham Audubon Society; Vicki Cornish, Marine Mammal Commission; Laura Engleby, National Oceanic and Atmospheric Administration; Erin Fougères, National Oceanic and Atmospheric Administration; John Hildebrand, University of California San Diego; Keith D. Mullin, National Oceanic and Atmospheric Administration; Steve Rockwood, Florida Fish and Wildlife Conservation Commission; Kent Smith, Florida Fish and Wildlife Conservation Commission; Moby Solangi, Institute for Marine Mammal Studies; and Leslie Ward, Florida Fish and Wildlife Conservation Commission.

Marine Fish

Neil Baertlein, National Oceanic and Atmospheric Administration; Donna B. Bellais, Gulf States Marine Fisheries Commission; Cindy Y. Bohannon, Texas Parks and Wildlife Department; Kenneth Brennan, National Oceanic and Atmospheric Administration; Russell Brodie, Florida Fish and Wildlife Conservation Commission; Steve Brown, Florida Fish and Wildlife Conservation Commission; John Carlson, National Oceanic and Atmospheric Administration; James Cowan, Louisiana State University; Carol Davis, Florida Fish and Wildlife Conservation Commission; Elizabeth Scott-Denton, National Oceanic and Atmospheric Administration; Michael Drexler, Ocean Conservancy; Mark Fisher, Texas Parks and Wildlife Department; Samantha Fontenelle, U.S. Environmental Protection Agency; Jim Franks, University of Southern Mississippi; David R. Gloeckner, National Oceanic and

Atmospheric Administration; Lee Green, Texas Parks and Wildlife Department; Lynne Hamlin, Texas Parks and Wildlife Department; Jill Hendon, University of Southern Mississippi; Read Hendon, University of Southern Mississippi; Debbie Leffler, Florida Fish and Wildlife Conservation Commission; Jerry Mambretti, Texas Parks and Wildlife Department; Craig Newton, Alabama Department of Conservation & Natural Resources; William Patterson, University of South Alabama; Todd Phillips, Ocean Conservancy; Joe Powers, Louisiana State University; Jeff Rester, Gulf States Marine Fisheries Commission; Russell Rigby, Alabama Department of Conservation & Natural Resources; Joe Smith, National Oceanic and Atmospheric Administration; Steven J. VanderKooy, Gulf States Marine Fisheries Commission; and Jyotika Virmani, XPRIZE.

Sea Turtles

Dave Addison, Conservancy of Southwest Florida; Carrie Backlund, U.S. Air Force; Trish Bargo, East Coast Observers; Beth Brost, Florida Fish and Wildlife Conservation Commission; Raymond Carthy, University of Florida; Bruce Drye, Florida Department of Environmental Protection; Sheryan Epperly, National Oceanic and Atmospheric Administration; Allen Foley, Florida Fish and Wildlife Conservation Commission; Suzi Fox, Anna Maria Turtle Watch and Shorebird Monitoring; George Gray, Okaloosa Turtle Watch; Bruce Hagedorn, U.S. Air Force; Robert Hardy, Florida Fish and Wildlife Conservation Commission; Kristen Hart, U.S. Geological Survey; Eve Haverfield, Turtle Time Inc.; Rick Herren, Sea Turtle Conservancy; Cathy Holmes, Navarre Beach Sea Turtle Patrol; Inwater Research Group, Inc.; Wendy Jones, United States Air Force; Ray Kirkwood, Friends of the Matagorda and Aransas National Wildlife Refuges; Maura Kraus, Collier County; Meg Lamont, U.S. Geological Survey; Andre Landry, Texas A&M at Galveston; Michael Lusk, U.S. Fish and Wildlife Service; Sharon Maxwell, South Walton Turtle Watch; Tracey Mueller, Mote Marine Laboratory; James Nance, National Oceanic and Atmospheric Administration; David Nelson, U.S. Army Research and Development Center; Mark Nicholas, National Park Service; Will Parks, REMSA, Inc.; Jonathan Pitchford, Institute for Marine Mammal Studies; Mike Reynolds, Share The Beach; Larry Richardson, U.S. Fish and Wildlife Service; Jack Rudloe, Gulf SpecimenMarine Lab; Rick Sall, Save-A-Turtle; Jeffrey Schmid, Conservancy of Southwest Florida; Jill Schmid, Rookery Bay National Estuarine Research Reserve; Elizabeth Scott-Denton, National Oceanic and Atmospheric Administration; Donna Shaver, National Park Service; Christopher Slay, Coastwise Consulting; Leslee Stokes, National Oceanic and Atmospheric Administration; Leslie Ward, Florida Fish and Wildlife Conservation Commission; Bill Wargo, Alligator Point Sea Turtle Patrol; Kennard Watson, Panama City Beach Turtle Watch; Thane Wibbels, University of Alabama at Birmingham; Blair Witherington, University of Florida; and Tracy Zielger, National Park Service.

Nearshore Sediments and Associated Resources

Linda Broach, Texas Commission on Environmental Quality; Ryan Gandy, Florida Fish and Wildlife Conservation Commission; Steve Geiger, Florida Fish and Wildlife Conservation Commission; and Ian Hartwell, National Oceanic and Atmospheric Administration.

Oysters

Evan Anderson, University of Southern Mississippi; Bill Balboa, Texas Sea Grant; Seth Blitch, The Nature Conservancy; Mark Brainard, Mississippi Department o Marine Resources; Ron Dawsey, Alabama Department of Public Health; Greg Dunn, Alabama Department of Public Health; Jill Fleiger, Florida Department of Agriculture and Consumer Services; Scott Gordon, Mississippi Department of Marine Resources; Gary Heideman, Texas Department of State Health Services; Jason Herrmann, Alabama

Department of Conservation and Natural Resources; Chris Lemaire, Louisiana Department of Health and Hospitals; John Mareska, Alabama Department of Conservation and Natural Resources; Emily Maung-Douglass, Louisiana Sea Grant; Greg Piniak, National Oceanic and Atmospheric Administration; Scott Rikard, Auburn University; Thomas M. Soniat, University of New Orleans; Dan Van-Nostrand, National Oceanic and Atmospheric Administration; and Bill Walton, Auburn University.

Submerged Aquatic Vegetation

Patrick Biber, University of Southern Mississippi; Paul Carlson, Florida Fish and Wildlife Conservation Commission; Brandy Foley, Choctawatchee Basin Alliance; Penny Hall, Florida Fish and Wildlife Conservation Commission; Sara Wilson, University of Texas at Austin; and Keith Kolasa, Southwest Florida Water Management District.

Shallow- and Mid-water Corals

Mike Colella, Florida Fish and Wildlife Conservation Commission; Andrew David, National Oceanic and Atmospheric Administration Fisheries; Stacy Hargrove, National Oceanic and Atmospheric Administration; Emma Hickerson, Flower Garden Banks National Marine Sanctuary; Jennifer Schull, National Oceanic and Atmospheric Administration; and Dana Williams, National Oceanic and Atmospheric Administration.

Shorelines

Tim Axton, U.S. Army Corp of Engineers ; Just Cebrian, University of South Alabama; Robert Brantley, Florida Department of Environmental Protection; Nicole Cormier, U.S. Geological Survey; and Nathaniel Plant, U.S. Geological Survey.

Terrestrial Species

Aaron Baxter, Center for Coastal Studies; Joseph Butler, University of North Florida; Andrew Coleman, Birmingham Audubon Society; Amos Cooper, Texas Parks and Wildlife Department; Christina Mohrman, Florida A&M University; William Selman, Rockefeller National Wildlife Refuge; and Kristi Yanchis, U.S. Fish and Wildlife Service.

Gray snapper, Gulf of Mexico

APPENDIX A: METHODS

Ocean Conservancy's Charting the Gulf: Analyzing the Gaps in Long-term Monitoring of the Gulf of Mexico consisted of three main phases: 1) creating an inventory of long-term monitoring efforts relevant to impacted natural resources; 2) identifying high-priority monitoring or data collection activities needed to track the status of species or habitats recovering from the BP oil disaster; and 3) identifying gaps in space, time and priority species/areas coverage for each monitoring priority. Phases one (inventory) and two (priorities) were carried out simultaneously, and phase three (gap analysis) was completed only after phases one and two were complete for each resource category.

PHASE 1: INVENTORY OF LONG-TERM MONITORING

The first phase of the gap analysis project began with an inventory of long-term monitoring efforts in the Gulf relevant to 12 resource categories of natural resources used by the *Deepwater Horizon* Trustee Council, plus one additional resource category for ecosystem drivers. The inventory captures information on individual monitoring efforts obtained through meetings with resource experts and a review of primary literature and monitoring plans, such as the Gulf of Mexico Alliance Gulf Monitoring Network white paper (2013) and the Gulf Coastal Ocean Observing System build-out plan (2014). Ocean Conservancy met or corresponded with nearly 300 individuals from federal and state agencies, academia and nonprofits. These communications were essential to compiling information on the geographic and temporal scope, sampling methods, and focal species of long-term monitoring programs in the Gulf.

For purposes of the gap analysis, the inventory was not intended to be an exhaustive catalog of every monitoring effort in existence, but instead a targeted search for programs that met two requirements: 1) a minimum data record of five years of continuous sampling or a minimum of two sample years that span the five-year range, and 2) a principal source of information for resource assessment or management. A principal program is a program believed to be the most relevant to tracking the status and health of injured natural resources and meets at least one of the following criteria:

1. Geographic Scope: The monitoring program covers a majority of the resource extent for an administrative or management agency's jurisdiction of the resource, or it is Gulf-wide. (e.g., SEAMAP, sanctuary assessments or state-level seagrass surveys);
2. Primary Data Source: The program serves as the primary source of information on the resource for the managing agency charged with assessing the particular resource (e.g., Florida FWC sea turtle index nesting beaches or USFWS waterfowl harvest assessments);
3. NRDA Resource Category: The program directly monitors the resource defined by a NRDA resource category. (e.g., NOAA's coastal change and analysis program for shorelines);
4. Foundational Data Source: The program does not directly monitor an injured resource, but data from the program is used by management agencies or the research community to understand population, habitat or ecosystem dynamics (e.g., currents, sea surface temperature or ocean color) and the sampling scheme has broad coverage in space and time; or
5. Limited Data Availability on the Particular Resource: There are such limited data sources within an administrative boundary (federal or state waters) for a resource category that any existing programs classify as primary (e.g., deep-water communities).

Ocean Conservancy documented approximately 640 long-term monitoring efforts in the full inventory, ranging from abiotic characteristics of the marine environment to population assessments of forage fish and colonial nesting shorebirds. The above filter was applied to select a subset of inventory programs eligible for inclusion in the gap analysis (see Appendix D for a summary). The subset represents those monitoring programs in the inventory that collect information relevant to the assessed priorities.

Records in the Inventory

The inventory is a collection of metadata for approximately 640 active or discontinued long-term monitoring efforts in coastal areas or marine waters of the U.S. Gulf. Monitoring data themselves are not captured. The table below provides a summary of the fields for which information on each of the individual efforts was obtained. The goal of the inventory was to capture as many efforts as possible that could provide pre- and post-disaster data on natural resource condition for use in status and trends assessments, or serve as historical record for those efforts that are no longer active. There are likely environmental monitoring efforts in the coastal or offshore areas of the Gulf that are not documented in this inventory because they were either not relevant to the project's goals or were not identified. Metadata fields included in the inventory are shown in Table 4.

Natural Resource Categories

The natural resource categories used in Ocean Conservancy's assessment of monitoring coverage and gaps are, with one exception, the same as those used by the *Deepwater Horizon* Trustee Council. Ocean Conservancy chose the NRDA resource categories to help ensure the findings can be easily integrated into long-term restoration planning and monitoring efforts for impacted resources and habitats. Ecosystem drivers is the one category that was not identified by the *Deepwater Horizon* Trustee Council but included in this analysis. The category of human use, such as recreational fishing or beach activities, was excluded from this analysis because it falls outside the ecological focus of the assessment. The recreational, socio-economic and human health impacts of the BP oil disaster are important topics for further study and should be included in long-term studies to ensure lingering harm is documented and Gulf Coast communities affected by the disaster are made whole. The National Academy of Sciences Gulf Research Program has identified community resilience and human health issues as a priority for research in its document *The Gulf Research Program: A Strategic Vision* (2014).

Table 4: Metadata fields for monitoring efforts included in the inventory

• Unique iden fica on number	• Project time frame	• Data publicly available?
• Program/monitoring name	• Program start date	• Data acquired by Ocean Conservancy?
• Program website	• Program end date	• Data stored in a database?
• Sampling method(s)	• Managing en ty	• Point of contact
• What is monitored	• Funding source(s)	• Contact email address
• Sampling frequency and schedule	• Funding future	• Contact phone number
• Parameters measured	• Data loca on	• Notes about the program
• Discon nui es (e.g., missing years)	• Spa al data collected?	
• Where sampling occurs	• Data format	

PHASE 2: IDENTIFICATION OF PRIORITY MONITORING ACTIVITIES

The second phase of Ocean Conservancy's assessment included the identification and verification of priority activities for monitoring the recovery of natural resources impacted by the BP oil disaster. The identification of recovery monitoring activities began with a literature review of publications relevant to the BP oil disaster or specific resource categories for recommendations pertaining to long-term monitoring needs. Peer-reviewed research papers on oil disaster impacts and NRDA Trustee reports were particularly helpful. An attempt was made to identify the highest data collection priorities to guide decision-makers and avoid a lengthy list of priorities. Where applicable, relevant species or geographic areas were included for each priority to highlight resources for which there is evidence of injury, and therefore, the need for long-term monitoring is more urgent.

Following the literature review, Ocean Conservancy consulted subject matter experts either through email or phone interviews, asking them to verify the monitoring priorities on a resource-by-resource basis. Each expert confirmed whether a given priority was indeed an important data collection or research activity for assessing post-BP oil disaster resource condition and recovery. Experts were given the opportunity to add priorities and any relevant species they thought were important and missing from the list. Ocean Conservancy approached a minimum of two expert reviewers per resource category. Expert input was incorporated and priorities were revised or synthesized further to improve clarity and avoid duplication. The result was a list of resource-specific monitoring priorities that could then be cross-referenced with the inventory of eligible efforts for determining gaps in coverage (See Appendix B for expanded priorities).

PHASE 3: ANALYSIS OF GAPS IN MONITORING COVERAGE

The third phase of Ocean Conservancy's assessment determined whether, and to what extent, the long-term monitoring priorities identified in phase two could be met through efforts documented in the inventory. Approximately 400 entries in the inventory were used in the analysis because they met the definition of an eligible or principal monitoring effort. The goal was to highlight the most significant gaps in broad coverage at the regional level, and not produce an exhaustive list of high-resolution, localized gaps. Three categories of coverage were analyzed with respect to each monitoring priority: 1) priority species, 2) space and 3) time. The objective of the analysis was to determine whether an existing effort provided the relevant data needed to supplement tracking recovery of a particular resource category during critical times of the year (e.g., migration, spawning) across the U.S. Gulf.

A deviation from this approach involved the assessment of monitoring programs for ecosystem drivers. The physical aspects of the marine ecosystem do not lend themselves to identification of gaps in the same manner as the NRDA injury categories for living marine resources or habitats. Therefore the assessment of gaps in species, geography and time did not apply. Instead we approached the assessment of ecosystem drivers by summarizing the types of monitoring programs that exist and described a select few high-level gaps. In describing the general gaps in the observation system for monitoring broad-scale ecosystem drivers we relied on input from the Gulf Coastal and Ocean Observing System, specifically the build-out plan: *A Sustained, Integrated Ocean Observing System for the Gulf of Mexico (GCOOS): Infrastructure for Decision Making* (2014). This plan describes the needs for an enhanced observing system to meet societal goals beyond the capabilities of the system in existence today.

Interpreting Gaps

Gaps in monitoring coverage are based on an interpretation of monitoring needs and existing coverage, and should be considered proxies for the adequacy of coverage. However, a gap is not a prescription for what type, where or how frequently monitoring should occur. Ultimately, decision-makers will need to consider many factors, including which gaps are important to fill and to what degree monitoring needs to be enhanced, in developing a monitoring program that is representative and statistically valid to assess the status and trends for a resource category, species or habitat. In addition, it is possible that the analysis overstated gaps in coverage or identified gaps that do not exist in reality due to missing monitoring efforts.

Gap Definition Guidelines

Ocean Conservancy staff prepared guidelines (Table 5) to help ensure the gap categories (priority species, space, and time) and degrees of gaps (full, partial or no gap) were defined clearly and could be applied consistently across resource categories. In many cases, the difference between gap categories is nuanced and required a judgement call based on input from experts and a review of published reports and papers. The intent of defining gaps is to provide a high-level assessment of monitoring associated with each priority.

Table 5: Gap definition guidelines

<table>
<tr><th colspan="3">PRIORITY SPECIES</th></tr>
<tr><td colspan="3">Identified as priorities because of exposure to hydrocarbons/dispersants or evidence of injury, as identified by experts or in publicaons.</td></tr>
<tr><th>Full Gap</th><th>Partial Gap</th><th>No Gap</th></tr>
<tr>
<td>Primary criterion: One or more of the priority species are not sampled by monitoring. (The full gap is assigned to the “priority species” category, not the full resource category.)
Note: Monitoring coverage of non-priority species was not within the parameters of this category for analysis.

Hypothec al example: A full gap would apply when monitoring abundance of a priority marine fish species, or suite of priority marine fish species, is not associated with any exis ng program, and therefore no coverage exists for the species of concern.</td>
<td>Primary criterion: Monitoring exists for all priority species, but may be too limited for assessing status and trends.

Hypothe cal example: Monitoring abundance of a priority marine fish species, or suite of priority marine fish, occurs under existing program(s), but the coverage is insufficient to meet the priority needs (based on reports, personal communication with subject ma er experts, review of literature or professional opinion of Ocean Conservancy staff).</td>
<td>Primary criterion: Priority species are sampled, or suscep ble to sampling. Exis ng monitoring sufficiently addresses needs of understanding priority species.

Hypothe cal example: Monitoring abundance of a priority marine fish species, or suite of priority marine fish, occurs under an existing program(s) such that sufficient data are available to sasf y the monitoring priority.</td>
</tr>
</table>

Table 5: Gap definition guidelines (continued)

SPACE

Applies not only to the identified priority species or areas but the full resource category.

Full Gap

Primary criteria: Any situation in which at least one of the primary criteria is met:

1. No sustained monitoring exists for an important area.
2. Status and trend assessment is not possible for that area.

Hypothec al example: *Monitoring sea turtle nesting success is not conducted at beaches throughout the U.S. Gulf.*

Partial Gap

Primary criteria: Any situation in which at least one of the primary criteria is met:

1. Sustained monitoring exists but does not meet the full needs of addressing the specific monitoring priority or is determined to be geographically limited.
2. Monitoring exists but may be too limited for assessing status and trends.

Hypothec al example: *Monitoring sea turtle nesting success is conducted at key beaches throughout the U.S. Gulf, but insufficient data are collected, or not enough beaches are sampled to obtain data needed for status and trends assessments.*

No Gap

Primary criteria: Any situation in which at least one of the primary criteria is met:

1. Monitoring appears sufficient for assessing status and trends.
2. Monitoring represents a system of sen nel sites, designed for that purpose.

Note: Sustained monitoring exists in areas needed to adequately assess long-term status and trends of the priority species or habitat (e.g., appropriate sentinel sites are established that are intended to represent similar communities or species across the full range of occurrence, with the understanding that the sampling design was specifically created to support the needs of sentinel site assessment).

Hypothec al example: *Monitoring sea turtle nesting success is conducted at a sufficient number of geographically stra fied key beaches throughout the U.S. Gulf to track status and trends.*

Table 5: Gap definition guidelines (continued)

TIME

Addresses time and seasonality of existing surveys; focus of gap analysis is on existing surveys only.

Full Gap

Primary criteria: Any situation in which at least one of the primary criteria is met:

1. Sustained sampling is no longer acv e.
2. Important seasonality is missed from current sampling.
3. Complete life stage missed that is crucial for understanding the success of restoration during current sampling.

Hypothec al example: *Monitoring sea turtle nes ng success is not possible because data are not collected during sea turtle nesting season under an existing program, regardless of species.*

Partial Gap

Primary criteria: Any situation in which at least one of the primary criteria is met:

1. Sustained sampling is limited for a given season, or important trends in seasonality are missed from current sampling.
2. Sustained sampling is limited for a given life stage.
3. Inter-year intervals exist between sampling efforts, creating disconn-uities in data time series.

Addi onal criterion: Situa ons in which species or habitats are monitored, but not all seasons or times are sufficient as determined by reports, subject ma er expert personal communication, litera-ture or professional opinion of Ocean Conservancy staff.

Hypothec al example: *Monitoring sea turtle nesting success is conducted, but is limited because sampling only occurs during part of the nes ng season, or sampling is conducted too irregularly from year to year to idenf y clear trends.*

No Gap

Primary criteria: Any situation in which at least one of the primary criteria is met:

1. Sustained monitoring documents all important life stages and/or seasons of the resource category needed for status and trend assessment.
2. Monitoring sufficiently addresses needs of understanding the specific monitoring priority.

Hypothec al example: *Monitoring sea turtle nesting success is conducted on all key nes ng beaches consistently each year such that data are available for idenf ying status and trends.*

Literature Cited (METHODS)

Deepwater Horizon Trustee Council. (2012). *Natural resource damage assessment April 2012 status update for the* Deepwater Horizon *oil spill*. Retrieved from http://www.gulfspill restoration.noaa.gov/wp-content/uploads/FINAL_NRDA_Status Update_ April2012.pdf

Gulf of Mexico Alliance Water Quality Team. (2013). *White paper on Gulf of Mexico water-quality monitoring: Providing water-quality information to support informed resource management and public knowledge.* Retrieved from http://www.gulfofmexicoalliance.org/projects/files/goma _gulf_monitoring_white_paper.pdf

Gulf of Mexico Coastal Ocean Observing System. (2014). *Gulf of Mexico coastal ocean observing system version 2.0: A sustained, integrated ocean observing system for the Gulf of Mexico (GCOOS): Infrastructure for decision-making.* College Station, TX: Author.

National Academy of Sciences. (2014). *The Gulf Research Program: A strategic vision.* Washington, DC: The National Academies Press.

American oystercatcher, Florida Gulf Coast

APPENDIX B: EXPANDED PRIORITY TABLES

Included in Appendix B are the long-term monitoring and research needs identified through our literature and expert review processes. Some of these priorities were further synthesized or combined during our internal and expert review process to avoid duplication or improve clarity of the priority.

Ecosystem Drivers [1]	
Monitoring/Research Priority	Priority Species or Area
Sea level across the Gulf; currents, salinity, acidity (pH), dissolved oxygen and temperature with depth from nearshore to offshore waters	No priority species or areas were idenfied f or ecosystem drivers because of their range of influence.
The volume and concentraons of nutrien ts, sediment, organic ma er and freshwater in the discharge of the Mississippi and other major rivers	No priority species or areas were idenfied f or ecosystem drivers because of their range of influence.
Primary producon (c arbon fixaon and dissolv ed oxygen concentraons) on shelf and offshore	No priority species or areas were idenfied f or ecosystem drivers because of their range of influence.
Wind events across the shelf cric al in transporng lar vae or juvenile crabs, shrimp and fish into estuaries, and basin-scale ocean circulaon lik e the intensity of the Loop Current and its eddies	No priority species or areas were idenfied f or ecosystem drivers because of their range of influence.
Abundances of keystone species, such as apex predators, keystone forage fishes, and habitat engineers, which help organize ocean and coastal ecosystems (The gap analyses for the 12 natural resource categories address this priority, so it is not included in the ecosystem drivers secon.)	No priority species or areas were idenfied f or ecosystem drivers because of their range of influence.

Deep-water Communities [2,3,4,5,6,7,8,9,10,11]	
Monitoring/Research Priority	Priority Species or Area
Monitor deep-water habitat use by mobile fauna including larger fish species	Contaminated deep-water seafloor communies
Map the distribuon, s tructure and condion of deep-w ater communies	Contaminated deep-water seafloor communies
Establish long-term monitoring studies of deep-water communies t o further understand the vulnerability and recovery trajectories of these communies t o/from disturbance including exposure to petroleum hydrocarbons	Contaminated deep-water seafloor communies
Monitor deep-sea microbial community structure to understand the fate and effect of dispersant compounds in the environment	Contaminated deep-water seafloor communies

Water Column and Invertebrates [3,12,13]

Monitoring/Research Priority	Priority Species or Area
Mesopelagic and bathypelagic community composion a t index sites near depth zone of well blowout	Whole community study
Zooplankton densies in oil disas ter impact zone to detect changes in base of food chain as indicator of recovering marine fish populaons	Copepods, chaetoganths, decapods, ostracods, and amphipods and include whole community enumeraon of samples
Monitor mysid and copepod species composion in ar eas of suspected oiling and test individuals for chronic hydrocarbon exposure as a bioindicator of residual oil and a proxy for the recovery of predatory fish species	Nearshore: Mysid shrimp and copepods; Offshore: Copepods
Densies of g elanous z ooplankton and water column feeders	Shelf/off-shelf: Jellyfish, larvaceans, doliolids, salps and squid

Birds [3,6,10,13,14,15,16,17]

Monitoring/Research Priority	Priority Species or Area
Monitor avian species spaal use of habit at types to understand the importance of specific habitats to local bird populaons	Common loon, American white pelican, brown pelican, royal tern, black skimmer, laughing gull and northern gannet
Idenfy species-specific s tressors, develop measures of health (e.g., producvity) and g ather informaon on s tressors and the health of individuals and populaons (especially f or those species affected by the BP oil disaster or oil and gas acvies or those tha t are of conservaon concern)	Common loon, American white pelican, brown pelican, royal tern, black skimmer, laughing gull and northern gannet
Monitor abundance, density and distribuon of bir d populaons impact ed by the BP oil disaster	Common loon, American white pelican, brown pelican, royal tern, black skimmer, laughing gull and northern gannet
Idenfy and monit or key ecosystem variables (e.g., prey density, availability of roost sites and distance among high quality sites), ecosystem drivers and their respecv e impacts on avian populaons and species' habit at use of the region	Common loon, American white pelican, brown pelican, royal tern, black skimmer, laughing gull and northern gannet
Maximize integraon of monit oring projects; develop and implement standardized regional monitoring protocols and integrate into a centralized, publicly accessible database to monitor coastal bird populaons (Iden fy oper aons and manag ement responsibility of the database)	Not a monitoring priority, but an overarching need

Appendix B: Detail of monitoring priorities (continued)

Marine Mammals [18,19,20,21,22,23,24,25,26]	
Monitoring/Research Priority	Priority Species or Area
Observe and assess stranded mammals to collect complete life history informaon (morphometrics, body condion, r eproducv e status, age, stock ID, stomach contents) and to determine mortality and injury rates, likely cause of death, overall health (including immune funcon, hormone lev els, evidence of disease, exposure to toxins, etc.)	Primarily nearshore bolenose dolphins, other marine mammal species when they strand
Monitor abundance and distribuon of marine mammal s tocks in nearshore (coastal and bay/sound/estuary) waters (<200m)	Bolenose dolphins, A tlanc spo ed dolphins, Bryde's whales
Monitor abundance and distribuon of marine mammal s tocks in offshore waters (>200m)	Sperm whales, beaked whales, pelagic delphinids
Determine stock structure of marine mammal populaons	Bay/sound/estuary bolenose dolphins, Bry de's whales, sperm whales
Assess populaon demogr aphics and reproducv e rates (by monitoring and tracking mother/calf pairs)	Bay/sound/estuary and coastal bolenose dolphins
Assess habitat use (and potenal vulner ability to various natural and human-caused acvies) by monitoring diving and foraging behavior, habitat associaons and c orrelaons with other oceanographic factors	Bolenose dolphins, sperm whales, Bry de's whales
Monitor interacons and inciden tal bycatch in U.S. Gulf commercial and recreaonal fisheries, with an emphasis on the commercial shrimp trawl fishery and the recreaonal hook -and-line fishery	Bolenose dolphins (w estern coastal and northern coastal stocks in bay/sound/estuary stocks throughout the Gulf)
Contribute data to regional (Gulf of Mexico) database(s) such as the Gulf of Mexico Dolphin Idenfic aon S ystem established for fin-based photo-idenfic aon of marine mammals	Not a gap analysis priority, but an overall need

Marine Fish [3,27,28,29,30,31,32]	
Monitoring/Research Priority	Priority Species or Area
Collect samples of fish, including eggs, larvae and adults, and conduct toxicity tesng b y analyzing liver and bile, as well as whole body samples, for PAH metabolites as an indicator of chronic PAH exposure and determine effects of that exposure	Bo om-dwelling shelf fishes, including reef fish (e.g., snappers and groupers), sciaenids, mahi, Gulf menhaden, flounders, Gulf killifish
Monitor changes in movement or migratory behavior and life history parameters such as fish condion (e. g., deformies), gr owth rates and related survivorship, and reproducv e impairment	Tunas, amberjack, swordfish, mahi, cobia, billfish, red snapper, tripletail, king mackerel, Spanish mackerel
Nearshore and offshore fishery-independent sampling of larvae, juveniles and adults to detect persistent differences in fish populaon dynamics, fish c ommunity structure or trophic effects of the BP oil disaster	Bluefin tuna, billfishes, mahi, reef fish, Gulf menhaden in 0 year class, silversides, anchovies
Conduct regional mapping to idenfy and delinea te benthic habitats which serve as nursery grounds or essenal fish habit at that may have been impacted by oil/dispersants	Natural reef, corals, oyster reef, submerged aquac vegetaon

Sea Turtles [3,33,34,35,36,37]

Monitoring/Research Priority	Priority Species or Area
Connue or e xpand efforts at nesng beaches t o collect data on reproducv e or demographic parameters, such as number of nests, clutch size, length of incubaon, emer gence success, nesng success and ha tchling sex raos, t o assess long-term declines in populaons	Kemp's ridley
Monitor neophyte (first-me) nes ters and measure proporon of neoph ytes to returning nesters to measure adult recruitment idenfied b y body and clutch size, hatching success, and tag returns	Kemp's ridley
Assess potenal e xposure and effects of oil disaster on nesng f emales, their nests and their eggs by tagging females for post- and inter-nesng dis tribuon in formaon, chemic al and toxicological analysis of embryo mortalies and ha tchling ssue and sur vival rates	Kemp's ridley, loggerhead
Idenfy import ant marine foraging, breeding and inter-nesng habit ats and determine migratory pathways among foraging grounds and between foraging grounds and nesng beaches	Kemp's ridley, loggerhead
Design and implement stas c ally valid monitoring programs in all federal and state fisheries that have potenal t o interact with sea turtles, and quanfy the impact of those acvies on the species; monitor incidental take from U.S. and Mexico fisheries	Kemp's ridley, loggerhead

Nearshore Sediments and Associated Resources [3,30,38,39,40,41]

Monitoring/Research Priority	Priority Species or Area
Monitor the presence/absence and concentraons of h ydrocarbons associated with the BP oil disaster in sediments collected from nearshore subdal ar eas for comparison to baseline data	Areas impacted by hydrocarbons associated with the BP oil disaster
Monitor the density, abundance, biomass and benthic species associated with nearshore sediments/communies and dev elop an index of bioc in tegrity or a mulv ariate approach to measure community impacts of petroleum exposure	Areas impacted by hydrocarbons associated with the BP oil disaster and comparable unoiled areas
Study long-term, chronic or sublethal exposure of benthic organisms to PAHs and oiled sediments, with emphasis on detecng div ergent gene expression, developmental abnormalies (e. g., cardiovascular defects in embryonic fish, delayed hatching), or physiological response (e.g., compromised immunological, life history traits)	Coastal fishes, white shrimp, brown shrimp, blue crabs

Appendix B: Detail of monitoring priorities (continued)

Oysters [6,9,42,43,44]	
Monitoring/Research Priority	Priority Species or Area
Map the distribuon and area of oyster reefs Gulf-wide to be er manage for sustainable fisheries, reef rebuilding and restoraon (using, for example, scan sonar to conduct nearshore habitat mapping)	Oyster reefs impacted by the BP oil disaster through contaminaon or response efforts (as idenfied in the 2012 NRDA Status Update)
Consistently and rigorously monitor oyster reefs using standard performance metrics (e.g., cultch density, oyster area) to quanfy fishery and ecosystem service changes. This includes monitoring restoraon progress and effecveness at historically sampled sites, injured sites, response sites (e.g., freshwater diversions) and random sites. In many cases, this will require expanding the number of sites and number of replicate samples across monitoring efforts. Notes: 1) For metrics, start with the Basic Universal Metrics developed by Bagge et al. (2014): 1. reef areal dimensions, 2. reef height, 3. oyster density, 4. oyster size-frequency distribuon, and adapt or add addional parameters (e.g., cultch density, oyster abundance) as necessary. 2) A determinaon of the error of esmaon of stock abundance should precede any determinaon of the number of sites and replicates needed. Such a determinaon would likely suggest that indeed the number of sample sites and replicates should be increased.	Oyster reefs impacted by the BP oil disaster through contaminaon or response efforts (as idenfied in the 2012 NRDA Status Update)
Monitor environmental condions (e.g., temperature, dissolved oxygen, pH and salinity) near oyster reefs (The strategic placement of automated environmental monitoring staons in oyster-growing areas is one strategy.)	Oyster reefs impacted by the BP oil disaster through contaminaon or response efforts (as idenfied in the 2012 NRDA Status Update)
Expand efforts to monitor oyster disease occurrence, frequency and distribuon Gulf-wide and consistently (A Gulf-wide oyster disease monitoring program exists [www.oystersennel.org] and should be enhanced not duplicated.)	Oyster reefs impacted by the BP oil disaster through contaminaon or response efforts (as idenfied in the 2012 NRDA Status Update)
Monitor oyster fisheries harvest	Oyster reefs impacted by the BP oil disaster through contaminaon or response efforts (as idenfied in the 2012 NRDA Status Update)

Submerged Aquatic Vegetaon [45,46,47]	
Monitoring/Research Priority	Priority Species or Area
Conduct aerial imagery surveys of submerged aquac vegetaon and perform advanced imagery analysis to produce a fine-scale submerged aquac vegetaon classificaon capable of detecng changes in submerged aquac vegetaon coverage	*Halodule wrightii, Thalassia testudinum, Syringodium filiforme, Halophila engelmannii, Halophila decipiens, Ruppia maritima*
Monitor natural recovery of seagrasses scarred by propellers of response vessels by measuring percent cover and shoot density; assess local reference sites to determine if baseline condions or background factors (e.g., poor water quality, disease) might affect recovery of injured sites	*Halodule wrightii, Thalassia testudinum, Syringodium filiforme, Halophila engelmannii, Halophila decipiens, Ruppia maritima*

Shallow- and Mid-water Corals[3,6,8,9,48,49]	
Monitoring/Research Priority	**Priority Species or Area**
Long-term datasets to help quanfy the abundance, dis tribuon, s tatus and trends of Gulf corals	Species/areas in oiled region of Gulf
Complete habitat mapping (including ground-truthing) in the Gulf of Mexico using high-resoluon ba thymetric surveys, to document and track distribuon of all c oral reefs and hard-bo om habitats Notes: 1) "Emergent rock substrate often supports 'live-bo om' communities c onsisng of spong es, hydroids, corals, and sea whips that can ar act dense fish populaons. These c ommunies, while common and widespread, are not adequately mapped to permit a detailed assessment."(NRDA Status update, 2012). 2) Habitat mapping is not the same type of repeated measurement that is referenced in the other priories. Ins tead, it is a sustained effort to map these habitats in the Gulf over a long-term period of me t o fill knowledge gaps. Repeated mapping will be required to document change in the distribuon and c ondion of ben thic communies and species assemblag es.	Species/areas in oiled region of Gulf
Monitor exisng r estoraon pr ojects and compare to results from undamaged coral reefs to learn about community processes that are important for recovery, such as coral reproducv e biology, coral recruitment, algal growth, links between coral health/habitat provision and fish populaons, r esistance to perturbaons, and c oral reef ecosystem resilience	Species/areas in oiled region of Gulf
Monitor key physical and chemical data in real and near-real me a t coral reef sites, including temperature, salinity, PAR, UV, water clarity, nutrients, and carbon dioxide, to relate environmental changes with observed responses (Jones et al., 2000), such as coral bleaching, algal blooms, and disease events	Species/areas in oiled region of Gulf
Monitor climate change and ocean acidificaon impacts on c oral at sennel sit es to establish baselines for future events or management acons	Flower Garden Banks Naonal Marine Sanctuary , Madison-Swanson MPA, Dry Tortugas Naonal P ark and Pulley Ridge HAPC

Appendix B: Detail of monitoring priorities (continued)

Shorelines [6,9,50,51]

Monitoring/Research Priority	Priority Species or Area
Monitor shoreline posion and f orm by measuring shoreline erosion, accreon, sub sidence and sediment elevaon t able	Oiled/impacted areas from SCAT maps
Monitor vegetav e communities (e. g., composion, abundance, div ersity and producvity of shoreline plant communities)	Forested and herbaceous wetland vegetaon species
Monitor spaal in tegrity of shoreline habitats to understand changes in habitat distribuon, landscape habitat size and type, fragmentaon, c onnecvity , and relav e locaon	Wetlands, uplands, ridges and barrier islands
Document changes in soil condion (e. g., organic ma er content and biogeochemical processes including the fate of PAHs)	Oiled/impacted areas from SCAT maps
Monitor addional (non- BP oil disaster) shoreline stressors that could impact rates of recovery, such as sea level rise, wave energy and the fate and transport of sediment	Oiled/impacted areas from SCAT maps
Monitor interdal in vertebrates for abundance, size distribuons and pr esence of contaminants (PAH concentraon) as a biologic al indicator of coastal polluon	Coquina clams

Terrestrial Species [52,53,54,55,56]

Monitoring/Research Priority	Priority Species or Area
Monitor the occurrence, extent and severity of disturbance or diminishment of habitat from oil disaster response acvies or r estoraon acons, specific ally, habitats that are currently or potenally occupied b y injured terrestrial species (e.g., diamondback terrapin, American alligator and beach mice species) (This priority is addressed under “shorelines,” so not included in the Terrestrial Species gap analysis)	Beach mice species, American alligator, diamondback terrapin
Gather long-term observaons t o understand demography, distribuon and habit at use of injured terrestrial species	Beach mice species, American alligator, diamondback terrapin
Monitor habitat changes (e.g., salinity changes from diversions), map and incorporate changes into management plans (This priority is addressed under “Shorelines,” so not included in the Terrestrial Species gap analysis)	Beach mice species, American alligator, diamondback terrapin
Monitor alligator populaons and the number of individuals har vested annually during the nuisance alligator season, as well as sex and size of harvested individuals	American alligator
Monitor long-term status and trends of terrestrial arthropod populaons in oiled mar shes	Ants, crickets and spiders

Literature Review (MONITORING PRIORITIES)

1. Spies, R. (2015). Driver priorities. [Personal communication]. Little River, CA: Applied Marine Sciences.

2. Montagna, P. A., Baguley, J. G., Cooksey, C., Hartwell, I., Hyde, L. J., Hyland, J. L., Kalke, R. D., Kracker, L. M., Reuscher, M., & Rhodes, A. C. E. (2013). Deep-sea benthic footprint of the *Deepwater Horizon* blowout. *PLoS ONE, 8*(8), e70540.

3. *Deepwater Horizon* Trustee Council. (2012). *Natural Resource Damage Assessment April 2012 status update for the* Deepwater Horizon *oil spill*. Retrieved from http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf

4. White, H. K., Hsing, P.-Y., Cho, W., Shank, T. M., Cordes, E. E., Quattrini, A. M., Nelson, R. K., Camilli, R., Demopoulos, A. W. J., German, C. R., Brooks, J. M., Roberts, H., Shedd, W., Reddy, C. M., & Fisher, C. R. (2012). Impact of the *Deepwater Horizon* oil spill on a deep-water coral community in the Gulf of Mexico. *Proceedings of the National Academy of Sciences, 109*(50), 20303-20308.

5. Continental Shelf Associates International, Inc. (2007). *Characterization of northern Gulf of Mexico deep-water hard bottom communities with emphasis on* Lophelia *coral.* (U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2007-044).

6. Gulf of Mexico Coastal Ocean Observing System. (2014). *Gulf of Mexico coastal ocean observing system version 2.0: A sustained, integrated ocean observing system for the Gulf of Mexico (GCOOS): Infrastructure for decision-making.* College Station, TX: Author.

7. Fisher, C., Roberts, H., Cordes, E., & Bernard, B. (2007). Cold seeps and associated communities of the Gulf of Mexico. *Oceanography, 20*(4), 118-129.

8. Brown, C., Andrews, K., Brenner, J., Tunnell, J. W., Canfield, C., Dorsett, C., Driscoll, M., Johnson, E., & Kaderka, S. (2011). *Strategy for restoring the Gulf of Mexico (A cooperative NGO report).* Arlington, VA: The Nature Conservancy.

9. Gulf Coast Ecosystem Restoration Task Force. (2011). *Gulf of Mexico regional ecosystem restoration strategy.* Retrieved from http://restoreactscience program.noaa.gov/wp-content/ uploads/2015/08/GOM-Reg-Eco-Restoration-Strategy-2011.pdf

10. Gulf of Mexico University Research Collaborative, Ocean Conservancy, & Florida Institute of Oceanography. (2012). *Marine restoration priorities and science principles: Results of the expert panel workshop in St. Petersburg, Florida on April 24-25, 2012.* St. Petersburg, FL: Authors.

11. Peterson, C. H., Coleman, F. C., Jackson, J. B. C., Turner, R. E., Rowe, G. T., Barber, R. T., Bjorndal, K. A., Carney, R. S., Cowen, R. K., Hoekstra, J. M., Hollibaugh, J. T., Laska, S. B., Luettich Jr., R. A., Osenberg, C. W., Roady, S. E., Senner, S., Teal, J. M., & Wang, P. (2011). *A once and future Gulf of Mexico ecosystem: Restoration recommendations of an expert working group.* Washington, DC: Pew Environment Group.

12. Hemmer, M. J., Barron, M. G., & Greene, R. M. (2011). Comparative toxicity of eight oil dispersants, Louisiana sweet crude oil (LSC), and chemically dispersed LSC to two aquatic test species. *Environmental Toxicology and Chemistry, 30*(10), 2244-2252.

13. Hunter, W. C., Golder, W., Melvin, S., & Wheeler, J. (2006). *Southeast United States regional waterbird conservation plan.* Retrieved from http://www.waterbirdconservation.org/pdfs/regional/seusplanfinal906.pdf

14. Gulf of Mexico Bird Monitoring SDM Working Group. (unpublished). *Structured Decision Process to Articulate and Coordinate Bird-Habitat Monitoring across the Gulf of Mexico. Draft technical report.*

15. Haney, J. C., Geiger, H. J., & Short, J. W. (2014). Bird mortality from the *Deepwater Horizon* oil spill. I: Exposure probability in the offshore Gulf of Mexico. *Marine Ecological Progress Series, 513*, 225-237.

16. Haney, J. C., Geiger, H. J., & Short, J. W. (2014). Bird mortality from the *Deepwater Horizon* oil spill. II. Carcass sampling and exposure probability in the coastal Gulf of Mexico. *Marine Ecological Progress Series, 513*, 239-252.

17. Brown, S., Hickey, C., Harrington, B., & Gill, R. (Eds.). (2001). *The U.S. shorebird conservation plan, second edition*. Manomet, MA: Manomet Center for Conservation Sciences.

18. Marine Mammal Commission. (2011). *Assessing the long-term effects of the BP* Deepwater Horizon *oil spill on marine mammals in the Gulf of Mexico: A statement of research needs*. Bethesda, MD: Author.

19. Williams, R., Gero, S., Bejder, L., Calambokidis, J., Kraus, S. D., Lusseau, D., Read, A. J., & Robbins, J. (2011). Underestimating the damage: Interpreting cetacean carcass recoveries in the context of the *Deepwater Horizon*/BP incident. *Conservation Letters, 4*(3), 228-233.

20. Peltier, H., Dabin, W., Daniel, P., Canneyt, O. V., Dorémus, G., Huon, M., & Ridoux, V. (2012). The significance of stranding data as indicators of cetacean populations at sea: Modelling the drift of cetacean carcasses. *Ecological Indicators, 18,* 278-290.

21. Vollmer, N. L., & Rosel, P. E. (2013). A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the northern Gulf of Mexico: Population biology, potential threats, and management. *Southeastern Naturalist, 12*(6), 1-43.

22. Rice, A. N., Palmer, K. J., Tielens, J. T., Muirhead, C. A., & Clark, C. W. (2014). Potential Bryde's whale (*Balaenoptera edeni*) calls recorded in the northern Gulf of Mexico. *Journal of the Acoustical Society of America, 135*(5), 3066-3076.

23. Rosel, P. E., & Wilcox, L. A. (2014). Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico. *Endangered Species Research, 25*, 19-34.

24. Soldevilla, M. S., Garrison, L. P., Scott-Denton, E., & Nance, J. M. (2015). *Estimation of marine mammal bycatch mortality in the Gulf of Mexico shrimp otter trawl fishery.* (NOAA Technical Memor-andum NMFS-SEFSC-672). Miami, FL: Southeast Fisheries Science Center.

25. Phillips, N. M. & Rosel, P. E. (2014). *A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: Development and application to bay, sound and estuary stocks in Texas.* (NOAA Technical Memorandum NMFS-SEFSC-665). Lafayette, LA: Southeast Fisheries Science Center.

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

27. Jewett, S. C., Dean, T. A., Woodin, B. R., Hoberg, M. K., & Stegeman, J. J. (2000). *Exposure to hydrocarbons ten years after the* Exxon Valdez *oil spill: Evidence from cytochrome P4501A expression and biliary FACs in nearshore demersal fishes.* (Restoration project 99379 final report to the Alaska Department of Fish and Game). Retrieved from http://www.arlis.org/docs/vol1/48689429.pdf

28. Murawski, S. A., Hogarth, W. T., Peebles, E. B., & Barbeiri, L. (2014). Prevalence of external skin lesions and polycyclic aromatic hydrocarbon concentrations in Gulf of Mexico fishes, post-*Deepwater Horizon*. *Transactions of the American Fisheries Society, 143*(4), 1084-1097.

29. Peterson, C. H., Rice, S. D., Short, J. W., Esler, D., Bodkin, J. L., Ballachey, B. E., & Irons, D. B. (2003). Long-term ecosystem response to the *Exxon Valdez* oil spill. *Science, 302*, 2082-2086.

30. Fodrie, F. J., Heck, K. L., & Bograd, S. J. (2011). Response of coastal fishes to the Gulf of Mexico oil disaster. *PLoS ONE, 6*(7), e21609.

31. Incardona, J. P., Gardner, L. D., Linbo, T. L., Brown, T. L., Esbaugh, A. J., Mager, E. M., Stieglitz, J. D., French, B. L., Labenia, J. S., Laetz, C. A., Tagal, M., Sloan, C. A., Elizur, A., Benetti, D. D., Grosell, M., Block, B. A., & Scholz, N. L. (2013). *Deepwater Horizon* crude oil impacts the developing

hearts of large predatory pelagic fish. *Proceedings of the National Academy of Sciences, 111*(15), E1510-E1518.

32. Atlantic Bluefin Tuna Status Review Team. (2011). *Status review report of Atlantic bluefin tuna (*Thunnus thynnus*)*. Retrieved from http://www.nmfs.noaa.gov/ stories/ 2011/05/docs/ bft_srr_final.pdf

33. National Marine Fisheries Service. (2013). *Biological report on the designation of marine critical habitat for the loggerhead sea turtle,* Caretta caretta. Silver Spring, MD: Author.

34. Lamont, M. M., Carthy, R. R., & Fujisaki, I. (2012). Declining reproductive parameters highlight conservation needs of loggerhead turtles (*Caretta caretta*) in the northern Gulf of Mexico. *Chelonian Conservation and Biology, 11*(2), 190-196.

35. National Marine Fisheries Service, U.S. Fish and Wildlife Service, & Secretaría de Medio Ambiente y Recursos Naturales. (2010). *Bi-national recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*), second revision*. Silver Spring, MD: Author.

36. Gallaway, B. J., Caillouet Jr., C. W., Plotkin, P. T., Gazey, W. J., Cole, J. G., & Raborn, S. W. (2013). *Kemp's ridley stock assessment project*. Ocean Springs, MS: Gulf States Marine Fisheries Commission.

37. Bjorndal, K. A., Bowen, B. W., Chaloupka, M., Crowder, L. B., Heppell, S. S., Jones, C. M., Lutcavage, M. E., Policansky, D., Solow, A.R., & Witherington, B. E. (2011). Better science needed for restoration in the Gulf of Mexico. *Science, 331*, (6017), 537-538.

38. Dubansky, B., Whitehead, A., Miller, J., Rice, C. D., & Galvez, F. (2013). Multi-tissue molecular, genomic, and developmental effects of the *Deepwater Horizon* oil spill on resident Gulf killifish (*Fundulus grandis*). *Environmental Science and Technology, 47*(10), 5074-5082.

39. van der Ham J. L., & de Mutsert, K. (2014) Abundance and size of Gulf shrimp in Louisiana's coastal estuaries following the *Deepwater Horizon* oil spill. *PLoS ONE, 9*(10), e108884.

40. *Exxon Valdez* Oil Spill Trustee Council. (1994). Exxon Valdez *oil spill restoration plan*. Anchorage, AK: Author.

41. *Deepwater Horizon* Trustee Council. (2010). *Addendum to the pre-assessment phase water sampling plan: Pre-assessment phase sediment sampling for NRDA purposes in Louisiana.* Retrieved from http:// www.gulfspillrestoration .noaa.gov/wp-content/uploads/2011/02/ 2010_11_09_SEDIMENT_Pre-Assess-ment_Water_Sampling_Addendum. redacted.pdf

42. Beck, M. W., Brumbaugh, R. D., Airoldi, L., Carranza, A., Coen, L. D., Crawford, C., Defeo, O., Edgar, G. J., Hancock, B., Kay, M., Lenihan, H., Luckenbach, M. W., Toropova, C. L., & Zhang, G. (2009). *Shellfish reefs at risk: A global analysis of problems and solutions*. Arlington, VA: The Nature Conservancy.

43. Baggett, L. P., Powers, S. P., Brumbaugh, R., Coen, L. D., DeAngelis, B., Greene, J., Hancock, B., & Morlock, S. (2014). *Oyster habitat restoration monitoring and assessment handbook.* Arlington, VA: The Nature Conservancy.

44. La Peyre, M., Furlong, J., Brown, L. A., Piazza, B. P., & Brown, K. (2014). Oyster reef restoration in the northern Gulf of Mexico: Extent, methods and outcomes. *Ocean & Coastal Management, 89*, 20-28.

45. *Deepwater Horizon* Trustee Council. (2013). *Mississippi Canyon 252 assessment plan concerning aerial imagery in the northern Gulf of Mexico.* Retrieved from http://www. gulfspillrestoration.noaa.gov/wp-content/uploads/2013_03_15_AERIAL _Aerial_Imagery_Assessment_ Work_Plan_FINAL.pdf

46. DiDonato, E. (2012). Deepwater Horizon/ *Mississippi Canyon 252 oil spill plan for assessing recovery of submerged aquatic vegetation propeller scars at Gulf Islands National Seashore*. Fort Collins, CO: National Park Service, Water Resources Division.

47. Bourgeois, R. P., Floyd, M., Carter, J., & Ward, S. (2011). *Natural Resource Damage Assessment work plan for assessing potential impacts to fresh and brackish water submerged aquatic vegetation communities from the* Deepwater Horizon *(MC 252) oil spill*. Retrieved from http://www.gulfspill

restoration.noaa.gov/wp-content/uploads/2011/04/2011_01_20_SAV_Freshwater_Brackish_Water_Plan_LA.redacted2.pdf

48. Puglise, K. A., & Kelty, R. (Eds.). (2007). *NOAA coral reef ecosystem research plan for fiscal years 2007 to 2011.* (NOAA Technical Memorandum CRCP 1). Silver Spring, MD: NOAA Coral Reef Conservation Program.

49. National Oceanic and Atmospheric Administration. (2012). *Flower Garden Banks National Marine Sanctuary final management plan.* Silver Spring, MD: Author.

50. Snyder, R. A., Vestal, A., Welch, C., Barnes, G., Pelot, R., Ederington-Hagy, M., & Hileman, F. (2014). PAH concentrations in coquina (*Donax* spp.) on a sandy beach shoreline impacted by a marine oil spill. *Marine Pollution Bulletin, 83*(1), 87-91.

51. Hijuelos, A. C., & Hemmerling, S. A. (2015). *Coastwide and Barataria Basin monitoring plans for Louisiana's System-Wide Assessment and Monitoring Program (SWAMP).* Baton Rouge, LA: The Water Institute of the Gulf.

52. Butler, J. A., Heinrich, G. L., & Seigel, R. A. (2006). Third workshop on the ecology, status and conservation of diamondback terrapins (*Malaclemys terrapin*): Results and recommendations. *Chelonian Conservation and Biology, 5*(2), 331-334.

53. Selman, W., Baccigalopi, B., & Baccigalopi, C. (2014). Distribution and abundance of diamondback terrapins (*Malachlemys terrapin*) in Southwestern Louisiana. *Chelonian Conservation and Biology, 13*(2), 131-139.

54. Louisiana Department of Wildlife and Fisheries. (2013). *Louisiana's alligator management program, 2012-2013 annual report.* Baton Rouge, LA: Author.

55. Louisiana Department of Wildlife and Fisheries Rockefeller Wildlife Refuge. *Research*. (2015, February 6). Retrieved from http://www.wlf.louisiana.gov/rockefeller/research

56. Hooper-Bui, L. (2013). *Putting the canary back in the coal mine: Crickets and ants in salt marshes post-Macondo blowout.* Proceedings from 2013 Gulf of Mexico Oil Spill & Ecosystem Science Conference. New Orleans, LA.


Blue crab, Louisiana Gulf Coast

APPENDIX C: EXPANDED GAP DESCRIPTIONS

Deep-water Communities			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Monitor deep-water habitat use by mobile fauna including larger fish species	N/A	Full gap. No Gulf-wide efforts address this priority. Only localized monitoring of mobile fauna use of deep-water habitats is occurring. The SERPENT program opportunisc ally documents occurrences of mobile fauna near oil and gas infrastructure; however, this type of qualitav e data is not sufficient to understand status and trends of organisms.	Full gap. No sustained long-term monitoring of mobile fauna use of deep-water habitats is occurring. The SERPENT program operates opportunisc ally when ROVs are not being used for oil and gas purposes; however, this type of qualitav e data is not sufficient to understand status and trends of these organisms.
Map the distribuon, s tructure and condion of deep-w ater communies	N/A	Paral g ap. Isolated mapping efforts have documented the distribuon of some deep-w ater communities; ho wever, there is no Gulf-wide comprehensive coverage to be able to characterize the status and changes in deep-water communities.	Paral g ap. Monitoring efforts have been opportunisc and in termi ent. There have been limited opportunies t o characterize the condion of deep-water communies o ver me.
Establish long-term monitoring studies of deep-water communies t o further understand the vulnerability and recovery trajectories of these communies t o/from disturbance including exposure to petroleum hydrocarbons	N/A	Paral g ap. No Gulf-wide efforts exist to address this priority; however, there are small areas in the Gulf in which repeated monitoring of deep-water communities has occurr ed. Specific efforts have focused on sediment bacteria, small pros ts and metazoans. In addion, monit oring efforts have been inia ted post-BP oil disaster both for NRDA and other programs that will capture many priories. A t the me of public aon, man y of these studies were either not available to the public or did not span at least five years.	Full gap. No sustained long-term monitoring efforts document all deep-water communies' lif e stages or seasons.
Monitor deep-sea microbial community structure to understand the fate and effect of dispersant compounds in the environment	N/A	Full gap. No monitoring of deep-water microbial communities is occurring an ywhere in the Gulf.	Full gap. No sustained long-term monitoring of deep-water microbial communies is occurring.

Appendix C: Detail of gap explanations (continued)

Water Column and Invertebrates			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Mesopelagic and bathypelagic community composion a t index sites near depth zone of well blowout	Full gap. No monitoring of mesopelagic and bathypelagic communities.	Full gap. No monitoring at mesopelagic and bathypelagic depths.	Full gap. No monitoring at mesopelagic and bathypelagic depths.
Zooplankton densies in oil disaster impact zone to detect changes in base of food chain as indicator of recovering marine fish populaons	Paral g ap. Copepods underrepresented due to sampling gear limitaons, parcularly mesh siz e.	Paral g ap. Areas deeper than epipelagic zone (>200m depth).	Paral g ap. Less sampling during summer and winter seasons.
Monitor mysid and copepod species composion in ar eas of suspected oiling and test individuals for chronic hydrocarbon exposure as a bioindicator of residual oil and a proxy for the recovery of predatory fish species	Full gap. Copepods and mysid shrimp underrepresented due to sampling gear limitaons. No t esng of h ydrocarbon exposure in long-term efforts.	Paral g ap. Areas deeper than epipelagic zone (>200m depth) and all areas for tesng h ydrocarbon exposure through long-term efforts.	Paral g ap. Less sampling during summer and winter seasons.
Densies of g elanous zooplankton and water column feeders	Full gap. Net-based gear not opmiz ed for sampling delicate, gelanous or ganisms.	Full gap. No sampling in Gulf designed to target delicate, gelanous or ganisms.	Full gap. No sampling designed to target delicate, gelanous or ganisms.

Appendix C: Detail of gap explanations (continued)

Birds			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Monitor avian species spaal use of habitat types to understand the importance of specific habitats to local bird populaons	Full gap. No monitoring of spaal use of habitat types for priority species is occurring.	Full gap. No long-term monitoring targeng spa al use of habit at types is occurring anywhere in the Gulf.	Full gap. No long-term monitoring targeng spa al use of habit at types is occurring at any me during the y ear.
Idenfy species-specific stressors, develop measures of health (e.g., producvity) and gather informaon on s tressors and the health of individuals and populaons. (especially f or those species affected by the BP oil disaster or oil and gas acvies or those that are of conservaon concern)	Full gap. Monitoring of species-specific stressors is limited or absent for priority species. NRDA monitoring may provide this type of monitoring for priority species exposed to oil.	Paral g ap. The Florida Park Service District One shorebird surveys are the only long-term monitoring efforts that focus on species-specific stressor tracking; however, efforts cover disturbance for only five Gulf species (snowy plover, Wilson's plover, American oystercatcher, least tern and black skimmer) and do not measure indicators of health.	Paral g ap. Although very few efforts collect this type of informaon, the one that does gathers sufficient informaon t o track disturbance through all seasons for the five species (snowy plover, Wilson's plover, American oystercatcher, least tern and black skimmer) monitored.
Monitoring abundance, density, and distribuon of bir d populaons of species impact ed by the BP oil disaster	Full gap. Monitoring of northern gannet abundance, density and distribuon is not occurring, and lile f or common loons; therefore, not all priority species are monitored.	Paral g ap. Monitoring is occurring for colonial wading birds and shorebirds around the Gulf, but pelagic bird monitoring is not occurring.	No gap. Exisng monit oring of priority colonial wading birds and shorebirds is occurring, and exisng sur veys are repeated during all seasons.
Idenfy and monit or key ecosystem variables (e.g., prey density, availability of roost sites, and distance among high quality sites), ecosystem drivers and their respecv e impacts on avian populaons and species' habit at use of the region	Full gap. Monitoring of ecosystem variables and drivers is not occurring for all priority bird species.	Paral g ap. Very few monitoring efforts are targeng ec osystem variables and drivers for birds. The Monitoring Avian Producvity and Sur vivorship Program monitors songbird vital rates and environmental condions a t a few long-term sites around the Gulf, and the Everglades wading bird monitoring efforts tracks annual precipitaon tr ends in addion t o wading bird monitoring; however, these efforts are limited in spaal e xtent and across ecosystem variables.	No gap. The few programs that meet this priority do gather informaon t o track the status and trends of species and targeted ecosystem variables.

Appendix C: Detail of gap explanations (continued)

Marine Mammals			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Observe and assess stranded mammals	Paral g ap. Very limited response capacity for all species.	Paral g ap. Lowest response capacity in offshore waters as well as Texas Coastal Bend, western Louisiana, Big Bend of Florida, southeast Florida and Mexico.	Paral g ap. Volunteer response is opportunisc and v aries depending on availability of resources and trained staff.
Monitor abundance and distribuon of marine mammal stocks in nearshore (coastal and bay/sound/estuary) waters (<200m)	Paral g ap. Monitoring occurring for all priority species but is very limited, and there are no sustained efforts for species such as Atlanc spo ed dolphins when they move into offshore areas.	Paral g ap. Sustained monitoring occurs only in Sarasota Bay, Mississippi Sound and from 1992-2001 in southeast Florida.	No gap. For nearly all species assessed through currently exisng pr ograms, all seasons and life stages are potenally documented during the few currently exisng sur veys.
Monitor abundance and distribuon of marine mammal stocks in offshore waters (>200m)	Paral g ap. A majority of survey effort has been visual assessments; therefore crypc species, such as beaked whales, are historically under-represented.	Paral g ap. Data limited by detecon range of 5 exisng passiv e acousc sur vey staons in the northern Gulf and ship-based visual survey transects of SEAMAP icthyoplankton sampling in pelagic waters during 1991-2001 sampling period.	No gap. For nearly all species assessed through currently exisng pr ograms, all seasons and life stages are potenally documented during the single currently exisng sur vey.
Determine stock structure of marine mammal populaons	Full gap. Status and trends not possible for most bolenose dolphin s tocks and all Bryde's and sperm whales.	Paral g ap. Monitoring isolated to Mississippi Sound and Sarasota Bay, therefore, a Gulf-wide assessment of stock structure is not possible.	No gap. For nearly all species assessed through currently exisng pr ograms, all seasons and life stages are potenally documented during the few currently exisng sur veys.
Assess populaon demogr aphics and reproducv e rates	Paral g ap. Very limited sustained demographic monitoring.	Paral g ap. No Gulf-wide status and trends possible with lack of sustained monitoring beyond survey areas in Mississippi Sound and Sarasota Bay.	No gap. For nearly all species assessed through currently exisng pr ograms, all seasons and life stages are potenally documented during the few currently exisng sur veys.
Assess habitat use	Full gap. No sustained monitoring to assess full suite of habitats used for any species.	Full gap. No sustained monitoring to assess full suite of habitats used beyond survey areas in Mississippi Sound and Sarasota Bay.	Full gap. No sustained monitoring to assess full suite of habitats used during any season or life stage.
Monitor bycatch and interacons in U .S. Gulf commercial and recreaonal fisheries	Paral g ap. All species potenally det ected by observers on commercial fishing vessels, but no means of documenng bolenose dolphin in teracon on priv ate recreaonal fishing boa ts and for-hire vessels.	Paral g ap. Observer coverage is low across all fisheries of federal waters, lower on vessels permi ed for state waters and no coverage on private recreaonal fishing boats and for-hire vessels. Observer coverage is unknown for vessels in Mexican fishery, but expected to be lower than U.S. waters.	Paral g ap. Very limited coverage of observers on fishing vessels annually, during all seasons, and none on private vessels.

Marine Fish			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Sampling fish eggs, larvae and adults for presence of PAH metabolites and determine toxicity effects of PAH exposure*	Full gap. No status and trends possible with lack of sustained monitoring of PAH levels.	Paral g ap. There is a single effort that monitors PAH levels in coastal sharks of the north-central Gulf. There are no other known sustained surveys.	Paral g ap. No status and trends possible with lack of sustained monitoring of PAH levels.
Changes in migratory behavior and life history parameters	Paral g ap. There are no fishery independent monitoring efforts that target the pelagic priority species, with the excepon of limit ed ichthyoplankton life stage sampling. Landings data from fishery-dependent surveys supplement informaon on these species but ar e limited by inherent bias from non-random fishery selecvity .	Paral g ap. Area of lowest sustained fishery independent effort is in pelagic waters relav e to coastal bays and estuaries. Fishery dependent surveys of pelagic fishing acvity supplemen t informaon on pelagic w aters, but are limited by inherent bias from non-random fishery selecvity .	Paral g ap. No pelagic ichthyoplankton surveys in summer or shrimp/groundfish surveys in spring and summer of connen tal shelf waters.
Nearshore and offshore fishery-independent sampling of larvae, juvenile and adults to detect persistent differences in fish populaon dynamics, fish community structure or trophic effects of the oil disaster	Paral g ap. There are no monitoring efforts that target the pelagic priority species, with the excepon of limit ed ichthyoplankton life stages.	Paral g ap. Sampling is lowest in pelagic waters, with more effort in state coastal waters sampled.	Paral g ap. No pelagic ichthyoplankton surveys in summer or shrimp/groundfish surveys in spring and summer of connen tal shelf waters.
Regional mapping of nursery grounds and benthic essenal fish habitats that may have been impacted by oil/dispersants	Paral g ap. Very limited high resoluon benthic habitat mapping efforts that support more discrete delineaon of the inial mosaic of essen al fish habit at are occuring. The exisng spar se efforts target reef habitats.	Paral g ap. No sustained efforts of connen tal slope and abyssal benthic habitats. Very limited habitat mapping efforts are conducted across the connen tal shelf, targeng har d bo om reef habitats.	Paral g ap. Mapping acvies ar e occurring but they are intermi ent with limited opportunies t o provide assessment of habitat extent and condion with r epeat delineaon thr ough me.

* Toxicity effects from lab studies are required to understand impact from PAH exposure

Appendix C: Detail of gap explanations (continued)

Sea Turtles			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Connue or e xpand evaluaon efforts at nesng beaches in U .S.	No gap. Nesng acvity of all species is monitored with exisng sur veys.	Paral g ap. Data primarily derived from volunteer capacity, which depends on availability of resources and trained staff at nesng beaches.	Paral g ap. Nest surveys and evaluaons may be limited by volunteer and staff resources on nesng beaches thr oughout nesng season.
Monitor neophyte (first-me) nesters	No gap. Primary nesng beach in U .S. conducts saturaon t agging.	Paral g ap. Neophyte effort is concentrated at Padre Island Naonal Seashore, Dry Tortugas Naonal P ark, and in Florida at Keewaydin Island and Cape San Blas.	Paral g ap. Effort varies throughout nesng season a t some locaons tha t tag nesng f emales during short, discrete segments for research and monitoring projects.
Assess reproducon and potenal e xposure effects of oil	Full gap. No sustained assessment outside of NRDA.	Full gap. No sustained assessment outside of NRDA.	Full gap. No sustained assessment outside of NRDA.
Idenfy import ant foraging, breeding, inter-nesng and migratory habitats	No gap. Exisng e fforts monitor both priority species.	Paral g ap. Assessment is limited to nesng f emales from 2 Texas beaches and 3 Florida beaches, and in-water areas from 5 Florida sites, 1 Alabama site and another in Mississippi.	Paral g ap. There is much less tagging effort outside of nesng season f or tracking habitat use.
Monitor incidental take from U.S. and Mexico fisheries	No gap. All species potenally det ected by observers on fishing vessels or from fishery surveys.	Paral g ap. Observer coverage is low across all fisheries of federal waters, lower on vessels permi ed for state waters and no coverage on private recreaonal fishing boats and for-hire vessels. Observer coverage is unknown for vessels in Mexican fishery, but expected to be lower than U.S. waters.	Paral g ap. Very limited coverage of observers on fishing vessels annually, during all seasons.

Nearshore Sediments and Associated Resources			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Hydrocarbons in sediments collected from nearshore subdal ar eas for comparison to baseline data	N/A	Paral g ap. The sampling locaons ar e very sparse across the northern Gulf.	Paral g ap. Most sediment toxicity monitoring programs have been downscaled in recent years; others have been acv e naon wide for many years but are short-term, intensive studies at the project site level.
Monitor benthic and epibenthic species associated with nearshore sediments/ communies and dev elop mulv ariate approach to measure community impacts of hydrocarbon exposure	No gap. All benthic and epibenthic macroinvertebrate species are potenally detected in areas sampled.	No gap. All major estuaries and bays have been sampled by exisng , downscaled or terminated programs.	Paral g ap. Monitoring programs that assess benthic community assemblages either do not resample areas or the return interval is too long to track exposure from acute impacts.
Exposure of benthic organisms to PAHs and oiled sediments, with emphasis on detecng div ergent gene expression, developmental abnormalies or ph ysiological response	Full gap. No species are assessed for physiological, developmental or genec responses to hydrocarbon exposure beyond contaminant presence in bodily ssue.	Full gap. There are no monitoring efforts in the region that assess for physiological, developmental or genec r esponses to hydrocarbon exposure beyond contaminant presence in bodily ssue.	Full gap. There have not been monitoring efforts in the region that assessed for physiological, developmental or genec responses to hydrocarbon exposure beyond contaminant presence in bodily ssue.

Appendix C: Detail of gap explanations (continued)

Oysters			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Map the distribuon and ar ea of oyster reefs Gulf-wide	N/A	Paral g ap. Although mapping exists in parts of all Gulf states, there are no comprehensive and consistent mapping efforts Gulf-wide.	Paral g ap. There are gaps in consistent mapping across the Gulf due to the date and frequency with which reefs have been mapped.*
Monitor oyster reefs using standard metrics to consistently and rigorously monitor oyster reefs at historically sampled sites, injured sites, response sites and random sites	N/A	Full gap. There are no established standard monitoring metrics or protocols for oysters Gulf-wide. Some parameters, such as oyster abundance, are measured in all Gulf states; however, the methods by which measurements are made are not standardized.	Full gap. There are no sustained standardized monitoring metrics for oysters in the Gulf that capture all of these parameters. Some metrics are captured on a sustained and reoccurring schedule; however, there are no standardized metrics across programs.
Monitor environmental condions (e. g., temperature, dissolved oxygen and salinity) near oyster reefs	N/A	Paral g ap. Key environmental condions ar e not monitored across oyster sites in the Gulf. While temperature and salinity are consistently monitored at oyster sites across all Gulf states, monitoring of pH and dissolved oxygen is a gap at many known oyster sites in Louisiana, Alabama and Mississippi.	No gap. Monitoring of environmental condions occurs at least quarterly, and often more frequently at established monitoring efforts. This is sufficient to track status and trends; however, expanding monitoring to more sites based on a stas c al design would add value.
Monitor oyster disease occurrence, frequency and distribuon Gulf -wide and consistently	N/A	Paral g ap. Gaps exist across all five Gulf states for oyster disease monitoring. The oyster sennel network monitors oyster disease at 18 sites across the Gulf, and Alabama conducts fishery-independent monitoring; however, this leaves large gaps across Gulf oyster reefs. Specifically, gaps exist at impacted sites along the Louisiana coast landward of Chandeleur Sound to the Mississippi state line, coastal Mississippi outside of one site near Bay St. Louis, and in coastal Florida from Pensacola to Apalachicola.	Paral g ap. Monitoring is intermi ent and opportunisc a t established sites, which leaves gaps throughout the year and across numerous years.
Monitor oyster fisheries harvest	N/A	No gap. Oyster fisheries harvest is monitored at sites across all Gulf states.	No gap. Oyster harvest is monitored during me frames relevant to harvest and is sufficient to track the status and trends of oyster fisheries harvest.

* There are no sustained mapping efforts to map the distribution and area of oyster reefs Gulf-wide. However, once these parameters are established, the frequency with which mapping efforts will need to be repeated should be determined by the desired goals.

Submerged Aquatic Vegetaon			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Conduct aerial surveys of submerged aquac v egetaon t o detect changes in coverage.	No gap. All species are potenally surveyed by exisng aerial sur veys.	Paral g ap. Gaps in seagrass aerial surveys occur in Texas, Louisiana, Mississippi, Alabama and in Florida in the following areas: between Cape Romano and Key West, between Anclote Key and Cedar Keys, and from the Suwannee River to Alligator Point. Short-term monitoring has occurred in Texas in Corpus Chris, in Copano, Aransas, Nueces, and Redfish bays, and from Upper Laguna Madre to Lower Laguna Madre.	Paral g ap. All but one of the monitoring efforts has gaps in me. The fr equency with which monitoring should occur is based on recommendaons made b y the Florida Seagrass Integrated Mapping and Monitoring program that aerial surveys be conducted at least every six years to track status and trends of seagrass beds. The one excepon is the Sar asota Bay effort, which repeats aerial surveys every two years.
Monitor seagrass percent cover and shoot density to track natural recovery from physical damage	No gap. All seagrass species are potenally monitored by exisng per cent cover and shoot density monitoring efforts.	Paral g ap. Gaps in monitoring of seagrass cover and density occur throughout Texas and in Florida in the following areas: from Perdido Bay to Choctawhatchee Bay, in Waccasassa Bay, in the southern Springs Coast, in porons of the inshor e Ten Thousand Islands, in Volusia County, and in large areas offshore of Florida's Big Bend and the Ten Thousand Islands.	No gap. Exisng monit oring surveys are sufficient to track the status and trends of submerged aquac v egetaon ar eas.

Appendix C: Detail of gap explanations (continued)

Shallow- and Mid-water Corals			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Quanfy s tatus and trends of Gulf corals	N/A	Paral g ap. Representav e coral sites outside the Flower Garden Banks and Florida Keys naonal marine sanctuaries are not surveyed.	No gap. Exisng annual monit oring surveys at the Flower Garden Banks and Florida Keys naonal marine sanctuaries remain acv e.
High-resoluon habit at mapping to document and track distribuon of c oral and hard-bo om habitats*	N/A	Paral g ap. There are limited sustained mapping efforts to document and track coral or hard bo om habitat distribuon outside of es tablished sites in the Flower Garden Banks and Florida Keys naonal marine sanctuaries.	Paral g ap. Monitoring efforts have been opportunisc and in termi ent. There have been limited opportunies t o document and track distribuon of priority c oral communities thr ough me.
Monitor community processes at exisng r estoraon pr ojects and compare trends to undamaged coral reefs	N/A	Paral g ap. There is limited integraon of protocols for monitoring community processes across sites. Representav e coral reefs that exist outside the Flower Garden Banks and Florida Keys naonal marine sanctuaries or the marine protected area survey locaons: Madison-Swanson, Steamboat Lumps, The Edges, Twin Ridges and Northern Banks.	Paral g ap. Several long-term surveys have been terminated at potenal r eference sites: St. Joseph Bay Aquac P reserve, Pulley Ridge, Madison-Swanson, Steamboat Lumps, The Edges, Twin Ridges and Northern Banks.
Monitor full suite of key physical and chemical data to relate environmental changes with observed responses, such as coral bleaching, algal blooms and disease events	N/A	Full gap. No sustained monitoring of a full suite of key physical and chemical parameters beyond the study sites of the Flower Garden Banks and Florida Keys naonal marine sanctuaries.	Full gap. No sustained monitoring of full suite of key physical and chemical parameters beyond temperature.**
Monitor climate change and ocean acidificaon impacts on coral at sennel sit es to establish baselines for future events or management acons	N/A	Paral g ap. Very limited sustained monitoring of metrics tracking climate change and ocean acidificaon outside the Florida K eys Reef Tract. An integrated sennel sit e program does not currently exist.	Full gap. While limited biannual monitoring along the Florida Keys Reef Tract remain acv e, there is an absence of an integrated sennel sit e program to establish consistent baseline condions.

* Habitat mapping is not the same type of repeated measurement that is referenced in the other priorities. Instead, it is a sustained effort to map these habitats in the Gulf over a long-term period of time to fill knowledge gaps. Repeated mapping will be required to document change in the distribution and condition of benthic communities and species assemblages.

** Temperature is the only physical parameter measured continuously at select sites.

Shorelines			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Monitor shoreline posion and form	N/A	Paral g ap. Although elevaon and topography are monitored around the Gulf, there appear to be gaps in areas landward of barrier islands in Mississippi and Alabama and in Texas for some ecological processes (e.g., accreon and er osion).	Paral g ap. There are gaps throughout the year because exisng sus tained monitoring efforts occur annually. This monitoring schedule does not capture seasonal changes.
Monitor vegetav e communies	No gap. Exisng monit oring programs monitor both forested and herbaceous wetland vegetaon species.	Paral g ap. Gaps in monitoring occur along the coasts of Texas, Mississippi, Alabama east of Mobile Bay and along the Florida Panhandle.	No gap. Exisng monit oring efforts capture seasonality and complement each other in a way that fills inter-annual variaon.
Monitor spaal in tegrity of shoreline habitats	N/A	No gap. At a coarse scale exisng r emote sensing programs and associated classificaon programs cover all Gulf shoreline habitats.	No gap. Exisng Landsa t scans provide data to monitor shoreline land cover type at an interval of every 16 days.
Document changes in soil condion (specific ally related to PAHs)	N/A	Paral g ap. The Louisiana Coastwide Reference Monitoring System monitors soil condion in Louisiana, and the USGS Barrier Island Evoluon P roject monitors sediment of barrier islands in the northern Gulf. However, PAH presence and impacts are not idenfied as monitoring targets. Therefore, gaps exist along the coast of Texas for all soil condion monitoring, and along Louisiana, Mississippi, Alabama & Florida for monitoring PAH presence and effects.	No gap. The exisng Louisiana Coas twide Reference Monitoring System monitors sediment biannually, which captures seasonal trends and is based on a stas c ally designed monitoring schedule.
Monitor addional shor eline stressors that could impact rates of recovery	N/A	Paral g ap. Barrier islands are monitored along the coast of Louisiana, Mississippi, Alabama & Florida. Gaps in stressor monitoring occur along the coast of Texas and in areas landward of barrier islands in Mississippi and Alabama.	No gap. Monitoring frequency varies across efforts from annually, quarterly or biannually. This wide range of sampling frequency will capture trends across seasons.
Monitor interdal in vertebrates as a biological indicator of coastal polluon	Full gap. No long-term monitoring of coquina clams is occurring.	Paral g ap. Only the Mussel Watch program captures this priority. Gaps exist in areas not monitored through Mussel Watch, such as in the Big Bend region of Florida and the Texas Coastal Bend.	Full gap. Long-term monitoring was occurring through Mussel Watch; however, these sampling staons w ere terminated in 2015.

Appendix C: Detail of gap explanations (continued)

Terrestrial Species			
Monitoring/Research Priority	General Gaps- Species	General Gaps- Space	General Gaps- Time
Gather long-term observavons t o understand demography, distribuon and habit at use of injured terrestrial species	No gap. All priority species have some level of long-term monitoring; however, monitoring is not sufficient to assess status and trends of diamond back terrapins. For the beach mice species, the details of exisng monit oring efforts are unknown, so the adequacy of these efforts is also unknown.	Full gap. There are no Gulf-wide efforts to monitor terrestrial species. No sustained monitoring exists Gulf-wide, and status and trend assessments are not possible for terrestrial species in many areas of the Gulf.	Paral g ap. There are limited monitoring efforts that collect data on terrestrial species for all seasons and life stages. Sustained sampling is limited for terrestrial species, and important trends in seasonality are missed from current sampling.
Monitor alligator populaons and the number of individuals harvested annually, including nuisance alligators, as well as sex and size of harvested individuals	No gap. The priority species, American alligator, is monitored to meet this priority.	No gap. American alligators are monitored in all Gulf states including areas with harvest; however, the details of the monitoring efforts in Alabama are unknown.	Paral g ap. Important trends in seasonality for American alligators are missed from current sampling.
Monitor long-term status and trends of terrestrial arthropod populaons in oiled mar shes to understand trophic interacons and shifts	Full gap. There are no efforts that meet this need. Preliminary monitoring has been conducted by Dr. Linda Hooper-Bui at LSU in some Louisiana oiled marshes.	Paral g ap. There are no Gulf-wide efforts to monitor terrestrial arthropod species; however, limited short-term monitoring is occurring in some oiled marshes in Louisiana.	Full gap. There are no efforts that monitor all seasons or life stages of terrestrial arthropods.

APPENDIX D: A SUBSET OF LONG-TERM MONITORING EFFORTS IN THE GULF OF MEXICO DERIVED FROM FULL INVENTORY

Field definitions

ID:	The database reference number (simple integer format). Please note, the numbers are not the count of programs and are not necessarily listed in sequential order. They are cataloged in the order they were identified.
Monitoring Program or Effort Name:	The reference name assigned to the monitoring activity in the database.
Summary:	General reference category of parameters monitored by the program.
Start-End Years:	The year an aspect of the monitoring activity was initiated and the year the program was concluded or no longer active.

ID	Monitoring Program or Effort Name	Summary	Start-End Years
1	Atlantic Oceanographic and Meteorological Laboratory (AOML) South Florida Program Drifting Buoys	Currents	1995- 2012
2	Atlantic Oceanographic and Meteorological Laboratory (AOML) South Florida Program Moored Instrument Array	Temperature, salinity, ocean currents	1995- 2012
3	Atlantic Oceanographic and Meteorological Laboratory (AOML) South Florida Program Synoptic Shipboard Surveys	Water chemistry	1995- 2012
4	Argos	Sea surface variables, currents, biogeochemical observations	2001- Current
5	National Data Buoy Center	Sea surface variables	1967- Current
6	National Water Level Observation Network	Currents, sea surface variables	1812- Current
7	National Water Information System	Flow rates, water levels, water quality, water use	Undetermined- Current
8	United States Army Corp of Engineers Water Levels of Rivers and Lakes	Flow rates, water levels, water quality	mid-1800s- Current
9	Sea-Viewing Wide Field-of-View Sensor (SeaWiFS)	Water quality	1997- 2010
10	Ocean Color Monitor	Ocean color	2009- 2014
11	Envisat	Sea surface variables	2002- 2012
12	Aqua	Atmosphere, sea surface variables, ocean color	2000- Current
13	Aquarius	Sea surface variables	2011- 2015
14	Visible Infrared Imaging Radiometer Suite (VIIRS)	Land and ocean imagery, atmos-phere, land and sea surface variables, ocean color	2011- Current
15	Ocean Surface Topography Mission/JASON-2	Sea surface variables	2008- Current
16	Quick Sca erometer (QuikSCAT)	Wind	1999- Current
17	JASON-1	Sea surface variables, circulation	2001- 2013
18	Landsat-7	Landcover	1999- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
19	Landsat Data Continuity Mission/Landsat-8	Landcover	2013- Current
20	Polar Orbiting Environmental Satellites, Initial Joint Polar-Orbiting Operaonal Satellite System	Sea surface variables, water quality, atmosphere	1978- Current
21	Oceansat-1	Winds, sea surface variables, water quality, algal blooms, atmosphere	2009- 2014
22	Geostationary Operational Environmental Satellite (GOES)- East	Atmosphere, sea surface variables, land, sun	1975- Current
23	University of Southern Mississippi High Frequency Coastal Ocean Dynamics Applications Radar (CODAR)	Currents	2007- Current
24	University of South Florida Coastal Ocean Monitoring and Prediction System High Frequency Coastal Ocean Dynamics Applications Radar (CODAR)	Currents	Undetermined- Current
25	University of Miami/Rosenstiel School of Marine and Atmospheric Science High Frequency Wave Radar (WERA)	Currents	Undetermined- Current
26	National Institute for Undersea Science and Technology (NIUST) Seafloor Hydrates Research Observatory	Deep-sea vent science	2003- Current
27	Mobile Bay Environmental Monitoring	Weather, water quality	2003- Current
30	Coastal Bird Survey	Bird counts	2010- Current
32	Gulf of Mexico States Shark Pupping and Nursery Area (GULFSPAN)	Shark population ecology, water quality	2003- 2007
34	Trip Interview Program	Marine catch and bycatch	1983- Current
35	Gulf of Mexico Fisheries Information Network (GulfFIN) Biological Sampling	Marine fishery catch, effort, and participation	2002- Current
37	Menhaden Captains Daily Fishing Report and Dockside Assessments	Marine catch and bycatch	1964- Current
39	Shrimp Observer Program	Marine harvest and bycatch	1992- Current
40	Bo om Longline Observer Program	Marine harvest and bycatch	1994- Current
41	Gillnet Observer Program	Marine harvest and bycatch	1993- Current
42	Gulf of Mexico Vertical Line Observer Program	Marine harvest and bycatch	2006- Current
46	Large Pelagic Logbooks	Marine harvest and bycatch	1986- Current
50	Florida Dealer Trip Ticket Reports	Commercial marine catch and bycatch	1984- Current
51	Alabama Dealer Trip Ticket Reports	Commercial marine catch and bycatch	2001- Current
52	Mississippi Dealer Trip Ticket Reports	Commercial marine catch and bycatch	2003- Current
53	Louisiana Dealer Trip Ticket Reports	Commercial marine catch and bycatch	1999- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
54	Texas Dealer Trip Ticket Reports	Commercial marine catch and bycatch	1986- Current
56	Marine Recreational Information Program (MRIP)	Marine recreational catch and effort	1979- Current
57	Gulf of Mexico Fisheries Information Network (GulfFIN) Head Boat Port Sampling	Marine recreational catch and effort	1986- Current
58	Marine Sport Harvest Program (Creel Surveys)	Marine recreational catch and bycatch	1974- Current
60	Southeast Area Monitoring and Assessment Program (SEAMAP)- Gulf of Mexico Fall & Summer Shrimp/Groundfish Survey	Marine fisheries, environmental	1981- Current
61	Southeast Area Monitoring and Assessment Program (SEAMAP)- Gulf of Mexico Fall, Winter & Spring Plankton Survey	Marine fisheries	1981- Current
62	Southeast Area Monitoring and Assessment Program (SEAMAP)- Gulf of Mexico Reef Fish Survey	Marine fisheries	1992- Current
63	Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Inshore Bo om Longline Survey	Marine fisheries, environmental data	2008- Current
64	Southeast Area Monitoring and Assessment Program (SEAMAP) - Gulf of Mexico Vertical Longline Survey	Marine fisheries	2010- Current
65	Texas Parks and Wildlife Department Fishery Independent Sampling	Marine fisheries, water quality	1975- Current
67	Mississippi Department of Marine Resources and Gulf Coast Research Laboratory Fishery Independent Sampling	Marine fisheries	1974- Current
69	Florida Fish and Wildlife Conservation Commission Fishery Independent Monitoring Estuarine Surveys	Marine fisheries, water quality	1989- Current
70	Fisheries Oceanography of Coastal Alabama	Marine fisheries	2004- 2015
71	National Wetland Inventory	Wetland distribution	1974- Current
73	Marine Mammal Health and Stranding Response Program	Marine mammal stranding	1992- Current
81	Sarasota Dolphin Research Program	Dolphin photo-identificaon,` population ecology, radio tracking	1970- Current
87	Southeast Area Monitoring and Assessment Program (SEAMAP)- Plankton Sampling	Plankton ecology	1991- 2001
91	Texas Observatory for Algal Succession Time-series	Phytoplankton bloom potential	2008- Current
92	Southwest Florida Red Tide Program	Phytoplankton bloom potential, water quality	Undetermined- Undetermined
95	Harmful Algal Bloom Marine Observation Network	Phytoplankton bloom potential, water quality, currents, wind	2000- Current
102	National Status and Trends Mussel Watch	Bivalve health	1986- 2010
104	National Listing of Fish Advisories	Fish advisories	1993- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
115	Environmental Monitoring Assessment Program	Water quality, sediment chemistry and toxicity, benthic ecology, fish ssue` toxicity	1990- 2006
116	Hypoxia in the Northern Gulf of Mexico	Water quality, hypoxia	1985- Current
117	Mechanisms Controlling Hypoxia Project	Water quality, hypoxia	2003- 2014
118	National Aquatic Resource Surveys National Coastal Assessment	Water quality, sediment quality, benthic community ecology, coastal habitat loss, fish tissue contaminants	1990- Current
119	National Status and Trends Bioeffects program	Coastal contamination, sediment toxicity, benthic macroinvertebrate toxicity	1986- Current
120	National Water Quality Assessment	Water contamination, sediment toxicity, aquatic organism ssue` toxicity	1991- Current
121	Louisiana Ambient Surface Water Quality Monitoring	Water quality	1958- Current
122	Dauphin Island Sea Laboratory Seagrass Monitoring	Seagrass characterization	2009- Undetermined
125	Monitoring Polycyclic Aromatic Hydrocarbons in Coastal Sharks	Shark tissue toxicity	2006- Current
129	Apalachicola National Estuarine Research Reserve Juvenile Fish and Benthic Macroinvertebrate Monitoring	Fish and benthic macroinvertebrate abundance, water quality	2000- Current
131	Long-term Monitoring of the East and West Flower Garden Banks	Coral reef ecology and health	1988- Current
132	St. Joseph Bay Coral Monitoring	Coral distribution	2006- 2011
135	Florida Keys National Marine Sanctuary Seagrass Monitoring Project	Seagrass ecology	1995- Current
136	Population Status of Elkhorn Coral	Coral distribution	2004- Current
137	Texas Stream Team	Water quality	1991- Undetermined
138	Seasonal Variation in Nutrients and Microalgal Community Composition	Phytoplankton bloom potential, water quality	2007- 2009
140	Dauphin Island Sea Laboratory Environmental Monitoring	Weather, water quality	1998- Current
144	Oyster Assessment and Monitoring	Oyster reef ecology, water quality	Undetermined- Undetermined
151	Southeast Florida Aerial Surveys	Aerial surveys for marine animals and human use	1992- 2001
165	Institute for Marine Mammal Studies Bolenose Dolphin Sur veys	Dolphin population ecology, behavior, water quality	2004- Current
166	Institute for Marine Mammal Studies Bolenose Dolphin Str anding Response Program	Dolphin stranding	1984- Current
167	Bolenose Dolphin Health Assessmen ts	Dolphin health	1978- 1988
169	Abundance, Distribution, and Condition of *Acropora* Corals, Other Benthic Coral Reef Organisms, and Marine Debris	Benthic condition, marine debris	1998- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
175	Florida Statewide Nesting Beach Survey	Sea turtle nesting	1979- Current
176	Florida Index Nesting Beach Sea Turtle Nesting Surveys	Sea turtle nesting	1996- 2013
186	Conservancy of Southwest Florida Nesting Surveys	Sea turtle nesting	1983- Current
191	Southwest Florida Satellite Tracking Program	Sea turtle satellite tracking	2009- Current
195	Threatened and Endangered Sea Turtles in Marine Protected Areas of the Greater Everglades	Sea turtle satellite tracking	2005- 2018
222	Long-Term In-Water Studies of Sea Turtles in Florida Bay	Sea turtle in-water populaon` dynamics	1990- 2016
223	Mustang Island Sea Turtle Nesting Surveys	Sea turtle nesting surveys	Undetermined- Undetermined
224	Matagorda Peninsula Sea Turtle Nesting Surveys	Sea turtle nesting surveys	Undetermined- Undetermined
227	Institute of Marine Mammal Studies Sea Turtle Nesting Surveys	Sea turtle nesting surveys	2000- Current
228	Institute of Maine Mammal Studies Sea Turtle Satellite Tracking	Sea turtle satellite tracking	2010- Current
229	Inwater Research Group, Inc. Key West National Wildlife Refuge Sea Turtle Surveys	Sea turtle nesting surveys	2002- 2017
230	Mote Marine Laboratory Sea Turtle Nesting Surveys	Sea turtle nesting surveys	1982- Current
236	Kemp's ridley Sea Turtle Recovery Project Nesting Survey	Sea turtle nesting surveys	1978- Current
242	Kemp's ridley Sea Turtle Recovery Project Satellite Tracking Study	Sea turtle satellite tracking	1997- Current
253	Texas A&M University In-Water Sea Turtle Studies	Sea turtle in-water populaon` dynamics	1998- 2011
254	South Padre Island and Boca Chica Sea Turtle Nesting Surveys	Sea turtle nesting surveys	1977- Current
255	Alabama Sea Turtle Nesting Surveys	Sea turtle nesting surveys	2001- Current
258	Texas A&M University Sea Turtle Nesting Surveys	Sea turtle nesting surveys	1991- 2011
269	University of Alabama at Birmingham In-Water Sea Turtle Research Program	Sea turtle in-water populaon` dynamics	1999- 2009
270	Northwest Florida In-Water Sea Turtle Studies	Sea turtle in-water populaon` dynamics	2001- 2018
273	Eglin Air Force Base Cape San Blas Station Sea Turtle Nesting Surveys	Sea turtle nesting surveys	1994- Current
295	Florida Coral Reef Evaluation and Monitoring Project	Coral reef ecology	1996- Current
296	Florida Keys National Marine Sanctuary Seagrass Monitoring Project	Seagrass distribution and abundance	1995- Current
297	Florida Keys National Marine Sanctuary Water Quality Monitoring Project	Water quality	1995- Current
298	Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study	Deep sea benthic ecology	1999- 2014
299	Louisiana Universities Marine Consortium (LUMCON) Environmental Monitoring	Weather, water quality	1991- Current
300	Texas Automated Buoy System	Weather, sea surface condions,` currents	1995- Current
301	Texas Coastal Ocean Observation Network	Weather, sea surface conditions, water quality	1988- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
302	Wave-Current-Surge Information System for Coastal Louisiana	Weather, sea surface condions,` currents	2005- Current
303	River, Estuary and Coastal Observing Network	Water quality	2007- Undetermined
304	Florida State University Center for Ocean-Atmospheric Prediction Studies	Weather, water quality	2007- 2013
314	Stetson Bank Coral Monitoring	Coral reef ecology, water quality	1993- Current
315	Northern Gulf of Mexico Marine Protected Areas Surveys	Marine protected area conditions	2001- 2014
316	Pulley Ridge Fish Survey	Deepwater reef ecology	2004- 2009
317	Terra Ceia Aquatic Preserve Water Quality Monitoring	Water quality	Undetermined- Current
318	Everglades National Park Water Quality Monitoring	Water quality	Undetermined- Current
320	Louisiana Offshore Oil Port Oil Pla. orm Environmental Monitoring	Wind, sea surface condions, w eather	Undetermined- Current
321	Scripps Instuon of Oceanogr aphy Wave Buoy	Waves, sea surface temperature	Undetermined- Current
322	United States Environmental Protecon Ag ency and Mexican Government Cooperav e Program	Wind, weather	2011- Current
323	ATP Oil and Gas Corporaon Ac ousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
324	Amerada Hess Corporaon Ac ousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
325	Anadarko Petroleum Corporaon Ac ousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
326	BHP Billiton Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
327	Brish P etroleum, Inc. Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
328	Chevron Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
329	ConocoPhillips Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
330	ENI Petroleum Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
331	El Paso E&P Company, L.P. Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
332	ExxonMobil Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
333	Freeport-McMoRan Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
334	Helix Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
335	Kerr-McGee Oil and Gas Corporaon Ac ousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
336	LLOG Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
337	Maersk Drilling USA Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
338	Marathon Oil Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
339	Mariner Energy, Inc. Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
340	Marubeni Oil and Gas, Inc. Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
341	Murphy Exploraon & P roducon Compan y Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
342	Newfield Exploraon Compan y Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
343	Noble Energy, Inc. Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
344	Petrobras- USA Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
345	Repsol Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
346	Shell Internaonal E&P Ac ousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
347	Statoil Hydro Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
348	Stone Energy Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
349	Total USA, Inc. Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
350	Walter Oil and Gas Corporaon Ac ousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
351	Williams Acousc Doppler Curr ent Profiler (ADCP)	Currents	Undetermined- Current
352	Central Gulf Ocean Observing System USM3M01 Buoy	Sea surface variables, wind, currents, waves, water quality	2004- 2013
354	Rookery Bay Naonal Es tuarine Research Reserve System-Wide Monitoring Program	Water quality	1996- Current
355	Apalachicola Naonal Es tuarine Research Reserve System-Wide Monitoring Program	Water quality	1995- Current
356	Week's Bay Naonal Es tuarine Research Reserve System-Wide Monitoring Program	Water quality	1995- Current
357	Grand Bay Naonal Es tuarine Research Reserve System-Wide Monitoring Program	Water quality	2004- Current
358	Mission Aransas Naonal Es tuarine Research Reserve System-Wide Monitoring Program	Water quality	2005- Current
359	Everglades Naonal P ark Hydrologic Monitoring Program	Weather, water quality	1988- Current
361	Naonal Marine Fisheries Ser vice Aerial Surveys	Aerial surveys	1989- 1998
381	Louisiana Barrier Island Comprehensive Monitoring	Barrier island ecology	2006- Current
384	Naonal Coas tal Mapping Program	Coastal mapping	2003- Current
386	Coastal Change Analysis Program	Coastal change analysis	1985- Current
387	Louisiana Marine Mammal & Sea Turtle Rescue Program	Marine mammal and sea turtle strandings	2000- Current
388	Alabama Marine Mammal Stranding Network Response Program	Marine mammal strandings	2008- Current
389	Emerald Coast Wildlife Refuge Stranding Response Program	Marine mammal strandings	1994- Current
390	Southwest Florida Stranding Response Program	Marine mammal strandings	1991- Current
391	Florida Aquarium Stranding Response Program	Marine mammal strandings	Undetermined- Current
392	South Florida Marine Mammal Stranding Response Program	Marine mammal strandings	Undetermined- Current
393	Texas Marine Mammal Stranding Network	Marine mammal strandings	1980- Current
394	Clearwater Marine Aquarium Stranding Response Program	Marine mammal strandings	Undetermined- Current
395	Gulf World Marine Park/Instut e Stranding Response Program	Marine mammal strandings	1970- Current
396	Louisiana Stranding Response Program	Marine mammal strandings	Undetermined- Current
397	Mote Marine Laboratory Stranding Response Program	Marine mammal strandings	Undetermined- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
398	Marine Mammal Pathobiology Laboratory Stranding Response Program	Marine mammal strandings	1974- Current
401	Moderate-Resoluon Imaging Spectr ometer (MODIS)	Water quality, phytoplankton bloom potenal, a tmosphere, surface water variables, land properes	2000- Current
402	Landsat-1	Landcover	1972- 1978
403	Landsat-2	Landcover	1975- 1983
404	Landsat-3	Landcover	1978- 1983
405	Landsat-4	Landcover	1982- 1993
406	Landsat-5	Landcover	1984- 2013
412	Relav e Abundance, Temporal Pa erns and Growth of Sea Turtles at Mansfield Channel, Padre Island, Texas	Sea turtle in-water populaon biology , satellite tracking	1989- 1997
418	Advanced Microwave Scanning Radiometer for EOS (AMSR-E)	Sea surface condions, wind	2002- 2011
423	Advanced Earth Observing Satellite 2 (ADEOS II)	Wind	2002- Undetermined
430	Scripps Passive Acousc Monit oring for Marine Mammals	Marine mammal acouscs	2010- Current
431	Galveston Bay Water Quality Monitoring	Water quality	1991- Current
432	Sabine River Water Quality Monitoring	Water quality	1998- Current
433	Guadalupe-Blanco River Water Quality Monitoring	Water quality	1987- Current
434	Mississippi Statewide Assessment (Total Maximum Daily Load) Program	Water quality, fish ssue t oxicity	1992- Current
435	Earth System Research Laboratory	Weather	2014- Undetermined
437	Mississippi Ambient Air Monitoring	Air quality	2001- Undetermined
441	Louisiana Fisheries Independent Monitoring- Inshore and Nearshore Gillnet Sampling	Marine fisheries, water quality	1985- Current
442	Louisiana Fisheries Independent Monitoring- Inshore and Nearshore Seine Sampling	Marine fisheries	1985- Current
445	Louisiana Shellfish Monitoring Program- Fish Trawls	Marine fisheries	1996- Current
450	Lower Colorado River Authority (LCRA) Bay Monitoring Program	Water quality	1992- Undetermined
451	Texas Water Development Board (TWDB) Datasonde Program	Water quality	1986- Undetermined
453	Physical Oceanographic Real-Time System (PORTS)	Currents, des, w ater quality	1999- Undetermined
454	Texas Clean Rivers Program	Water quality	1968- Undetermined
455	Oyster Sennel - Oyster Health Program	Oyster disease	1970- Current
456	Oyster Sennel - Water Quality Program	Water quality, oyster health	1970- Undetermined
458	Lake Pontchartrain Water Quality Program	Water quality	2001- Undetermined
459	Alabama Water Watch (AWW)	Water quality	1993- Undetermined
460	Flower Garden Banks Naonal Marine Sanctuary (FGBNMS) CTD Program	Water quality	1995- Current
461	Alabama Coastal Nonpoint Polluon Con trol Program	Water quality	1998- Undetermined
462	Texas Water Development Board (TWDB) Hydrology Program	Hydrology	1941- Undetermined
463	Texas Surface Water Quality Monitoring Program	Water quality, sediment quality	1967- Current

ID	Monitoring Program or Effort Name	Summary	Start-End Years
464	Gulf Hypoxia Monitoring	Water quality, hypoxia, sediments	2002- 2010
465	Mississippi Coastal Assessment Program	Water quality, fish ssue t oxicity	2007- Current
466	Florida's Strategic Monitoring Program for Total Maximum Daily Loads	Water quality	1998- Undetermined
467	Yellow River Marsh Aquac P reserve Water Quality Monitoring	Water quality	2015- Undetermined
468	St. Joseph Bay Aquac P reserve Water Quality Monitoring	Water quality	2005- 2011
469	Alligator Harbor Aquac P reserve Water Quality Monitoring	Water quality	2001- 2011
470	Apalachicola Bay Aquac P reserve Water Quality Monitoring	Water quality	2007- 2008
471	Big Bend Seagrasses Aquac P reserve Water Quality Monitoring	Water quality	2004- Undetermined
472	St. Marns Mar sh Aquac P reserve Water Quality Monitoring	Water quality	2004- Undetermined
473	Terra Ceia Aquac P reserve Water Quality Monitoring	Water quality	2004- 2011
474	Estero Bay Aquac P reserve Water Quality Monitoring	Water quality	2005- Undetermined
475	Cape Romano Ten Thousand Islands Aquac P reserve Water Quality Monitoring	Water quality	Undetermined- Undetermined
476	Charlo e Harbor Estuaries Volunteer Water Quality Monitoring Network	Water quality, weather	1998- Undetermined
477	Suwannee River Water Management District Water Resource Monitoring Program	Water quality	1994- Undetermined
478	Texas A&M University at Galveston Phytoplankton Dynamics Laboratory	Water quality, plankton	2008- Undetermined
479	Southwest Florida Water Management District- Project Coast	Water quality	1997- 2013
480	Southwest Florida Water Management District- Stream Water Quality Network- Coastal Rivers and Kings Bay Monitoring Programs	Water quality	2003- Undetermined
481	Texas A&M University Vibrio Monitoring in Oysters	Oyster disease	1989- Current
482	Texas Seafood and Aquac Lif e Group Water Monitoring Program	Water quality	1950- Undetermined
483	Texas Seafood and Aquac Lif e Group Tissue Monitoring Program	Marine fisheries ssue t oxicity	1970- Current
502	Naonal Cen ters for Environmental Predicon's Marine Surf ace Data	Sea surface variables	1991- 2011
504	University of West Florida Gulf of Mexico CTD Profile Program	Water quality	2004- 2012
505	Pensacola Bay Water Quality Monitoring Program	Water quality	2011- Undetermined
509	Southeastern Environmental Research Program	Water quality	1995- Undetermined
511	St. Andrew Baywatch Program	Water quality	1990- Undetermined
512	Matlacha Pass Aquac P reserve Water Quality Monitoring Program	Water quality	2005- Undetermined
513	Coastal Charlo e Harbor Monitoring Network	Water quality	2002- Undetermined
514	Florida LAKEWATCH Program	Water quality	2000- Undetermined
519	Florida Fishery Independent Monitoring- Baiish Sur veys	Marine fisheries, water quality	1993- Current
520	Florida Southeast Area Monitoring and Assessment Program (SEAMAP)- Groundfish Surveys	Marine fisheries, water quality	2008- 2018
521	Florida Southeast Area Monitoring and Assessment Program (SEAMAP)- Ichthyoplankton Surveys	Marine fisheries, water quality	2014- 2018

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
522	Florida Southeast Area Monitoring and Assessment Program (SEAMAP)- Reef Fish Surveys	Marine fisheries, water quality, habitat	2008- Current
524	Alabama Fisheries Assessment and Monitoring Program - Trawl Sampling	Marine fisheries	1977- Current
525	Alabama Fisheries Assessment and Monitoring Program - Gillnet sampling	Marine fisheries, water quality	2001- Current
526	Alabama Fisheries Assessment and Monitoring Program - Shoreline sampling	Marine fisheries, habitat	1977- Current
528	Mississippi Interjurisdiconal Fisheries Coas tal Finfish Gillnet Survey	Marine fisheries	2006- Current
529	Mississippi Interjurisdiconal Fisheries Inshor e Finfish Trawl Survey	Marine fisheries	2006- Current
532	Alabama Southeast Area Monitoring and Assessment Program (SEAMAP)- Ichthyoplankton Sampling	Marine fisheries, water quality, wind, waves, precipitaon	1986- Undetermined
533	Mississippi Southeast Area Monitoring and Assessment Program (SEAMAP)- Ichthyoplankton Sampling	Marine fisheries, water quality, wind, waves, precipitaon	1983- Current
534	Alabama Fishery Independent Oyster Monitoring	Oyster reef ecology	1971- Current
537	Choctawhatchee Basin Alliance Living Shorelines Oyster Reef Monitoring	Oyster reef ecology, water quality	2012- Current
538	Mississippi Interjurisdiconal Oy ster Dredge Monitoring Survey	Oyster reef ecology	2009- Current
539	Mississippi Interjurisdiconal Oy ster Visual Monitoring Survey Square Meter Sampling	Oyster reef ecology	2006- Current
540	Shellfish Harvesng Ar ea Monitoring	Bivalve disease, water quality, rainfall, stage, phytoplankton bloom potenal	1970- Current
541	Alabama Shellfish Monitoring Program	Oyster disease, phytoplankton bloom potenal, w ater quality, de, wind	1960- Current
542	Apalachicola Naonal Es tuarine Research Reserve Oyster Growth Project	Oyster reef populaon dynamics	2004- 2009
544	Dauphin Island Sea Laboratory Oyster Habitat Assessment	Oyster reef ecology, water quality	2003- Current
545	Louisiana Oyster Dredge Sampling	Oyster reef populaon dynamics	1992- Current
546	Louisiana Annual Oyster Stock Assessment and Sampling	Oyster reef populaon dynamics	1980- Current
547	Louisiana Department of Wildlife and Fisheries Neser T ray Coastal Oyster Sampling	Oyster reef ecology	1988- Current
548	Louisiana Oyster Harvest Monitoring	Oyster harvest	1999- Current
549	Texas State Shellfish Harvest Area Monitoring	Oyster health, water quality, rainfall, stage, wind	1950- Current
550	Mississippi State Shellfish Harvest Area Monitoring	Oyster health, water quality, stage, wind	1940- Current
553	Pinellas County Ambient and Seagrass Monitoring Programs	Seagrass ecology, water quality	1998- Current
554	Choctawhatchee Basin Alliance Seagrass Monitoring	Seagrass ecology, water quality	2009- Current
555	Florida Seagrass Integrated Monitoring and Mapping Project	Seagrass mapping	Early 2000s- Current
556	St. Andrew Bay Aquac P reserve Seagrass Monitoring	Seagrass ecology	2000- Current
557	St. Joseph Bay Aquac P reserve Seagrass Monitoring	Seagrass ecology, water quality	2002- 2010

ID	Monitoring Program or Effort Name	Summary	Start-End Years
558	Franklin County Coastal Waters Seagrass Monitoring	Seagrass ecology, water quality	2006- Current
559	Northern Big Bend Seagrass Monitoring	Seagrass ecology, bay scallops and urchin density, water quality	2002- Current
560	Northern Big Bend Seagrasses Aquac P reserve Seagrass Monitoring	Seagrass ecology, water quality	2000- Current
561	Southern Big Bend Region Seagrass Monitoring	Seagrass ecology, water quality	2004- Current
563	Springs Coast Seagrass Monitoring	Seagrass ecology	1997- Current
564	Western Pinellas County Seagrass Monitoring	Seagrass ecology	2006- Current
565	Tampa Bay Seagrass Monitoring	Seagrass ecology	1986- Current
566	Tampa Bay Seagrass Mapping	Seagrass mapping	1988- Current
567	Sarasota Bay Seagrass Monitoring	Seagrass ecology	1999- Current
568	Sarasota County Seagrass Monitoring of Sarasota Bay	Seagrass ecology	2004- Current
569	Seagrass Integrated Mapping and Monitoring Program- Sarasota Bay Aerial Mapping	Seagrass mapping	1988- Current
570	Charlo e Harbor Seagrass Monitoring	Seagrass ecology	1999- Current
571	Estero Bay Seagrass Monitoring	Seagrass ecology, water quality	2002- Current
572	Rookery Bay Naonal Es tuarine Research Reserve Seagrass Monitoring	Seagrass ecology, water quality	1998- 2005
573	Ten Thousand Islands Seagrass Monitoring	Seagrass ecology, aerial mapping	1998- 2009
581	Mississippi-Alabama Pinnacle Trend Ecosystem Monitoring	Deep-sea biological communies, carbonate mound biogeochemistry	1996- 2011
583	Pennsylvania State Deep-Sea Coral Studies	Deep-sea octocoral growth	2010- 2017
584	Scienfic and En vironmental Remotely Operated Vehicle (ROV) Partnership using Exisng Indus trial Technology Project	Species observaons near oil and g as operaons	2006- Current
586	Cric al Life History Parameters of the Texas Diamondback Terrapin, *Malaclemys terrapin littoralis*	Diamondback terrapin populaon biology	2007- Current
587	Perdido Key Beach Mouse Recovery Plan Monitoring	Beach mouse populaon dynamics	1985- Undetermined
588	Louisiana State University insect sampling in Barataria Bay	Insect abundance	2010- Undetermined
589	Alabama Beach Mouse monitoring in Bon Secour Naonal Wildlif e Refuge	Beach mouse populaon dynamics	1988- Current
590	Alabama Beach Mouse Detecon/Nondet econ Sur veys in Baldwin County	Beach mouse populaon dynamics	1991- 2008
592	Louisiana Diamondback Terrapin Monitoring	Diamondback terrapin populaon dynamics	2011- Current
594	Florida Choctawhatchee Beach Mouse Recovery Monitoring	Beach mouse populaon dynamics	1987- 2007
595	Texas Alligator Management Program	Alligator counts	1976- Current
596	Florida Alligator Management Program	Alligator harvest management	1997- Current
597	Mississippi Alligator Management Program	Alligator management	1972- Current
598	Louisiana Wild Alligator Management Program	Alligator populaon dynamics	1970- Current
599	Nueces Estuary Diamondback Terrapin Monitoring	Diamondback terrapin populaon biology	2010- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
600	Alabama Beach Mouse Monitoring- Incidental Take Permit Habitat Conservaon Plan	Beach mouse populaon dynamics	Undetermined- Undetermined
602	St. Andrew Beach Mouse Monitoring	Beach mouse populaon dynamics	2000- Current
603	Texas Department of State Health Services Water and Sediment Monitoring	Water quality, sediment quality	2004- 2007
608	Florida Stone Crab Monitoring Program	Stone crab biology, water quality	1985- Current
610	Texas Oyster Resource Monitoring Program	Bivalve ecology	1985- Current
618	Coastwide Reference Monitoring System	Sediments, marsh and forest vegetaon, w etland characterizaon	2006- Current
619	Coastal Mapping Program	Shoreline change	2005- Current
620	Inventory and Monitoring Network Status and Trends	Sediment surface elevaon	2011- Current
621	Texas Shoreline Change Project	Shoreline change	2000- Current
622	Coastal Data Acquision P rogram- Regional Coastal Monitoring	Shoreline change	2000- 2008
623	Gulf-Fronng Shor eline Monitoring Program	Shoreline change	2002- Current
624	Mississippi Coastal Geology Program	Shoreline change	1989- Current
625	Rookery Bay Naonal Es tuarine Research Reserve Shoreline Monitoring	Shoreline change	2001- Current
630	Tampa Bay Surface Elevaon Monit oring	Sediment surface elevaon	2010- Current
631	Pinellas County Beach Profiling	Shoreline change	2006- Current
632	Grand Bay Naonal Es tuarine Research Reserve Surface Elevaon Monit oring	Sediment surface elevaon	2011- Current
633	Barrier Island Evoluon P roject	Barrier island dynamics	1998- Current
636	Short-Term Shoreline Change and Beach/Dune Morphodynamics Along the Gulf Coast	Shoreline change	2010- 2014
640	Change and Soil Accreon in the Mangr ove Salinity Transion Z one	Sediment surface elevaon, v erc al accreon	1998- Current
642	Sediment Elevaon and Accumula on in R esponse to Hydrology, Vegetaon, and Disturbance in Southwest Florida	Sediment surface elevaon, v erc al accreon	1998- Current
643	University of Louisiana Coastal Plant Ecology Program	Sea surface condions	2006- Current
658	Louisiana Molluscan Shellfish Program	Bivalve health, water quality	1989- Current
708	Aransas Naonal Wildlif e Refuge Marsh Bird Survey	Marsh bird counts	2005- 2009
709	Aransas Naonal Wildlif e Refuge Winter Plover Survey	Shorebird counts	2003- 2011
711	Texas Naonal Wildlif e Refuge Secrev e Marsh Bird Survey	Marsh bird counts	2005- Current
715	Laguna Atascosa Naonal Wildlif e Refuge Plover Survey	Shorebird counts	1990- 2016
720	North American Breeding Bird Survey in Texas	Bird counts	1966- Current
722	San Bernard Naonal Wildlif e Refuge Migratory Shorebird Surveys	Shorebird counts	1998- Current
725	Chenier Plain, McFaddin, and Texas Point King and Clapper Rail surveys	Marsh bird counts	Undetermined- Undetermined
726	Texas Colonial Waterbird Survey (TCWS)	Waterbird counts	1973- Current
733	Mustang Island Bird Surveys	Bird counts	1985- Current
748	Breton Naonal Wildlif e Refuge Piping Plover Survey	Shorebird counts	1995- Current

ID	Monitoring Program or Effort Name	Summary	Start-End Years
749	Breton Naonal Wildlif e Refuge Brown Pelican Banding	Waterbird banding	2000- Current
750	Colonial Seabird Producon Assessmen t	Seabird reproducv e success	1990- Current
755	Slt Sandpiper s Habitat Management Monitoring	Shorebird habitat assessment	2008- Undetermined
764	Lacassine Naonal Wildlif e Refuge Shorebird Surveys	Shorebird counts	1953- Current
765	Lacassine Naonal Wildlif e Refuge Wading Bird Nesng Sur vey	Wading bird nesng c ounts	1997- Current
768	Louisiana Brown Pelican Nesng and P roducvity Sur veys	Waterbird counts and producvity	1971- 2008
769	Louisiana Secrev e Marsh Bird Callback Surveys	Marsh bird counts	2010- 2015
771	Louisiana Coastal Bird Conservaon P rogram	Shorebird breeding pair counts	2005- 2015
772	Louisiana Colonial Waterbird Surveys	Waterbird nest counts	1983- 2014
775	Opportunisc P elagic Bird Surveys	Pelagic bird counts	1986- 2007
776	North American Breeding Bird Survey in Louisiana	Breeding bird counts	1967- Current
784	Mississippi Colonial Shrubnesng Sur veys	Breeding bird counts	1977- 1983
785	Mississippi Marsh Bird Research and Monitoring Program	Marsh bird counts	2005- Current
786	Mississippi Marsh Bird Research and Monitoring Program	Marsh bird counts	2005- 2012
787	Monitoring Avian Producvity and Sur vivorship (MAPS) Program	Bird counts	2000- Current
790	Audubon Least Tern and Black Skimmer Surveys	Shorebird nest counts	1985- Undetermined
800	Mississippi Sandhill Crane Naonal Wildlif e Refuge Secrev e Marsh Bird Survey	Marsh bird counts	2004- Current
806	Mississippi Nonbreeding Beach Shorebird Survey	Shorebird survey	2006- 2012
807	North American Breeding Bird Survey in Mississippi	Bird counts	1976- Current
812	Monitoring Avian Producvity and Sur vivorship (MAPS) at Bon Secour	Bird producvity and sur vivorship	2014- 2018
814	Bon Secour Naonal Wildlif e Refuge Shorebird Survey	Shorebird count	2008- Current
816	Colonial Water Bird Surveys of Florida	Water bird counts	Undetermined- Undetermined
818	Florida Park Service District 1 Shorebird Nesng Sur veys	Shorebird nest count	Undetermined- Undetermined
819	Florida Panhandle Nonbreeding Bird Surveys	Coastal bird counts	2010- Current
820	Florida Panhandle Shorebird Breeding Bird Surveys	Shorebird counts	2008- Current
821	Gulf Islands Naonal Seashor e Shorebird Nesng Sur veys	Shorebird nest counts	1995- Undetermined
822	Gulf Islands Naonal Seashor e Nonbreeding Shorebird Surveys	Shorebird counts	1995- Undetermined
824	Florida Nesng Secr ev e Marsh Bird Surveys	Marsh bird nest counts	Undetermined- Undetermined
825	Florida Statewide Colonial Bird Beach/Ground Nesng Sur veys	Colonial bird nest counts	2005- Undetermined
830	Tyndall Beach Air Force Base Nesng Bir d Surveys	Bird nest counts	Undetermined- Undetermined
831	Naonal P ark Service Comprehensive Bird Surveys	Bird counts	Undetermined- Undetermined
835	Cedar Keys Naonal Wildlif e Refuge American Oystercatcher Monitoring	Shorebird counts	2009- Current
837	Florida Naonal Wildlif e Refuge Shorebird Nesng Sur veys	Shorebird nest counts	2005- Current
838	Cedar Keys Naonal Wildlif e Refuge Non-Nesng Shor ebird and Seabird Surveys	Shorebird and seabird counts	2009- Current
839	Cedar Keys Naonal Wildlif e Refuge Wading Bird Flight-Line Counts	Wading bird counts	1997- Current

Appendix D: Inventory of Long-term Monitoring Projects (continued)

ID	Monitoring Program or Effort Name	Summary	Start-End Years
840	Chassahowitzka Naonal Wildlif e Refuge Colonial Waterbird Survey	Waterbird counts	1958- Current
841	Chassahowitzka Naonal Wildlif e Refuge Waterfowl Survey	Waterfowl counts	1958- Current
843	Egmont Key Colonial Waterbird Survey	Colonial waterbird counts	1955- Current
847	J.N. 'Ding' Darling Naonal Wildlif e Refuge Colonial Nesng Bir d Survey	Colonial nest counts	1960- Current
849	J.N. 'Ding' Darling Naonal Wildlif e Refuge Shorebird Survey	Shorebird count	1974- Current
852	Key West Naonal Wildlif e Refuge Piping Plover Wintering Survey	Shorebird counts	1990- Current
855	Lower Suwannee Naonal Wildlif e Refuge American Oystercatcher Monitoring	Shorebird counts	2009- Current
858	Lower Suwannee Naonal Wildlif e Refuge Florida Non-Nesng Shor ebird and Seabird Surveys	Shorebird and seabird counts	2009- Current
860	Pine Island Naonal Wildlif e Refuge Colonial Nesng Bir d Survey	Colonial bird nest count	2000- Current
861	Pinellas Naonal Wildlif e Refuge Colonial Waterbird Survey	Colonial waterbird count	1955- Current
864	St. Marks Naonal Wildlif e Refuge Colonial Wading Bird Breeding Survey	Colonial wading bird nest counts	1965- Current
865	St. Marks Naonal Wildlif e Refuge Non-Nesng Shor ebird and Seabird Surveys	Shorebird and seabird counts	2009- Current
867	St. Marks Naonal Wildlif e Refuge Least Tern Nesng Pla orm Survey	Shorebird nest counts	1986- Current
873	St. Marks Naonal Wildlif e Refuge Shorebird Monitoring Survey	Shorebird counts	1980- Current
878	St. Vincent Naonal Wildlif e Refuge American Oystercatcher Monitoring	Shorebird counts	2009- Current
880	St. Vincent Naonal Wildlif e Refuge Non-Nesng Shor ebird and Seabird Surveys	Shorebird and seabird counts	2009- Current
882	Ten Thousand Islands Naonal Wildlif e Refuge Internaonal Shor ebird Survey	Shorebird count	1999- Current
883	Apalachicola Naonal Es tuarine Research Reserve Coastal Shorebird Monitoring	Shorebird counts	1985- Current
884	Everglades Wading Bird Monitoring	Wading bird counts, nesng pair counts, nest success	1995- Current
885	North American Breeding Bird Survey	Bird counts	1967- Current
887	Florida Joint Coastal Permit Monitoring	Coastal monitoring; varies by permit	2008- Current
889	Internaonal Piping Plo ver Census	Shorebird counts	1991- Current
890	Christmas Bird Count	Bird counts	1900- Current
891	TOPEX/Poseidon	Sea surface variables	1992- 2006
894	Southeast Fishery Science Center Cooperav e Tagging Center	Marine fish tags	1954- Current
897	Pelagic Longline Observer Program	Marine Fisheries	1992- Current
898	Florida Annual Canvas Data Survey	Marine Fisheries	1960- Current
899	USGS Coral Reef Ecosystem Studies (CREST) Project	Coral calcificaon r ates	2009- Current

About Ocean Conservancy

Ocean Conservancy educates and empowers citizens to take action on behalf of the ocean. From the Arctic to the Gulf of Mexico to the halls of Congress, Ocean Conservancy brings people together to find solutions for our water planet. Informed by science, our work guides policy and engages people in protecting the ocean and its wildlife for future generations. With staff and offices in St. Petersburg, Florida; Mobile, Alabama; Baton Rouge and New Orleans, Louisiana; and Austin, Texas, Ocean Conservancy has been deeply engaged in Gulf of Mexico fisheries work for more than two decades and intensively on restoration of the Gulf ecosystem since the BP *Deepwater Horizon* oil disaster began.

Photo Credits

Front cover: brown pelicans © Jonathan Filskov / Getty Images
p. 1: loggerhead turtle © Matt9122 / Shutterstock
p. 4: Florida dunes © Mark Winfrey
p. 6: laughing gulls © Brian Lasenby
p. 9-10: Gulf Coast sunset © kathmanduphotog / Shutterstock
p. 11: NOAA research vessel *Okeanos Explorer*, courtesy NOAA
p. 12: oceanographic sampling, Ocean Conservancy photo
p. 14: ecosystem drivers original artwork by J. R. Allen
p. 15: tube worms and mussels, courtesy NOAA Ocean Explorer Gulf of Mexico Expedition 2002
p. 16: cold-water coral, courtesy NOAA Ocean Explorer *Lophelia* II Expedition 2009
p. 16: cold-water community, courtesy NOAA Ocean Explorer Gulf of Mexico Expedition 2002
p. 17: copepod © Julia Zekely / University of Vienna
p. 18: blue crab larva, courtesy NOAA
p. 18: moon jelly, courtesy NOAA
p. 19: common loon, courtesy U.S. National Park Service
p. 20: laughing gulls © Brian Lasenby, northern gannet courtesy U.S. National Park Service, black skimmer © Ivan Kuzmin, brown pelican © Brian Lasenby
p. 21,22: bottlenose dolphin © Darryl Vest
p. 23: red snapper © Ned Deloach / Marine Life Images
p. 24: shrimp boat, courtesy Bethany Carl Kraft / Ocean Conservancy
p. 25: loggerhead turtle, courtesy NOAA
p. 26: Kemp's ridley hatchlings, courtesy U.S. National Park Service
p. 27: blue crab, courtesy South Carolina Department of Natural Resources
p. 28: mullet on sandy bottom © Sam Farkas
p. 29: oyster reef © David Mathews
p. 30: oyster reef © Amy Diaz de Villegas / WFSU-TV
p. 31: seagrass with spotted pinfish © Keith Kolasa
p. 32: diverse green algae © Keith Kolasa
p. 33, 34: shallow-water coral, courtesy NOAA
p. 36: mangrove shoreline © Juli Scalzi
p. 37: beach mouse, courtesy U.S. Fish and Wildlife Service
p. 38: diamondback terrapin, Ryan Hagerty / U.S. Fish and Wildlife Service
p. 40: fishery observer holding turtle, courtesy NOAA SEFSC
p. 50: school of gray snapper, Brett Seymour / U.S. National Park Service
p. 57: American oystercatcher © fotoguy22 / Istockphoto
p. 68: blue crab © Melia Muse / Istockphoto
Opposite: sea turtle, Gulf of Mexico © Perice / Istockphoto

Graphic Design by Jennifer Allen

Charting the Gulf

Ocean Conservancy

Gulf Restoration Center
307 Tchoupitoulas St, Suite 300
New Orleans, LA 70130
Ph. 504-208-5813 | www.oceanconservancy.org/gulf | Follow us

KING KREBS & JURGENS PLLC

HENRY A. KING (1)
PATRICIA A. KREBS (1)
GEORGE B. JURGENS III
ROBERT J. BURVANT (1)
J. GRANT COLEMAN, LLM (2)(4)
ERIC E. JARRELL
LEN R. BRIGNAC (1) (3)(5)
TIMOTHY S. MADDEN
ROBERT J. STEFANI (1) (2)(7)

JAMES D. BERCAW
LINDSAY A. LARSON III
DAVID A. STRAUSS (1) (8)
JEFFREY M. BURMASTER
DOUGLAS P. MATTHEWS
MICHAEL L. VINCENZO
CHRISTIAN A. GARBETT (1)
JOHN A. CANGELOSI
ADAM P. MASSEY

COUNSELORS AT LAW
201 ST. CHARLES AVENUE
45TH FLOOR
NEW ORLEANS, LA 70170
TELEPHONE: (504) 582-3800
FAX: (504) 582-1233

JOSEPH A. DEVALL, JR
SUSAN E. DINNEEN (2) (10)
MICHAEL J. CERNIGLIA (11)
BRENT M. BURNS
R. DANIEL SERIO, JR.
CAROLYN S. BUCKLEY
REED M. COLEMAN (12)

FABIAN M. NEHRBASS
NICOLE M. BABB
LAURA E. AVERY
BRIAN A. CLARK
ANDREW J. REBENNACK
Of Counsel:
JOSEPH R. MESSA (8)
JOANNE MANTIS (8)
SARAH MONSOUR

(1) ALSO ADMITTED IN TEXAS
(2) ALSO ADMITTED IN WASHINGTON, D.C.
(3) ALSO ADMITTED IN FLORIDA
(4) TAX LAW SPECIALIST CERTIFIED BY THE LOUISIANA BOARD OF LEGAL SPECIALIZATION
(5) REGISTERED PATENT ATTORNEY
(6) ALSO ADMITTED IN GREECE
(7) ALSO ADMITTED IN NEW YORK
(8) ALSO ADMITTED IN ILLINOIS
(9) ADMITTED IN TEXAS ONLY
(10) ALSO ADMITTED IN MARYLAND
(11) ALSO ADMITTED IN COLORADO
(12) ALSO ADMITTED IN ALABAMA

Michael Louis Vincenzo
Attorney at Law
mvincenzo@kingkrebs.com
504.582.3810 Direct

December 4, 2015

VIA CERTIFIED MAIL NO. 7010 1060 0000 3843 0850
RETURN RECEIPT REQUESTED

Assistant Attorney General
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
U.S. Department of Justice
Washington, DC 20044–7611
(Re: DJ # 90-5-1-1-10026)

VIA CERTIFIED MAIL NO. 7010 1060 0000 3843 0836
RETURN RECEIPT REQUESTED

Natural Resource Damage Assessment
U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

VIA CERTIFIED MAIL NO. 7010 1060 0000 3843 0843
RETURN RECEIPT REQUESTED

EES Case Management Unit
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
U.S. Department of Justice
Washington, DC 20044–7611
(Re: DJ # 90-5-1-1-10026)

Re: *U.S. v. BP Exploration and Production et al.*, Civil No. 10–4536 (E.D. La.) (centralized in MDL 2179: In Re: Oil Spill by the Oil Rig ''Deepwater Horizon'' in the Gulf of Mexico, April 20, 2012), D.J. Ref. 90–5–1–1–10026.

Comment of Plaquemines Parish and the Town of Grand Isle to the Proposed Consent Decree Among Defendants BP Exploration & Production Inc. ("BPXP"), The United States of America and the States of Alabama, Florida, Louisiana, Mississippi and Texas

To Whom It May Concern:

Attached hereto are the comments of The Parish of Plaquemines and the Town of Grand Isle to the Proposed Consent Decree Among Defendants BPXP, The United States of America and the States of

Alabama, Florida, Louisiana, Mississippi and Texas. An electronic submission of these comments was made this same date through the Department of Justice.

Please advise if you have any questions.

With best regards, I remain,

Very Truly Yours,

Michael Louis Vincenzo

MLV/db
Attachment

cc: Joel Loeffelholz (via email) (w/attach)
David Landry (via email) (w/attach)
Scott Bickford (via email) (w/attach)
Henry A. King (via email) (w/attach)
David Colvin (via email) (w/attach)

U.S. v. BP Exploration and Production et al, Civil No. 10–4536 (E.D. La.) (centralized in MDL 2179: *In Re: Oil Spill by the Oil Rig ''Deepwater Horizon'' in the Gulf of Mexico,* April 20, 2012), D.J. Ref. 90–5–1–1–10026.

COMMENTS BY THE PARISH OF PLAQUEMINES AND THE TOWN OF GRAND ISLE TO THE PROPOSED CONSENT DECREE AMONG DEFENDANTS BP EXPLORATION & PRODUCTION INC. ("BPXP"), THE UNITED STATES OF AMERICA, AND THE STATES OF ALABAMA, FLORIDA, LOUISIANA, MISSISSIPPI AND TEXAS

NOW COMES Plaquemines Parish Government ("Plaquemines Parish") and the Town of Grand Isle ("Grand Isle"), in accordance with the Court's Order dated October 5th, 2015, hereby submit the following comments ("Comments") to the proposed Consent Decree Among Defendant BP Exploration & Production Inc. ("BPXP"), the United States of America, And the States of Alabama, Florida, Louisiana, Mississippi, and Texas ("Gulf States").

Plaquemines Parish and Grand Isle previously appeared at the public hearing held in New Orleans on October 22, 2015 and submitted comments regarding the Consent Decree and the PDARP-PEIS into the record of this matter. The following Comments supplement the previous comments raised by Plaquemines Parish and Grand Isle at the October 22, 2015 public hearing.

The purpose of these Comments is to request that the Consent Decree be amended to include certain clarifying language which more acutely reflects the intent of the parties to the Consent Decree as well as the permissible legal scope of the covenants contained therein.

Proposed Amendments to Certain Definitions and Provisions of the Consent Decree

Plaquemines Parish and Grand Isle propose the following revisions to the Consent Decree:

1. <u>Definition of "Gulf State" or "Gulf States"</u>

The Consent Decree's current definition of "**Gulf State**" or "**Gulf States**" presently reads as follows:

> y. "**Gulf State**" or "**Gulf States**" means one or more of the States of Alabama, Florida, Louisiana, Mississippi, and Texas.

Plaquemines Parish and Grand Isle request that the this definition be amended to clarify the fact, as expressed in other sections of the Consent Decree, that "**Gulf State**" or "**Gulf States**" do not include Local Government Entities. The suggested revised definition would be as follows:

> y. "**Gulf State**" or "**Gulf States**" means one or more of the States of Alabama, Florida, Louisiana, Mississippi, and Texas. This definition expressly excludes Local Government Entities (as defined in paragraph 74 below).

2. <u>Definition of "Natural Resource" and "Natural Resources"</u>

The Consent Decree's current definition of "**Natural Resource**" and "**Natural Resources**" Presently reads as follows:

> dd. "**Natural Resource**" and "**Natural Resources**" means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, sediment, habitat, supporting ecosystem, and/or any other such resources at any time belonging to, managed by, held in trust by, appertaining to, regulated by, assessed as part of the Deepwater Horizon Natural Resource Damages assessment, or otherwise controlled by the United States (including resources of the exclusive economic zone; "system unit resources" as defined by 54 U.S.C. § 100721(3); "park system resources" as defined by 16 U.S.C. § 19jj(d); and marine "sanctuary resources" as defined by 16 U.S.C. § 1432(8)), any Gulf State, and/or any Trustee.

Plaquemines Parish and Grand Isle request that this definition be amended to: (1) remove the words "at any time" in order to clarify that "**Natural Resource**" and "**Natural Resources**" subject to the Consent Decree do not include properties which may have once belonged to the

United States or a Gulf State but where title was transferred prior to the effective date of the Consent Decree; and (2) to move the clause "assessed as part of the Deepwater Horizon Natural Resource Damages assessment" to the end of the paragraph to clarify that **"Natural Resource"** and **"Natural Resources"** consist of those resources actually assessed as part of the Natural Resource Damages assessment. The suggested revised definition would be as follows:

> dd. **"Natural Resource"** and **"Natural Resources"** means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, sediment, habitat, supporting ecosystem, and/or any other such resources belonging to, managed by, held in trust by, appertaining to, regulated by, or otherwise controlled by the United States (including resources of the exclusive economic zone; "system unit resources" as defined by 54 U.S.C. § 100721(3); "park system resources" as defined by 16 U.S.C. § 19jj(d); and marine "sanctuary resources" as defined by 16 U.S.C. § 1432(8)), any Gulf State, and/or any Trustee assessed as part of the *Deepwater Horizon* Natural Resource Damages assessment.

3. <u>Savings Provision</u>

Paragraph 67 of the Consent Decree currently reads as follows:

> 67. <u>Savings Provision</u>. Except as provided in Paragraph 66, other than the Project Stipulations entered into pursuant to the Framework Agreement, these covenants not to sue do not affect rights under any written agreement or settlement, existing as of July 2, 2015 to which any instrumentality of the United States and any of the BP Entities are both a party.

Plaquemines Parish and Grand Isle request that this definition be amended to clarify that Local Government Entities are expressly excluded from the Consent Decree by adding the following sentence:

> Further, these covenants not to sue do not affect the rights of any Local Government Entity (as defined in paragraph 74 below).

The suggested revised paragraph 67 would read as follows:

> 67. <u>Savings Provision</u>. Except as provided in Paragraph 66, other than the Project Stipulations entered into pursuant to the Framework Agreement, these covenants not to sue do not affect rights under any written agreement or settlement, existing as of July 2, 2015 to which any instrumentality of the United States and any of the BP Entities are both a party. Further, these covenants not to sue do not affect the rights of any Local Government Entity (as defined in paragraph 74 below).

4. <u>Instrumentalities</u>

Paragraph 74 of the Consent Decree currently reads as follows:

> 74. Instrumentalities. All references to the Gulf States in this Section XIII and Paragraph 5 shall include each and every of the five Gulf States and, respectively, all State Trustees, all branches, agencies, associations, authorities, boards, bureaus, councils, departments, educational institutions or systems, components, public benefits corporations, or other instrumentalities of any kind, administrators, elected or unelected officials, officers or delegates (other than in their individual capacities), attorneys, or other agents of any kind of each of the Gulf States, provided however that a reference to a Gulf State shall not include counties, parishes, municipalities, or any other local governmental or local political subdivisions authorized by law to perform local governmental functions.

Plaquemines Parish and Grand Isle request paragraph 74 be amended to specify the definition of Local Government Entities and to clarify that Local Government Entities are expressly excluded from the Consent Decree by adding the following text:

> (collectively "Local Government Entities"). Nothing in this Consent Decree shall be deemed to constitute a waiver of any rights or claims of Local Government Entities provided for under the OPA, general maritime law, or other applicable statute or law.

Plaquemines Parish and Grand Isle also request paragraph 74 be amended to omit the term in "this Section XIII and Paragraph 5" to clarify that the definition of Gulf States has one meaning throughout the entirety of the Consent Decree.

The suggested revised paragraph 74 would read as follows:

> 74. Instrumentalities. All references to the Gulf States shall include each and every of the five Gulf States and, respectively, all State Trustees, all branches, agencies, associations, authorities, boards, bureaus, councils, departments, educational institutions or systems, components, public benefits corporations, or other instrumentalities of any kind, administrators, elected or unelected officials, officers or delegates (other than in their individual capacities), attorneys, or other agents of any kind of each of the Gulf States, provided however that all references to a Gulf State shall not include counties, parishes, municipalities, or any other local governmental or local political subdivisions authorized by law to perform local governmental functions (collectively "Local Government Entities"). Nothing in this Consent Decree shall be deemed to constitute a waiver of any rights or claims of Local Government Entities provided for under the OPA, general maritime law, or other applicable statute or law.

Respectfully Submitted,
MARTZELL & BICKFORD

/s/Scott R. Bickford
SCOTT R. BICKFORD, T. A. (#1165)
LAWRENCE J. CENTOLA, III (#27402)
usdcedla@mbfirm.com
338 Lafayette Street
New Orleans, LA 70130
(504) 581-9065 Telephone
(504) 581-7635 Fax
Special Counsel for the Parish of Plaquemines, the Town of Grand Isle and their Subdivisions and Districts

AND

/s/David Landry
DAVID L. LANDRY (#7978)
The Law Office of David L. Landry
2landry@cox.net
1214 Parasol Place
Pensacola, Florida 32507
(850) 492-7240

Special Counsel for the Parish of Plaquemines and its Subdivisions and Districts

AND

/s/Henry King
HENRY A. KING (#7393)
MICHAEL L. VINCENZO (#23965)
King, Krebs & Jurgens, PLLC
hking@kingkrebs.com
mvincenzo@kingkrebs.com
201 St. Charles Avenue, 45th Floor
New Orleans, LA 70170
504-582-3800 Telephone
504-582-1233 Fax
Special Counsel for the Parish of Plaquemines and its Subdivisions and Districts

s/David L. Colvin
DAVID L. COLVIN (#4353)
COLVIN LAW FIRM
davec@dcolvinlaw.com
230 Huey P. Long Avenue
Gretna, LA 70053
504-367-9001 Telephone
504-367-0650 Fax
Counsel for The Town of Grand Isle and Grand Isle Independent Levee District

4 December 2015

Deepwater Horizon Natural Resource Damage Assessment Trustees
c/o U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, Georgia 30345

Dear Trustees:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the Trustees' Draft Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS) for the Gulf of Mexico and associated notice (80 Fed. Reg. 60126). The Draft PDARP/PEIS summarizes the assessment of impacts of the Deepwater Horizon oil spill on Gulf natural resources and on the services those resources provide, and describes the Trustees' programmatic alternatives to restore natural resources, ecological services, and recreational use services injured or lost as a result of the spill.

The Commission commends the Trustees for the comprehensive assessment of impacts in the PDARP/PDEIS, especially considering the shortage of available information on pre-spill abundance, distribution, and vital rates for many of the Gulf's natural resources, including marine mammals. Determination of the extent of exposure and injury to marine mammals required an exhaustive analysis of information obtained from pre- and post-spill population surveys, behavioral observations, strandings, health assessments, toxicity testing, environmental and oceanographic studies, and the scientific literature. The number of marine mammals estimated to have been killed or injured due to exposure to oil and oil response activities is staggering and represents a significant challenge to the recovery of several marine mammal stocks.

The Commission has focused its comments and recommendations on the restoration and monitoring aspects of the PDARP/PEIS. The settlement agreement with BP directs the allocation of specific funding amounts among state, region-wide, and open ocean resources, and it is incumbent on the Trustees to ensure that marine mammal restoration and monitoring activities are designed and implemented to maximize recovery and minimize additional stress on impacted stocks.

The Trustees' preferred alternative

The guiding principle of the Trustees' restoration plan, as mandated by the Oil Pollution Act, is to restore the range of habitats, resources, and services injured by the Deepwater Horizon oil spill. The Trustees have proposed to address this mandate by allocating restoration funds to meet the following high-level goals—

- Restore and conserve habitat;
- Restore water quality;
- Replenish and protect living coastal and marine resources;

- Provide and enhance recreational opportunities; and
- Provide for monitoring, adaptive management, and administrative oversight to support restoration implementation.

The Trustees have proposed to meet those goals through an "integrated restoration portfolio" that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the northern Gulf of Mexico ecosystem (the Trustees' preferred alternative). Other alternatives considered and evaluated by the Trustees were a resource-specific restoration portfolio that emphasizes close, well-defined relationships between injured resources and the restoration types (Alternative B), the deferral of restoration plan development in favor of continued injury assessment (Alternative C), and the natural recovery/no action alternative (Alternative D).

The Commission supports the implementation of the Trustees' preferred alternative as it combines large-scale habitat restoration projects for areas determined to have been directly and indirectly impacted by the oil spill with species-specific restoration projects. The Trustees' preferred alternative also provides for Gulf-wide monitoring and adaptive management to track restoration performance and guide changes in projects when needed to enhance effectiveness. The large-scale nature of the oil spill and the extent of impacts across numerous habitats and species necessitate an integrated, region-wide approach which would not be addressed adequately by a resource-specific approach (Alternative B), a delay in implementing restoration (Alternative C), or reliance solely on natural recovery (Alternative D). Therefore, the Commission recommends that the Trustees implement their preferred alternative to maximize the potential for broad-scale environmental benefits while also addressing resource-specific restoration goals.

Marine mammal restoration activities

Under the preferred alternative, the Trustees have proposed a suite of activities to restore marine mammals impacted by the spill. They were designed to address three top level goals—

- Restoration of injured marine mammal stocks across the diverse habitats and geographic ranges they occupy;
- Mitigation of key stressors to support resilient marine mammal populations by collecting and using information from population and health assessments and information on spatiotemporal distribution; and
- Accounting for the ecological needs of the stocks, improving resilience to natural stressors, and addressing human-caused threats.

The Trustees' proposed approaches to achieve marine mammal restoration goals include—

- Reducing commercial fishery bycatch through collaborative partnerships.
- Reducing injury and mortality of bottlenose dolphins from hook and line fishing gear.
- Increasing marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats.
- Measuring noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals.

- Reducing injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities.
- Reducing marine mammal takes through enhanced state enforcement of the Marine Mammal Protection Act (MMPA).
- Reducing injury and mortality of marine mammals from vessel collisions.
- Protecting and conserving marine, coastal, estuarine, and riparian habitats.

The proposed restoration approaches are focused on restoration of marine mammal stocks determined to have been directly or indirectly impacted by the spill, particularly bottlenose dolphins, with some activities (i.e., gaining a better understanding of the causes of illness and mortality) expected to also benefit marine mammal stocks beyond the oil spill direct-impact area. The Commission agrees that the proposed restoration activities meet the requirements of the Oil Pollution Act by addressing some of the most significant anthropogenic threats that could impede recovery of oil spill-affected marine mammals in the Gulf. The Commission also recognizes that options are limited for other, more direct marine mammal restoration activities, such as rehabilitation or replacement of injured resources or acquisition of equivalent resources.

With the exception of measuring and characterizing sound sources and reducing anthropogenic sound in areas of overlap with high densities of marine mammals, the Trustees have limited activities directed toward restoration of Bryde's whales, sperm whales, and other oceanic stocks of impacted marine mammals. In this regard, one additional restoration approach that the Trustees should consider to enhance restoration efforts in oceanic waters is the designation of marine protected areas. Marine protected areas have the potential to benefit marine mammal populations (and other marine species) that were impacted by the oil spill and for which few other restoration options are available. Depending on the mechanism used, the designation could provide protection for recovering marine mammals by restricting oil and gas activities, restricting certain types of fishing activities or fishing gear, providing targeted education and outreach, and monitoring resources and activities.

Two areas that the Trustees should consider designating as marine protected areas are the DeSoto and Mississippi Canyons. These areas provide important habitat for Bryde's whales and sperm whales, respectively, as well as for other oceanic marine mammals and deep-sea coral communities. The northern Gulf of Mexico stock of Bryde's whales inhabits DeSoto Canyon and adjacent continental slope waters extending east and south of the Canyon, and Bryde's whales are the only regularly occurring baleen whale in the Gulf (Waring et al. 2013, Rosel and Wilcox 2014). The northern Gulf of Mexico stock of sperm whales also represent a distinct stock in the Gulf. Sperm whales are found throughout offshore waters of the Gulf, but the Mississippi Canyon represents an important feeding area (Jochens et al. 2008). Both species of large whales were impacted by the oil spill, with estimates of 17 percent of the Bryde's whale population killed and 6 percent of the sperm whale population killed (DWH MMIQT 2015). Mississippi Canyon was subject to intense and prolonged oiling below and at the surface during the spill (Stout et al. 2015). DeSoto Canyon was less heavily contaminated but also experienced oiling at the surface and seafloor (Brooks et al. 2015). Other marine mammals found regularly or occasionally in these areas include Atlantic spotted dolphins, Blainville's beaked whales, Cuvier's beaked whales, Gervais' beaked whales, dwarf and pygmy sperm whales, oceanic and continental shelf stocks of bottlenose dolphins, pantropical spotted dolphins, Risso's dolphins, rough-toothed dolphins, short-finned pilot whales, spinner dolphins, and striped dolphins (Waring et al. 2013). Less is known about the distribution of other oceanic marine mammals within these areas, such as Clymene's dolphins, Fraser's dolphins, killer whales, false killer whales, melon-headed whales, and pygmy killer whales.

The designation of marine protected areas was noted by the Trustees as a mechanism for addressing key threats to mesophotic and deep benthic communities (Section 5.5.13.3). However, no information was provided in the PDARP/PEIS on what specific areas in the Gulf the Trustees might be considering for such designation. The Commission believes that areas that provide protection for multiple species, including marine mammals, should be priorities for designation. The Commission therefore recommends that the Trustees consider designating as marine protected areas those marine mammal habitats that were significantly impacted by the spill and for which few other restoration activities exist, such as DeSoto Canyon and Mississippi Canyon.

Potential impacts of habitat restoration projects on marine mammals

The primary focus of the draft PDARP/PEIS is the restoration of wetlands and coastal and nearshore habitats impacted by the oil spill. Under the Trustees' preferred alternative (Section 5.5), this would include the creation and enhancement of ecologically connected coastal habitats, the controlled diversion of Mississippi River waters into adjacent wetlands, and restoration across a range of coastal habitats in the spill-impacted area including beaches, dunes, islands, barrier headlands, oyster reefs, and submerged aquatic vegetation (SAV). If executed properly, those projects should address the Trustees' restoration goals for many nearshore aquatic species impacted by the spill, including marine mammals such as bottlenose dolphins and manatees. However, as noted in the draft PDARP/PEIS, those projects also have the potential to result in unintended adverse impacts on inshore and nearshore marine mammals and their prey species.

Habitat restoration projects under the Trustees' preferred alternative would involve dredging, beach renourishment, restoration and construction of barrier and coastal islands, backfilling of canals, river and sediment diversions, and construction of living shorelines, groins, and breakwaters. Potential impacts on natural resources from these restoration activities were identified briefly in section 6.4 of the PDARP/PEIS, but the Commission would like to highlight the following specific concerns regarding potential impacts on marine mammals.

- Dredging of contaminated sediments can temporarily re-suspend pollutants into the water column where they may be ingested by marine mammal prey (Martins et al. 2012); re-suspended nutrients can contribute to the development of, or exacerbate, harmful algal blooms (Van Dolah 2000).
- Beach renourishment can alter benthic communities and affect the prey of marine mammals (Peterson and Bishop 2005).
- Backfilling of canals can trap marine mammals and block access to their natural habitat, requiring rescue and relocation of the "stranded" animals.
- River diversions can increase freshwater input into marsh habitat, exposing dolphins to low-salinity waters. Such exposure can compromise epidermal integrity (as evidenced by skin lesions), cause physiological stress, and contribute to secondary infections (Wilson et al. 1999; Holyoake et al. 2010; Mullin et al. 2015). Low-salinity conditions can also affect the distribution of dolphin prey (Barros and Odell 1990).

- Disturbance from construction activities and associated vessel traffic can increase sound levels and disrupt foraging, habitat use, daily or migratory movements, and other behavior (Nowacek et al. 2001, 2004). Increased vessel traffic can also increase the risk of vessel strikes (FWS 2001, Wells et al. 2008, Bechdel et al. 2009).

If not carefully managed, habitat restoration activities could present a significant impediment to the recovery of inshore marine mammals impacted by the oil spill, including bottlenose dolphin stocks in Barataria Bay, the Mississippi River Delta, Mississippi Sound, and Mobile Bay. The Trustees estimated that 12 to 59 percent of the total population of those stocks was killed due to the oil spill, and that the timespan for recovery of those stocks could be from 31 to 52 years (Section 4.9). Although impacts to Florida manatees were not quantified by the Trustees and were likely not as severe, habitat restoration projects in certain areas also have the potential to impact manatees. To prevent additional impacts to all marine mammals, <u>the Commission recommends</u> that the Trustees conduct site-specific analyses under the National Environmental Policy Act (NEPA) of proposed habitat restoration projects and associated activities to ensure that there has been a thorough evaluation of potential project-specific and cumulative impacts on marine mammals, their habitat, and prey. <u>The Commission further recommends</u> that the Trustees work with the National Marine Fisheries Service (NMFS) and the Fish and Wildlife Service (FWS) to ensure that habitat restoration projects are sufficiently adapted and monitored to minimize adverse short- and long-term impacts on marine mammals.

The importance of comprehensive monitoring

As noted in the draft PDARP/PEIS, monitoring is a critical component to evaluate restoration outcomes and determine the need for any corrective actions. A comprehensive and well-designed monitoring program is critical to understanding the Gulf ecosystem, inform future decision-making, and gauge the effectiveness of restoration activities (see, for example, Goetz et al. 2004). A recent workshop convened by the National Academy of Sciences Gulf Research Program (2015) noted that—

> "Environmental monitoring information can be used to increase basic understanding, identify emerging problems and long-term trends, inform restoration projects, prioritize use of resources, and provide information to guide policy and management. For rapidly changing regions like the Gulf of Mexico, monitoring efforts also can yield reference data that flag emerging environmental and health concerns."

Both site-specific and broad-scale monitoring should be part of the adaptive management system used by the Trustees and its restoration partners. In general, restoration monitoring plans should be interdisciplinary and inter-institutional, with monitoring goals and long-term stable funding identified at the outset. Plans should include monitoring of key physical, biological, and ecological parameters before, during, and after restoration activities. Biological and ecological monitoring should include regular, systematic, and long-term surveys of a broad range of representative marine species, including plants, invertebrates, fish, birds, sea turtles, and marine mammals. Such surveys should be conducted at sufficient levels of effort and frequency to allow detection of changes with a high level of confidence.

Enhanced monitoring of impacted marine mammal stocks, and the integration of newly collected information with existing databases and data sets, can help to focus marine mammal restoration activities and assess their effectiveness over the long term. It also can assist in identifying unintended and potentially adverse effects of habitat restoration activities on marine mammals. Rather than developing new, stand-alone data collection programs to track the restoration and recovery of impacted marine mammals and/or monitor the effects of habitat restoration projects, the Commission recommends that the Trustees use, support, and expand existing marine mammal monitoring programs in all areas of the Gulf as the basis for an integrated, long-term approach to monitoring the restoration of marine mammals.

There are several existing marine mammal monitoring programs[1] that the Trustees should consider expanding as part of its project-specific and broad-scale restoration monitoring efforts.

- Capture-mark-recapture studies (e.g., photo-identification) from small vessels can provide information on abundance, distribution, movements, behavior, and vital rates for bottlenose dolphins and manatees. Repeated, long-term studies allow detection of population-level changes in response to environmental and human-caused perturbations. Such studies are typically conducted by non-governmental organizations, academic institutions, and state resource agencies, as well as NMFS (for bottlenose dolphins), and the U.S. Geological Survey (USGS; for manatees). Centralized large-scale, collaborative photo-identification catalogs have been established (e.g., the Gulf of Mexico Dolphin Identification System, or GoMDIS), providing a basis for tracking movements of individual animals beyond project study sites and detecting range shifts in response to environmental changes.
- Visual observations from aerial surveys are used to determine abundance and distribution of bottlenose and Atlantic spotted dolphins and manatees in nearshore and coastal waters. Aerial surveys for dolphins are conducted by NMFS and for manatees by FWRI, USGS, and other entities.
- Shipboard surveys are used to determine abundance and distribution of oceanic cetaceans. They are used also as a platform for satellite tagging to provide information on individual ranging patterns; more sophisticated satellite tags also can provide information on diving patterns and habitat use. Shipboard surveys and tagging of oceanic cetaceans are conducted primarily by NMFS due to cost and infrastructure requirements, but surveys have also been conducted independently by, or in collaboration with, academic institutions and non-governmental organizations.
- Remote biopsy samples collected as part of nearshore and offshore vessel-based surveys can provide information on stock structure, contaminants, diet (stable isotopes), and reproductive status (sex, hormones, etc.).
- Acoustic recordings of vocalizing cetaceans can be used to complement visual observations on shipboard surveys using towed arrays. Fixed acoustic arrays (i.e., acoustic buoys) can provide continuous detections of vocalizing cetaceans in a limited spatial area to determine presence and distribution; they also can be used to determine densities of animals if other species-specific information exists (such as group size and call rates). Acoustic data are

[1] Monitoring activities identified here generally involve the taking of marine mammals and therefore require permits or other authorizations under the MMPA (for bottlenose dolphins and manatees) and the ESA (for manatees).

obtained from fixed arrays deployed by academic institutions located in the Gulf and elsewhere, and also by NMFS.

- Live-capture/release health assessments of dolphins and manatees are used to investigate unusual mortality events and the effects of environmental stressors. Health assessments to investigate sub-lethal effects on bottlenose dolphins from the Deepwater Horizon oil spill were conducted at two oil-impacted sites in the Gulf (Barataria Bay and Mississippi Sound) and at a long-term reference site in Sarasota Bay. Similar manatee health assessments have been conducted in Florida waters. Health assessments are personnel- and resource-intensive and typically involve collaborators from a large number of federal and state agencies and private institutions in the Gulf and elsewhere.
- The NMFS Marine Mammal Health and Stranding Response Program oversees a national volunteer network of trained responders and veterinarians who are authorized under the MMPA to respond to, rescue, and rehabilitate live-stranded marine mammals and investigate dead-stranded marine mammals. The information collected from stranded marine mammals is used to assess marine mammal health and health trends; correlate health and trend data with biological, physical, and chemical environmental parameters; and coordinate responses to unusual mortality events. Stranding network members are located in each of the five Gulf states[2] and are typically associated with non-governmental organizations, academic institutions, and state agencies. NMFS provides administration, coordination, and data management for the program.
- The Manatee Salvage and Necropsy Program at the Florida Fish and Wildlife Research Institute (FWRI) supports efforts to salvage and necropsy Florida manatees throughout their range, including animals that strand outside the state of Florida, and to identify and track trends in manatee mortality.
- The U.S. Fish and Wildlife Service (FWS) and FWRI respond to calls about injured and distressed manatees throughout the southeastern United States. As necessary, they engage in or coordinate capture and transport to three authorized zoo and aquarium hospitals in Florida for rehabilitation and eventual release back into the wild through the Manatee Rescue and Rehabilitation Partnership.

Coordination and resources

The Trustees face a considerable challenge in implementing restoration activities for marine mammals in the face of data gaps and dispersed science capacity in the Gulf. Prioritizing data needs and meeting those needs through expanded data collection and monitoring will require strong leadership by the Trustees, Trustee Implementation Groups, and Individual Trustee Agencies. It will also require long-term, consistently maintained collaborations with Gulf marine mammal stranding network members, academics, not-for-profit organizations, educators, commercial and recreational fishermen, the oil and gas industry, wildlife tour operators, state enforcement agencies, and the public. Leadership from the agencies and organizations with prior experience collecting, analyzing, maintaining, and using biological, environmental, and socioeconomic data is central to building the collaborations needed to understand the status of, and address threats to, marine mammals.

---

[2] http://sero.nmfs.noaa.gov/protected_resources/marine_mammal_health_and_stranding_response_program/mmstranding_organizations/index.html

The Department of Commerce/NOAA and the Department of the Interior (DOI) are key partners for marine mammal restoration and monitoring in the Gulf. Under the MMPA, NOAA's NMFS has lead responsibility for research and management related to cetaceans and the Department of the Interior's FWS and USGS have lead responsibility for management and research (respectively) related to manatees. As demonstrated by the thoroughness of the damage assessments conducted after the oil spill, these agencies have significant expertise in designing and implementing population surveys, collecting and analyzing biological samples, conducting health assessments, and analyzing large data sets. They also have demonstrated leadership in coordinating with other public and private researchers, establishing data collection standards, training field personnel, conducting outreach and education programs, and maintaining and archiving data for broad access by other researchers and the public. NMFS and FWS have responsibility under the MMPA for reviewing and issuing marine mammal scientific research permits, stranding agreements, and incidental take authorizations, and under the Endangered Species Act (ESA) for conducting consultations with other federal agencies regarding actions that may affect endangered and threatened marine mammals and designated critical habitat (including habitat restoration projects proposed by the Trustees). NMFS and FWS also enforce the taking prohibitions of the MMPA and ESA in partnership with state natural resource agencies.

The Commission is concerned that without additional staff resources over the timeframe identified for restoration, these agencies will have limited ability to help guide and coordinate marine mammal restoration and monitoring activities in the Gulf. Without such guidance and coordination, other restoration partners in the Gulf[3] may undertake monitoring activities that are not compatible with, and do not build on, existing data collection and management programs. This would ultimately limit the Trustees' ability to evaluate the performance and long-term success of restoration activities. Additional staff are needed also to prepare and review environmental compliance documents required under NEPA and to conduct consultations and issue take authorizations as needed under the ESA and MMPA. With additional staff, these agencies also could help leverage and coordinate the broader suite of restoration resources available in the Gulf. Therefore, the Commission recommends that NOAA and DOI, as Deepwater Horizon Trustees, dedicate additional long-term staff to help guide and coordinate marine mammal restoration, monitoring, and environmental compliance activities in the Gulf.

To assist the Trustees in its planning efforts, the Commission is enclosing the summary report from the Gulf of Mexico Marine Mammal Research and Monitoring Meeting convened by the Commission and several partners in April 2015. The objectives of the meeting were to identify high priority marine mammal information needs for the next 5-15 years and to discuss existing and emerging funding opportunities in the Gulf of Mexico. The report highlights what is known (and not known) regarding marine mammal abundance, distribution, stock structure, habitat use, and causes of mortality and morbidity. It also provides information that may be useful in mitigating human impacts on marine mammals in the Gulf associated with oil and gas exploration and development, commercial and recreational fishing, shipping, tourism, military operations, and pollution.

---

[3] Including, but not limited to, the RESTORE Act Ecosystem Restoration Council, the RESTORE Act Centers of Excellence, the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund, and the National Academy of Sciences Gulf Research Program.

The Commission hopes that information presented at the April meeting and summarized in the report will assist the Trustees in their planning efforts and also help pave the way for additional collaboration in the Gulf region. More information regarding the meeting, and PDF versions of the presentations and posters, are available at: http://www.mmc.gov/gom/gom_meeting.shtml.

The Commission understands that the Trustees will be developing their implementation strategy in more detail over the coming year. The Commission would welcome the opportunity to contribute to those efforts in any capacity that the Trustees deem appropriate.

Sincerely,

Rebecca J. Lent, Ph.D.
Executive Director

Enclosure

References

Barros, N.B., and D.K. Odell. 1990. Food habits of bottlenose dolphins in the southeastern United States. Pages 309–328 *in* S. Leatherwood and R. Reeves (eds.). The Bottlenose Dolphin. Academic Press, San Diego, California, 653 pages.

Bechdel, S.E., M.S. Mazzoil, M.E. Murdoch, E.M. Howells, J.S. Reif, and S.D. McCulloch. 2009. Prevalence and impacts of motorized vessels on bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida. Aquatic Mammals 35(3):367-377.

Brooks, G.R., R.A. Larson, P.T. Schwing, I. Romero, C. Moore, G-J. Reichart, T. Jilbert, J.P. Chanton, D.W. Hastings, W.A. Overholt, K.P. Marks, J.E. Kostka, C.W. Holmes, and D. Hollander. 2015. Sedimentation pulse in the NE Gulf of Mexico following the 2010 DWH blowout. PLoS ONE 10(7):e0132341.

DWH MMIQT (Deepwater Horizon Marine Mammal Injury Quantification Team). 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the Deepwater Horizon oil spill. DWH Marine Mammal NRDA Technical Working Group Report. At https://www.doi.gov/deepwaterhorizon/adminrecord.

FWS. 2001. Florida manatee recovery plan (*Trichechus manatus latirostris*), Third Revision. Atlanta, Georgia, 144 pages plus appendices. At http://www.fws.gov/northflorida/Manatee/Recovery%20Plan/2001_FWS_Florida_Manatee_Recovery_Plan.pdf.

Goetz, F., C. Tanner, C.S. Simenstad, K. Fresh, T. Mumford, and M. Logsdon. 2004. Guiding restoration principles. Puget Sound Nearshore Partnership, Report Number 2004-03. Washington Sea Grant Program, University of Washington, Seattle, Washington, 16 pages. At http://pugetsoundnearshore.org/technical_papers/nearshore_guiding_principles.pdf.

Holyoake, C., H. Finn, N. Stephens, P. Duignan, C. Salgado, H. Smith, L. Bejder, T. Linke, C. Daniel, and H. Lo. 2010. Technical report on the bottlenose dolphin (*Tursiops aduncus*) unusual mortality event within the Swan Canning Riverpark, June-October 2009. Report to the Swan River Trust, 234 pages. At http://www.swanrivertrust.wa.gov.au/docs/technical-reports/technical-report-on-the-bottlenose-dolphin-unusual-mortality-event-within-the-swan-canning-riverpark-june-october-2009.pdf.

Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, and B. Würsig. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana; OCS Study MMS 2008-006, 323 pages. At http://seawater.tamu.edu/swss/doc/2008-006.pdf.

Martins, M., P.M. Costa, J. Raimundo, C. Vale, A.M. Ferreira, and M.H. Costa. 2012. Impact of remobilized contaminants in *Mytilus edulis* during dredging operations in a harbour area: Bioaccumulation and biomarker responses. Ecotoxicology and Environmental Safety 85:96-103.

Mullin, K.D., K. Barry, C. Sinclair, J. Litz, K. Maze-Foley, E. Fougeres, B. Mase-Guthrie, R. Ewing, A. Gorgone, J. Adams, and M. Tumlin. 2015. Common bottlenose dolphins (*Tursiops truncatus*) in Lake Pontchartrain, Louisiana: 2007 to mid-2014. NOAA Technical Memorandum NMFS-SEFSC-673, 43 pages. At: http://docs.lib.noaa.gov/noaa_documents/NMFS/SEFSC/TM_NMFS_SEFSC/NMFS_SEFSC_TM_673.pdf.

Nowacek, S.M., R.S. Wells, and A.R. Solow. 2001. Short-term effects of boat traffic on bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. Marine Mammal Science 17(4):673-688.

Nowacek, S.M., R.S. Wells, D.P. Nowacek, E.C.G. Owen, T.R. Speakman, and R.O. Flamm. 2004. Florida manatees, *Trichechus manatus latirostris*, respond to approaching vessels. Biological Conservation 119:517-523.

National Academy of Sciences. 2015. Opportunities for the Gulf Research Program: Monitoring ecosystem restoration and deep water environments: A workshop summary. The National Academies Press, Washington, D.C., 52 pages. At http://www.nap.edu/catalog.php?record_id=21673.

Peterson, C.H., and M. Bishop. 2005. Assessing the environmental impacts of beach renourishment. BioScience 55(10):887-896.

Rosel, P.E., and L.A. Wilcox. 2014. Genetic evidence reveals a unique lineage of Bryde's whales in the northern Gulf of Mexico. Endangered Species Research 25:19–34.

Stout, S.A., S. Rouhani, B. Liu, and J. Oehrig. 2015. Spatial extent ("footprint") and volume of Macondo oil found on the deep-sea floor following the Deepwater Horizon oil spill. (CHEM_TR.16). DWH Natural Resource Exposure NRDA Technical Working Group Report. At https://www.doi.gov/deepwaterhorizon/adminrecord.

Van Dolah, F.M. 2000. Marine algal toxins: Origins, health effects, and their increased occurrence. Environmental Health Perspectives 108 (Supplement 1):133-141.

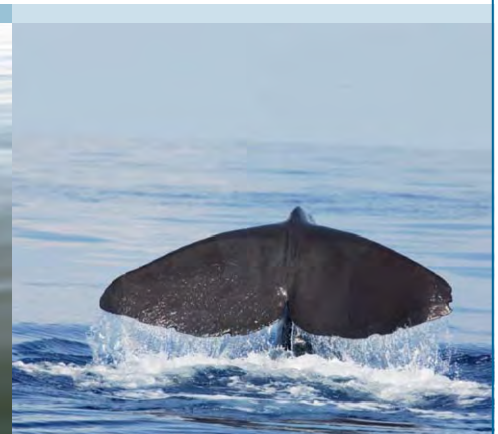
Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel (eds). 2013. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2012, 419 pages. At http://www.nmfs.noaa.gov/pr/sars/region.htm.

Wells, R.S., J.B. Allen, S. Hofmann, K. Bassos-Hull, D.A. Fauquier, N.B. Barros, R.E. DeLynn, G. Sutton, V. Socha, and M.D. Scott. 2008. Consequences of injuries on survival and reproduction of common bottlenose dolphins (*Tursiops truncatus*) along the west coast of Florida. Marine Mammal Science 24:774-794.

Wilson, B., H. Arnold, G. Bearzi, C.M. Fortuna, R. Gaspar, S. Ingram, C. Liret, S. Pribanic, A.J. Read, V. Ridoux, K. Schneider, K.W. Urian, R.S. Wells, C. Wood, P.M. Thompson, and P.S. Hammond. 1999. Epidermal disease in bottlenose dolphins: Impacts of natural and anthropogenic factors. Proceedings of the Royal Society of London: B 256:1077-1083.

Gulf of Mexico Marine Mammal Research and Monitoring Meeting





7-8 April 2015
New Orleans, Louisiana

Summary Report

Marine Mammal Commission
An Independent Agency of the U.S. Government
4340 East-West Highway, Room 700
Bethesda, MD 20814

November 2015

Gulf of Mexico Marine Mammal Research and Monitoring Meeting

7-8 April 2015
New Orleans, Louisiana

Summary Report

Edited By:
Victoria R. Cornish
Marine Mammal Commission
4340 East-West Highway, Room 700
Bethesda, MD 20814

November 2015

DISCLAIMER

This report was prepared by the Marine Mammal Commission, in coordination with the Steering Committee members, session moderators, and presenters. The mention of trade names or commercial products does not constitute endorsement by the Marine Mammal Commission.

CITATION

Suggested format for citation of this report:

Cornish, V. (ed.). 2015. Gulf of Mexico Marine Mammal Research and Monitoring Meeting: Summary Report. Marine Mammal Commission, Bethesda, MD 20910. 110 pages.

REPORT AVAILABILITY

This report, the meeting program, and a PDF version of presentations and posters from the meeting are available at www.mmc.gov.

PHOTOGRAPHS AND FIGURES

Photographs of cetaceans used on the cover and in the report were provided by Keith Mullin, National Marine Fisheries Service (NMFS) Pascagoula Laboratory, and were taken under authority of Marine Mammal Protection Act (MMPA) permit number 779-1633. The photograph of the Florida manatee on the front cover was provided by Chris Simoniello, Gulf of Mexico Coastal Ocean Observing System (GCOOS). Other photographs and figures used in the report were from presentations made at the meeting or from online sources and are credited accordingly.

EXECUTIVE SUMMARY

On April 7-8, 2015, marine mammal scientists and managers working in the Gulf of Mexico met in New Orleans, Louisiana, to discuss the state of marine mammal science in the Gulf. One hundred people attended the meeting, with presentations and posters summarizing recent and ongoing projects in the Gulf. Meeting participants also discussed existing and emerging funding opportunities, some of which could be used to expand research, monitoring, and analytical capabilities to address priority information needs for marine mammals in the Gulf.

This report is a summary of the presentations made at the meeting and ensuing discussions. The appendices provide a list of posters presented at the meeting, descriptions of 53 recent and ongoing marine mammal projects in the Gulf, as submitted by researchers themselves prior to the meeting, and a list of meeting registrants.

Some of the more general observations made at the meeting include the following—

- The economies of states bordering the Gulf contribute significantly to the nation's gross domestic product, but those economies depend to a considerable degree on a vibrant, healthy marine environment with abundant living resources.
- Marine mammals are an important component of the Gulf ecosystem.
- Research and monitoring of marine mammals in the Gulf must address the information needs arising from various legal mandates, including the Marine Mammal Protection Act, Endangered Species Act, and National Environmental Policy Act.
- Better information on marine mammal abundance, distribution, habitat use, and behavior is necessary if we are to mitigate the potential impacts of human activities in the Gulf, including those associated with oil and gas exploration and development, commercial and recreational fishing, shipping, military operations, tourism, and pollution.
- Standardized methods of collecting and archiving data, training in those methods, and improved access to data are needed to support efforts aimed at assessing the individual and cumulative impacts of human activities on marine mammals in the Gulf.
- Marine mammal models that account for environmental drivers and stressors at the individual, population, and ecosystem level are needed.
- Restoration projects that may affect marine mammals, their habitat, and prey should include a monitoring component to evaluate the effects of restoration activities on marine mammals.
- Several funding opportunities exist (or are in the planning stages) that could be used to expand marine mammal restoration, research, monitoring, and analytical capabilities in the Gulf, but each has specific focus areas and constraints.
- Recent trends in funding and publishing research require that data are made publicly available in a timely manner after the completion of the project and that data are discoverable in an easily accessible repository. This has not been a common practice for most marine mammal data and will need to be addressed.
- A coordinated and collaborative approach to developing a Gulf-wide action plan would help ensure that priority restoration, research, monitoring, and assessment needs for marine mammals are identified, and that potential funds and research capacity are leveraged for maximum benefit.

The information presented and ideas expressed at the meeting and reflected in this report are intended to help build a strong foundation for expanded marine mammal research and monitoring in the Gulf of Mexico, and to better conserve and protect marine mammals that are a part of this complex, diverse, and changing environment.

ACKNOWLEDGMENTS

The Marine Mammal Commission would like to thank the Steering Committee members (listed below) and all of the meeting presenters, session moderators, breakout group leaders, sponsors, and participants who contributed their time and efforts to make this meeting a success.

Vicki Cornish, Chair
Marine Mammal Commission (Sponsor)

Laura Engleby
National Marine Fisheries Service

Deborah Epperson
Bureau of Safety and Environmental Enforcement

Libby Fetherston
Ocean Conservancy

Tré Glenn
Bureau of Ocean Energy Management

Kathryn Mengerink and Teresa Chan
Environmental Law Institute (Sponsor)

Paula Moreno
University of Southern Mississippi
Gulf Coast Research Laboratory

Keith Mullin
National Marine Fisheries Service

Pamela Plotkin
Texas A&M University (Sponsor)

Jason Recher and Sarah Gretchen
Audubon Nature Institute

Randall R. Reeves
Marine Mammal Commission

Samantha Simmons
Marine Mammal Commission

Stephanie Watson
Gulf of Mexico Coastal Ocean Observing System (Sponsor)

Randall Wells
Chicago Zoological Society, Sarasota Dolphin Research Program

Graham Worthy
University of Central Florida

Table of Contents

APPENDICES

FIGURES

TABLES

INTRODUCTION AND MEETING OBJECTIVES

Vicki Cornish, Marine Mammal Commission

Numerous workshops and planning efforts have been conducted to review information on marine mammals and identify and address gaps in knowledge regarding their conservation status and the impacts of human activities in the northern Gulf of Mexico (Keller and James 1983, Tucker & Assoc. 1989, McKay et al. 1999, Mullin et al. 2007, NMFS 2008, MMC 2008). Those workshops and planning efforts have helped to focus resources on research and monitoring[1] studies to meet the legal mandates of the Marine Mammal Protection Act (MMPA), the Endangered Species Acton (ESA), and the National Environmental Policy Act (NEPA) to protect, conserve, and promote the recovery of marine mammal populations. Studies have included abundance and distribution surveys as well as relatively intense research on certain species (e.g., sperm whales, manatees, and bottlenose dolphins). However, federal funding for marine mammal stock assessment surveys and research has waned at the same time that human activities in the northern Gulf (e.g., oil and gas development, commercial shipping, military training, commercial and recreational fishing, and tourism) have increased.

Pantropical spotted dolphin (*Stenella attenuata*)
(*Credit: NMFS*)

The inadequacy of baseline information regarding Gulf of Mexico marine mammals became apparent during and after the 2010 Deepwater Horizon oil spill (DWHOS). The explosion on BP's Deepwater Horizon drilling platform off Venice, Louisiana, killed 11 workers and led to an oil spill of unprecedented volume, spatial extent, and duration.[2] It also involved response and clean-up efforts that may have impacted marine mammals. The Oil Pollution Act of 1990 required federal, state, and tribal authorities to conduct an assessment of injuries to natural resources affected by the spill (known as a natural resource damage assessment, or NRDA). However, the assessment of injuries to marine mammals has been hampered by the paucity of pre-spill baseline information on the status and health of marine mammals in the Gulf. Considerable research and monitoring was initiated during and after the spill. However, understanding its full impact on marine mammals and other living marine resources will continue to be challenging.

Fortunately, funding that is becoming available for restoration of the Gulf, post-DWHOS, could provide significant opportunities to increase basic scientific information on marine mammals and also obtain information needed to restore injured populations. In addition, the need to understand and minimize the effects of oil and gas exploration on marine mammals in the northern Gulf has prompted the Bureau of Ocean Energy Management (BOEM) to begin development of a long-term monitoring plan[3] to increase knowledge of marine mammals and the potential impacts related to energy exploration activities. However, it is incumbent on marine mammal scientists and managers working in the Gulf to identify research and monitoring priorities that meet pressing conservation needs for Gulf marine

[1] For the purpose of this report, research refers to the application of scientific methods to investigate, confirm, or revise theories or hypotheses regarding the relationships among various phenomena; monitoring refers to observations conducted over an extended period of time without intent to alter or affect what is being observed. In some cases, these terms may be used interchangeably.
[2] http://www.restorethegulf.gov/coast-guard-response/response
[3] http://www.gpo.gov/fdsys/pkg/FR-2014-11-07/pdf/2014-26520.pdf

mammals and also how those priorities align with funding opportunities. Many of these opportunities focus on multi-disciplinary, multi-species studies, and will require investigators to work across disciplines to better understand threats to marine mammals and promote a more resilient Gulf ecosystem.

Considering the need to expand research and monitoring efforts for Gulf marine mammals and the potential opportunities presented by increased Gulf restoration-related funding, the Marine Mammal Commission (MMC) and several other partners convened the Gulf of Mexico Marine Mammal Research and Monitoring Meeting in New Orleans, Louisiana on 7-8 April 2015, at the Astor Crowne Plaza.

The objectives of the meeting were to—

- Provide an overview of marine mammal stocks and human activities that might affect them
- Review marine mammal research and monitoring programs
- Identify potential funding sources/opportunities for marine mammal research and monitoring
- Identify high-priority information needs for the next 5-15 years, and
- Discuss options for collaborations to facilitate long-term planning, information sharing, and capacity building.

Four years ago, the MMC outlined its priorities for marine mammal research in the Gulf in the form of a Statement of Research Needs (MMC 2011). That statement was informed by input from several federal agencies working in the Gulf and was submitted to Congress as an independent MMC document. It was the MMC's expectation that its Statement of Research Needs would help drive research efforts directed at Gulf marine mammals in light of ongoing injury assessments and restoration planning associated with the NRDA process. Although we have seen increased research and monitoring efforts on marine mammals since the spill, it is clear that more can and should be done, especially across disciplines.

Meeting Participants and Research Focal Areas

One hundred people with a diverse array of affiliations (Figure 1)[4] participated in the meeting (see Appendix C for a list of all registrants). There were 28 oral presentations and 20 poster presentations. Summaries of the oral presentations are provided in the main body of this report; poster presentations are listed in Appendix A.

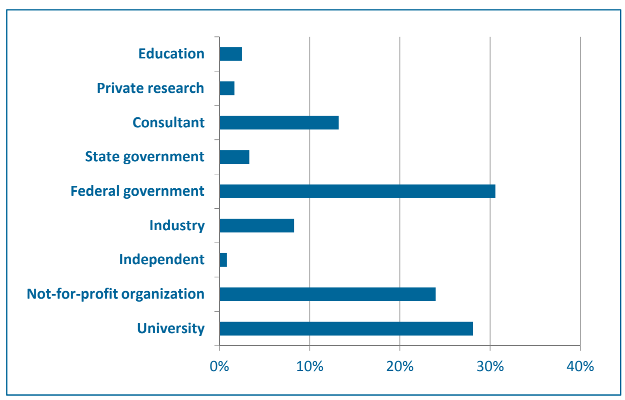


Figure 1: Meeting registrants, by affiliation (n=121)

Prior to the meeting, the Steering Committee requested that meeting participants provide descriptions of up to three marine mammal-related projects or programs for which they serve(d) as Principal Investigators (PIs). The Steering Committee received 53 project descriptions from 35 PIs. The project descriptions are provided in Appendix B of this report.

[4] The chart represents responses from 121 registrants, 98 of whom attended the meeting, 23 did not; 1 entry was a duplicate. The figure does not include responses from 3 late registrants.

Figures 2, 3, and 4 summarize the types of information provided by the PIs on focal species, focal habitats, and research objectives.

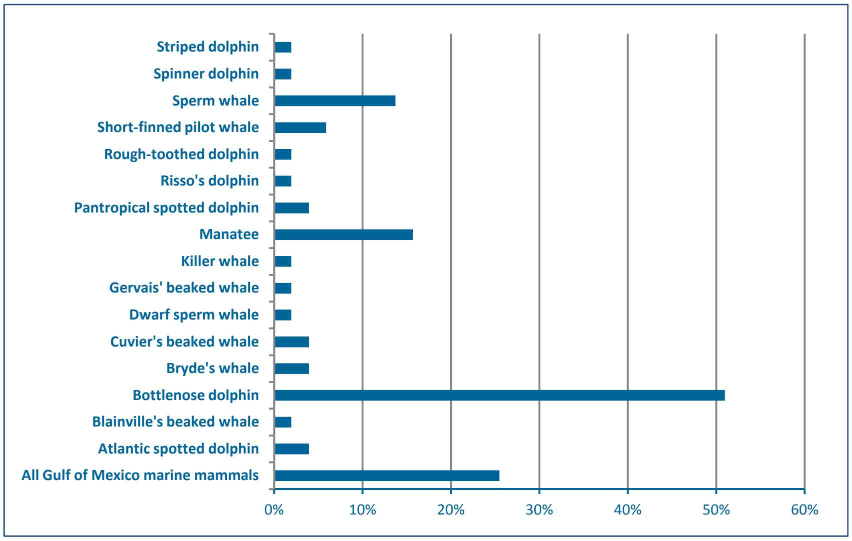


Figure 2: Focal species - Percent of responses (n=51)

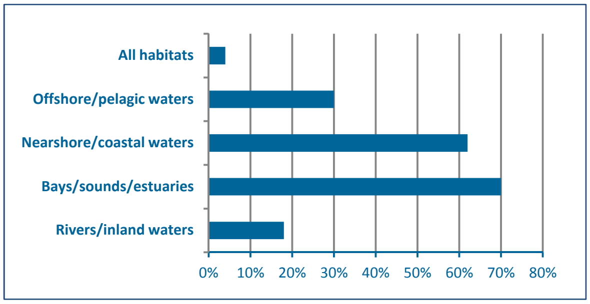


Figure 3: Focal habitats - Percent of responses (n=50)

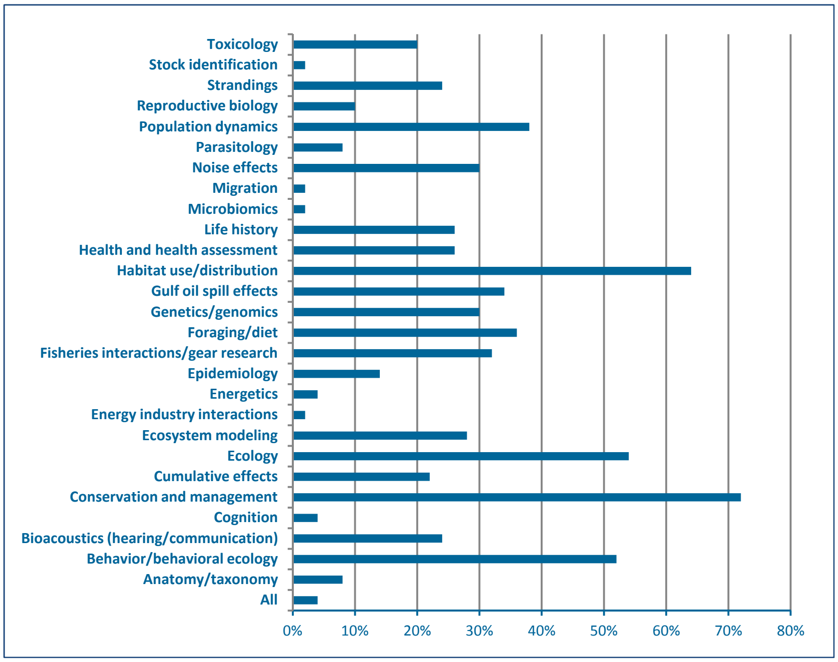


Figure 4: Research objectives - Percent of responses (n=50)

OPENING REMARKS

Frances Gulland, Marine Mammal Commission

The Deepwater Horizon oil spill has brought some much-needed attention to the Gulf, but it is just one of many crises threatening marine mammals. Marine mammals face multiple threats, not only in the Gulf but worldwide. These include, for example, harmful algal blooms, increasing noise, and increasing ship traffic. We need to use the information gained from the Deepwater Horizon oil crisis and take a more synthetic approach to understanding the cumulative impacts of human actions and what we can do to minimize those impacts.

> *"As Winston Churchill said, never let a good crisis go to waste."*
> (Frances Gulland, Opening Remarks)

The 1989 Exxon Valdez oil spill taught us several things. First, we have no idea how to “restore” marine mammals injured or killed as a result of exposure to oil. Second, without adequate baseline data, we have no way of accurately assessing the full extent of injuries caused by a spill. Prevention is key, but we also need to have the right kind of information *before* a crisis arises if we are to be able to advise managers appropriately. The challenge looking forward, as a research community, is to improve both collaboration and communication—collaboration so that the science we conduct is not piecemeal, and communication with other scientists and with managers to ensure we are asking the right questions and collecting the right data.

OVERVIEW OF MARINE MAMMALS AND THREATS IN THE GULF OF MEXICO: THE BIG PICTURE

Laura Engleby, NMFS Southeast Regional Office

The Gulf of Mexico contributes significantly to the nation's overall economy. The Gulf region is comprised of 600,000 square miles of ocean in the U.S. EEZ, and the U.S. portion of the Gulf coastline extends 47,000 miles. Twenty-one million people live along the Gulf coast—more than a third of the total Gulf population—and the human population in the Gulf is increasing faster than the rest of the United States. The Gulf is one of the most heavily industrialized bodies of water in the world, and its economy is intertwined with its natural resource base—oil and gas reserves, commercial and recreational fisheries, wildlife tourism, and shipping.

There are 21 cetacean species in the Gulf, representing 56 stocks, all of which are managed by NMFS. The eastern Gulf is also home to the manatee, which is managed by the U.S. Fish and Wildlife Service (FWS). Bottlenose dolphins account for 36 of the cetacean stocks, with 31 found in bays, sounds, and estuaries, 3 in coastal waters, 1 on the Continental Shelf, and 1 in oceanic waters. Also found on the Continental Shelf are Atlantic spotted dolphins. The remaining 19 cetacean species/stocks occur in oceanic waters (Table 1).

All marine mammals in the Gulf of Mexico are protected under the Marine Mammal Protection Act (MMPA). Sperm whales and manatees are also protected under the Endangered Species Act (ESA). The goal of the MMPA is to conserve and protect marine mammals and the ecosystems upon which they depend. More specifically, the MMPA directs the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) to prevent stocks from declining to below their Optimum Sustainable Population (OSP), and to recover those that have. The goal of the ESA is to protect and recover imperiled species. Additionally, the National Environmental Policy Act (NEPA) directs federal agencies to ensure that federal agencies evaluate environmental impacts of various alternatives when making decisions. All federal agencies operating in the marine environment are users of environmental information and must comply with the provisions of the MMPA, ESA, NEPA, and other applicable statutes. Therefore, research priorities should be linked to these legal mandates.

Table 1: Gulf of Mexico Marine Mammals
Bays/Sounds/Estuaries
Bottlenose dolphin (31 stocks)
Florida manatee (ESA-listed species)
Coastal waters (0-20 m)
Bottlenose dolphin (3 stocks)
Continental Shelf waters (20-200 m)
Atlantic spotted dolphin
Bottlenose dolphin
Oceanic waters (≥ 200 m)
Blainville's beaked whale
Bottlenose dolphin
Bryde's whale (proposed for ESA listing)
Clymene dolphin
Cuvier's beaked whale
Dwarf sperm whale
False killer whale
Fraser's dolphin
Gervais' beaked whale
Killer whale
Melon-headed whale
Pantropical spotted dolphin
Pygmy killer whale
Pygmy sperm whale
Risso's dolphin
Rough-toothed dolphin
Short-finned pilot whale
Sperm whale (ESA-listed species)
Spinner dolphin
Striped dolphin

To comply with these mandates, managers need to understand threats to marine mammals and their individual and cumulative impacts. They must also develop ways to address those threats so as to balance healthy economies with healthy ecosystems and healthy marine mammal populations.

Some of the more significant threats to Gulf marine mammals and their importance to the Gulf ecosystem—

- Oil and gas development - The Gulf offshore area (also referred to as the Outer Continental Shelf) accounts for 17% of total U.S. crude oil production[5]. Threats to marine mammals include seismic exploration, explosive platform removal, vessel and air traffic, and oil spills.
- Commercial shipping - Shipping activities are a significant contributor to the Gulf economy, with the Gulf having 13 of the 20 U.S leading ports. Shipping can result in vessel strikes, oil spills and other hazardous material discharges, habitat disruption due to dredging (to maintain shipping lanes), marine debris, sewage, and noise.
- Fisheries - Gulf commercial fisheries are some of the most productive in the world, landing $818 million in revenue in 2011 (primarily shrimp and menhaden). Recreational fishermen took more than 23 million trips in 2009, accounting for more than 44% of the U.S. recreational fishing catch (NMFS 2009). Threats include entanglement in or ingestion of fishing gear, declining prey stocks, vessel strikes, and illegal feeding by fishermen. Intentional harassment has also been observed toward dolphins that take bait or catch (depredation).
- Wildlife viewing and tourism - Annual revenues from watching wildlife are $6.5 billion, and wildlife viewing attracts more visitors than other wildlife activities (Stokes and Lowe 2013). There are no current statistics on marine mammal tourism but dolphin viewing supports a large industry in the Gulf and worldwide. In 1991, 60,000 people went on commercial dolphin tours; that number increased to over 500,000 by 2009 and is likely an underestimate (O'Connor et al. 2009). Threats from wildlife viewing include vessel strikes, illegal feeding, behavioral conditioning, and changes in distribution, all of which have implications for reproduction and health.

Information needs and approaches to enhance protections and recover marine mammals and their ecosystems include—

- Data on marine mammal abundance, habitat use, distribution, and behavior
- Data to help assess, understand, and mitigate threats from human activities (e.g., to address threats from tourism, more information is needed on viewing patterns by different tourism sectors and also on social attitudes and perceptions about marine mammals)

[5] http://www.eia.gov/special/gulf_of_mexico/

- Standardized data collection across the Gulf to facilitate comparative analyses while still allowing for innovation, and
- Ensuring that data informs management through structured decision-making, prioritization of data collection and species by managers, and the development of better metrics for determining progress and success.

There are several large-scale Gulf of Mexico initiatives in place or under development but none are focused on data needs for marine mammals. Moving forward, we need a region-wide action plan for marine mammals that will contribute to protecting and conserving marine mammal populations in the Gulf.

CURRENT MARINE MAMMAL RESEARCH AND MONITORING PROGRAMS

The objective of this session was to have invited presenters provide a brief overview of the types of research and monitoring programs being conducted in the Gulf, including information on program objectives, methods used, findings to date, how information is being used, future directions, and key data gaps.

I. ABUNDANCE, DISTRIBUTION, AND STOCK STRUCTURE

Moderator: Keith Mullin, NMFS Pascagoula Laboratory

SEFSC Research on Cetacean Abundance, Distribution & Stock Structure

Keith Mullin, NMFS Pascagoula Laboratory

NMFS's research in the Gulf of Mexico is directed at meeting the mandates of the MMPA to ensure that marine mammals remain a significant functioning of the ecosystem they inhabit. This requires information on the status of each stock relative to Optimum Sustainable Population (OSP). If a stock is below OSP, NMFS is required to take action to replenish the stock. Stocks are defined as a group of marine mammals of the same species in a common spatial arrangement that interbreed when mature. Functionally, these groups are delineated by a low rate of genetic exchange, are demographically independent, or, for management purposes, experience differential risks.

MMPA-mandated stock assessment reports require information on how each stock is defined as well as its range, population size, maximum net productivity rate, potential biological removal (PBR)[6], annual human-caused mortality and serious injury, and status. To gather this information, the NMFS Southeast Fisheries Science Center (SEFSC) conducts the following research activities (see also project descriptions by Hohn, Mullin, and Phillips in Appendix B)—

- Abundance surveys - aerial and vessel surveys to estimate and monitor abundance and distribution over time
- Stock Definition - genetics (using tissue samples), tagging, and photo-identification studies
- Habitat studies - using oceanographic and biological data from surveys and remote sensing, and
- Mortality assessments - using data collected by fisheries observers and through the stranding response program.

[6] PBR is defined in the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a stock while allowing that stock to reach or maintain OSP.

Methods used differ by habitat and, in some cases, species. Line transect surveys are used to collect data from ships and aircraft for large open habitats (e.g., oceanic and coastal shelf waters) to estimate density and abundance. Ship-based surveys are used to collect line transect data as well as biopsy samples, oceanographic data, and acoustic data. Capture-mark-recapture methods (including photo-ID) are used to estimate abundance of dolphins in bays, sounds, and estuaries, and to determine survival rates, identify residents individuals, and collect information on individual ranging patterns and habitat use (Conn et al. 2011, Melancon et al. 2011, Rosel et al. 2011). Remote biopsy sampling is used to on vessel surveys to collect samples for genetics (stock structure), contaminants, stable isotopes, and reproductive hormones (Sinclair et al. 2015).

Although some information is available on habitat partitioning in bay/sound/estuary stocks of bottlenose dolphins, more information is needed to determine whether the current stock designations (Figure 5) are accurate and realistic. In addition, very little information is available to determine whether the single stock designations for most of the oceanic cetacean species are appropriate. Genetic analyses may reveal intra-Gulf stock structure for certain species, such as the eastern and western genetic clusters found for Atlantic spotted dolphins (Viricel and Rosel 2014). The SEFSC will be examining genetic samples from pantropical spotted dolphins next.

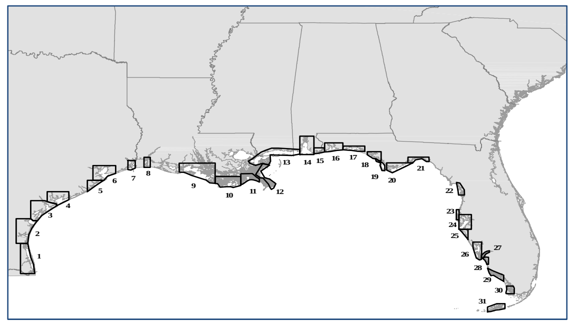


Figure 5: Map of northern Gulf of Mexico depicting the approximate boundaries of the 31 currently recognized bay, sound, and estuary stocks of bottlenose dolphins. (*Adapted from Vollmer and Rosel 2013*)

There are several challenges to estimating abundance and distribution of Gulf marine mammals. Most of the oceanic stocks are likely transboundary, occurring in waters of other countries (such as Mexico and Cuba) for which survey data are lacking. The Gulf is relatively small and so without data from the southern Gulf, abundance estimates derived from surveys conducted only in the northern Gulf are difficult to interpret. In addition, NMFS's guidelines for assessing marine mammal stocks suggest that abundance estimates and PBR be updated at least every eight years (Moore and Merrick 2011). Obtaining timely abundance estimates has been challenging for all stocks due to limited resources and infrastructure in the Gulf, but particularly for the stocks of bay/sound/estuary stocks of bottlenose dolphins.

Passive Acoustic Monitoring for Marine Mammals

John Hildebrand, Scripps Institution of Oceanography
With contributions from:
Natalia Sidorovskaia, University of Louisiana at Lafayette and Aaron Rice, Cornell University

Passive acoustic monitoring is an important complement to traditional visual surveys in the long-term monitoring of marine mammals, and an essential tool for detection of deep-diving marine mammals that is otherwise difficult using traditional surveys. Acoustic recorders can determine not only what species are present in an area but also, in some cases, how many animals are present. This kind of quantitative information can be used to determine marine mammal densities in an area, and with sufficient spatial coverage, can also be used for estimating abundance.

Towed acoustic recorders can be used to complement visual observations made during vessel surveys. Moored or "fixed" acoustic recorders may have more limited spatial coverage than towed arrays but provide essentially continuous temporal coverage. This is particularly advantageous during an event such as an oil spill, because it allows researchers to track behavior over time in response to that event.

Mississippi Canyon, where the Deepwater Horizon spill occurred, is known as a high-use area for sperm whales (Jochens et al. 2008). In 2010, immediately after the spill, Scripps deployed a High-frequency Acoustic Recording Package (HARP) at a site near the well. That was followed by HARP deployments later in 2010 at four other sites in the Gulf to the west, east, and south of the spill site. At the same time, Cornell deployed 22 Marine Acoustic Recording Units (MARUs) in the same general areas. Some previous recordings using Ecological Acoustic Recorders (EARs) had also been made in the Mississippi Canyon area by researchers from the University of Louisiana's Littoral Acoustic Demonstration Center (LADC). (See project descriptions by Hildebrand and Sidorovskaia in Appendix B.)

Acoustic signals from the HARPs were analyzed to determine the presence of sperm whales in each area and over time. Sperm whales continued to be detected in this area after the spill, with some days having consistent sperm whale detections all day long.

To estimate densities of sperm whales and other vocalizing marine mammals around each HARP deployment, Hildebrand developed a model using best available information on the probability of sighting a group of animals, the average group size, and the probability of animals being vocal at any given time. Those estimates were then compared to NMFS-derived density estimates for the same areas based on visual survey data. The density estimates for the well site were consistently higher than other sites in which HARPs were deployed. As a next step, sightings and acoustic data can be used to test hypotheses regarding potential high-use areas and to help define overall distribution patterns. However, at present, spatial coverage is not adequate to derive abundance estimates.

Acoustic monitoring can also collect information on species that are difficult to detect visually, such as pygmy and dwarf sperm whales. The high-frequency, porpoise-like clicks made by these two *Kogia* species were detected, on average, about 1% of the time near the Mississippi Canyon and also seemed to exhibit a north-south gradient similar to sperm whales. Density estimates derived from acoustic detections were an order of magnitude higher than estimates based on visual observations.

Four species of beaked whales were detected acoustically in the Gulf. Three were known from other recordings (Gervais', Blainville's, Cuvier's), but a fourth species was detected in the Gulf with a similar "sweep" signal characteristic of beaked whales. The density of Gervais' and Cuvier's beaked whales was highest in the south, near the Dry Tortugas, which is opposite of what was seen for sperm whales. Detections also showed seasonal variations, with beaked whale presence in the northern Gulf highest during the winter months.

Gervais' beaked whale (*Mesoplodon europaeus*)
(*Credit: NMFS*)

Detecting dolphins from acoustic recordings is more difficult, as there are several closely related species. Delphinid clicks were detected near the well site in varying numbers, and clicks from at least four different *Stenella* species have been identified, with shifts in the occurrence of different species both seasonally and from year to year.

Future priorities for the Gulf include—

- Continuation of time-series data collection
- Increased effort in areas of significant human use not currently well sampled (such as deepwater non-slope areas, the western Gulf, and Mexican waters)
- Collection of acoustic (towed array) data during visual surveys to refine understanding of delphinid calls, and
- More tagging and tracking to refine density-estimation parameters.

The last two would be especially helpful in converting acoustic detections to quantitative estimates.

Sperm Whale Diving Behavior Reveals Changes in Benthic Foraging Around Macondo Spill Site
Bruce Mate, Oregon State University Marine Mammal Institute
(See also project description in Appendix B)

Sperm whale tagging has been conducted in the Gulf of Mexico for about eight years. The first five years of tagging was done from 2001-2005 under the Sperm Whale Seismic Study (Jochens et al. 2008), which was funded by the Minerals Management Service (now the Bureau of Ocean Energy Management; BOEM). Tagging of sperm whales was resumed during the spill and continued for an additional three years with funding from BP.

Sperm whale (*Physeter macrocephalus*)
(*Credit: NMFS*)

Sperm whales, like most mammals, consume approximately 4% of their body weight each day, or a ton of food daily for a 30-ton sperm whale. Sperm whales are gregarious, live in social units, and emit high-frequency clicks when foraging. Tags used for sperm whales were designed to collect information on vocalizations and dive parameters, including time of day, depth, and GPS location, with some of the more advanced tags also having accelerometers to detect feeding lunges. Tags stay on females for about six months and males about nine months. Limited volumes of data are transmitted periodically when whales are at the surface but more detailed data become available only upon release of the tag and subsequent retrieval.

Tags have provided information on more than 800 sperm whale dives. Contrary to previous belief, females that appear to be traveling together as a group at the surface dive asynchronously, to different depths and for different durations. One hypothesis that might explain this behavior is that whales spread out when food is scarce, yet keep track of one another and cluster where food is more abundant. In general, ranges of sperm whales overlap but individual whales appear to have different core areas.

Sperm whale dive behavior in the northern Gulf is highly variable, but a few patterns have emerged. Sperm whales travel on average about 35 miles per day and feed both at night and during the day, with dives reaching over a mile in depth and lasting longer than 75 minutes. Sperm whales appear to forage preferentially near the bottom, as indicated by frequent lunging and rolling. Data collected during and after the spill indicated that sperm whales appeared to be avoiding a large area centered on the spill site. This area experienced heavy amounts of oil discharge as well as dispersants and burn products that settled at depth. Sperm whale dives in that area appear to have been primarily transitory, with limited foraging effort observed.

Biologists have difficulty determining the long-term impacts of events such as oil spills on marine mammals. But tagging represents a tool that can help us understand these impacts. For example, tagging data have shown that what was once a rich feeding area in the Mississippi Canyon for sperm whales is now experiencing limited use. The factors influencing changes in sperm whale diving and feeding behavior in that area need further investigation.

Monitoring Population Dynamics of the Florida Manatee

Leslie Ward-Geiger

Florida Fish and Wildlife Conservation Commission (FWCC), Florida Wildlife Research Institute (FWRI)

The Florida manatee monitoring program has been in place for over 30 years. The manatee monitoring plan's goal is "to effectively manage the population in perpetuity throughout Florida by securing habitat and minimizing threats." The plan strives to align research activities with key management objectives, which are to understand, describe, and monitor sustainable, healthy populations.

Florida manatee (*Trichechus manatus*)
(*Credit: FWCC/FWRI*)

The manatee research program focuses on methods to understand population dynamics, habitat needs, threats, and responses to management actions. Operationally, the program must be able to support timely, collaborative updates to the "core biological model" which is the population model used by the state to predict manatee abundance in the long term (Runge et al. 2007). From a planning perspective, it is important to understand that the various research projects conducted by the program are inter-related and require intermediate conceptual frameworks. That makes research conducted at the project level more effective and easier to manage.

Some of the methods that are used for population assessment and monitoring include carcass salvage, necropsy, and rescue; health assessments; aerial surveys; recaptures of marked individuals (photo-identification, genetics, PIT tags); and behavioral ecology (see also project descriptions by Ward in Appendix B).

Some research highlights—

- Annual mortality numbers and rescues have been tracked since 1974 and there has been a steady rise in mortality, with the current annual average (2009-2014) at 574 manatees per year (Table 2).
- Higher than average mortality years are attributed primarily to Unusual Mortality Events (UMEs). There have been nine UMEs since 1996, six due to red tide, two to cold stress, and one to a red tide repeat event.
- Health assessments provide critical baseline health information from live-captured manatees, and 263 health assessments have been conducted since 2008, in collaboration with numerous partner organizations.
- Annual aerial surveys have provided counts of manatees for both coasts as a proxy for abundance, but new aerial survey methods were initiated in recent years resulting in the first statewide abundance estimate of 6,350 manatees (Martin et al. 2015).

- Over 3,400 manatees are in the state-wide photo-identification catalog and data are used to estimate survival and reproduction rates and to study movements, habitat use, site fidelity, and behavior, and to model population dynamics (Kendall et al 2013).
- Genetics samples have been acquired for over 1,000 individual manatees.
- Loss of warm-water habitat is a significant threat to manatees, and water temperatures are monitored throughout the state during winter months.

Table 2: Manatee Deaths and their Causes, 2009-2014

Year	Water craft	Flood Gate/ Lock	Other Human	Perinatal	Cold Stress	Natural	No Necropsy or Not Recovered	Undet/ Too Decomp	Undet/ Other	Total
2014	68 (18%)	3	9	99	26	26	16	88	36	371
2013	62 (8%)	5	10	129	39	196	100	129	149	830
2012	72 (24%)	12	8	70	30	58	8	87	37	392
2011	74 (19%)	2	4	78	114	40	12	99	16	453
2010	66 (10%)	1	5	97	282	23	67	183	25	766
2009	87 (23%)	5	7	114	56	37	10	90	13	429
5-year avg.	84 (17%)	5	6	97	104	70	39	117	48	574

Future needs and goals include—

- Clarifying the objectives of the carcass recovery and necropsy program
- Focusing data collection to support timely updates of population model parameters
- Assessing sampling effort needs for projects such as photo-ID and genetics and adjusting effort as appropriate
- Evaluating the integration of inter-dependent information components and investing in data management, and
- Deriving annual estimates of abundance using an integrated population modeling approach.

The U.S. Geological Survey (USGS) Sirenia Project works closely with FWRI on manatee research. The USGS has a project funded by BOEM that is looking at manatee movements, distribution, and habitat use in the northern Gulf and how those characteristics might be affected by energy-related activities. The Sirenia Project is compiling a cooperator database for people interested in sightings and strandings in the northern Gulf and is also compiling a database of historical sightings to update a landmark 2005 paper that summarized sightings chronologically. (See also project descriptions by Slone in Appendix B.)

II. HEALTH, STRANDINGS, AND LIFE HISTORY

Moderator: Randall Wells,
Chicago Zoological Society/Sarasota Dolphin Research Program

Overview of the Gulf of Mexico Marine Mammal Stranding Network

Erin Fougeres, NMFS Southeast Regional Office

The Marine Mammal Health and Stranding Response Program (MMHSRP) was established in 1992 under Title IV of the MMPA. The objectives of the program are to collect and disseminate data on health and health trends; correlate heath and trends data with biological, physical, and chemical environmental parameters; and coordinate effective responses to unusual mortality and morbidity events. Components of the program include stranding response, rehabilitation and release, disentanglement, disease and unusual mortality event investigations, biomonitoring and health assessments, tissue banking and associated quality assurance, data management, and administration of the Prescott Grant program.

Stranded marine mammals are those animals found sick, injured, or dead along the beach. Strandings also include animals that are entrapped or disoriented and unable to return to their natural habitat without assistance. Marine mammals may strand as single individuals, mom and calf pairs, or mass strandings involving two or more animals that are not a mom/calf pair. Under the MMPA, strandings require investigation by trained and authorized marine mammal stranding network personnel. The majority of responders are volunteers or employees of non-profit organizations (authorized through stranding agreements issued under Section 112(c) of the MMPA) or local, state, or federal agencies (authorized under Section 109(h)). Additional permits are required to respond to marine mammals listed under the ESA (such as sperm whales and manatees).

The Gulf of Mexico Marine Mammal Stranding Network (Table 3) consists of 10 stranding agreement holders, one organization whose stranding agreement is under review, and 3 designee organizations. In addition, there are two primary state agencies that have dedicated stranding response capabilities and several other state agencies that assist as needed. There are also several authorized rehabilitation facilities, one of which is not involved in stranding response. (See project descriptions by Carmichael (AL), Smith (LA), Solangi (MS), and Whitehead (TX) in Appendix B.)

Table 3: Gulf of Mexico Marine Mammal Stranding Network Members

Organization	Geographic Areas of Responsibility	Stranding Response	Rehab Facility
Texas			
Texas Marine Mammal Stranding Network (TMMSN)	Texas	√	√
Texas State Aquarium (TMMSN designee)	Texas		√
SeaWorld San Antonio (TMMSN designee)	Texas	√	
Louisiana			
Louisiana Department of Wildlife and Fisheries	Louisiana	√	
Audubon Aquarium of the Americas	Louisiana	√	√
Mississippi			
Institute for Marine Mammal Studies	Mississippi (and Alabama for live stranded animals only)	√	√
Alabama			
Dauphin Island Sea Lab	Alabama	√	
Florida (Gulf Coast)			
Emerald Coast Wildlife Refuge	Escambia, Santa Rosa, Okaloosa, and Walton counties	√	
Gulf World Marine Park	Walton, Bay, Gulf, Franklin, and Wakulla counties	√	√
University of Florida (proposal under review)	Taylor, Dixie, and Levy counties	√	
SeaWorld Orlando	Florida		√
Clearwater Marine Aquarium	Levy, Citrus, Hernando, Pasco, Hillsborough, and Pinellas counties		√
FWCC Marine Mammal Pathobiology Lab	Manatee through Citrus counties	√	
Florida Aquarium	Tampa Bay area	√	√ (manatees only)

Table 3: Gulf of Mexico Marine Mammal Stranding Network Members			
Organization	**Geographic Areas of Responsibility**	**Stranding Response**	**Rehab Facility**
Mote Marine Lab	Manatee, Sarasota, Charlotte, and northern Lee counties	√	√
Chicago Zoological Society/Sarasota Dolphin Research Program (Mote Marine Lab designee)	Manatee, Sarasota, Charlotte, and northern Lee counties	√	
FWCC Southwest Field Lab	Charlotte, Lee, and Collier counties	√	
Marine Mammal Conservancy	Southern Dade and Monroe counties through Key West	√	√

External funding for the Gulf stranding network is primarily from the Prescott Grant program, with additional funds provided since 2010 by the Deepwater Horizon oil spill response and natural resource damage assessment. Funding levels are inconsistent by year and also vary by state based on amount of coastline and number of stranded animals.

Key needs for the future include—
- Enhanced capacity for reporting, response and recovery in remote areas (e.g., southern Texas, western Louisiana, big bend Florida, southern Collier/northern Monroe Counties in Florida)
- Increased standardized data collection, diagnostic and analytical capacity Gulf-wide
- More consistent funding (e.g., through enhanced fundraising capabilities, increased funding opportunities, and greater success with private and Federal dollars)
- Increased communication and sharing of information/data across the Gulf, between network partners and with NOAA, including collaborative databases
- Integrating stranding data with other health datasets
- Increased capacity to monitor and respond to free-swimming, entangled small cetaceans
- Increased capacity to monitor animals that are rehabilitated and released or deemed appropriate for immediate release from the stranding site, and
- Increased capacity to respond to mass strandings, large whales, Unusual Mortality Events, and natural/anthropogenic disasters.

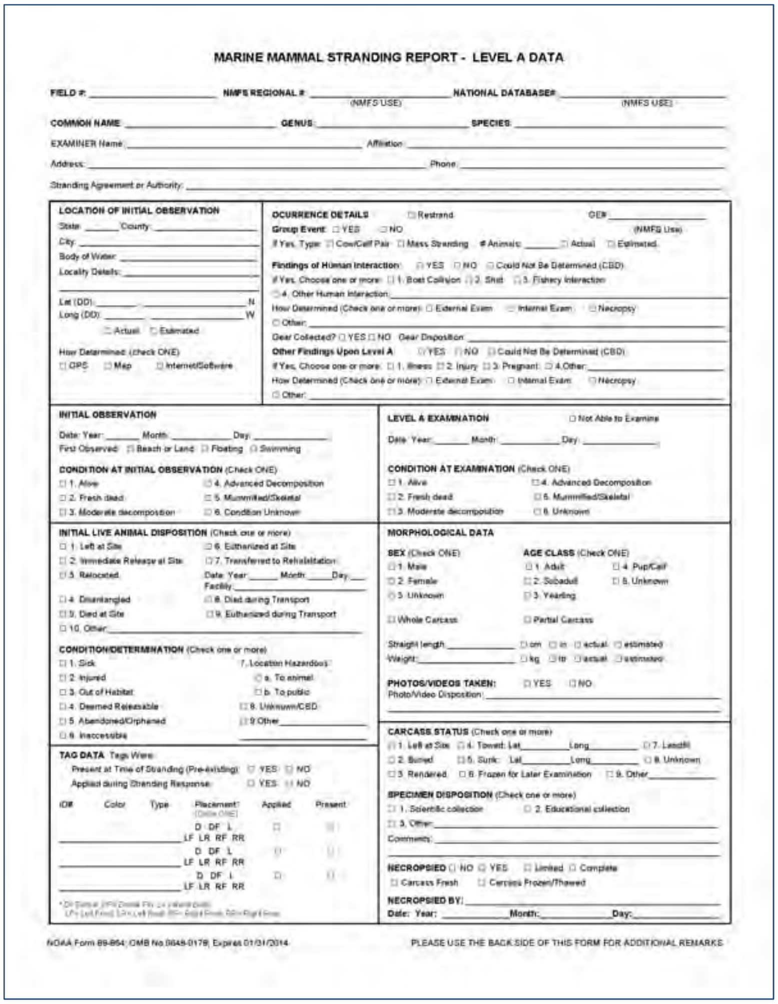
Overview of Cetacean Stranding Data from the Gulf of Mexico: 2000-2014

Jenny Litz, NMFS Southeast Fisheries Science Center

(See also project description in Appendix B)

Stranding data are important to answer a wide range of questions regarding species distribution, stock structure, health and disease, life history parameters (such as age, diet, and reproductive biology), anatomy and physiology, human interactions (such as fishery interactions or vessel strikes), and other threats to marine mammal populations. The consistent collection of stranding data over the long-term is critical for informing management decisions, identifying unusual events, and understanding changes to health and mortality trends.

Stranding network members are required to submit certain basic data to NMFS for all stranded marine mammals. Those data, termed Level A data, include the species and type of stranding, date and location of the stranding event, the condition of the animal(s), whether there was indication of human interaction, and disposition of the animal (Figure 6). NMFS provides training and instructions for completing the Level A data form and validates all data received. NMFS encourages the collection of more detailed data on stranded animals (Level B and C data) including body measurements, gross necropsy reports, and results of tissue analyses, which may be required during investigation of certain events, such as unusual mortality events, oil spills, mass strandings, etc.



MARINE MAMMAL STRANDING REPORT - LEVEL A DATA

FIELD #: NMFS REGIONAL #: (NMFS USE) NATIONAL DATABASE#: (NMFS USE)

COMMON NAME: GENUS: SPECIES:

EXAMINER Name: Affiliation:

Address: Phone:

Standing Agreement or Authority:

LOCATION OF INITIAL OBSERVATION
State: County:
City:
Body of Water:
Locality Details:
Lat (DD): N
Long (DD): W
☐ Actual ☐ Estimated
How Determined: (check ONE)
☐ GPS ☐ Map ☐ Internet/Software

OCURRENCE DETAILS ☐ Restrand GE#: (NMFS Use)
Group Event: ☐ YES ☐ NO
If Yes, Type: ☐ Cow/Calf Pair ☐ Mass Stranding # Animals: ☐ Actual ☐ Estimated
Findings of Human Interaction: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)
If Yes, Choose one or more: ☐ 1. Boat Collision ☐ 2. Shot ☐ 3. Fishery Interaction
☐ 4. Other Human Interaction:
How Determined (Check one or more): ☐ External Exam ☐ Internal Exam ☐ Necropsy
☐ Other:
Gear Collected? ☐ YES ☐ NO Gear Disposition:
Other Findings Upon Level A: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)
If Yes, Choose one or more: ☐ 1. Illness ☐ 2. Injury ☐ 3. Pregnant ☐ 4.Other:
How Determined (Check one or more): ☐ External Exam ☐ Internal Exam ☐ Necropsy
☐ Other:

INITIAL OBSERVATION
Date: Year: Month: Day:
First Observed: ☐ Beach or Land ☐ Floating ☐ Swimming

CONDITION AT INITIAL OBSERVATION (Check ONE)
☐ 1. Alive ☐ 4. Advanced Decomposition
☐ 2. Fresh dead ☐ 5. Mummified/Skeletal
☐ 3. Moderate decomposition ☐ 6. Condition Unknown

INITIAL LIVE ANIMAL DISPOSITION (Check one or more)
☐ 1. Left at Site ☐ 6. Euthanized at Site
☐ 2. Immediate Release at Site ☐ 7. Transferred to Rehabilitation
☐ 3. Relocated Date: Year: Month: Day: Facility:
☐ 4. Disentangled ☐ 8. Died during Transport
☐ 5. Died at Site ☐ 9. Euthanized during Transport
☐ 10. Other:

CONDITION/DETERMINATION (Check one or more)
☐ 1. Sick 7. Location Hazardous:
☐ 2. Injured ☐ a. To animal
☐ 3. Out of Habitat ☐ b. To public
☐ 4. Deemed Releasable ☐ 8. Unknown/CBD
☐ 5. Abandoned/Orphaned ☐ 9 Other
☐ 6. Inaccessible

TAG DATA Tags Were:
Present at Time of Stranding (Pre-existing): ☐ YES ☐ NO
Applied during Stranding Response: ☐ YES ☐ NO

ID#	Color	Type	Placement* (Circle ONE)	Applied	Present
			D DF L LF LR RF RR	☐	☐
			D DF L LF LR RF RR	☐	☐
			D DF L LF LR RF RR	☐	☐

LEVEL A EXAMINATION ☐ Not Able to Examine
Date: Year: Month: Day:

CONDITION AT EXAMINATION (Check ONE)
☐ 1. Alive ☐ 4. Advanced Decomposition
☐ 2. Fresh dead ☐ 5. Mummified/Skeletal
☐ 3. Moderate decomposition ☐ 6. Unknown

MORPHOLOGICAL DATA
SEX (Check ONE): ☐ 1. Male ☐ 2. Female ☐ 3. Unknown
AGE CLASS (Check ONE): ☐ 1. Adult ☐ 2. Subadult ☐ 3. Yearling ☐ 4. Pup/Calf ☐ 5. Unknown
☐ Whole Carcass ☐ Partial Carcass
Straight length: ☐ cm ☐ in ☐ actual ☐ estimated
Weight: ☐ kg ☐ lb ☐ actual ☐ estimated

PHOTOS/VIDEOS TAKEN: ☐ YES ☐ NO
Photo/Video Disposition:

CARCASS STATUS (Check one or more)
☐ 1. Left at Site ☐ 4. Towed: Lat Long ☐ 7. Landfill
☐ 2. Buried ☐ 5. Sunk: Lat Long ☐ 8. Unknown
☐ 3. Rendered ☐ 6. Frozen for Later Examination ☐ 9. Other

SPECIMEN DISPOSITION (Check one or more)
☐ 1. Scientific collection ☐ 2. Educational collection
☐ 3. Other:
Comments:

NECROPSIED ☐ NO ☐ YES ☐ Limited ☐ Complete
☐ Carcass Fresh ☐ Carcass Frozen/Thawed
NECROPSIED BY:
Date: Year: Month: Day:

NOAA Form 89-864; OMB No.0648-0178; Expires 01/31/2014

PLEASE USE THE BACK SIDE OF THIS FORM FOR ADDITIONAL REMARKS

Figure 6: NMFS Level A data form (*Credit: NMFS*)

An analysis of Level A cetacean stranding data from the Gulf collected from 2000-2014 showed that the Gulf averages 375 strandings per year, with 85% of strandings involving bottlenose dolphins. The highest number of strandings occur from January to April, with a peak in March. Other species that typically strand include short-finned pilot whales, rough-toothed dolphins, pygmy and dwarf sperm whales, spotted dolphins, other small cetaceans, and sperm whales. Strandings of beaked and baleen whales are rare (~1%). Mass strandings of pilot whales and rough-toothed dolphins are relatively common on the west coast of Florida (especially in the southwest) but they occur throughout the northern Gulf. Less than 25% of bottlenose dolphins strand alive or freshly dead, whereas other species tend to strand alive or freshly dead more frequently. More than half of live-stranded animals either die or are euthanized on the beach or in rehab. Those that survive are either released from the site (17%) or after some amount of rehab (~6%), or remain in captivity. About 75% of freshly dead animals were necropsied.

Human interactions are a major focus of Level A investigations. However, for most stranded animals, responders are unable to determine whether signs of human interactions were present, either because the animals were too decomposed or the markings were unidentifiable. For the 8% of animals scored as positive for human interactions, 38% involved fishery interactions, 13% involved vessel strikes, 5% were shot, and 44% had signs of other types of human interaction.

The largest die-off of bottlenose dolphins ever recorded for the Gulf began in February 2010 and is still ongoing[7]. The Northern Gulf of Mexico Cetacean Unusual Mortality Event covers an area from the Florida panhandle to the Louisiana-Texas border. Approximately 1,350 cetaceans have stranded since 2010, 87% of which were bottlenose dolphins. Most animals (94%) stranded dead, and over 30,000

[7] http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico2010.htm

tissue samples have been collected. Researchers have ruled out morbillivirus and biotoxins as primary causes. Analysis of samples collected through June 2013 showed that there were multiple demographic clusters of dolphin mortalities (Venn-Watson et al. 2015), and that the largest prolonged cluster was in Barataria Bay, Louisiana, in August 2010-2011. Barataria Bay was one of the most heavily oiled areas during the Deepwater Horizon oil spill.

A separate UME was declared in Texas in 2011[8], and that investigation is still ongoing. It involved 126 bottlenose dolphins, with a large number of juveniles and yearling age classes. There were concurrent harmful algal blooms and mortalities of other marine and terrestrial species, but biotoxin levels in dolphin tissues were at baseline levels except for brevetoxin. NMFS is continuing to investigate all potential contributing factors including the role of harmful algal blooms.

To maximize the information gained from stranding events, there is a continued need for—

- Enhancing the capacity of the Gulf stranding network
- Continuing long-term standardized data collection
- Increasing diagnostic and analytical capacity Gulf-wide
- Data sharing and collaborative databases among NOAA, the stranding network partners, and researchers with access to Level B and C data, and
- Integrating stranding data with other health and environmental datasets.

Bottlenose Dolphin Research on Florida's West Coast: 4+ Decades of Research, 5 Generations of Dolphins, and 3 Generations of Scientists

Randall Wells and the staff, students, and collaborators of the Chicago Zoological Society's (CZS) Sarasota Dolphin Research Program (SDRP)
(see also project description in Appendix B)

Bottlenose dolphin research was initiated in Sarasota Bay, Florida, in 1970. The research started with a tagging program based out of Mote Marine Lab, working from Tampa Bay to Charlotte Harbor. Tagging showed localized movements of dolphins in the area, which set the stage for further research. Years of study have shown multi-generational, multi-decadal, year-round residency of dolphins in the Sarasota Bay area (Figure 7). The current community is comprised of about 160 dolphins spanning five concurrent generations. About 96% of dolphins that are more than 15 years old have been seen for 15 to 40 years; these are long-term residents to the area. These long-term residency findings have set the stage for longitudinal research, especially the ability to repeatedly and predictably find identifiable animals of known age, sex, and relationships in shallow, sheltered waters.

Study areas include the following—

- Movements, ranging patterns, habitat use, population definition
- Life history, genetics, and factors affecting survivorship and reproductive success
- Foraging ecology
- Behavior, social structure and communication
- Health, body condition, environmental contaminants
- Human interactions, and
- Technology development and testing.

[8] http://www.nmfs.noaa.gov/pr/health/mmume/bottlenosedolphins_texas.htm

The program also facilitates transferring technology and expertise to other populations, species, and situations around the world.

A variety of research methods and tools are used to study Sarasota Bay dolphins. Photo-identification has been used since 1977 using nicks and notches on dorsal surface to reliably identify individual animals. These data provide information on abundance, movements, and reproductive success. Photographic identification also allows for monitoring of human interactions, which is of increasing concern around much of the southeastern United States.

Figure 7: Multi-generational pod of bottlenose dolphins in Sarasota Bay: Photo taken in 2012, y.o. = years old
(*Credit: R. Wells, CZS/SDRP*)

Sarasota Bay dolphins, like other dolphin populations, face a variety of threats both concurrently and cumulatively, including disease, failure to thrive, harmful algal blooms, sharks, stingrays, hurricanes, entanglement in commercial and recreational fishing gear, human provisioning, disturbance from vessels, coastline construction, industrial activities, marine construction, pesticides, and oil spills. Population viability analyses can help to understand the individual impacts of these threats and what would happen to the population if some of the threats were removed.

Other tools used to study bottlenose dolphins in Sarasota Bay include—

- Lateral photos and unmanned aerial vehicle images to assess body condition remotely
- Health assessments to study body and health condition, contaminants, biotoxins, life history, and hearing
- Photo-identification and capture-release studies to understand population structure
- Remote biopsy sampling to collect samples for genetics, contaminants, stable isotopes, and hormones
- Focal animal observations to record and interpret behavior patterns
- Electronic tagging to track movement patterns and study diving and foraging behavior
- Prey fish sampling and analysis of stomach contents from stranded animals to understand behavior, habitat use, and population dynamics relative to prey
- Harmful algal bloom sampling to understand impacts of red tide events on dolphin abundance, reproduction, movements, and feeding
- Analysis of stranded animals to understand and minimize human-caused sources of mortality
- Intervention and rescue of stranded animals, and
- Tagging and tracking of animals that have been released after rehabilitation.

The program has been instrumental in increasing conservation capacity in the region and throughout the world. The program provides graduate students and undergraduate interns with data collection opportunities, data, samples, and guidance on research. The program also serves to educate the public and raise awareness regarding threats associated with feeding and human interactions, in coordination with the NMFS Southeast Regional Office. The program assists in research and health assessments in other areas, and the Sarasota Bay population serves as a reference population for comparative studies. The program also provides opportunities for other researchers to "piggy-back" on the work being conducted without additional risk to the dolphins.

Observations and recommendations for bay, sound, and estuary, and coastal dolphin research—

- Available information is inadequate for appropriate management of many inshore dolphin stocks.
- More effort is needed to ensure that data required for management continues to be up-to-date and does not become obsolete.
- Efforts should be scaled relative to the nature and urgency of needs, the availability of resources, and the acceptability of risks to the animals.
  - Photo-identification presents the least risk to dolphins and provides the most important, basic data on abundance, distribution, residency, habitat use, survivorship, and reproductive rates.
  - Biopsy darting is low risk but provides genetics and stable isotopes for stock assignment, contaminant loads, and hormone levels.
  - Remote assessment of body condition is potentially a viable tool prior to, or in lieu of, more complex and risky work that involves capture-release for health assessment.
  - If capture-release is used for health assessment, telemetry tags should be used to help define stock boundaries.
- Collaborations and leveraging opportunities are critical for enhancing research beyond the capacity of an individual program.

The Gulf of Mexico Dolphin Identification System (GOMDIS) is an effort to compile as many dolphin photo-identification catalogs as possible from around the Gulf and make them available in an online repository so that they can be used to track individuals around the Gulf. There is buy-in from more than 20 groups in the United States, and Mexico and Cuba are also participating (see also project description by Wells in Appendix B).

Bottlenose Dolphin Health Assessment Studies

Lori Schwacke, NOAA National Ocean Service (NOS), National Centers for Coastal Ocean Science
(See also project description in Appendix B)

Health assessments are used by NOAA to identify and understand population stressors, mitigate their effects or plan more effective conservation measures, and in response to certain management drivers (e.g., MMPA, ESA, NOAA's Ocean and Human Health initiative, and, more recently, for Natural Resource Damage Assessments - NRDAs).

NOAA has taken a tiered approach to health assessment—

- Tier 1: Hazard identification - investigations of stranded animals and environmental monitoring.
- Tier 2: Exposure (and effects) assessment - photographic monitoring and remote biopsy tissue sampling.
- Tier 3: Effects (and exposure) assessment - Capture-release health assessment, tagging, and longitudinal photographic monitoring.

Capture-release health assessments involve large teams of researchers using multiple vessels (Figure 8). A large net is used to encircle one or more dolphins in shallow water. The team then enters the water and once the dolphin is disentangled from the net and restrained, blood is collected and vital signs are assessed. The dolphin is then brought up onto a specially designed platform on a boat for further examination. This include morphometrics, swab samples of the genitals and blowhole, blubber biopsies, ultrasound, and more recently, additional assays such as dental x-rays. Samples are processed on the boat for timeliness and quality control purposes.

Figure 8: Team of researchers conducting a health assessment on a bottlenose dolphin (*Credit: NMFS/NOS*)

Diagnostics include a physical exam, ultrasound, mass:length ratio, complete blood count (CBC)/blood chemistry/blood gases, serology, pathogens, endocrinology, immunology, urinalysis, skin and oral assessment, biotoxin and contaminant measures, and blowhole swabs. Most of these diagnostics can only be obtained by capturing and restraining animals. Health assessments conducted on bottlenose dolphins in the Southeast have used standardized protocols and established laboratories for sample analysis. The pooling of available samples has resulted in the establishment of reference intervals for many health parameters, such as CBC, serum chemistry, mass:length ratio, and also baseline levels for persistent organic pollutants (POPs) including polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and a suite of organochlorine pesticides.

Health assessments have been conducted on bottlenose dolphin populations in various locations on the east coast of the United States and also in the Gulf. The first assessments to be conducted in the Gulf were in Sarasota Bay, Florida (1987-present), Mississippi Sound, Mississippi (1982-83), and Matagorda Bay, Texas (1992). More recently assessments have been conducted in St. Joseph Bay, Florida (2005-06), Barataria Bay, Louisiana (2011, 2013, 2014), and Mississippi Sound (2013), as well as continued studies in Sarasota Bay.

Notable findings published to date include—

- Florida *Tursiops* populations are exposed to multiple biotoxins (Schwacke et al. 2010, Twiner et al. 2011).
- Morbillivirus circulates in northern Gulf *Tursiops* stocks (Rowles et al. 2010).
- Highest POP concentrations in *Tursiops* are found along mid-Atlantic coast (Kucklick et al. 2011, Balmer et al. 2011)
- POP concentrations in *Tursiops* vary with sex, reproductive status, and temporally, and there is a correlation between concentration in blubber versus blood (Yordy et al. 2010).
- Lung, adrenal health effects, and poor body condition were found in *Tursiops* following oil exposure (Schwacke et al. 2013).

The future vision for health assessments is to obtain more information from remote sampling, including biopsy, breath, and tagging. This would minimize the need for capture-release health assessments because they represent higher risk to dolphins and to the team, and because of the difficult logistics and high costs. We also need coordinated data management, mapping, and spatial/temporal analysis to maximize the information gained from available samples.

Ongoing efforts that we should support across tiers include—

- Tier 1 - Coordinated surveillance through the Marine Mammal Health Monitoring and Assessment Platform (Health MAP) and NOS Coastal Intelligence.

- Tier 2 - Photo-ID through GOMDIS, the Ocean Biogeographic Information System - Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP), and GCOOS, and also remote biopsy through HealthMAP.
- Tier 3 - Capture-release through HealthMAP, and longitudinal monitoring through GoMDIS and GCOOS.

III. UNDERSTANDING EFFECTS OF HUMAN ACTIVITIES ON MARINE MAMMALS

Moderator: Laura Engleby, NMFS Southeast Regional Office

Epidemiological Studies on Biological and Chemical Effects on Cetaceans

Teri Rowles, NMFS Office of Protected Resources

The MMHSRP supports epidemiological studies that integrate information on marine mammal health and health trends, abundance, distribution, and life history with environmental parameters. Marine mammal health and life history data are derived from a variety of sources including strandings, live-capture health assessments, by-caught animals, and remote sampling of wild populations. Statistical modeling is then used to assess population risk and impact.

Epidemiological studies seek to understand the connection between the source of a perturbation, the exposure pathway, and its ultimate effect on an individual or population. This is achieved for wildlife populations by integrating information across data sets and populations to investigate both individual events and comparisons between events. Care must be taken to collect as much information as possible from each animal even though, in some cases, its immediate use may not be apparent. Baseline studies are key, as well as the use of standardized procedures for sample collection, handling, storage, and archival, as well as the use of common terminologies. Having archived data and samples allow researchers to conduct retrospective analyses and comparisons across geographic boundaries. These types of analyses are becoming increasingly important given increasing levels of human activities in the marine environment, and require strong collaborations between government, academic, private, and non-profit entities.

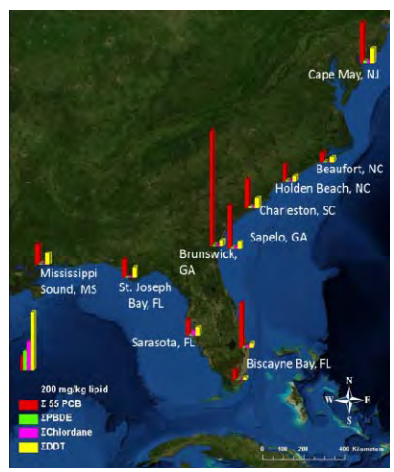


Figure 9: Contaminant signatures for bottlenose dolphin stocks
(*Credit: Kucklick et al. 2011*)

The benefits of an epidemiological approach include being able to assess status and trends in the face of change and to identify and predict possible causes of change. It also allows scientists and managers to detect emerging problems, assess the individual and cumulative impacts of human activities, evaluate the effectiveness of mitigation or restoration efforts, and recommend actions to reduce risks and promote recovery. Examples of where this approach has been used include studies on the effects of harmful algal blooms on the U.S. west coast (by the Wildlife Algal-toxin Research and Response Network; WARRN-West) and the identification of unique contaminant "signatures" associated with populations of bottlenose dolphins in the southeast and Gulf of Mexico (Kucklick et al. 2011; Figure 9). Two collaborative programs between NMFS and the National Institute of Standards and Technology (NIST) that have helped developed reference materials and analytical standards for marine mammals include the Analytical Quality Assurance program for chemical analyses (focusing on persistent organic pollutants and trace elements) and the National Marine Mammal Tissue Bank (NMMTB).

Health MAP is a new initiative being piloted on the West Coast that will integrate high quality marine mammal health data collected from stranded and wild animals to identify and track trends across regions to answer scientific, policy, and public questions. Its goal is to apply an ecosystem-based approach to provide bigger picture situational awareness and predictability based on coinciding changes in ocean conditions, prey, and marine mammal health. It also seeks to engage and educate the public regarding the relevance of marine mammal and ocean health to their interests, health, and welfare. Other efforts to develop data standards and databases to facilitate integration of ocean health and environmental data include the national and regional ocean observing systems (e.g., GCOOS, OBIS-SEAMAP, the Emergency Response Management Application (ERMA), the Wildlife Health Information Sharing Partnership Event Reporting System (WHISPers), the Marine Sample Tracking & Analytical Reporting (Marine STAR) database, and the National Environmental Public Health Tracking Network).

Future directions for expanded epidemiological analyses in the Gulf of Mexico include—
- Enhanced preparedness and response, particularly the ability to work across regions and networks to address common problems (e.g., oil spills and extreme weather events)
- Further development of the Marine Mammal HealthMAP
- Animal/sample/analytical and data standards
- Marine mammal health network of collaborators
- Training
- Interdisciplinary approach with integrated and interoperable databases
- Specimen and data archival and tracking system, and
- Research, development, validation and technology transfer of new methods.

A question was asked about whether mortalities associated with the northern Gulf of Mexico UME before and after the Deepwater Horizon oil spill could be partitioned out; Dr. Rowles referred the audience to a recent paper by Venn-Watson et al. (2015) that identified demographic clusters of bottlenose dolphins historically and within the UME. The authors identified a cluster in northern Louisiana and Mississippi during March 2010-May 2010 that had different characteristics from other clusters identified during the UME timeframe. Additional analyses are in progress.

Variability in the Gulf of Mexico's Marine Acoustic Environment

Christopher Clark, Cornell University

Human activities pose a risk in the marine environment over enormous temporal and spatial scales, and researchers and managers are working to understand the significance of these activities to both individual marine mammals and populations. Marine vertebrates rely on hearing and there is increasing evidence that there are a variety of mechanisms by which invertebrates can also sense sound. Each species of marine mammal has a different acoustic "space" defined by the range of frequencies that it can detect, the distance at which it can detect that sound, and time. This acoustic space is a component of each species' natural habitat, and marine mammals require a healthy acoustic habitat in which to live. Research is being conducted that is helping us understand the relationship of marine mammals to their acoustic habitat, and how that habitat is being affected by human activities. Two primary sources of sound that affect marine mammals are commercial ship traffic and seismic airgun surveys.

Large commercial vessels have transponders that are used to track their position and movements. The data from these transponders have been used to develop sound maps and animations that show the acoustic footprint of the low-frequency sound generated by these vessels as they move through important marine mammal habitats. For example, the aggregate background noise in waters off Boston — important right whale feeding habitat in the Gulf of Maine — is roughly two to three orders of magnitude more noisy in the low-frequency range (the range at which baleen whales are most sensitive) than it was one hundred years ago. The sound generated by these vessels shrink the acoustic space over which whales can communicate. Low-frequency sound, in particular, can travel very effectively over a great distance in the ocean.

Figure 10: A seismic vessel shooting a 3D marine survey
(*Credit: Western Geophysical*)

Seismic airgun surveys are used in oil and gas exploration and geophysical research (Figure 10) and generate a high pulse of low-frequency energy roughly every 10 seconds. Airguns can be detected at distances much farther than the distances at which seismic operators are required to impose mitigation measures for marine mammals. Fin and humpback whales have been reported to alter their communications by reducing calls when airguns are nearby and resuming calls when the seismic survey vessel has moved away. This is evidence of a biologically significant behavioral response to airguns, but the population-level significance of these behavioral responses are unknown. Studies of ambient noise levels in Baffin Bay before and during a seismic survey indicate that in addition to the impulsive sounds generated every 10 seconds, there are reflections of low-frequency sounds detected between pulses. Seismic surveys were halted temporarily during the Deepwater Horizon event, but were resumed in November 2010. Acoustic recorders detected seismic reflections from a multi-vessel "coiled" seismic survey in the central northern Gulf of Mexico as far away as the western edge of the Gulf and the Yucatan Peninsula off Mexico.

Tracking and synthesis of cumulative noise levels over time can help determine biologically important sound levels. Tools that are used include graphical depictions, or conceptualizations, of sound that can indicate the scale of various sound sources and the mechanisms, or "recipes", used to process sound recordings that help to identify what species are present. Because of the large amounts of data being collected around the world, collaborations are critical, as are data standards and open-access data systems and databases. Sound propagation can now be modeled in real-time using high-performance computers to process large amounts of aggregate data. The technologies and automated process capabilities exist and there is a large degree of public interest in this issue. However, we must determine if people in the Gulf are truly interested in addressing sound as a component of a sustained, healthy ocean ecosystem.

Recreational Interactions - Growing Threats to Gulf Marine Mammals

Katie McHugh, Chicago Zoological Society / Sarasota Dolphin Research Program

Nearshore and coastal habitats throughout the Gulf of Mexico are adjacent to areas of high human population. The high degree of overlap with human activities results in concern for both bottlenose dolphins and manatees, both of which have documented impacts from recreational fishing, boating, and tourism, including mortalities, injuries and harassment/disturbance. Interactions occur throughout the northern Gulf, and are increasing. Florida is a hot spot with respect to both research being conducted and known interactions. The large variety of user groups and stakeholders and multiple management jurisdictions involved in such interactions makes finding solutions challenging from a monitoring, management, and mitigation perspective.

Human activities of concern for bottlenose dolphins include—

- Recreational fisheries - Interactions stem from entanglement in or ingestion of active or discarded fishing gear, depredation on bait or catch, scavenging of released fish, habitat degradation, and provisioning of animals. They can also stem from retaliation or lethal deterrence by fishermen for depredation on bait or catch. Acute and chronic impacts include altered behavior, decreased nutritional status, injury, and mortality.
- Tourism and recreational activities - Interactions occur with recreational boaters, jet skis, dolphin and whale watching tour boats (particularly those operating irresponsibly by touching, feeding, swimming with, or harassing animals), and include boat strikes, disruption of natural behaviors, changes in group composition, association of people/boats with food if provisioning occurs, and conditioning. Long-term avoidance of high-use areas can lead to localized declines in abundance or shifts in habitat use to sub-optimal habitat. Acute and chronic impacts include altered behavior, decreased nutritional status and growth rate, injury, and mortality.

Human populations in the Gulf are increasing. There are already more than 50 million people living in the coastal belt, and the population in the Gulf is expected to increase 40% from 1995-2025 (Yoskowitz et al. 2013). This has led to a significant increase in recreational activities. For example, the number of registered boats increased 82% in Florida from 1981 to 2010, and changes in the design and increasing speed of recreational boats can increase the probability of vessel strikes of dolphins and manatees. Tourism is also on the rise in all five Gulf states as well as Mexico and Cuba, and is now the second highest economic driver in the Gulf. In some areas, tourists outnumber residents during certain seasons.

Recreational fishing and boating are extremely popular activities, and are activities engaged in by both tourists and residents. Recreationally caught fish are generally released in compliance with fishery management regulations, but this may result in dolphins associating fish (food) with recreational vessels. Wildlife viewing is also increasing, but its popularity is a double-edged sword. Although it can be an important tool to foster education and support for conservation, if viewing is not conducted responsibly, and activities are not regulated or existing laws enforced, inappropriate or illegal interactions (Figure 11) can have short and long-term impacts on individuals and populations.

Figure 11: Illegal feeding of a bottlenose dolphin (*Credit: SDRP*)

Serious injuries and mortalities to dolphins from recreational activities are at fairly low levels compared to other sources, but the added stressor on populations already facing many other threats can put local communities at risk. For example, in Sarasota Bay, 2% of the dolphin population was lost to gear entanglement and ingestion in 2006 – a rate that is not sustainable over long term. Over the long term, approximately 25% of dolphin deaths in Sarasota Bay were human-related (recreational fishing and boat strikes). Interactions with recreational hook and line gear are widespread throughout the Gulf and affect several bay/sound/estuary and coastal dolphin stocks. Depredation by dolphins on recreational fishing gear and discarded fish has been documented in Sarasota Bay, as well as the Florida Panhandle and

Alabama (see project description by Shippee in Appendix B). Reports of vessel strikes are also widespread, with the greatest number of collisions reported in Florida and Texas. Illegal feeding and swim-with programs resulting in harassment of dolphins occurs regularly in areas such as Panama City, Sarasota Bay, and Key West, Florida, and Corpus Christi, Texas. Photo-ID studies and GoMDIS are mechanisms that can be used to track sub-lethal fishing and boating-related injuries. Recovery and investigation of stranded animals also play an important role in documenting and tracking trends in fishing gear and other human interactions.

Figure 12: Snorkelers interact with a manatee at the Crystal River National Wildlife Refuge
(*Credit: Reuters*)

Manatees experience larger numbers of human-related injuries and deaths as compared to dolphins, resulting in higher impacts on this endangered species. Deaths from collisions with watercraft have been increasing over time, but there is some evidence that the rate of increase has slowed due to increased protection efforts even as the number of registered boats has increased. "Slow speed" zones have been shown to be particularly effective at reducing risk by providing additional time for both boats and manatees to react, and by reducing the severity of injuries if a collision occurs. Manatees are also subject to harassment by recreational boaters and swim-with tourism in winter warm-water refuges (such as Crystal River, Florida; Figure 12), with manatees showing clear disturbance and avoidance behavior. Provisioning manatees with freshwater occurs throughout Florida and can condition animals inappropriately to human contact, which can result in harm.

Mitigation of harmful interactions is key. Interventions and rescues of injured animals can help reduce mortality risk but are logistically complex, expensive, and not always successful. Prevention of interactions is more effective, but depends not only on enforcement of existing regulations but also a better understanding of how and why interactions occur. For example, a voluntary compliance program implemented in 2007 aimed at tour operators in Key West (i.e., the DolphinSMART program) resulted in an initial decrease in impacts, but follow-up studies have shown that the effectiveness of the program has waned over time. In Panama City, where illegal feeding and swim-with activities are pervasive, NMFS has stepped up both outreach and enforcement but neither has been completely effective at reducing impacts. Recent research on the human dimension of the feeding and harassment problem in Panama City has shown that concern for dolphins has not translated into compliance with MMPA regulations prohibiting feeding and harassment (Duda et al. 2013).

Long-term, year-round studies, such as those conducted in Sarasota Bay, coupled with data from stranded animals, can help provide a more complete picture of causes of interactions, interaction rates, and trends over time. This information can then be used to determine which mitigation options and strategies have the highest probability of success.

Priorities for the future include—

- Characterizing the true scope and nature of interactions as well as driving factors throughout Gulf
- Understanding the long-term and cumulative impacts of repeated sub-lethal interactions
- Increasing interdisciplinary human dimensions work
- Supporting enforcement and interventions
- Evaluating the effectiveness of current measures and developing improved mitigation options, and
- Taking a collaborative approach.

Commercial Fisheries and Marine Mammal Bycatch

Lance Garrison, NMFS Southeast Fisheries Science Center

Commercial fisheries are vital to the economy of the Gulf, with fishermen landing 1.8 billion pounds of fish and shellfish in 2011 and earning $818 million in landings revenue[9]. Landings revenue was dominated by shrimp ($438 million) and menhaden ($104 million). The MMPA requires NMFS to develop an annual List of Fisheries, which categorizes commercial fisheries by the frequency of incidental serious injuries and mortalities (SI/M) of marine mammals. Category I fisheries have frequent SI/M's, Category II fisheries have occasional SI/M's, and Category III fisheries have rare or no known SI/M's. The MMPA imposes requirements on Category I and II fisheries including reporting all marine mammal interactions and carrying a fisheries observer if requested by NMFS. Table 4 provides a listing of the Category I, II, and III commercial fisheries in the Gulf, as identified in the 2015 List of Fisheries (79 Fed. Reg. 77919, 29 December 2014), as well as stocks reported to interact with each fishery.

Table 4: Gulf of Mexico Commercial Fisheries, by Category

Fishery	Gulf marine mammal stocks affected
Category I	
Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline	Bottlenose dolphin (oceanic), Gervais' beaked whale, killer whale, pantropical spotted dolphin, Risso's dolphin, short-finned pilot whale, sperm whale
Category II	
Gulf of Mexico menhaden purse seine	Bottlenose dolphin (BSE and coastal)
Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl	Atlantic spotted dolphin, bottlenose dolphin (BSE, coastal, shelf), Florida manatee
Gulf of Mexico gillnet	Bottlenose dolphin (BSE and coastal)
Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot	Bottlenose dolphin (BSE and coastal)
Category III	
Gulf of Mexico butterfish trawl	Bottlenose dolphin (continental shelf and oceanic)
Gulf of Mexico mixed species trawl	None documented
FL West Coast sardine purse seine	Bottlenose dolphin (coastal)
Southeastern U.S. Atlantic, Gulf of Mexico, and Caribbean snapper- grouper and other reef fish bottom longline/ hook-and-line	Bottlenose dolphin (continental shelf)
Southeastern U.S. Atlantic, Gulf of Mexico shark bottom longline/hook-and-line	Bottlenose dolphin (coastal)
Southeastern U.S. Atlantic, Gulf of Mexico, and Caribbean pelagic hook-and-line/harpoon	None documented
U.S. Atlantic, Gulf of Mexico trotline	None documented
FL spiny lobster trap/pot	Bottlenose dolphin (BSE and coastal)
Gulf of Mexico blue crab trap/pot	Bottlenose dolphin (BSE and coastal)
Gulf of Mexico mixed species trap/pot	None documented
Southeastern U.S. Atlantic, Gulf of Mexico golden crab trap/pot	None documented
U.S. Mid-Atlantic/Gulf of Mexico oyster dredge	None documented
Gulf of Mexico haul/beach seine	None documented
Atlantic Ocean, Gulf of Mexico, Caribbean shellfish dive, hand/mechanical collection	None documented
Gulf of Mexico, Southeast Atlantic, Mid-Atlantic, and Caribbean cast net	None documented
Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel	Bottlenose dolphin (BSE and coastal)

[9] https://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2011/FEUS2011%20-%20Gulf%20of%20Mexico.pdf

Because most of the stocks affected by commercial fisheries in the Gulf are bottlenose dolphins, the rest of the presentation focused on dolphin interactions in those fisheries as opposed to all marine mammal species/stocks in the Gulf. Nearly all coastal and bay/sound/estuary (BSE) stocks of bottlenose dolphins have the potential to interact with multiple commercial fisheries. Those stocks are therefore of particular concern due to the impact that even a small number of takes can have on each stock.

Gulf of Mexico large pelagics longline

The pelagic longline fishery targets swordfish, tuna, mahi, and sharks, and operates within the US Exclusive Economic Zone (EEZ) off the continental shelf in the high seas from Florida to Texas; fishing has been prohibited in DeSoto Canyon since 2000. Observers covered 24.7% of sets in the Gulf in 2013, but in the last five years coverage has been highly variable by quarter, with 8% coverage in the first, third, and fourth quarter and 100% observer coverage of the experimental fishery for bluefin tuna in the second quarter (Garrison and Stokes 2014). This has allowed observers to document nearly all interactions in the second quarter, including rare interactions with many of the species identified in Table 4. Interactions involve hooks in the mouth and entanglement in fishing line. Most animals are released alive but many are released with a hook in the mouth, which is the primary source of serious injury.

Gulf of Mexico menhaden purse seine fishery

The purse seine fishery operates exclusively in the northern Gulf, with effort limited to inshore waters off Louisiana east and west of the Mississippi River (SEDAR 2013). The fishery experienced a significant decrease in effort from 2011 to 2012, and the fishery has been changing in recent years. Interactions are primarily with the northern and western coastal stocks of bottlenose dolphins. There are a small number of vessels (37-40) in the fleet but a fairly large number of sets. Observer coverage has been limited with only a pilot program in 2011. Three takes were observed, and all were released alive and uninjured. There have been 13 self-reported takes from 2000-2013, and previous analyses suggest as many as 57 mortalities occurred between 1992-1995.

Gulf of Mexico gillnet fishery

The gillnet fishery is relatively small and like the menhaden fishery, it targets prey species of marine mammals including Spanish mackerel, spotted seatrout, mullet, Florida pompano, and flounder. Gillnets are prohibited in Florida and Texas state waters, and effort is limited to about 200 fishermen operating off Louisiana, Mississippi, and Alabama. Since 2012 there has been a low level of observer coverage in state waters (less than 10%) and although no marine mammal takes have been observed to date, takes have occurred in gillnets used in fishery research so the potential for interactions exists.

Gulf of Mexico shrimp trawl fishery

Fishing effort in the shrimp trawl fishery (Figure 13) occurs in estuarine, near coastal, and offshore continental shelf waters. There are more than 4,000 permitted vessels, of which 1,500 are federally permitted. Despite significant bycatch of finfish and sea turtles in the shrimp fishery and associated research and management actions to reduce such bycatch, observer coverage has been extremely low and is limited to coastal waters (no coverage of estuarine waters). The program was only recently made mandatory and coverage was approximately 0.24% (± 0.21%) of total effort from 1997 to 2011. A total of 14 marine mammal mortalities

Figure 13: Bottlenose dolphin feeding alongside a shrimp trawl vessel in Galveston Bay, Texas
(*Credit: Environmental Institute of Houston*)

have been observed from 1993-2013, with 6 identified as bottlenose dolphins. In addition, 10 takes were observed in relocation and research trawls from 2000-2013. Recent analyses indicate mean annual mortality estimates from 2007-2011 exceed 10% of PBR for western and northern coastal bottlenose dolphin stocks (Soldevilla et al. 2015). Mortality estimates possibly exceed PBR by a significant amount for BSE stocks in Louisiana, Alabama, and Louisiana, but further data on both abundance and bycatch rates in inshore waters are needed. Other stocks at risk are Texas and Florida BSE dolphin stocks and Atlantic spotted dolphin.

Blue and stone crab trap and lobster pot fisheries

Trap and pot fisheries are broadly distributed throughout the Gulf in estuarine and nearshore waters. There are approximately 6,800 permit holders (which includes the entire state of Florida). Interactions stem from bottlenose dolphin feeding around the gear or playing with the buoy lines. There is no observer coverage of the fishery, which underscores the importance of quality data derived from stranded animals. From 2002-2013, 18 bottlenose dolphin strandings were associated or consistent with trap/pot gear (NMFS unpublished data).

Hook-and-line fisheries

Hook-and-line fisheries have both commercial and recreational components. There are 819 permitted longline vessels in the Gulf, with 100 of those using bottom longline gear. Grouper is targeted along the northeast Gulf and snapper along the northern and western Gulf. The target level of observer coverage is 8%, and two takes of bottlenose dolphins from the continental shelf stock have been reported, in 2010 and 2012 (Gulak et al. 2013). Commercial passenger fishing vessels operate Gulfwide, with more than 800,000 charterboat trips reported in 2014.[10] There is no observer coverage on these vessels. From 2002-2013, 81 strandings associated with hook-and-line gear were reported but responders could not determine whether the gear was recreational or commercial (NMFS unpublished data).

In summary, only five of the twelve commercial fisheries in the Gulf that have reported interactions with marine mammals have systematic observer coverage and that coverage is relatively limited. Documentation of commercial fishery interactions comes from various sources (e.g. strandings, fishermen self-reports) and represent minimum counts. There is not enough information to determine total annual fishery-related impacts to stocks. Dolphins depredating on gear and scavenging discarded fish are a concern and frustrated fishermen are taking extreme action. NMFS has prosecuted cases for shooting at dolphins and throwing pipe bombs in the shrimp, longline, and charter boat fisheries.

Information needs include—

- Abundance surveys for bottlenose dolphins stocks at highest risk for fishery interactions
- Augmented observer coverage of the shrimp fishery and gillnet in inshore state waters
- Enhanced understanding of fishery distribution in inshore and nearshore waters, and
- Creative ways to observe and monitor fisheries where traditional observer coverage is challenging (e.g. menhaden and crab pot fisheries).

PRIORITY INFORMATION NEEDS AND KNOWLEDGE GAPS

Moderator: Randall Reeves, Okapi Wildlife Associates/Marine Mammal Commission

The objective of this session was to provide a brief summary of recent efforts to assess current and recent research and monitoring efforts focused on marine mammals, to assess research capabilities, and

[10] http://www.st.nmfs.noaa.gov/recreational-fisheries/index

to identify information needs and knowledge gaps. The presentations were followed by a panel discussion on alignment of research and monitoring efforts and resources to address knowledge gaps.

Gulf of Mexico Long-term Monitoring: Assessment of Marine Vertebrate Programs

Libby Fetherston, Ocean Conservancy Gulf Restoration Program

Ocean Conservancy has undertaken an assessment of long-term monitoring programs for trust resources injured by the BP oil spill in the Gulf of Mexico to better understand what is being done (or has been done) and identify gaps in monitoring coverage. This will also help to match monitoring programs with available restoration funding.

A conceptual model of the Gulf ecosystem was presented (Figure 14), but it was stressed that we know very little about each component of that model. The challenge, therefore, is to populate the model with information about species, processes, and the various stressors that affect them, and to identify actions that will help the ecosystem recover from major stressors, such as oil spills. For marine mammals, the emphasis for restoration will necessarily be on *natural recovery* (because you can't just grow new dolphins), coupled with minimizing stressors that would otherwise slow natural recovery.

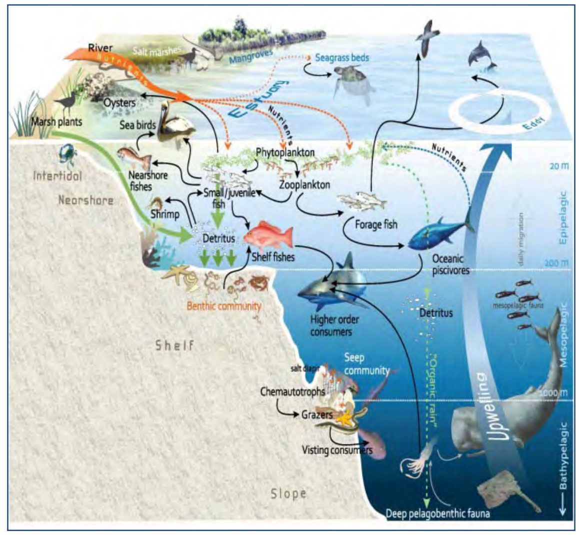


Figure 14: Conceptual model of the Gulf of Mexico ecosystem (*Credit: Ocean Conservancy*)

Ocean Conservancy is in the process of conducting an inventory of existing or past monitoring programs for each of the 13 restoration categories in the Deepwater Horizon NRDA, with a focus on publicly accessible programs that have a long-term data series (i.e., greater than five years). Those types of programs can provide the basic framework for an integrated monitoring program (referred to as "NRDA-plus"). Although several funding sources will be available for restoration of Gulf marine resources, the focus here is on NRDA because that funding source has the greatest potential to target marine mammals and sea turtles. In its assessment, Ocean Conservancy consulted with various experts to ensure that all relevant monitoring programs were included.

In its assessment, Ocean Conservancy identified a number of marine mammal monitoring efforts that had broad geographic coverage across the northern Gulf. However, several were pulsed activities, lasting only a couple of years. The Gulf stranding network was not included because it was not considered "traditional" monitoring.

Monitoring efforts that met the 5-year criterion were a smaller subset and included—

- Southeast Area Monitoring and Assessment Program (SEAMAP) plankton surveys
- Institute for Marine Mammal Studies (IMMS) health assessments
- Sarasota Dolphin Research Program, and
- IMMS dolphin surveys.

Monitoring priorities for marine mammals were developed in consultation with several marine mammal experts, and gaps in information were then identified for each priority area with respect to species, geographic area, and time (Table 5). Note that for several, the entire category was a gap.

Table 5: Ocean Conservancy Analysis of Monitoring Priorities and Gaps for Marine Mammals

Monitoring/Research Priority	General Gaps - Priority Species*	General Gaps - Geography	General Gaps - Time
Observe and assess stranded mammals	Pelagic species. This is a shore-based volunteer response network for stranded wildlife and carcasses of any species that wash ashore.	South Texas, West Louisiana, Big Bend of Florida, Southeast Florida	Volunteer response effort, so responsiveness depends on availability of resources and trained staff.
Monitor abundance and distribution of marine mammal stocks in nearshore waters (<200m), i.e., coastal and bay/sound/estuary	Low effort and lack of repeated monitoring of Atlantic spotted dolphins in majority of region outside of Mississippi Sound and Sarasota Bay; Bryde's whales.	From N extent of SEFSC aerial surveys to S extent of Sarasota Bay program. From N extent of Sarasota Bay program to E edge of Mississippi Sound. From LA/MS border to Brownsville, TX.	Entire category is a gap. No status and trends possible due to lack of sustained monitoring in coastal areas outside Mississippi Sound and Sarasota Bay, except 1992 - 2001 in SE FL.
Monitor abundance and distribution of marine mammal stocks in offshore waters (>200m)	None, there has been equal effort among species during short term surveys.	All areas are a gap. No status and trends possible without sustained monitoring, especially in oceanic waters and outside the US EEZ.	Entire category is a gap. There is no sustained monitoring programs in offshore waters.
Determine stock structure of marine mammal populations	Gap across all priority species. No status and trends possible without sustained monitoring in coastal areas outside Mississippi Sound and Sarasota Bay.	All areas are a gap. Only short-term studies have been done, there are no status and trends possible without sustained monitoring in coastal areas outside Mississippi Sound and Sarasota Bay.	Entire category is a gap. Only short-term studies have been done, there are no status and trends possible without sustained monitoring in coastal areas outside Mississippi Sound and Sarasota Bay.
Assess population demographics and reproductive rates	Gap across all priority species. No sustained monitoring beyond Mississippi Sound and Sarasota Bay.	All areas are a gap. No sustained monitoring beyond Mississippi Sound and Sarasota Bay.	Entire category is a gap. No sustained monitoring beyond Mississippi Sound and Sarasota Bay.
Assess habitat use	Gap across all priority species. No sustained monitoring beyond Mississippi Sound and Sarasota Bay.	All areas are a gap. No sustained monitoring beyond Mississippi Sound and Sarasota Bay.	Entire category is a gap. No sustained monitoring beyond Mississippi Sound and Sarasota Bay.

*Priority species identified for marine mammals: Atlantic spotted dolphins, bottlenose dolphins, Bryde's whales, sperm whales, and pelagic delphinids.

There is an opportunity to fill some of the monitoring gaps identified for marine mammals using restoration funds that will be available. Potential matches of funding sources with monitoring needs were identified, and some gaps are already being addressed in part, e.g. by the Alabama stranding network with funding from the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund, and acoustics work by the University of Louisiana at Lafayette with funding recently provided by the Gulf of Mexico Research Initiative (GoMRI). NRDA, as mentioned, has funded a number of marine mammal injury assessment projects and should be a significant source of support for injury recovery monitoring once those funds become available.

Cooperative Conservation for Marine Mammals in the Gulf of Mexico:
Developing a Plan for Action - Summary of Gulf of Mexico Regional Workshops
Laura Engleby, NMFS Southeast Regional Office

The NMFS Southeast Region, in partnership with MMC, hosted three workshops in the northern Gulf of Mexico in May 2013. Workshops were held in Baton Rouge, Louisiana, Pascagoula, Mississippi, and Galveston, Texas. The purpose of the workshops was to identify actions that would contribute to the survival of, and reduce negative impacts to, marine mammals through increased scientific knowledge, management, and public understanding.

The goals of the workshop were to—
- Provide an opportunity for exchange of information among Federal/state/local agencies, NGOs, academics, and other interested parties regarding the status and conservation of marine mammals in the Gulf
- Identify strategies and actions to address high priority needs fundamental to conserving marine mammals in the Gulf
- Stimulate and foster regional collaborations
- Identify ways to promote data integration and data sharing, and
- Identify potential sources of support and leverage.

The workshops were facilitated and the 77 participants represented a broad range of interests and affiliations. Presentations covered: (1) threats to marine mammals in the Gulf of Mexico; (2) status of ongoing NMFS research and priority needs for the future; (3) overall research needs; (4) marine mammal health and stranding response activities in the Gulf; and (5) overview of NRDA ongoing activities. After the presentations, participants were asked to identify, from a regional perspective (not just their institution) the three priority gaps that, if filled, would enhance marine mammal conservation in the Gulf.

Each workshop had nearly identical priorities, which are presented in Table 6. Each workshop group ranked stock assessments as the top priority, with second and third priorities identified as outreach and education regarding human interactions and enhancing regional coordination, communication, and collaboration. The Mississippi/Alabama and Texas groups also identified additional priorities as research on environmental and biological parameters and health of bottlenose dolphins.

Table 6: Priorities Identified by Workshop Groups in Different States

Priority	Louisiana Workshop	Mississippi/Alabama Workshop	Texas Workshop
1	Establish/maintain long term stock assessments	Conduct stock assessments	Need good stock assessments
2	Outreach and education regarding human interactions	Address human interactions (outreach, enforcement)	Better communication/networking
3	Coordination of regional efforts	Enhance collaboration	Outreach and education regarding illegal feeding/harassment of dolphins
4		Environmental parameters, biology, natural history, etc.	Health of bottlenose dolphins

With respect to stock assessments, challenges identified were the large geographic area in the Gulf, the number of marine mammal species/stocks, the logistics involved in conducting surveys, tracking movements of highly mobile species, lack of adequate infrastructure to conduct surveys (i.e., planes and ships), inadequate funding, inadequate analytical capacity, and a lack of standardized methods. Strategies to improve stock assessments included having a clear action plan for prioritizing stock assessments (including which species/species groups and how often), leveraging restoration and other sources of funding and also public interest in marine mammals, making the most of cooperative datasets (e.g., SEAMAP).

Data sharing is critical, and participants suggested that federal agencies require that all data collected by staff or contractors be available publicly. Public access to shared data sets could be facilitated through umbrella frameworks such as NOAA's Cetacean and Sound Mapping (CetMap) that link to or synthesize data from various sources, and all researchers should follow consistent data collection standards (e.g., for photo-ID studies; see Rosel et al. 2011).

For outreach and education regarding dolphin harassment, challenges included inconsistent or inadequate enforcement and a lack of resources to develop effective messaging and outreach materials and to disseminate information. In many cases, it will require user groups to overcome pre-conceived notions and take ownership of the problem. Potential strategies include using licensing to target outreach and education at the point of contact, increasing law enforcement, make dolphins a priority in the NMFS-state Joint Enforcement Agreements (JEAs), training and educating state officers, and strengthening state partnerships. It is also important to get youth involved at an early age, as kids represent a new generation and will help teach adults.

Bottlenose dolphin (*Tursiops truncatus*)
(Credit: NMFS)

Enhanced communication and collaboration was a universal theme, as was a need to know "who's who" and also "who's doing what" in the Gulf. Each group suggested that a directory be assembled for the Gulf that includes scientists, managers, decision-makers, and non-governmental organizations. There should also be increased opportunities for exchange of information and for training on standards and common data platforms.

A question was asked regarding follow-up from the meeting. Although lack of funding has been an issue for expanding stock assessments, this meeting was identified as a logical next step to achieve greater coordination and collaboration in the Gulf and to exchange information on what types of programs exist. This meeting's program book is essentially the "who's who" directory that was called for at the workshops. Another question was asked about interest and funding for conducting research in offshore waters. Although that was recognized as an important need, most of the focus was on human interactions in coastal waters as that is more of an issue for the states. In Texas, there has been an effort to meet and collaborate among researchers as a result of the workshops. Another question was asked about who is (or should be) responsible for conducting the training on standardized methods, as that training could help build research capacity in the Gulf. This will require identifying potential trainers (like Randall Wells at the Sarasota Dolphin Research Program) and then securing the funding to conduct training.

GCOOS Build-out Plan and Marine Mammals

Barb Kirkpatrick, Gulf of Mexico Coastal Ocean Observing System (GCOOS) Regional Association, with contributions from Chris Simoniello, Stephanie Watson, and Matt Howard

GCOOS was established in 2005 under the Global Ocean Observing System (GOOS) and the U.S. Integrated Ocean Observing System (IOOS). There are 11 regional associations across the United States. GCOOS's experience with handling large data sets involving marine mammals dates back to the Sperm Whale Seismic Study (SWSS) project (see project description by Biggs in Appendix B) and managed by researchers who then went on to establish GCOOS. GCOOS has five themes, including public health and safety, healthy ecosystems and water quality, mitigation of effects of coastal hazards, safe and efficient marine operations, and long-term ocean variability and changes. These themes overlap with work being done on and the concern for marine mammals, which cross over to the kinds of societal concerns that GCOOS is trying to address. GCOOS works under a member/partnership model, with data collected by partners (e.g., data from oceanographic buoys) that then stream the data to GCOOS. The GCOOS data portal is located at http://data.gcoos.org.

Version 1 of GCOOS's Build-Out Plan was developed prior to the Deepwater Horizon spill and was more of a skeleton framework. However, the spill underscored the importance of having a comprehensive, visionary plan of what an observing system should look like for the Gulf. Version 2.1[11] of the Build-Out Plan was developed with input from workshops involving various organizations, reviews of other plans, and subject matter expert writing teams. It has several elements that would incorporate data on marine mammals. Representative types of marine mammal data that GCOOS is seeking to incorporate can be found in Table 7.

GCOOS can help with marine mammal research and monitoring needs by tracking data collected with autonomous technology (drones and autonomous vehicles), fixed and bottom-mounted hydrophones and environmental sensors, high-frequency radar, aircraft, ships, tags/receivers, and satellites. GCOOS can also be a repository for data products and modeling. Historical data are primarily focused on oceanographic parameters, but GCOOS is interested in integrating wildlife tracking and telemetry data with existing ocean observing system infrastructure. For example, it is working with fish researchers and has developed a system for identifying the origin of "orphan" fish tags detected by observing systems throughout the Gulf (i.e., Integrated Tracking of Acoustically Tagged animals; iTAG), and also for controlling the amount of data made publicly available. There is also interest in incorporating data collected by using marine animals as mobile monitoring platforms into GCOOS.

Other regional Ocean Observing Systems are also working to incorporate marine mammal data into data portal and products. The Alaska Ocean Observing System (AOOS) is working with the Animal Telemetry Network (ATN) task team, led by the Office of Naval Research and IOOS, to develop a circum-Arctic ATN. AOOS has incorporated sightings data on Cook Inlet beluga whales, photo-ID data on humpback and killer whales, acoustic data on Arctic whales, and tagging data from ice seals. The Central and Northern California Ocean Observing System (CeNCOOS) is working with NMFS and the Marine Mammal Center to incorporate marine mammal health data (the HealthMAP initiative discussed by Teri Rowles).

In summary, GCOOS is looking to marine mammal scientists and managers in the Gulf to further develop its data portal and other initiatives. With its 10-year history in the Gulf, GCOOS has considerable expertise with biological and oceanographic information. Like the other Regional Ocean Observing

[11] http://gcoos.tamu.edu/BuildOut/BuildOutPlan-V2-1.pdf

Systems, GCOOS can play a lead role in fulfilling needs for marine mammal monitoring. GCOOS is funded by IOOS, and although funding has been fairly stable, the goal is to be able to expand its services. For example, although funding limitations have limited the incorporation of effort data by AOOS, GCOOS is striving to incorporate all information made available by researchers. Some of the data sets may be very large (i.e., acoustic data) and identifying long-term repositories for such data could be a problem.

Table 7: GCOOS Build-Out Plan and Marine Mammals

Focus area	Data or analytical outputs to be incorporated
Ecosystem and habitats	o Monitoring of marine mammal movement, prey, and habitat use o Identify, characterize, protect, and monitor habitats for each protected Gulf marine mammal species; mapping of marine mammal habitats and migration corridors to identify priorities for conservation o Monitoring physical and chemical factors affecting marine mammals; coupling behavior with physical parameters o Identification of stressors
Population status and trends	o Marine mammal species and abundance; more population information needed; many classified as "unknown" o Genetics information to classify populations o Population structure, in addition to population size and trends
Information on individuals	o Physiological and health monitoring o Health status and contaminant loads of stranded or live-captured animals, necropsies of dead animals, fecundity, controlled exposure experiments, genomics o Observations of condition of stranded animals, changes in diet as determined by observations of foraging behavior, stomach content o Observations of stranded animals, analysis of tissues for evidence of toxins, monitoring of Harmful Algal Blooms (HABs) and hypoxia
Effects of marine sound	o Monitor marine sound with emphasis on marine mammal habitat o Characterize the spectrum of ambient and human-generated sound in Gulf (especially 1-200,000Hz), how it varies spatially, and effects on marine mammals o Sound propagation, physical and physiological effects and hearing, behavioral reactions and biological significant effects, mitigation and monitoring, research tools
Modeling	o Comprehensive models of the Gulf (with drivers) o Model health and sustainability of marine mammal populations o Model sound propagation
Data products and integration	o Need for a data portal and data integration o Use of data management standards (interoperability, QA/QC, etc.)

Marine Mammal Monitoring of Geological and Geophysical Activities in the Gulf of Mexico
Jennifer Bosyk, Bureau of Ocean Energy Management (BOEM)

BOEM, along with the Bureau of Safety and Environmental Enforcement (BSEE) and NMFS as cooperating agencies, is preparing a Programmatic Environmental Impact Statement (PEIS) that will consider the environmental effects of all geological and geophysical (G&G) survey activities in federal waters of the Gulf. It will also identify and analyze appropriate mitigation measures for marine mammals that may be affected by such activities. The PEIS will be used by BOEM to support ongoing G&G permit applications in the Gulf, as well as its petition to NMFS for rulemaking under section 101(a)(5) of the MMPA (incidental taking) submitted on behalf of the oil and gas industry. NMFS is a cooperating agency so that it can use the PEIS in its MMPA decision-making process on the rulemaking and the subsequent issuance of annual Letters of Authorization (LOA) to individual G&G operators for incidental taking. A draft of the PEIS is expected to be published in March 2016, with the final to be published in April 2017.

A monitoring plan is a required component of the MMPA rulemaking. The requirements of a monitoring plan include—

- Improved understanding of the distribution and abundance of marine mammals in the Gulf
- Improved understanding of how stressors affect individuals or populations
- Evaluation of the effectiveness of the mitigation or monitoring that is being conducted, and
- Improved understanding of the relationship between G&G activities and the environment (e.g., source characterization, sound propagation, and ambient sound levels).

Fraser's dolphin (*Lagenodelphis hosei*)
(*Credit: NMFS*)

Via webinars, BOEM and NMFS solicited input from a variety of stakeholder groups, including the oil and gas industry, other federal agencies, resource managers, and academics, both within and outside the Gulf region. Input was specifically solicited on—

- The nature, scope, or context of likely marine mammal exposure to potential stressors
- Interrelationships between G&G activities and the affected environment
- Ongoing or upcoming research efforts that may be appropriate to coordinate with or leverage
- Major data gaps in the Gulf related to marine mammals
- Metrics for successful monitoring
- Advice on creating an adaptive, responsive monitoring structure, and
- Major impediments to monitoring programs.

The draft monitoring plan will be submitted to NMFS later this year. The plan will be based on hypothesis-driven research addressing species/stocks most likely to be impacted, and will seek to leverage existing efforts, including BOEM's planned and ongoing environmental studies. At the outset, BOEM plans to use a phased structure as it designs and implements its monitoring program, and will include periodic review and input by an external advisory group. The first opportunity for public review of the monitoring plan will be provided when NMFS releases the draft MMPA petition.

A question was regarding how much responsibility would be placed on industry to support the monitoring plan. At this point, BOEM is still working that out with industry. Another question was asked about the programmatic approach being used by BOEM. BOEM typically conducts programmatic EIS's (e.g., for its 5-year leasing programs; it also just recently prepared a PEIS for its G&G activities in the Atlantic), and they are used as planning tools that feed into subsequent, more narrowly focused stages of environmental review.

The BOEM-funded Atlantic Marine Assessment Program for Protected Species (AMAPPS) is providing important baseline information on marine mammals in the Atlantic. A participant asked whether such a program might be implemented in the Gulf to provide much-needed baseline information on marine mammals there. BOEM responded that other work has been conducted and is ongoing in the Gulf that has provided baseline information on marine mammals, and the BOEM Environmental Studies Program provides ongoing opportunities for research in all offshore areas. BOEM also is working to make all of its data from the Environmental Studies Program publicly available, dating back to the origin of the program more than 30 years ago.

A participant asked about the difference between annual incidental take authorizations and incidental take regulations. NMFS clarified that incidental takes can be authorized through either method, but it encourages applicants to pursue rulemaking and LOAs in cases where administrative "streamlining" benefits might be achieved through a rulemaking framework. This rulemaking is a unique case (in which BOEM is petitioning on behalf of industry), but NMFS would still review the proposed activities of each individual operator to determine potential takes and how these relate to the overall take levels analyzed as part of the rulemaking.

It was noted that obtaining a MMPA research permit can take three years or longer, and that this kind of process is especially onerous for an entry-level scientist. As BOEM, NMFS, and industry develop the G&G monitoring plan, they need to bear in mind the timeframe required for permitting. Meeting participants encouraged BOEM to actively engage marine mammal scientists and managers from the outset to ensure that the plan has a strong research foundation that is achievable within the envisioned timeframe. BOEM emphasized that the monitoring plan is meant to ensure that G&G operations conducted in the Gulf are in compliance with the MMPA incidental take requirements and other mandates. This will be in addition to the requirements for mitigation monitoring that apply to individual operators.

Atlantic spotted dolphin (*Stenella frontalis*)
(*Credit: NMFS*)

The draft monitoring plan will be ready for review by industry in the next few months, and the petition to NMFS, which the monitoring plan is part of, will then be made available for public comment at the end of 2015. It is BOEM's intention to have the rulemaking and the PEIS come out at the same time. The monitoring plan will be subject to an iterative process involving BOEM, NMFS, and industry. BOEM is developing a framework for monitoring at this stage, with the monitoring goals not finalized before the PEIS has been finalized. Impacts and priorities identified in the PEIS can then be incorporated into the final monitoring plan. An external advisory group will also help to adapt the plan's goals over time.

If BOEM is pursuing a rulemaking and the process also involves the issuance of individual LOAs, the question was asked whether that is more expedient than the one-year incidental harassment authorization (IHA) process. BOEM explained that the rulemaking establishes a framework for evaluating the individual LOAs up-front, as opposed to having each operator undertake the potentially longer IHA process.

A question was asked about the availability of information on marine mammal presence and distribution in the Gulf collected by observers on seismic vessels as part of industry's mitigation and monitoring requirements. BSEE is the agency that receives and reviews those reports, and it is currently in the process of making that information available to the public.

[A summary of the input received by BOEM during the stakeholder webinars was posted shortly after the meeting on the BOEM website.[12]]

[12] http://www.boem.gov/Synthesis-Report-Stakeholder-Webinars/

Group Discussion on Assessment of Information Needs

The need to improve data access and sharing of data was an issue raised in several presentations. Recently, the federal government directed all agencies to make data collected by federally funded programs publicly accessible. Participants were asked to comment on this requirement and the challenges likely to be encountered in its implementation. The referenced document[13] requires federal agency data to be made available to the public within 12 months of collection, and this applies to both current and historical data. Processes regarding how and where those data will be available are still being developed.[14] This directive also applies to government contractors and grantees (without the provisions concerning historical data). The requirements and processes arising from the directive will be part of the framework for how the government collects data in the future.

"If you don't have a nerd, go get one."
(Libby Fetherston on analytical capabilities that will be needed for data integration)

Mining different data sets and drawing useful insights from available data will be challenging everywhere, but especially so in the Gulf where data exists in many different databases and formats. Data must be subject to rigorous QA/QC and be in a format suitable for integrated analyses using advanced analytical techniques. It will also require interdisciplinary collaborations to develop models that can integrate different types of environmental and marine mammal data. As was noted by Fetherston, "If you don't have a nerd, go get one."

Scientific journals have long been grappling with the issue of access to data. Several journals now require authors to archive and make publicly available all data supporting published findings. This is a general trend, but one not without pitfalls, especially for long-term data collections. In addition, maintaining and managing data collected on long-lived species such as marine mammals is especially challenging. Data repositories must be designed to accommodate large data sets as well as associated metadata. They must take into account advancements in technology and methodology, be maintained and updated, be searchable, and be secure and stable over the long term.

The need for data to be collected in a standardized manner and made broadly available was noted throughout the presentations. The North Atlantic Right Whale Consortium[15] was suggested as a model for marine mammal data sharing. SEAMAP, a cooperative monitoring program among academia state and federal partners to survey plankton, fish and a suite of environmental data, was also mentioned as a model that has been operating in the Gulf for many years.

DATA SHARING AS A MECHANISM FOR COLLABORATION AND CAPACITY BUILDING

Moderator: Stephanie Watson, GCOOS

As noted in previous sessions, there are many different data types that are relevant to marine mammal scientists and managers. Broader access to those different data types is one important mechanism for enhancing collaboration and capacity building in the Gulf. The objective of this session was to discuss some of the basics of data sharing, including basic terminology, benefits of data sharing, various data

[13] This requirement was formalized in a 22 February 2013 memorandum issued by the White House Office of Science and Technology "Increasing Access to the Results of Federally Funded Scientific Research," available at https://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf.

[14] The NOAA Plan for Increasing Public Access to Research Results is available at http://docs.lib.noaa.gov/noaa_documents/NOAA_Research_Council/NOAA_PARR_Plan_v5.04.pdf.

[15] http://www.narwc.org/

portals and data systems, the importance of metadata, options for data sharing, making data "discoverable," and challenges to data sharing.

Data Sharing 101: The Five W's and Some Opportunities to Share Marine Mammal Data
Samantha Simmons, Marine Mammal Commission

Data sharing means different things to different people. To some researchers, data sharing may mean sharing data with students. While that may be adequate for certain datasets, there may be utility in taking data sharing to the next level, such as making a list of publications or even datasets available on a personal website. Others will make data available if it is a requirement of funders or scientific journals. However, that data may not be widely accessible or "discoverable" by the broader research community. The proposed "gold standard" of data sharing is making data that have been collected and gone through QA/QC freely available on widely accessible and reputable websites or data portals, along with relevant metadata that adheres to the metadata standards specific to that data type.

All researchers should be looking for ways to share data. Benefits to researchers themselves include increased opportunities for multi-disciplinary collaborations, the ability to address larger scientific questions (i.e., cumulative effects), and the opportunity to leave behind a legacy of work accomplished. Benefits to society include contributions to multi-disciplinary analyses such as integrated ecosystem assessments and the ability to analyze and predict the effects of climate change. Other benefits include maximizing the value of data collected (especially in a research environment faced with shrinking budgets), the ability to assemble long-term time-series data, and minimizing impacts of invasive research on animals.

Although data should be shared promptly, concerns have been raised about sharing data that is still being analyzed or supplemented with additional data collections. GCOOS has implemented a tiered access system as part of its iTAG network to restrict how widely data may be accessed (i.e, selected colleagues, the broader research community, or the public). Including metadata from the onset increases the value and visibility of the data. Posting links to the dataset (rather than the actual data) on widely accessible data portals increases its "discoverability" and also prevents researchers from having to upload datasets multiple times or as new data are collected.

Data can be shared through a number of different mechanisms and portals, including a developing federal architecture for access and archival of marine biological data and data products (the U.S. Federal Marine Biological Data Architecture; Figure 15). Some specific examples of data mechanisms and portals by different marine mammal data type include—

- Occurrence data (species, location, and abundance) - OBIS[16], iTAG, ATN[17], Ocean Tracking Network (OTN)[18]
- Behavior and environmental data - ATN
- Acoustics - Tethys, others?
- Genetics - GenBank, Dryad[19]
- Photo-ID - GoMDIS, OBIS-SEAMAP[20]
- Health data - HealthMAP, and

[16] http://www.usgs.gov/obis-usa/
[17] http://oceanview.pfeg.noaa.gov/ATN/
[18] http://oceantrackingnetwork.org/
[19] http://datadryad.org/
[20] http://seamap.env.duke.edu/

Other data portals for oceanographic data include—
- ERMA[22]
- Marine Cadastre[23], and
- GRIIDC (GoMRI Information and Data Cooperative (GRIIDC))[24]
- NOAA's ERDDAP[25].

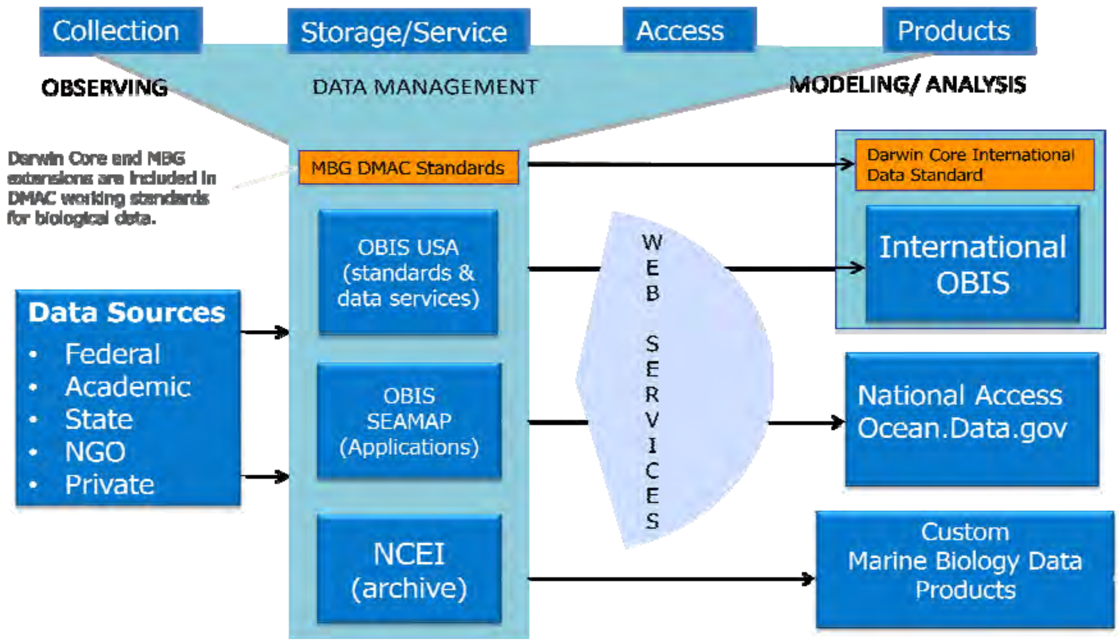


Figure 15: U.S. Federal Marine Biological Data Architecture (*Credit: S. Simmons, MMC*)

GRIIDC: Establishing a Gulf of Mexico Data Cooperative

James Gibeaut, Harte Research Institute, Texas A&M University, Corpus Christi

The mission of the GoMRI Information and Data Cooperative (GRIIDC) is to ensure a data and information legacy that promotes continual scientific discovery and public awareness of the Gulf of Mexico ecosystem. GRIIDC is managing diverse datasets from all of the 2,730 GoMRI researchers from 241 institutions. Their data holdings extend from May 2012 to February 2015 and the program is expected to continue for at least three more years.

As a condition of funding, all GoMRI researchers must make their data fully accessible to the public. Data and metadata must be submitted to GRIIDC no later than at the time of publication of results, or within 12 months of collection if no publication is expected. Users can access the data at no cost after completing a simple registration form. The benefits of data sharing include contributions to baseline data, increased efficiency, increased public trust, and more efficient planning and permitting. Data sharing also helps to inform policy, facilitate citizen science, enable new discoveries, and prevent

[21] http://www.wildme.org/wildbook/doku.php?id=start
[22] http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma
[23] http://marinecadastre.gov/data
[24] https://data.gulfresearchinitiative.org/
[25] http://coastwatch.pfeg.noaa.gov/erddap/index.html

reduced data availability over time. It is easiest to document metadata, and sharing data early allows data acquisition planning and collaboration, improved metadata, and more effective end-product review. Researchers may be reluctant to share if they get no credit (professionally) for sharing, if they have concerns about being “scooped” for their ideas, or if they have not planned in advance for the time and costs associated with sharing data. Conversely, ways to motivate researchers to share data include making it a requirement for funding or publication, using shared datasets as a metric in promotion reviews, and having data repositories create more user-friendly tools for submission, discovery, and citation (such as assigning data sets their own Digital Object Identifiers or DOI's).

GoMRI is trying to create a culture of sharing by providing—
- An efficient service (i.e., GRIIDC)
- Outreach and training
- Credit/DOIs for datasets
- Data-use statistics, and
- A public monitoring matrix that provides information on who is (and isn't) sharing data.

Establishing and maintaining all of those cultural elements will cost more money, especially in the early stages. However, this culture of data sharing will allow GRIIDC to expand beyond the current GoMRI datasets and to start developing integration products.

Group Discussion on Data Sharing

Participants indicated that the combination of “carrots” and “sticks” used by GoMRI to encourage data sharing is a good model given the value of data stemming from DWHOS-related research. However, the challenge remains of ensuring the datasets are used to generate integrated and synthetic descriptions of the Gulf ecosystem. GRIIDC is focusing initially on assembling the datasets, but it intends to address integration and synthesis challenges in the future. Funding for such products is already available, and more is anticipated in future funding rounds. For effective integration and synthesis, the repositories must be organized in such a way that all relevant datasets can be identified and accessed. This will be an important component of repositories used for housing data from restoration and monitoring efforts.

Spinner dolphin (*Stenella longirostris*)
(*Credit: NMFS*)

Carmichael noted that the Dauphin Island Sea Lab has a data management policy which has met the "gold standard" for data management and sharing. However, issues still arise because some of the data (e.g., Level A stranding data and sightings data) reside in various repositories. As new data are collected, a major challenge is to ensure data users are using updated data. To achieve this, datasets must be properly documented when updates are made, with data users directed (and enabled) to use the updated data in analyses. These issues highlight the need for carefully designed repositories with well-documented procedures for updating data and the metadata that describes it.

The 12-month “grace period” mentioned in the previous session, which gives federally-funded researchers one year to publish research before having to make their data publicly available, could be especially problematic for students in multi-year thesis or doctoral programs, or where data need to be synthesized over a longer timeframe to analyze effects of stressors such as climate change. Participants were concerned that publishing results based on a single year of data could be misleading and is in fact contrary to scientific “best practice” in most contexts involving empirical studies of natural phenomena, where year-to-year variability is to be expected. Strict adherence to the 12-month rule could result in flawed analyses. However, it may be possible to apply tiered levels of data sharing, depending on data sensitivity, data quality, etc. Gulland mentioned that institutions like the Marine Mammal Center have developed a system for "protecting" certain data that are being used by students until they have completed their projects. GoMRI also has applied the 12-month rule, and the likely trend will be for other funders to adopt similar timeframes.

NOAA's Environmental Research Division’s Data Access Program[26] (ERDDAP) was identified as a data system that should be considered for archiving marine mammal data. With the goal of "easier access to scientific data," ERDDAP can reformat user requests to conform to the format of the data as archived. It serves approximately 940 oceanographic datasets and can generate maps and other data products in the format requested by the user. It can also alert users when the datasets they are using have changed.

DEVELOPING A MONITORING FRAMEWORK FOR THE GULF

Moderator: Leslie Ward, FWCC/FWRI

Previous sessions discussed several needs that can be addressed with a clearly defined monitoring framework, including—

- Improved communication between researchers and managers so that they are focused on the same conceptual model
- Identifying management objectives and aligning those objectives with future research
- Identifying knowledge gaps and priority needs
- Integrating research components effectively to meet common objectives
- Identifying priority needs that can be addressed through partnerships, and
- Identifying where individual contributions fit into an overall monitoring framework.

This session considered a formal method — the structured decision-making (SDM) process – for analyzing a decision by breaking it into its components in order to identify the optimal way of meeting specific objectives. For example, within the FWCC manatee program, this process has been used to secure warm-water habitats into the future. A structured decision-making tool was developed that projected the consequences of management actions on parameters such as manatee abundance and population growth (Kosempa et al. 2014).

In general, failure to define objectives appropriately is one of the most common reasons for a breakdown in the SDM process. In developing priorities for marine mammal monitoring, it is important to consider the scale of objectives within an SDM framework and with a management perspective. Additionally, data management systems need to match the needs and objectives of the monitoring program, and the monitoring framework can include objectives for data management as well as specific management needs. FWCC has invested significant time and effort to ensure that its monitoring programs are matching the needs and timeframes of managers. For example, for the first time in the program's history, FWCC is providing photo-ID information within the same year of collection to inform analyses of survival rates and, in turn, population models. This allows managers to put crises in context.

[26] http://coastwatch.pfeg.noaa.gov/erddap/index.html

Toward a Gulf-Wide Bird Monitoring Network: Identifying Objectives to Prioritize Action
Randy Wilson, FWS Migratory Bird Program, with contributions from
John Tirpak, FWS Gulf Restoration Program, and Melanie Driscoll, National Audubon Society

The Gulf of Mexico bird scientists recently established an ad-hoc network of 20+ agencies and organizations working to develop a Gulf-wide bird monitoring plan, post-Deepwater Horizon. That network of scientists is dealing with many of the same issues being discussed by marine mammal scientists and likely also fish and sea turtle scientists. As a result there may be synergies in having the various groups share ideas and approaches. In common is the lack of a coordinated, objective-driven framework to guide monitoring efforts at large spatial scales across the Gulf (Bjorndal et al. 2011). Also in common are the lack of baseline data for many species and the lack of an ability to assess the effects of system drivers and management at large spatial and temporal scales.

The bird monitoring network is tackling these challenges by first defining a set of agreed-upon goals and values. Traditionally, single-loop learning solves problems by feeding the results and consequences of actions directly back into the kinds of actions that are taken. The bird network is instead taking a double-loop learning[26] approach that looks at the governing variables that influence why we do what we do and how we use new results and consequences to refine our actions. Those governing variables include our goals, values, beliefs, and conceptual frameworks. In the design of a monitoring network, we need to identify the goals, values, and key data needs that reflect the interactions and complexities of the Gulf ecosystem.

The network used a structured-decision making process based on Hammond et al. (1999), working progressively through stages as follows (Figure 16)—

- Frame the problem - under the broad vision of integrated restoration and management of the Gulf ecosystem, the goal of monitoring was to maximize the usefulness of bird monitoring data to inform and advance bird conservation. The problem statement was framed as:

  How do we develop a cost-effective bird monitoring strategy for the Gulf of Mexico that evaluates ongoing, chronic, and acute threats and conservation activities, maximizes learning, and is flexible and holistic enough to detect novel ecological threats with respect to management triggers and to evaluate new and emerging conservation activities?

  The decision then becomes: What suite of monitoring projects are needed to inform and facilitate bird conservation?
- Identify objectives - This stage involved an assessment of the network's core values, which were incorporated into the program's objectives (as underlined):
  - Fundamental objective 1: Maximize <u>Integration</u> of monitoring projects
  - Fundamental objective 2: Maximize <u>Rigor</u> of monitoring projects
  - Fundamental objective 3: Maximize <u>Relevance</u> of monitoring projects
    - Objective 3a: Maximize understanding of <u>Population and Habitat Status</u> assessments (i.e., baseline information)
    - Objective 3b: Maximize understanding of <u>Management Actions</u> and their respective impacts on bird populations and their habitat
    - Objective 3c: Maximize understanding of <u>Ecological Processes</u> and their respective impacts on bird populations and their habitat.

  Each objective was then weighted as a means of setting priorities. For each objective, sub-objectives were identified that would help meet that objective and then also weighted. The idea is that actions

[26] http://www.afs.org/blog/icl/?p=2653

can then be designed to meet those sub-objectives. For example, to assess the status of a population, the network identified 1) number of priority species surveyed, 2) spatial scope, and 3) temporal scope as survey sub-objectives, with each one weighted. Different survey designs were then scored according to how well they met objective-based performance metrics. This allowed managers to select the survey (or group of surveys) that yielded the greatest contribution to the program's values (in this case the maximum number of priority species surveyed over the largest spatial and temporal scale), evaluated against some constraining factor (e.g., cost).

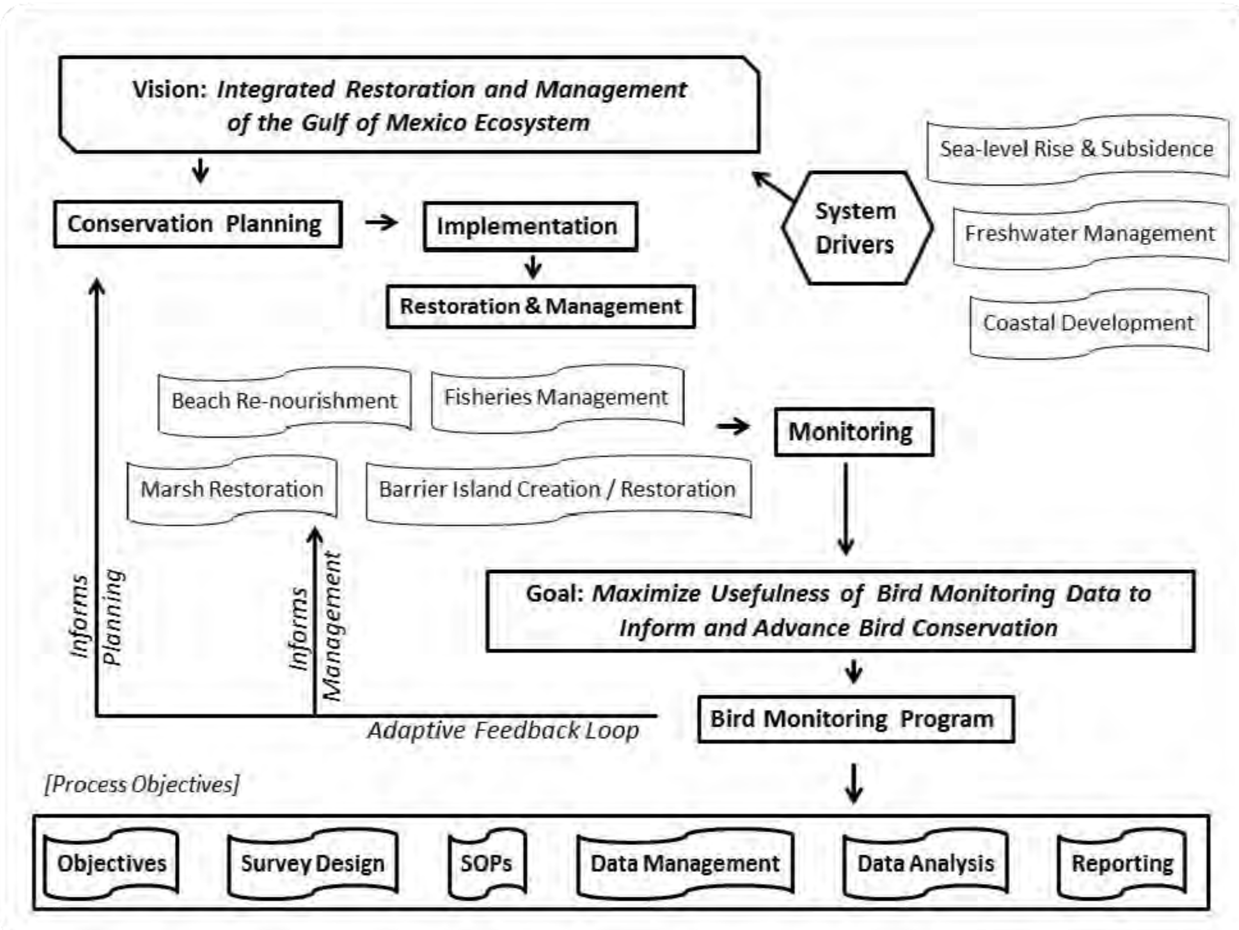


Figure 16: Framework for bird monitoring in the Gulf of Mexico (*Credit: R. Wilson, FWS*)

In summary, structured decision-making provides a pathway for moving conceptual models to reality. The model described here can help develop a monitoring framework that documents and reflects underlying decisions, assumptions, objectives, values, and priorities. Such a tool can be used to identify and rank data gaps and develop new monitoring approaches for establishing a long-term monitoring program. The process provides structure and tools to identify key program components, facilitate trade-off analyses, and coordinate with other biotic and abiotic monitoring efforts. This will increase the effectiveness of restoration expenditures, allow us to identify opportunities for pooling and leveraging resources, raise new funds to implement surveys, guide infrastructure development, and understand how important individual monitoring projects are from a regional perspective.

In response to a question, it was noted that the core bird working group is comprised of about 20 individuals and it has been working for about two years, with the last year and a half the most productive time. For now, the subject matter experts are the decision-makers, but as the process matures, agency directors and stakeholders will be consulted to ensure their values are represented and weighted appropriately. A technical report documenting the process has been drafted and Wilson offered to make the most current version of this document available upon request.

FUNDING OPPORTUNITIES IN THE GULF

Moderator: Kathryn Mengerink, Environmental Law Institute Ocean Program

The purpose of this panel was to provide an overview of potential funding sources for marine mammal research and monitoring in the Gulf, particularly those that have become available since the Deepwater Horizon oil spill. Presenters summarized the goals and objectives of each program and highlighted opportunities specific to marine mammals. The Environmental Law Institute (ELI) is a research and education organization that has been working in the Gulf since 2011. A summary of funding opportunities for recovery and restoration of the Gulf as well as other DWHOS-related synthesis materials are available on the ELI Gulf of Mexico Restoration & Recovery website[27].

Deepwater Horizon Oil Spill Natural Resource Damage Assessment Overview

Jean Cowan, NOAA Restoration Center

The Natural Resource Damage Assessment (NRDA) is a requirement of the Oil Pollution Act (15 C.F.R. §990). The Act provides guidance on how the NRDA Trustees are to resolve oil spill cases. The Trustees' specific responsibilities are to 1) determine the amount of injury to natural resources and the amount of lost services, 2) develop and oversee implementation of restoration plans to compensate the public for injuries and lost services, and 3) ensure the parties that were responsible for the damages (i.e., the polluters) pay for restoration.

The overarching goal of NRDA, as mandated by the Oil Pollution Act, is to restore, rehabilitate, replace, or acquire the equivalent of the injured natural resources and services to baseline conditions (were the spill not to have occurred) and to compensate the public for interim losses that occur during the time it takes for those resources to recover. The Trustees must implement monitoring that enables evaluation of success (i.e., meeting prescribed performance criteria) and/or the need for corrective actions. The amount and type of restoration will be dependent upon the amount and type of injury that is ultimately quantified. The NRDA is <u>not</u> a research funding opportunity, as research is explicitly not part of the Oil Pollution Act.

The Trustees for the Deepwater Horizon (DWH) are working together to conduct the injury assessments and to develop the restoration plan. There are nine Trustees: NOAA, Department of the Interior, Environmental Protection Agency, U.S. Department of Agriculture, and the states of Alabama, Florida, Louisiana, Mississippi, and Texas. Ultimately, the restoration plan developed by the DWH Trustees will balance what can be proven as injury and what can be quantified and defended as the restoration required to compensate for that injury. At the time of the meeting, the DWH Clean Water Act trial was still ongoing and the NRDA trial date had not been set. The injury assessment was also still ongoing and

[27] http://eli-ocean.org/gulf/

the amount and type of restoration that would be required had yet to be determined.[28] However, the Trustees had already identified marine mammals as one of the 13 NRDA injury categories (Figure 17).

The NRDA marine mammal team (many of whom were in attendance at the meeting) has started to identify the types of activities that may be appropriate for inclusion in the restoration plan. Those activities address many of the stressors that have been identified in the course of this meeting, and include—

- Habitat enhancement - e.g., debris removal, noise reduction, habitat restoration
- Direct resource response - e.g., stranding network, disentanglement
- Bycatch reduction - e.g., collaborative partnerships to reduce bycatch, fishery observers
- Other threat reduction - e.g., hook-and-line interactions, illegal feeding, and
- Restoration science to support restoration decision-making.

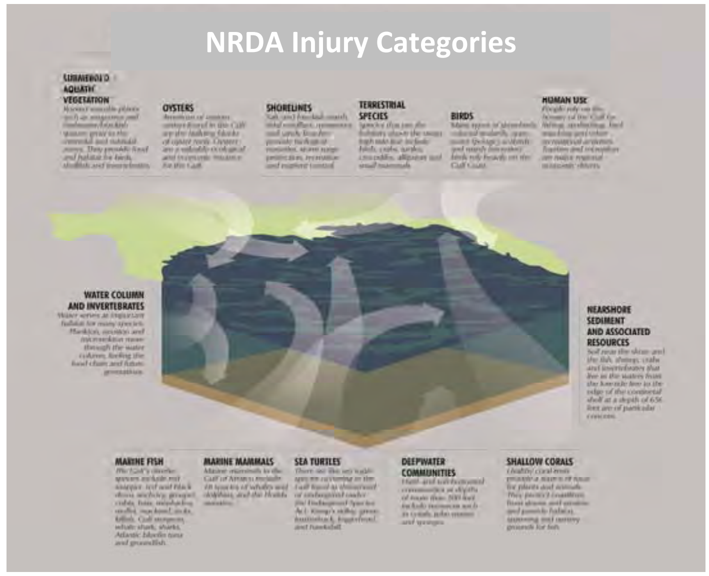


Figure 17: NRDA injury categories identified by the DWH Trustees
(*Credit: NOAA*)

In terms of restoration science, it would be beneficial to approach this in the same way that the bird monitoring network is approaching the development of a bird monitoring plan. In other words, with all of the identified restoration options, what combination of activities would allow us to meet the restoration goals and what science is needed to support that decision-making? OPA is quite clear in directing the Trustees to implement monitoring to evaluate project success and/or the need for corrective actions (i.e., adaptive management). Reasonable monitoring and oversight costs cover those activities necessary to gauge the progress, performance, and success of the restoration actions. The Trustees must also be able to illustrate restoration outcomes to the public and to demonstrate regulatory compliance (e.g., NEPA and ESA). In large and complex cases like the DWHOS, it is also important that monitoring support decision-making by assessing overall restoration progress; addressing information needs to improve restoration project selection, design, and implementation; and informing a science-based adaptive management approach to reduce the risk associated with less well understood options.

The Trustees will be releasing a draft assessment and restoration plan for public comment in the near future. The plan must select and implement restoration activities that will demonstrably compensate for injuries (i.e., restore injured resources). The timing and scale of full restoration is still uncertain, but will focus on injury compensation and rely on science to support the implementation of restoration and evaluate decisions.

[28] BP has since agreed to pay $18.7 billion to settle remaining claims under the Clean Water Act and NRDA.

The Resources and Ecosystem Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act
Gulf Coast Ecosystem Restoration Council
John Ettinger, RESTORE Act Ecosystem Restoration Council

The RESTORE Act[29] was passed in 2012 on a bipartisan basis. It directed that 80% of the Clean Water Act civil penalties should come back to the Gulf in support of environmental and economic restoration activities, rather than having all of those penalties go to the general fund. The RESTORE Act established a new federal entity — the Gulf Coast Ecosystem Restoration Council (the RESTORE Council) — comprised of six federal agencies[30] and the five Gulf states. Similar to a Board of Directors, each state has a vote and the Chair[31], which represents the federal agencies, also has a (veto) vote. The Council will exist as long as there are funds to distribute and then it goes away under legislation. The Council has responsibility for spending 30% of the Clean Water Act penalties that comprise the Gulf Coast Restoration Trust Fund (the Fund; Figure 18).

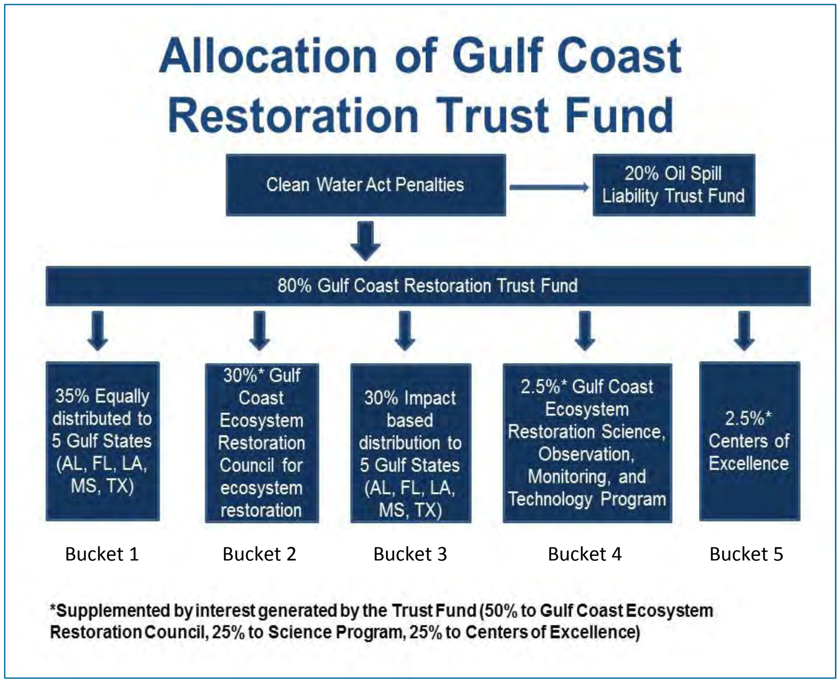


Figure 18: Allocation of funds under the five RESTORE Act "buckets"
(*Credit: The RESTORE Council*)

The five components, or "buckets," of the Trust Fund are allocated as follows—

- The Direct Component (Bucket 1) - 35% of the Fund will be equally distributed to the five Gulf states. In the case of Florida and Louisiana, the funds go directly to political subdivisions within each state. It is administered by the Treasury Department.
- The Council (Bucket 2) - 30% of the Fund is allocated to the Council. The Council selects projects and programs which it determines best address the requirements set forth in the RESTORE Act.
- The Spill Impact Component (Bucket 3) - 30% of the Fund is allocated to the states according to a formula set forth in the RESTORE Act. It is administered by the Council.
- The Gulf Coast Ecosystem Restoration Science, Observation, Monitoring, and Technology Program (the Science Program; Bucket 4) - 2.5% of the Fund is to be used for research, observation, and monitoring to support long-term sustainability of Gulf ecosystems and fisheries. It is administered by NOAA (see below for more info).

[29] http://www.treasury.gov/services/restore-act/Pages/default.aspx
[30] The six federal agencies are the Department of the Interior (DOI), the Department of Commerce (DOC), the Department of Agriculture (USDA), the Department of Homeland Security (DHS), the Army, and the Environmental Protection Agency (EPA).
[31] Currently the Secretary of the Department of Commerce.

- Centers of Excellence (Bucket 5) - 2.5% of the Fund is to be used to establish Centers of Excellence in each Gulf State to further science, monitoring, and technology. It is administered by the Treasury Department (see below for more information).

Transocean has settled its Clean Water Act penalties for $1 billion, of which 80% was distributed to the five buckets per the RESTORE Act. Bucket 1 has been authorized by Treasury to distribute its funds. Bucket 2 is active also and the Council has received 50 submissions for projects and programs from Council members and federally recognized tribes. The projects vary and include marsh creation, monitoring programs, and adaptive management. At present, the only "blue water" project submitted deals with corals. All projects, as well as independent reviews of each of them, are available for viewing on the Council's website.[32] Discussions are still ongoing regarding the allocation formula for Bucket 3 funds, but all five Gulf states are eligible for planning funds (5%) so that they can develop their own expenditure plans. The funding that will be available for the Council and under the other four buckets will not be determined until after the Clean Water Act trial is over, but potentially very large sums will be available. The challenge will be the development of a decision framework to integrate all of these projects and programs with NRDA and the other funding entities so that we are not carrying out "random acts of restoration" and instead are doing something cohesive, coordinated, and big-picture.

NOAA-led RESTORE Act Science Program

Roger Helm, U.S. Fish and Wildlife Service

The mission of the RESTORE Act Science Program (Bucket 4) is to initiate and sustain an integrative, holistic understanding of the Gulf ecosystem and support, to the maximum extent practicable, restoration efforts and the long-term sustainability of the ecosystem, including its fish stocks, fishing industries, habitat, and wildlife through ecosystem research, observation, monitoring, and technology development. The program receives only a very small portion of the RESTORE Act funds (2.5%, with $20 million currently available) so these are very lofty goals.

The program is run by NOAA but the Act requires NOAA to work with FWS to develop and implement the program. The program is designed to have management application and so the science needs of resource managers are a key driver. The long-term priorities of the program will build on work already being done by other DWH-related science and restoration programs to identify science and research needs. The program has also engaged other groups and stakeholders for additional input.

The program has developed a Science Plan that establishes ten long-term research priorities. It will provide a foundation for providing good quality information that will be useful for management of the Gulf. It also aims to leverage science being done with other funding entities in the Gulf, as required by the Act. The final version of the Science Plan is due out in late April 2015.[33] The ten priorities identified in the Science Plan are as follows (with priorities particularly relevant to marine mammal scientists and managers identified in bold)—

- Comprehensive understanding of ecosystem services, resilience, and vulnerabilities of coupled social and ecological systems
- Construct management-ready and accessible ecosystem models
- Improve monitoring, modeling, and forecasting of climate change and weather effects on the sustainability and resiliency of the ecosystem

[32] https://www.restorethegulf.gov/

[33] Available at http://restoreactscienceprogram.noaa.gov/science-plan.

- Comprehensive understanding of freshwater, sediment, and nutrient flows and impacts on coastal ecology and habitats
- **Comprehensive understanding of living coastal and marine resources, food web dynamics, habitat utilization, protected areas, and carbon flow**
- **Develop long-term trend and variability information on the status and health of the ecosystem, including humans**
- Develop, identify, and validate system-wide indicators of environmental and socioeconomic conditions
- **Develop decision-support tools to assist resource managers with management decisions planned to sustain habitats, living coastal and marine resources, and wildlife**
- **Network and integrate existing and planned data and information from monitoring programs, and**
- **Develop and implement advanced technologies to improve monitoring.**

In 2015, the program designated $2-$2.5 million for a research fund to address several short-term priorities (projects that could be completed within three years) whose results would inform the future direction of the Science Program as well as the other science and restoration initiatives planned or underway. Although over 100 letters of intent were received in response to this Federal Funding Opportunity (FFO), the program expects to award about seven projects, with final decisions expected to be announced in September.[34] A second FFO is expected to be announced early in 2016.

The program has a 25-member Science Advisory Board that provides independent guidance and review of the program. Members include representatives of the Gulf States Marine Fisheries Commission, the Gulf of Mexico Fishery Management Council, and the RESTORE Act Centers of Excellence. Subject matter experts are to include those with expertise in marine mammals.

RESTORE Act Centers of Excellence / Gulf of Mexico Research Initiative (GOMRI)

Andrew Shepard, Florida Institute of Oceanography

Each of the five Gulf states has, or will have, Centers of Excellence (Bucket 5), with $4 million in funding currently available for each state. The RESTORE Act requires the Centers to award competitive grants to nongovernmental entities and consortia, including public and private institutions of higher education, with an emphasis on science, technology, and monitoring in the Gulf Coast Region relevant to at least one of the eligible disciplines identified in the Act: coastal sustainability, coastal resources, offshore energy development, sustainable economic development, and monitoring and mapping.

The Florida Center of Excellence is managed by the Florida Institute of Oceanography (FIO)[35], which also coordinates the Gulf of Mexico University Research Collaborative (GOMURC)[36]. FIO is a consortium of 29 Florida marine science research and education institutions and is hosted by the University of South Florida. FIO held public scoping meetings which identified coastal sustainability, coastal resources, and monitoring and mapping as priorities for Florida. FIO's first request for proposals (RFP) will fund competitive grants totaling up to $2.5 million. The RFP has been issued and is directed at projects focused on coastal fisheries and wildlife ecosystem research and monitoring in the Florida Gulf Coast region. FIO is also initiating a rapid response grant designed to partner with other restoration programs on ecosystem monitoring. However, as with Centers in the other Gulf states, no funds can be dispersed until authority is received from Treasury.

[34] An announcement of funded research was made 1 September 2015 (http://restoreactscienceprogram.noaa.gov/research).
[35] http://www.fio.usf.edu/research/flracep
[36] More information regarding GOMURC is available at https://prezi.com/gymvz4dmf_6g/gomurc/.

The other Gulf states are in various stages of implementation of their Centers of Excellence. The Texas Commission on Environmental Quality (TCEQ) has designated two consortia as Centers, with the University of Houston-led consortium[38] focused on offshore energy and the Texas A&M University-Corpus Christi-led consortium[39] focused on all five disciplines. Louisiana's Coastal Protection and Restoration Authority (CPRA) has designated the Water Institute of the Gulf as its state Center of Excellence. Alabama's Gulf Coast Recovery Council (GCRC) is in the process soliciting proposals for its state Center[40], as is the Mississippi Department of Environmental Quality (MDEQ)[41].

The Gulf of Mexico Research Initiative (GoMRI) has been mentioned already at this meeting as an independent research program that was funded by BP in 2010. It was designed to study the impact of the DWHOS and associated response on the environment and public health in the Gulf (Figure 19). GoMRI convenes an annual Oil Spill and Ecosystem Science Conference and this past February it hosted a special session on large marine vertebrates. It also funds the GRIIDC data management system discussed earlier. Of the original $500 million, there is still about 39% remaining. Marine mammal projects funded by GoMRI have been limited but include a block grant to study bottlenose dolphins (see project description by Worthy in Appendix B), and a recent award to the University of Louisiana-Lafayette Littoral Acoustic Demonstration Center for marine mammal acoustic studies (see project description by Sidorovskaia in Appendix B).

Figure 19: Dolphins were some of the many living marine resources impacted by the DWHOS
(*Credit: NOAA*)

National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund (GEBF)

Jon Porthouse, National Fish and Wildlife Foundation

NFWF has $2.554 billion in funding for the GEBF, which came from a plea agreement between the Justice Department and the DWHOS responsible parties (BP and Transocean) to settle criminal charges. The plea agreement directs NFWF to conduct or fund projects that remedy harm, or reduce or eliminate risk of future harm, to Gulf coast natural resources. Those projects must be directed toward situations where there has been injury to, destruction of, loss of, or loss of use of resources resulting from the DWHOS. The funding agreement does not allow for funding of routine monitoring or projects that collect baseline data. In selecting projects for funding, NFWF is to consult with state resource managers, FWS, and NOAA, and the states have the lead responsibility for identifying projects to be proposed for

---

[38] The University of Houston-led consortium includes Rice University, NASA Johnson Space Center, Texas Southern University, Houston Community College, and Lone Star Community College.

[39] The Texas A&M University-led consortium includes Harte Research Institute for Gulf of Mexico Studies, Center for Translational Environmental Health Research, Texas A&M University–College Station, Texas A& M University–Galveston, University of Texas at Brownsville, Texas State University, University of Houston Law Center, Gulf of Mexico Coastal Ocean Observing System Regional Association, and University of Texas Medical Branch–Galveston.

[40] http://www.restorealabama.org/

[41] MDEQ announced on 15 October 2015 that it had had designated the Mississippi Based RESTORE Act Center of Excellence (MBRACE), a consortium led by the University of Southern Mississippi and including Jackson State University, the University of Mississippi, and Mississippi State University.

funding. This allows for closer coordination with restoration efforts under NRDA and the RESTORE Act, as the states are involved in each of those processes. FWS reviews the projects for technical merit and for opportunities to leverage funds with existing projects. All projects should be designed to maximize environmental benefits. Unlike some of the other Gulf funding programs, the GEBF has a set amount of funding, with the amount of funding going to each state dictated by the plea agreement, and a 6-year schedule for when funds are to be allocated. The progressive increase in funding available each year allows NFWF and the states to prioritize and think in advance about how to spend the larger amounts once they become available.

There are opportunities to fund marine mammal research and restoration monitoring under the GEBF but relationships among the researchers, the states, and the GEBF need to be structured appropriately to take full advantage of them. Two types of projects can be funded—habitat-related and living marine resource-related. NFWF anticipates spending most of its funding on habitat conservation and restoration projects because it is reasonably confident, based on experience, that if it identifies, locates, sizes, designs, and implements habitat projects appropriately, this will result in a wider array of benefits. For marine mammals, NFWF is looking to marine mammal researchers and managers to provide input to the states regarding where to site and how to size habitat projects to provide the maximum benefit for marine mammals. Projects directed at living marine resources include management and stewardship actions intended to increase the sustainability or population size of these species. NFWF's primary focus is on bays and estuaries, with less interest in offshore environments.

The funding process follows an annual cycle. States submit pre-proposals in April with full proposals invited in June and due in July. Funding decisions are made by November, in consultation with NOAA and FWS. In general, research and monitoring are not considered plea-compliant activities unless there is a specific and measurable benefit to a resource injured by the spill. For marine mammals, the most likely linkage is improved management capability (e.g., stranding networks reporting data to a standardized Gulf-wide database), especially where a specific type of information is lacking. Regional activities are possible, but costs (and activities) must be allocated to specific states. States must also be willing to prioritize a project amongst all of the other projects it is considering, so communication and outreach to state NFWF contacts is key. More information about the GEBF can be found on the NFWF website.[41]

National Academy of Sciences (NAS) Gulf Research Program / Ad-hoc Research Funders Forum

LaDon Swann, Auburn University and NAS Gulf Research Program Advisory Board

The NAS Gulf Research Program was established by the plea agreement settling Clean Water Act criminal penalties, and is funded at $500 million, to be disbursed over 30 years. A 25-person Advisory Group solicited input from stakeholders around the Gulf, both formally and informally, and reviewed various restoration-related documents to develop the program's strategic vision and mission.[42] As part of that mission, the program aims to enhance oil system safety and the protection of human health and the environment in the Gulf of Mexico and other U.S. outer continental shelf areas by seeking to improve understanding of the region’s interconnected human, environmental, and energy systems and fostering application of that understanding to activities that will benefit Gulf communities, ecosystems, and the Nation.

[41] http://www.nfwf.org/gulf/
[42] http://www.nas.edu/gulf/vision/index.htm

The program will fund studies, projects, and other activities using three broad approaches specified in the plea agreement: research and development, education and training, and environmental monitoring. Initial activities have included exploratory grants, workshops, and the development of a science policy fellowship (for graduate students) and an early career fellowship program (for pre-tenure professionals). An RFP will be issued in April for grants that synthesize existing data that could inform efforts to restore and maintain the Gulf's ecosystem services, or that enhance understanding of the Deep Gulf or its physical and biological connectivity to coastal communities. Also being formed under the National Research Council is a committee on "Effective Approaches for Monitoring and Assessing Gulf of Mexico Restoration Activities." More information about the Gulf Research Program and funding opportunities can be found on the NAS website.[43]
The Ad-Hoc Research Funders Forum is an effort to coordinate RESTORE and non-RESTORE research funders in the Gulf, including NOAA Sea Grant, FWS, USGS, NASA, EPA, and many others. No funding is associated with the forum, but there could be opportunities for collaborative, regional research activities jointly funded by one or more of these entities.

BOEM Environmental Studies Program: Science for Informed Decisions

Rodney Cluck, BOEM Division of Environmental Sciences

The mission of the Environmental Studies Program is to provide the information needed to incorporate environmental safeguards into offshore energy and mineral exploration and development. It aims to ensure that the best available scientific information is used for making management decisions to balance environmental protection with energy development. That could include decisions regarding impact assessments, leases, permits, rules for operators, consultations, and compliance with NEPA, MMPA, ESA, state laws, and associated mitigation requirements. The program focuses not only on marine mammals but also on sea turtles, birds, bats, fish, corals, and other benthic organisms. More generally, it protects marine, coastal, and human environments, biodiversity, air and water quality, and the resources that Native people depend on.

Funding varies by discipline, but a large portion of the program's $35 million annual research budget (27%) has been dedicated to marine mammals (Figure 20). The program has been ongoing for 40 years, and every year it funds between 30 and 40 new studies. Issues related to marine mammals include—

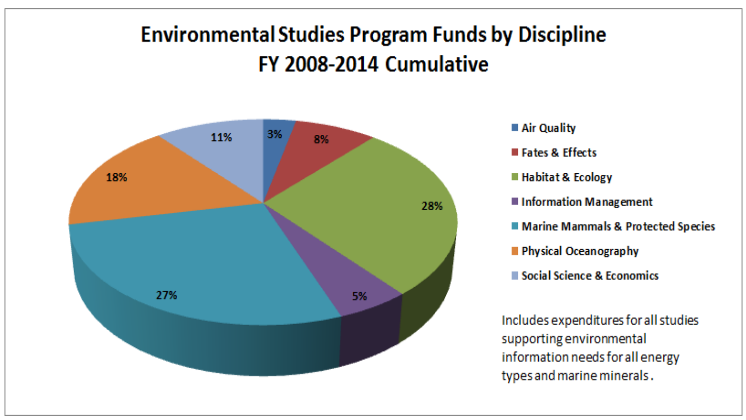


Figure 20: Allocation of BOEM Environmental Studies Program funding by discipline, FY 2008-2014 Cumulative (*Credit: BOEM*)

- Noise - acute and chronic physiological effects, behavioral effects
- Behavior - migration, diving, reproduction, calving, nursing
- Food - stocks of lower trophic level organisms, ecosystem dynamics
- Toxins - exposure to, and effects of, spilled oil and other contaminants, and
- Ship Strikes - occurrence, high risk areas, methods for avoidance.

[43] http://nas.edu/gulf/index.html

The program has spent about $1 billion since it started and PDF versions of all of the reports generated are in BOEM's Environmental Studies Program Information System (ESPIS). BOEM is now working to also make all of the data associated with those reports available through ESPIS. With all of the data available, it is BOEM's priority to re-analyze the historical data, particularly in light of other scientific information that is now available. There is also an opportunity now, given the funding available from the Environmental Studies Program, to leverage the long-term, wide-area monitoring that may be implemented under various restoration efforts in the Gulf. This will require new and expanded partnerships to share costs, data, expertise, and experience, tapping experts and resources from various federal agencies (including the Marine Mammal Commission, Office of Naval Research (ONR), Navy's Living Marine Resources Program (Navy LMR), NOAA, and NSF), the offshore energy industry, academics, and consultants. More information about the Environmental Studies Program can be found on BOEM's website.[44]

Sound and Marine Life Joint Industry Program: Research Program Update

Gary Wolinsky, Chevron

The Sound and Marine Life Joint Industry Program (SAML JIP) is an industry-led initiative focused on the effects of sound on marine life generated by oil industry exploration and production (E&P) activities globally. The international scope of the program is broader than most of the other Gulf-based programs discussed at this meeting, and the studies funded by the JIP typically have broad applicability. The program structure includes independent, external advisors, and funding is awarded through an RFP process that typically has a very high response rate. The activities of the JIP are strongly integrated into the sound and marine life research community. There are existing partnerships with a variety of organizations and JIP members have frequent interactions with the National Science Foundation (NSF), ONR, Navy LMR, NOAA and BOEM. JIP members believe that effective policy must stem from good, independent science. Advancements in understanding of the effects of E&P sound on marine life are expected to lead to better decision-making and to more effective mitigation strategies.

The JIP has had a varying number of industry members over time, and currently has 11 oil and gas E&P companies as well as the International Association of Geophysical Contractors (IAGC) and the International Association of Oil & Gas Producers (IOGP). Its total budget from 2006-2016 is $50 million. The amount available in Phase III of the program (2014-2016) is $18 million. Among the projects funded (or co-funded) to date are studies of behavioral responses of humpback whales to seismic survey activity (BOEM co-funded; Cato et al. 2012), the population consequences of (acoustic) disturbance (PCoD; Costa et al. 2012, Sills et al. 2014), controlled exposure experiments involving bottlenose dolphins (Finneran et al. 2013), modeling minke whale hearing (Tubelli et al. 2012), estimating cetacean density from passive acoustic monitoring (Marques et al. 2013), and the development of PAMGuard software for acoustic monitoring during seismic surveys (Gillespie et al. 2011). Ongoing projects include source characterization studies, a review of sound propagation models, and underwater hearing and masking studies. Phase III studies will include an update to sound exposure criteria (Southall et al. 2007), masking in seals, PCoD, an inventory of industry sound sources, equipment for use in low-visibility conditions, hearing recovery after exposure to intermittent sounds, and behavioral responses of fish to sound. More information about the SAML JIP, the proposal submittal process, ongoing projects, and project reports can be found on its newly redesigned website.[45]

[44] http://www.boem.gov/Studies/
[45] http://www.soundandmarinelife.org/

Questions Regarding Funding Opportunities

There was a question as to whether any of the funding sources could be used to address gaps in observer coverage of commercial fisheries (e.g., the shrimp trawl and menhaden purse seine fisheries). The NOAA-led RESTORE Act Science Program cannot be used to fund any of the activities that NOAA normally conducts. However, NRDA may be able to fund observer coverage as a monitoring activity as long as it is complementary to an existing observer program. The Florida Center of Excellence's current RFP includes a call to "develop innovative approaches and technologies to assess fish populations, fishing activities, ecosystem impacts of fishing activities, and pressure on resources," and expanding observer coverage could fit into that requirement.

Another question was whether the timing of RFPs and reviews are coordinated such that a project could be funded by two or more funding entities if it met the criteria for more than one program. One of the funders noted that coordination among programs was a primary goal and that measures were being taken to achieve it but more could be done. The RESTORE Act does not allow for a formal coordination process, but the program coordinators are having the relevant conversations. The various programs are just starting to issue RFPs so it is anticipated that there will be a more consistent effort by the funders to discuss projects. The Centers of Excellence have not all been designated yet and also have yet to be funded but they are all talking and sharing information and they are mandated by the RESTORE Act to cooperate and coordinate.

PRIORITY INFORMATION NEEDS AND KNOWLEDGE GAPS - BREAKOUT GROUP DISCUSSIONS

There were five breakout groups, and each was given similar questions to answer:

- What specific conservation and management needs does this address?
- What new data collection would be needed?
- What additional assets are needed (aircraft, vessels, acoustic recorders, etc)?
- What analytical capabilities are needed?
- How can data sharing be facilitated and what mechanisms might be used?
- What are some complementary data sets?
- What opportunities are there for enhanced collaboration?
- What potential funding opportunities might help to meet this need?
- Can other resources be leveraged?

I. Abundance and Stock Structure

Led by Samantha Simmons, MMC

Based on the existing gaps in the Gulf regarding species abundance and stock structure, across all habitats (bay/sound/estuary, coastal and shelf, and offshore), the first priority identified by the group was to develop a process for prioritization of stocks. Parameters that could be used in the evaluation of stocks were existing information on abundance, stock structure, habitat use or value, threats, and distinctiveness. The first step in that process would be to compile an inventory of existing data as well as the confidence in that data, in terms of coefficients of variation.

The next step would be to evaluate the best methods available for estimating abundance and stock structure, including traditional methods such as line transect surveys and genetics, but also alternative and advanced survey technologies. We also need to evaluate the respective costs of each method to determine which survey methods would be most cost-effective.

In establishing priorities, we also need to think about the management drivers. It was noted that marine mammals do not appear to fit nicely into any of the funding "buckets" discussed earlier, so we may need a separate effort to identify appropriate funding opportunities for addressing these gaps. One of the funders clarified that much of the *current* funding available for restoration is focused on states and coastal waters and a gap exists for more pelagic species.

There was much discussion of leadership, and where the leadership would come from to spearhead this effort. This is important not only for filling data gaps for abundance and stock structure, but for each of the breakout session topics. It was suggested that MMC could provide some of that leadership, but MMC has traditionally focused on relationships with other federal agencies and building relationships with state agencies will take more time and effort. There are several marine mammal scientists that are working at the state level, but we need to do more to identify the advocates for marine mammals and the funding decision-makers in each of the states. The states have not traditionally been involved in marine mammal research, especially in offshore waters where there are huge data gaps.

False killer whale (*Pseudorca crassidens*)
(*Credit: NMFS*)

II. Distribution and Habitat Use

Led by Stephanie Watson and Chris Simoniello, GCOOS

The group identified four priority information needs, in order of priority (second and third are equal priority)—

- Site-specific analyses of habitat use
- Understand large-scale drivers of movement coupled with physical parameters
- Broad-scale seasonal data to understand temporal changes in distribution, and
- Identify prey species and their distribution for different marine mammals (food web dynamics).

For each of the priorities, the conservation/management needs include the identification of site-specific impacts, the development of marine protected areas, overlaying foraging areas with restoration areas, assessing restoration success, and understanding habitat quality and quantity. The means by which to address data needs would have to be identified for each specific site but would likely include aerial surveys, acoustics, underwater gliders, and tagging. Although NMFS has access to its large vessel for marine mammal surveys for 60 days each summer, additional assets that would be needed include large research vessels and advanced glider and drone technology (and ground-truthing these technologies with existing data sets).

Needed analytical capabilities include the development of improved methods for multi-scale habitat assessments including integration across platforms and different scales—basically an integrated analytical approach. The group discussed conducting a small-scale pilot project in an area where there are data and compile the information from different observing or monitoring platforms (e.g., acoustics, tagging, aerial surveys) and aggregate that into an integrated data product. This could require an "inventory" of existing data sets and an evaluation of what approaches might be available to analyze data at both fine and broad scales. Sperm whales may be a good test case.

Additional resources to be leveraged could include fiber optics, GCOOS data integration, seakeepers/vessels of opportunity (e.g., Dept of Transportation or shipping industry platforms), Ocean Tracking (sharks, etc.), piggybacking on SEAMAP or LiDAR surveys (although they have a rigid survey design), and citizen-based science or shore-based data collection opportunities (such as smart phone apps to report marine mammal sightings).

III. Strandings, Health Assessments, and Life History

Led by Frances Gulland, MMC

Data from strandings and health assessments provides information on both marine mammal health and life history. However, there are significant information gaps on health data for all marine mammal stocks in the Gulf. There are also gaps in life history for all Gulf species except bottlenose dolphins and manatees.

One of the overarching needs identified was to collaborate with Mexico and Cuba on data collection, training, and data sharing. This would help in the integration of data from an animal that may have been exposed to some threat outside U.S. waters that then strands in the U.S portion of the Gulf.

Priority species for data collection efforts include bottlenose dolphins, *Kogia* spp. (dwarf and pygmy sperm whales), Bryde's whales, and sperm whales. We also need to conduct hazard/threat assessments for all non-*Tursiops* stocks, applying the method used for *Tursiops* in Texas waters by Phillips and Rosel (2014). To facilitate data sharing and collaboration, we need to inventory samples and data so that information collected could be accessed by different researchers or managers in the Gulf and elsewhere. That would help ensure maximum use of existing data and resources. That inventory needs to be a living data set.

Bryde's whale (*Balaenoptera edeni*)
(*Credit: NMFS*)

The group also discussed the challenge of convincing managers at the state level why they should care about the health of a marine mammal stock that occurs in offshore waters. We need to find compelling ways to communicate the need to address information gaps to others outside the marine mammal research community.

IV. Human Activities: Sound

Led by Tiff Brookens, MMC

The top three priorities for research and monitoring to assess the effects of human-generated sound were as follows—

- Characterization of human-generated sounds

    - Seismic as well as vessel traffic and other sources
    - Seasonality and inter-annual trends in the Gulf/soundscape
- Behavioral response to sound at individual/population/species level
    - Short term, acute impacts and longer term, chronic and cumulative impacts
    - Effects on prey and ecosystem approaches to analyzing impacts
- Hearing capabilities and audiograms, particularly for non-*Tursiops* delphinids and low-frequency cetaceans (i.e., Bryde's whales)—audio-evoked potential (AEP) data can be collected from stranded animals and finite element modeling can be used to determine potential hearing capabilities.

Passive acoustic data can provide information not only on the sound sources but also on the distribution and (depending on the devices used and how they were used) the densities of animals. This has implications for leveraging the data collected. More generally, baseline data on the abundance, density, and distribution of marine mammals (whether gleaned from line-transect surveys, acoustic monitoring, or both) is necessary to inform analyses of exposures, behavioral responses, and cumulative impacts.

Additional priorities identified—
- Better spatial resolution of abundance/density/distribution data (a priority identified by this group but addressed by other breakout groups)
- Life cycle and source characteristics of a sound field
- Further development of methods to assess effects of sound (e.g., behavioral response, opportunistic studies), and
- Assessment of soundscape as a habitat feature for marine mammals.

Conservation and management needs were to—
- Support incidental take authorization permit applications and analyses
- Characterize sound-generating activities and conduct sound source verifications and modeling
- Address impacts of shipping-related sound (especially in light of the expansion of the Panama Canal), and
- Understand behavioral responses, especially for deep-water species.

Data collection needs for sound characterizations include more spatio-temporal monitoring of anthropogenic sound and an inventory of sound-generating activities, with a focus on areas with species of concern. For behavioral response studies, short-term data collections are more feasible, but data collection methods need to be improved. Better information also is needed to understand population-level impacts. To collect audiograms, AEP data, technology development and standardization, and training for stranding network members is needed.

Analytical capabilities needed to characterize the Gulf soundscape include more "computer nerds" and the ability to handle big data sets using qualified staff and enhanced storage capabilities. Behavioral response studies will require analysis of the effects of sound on individual animals, new and improved analytical technologies and methods, and a more comprehensive analysis of existing data.

For all of the priorities identified, more funding is needed for data collection and analysis, but there may be opportunities to collaborate on funding with BOEM or other entities (perhaps an AMAPPS[46] for the

[46] AMAPPS, or the Atlantic Marine Assessment Program for Protected Species, is a joint BOEM/NOAA/Navy/FWS initiative to collect broad-scale, multiple year, year-round sightings and vocalizations to determine abundance, density, and distribution of

Gulf?). Also needed are opportunistically collected baseline data (i.e., when hurricanes or other events create a lull in anthropogenic activities) and an evaluation of existing sound data. Behavioral response studies should leverage studies being conducted elsewhere (i.e., response to Navy sonar in the Pacific, humpback whale response to seismic activity off Australia).

V. Human Activities: Fishing and Tourism

Led by Randall Reeves, MMC

The top priorities identified for research and monitoring to assess impacts of fishing and tourism were—

- Better geo-referenced information on the nature, frequency, and scale of human activities in the marine environment (boating, shipping, fishing, wildlife tourism[47], etc.) and overlay that with known distributions of marine mammals to develop a risk assessment matrix. Information would include—
    - Inventory of manatee- and dolphin-focused tourism (dolphin and manatee watching, tour operators) in Gulf and metrics to gauge effort (number of vessels, trips, operators, etc.)
    - Nature and levels of fishery interactions (depredation and bycatch) for swordfish/tuna/shark longline, reef fish longline, hook-and-line, purse seine, and recreational fisheries
- Information on "human dimensions" aspects, such as—
    - Characteristics of people who interact with marine mammals (e.g., what circumstances may cause people to shoot at a dolphin?)
    - The motivations of people who want to swim with dolphins, and things that might motivate them to change their behavior.

The big-picture need is to identify the scope and nature of human interactions with marine mammals and understand how any threats resulting from those interactions relate to the larger suite of threats in the Gulf (pollution, habitat loss, noise, etc.). What are the most relevant and significant problems associated with fishing and tourism (e.g., derelict gear, feeding dolphins, entanglement, hooking), and how can these be addressed in order to target limited funds for mitigation? It was noted that some problem areas for tourism interactions have not responded to outreach or enforcement efforts to date, and this led to the suggestion that attention should focus elsewhere. However, there was concern that if one community is “getting away with” something and profiting from the activity (e.g., feeding dolphins), this would have a "wildfire effect," with other communities more likely to engage in the same activity.

The group identified marine mammal interactions with commercial fisheries as a priority for which more information is needed, including improved understanding of the impacts of lost or abandoned fishing gear. The importance of knowing more about the impacts on marine mammals of recreation, fishing, and tourism in the southern Gulf of Mexico (Cuba and Mexico) was also emphasized.

Much of the human dimension boils down to understanding and preventing the activities of individuals or particular communities of individuals that are harmful to marine mammals. A risk assessment approach would be helpful. For example, with regard to recreational fishing and tourism, overlays of various types and locations of human recreational activity on top of information on marine mammal population abundance and behavior could enable managers to do a better job of tailoring mitigation

marine mammals, sea turtles, and seabirds in the Mid- and North Atlantic OCS planning areas (http://www.nefsc.noaa.gov/psb/AMAPPS/).

[47] Members of the group generally agreed that wildlife-centered tourism was beneficial for both the economy and the environment, and therefore it should be encouraged, albeit with appropriate safeguards in place to ensure that such tourism does not jeopardize the health of the target animal populations and is safe for people.

efforts to specific needs. Also, predicting where problems are likely to occur should help address the "wildfire effect" issue.

ALIGNMENT OF FUNDING OPPORTUNITIES WITH INFORMATION NEEDS AND KNOWLEDGE GAPS - GROUP DISCUSSION

Moderated by Kathryn Mengerink, Environmental Law Institute

Some of the issues we heard from the funders that are relevant for marine mammals—

- NRDA is focused on restoration rather than research, but restoration includes implementation of the restoration plans and monitoring their effectiveness. Restoration of marine mammals is a little different than restoration of other resources, and the challenge is to fit that into the monitoring priorities identified at this meeting. How can marine mammal restoration link to long-term monitoring needs? Can restoration monitoring address those broader monitoring needs?
- The RESTORE Council has had one call for proposals to date, but that process is largely driven by state Council representatives. How can marine mammal scientists and managers work within this process to ensure that the Council is considering marine mammals appropriately?
- The RESTORE Act Spill Impact Component is a state program overseen by the RESTORE Council and there are planning grants being made available to the states to address spill impacts. This also gets at the question of what the role the states play in marine mammal research and how the marine mammal research community can engage with states in that process.
- The RESTORE Act Science Program has already issued an RFP and more are expected in the future. Although there is only $20 million currently available under that program, additional funds will be available in the future. Several of the Science Program's objectives align with marine mammal research needs, including living marine resources, food webs, long-term trends, monitoring, and habitat management, as well as coupled social-ecological systems.
- The RESTORE Act Centers of Excellence programs still have a lot of unknowns so it's unclear at present where there could be alignment with marine mammal needs.
- GoMRI has about 40% of its available funding remaining to be allocated over roughly the next five years.
- The NFWF GEBF is focused on resources harmed by the spill, primarily in bays, sounds, estuaries, and coastal waters. The funds are going to the states and we need to engage with the states regarding priorities for marine mammals.
- The NAS Gulf Research Program's focus is on environmental monitoring, which has been a major area of discussion at this meeting, but questions remain as to how to develop effective monitoring systems. The upcoming National Academy study will look at effective approaches for monitoring restoration activities and there may be marine mammal researchers and managers that can inform that process.[48] There is also funding for leadership and policy fellows.
- There are a lot more funding opportunities in the Gulf and the Ad-Hoc Research Funders Forum is looking at how those programs can link to each other and encourage collaboration.

Risso's dolphins (*Grampus griseus*)
(*Credit: NMFS*)

[48] Frances Gulland was appointed to the NRC panel, which had four meetings scheduled for 2015 (http://www8.nationalacademies.org/cp/projectview.aspx?key=49695).

- The BOEM Environmental Studies Program has allocated, on average, 27% of its annual $35 million budget to marine mammals and other protected species. BOEM is particularly interested in data systems, reanalysis of existing data, and long-term monitoring.
- The SAML JIP is an internationally-focused program focused on research of broad applicability, but there are many focal areas relevant to the Gulf, including acoustic monitoring and the effects of sound on marine mammals.

Clymene dolphin (*Stenella clymene*)
(*Credit: NMFS*)

A suggestion was made to highlight the economics of wildlife viewing and the importance of those activities to state economies as one way of engaging state resource managers and associated funding entities. As a first step, we need to identify who the appropriate representatives are within each state. Perhaps a working group could be formed to figure this out and develop a strategy for engagement.

There were also several funding entities that expressed interested in data synthesis and integration projects (e.g., NAS Gulf Research Program), so there may be marine mammal projects that fit that need.

Having different marine mammal researchers all proposing separate projects is probably not as effective as collaborating on projects that might fit one of more of these buckets. Therefore, we might consider developing one or more overarching marine mammal projects that address the priorities outlined by the funders and which include a variety of tools, technologies, and strategies for addressing research and monitoring needs. If we had a group that could bring this plan together for the marine mammal research community, we may be more competitive for funds that are not necessarily focused on marine mammals.

The NAS Gulf Research Program is looking at ways to better integrate existing monitoring systems. One of the groups discussed the ability to integrate new technologies, like additional acoustic moorings, to supplement ship-based surveys. That is especially important for expensive and hard-to-reach areas, like the deep pelagic waters of the Gulf. There were several examples presented here regarding how to better use existing resources by having a more integrated monitoring approach.
We also need to find ways to communicate to the public the importance of marine mammals to the Gulf, the role they play, and the impact of human activities on marine mammals. This would provide support not only at the agency level but also within the public for additional research and monitoring of marine mammals.

Another point was raised regarding BOEM's interest in analyzing historical data. Several researchers have samples or data that they have collected over the years but don't have the capacity to evaluate or archive in a data system. Could the available funding opportunities be used to provide a mechanism to support the development of those data systems or an inventory of those samples?

Having marine mammal scientists and managers working in the Gulf identify their highest priorities for research and having the funders hear the same priorities from everyone is very powerful and would make the funders feel more comfortable allocating funds to marine mammal projects. This is especially true for the states that are not familiar with research on marine mammals. They will be looking to the experts to bring that information forward, especially if the experts come forward as a community with a set of shared priorities. There may even be opportunity for scientists working on marine mammals and other large marine vertebrates to come together on common approaches to prioritizing research. This is a good time, as funders are just starting to sort things out and plan, but once the funds start to flow they will need to allocate those funds rather quickly. We need to be ready for that.

One of the funders noted that all of the funders are feeling the pressure to coordinate and use the correct instruments for doing that. However, we shouldn't wait for the funders to work through the appropriate conceptual ecological model to drive a coordinated Gulf restoration plan. Marine mammals are one of the 13 NRDA injury categories and there is tremendous interest in marine mammals, so there are opportunities to address marine mammal research and monitoring needs. Having a plan will help the funders include specific examples of marine mammal projects in their RFPs. The funders talk amongst themselves, and what comes from the marine mammal research community is one of the most important considerations they take into account. When multiple communities come together with a similar message, that provides a strong rationale for funders to follow a course of action. When the funders or the states hear different or competing objectives, or when proposed activities do not link well with what the states want, it will be difficult for those activities to be selected. This is also a very different funding model, with funds being allocated by the states rather than from Congress or the federal agencies. And once the Clean Water case settles, the funding will remain available over a long timeframe. The funds have certain restrictions, but the vision for the funds is expansive, long-term, and holistic. Even having one or two things that marine mammal scientists and managers agree on as their priorities will increase the probability of funding exponentially.

One of the other funders agreed that the marine mammal research community can help drive the funding process, but it will require leadership to get on the funders' radar. The MMC was invited to come to the next meeting of the National Ocean Partnership Program (NOPP) to engage other federal agencies and have the outcome of this meeting communicated to the Subcommittee on Ocean Science and Technology (SOST)[49]. The major interest of the NOPP is to look across a broader ecosystem perspective. For marine mammals, we should be thinking about how that fits in with other ecosystem variables (physical, social, and economic). The MMC could carry that voice for marine mammal scientists and managers working in the Gulf.

A number of the states and federal agencies have developed a vision and list of priorities for Gulf restoration (e.g., Louisiana's Master Plan, FWS's Vision for a Healthy Gulf of Mexico Watershed[50]), as have several NGOs (Ocean Conservancy[51], The Nature Conservancy[52], and the National Wildlife Federation[53]). NOAA has yet to release its restoration vision for the Gulf,[54] nor has the NMFS Office of Protected Resources. The MMC's organization of the marine mammal research community is timely, and putting forward our collective vision for the next 5-15 years would be a powerful statement in this vacuum. It would also be useful to have a "Marine Mammal Action Plan" for the Gulf that integrates the management drivers and the science to get at a structured decision-making model. That plan requires

[49] The SOST is the lead interagency entity for Federal coordination on ocean science and technology (see https://www.whitehouse.gov/administration/eop/ostp/nstc/oceans).
[50] http://www.fws.gov/gulfrestoration/pdf/VisionDocument.pdf
[51] http://www.oceanconservancy.org/places/gulf-of-mexico/gulf-restoration.html
[52] http://www.nature.org/ourinitiatives/regions/northamerica/areas/gulfofmexico/restoration/index.htm
[53] http://www.nwf.org/News-and-Magazines/Media-Center/News-by-Topic/Wildlife/2014/12-09-14-A-Vision-For-Comprehensive-Gulf-Restoration.aspx
[54] NOAA's Strategy for a Healthy Gulf of Mexico was released in late April 2015 (http://www.habitat.noaa.gov/pdf/healthy_gulf_of_mexico_april2015.pdf).

that management clearly articulates its objectives and then illustrate how the science can help meet those objectives.

OPTIONS FOR DEVELOPING A GULF-WIDE MARINE MAMMAL RESEARCH AND MONITORING PLAN

Moderated by Vicki Cornish and Michael Tillman, MMC

The MMC was prompted to hold this meeting to understand oil spill impacts and explore restoration opportunities associated with the Deepwater Horizon oil spill. Moreover, the Commission was concerned that discussions at such meetings had generally not recognized and reflected the importance of marine mammals in the Gulf ecosystem and the threats they face from various human activities. One potential model of the kind of thing needed in the Gulf is the Alaska Marine Science Symposium (AMSS), which emphasizes an integrated approach to understanding ecosystem-wide impacts of various stressors. The AMSS consistently includes explicit consideration of marine mammals and the roles they play in both the ecosystem and the Alaskan regional economy. The MMC envisions a similarly integrative and regular forum for the Gulf region, and believes the time is ripe to establish such a forum (or equivalent mechanism). With its present composition, the MMC is strongly committed to ensuring a resilient Gulf ecosystem that includes marine mammals, but the Commissioners and staff are all based at a considerable distance from the Gulf and want to make sure that they have heard the voices and priorities directly from people living and working in the region. The priorities outlined in the Commission's 2011 Statement of Research Needs (MMC 2011) may not be sufficiently up to date or detailed, and it was expected that the present meeting would rectify that by facilitating the collaborative development of an action plan for building research capacity and information exchange in the Gulf.

Melon-headed whale (*Peponocephala electra*)
(*Credit: NMFS*)

The funding that has become available as a result of the DWHOS is almost entirely directed to the states, which have a large stake in the outcome. However, if allocation of those funds is driven solely by the states, marine mammals, especially the outer shelf and deepwater species, are likely to lose because the states' interests tend to be parochial and coast-oriented. Without strong, forceful leadership within the marine mammal research community to identify and communicate priorities, there is a risk that a great deal of money will be spent on restoration but little of it to the direct benefit of marine mammals. One way to address this would be through the development of a regional coalition aimed at regular meetings with state decision-makers on the importance of marine mammal research and monitoring. This coalition could, among other tasks, educate state decision-makers about the economic benefits of marine mammals to their economies (Stokes and Lowe 2013).

One of the needs expressed by the funders was to monitor the recovery of certain species, which would involve many of the activities discussed at the meeting. In addition, oil and gas development in the Gulf is bound to continue, and BOEM will therefore continue to be attentive to the potential impacts of exploration and development on offshore species. Sharing data and coordinating activities were identified as overarching needs, as well as collaborative planning. One successful model for doing so, the AMSS, grew out of the Exxon Valdez oil spill, with the purpose of furthering outreach and education regarding the ecosystem impacts of the spill and other stressors. The annual AMSS meetings provide the opportunity for researchers to exchange information on results and plans, develop collaborations, and share resources, which collectively are directed at meeting the objectives of various funders. The agendas of AMSS meetings are organized according to different ecosystem components, ensuring multi-disciplinary thinking and a focus on ecological linkages.

The MMC would like, as a result of this meeting, to see scientists and managers in the Gulf take full advantage of the information presented and develop their own collaborative strategic vision or plan for marine mammal science and conservation. It will be essential for funding sources and state recipients of funds to participate as full partners in this endeavor. Ocean Conservancy offered to help with the effort of forging the documentation and discussions from this meeting (and other sources) into a draft action plan, and the MMC is eager to play a supporting role. Even though the responsibility for marine mammal conservation and management rests primarily with the federal government, the coastal states have their own clear stake in a healthy, productive, and diverse ecosystem and in profitable, environmentally responsible fisheries, offshore energy development, and tourism.

The MMC thanked the sponsors, the steering committee, the moderators, the presenters, and participants and adjourned the meeting.

REFERENCES

Adimey, N.M., C.A. Hudak, J.R. Powell, K.Bassos-Hull, A. Foley, N.A. Farmer, L. White, and K. Minch. 2014. Fishery gear interactions from stranded bottlenose dolphins, Florida manatees and sea turtles in Florida, U.S.A. Marine Pollution Bulletin 81:103–115.

Balmer, B.C., L.H. Schwacke, R.S. Wells, R.C. George, J. Hoguet, J.R. Kucklick, S.M. Lane, A. Martinez, W.A. McLellan, P.E. Rosel, T.K. Rowles, K. Sparks, T. Speakman, E.S. Zolman, and D.A. Pabst. 2011. Relationship between persistent organic pollutants (POPs) and ranging patterns in common bottlenose dolphins (*Tursiops truncatus*) from coastal Georgia, USA. Science of the Total Environment 409:2094-2101.

Bjorndal, K.A., B.W. Bowen, M. Chaloupka, L.B. Crowder, S.S. Heppell, C.M. Jones, M.E. Lutcavage, D. Policansky, A.R. Solow, B.E. Witherington. 2011. Better science needed for restoration in the Gulf of Mexico. Science. 331(6017):537-538.

Cato, D.H., M.J. Noad, R.A. Dunlop, R.D. McCauley, N.J. Gales, C.P. Salgado-Kent, H. Kniest, D. Paton, K.C.S. Jenner, J. Noad, A.L. Maggi, I.M. Parnum, and A.J. Duncan. 2012. Project BRAHSS: Behavioural response of Australian humpback whales to seismic surveys, *in* T. McMinn (ed.), Acoustics 2012 Fremantle: Acoustics, Development and the Environment, The 2012 Conference of the Australian Acoustical Society, 21-23 Nov 2012. Fremantle, Western Australia: Australian Acoustical Society. At http://espace.library.curtin.edu.au/cgi-bin/espace.pdf?file=/2013/03/28/file_1/191033.

Conn, P.B., A.M. Gorgone, A.R. Jugovich, B.L. Byrd, and L.J. Hansen. 2011. Accounting for transients when estimating abundance of bottlenose dolphins in Choctawatchee Bay, Florida. The Journal of Wildlife Management 75(3):569-579.

Costa, D.P. 2012. A bioenergetics approach to developing a population consequences of acoustic disturbance model, *in* A.N. Popper and A. Hawkins (eds.), The Effects of Noise on Aquatic Life, Advances in Experimental Medicine and Biology 730, Springer, New York.

Duda, M.D., T. Beppler, and S.C. Horstman. 2013. Attitudes toward illegal feeding and harassment of wild dolphins in Panama City. Human Dimensions of Wildlife 18(3):236-238.

Finneran, J.J., and C.E. Schlundt. 2013. Effects of fatiguing tone frequency on temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*). The Journal of the Acoustical Society of America 133:1819.

Garrison, L.P., and L. Stokes. 2014. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2013. NOAA Technical Memorandum NMFS-SEFSC-667. NMFS Southeast Fisheries Science Center, Miami, Florida. 61 pages.

Gillespie, D. P. White, M. Caillat, and J. Gordon. 2011. Development and implementation of automatic classification of odontocetes within PAMGuard. Report prepared by SMRU Limited the University of Southampton for E&P Sound and Marine Life Programme, Project Number MMM.0108.OGP. 68 pages. At http://www.soundandmarinelife.org/libraryfile/1275.

Gulak, S.J.B., M.P. Enzenauer, and J.K. Carlson. 2013. Characterization of the shark and reef fish bottom longline fisheries: 2012. NOAA Technical Memorandum NMFS-SEFSC-652. NMFS Southeast Fisheries Science Center, Panama City, Florida. 42 pages.

Hammond, J.S., R.L. Keeney, and H. Raiffa. 1999. Smart Choices: A Practical Guide to Making Better Life Decisions. Broadway Books, New York, N.Y. 256 pages.

Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, and B. Würsig. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis Report. OCS Study MMS 2008-006. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana. 323 pages. At http://seawater.tamu.edu/swss/doc/2008-006.pdf.

Keller, C.E., and J.K. Adams., eds. 1983. Proceedings of a workshop on cetaceans and sea turtles in the Gulf of Mexico: study planning for effects of Outer Continental Shelf development. Prepared by the U.S. Fish and Wildlife Service for the Minerals Management Service, Metairie, Louisiana. 42 pages.

Kendall, W.L., R.J. Barker, G.C. White, M.S. Lindberg, C.A. Langtimm, and C.L. Peñaloza. 2013. Combining dead recovery, auxiliary observations and robust design data to estimate demographic parameters from marked individuals. Methods in Ecology and Evolution 4:828-835.

Kosempa, M. J. Martim, F. Johnson, R. Mezich, B. Stith, C. Deutsch, M. Masi, and H. Edwards. 2014. Structured decision making for management of warm-water habitat for manatees. Final report to U.S. Fish and Wildlife Service. FWC/FWRI File F2852-10-14-F. 25 pages plus appendices.

Kucklick, J., L. Schwacke, R. Wells, A. Hohn, A. Guichard, J. Yordy, L. Hansen, E. Zolman, R. Wilson, J. Litz, D. Nowacek, T. Rowles, R. Pugh, B. Balmer, C. Sinclair, and P. Rosel. 2011. Bottlenose dolphins as indicators of persistent organic pollutants in the western North Atlantic Ocean and northern Gulf of Mexico. Environmental Science & Technology 45:4270-4277.

Marques, T.A. L. Thomas, S.W. Martin, D.K. Mellinger, J.A. Ward, D.J. Moretti, D. Harris, and P.L. Tyack. 2013. Estimating animal population density using passive acoustics. Biological Reviews 88:287-309.

Martin, J., H.H. Edwards, C.J. Fonnesbeck, S.M. Koslovsky, C.W. Harmak, and T.M. Dane. 2015. Combining information for monitoring at large spatial scales: First statewide abundance estimate of the Florida manatee. Biological Conservation 186:44–51.

McKay, M., J. Nides, W. Lang, and D. Vigil. 2001. Gulf of Mexico Marine Protected Species Workshop, June 1999. MMS 2001-039. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana. 171 pages.

Melancon, R.S., S.M. Lane, T. Speakman, L.B. Hart, C. Sinclair, J. Adams, P.E. Rosel, and L. Schwacke. 2011. Photo-identification field and laboratory protocols utilizing Finbase version 2. NOAA Technical Memorandum NMFS-SEFSC-627, Lafayette, Louisiana. 46 pages.

MMC. 2008. Annual Report to Congress. Marine Mammal Commission, Bethesda, Maryland. 269 pages.

MMC. 2011. Assessing the long-term effects of the BP Deepwater Horizon oil spill on marine mammals in the Gulf of Mexico: a statement of research needs. Marine Mammal Commission, Bethesda, Maryland. 38 pages.

Moore, J. E., and R. Merrick. 2011. Guidelines for Assessing Marine Mammal Stocks: Report of the GAMMS II Workshop, February 15-18, 2011, La Jolla, California. NOAA Technical Memorandum NMFS-OPR-47. NMFS Office of Protected Resources, Silver Spring, Maryland. 95 pages. At http://www.nmfs.noaa.gov/pr/pdfs/sars/gamms3_nmfsopr47.pdf.

Mullin, K., P. Rosel, A. Hohn, and L. Garrison. 2007. Bottlenose dolphin stock structure research plan for the central northern Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-563. NMFS Southeast Fisheries Science Center, Miami, Florida. 27 pages.

NMFS. 2008. Southeast Fisheries Science Center Strategic Plan For Marine Mammals Research. NMFS Southeast Fisheries Science Center, Miami, Florida. 26 pages.

NMFS. 2010. Fisheries of the United States: 2009. Current Fishery Statistics No. 2009. NMFS Office of Science and Technology, Fisheries Statistics Division, Silver Spring, Maryland. 103 pages. At http://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus09/fus_2009.pdf.

O'Connor, S., R. Campbell, H. Cortez, and T. Knowles. 2009. Whale Watching Worldwide: Tourism numbers, expenditures, and expanding economic benefits. A special report from the International Fund for Animal Welfare, Yarmouth, Massachusetts, U.S.A., prepared by Economists at Large. 295 pages. At https://ifaw.jacksonriverdev.com/sites/default/files/whale_watching_worldwide.pdf.

Phillips, N.M., and P.E. Rosel. 2014. A Method for Prioritizing Research on Common Bottlenose Dolphin Stocks Through Evaluating Threats and Data Availability: Development and Application to Bay, Sound and Estuary Stocks in Texas. NOAA Technical Memorandum NMFS-SEFSC-665. U.S. Department of Commerce, NOAA Fisheries, Southeast Fisheries Science Center, Lafayette, LA. 146 pages.

Rosel, P.E., K.D. Mullin, L. Garrison, L. Schwacke, J. Adams, B. Balmer, P. Conn, M.J. Conroy, T. Eguchi, A. Gorgone, A. Hohn, M. Mazzoil, C. Schwarz, C. Sinclair, T. Speakman, K. Urian, N. Vollmer, P. Wade, R. Wells, and E. Zolman. 2011. Photo-identification capture-mark-recapture techniques for estimating abundance of bay, sound, and estuary populations of bottlenose dolphins along the U.S. East Coast and Gulf of Mexico: A workshop report. NOAA Technical Memorandum NMFS-SEFSC-621. NMFS Southeast Fisheries Science Center, Lafayette, Louisiana. 30 pages.

Rowles, T.K., L.S. Schwacke, R.S. Wells, J.T. Saliki, L. Hansen, A. Hohn, F. Townsend, R.A. Sayre, and A.J. Hall. 2011. Evidence of susceptibility to morbillivirus infection in cetaceans from the United States. Marine Mammal Science 27(1):1-19.

Runge, M.C., C.A. Sanders-Reed, C.A. Langtimm, C.J. Fonnesbeck. 2007. A quantitative threats analysis for the Florida Manatee (*Trichechus manatus latirostris*). U.S. Geological Survey Open-File Report 2007-1086. 34 pages. At http://www.eahcp.org/files/uploads/Rungeetal.20071.pdf.

Schwacke, L.H., M.J. Twiner, S. De Guise, B.C. Balmer, R.S. Wells, F.I. Townsend, D.C. Rotstein, R.A. Varela, L.J. Hansen, E.S. Zolman, T.R. Spradlin, M. Levin, H. Leibrecht, Z. Wang, T.K. Rowles. 2010. Eosinophilia and biotoxin exposure in bottlenose dolphins (*Tursiops truncatus*) from a coastal area impacted by repeated mortality events. Environmental Research 110:548-555.

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2013. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. Environmental Science & Technology 48:93-103.

SEDAR (Southeast Data, Assessment, and Review). 2013. SEDAR 32A - Gulf of Mexico Menhaden Stock Assessment Report. SEDAR, North Charleston, South Carolina. 422 pages. At http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=32A.

Sills, J.M., B.L. Southall, and C. Reichmuth. 2014. Amphibious hearing in spotted seals (*Phoca largha*): underwater audiograms, aerial audiograms and critical ratio measurements. The Journal of Experimental Biology 217:726-734.

Sinclair, C., J. Sinclair, E. Zolman, A. Martinez, B. Balmer, and K. Barry. 2015. Remote biopsy field sampling procedures for cetaceans used during the Natural Resource Damage Assessment of the MSC252 Deepwater Horizon Oil Spill. NOAA Technical Memorandum NMFS-SEFSC-670, Pascagoula, Mississippi. 28 pages.

Soldevilla, M.S., L.P. Garrison, E. Scott-Denton, J.M. Nance. 2015. Estimation of marine mammal bycatch mortality in the Gulf of Mexico shrimp otter trawl fishery. NOAA Technical Memorandum NMFS-SEFSC-672. NMFS Southeast Fisheries Science Center, Miami, Florida. 70 pages. At http://docs.lib.noaa.gov/noaa_documents/NMFS/SEFSC/TM_NMFS_SEFSC/NMFS_SEFSC_TM_672.pdf.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendation. Aquatic Mammals 33:411–521.

Stokes, S., and M. Lowe, with contributing researchers R. Owen and S. Mine. 2013. Wildlife Tourism and the Gulf Coast Economy. Prepared by Datu Research, LLC for the Environmental Defense Fund. 55 pages. At http://www.daturesearch.com/wp-content/uploads/WildlifeTourismReport_FINAL.pdf.

Tubelli, A.A, A. Zosuls, D.R. Ketten, M. Yamato, and D.C. Mountain. 2012. A prediction of the minke whale (*Balaenoptera acutorostrata*) middle-ear transfer function. The Journal of the Acoustical Society of America 132(5):3263-3272.

Tucker & Associates, Inc. 1990. Sea turtles and marine mammals of the Gulf of Mexico, proceedings of a workshop held in New Orleans, August 1-3, 1989. OCS Study MMS 90-0009. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana. 211 pages.

Twiner, M.J., S. Fire, L. Schwacke, L. Davidson, Z. Wang, S. Morton, S. Roth, B. Balmer, T.K. Rowles, and R.S. Wells. 2011. Concurrent exposure of bottlenose dolphins (*Tursiops truncatus*) to multiple algal toxins in Sarasota Bay, Florida, USA. PLoS ONE 6(3):e17394.

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) Unusual Mortality Event: January 2010 - June 2013. PLoS ONE 10(2):e0117248.

Viricel, A., and P.E. Rosel. 2014. Hierarchical population structure and habitat differences in a highly mobile marine species: the Atlantic spotted dolphin. Molecular Ecology 23:5018-5035.

Vollmer, N.L., and P.E. Rosel. 2013. A review of common bottlenose dolphins (*Tursiops truncatus truncatus*) in the northern Gulf of Mexico: Population biology, potential threats, and management. Southern Naturalist 12(Monograph 6):1–43.

Wells, R.S., J.B. Allen, G. Lovewell, J. Gorzelany, R.E. Delynn, D.A. Fauquier, and N.B. Barros. 2015. Carcass-recovery rates for resident bottlenose dolphins in Sarasota Bay, Florida. Marine Mammal Science 31(1):355-368.

Yordy, J.E., R.S. Wells, B.C. Balmer, L.H. Schwacke, T.K. Rowles, and J.R. Kuclick. 2010. Partitioning of persistent organic pollutants between blubber and blood of wild bottlenose dolphins: Implications for biomonitoring and health. Environmental Science and Technology 44(12):4789–4795.

Yoskowitz, D., C. Leon, J. Gibeaut, B. Lupher, M. Lopez, C. Santos, G. Sutton, and L. McKinney. 2013. Gulf 360: State of the Gulf of Mexico. Harte Research Institute for Gulf of Mexico Studies, Texas A&M University-Corpus Christi, Texas. 52 pages. At http://gulf360.org/docs/report.pdf.

APPENDIX A: LIST OF POSTER PRESENTATIONS

PDF versions of the posters presented at the meeting are available at www.mmc.gov.

Baker, Scott, Oregon State University
Archiving and Accessing a 'DNA Register' for Individual Identification and Stock Structure of Sperm Whales in the Gulf of Mexico

Carmichael, Ruth and Noel Wingers, Dauphin Island Sea Lab — Three posters:
Sighting Demographics of the West Indian manatee (*Trichechus manatus*) in Alabama and Mississippi waters
Modeling West Indian Manatee Movements Informs Space Use Patterns and Phenology in the Northern Gulf of Mexico
Distribution of Stranded Bottlenose Dolphins (*Tursiops truncatus*) in Alabama Waters from 2004 – 2013

Cush, Carolyn, Chicago Zoological Society
Gulf of Mexico Dolphin Identification System (GoMDIS) - A Collaborative Tool for Bottlenose Dolphin Conservation & Monitoring

Fazioli, Kristi, University of Houston-Clear Lake Environmental Institute of Houston
An Apparent Increase in Bottlenose Dolphins in Upper Galveston Bay: City Slickers or Tourists?

Frasier, Kaitlin, Scripps Institution of Oceanography
Long-term Passive Acoustic Monitoring of Dolphins in the Gulf of Mexico

Hohn, Aleta, NMFS Beaufort Laboratory
Assigning *Tursiops* Strandings to Stock Using Stable Isotope Ratios

Kerr, Iain, Ocean Alliance
Marine Mammal Toxicological Research and Education: Five summers in the Gulf of Mexico in Response to the Deepwater Horizon Disaster

Martinez-Serrano, Ibiza, Universidad Veracruzano — Two posters:
Biological Monitoring Program Based on Indicator Species of Ecological Integrity in the National Park "Sistema Arrecifal Veracruzano" (Veracruz Reef System)
Use and Characterization of Habitat by the Antillean Manatee (*Trichechus manatus manatus*) in the South of Veracruz, Mexico

Moreno, Paula, USM Gulf Coast Research Laboratory — Two posters:
Independent Advisory Team for Marine Mammal Assessment
Gulf Coast Research Laboratory: Marine Mammal Research

Norris, Thomas, Bio-Waves, Inc.
Passive Listening, Active Mitigation: Passive Acoustic Monitoring and Mitigation of Oceanic Delphinids During Mid-Water Net Trawl Sampling on NOAA's R/V Pisces

Phillips, Nicole, University of Miami / NMFS Lafayette Laboratory
A Method for Prioritizing Research on Common Bottlenose Dolphin Stocks through Evaluating Threats and Data Availability: Development and Application to Bay, Sound and Estuary Stocks in Texas

Pitchford, Jonathan, Institute for Marine Mammal Studies

Predictive Spatial Modeling of Seasonal Bottlenose Dolphin (*Tursiops truncatus*) Distributions in the Mississippi Sound

Shippee, Steve, Marine Wildlife Response

Can Simple Tackle Modifications and Use of Fish Descenders Decrease Harmful Fishery Interactions with Bottlenose Dolphins?

Slone, Dan, US Geological Survey

USGS Manatee Research in the Gulf of Mexico: Movement and Habitat Use in the Northern GOM to Assist BOEM with Management of Coastal Resources

Solangi, Moby, Institute for Marine Mammal Studies

Bottlenose Dolphin (*Tursiops truncatus*) Stranding Response and Research

Stimmelmayer, Raphaela, North Slope Borough (in absentia)

Bile Collection Technique in Subsistence Harvested Beluga Whales (*Delphinapterus leucas*): Proof of Concept Study

Appendix B. Project Descriptions

The following section contains descriptions of 53 recent or current marine mammal research and monitoring projects in the Gulf. The information was compiled from information provided by meeting registrants, as well as others that were not able to attend the meeting.

Archiving and accessing a 'DNA register' for sperm whales in the Gulf of Mexico

Baker, C. Scott, Oregon State University, Marine Mammal Institute, 2030 SE Marine Science Dr, Newport, OR 97365, 541-272-0560, scott.baker@oregonstate.edu
Co-investigators: Bruce Mate, Oregon State University; Dan Engelhaupt, HDR, Inc.; Alana Alexander, University of Kansas
Duration of Project: 06/2015 – 06/2017
Websites: mmi.oregonstate.edu/c-scott-baker, www.splashcatalog.org/mmuwildbook

Focal species
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Behavior/behavioral ecology
Conservation and management
Genetics/genomics
Gulf oil spill effects
Habitat use/distribution
Life history
Population dynamics

Project Description

A growing number of long-term studies of marine mammals and other marine megafauna (e.g., sharks, and turtles) are collecting spatially explicit records linked through individual identification to genetic samples, photo-identification and telemetry. These spatio-temporal records have been used to track the migration and life history parameters of individuals, to estimate the abundance and trends of populations by capture-recapture and, in the case of genetic markers, to infer close kinship (e.g., parent/offspring relationships) and define management units, or Distinct Population Segments. Here we describe progress with developing a 'register' of DNA profiles for sperm whales in the Gulf of Mexico, using biopsy samples and a standard set of genetic markers (e.g., mtDNA haplotypes, microsatellite genotypes, and sex). These DNA profiles have now been used for individual identification and matching between investigators and across projects extending from the Sperm Whale Seismic Study (SWSS) and the Voyage of the Odyssey, to more recent project resulting from the Deepwater Horizon spill. We also describe progress with developing a cloud-based program, with distributed management, for archiving and accessing the spatially explicit records associated with DNA profiles. The database structure and tools provide for visual exploration of individual encounters and group occurrences of individual whales identified by DNA profiles, by photographs of natural marking (photo-ID), or from both sources of identity.

Keywords: DNA profiling, biopsy samples, computation, photo-identification

---

Pressure Wave Acoustic Study for Well Decommissioning in the Gulf of Mexico

Barkaszi, Mary Jo, CSA Ocean Sciences, 8502 SW Kansas Ave, Stuart, FL 33701, 772-219-3000, mbarkaszi@conshelf.com
Co-investigators: Adam Frankle, MAI; Billy Poe, Explosive Services International; Tre Glen, (COR) BOEM
Duration of Project: 10/1/2014 - 11/1/2015
Website: www.csaocean.com

Focal species
All Gulf of Mexico marine mammals and marine turtles

Focal habitats
Offshore/pelagic waters

Objectives
Conservation and management
Noise effects

Project Description

Pressure wave measurements were taken at explosive well decommissioning events for data comparisons and enhancement of the ARA Underwater Calculator (UWC), which provides regulators with information for establishing safety zones for marine species during these events.

Keywords: Pressure wave, acoustic, Underwater Calculator, Explosive Removal of Offshore Structures (EROS)

Sperm Whale Seismic Studies

Biggs, Douglas, Texas A&M University, 979-219-4163, d-biggs@tamu.edu
Co-investigators: Peter Tyack, WHOI; Bruce Mate, OSU; Aaron Thode, SIO
Duration of Project: 2001 - 2007

Project Description
I was Chief Scientist for SWSS fieldwork (2001-2005).

Keywords: Sperm whales, habitat, controlled exposure experiments, partnership, government, academia, industry

Focal species
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Behavior/behavioral ecology
Foraging/diet
Genetics/genomics
Habitat use/distribution
Noise effects
Population dynamics

Mapping and conservation of marine migratory species in the Gulf of Mexico

Brenner, Jorge, The Nature Conservancy, 205 N. Carrizo St, Corpus Christi, TX 78401, 361-687-2209, jbrenner@tnc.org
Co-investigators: Carly Voight, TNC; David Mehlman, TNC
Duration of Project: 02/01/2014 - 03/01/2015

Project Description
The Nature Conservancy is working on synthesizing existing scientific information into a report and series of maps (incl. GIS products) to increase the Conservancy and its network of partners' understanding of marine migratory species in the Gulf of Mexico, their ecological migration strategies, migratory corridors and stepping-stones used to migrate. Additionally the study will provide a series of research and conservation recommendations for future projects, including needs for coastal and marine habitat restoration. This project focuses in marine species of fish, sea turtles, marine mammals and birds, including estuarine, commercial, recreational, and highly migratory species. This project will be conducted at the Gulf of Mexico whole system scale. It will support the integration of a comprehensive view of the features, processes and areas used to migrate along the Gulf and into/outside the Gulf. This project intends to support a broad audience in the decision-making processes ranging from research needs, to commercial and recreational fishing industry to non-profit organizations and agencies working to conserve coastal and marine areas.

Keywords: Gulf of Mexico, migratory species, migrations, corridors, conservation

Focal species
Manatee
Sperm whale

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters
Offshore/pelagic waters

Objectives
Conservation and management
Ecosystem modeling
Fisheries interactions/gear research
Habitat use/distribution
Migration

Proposed data collection plan to assess injury to West Indian manatees from the Deepwater Horizon Oil Spill outside of Florida

Carmichael, Ruth H., Dauphin Island Sea Lab, 101 Bienville Blvd., Dauphin Island, AL 36528, 251-861-2141, rcarmichael@disl.org
Co-investigators: James Powell, Monica Ross, Nicole Adimey
Duration of Project: 05/01/2010 - 11/01/2010

Project Description
Aerial surveys from western Florida through eastern Louisiana to document locations of manatees and surface oil; collaboration with Sea to Shore Alliance and Florida Fish and Wildlife Conservation Commission.

Keywords: Aerial survey, *Trichechus manatus*, NRDA, oil spill

Focal species
Manatee

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Conservation and management
Ecology
Gulf oil spill effects
Habitat use/distribution
Life history

Effects of oil contaminants on sentinel benthic and pelagic species in Mobile Bay

Carmichael, Ruth H., Dauphin Island Sea Lab, 101 Bienville Blvd., Dauphin Island, AL 36528, 251-861-2141, rcarmichael@disl.org
Co-investigators: Anne Boettcher, Kyeong Park, Kristie Willett
Duration of Project: 07/01/2010 - 12/01/2010

Project Description
Effects of oil-derived substances on oysters and manatees; monitoring of tagged manatee distribution, movements, condition.

Keywords: *Trichechus manatus*, oil spill, telemetry

Focal species
Manatee (and eastern oysters)

Focal habitats
River/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Conservation and management
Ecology
Foraging/diet
Habitat use/distribution
Health and health assessment
Life history

A cooperative marine mammal stranding network for Alabama

Carmichael, Ruth H., Dauphin Island Sea Lab, 101 Bienville Blvd., Dauphin Island, AL 36528, 251-861-2141, rcarmichael@disl.org
Co-investigators: Kelly Brinkman
Duration of Project: 05/01/2011 - 03/01/2012

Project Description
Established equipment infrastructure for development of the AL Marine Mammal Stranding Network at DISL.

Keywords: Stranding, bottlenose dolphin, manatee

Focal species
All Gulf of Mexico species

Focal habitats
River/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters
Offshore/pelagic waters

Objectives
Anatomy/taxonomy
Conservation and management
Cumulative effects
Ecology
Epidemiology
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Gulf oil spill effects
Health and health assessment
Life history
Strandings
Toxicology

Phylogeography, Kinship, and Molecular Ecology of Sperm Whales

Engelhaupt, Dan, HDR, 1209 Independence Blvd, Suite 108, Virginia Beach, VA 23455, 757-354-6735, Daniel.Engelhaupt@hdrinc.com
Co-investigators: A. Rus Hoelzel, University of Durham, England
Duration of Project: 06/01/2000 - 04/01/2008
Website: http://seawater.tamu.edu/SWSS/

Project Description
The molecular ecology for sperm whales (*Physeter macrocephalus*) in the northern Gulf of Mexico was investigated in detail using a suite of molecular markers. In addition, several genetic related aspects for the Mediterranean Sea, North Sea and the North Atlantic Ocean putative sperm whale populations were described. These analyses have provided new insights requiring proper management to ensure the survival of the northern Gulf of Mexico sperm whale stock in an area of increasing industrial activity.

Keywords: Sperm Whale Seismic Study, sperm Whale, cetacean, microsatellite DNA, mitochondrial DNA

Focal species
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Genetics/genomics

Naval Surface Warfare Center Panama City Division - Training Range Marine Mammal Monitoring

Engelhaupt, Dan, HDR, 1209 Independence Blvd, Suite 108, Virginia Beach, VA 23455, 757-354-6735, Daniel.Engelhaupt@hdrinc.com
Co-investigators: Jennifer Latusek-Nabholz
Duration of Project: 04/01/2011 - 11/01/2014

Focal species
All Gulf of Mexico species

Focal habitats
Nearshore/coastal waters
Offshore/pelagic waters

Objectives
Behavior/behavioral ecology
Habitat use/distribution
Noise effects

Project Description

HDR working as a subcontractor to ARINC provided marine and biological resources monitoring and management services for the NSWC PCD. Marine species monitoring, evaluations, and/or assessments were conducted at various locations within the NSWC PCD's testing areas in the Gulf of Mexico as part of the Navy's requirements under their existing Letter of Authorizations. Specific tasks conducted under this contract included aerial and shipboard surveys; passive acoustic monitoring; behavioral studies; and management and coordination of complex projects during Navy training and testing exercises.

Keywords: Monitoring, dolphins, Navy, aerial surveys

Ecology and Conservation of the Common Bottlenose Dolphin (*Tursiops truncatus*) in the Bay, Sound, Estuary and Near-shore Coastal Waters of Texas

Fazioli, Kristi, UHCL Environmental Institute of Houston, 2700 Bay Area Blvd., Box 540, Houston, TX 77058, 281-283-3792, fazioli@uhcl.edu
Contributing Researchers: George Guillen, UHCL Environmental Institute of Houston; Bernd Würsig, Chris Marshall, Sarah Piwetz, Dara Orbach, Texas A&M University at Galveston; Tim Tristan, Will McGlaun, Texas Sealife Center; Andreas Fahlman, Danielle Kleinhenz, Linda Price-May, Texas A&M University Corpus Christi
Duration of Project: 05/01/2015 - Long-Term Monitoring

Focal species
Bottlenose dolphins

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Cumulative effects
Ecology
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Habitat use/distribution
Life history
Population dynamics
Toxicology

Project Description

Recent stock assessment reports, publications and workshops have called for increased collaborative research and the use of a multidisciplinary approach to elucidate fine-scale stock delineation in Gulf of Mexico (GoM) bay, sound and estuarine (BSE), and coastal environments. In response to these recommendations, the Texas Dolphin Research Collaborative aims to establish a long-term monitoring program that will provide population distribution and abundance estimates, identify natural and human-generated risks and establish baseline health and life history parameters for Texas BSE and near-coastal bottlenose dolphins. By coordinating the efforts of a network of institutions and researchers, we can facilitate the use of a multidisciplinary approach to provide thorough analyses, efficient use of resources, and a reduction of duplicative efforts. Data compiled by participating institutions will be published and presented in a variety of scientific and popular venues to disseminate results and aid in management decisions. In the event of an environmental disturbance, such as an oil spill, the underlying logistical structure and availability of baseline data will improve response efforts and allow us to characterize effects on Texas populations. Long-term collaborative efforts, such as those led by the Sarasota Dolphin Research Program on the west coast of Florida, and those used to elucidate stock structure on the Atlantic Coast have yielded invaluable data on the life history of bottlenose dolphin communities, supporting the validity of this approach and providing a blueprint for success.

Keywords: *Tursiops truncatus*, Texas, stock structure

Galveston Bay Dolphin Research and Conservation Program

Fazioli, Kristi, University of Houston-Clear Lake (UHCL), Environmental Institute of Houston, 2700 Bay Area Blvd., Box 540, Houston, TX 77058, 281-283-3792, fazioli@uhcl.edu
Co-investigators: Vanessa Mintzer, Galveston Bay Foundation
Duration of Project: 08/01/2013 - Long-term monitoring

Focal species
Bottlenose dolphins

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Cumulative effects
Ecology
Ecosystem modeling
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Habitat use/distribution
Health and health assessment
Life history
Population dynamics
Toxicology

Project Description
Galveston Bay, Texas is one of the most industrialized estuaries in the United States. An urban watershed supporting over 4 million people and the second largest petro-chemical complex in the world concentrates its effects in the western portion of upper Galveston Bay. Heavy maritime traffic traverses the Houston Ship Channel and port facilities are undergoing significant expansions in concurrence with the deepening of the Panama Canal. Water quality in this region prior to 1970 was severely impaired and Galveston Bay was named one of the EPA's top 10 most polluted water bodies. Corrective measures have improved water quality and the region now shows declining trends for ammonia, phosphorus, and chlorophyll a. However, while these trends have created a better environment for biological life in the bay, concerns over elevated concentrations of pathogenic bacteria and chlorinated organic compounds persist. The Department of State Health Services (DSHS) has issued seafood consumption advisories throughout the Galveston Bay system and initiated total maximum daily load (TMDL) projects for PCBs and Dioxins in the Houston Ship Channel and upper Galveston Bay. Evidence from recent surveys suggests that a bottlenose dolphin (*Tursiops truncatus*) population regularly utilizes upper Galveston Bay and the Houston Ship Channel, an area previously thought to have very little dolphin activity following surveys conducted in 1990 by Texas A&M University at Galveston (TAMUG). Increased activity in this area may reflect the success of efforts to protect Galveston Bay and improve water quality over the past 30 years, however little is known about their habitat use, site fidelity or stock structure in the region. In fact, critical data gaps exist for all Texas bay, sound and estuary bottlenose dolphin stocks and managers consider Galveston Bay a high priority for research. Elevated exposure to contaminants in upper Galveston bay, combined with additional anthropogenic stressors such as habitat loss, harmful algal blooms, noise pollution and human and fisheries interactions, place these dolphins at high risk. The Galveston Bay Foundation (GBF) is partnering with the Environmental Institute of Houston at the University of Houston, Clear Lake (EIH-UHCL) to conduct research on this understudied population and is establishing the Galveston Bay Dolphin Research and Conservation Program (GDRCP). Through long-term photo-id monitoring, mark-recapture techniques and remote biopsy darting, this program aims to tackle fundamental questions pertaining to the population's ecology, health and behavior. Fin catalogs will be compared to historical sightings in the TAMUG fin database and other programs along the Texas coast and will be entered into the Gulf of Mexico Dolphin Identification System (GoMDIS). Analysis of skin and tissue samples will be completed in collaboration with management agencies and contribute to conservation goals for the region. Corresponding education and outreach programs will increase public awareness by promoting bottlenose dolphins as sentinels for Galveston Bay ecosystem health and sustainability.

Keywords: Galveston Bay, stock structure, monitoring, contaminants, *Tursiops truncatus*

Eckerd College Dolphin Project

Gowans, Shannon, Eckerd College, 4200 54th Avenue South, St. Petersburg, FL 33711, 727-864-8388, gowanss@eckerd.edu
Co-investigators: John Reynolds III, Mote Marine Laboratory
Duration of Project: 12/01/1993 - present
Website: www.eckerd.edu/academics/marinescience/research/dolphin.php

Project Description

The Eckerd College Dolphin Project has been collecting distribution and photo-identification data on bottlenose dolphins in the Tampa Bay region since 1993. The photo-id database has been integrated with the Sarasota Dolphin Research Program and is in the process of integration with GoMDIS. The project was lead by John Reynolds III until 2004 and I have been in charge since then. The focus of the project has been to conduct long term monitoring of the population using sighting surveys and photo-identification. Our study area includes the inshore waters of Boca Ciegay Bay (the northern side of the mouth of Tampa Bay), the southwestern waters of Tampa Bay and Nearshore waters from Johns Pass to Egmont Key till about 5 nautical miles offshore. In recent years we have included both passive acoustic monitoring from moored hydrophones and towed hydrophones while following dolphin groups.

Focal species
Bottlenose dolphins

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Conservation and management
Ecology
Ecosystem modeling
Foraging/diet
Habitat use/distribution
Life history
Noise effects
Population dynamics

A Bottlenose Dolphin Surveillance Team for Mississippi Sound

Grimes, D. Jay, University of Southern Mississippi, Gulf Coast Research Laboratory, 300 Laurel Oak Drive, Ocean Springs, MS 39564, 228-818-8009, jay.grimes@usm.edu
Duration of Project: 08/25/2010 - 12/31/2014 (no cost ext to 12/15)
Website: www.usm.edu/gcrl/cv/grimes.jay/cv.grimes.jay.php

Project Description

Culture-based and non-culture-based microbiomic surveys of bottlenose dolphin samples from Barataria and Sarasota Bays (samples collected by NOAA and provided to us for microbiomics).

Keywords: Microbiomics, bottlenose dolphins, viruses, bacteria

Focal species
Bottlenose dolphins

Focal habitats
Bays/sounds/estuaries

Objectives
Microbiomics

Passive Acoustic Monitoring for Marine Mammals in the Gulf of Mexico

Hildebrand, John, Scripps Institution of Oceanography, UCSD – 0205, La Jolla, CA 92037, 858-534-4069, jhildebrand@ucsd.edu
Duration of Project: 05/01/2010 - present
Website: www.cetus.ucsd.edu

Focal species
All Gulf of Mexico marine mammals

Focal habitats
Offshore/pelagic waters

Objectives
Bioacoustics (hearing/communication)
Conservation and management
Ecology
Ecosystem modeling
Gulf oil spill effects
Habitat use/distribution
Noise effects

Project Description

Deep-diving cetaceans are an important component of the Gulf of Mexico ecosystem. These long-lived animals, including sperm whales, dwarf and pygmy sperm whales, and at least three species of beaked whales, forage in offshore and deepwater habitat, with presence in the region of the Deepwater Horizon Oil Spill. Due to their extended and deep foraging dives, these species are difficult to study with visual surveys but are readily detected by passive acoustic monitoring. Long-term passive acoustic monitoring at three sites along the continental slope, provides records of cetacean presence during and following the oil spill. High-frequency Acoustic Recording Packages (HARPS) recorded wideband (10 Hz - 100 kHz) acoustic data beginning in May 2010. One recording site was located near the Deepwater Horizon site, one was located to the west of the spill near Green Canyon, and one was located to the south of the spill off the Florida Escarpment. Acoustic data was scanned for echolocation clicks and classified for deep-diving cetacean species. Using parameters for cetacean sound production and acoustic detection range, estimates were made of population density by species. Time-series are presented for deep-diving cetacean presence in the Gulf of Mexico from May 2010 to September 2013. Higher rates of sperm whale detections were found in the northern Gulf of Mexico than in the southern Gulf of Mexico, whereas, beaked whales were found at their highest densities in the southern Gulf of Mexico. Gervais' beaked whale was the dominant beaked whale species detected at the northern Gulf of Mexico sites whereas Cuvier's beaked whale was the most detected species at the southern site. The relationship between cetacean presence and environmental parameters help provide an understanding of the ecology of these species as well as potential impact of the oil spill. This work was supported by BP and NOAA and any opinions, findings, and conclusions or other recommendations expressed are those of the authors and do not necessarily reflect the views of BP and/or any State or Federal Natural Resource Trustee.

Keywords: Passive acoustics, cetaceans

Assigning *Tursiops* strandings to stock using stable isotope ratios

Hohn, Aleta, NOAA, 101 Pivers Island Rd, Beaufort, NC 28516, 252-728-8797, aleta.hohn@noaa.gov
Co-investigators: Len Thomas, The Centre for Research into Ecological and Environmental Modeling, St Andrews, UK; Todd Speakman and Eric Zolman, NOAA, NOS, NCCOS, Hollings Marine Laboratory; Jenny Litz, NOAA, NMFS, SEFSC, Miami Laboratory; Carrie Sinclair, NOAA, NMFS, SEFSC, Mississippi Laboratories
Duration of Project: 01/01/2013 - 12/01/2015

Focal species
Bottlenose dolphins

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Conservation and management
Habitat use/distribution
Strandings
Stock identification

Project Description

Stable isotopes ratios have demonstrated value for assigning dolphins to different habitats. This technique is being explored for discriminating between common bottlenose dolphins that primarily inhabit coastal vs. estuarine waters.

Keywords: Stable isotope ratios, stock identification

Gulf of Mexico Odyssey Expeditions 2010 - 2014

Kerr, Iain, Ocean Alliance, 32 Horton Street, Gloucester, MA 01930, 978-281-2814 ext 15, Kerr@whale.org
Co-investigators: John Wise - University of Southern Maine
Duration of Project: Summer 2010 - Fall 2014
Website: www.whale.org

Project Description
The goal of these expeditions was to try to monitor the toxicological effects of the Deepwater Horizon disaster on offshore populations of marine mammals. Over five summers, we collected 349 biopsy samples from 4 species of cetaceans and a considerable amount of accompanying meta data. We grew 182 whale cell lines at sea. We focused our efforts primarily in the deep water off the continental shelf logging over 20,000 miles at sea. As far east as St Petersburg Florida, as far west as Galveston Texas, and as far south as Key West Florida.

Keywords: Sperm whales, Brydes whales, cell cultures, benign research techniques

Focal species
Bryde's whale
Cuvier's beaked whale
Short-finned pilot whale
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Conservation and management
Cumulative effects
Genetics/genomics
Gulf oil spill effects
Health and health assessment
Noise effects
Population dynamics
Toxicology

Gulf of Mexico Marine Mammal Stranding Network - data collection and important uses

Jenny Litz, NOAA Fisheries, SEFSC, 75 Virginia Beach Dr, Miami, FL, 33149, 305-361-4224, jenny.litz@noaa.gov
Co-investigators: NOAA, NMFS, Gulf of Mexico stranding network

Project Description
The marine mammal stranding network responds to an average of 375 cetacean strandings a year in the Gulf of Mexico (defined here as Monroe County through Texas, 15 year average 2000 - 2014). While 85% of those are bottlenose dolphins, at least 23 other species are represented in the data. Standardized stranding data collected by the SEUS marine mammal stranding network is critical for understanding long-term stranding trends and identifying unusual mortality events. In addition, data from marine mammal strandings provide valuable data that can be used to monitor human impacts on marine mammals, as well as, marine mammal health, distribution, and life history.

Keywords: Strandings, marine mammal health

Focal species
All Gulf of Mexico marine mammals

Focal habitats
All

Objectives
All

Biological Monitoring Program based on indicator species of ecological integrity in the National Park "Sistema Arrecifal Veracruzano" (Veracruz Reef System)

Martinez-Serrano, Ibiza, Universidad Veracruzana, Circ. Gonzalo Aguirre Beltran s/n, Zona Universitaria, Xalapa, Veracruz, Mexico 91090, 52-228-842-1748, ibimartinez@uv.mx
Co-investigators: Emilio A. Suárez-Dominguez, Universidad Veracruzana; Mauricio Hoyos-Padilla, Pelagios-Kakunjá, A.C.
Duration of Project: 04/01/2015 - 03/01/2018
Website: www.uv.mx/personal/ibimartinez

Project Description
Currently, the port of Veracruz, Mexico is under development to achieve an extension both in capacities and operations territory. Under these circumstances, the Mexican environmental authorities recommended an Environmental judge to watch that all construction operations will be developed under laws and with minimum impact to the environment. Furthermore, recommended an integral monitoring project. This project involves the study of three great marine vertebrates (sharks, sea turtles, and cetaceans) bioindicators and their ecology. We will address aspects such as distribution, density, use of area, migration patterns, and contaminants concentrations in order to know how the port operations will impact them and consequently to the entire environment, a very important reef such as the Veracruzan Reef System.

Focal species
Bottlenose dolphin
Rough-toothed dolphin
(Sea turtles and sharks)

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Ecosystem modeling
Habitat use/distribution
Health and health assessment
Population dynamics
Toxicology

Keywords: Elasmobranchs, Cetartiodactyles, sea turtles, port operations, behavioral ecology

---

Use and characterization of habitat by the Antillean Manatee (*Trichechus manatus manatus*) in the south of Veracruz, Mexico

Martinez-Serrano, Ibiza, Universidad Veracruzana, Circ. Gonzalo Aguirre Beltran s/n, Zona Universitaria, Xalapa, Veracruz, Mexico 91090, 52-228-842-1748, ibimartinez@uv.mx
Website: www.uv.mx/personal/ibimartinez

Project Description
In Mexico, the Antillean manatee (*Trichechus manatus manatus*) distribution is restricted to the south of the country. In the central coast of the Gulf of Mexico, during the 90's decade, the species was declared extinct in the south of the Veracruz state, specifically in the Coatzacoalcos River, due to pollution, ships traffic and habitat loss. Since then, no systematic surveys were developed. This region is important because of the oil exploration and production, but also because still bears well conserved patches of habitat and clean tributaries. The main goal of this study was to assess systematically the distribution, density, and use of habitat and its characterization of the manatee in the Coatzacoalcos River.

Focal species
Manatee

Focal habitats
Rivers/inland waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Ecosystem modeling
Fisheries interactions/gear research
Habitat use/distribution

Keywords: Habitat use, Antillean manatee, behavioral ecology

Sperm Whale Seismic Study - satellite-monitored tagging project

Mate, Bruce R., Oregon State University Marine Mammal Institute, 2030 SE Marine Science Drive, Newport, OR 97365, 541-867-0202, bruce.mate@oregonstate.edu
Co-investigators: Doug Biggs, Texas A&M; Ann Jochens, Texas A&M; Dan Englehaupt, HDR
Duration of Project: 04/01/2001 - 08/01/2005
Website: mmi.oregonstate.edu

Project Description
We tagged and tracked 58 sperm whales in the GoM to identify their seasonal presence, distribution, home ranges and genetic relationships.

Keywords: Argos, tracking, tagging, distribution

Focal species
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Ecology
Habitat use/distribution

Sperm whale assessment during and after the DWH oil spill

Mate, Bruce R., Oregon State University Marine Mammal Institute, 2030 SE Marine Science Drive, Newport, OR 97365, 541- 867-0202, bruce.mate@oregonstate.edu
Co-investigators: Ladd Irvine, Oregon State University
Duration of Project: 05/01/2010 - 12/01/2013
Website: mmi.oregonstate.edu

Project Description
Sperm whales were tagged during the spill and annually for 3 years after the spill to look for possible effects from the spill.

Keywords: Sperm whale, foraging, distribution, tagging, tracking

Focal species
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Cumulative effects
Ecology
Foraging/diet
Gulf oil spill effects
Habitat use/distribution

Independent Advisory Team (IAT) for Marine Mammal Assessment and Development/Testing of a Tier System for Application to Potential Biological Removal

Moreno, Paula, Gulf Coast Research Laboratory, University of Southern Mississippi,703 East Beach Drive, Ocean Springs, MS 39564, 228-818-8013, Paula.Moreno@usm.edu
Co-investigators: André Punt, University of Washington; Randall Reeves, Okapi Wildlife Associates; John Brandon, Greeneridge Sciences
Duration of Project: 08/01/2013 - Ongoing
Website: scemfis.org/research.html

Focal species
Applicable to several stocks

Focal habitats
Applicable to several habitats

Objectives
Conservation and management
Population dynamics

Project Description

The primary focus of the IAT is to examine sources of uncertainty (e.g., bias and precision) associated with estimates used for assessment of marine mammals (MM) in U.S. waters. Based on its review of literature, reports, data, and meetings with scientists and managers from NMFS and other entities, the IAT identifies research priorities and produces scientific recommendations to the Science Center for Marine Fisheries (SCeMFiS), a NSF Industry/University Cooperative Research Center. In addition, the IAT conducts research on issues related to MM assessment. In 2014 the IAT initiated a project entitled “Development and Testing of a Tier System for Application to Potential Biological Removal (PBR)”. PBR is defined in the Marine Mammal Protection Act as “the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.” PBR is calculated stock-by-stock, and is the basis for assessment and management of MM interactions in the U.S. To calculate PBR, three parameters are required: a minimum abundance estimate, a maximum theoretical or estimated net productivity rate, and a recovery factor. Data availability and level of uncertainty associated with some of these parameters, in particular abundance, may vary among stocks. The goal of this project is to develop a tier PBR system and test it using a Management Strategy Evaluation (MSE). A tier system would make better use of existing information by incorporating the best available information for each stock, which could mean drawing on more data than are currently used to set PBR for data-rich cases, and exploiting novel data sources and analytical approaches to set PBR for data-poor stocks. The MSE approach is widely used within the U.S. and elsewhere to evaluate the robustness of management strategies given scientific uncertainties. MSE involves three key steps: (a) development of a model, which represents the system being managed, (b) identification of candidate management strategies (in this case features of the proposed tier system such as how historical abundance estimates are weighted, how trends are estimated, and whether abundance data older than 8 years are used, and (c) evaluation, using simulation of the candidate management strategies. The PBR project is funded by the Western Pacific Fisheries Management Council.

Keywords: Marine mammal, stock assessment, Potential Biological Removal, Management Strategy Evaluation

Ecology, population dynamics and shrimp fishery interaction of Bottlenose dolphins in the Galveston Bay, Texas

Moreno, Paula, Gulf Coast Research Laboratory, Univ. Southern Mississippi, 703 East Beach Drive, Ocean Springs, MS 39564, 228-818-8013, Paula.Moreno@usm.edu
Website: scemfis.org/research.html

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Fisheries interactions/gear research
Foraging/diet
Gulf oil spill effects
Habitat use/distribution
Population dynamics

Project Description

Systematic vessel surveys were conducted over nearly a decade in the Galveston Bay (GB) to collect data on abundance, distribution, residency patterns and behavior of bottlenose dolphins. Environmental (e.g., depth, turbidity, dissolved oxygen) and vessel traffic data were collected on fixed stations along transects and after dolphin sightings. Noteworthy findings include identification of sub-areas of the GB with high relative abundance of dolphins and foraging hotspots. In addition, we quantified the relative importance of feeding in association with shrimp vessels. Next, we plan to estimate abundance and residence patterns in the GB using mark-recapture techniques on dorsal fin images collected during these surveys. We also plan to use this photo-ID data to determine whether feeding in association with shrimpers in the GB is a widespread foraging behavior exhibited by resident and transient dolphins or restricted to certain individuals or social units. This multi-year study offers a unique opportunity to characterize population dynamics and foraging patterns of bottlenose dolphins in a large Gulf of Mexico estuary. In addition, this study provides a baseline of pre-oil spill conditions against which the results of post oil spill studies can be compared. Assuming no major change in the Galveston Bay environment, and considering that GB is located more than 500 km from the DWH wellhead, major changes in this bottlenose dolphin population would not be anticipated. However, noting that the GB is a very productive estuary supporting resident and transient dolphins, it might offer alternative habitat to those populations that may have been adversely impacted by the DWH event.

Keywords: Abundance, shrimp fishery interactions, photo-identification, habitat use, pre-oil spill conditions

Trophic ecology of bottlenose dolphin-artisanal fisheries interactions in the coastal waters of Veracruz

Morteo, Eduardo, Universidad Veracruzana, Calle Dr. Luis Castelazo Ayala s/n, Km 2.5 Carr. Xalapa-Veracruz, Col. Industrial Animas, Xalapa, Veracruz, 91190 Mexico,52-228-841-8910, eduardo.morteo@gmail.com
Co-investigators: Fernando Elorriaga, CICIMAR/IPN; Ibiza Martinez, Fac.Biol./UV; Luis Abarca, IIB/UV
Duration of Project: 08/01/2014 - 12/01/2018
Website: www.uv.mx/personal/emorteo/investigacion/

Project Description
Determination of diet is necessary to understand the response of species to the ecosystem variability, but also their contribution as a source of mortality for they prey. Feeding is a fundamental aspect in dolphin ecology but one of the most difficult to study in wild populations; thus little is known regarding this issue across the distribution of such species, including the Mexican coasts of the Gulf of Mexico. Coastal bottlenose dolphins (Tursiops truncatus) are known to feed upon fishing gear, and although this may be true for only a fraction of the populations, it may also be very frequent. The extent of these interactions as a source of food for such individuals is unknown, thus this project aims to determine temporal variations in the composition, trophic level, and quality of the diet in bottlenose dolphins within the central coast of the State of Veracruz, emphasizing the differences in individuals that regularly interact with artisanal fisheries.

Keywords: Trophic dynamics, feeding ecology, artisanal fisheries, human-dolphin interactions, Gulf of Mexico

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Ecosystem modeling
Energetics
Epidemiology
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Habitat use/distribution
Health and health assessment
Life history
Population dynamics

Abundance and distribution of cetaceans in the Gulf of Mexico

Mullin, Keith, NOAA NMFS, 3209 Frederic Street, Pascagoula, MS 39567, 228-549-1632, Keith.D.Mullin@noaa.gov
Co-investigators: Lance Garrison, NOAA NMFS; Patricia Rosel, NOAA NMFS
Duration of Project: 1990 - 2015

Project Description
Large-scale line-transect surveys are conducted to estimate abundance and define the spatial distribution of cetacean species in continental shelf (2 species) and oceanic (20 species) waters in the U.S. Gulf of Mexico. Generally ships are used to survey oceanic habitat and aircraft are used for coastal and outer continental shelf habitats. To meet the mandates of the Marine Mammal Protection Act, a series of surveys is conducted at a minimum every 8 years. Additional objectives of the surveys are to define the habitat of each species and to collect biopsy samples to define stock structure.

Keywords: Abundance, density, spatial distribution, cetaceans

Focal species
All Gulf of Mexico marine mammals

Focal habitats
Nearshore/coastal waters
Offshore/pelagic waters

Objectives
Conservation and management
Ecosystem modeling
Genetics/genomics
Gulf oil spill effects
Habitat use/distribution

Developing Updated Abundance Estimates for Texas Bays using Photo ID Mark-Recapture

Mullin, Keith, NOAA NMFS, 3209 Frederic Street, Pascagoula, MS 39567, 228-549-1632, Keith.D.Mullin@noaa.gov
Co-investigators: Heidi Whitehead, Texas Marine Mammal Stranding Network; Errol Ronje, NOAA

Project Description

Abundance estimates for bottlenose dolphins in the Gulf of Mexico, including the Texas coast, are more than eight years old and considered insufficient for conservation management by NMFS. For example, recently the Texas Marine Mammal Stranding Network investigated a number of bottlenose dolphin Unusual Mortality Events and due to a lack of baseline information, potential impacts to the population were difficult to assess. Updated abundance estimates are important for understanding potential impacts of future mortalities and for conservation measures. Therefore, we initiated a multi-phase project to estimate abundance for central Texas coastal bays using photo-ID mark-recapture techniques that will provide updated baseline data for dolphins inhabiting these areas. The first phase completed was Galveston West Bay. The photo-ID data can also provide information on spatial and temporal patterns such as movement patterns, site fidelity, and seasonality of individual dolphins.

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries

Objectives
Conservation and management
Habitat use/distribution
Strandings

Key Words: Photo-ID, abundance, management, Texas

Passive acoustic monitoring and mitigation of mid and deep water net tows to prevent dolphin entanglements

Norris, Thomas, Bio-Waves Inc., 364 2nd Street, Suite #3, Encinitas, CA 92024, 760-452-2575, thomas.f.norris@bio-waves.net
Co-investigators: Ken Deslarzes, Geo-Marine
Duration of Project: Summer 2011- Fall 2011
Websites: www.biowaves.net; www.biowaves.net/research/pisces-dolphin-mitigation

Project Description

In 2011 NOAA deployed their research vessel, Pisces, to sample mid-and deep-water species of marine life (i.e. fish and crustaceans). Net trawls were conducted to examine the meso and bathypelagic fauna. The net tows were conducted both during the day and night, at stations located both inside and outside of the oil spill zone. Unfortunately during one of the earlier research cruises, three spotted dolphins (*Stenella attenuata*) were incidentally caught and drowned in one of the net deployments. At night, a potentially hazardous situation existed for delphinid species (which often were attracted to nets because of concentration of prey inside), but could not be seen by the tow operators because of light conditions. Because of this, NOAA requested Bio-Waves to provide a passive acoustic system to mitigate the possibility of catching dolphins both during the day and night while net tows where being conducted. During the night, when visual observations were not possible, passive acoustic monitoring was the only effective method to detect dolphins in the area. During this research cruises, Bio-Waves acousticians monitored a towed hydrophone array for 30 minutes prior to deployment of nets, and if any dolphins were detected, the deployment of the net was delayed. If dolphins were not detected, the array was retrieved and the trawl net was deployed. During four 10-day cruises in which Bio-Waves conducted passive acoustic monitoring and mitigation, no additional dolphins were incidentally caught in nets. This demonstrated the success of passive acoustic monitoring and mitigation for this activity, with limited impact on the success of the overall research objective.

Focal species
Pantropical spotted dolphin

Focal habitats
Offshore/pelagic waters

Objectives
Behavior/behavioral
Ecology
Bioacoustics (hearing/communication)
Conservation and management
Fisheries interactions/gear research

Keywords: Acoustics, monitoring, mitigation, dolphins, PAM

A method for prioritizing research on common bottlenose dolphin stocks through evaluating threats and data availability: development and application to bay, sound and estuary stocks in Texas

Phillips, Nicole, University of Miami, Cooperative Institute for Marine and Atmospheric Studies, NOAA Fisheries, 646 Cajundome Boulevard, Suite 219, Lafayette, LA 70506, 337-291-3148, nicole.phillips@noaa.gov
Co-investigators: Patricia Rosel, NOAA/SEFSC
Duration of Project: 09/01/2012 - 12/01/2015

Focal species
Bottlenose dolphin

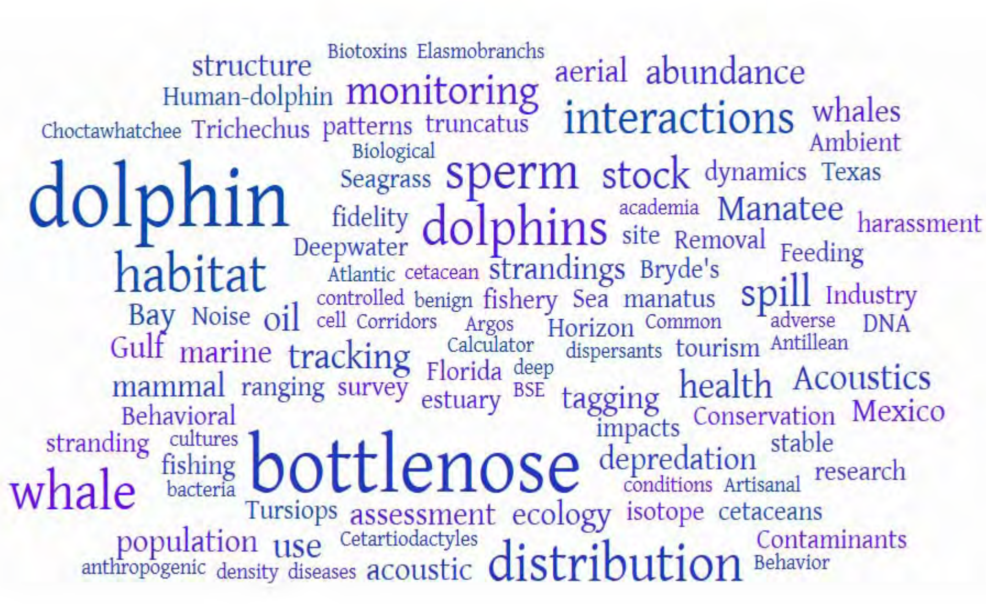
Focal habitats
Bays/sounds/estuaries

Objectives
Conservation and management

Project Description

Thirty-one stocks of common bottlenose dolphins have been delimited in the bay, sound and estuary (BSE) environments in the Gulf of Mexico from the Florida Keys to the Texas-Mexico border. For many of the stocks, up-to-date information necessary for accurate assessment of their status is limited. We have developed a scoring system to objectively prioritize these stocks relative to one another for basic stock assessment research to aid the decision making process and allow resources to be directed where they would be the most effective for meeting research and management objectives. This Threat Assessment Priority Scoring System incorporates a Cumulative Threat Score from an assessment of the presence, severity and impact of 19 potential threats impacting a given stock area and a Data Assessment Score from an evaluation of the quality of available stock assessment data for a stock. Together, the Cumulative Threat Score and Data Assessment Score are used to determine whether a particular stock should be given low, medium or high priority for research. When this method was applied to the Texas common bottlenose dolphin BSE stocks, they all scored as a 'high priority' with medium levels of threats and virtually no data assessment available for each stock. Galveston Bay, Laguna Madre and Corpus Christi Bay had the highest cumulative threat scores while Sabine Lake had the lowest, although this low score is partially attributed to a lack of comprehensive information on the threats in this area. It is expected that future work will provide the scores and priority rankings for the remaining common bottlenose dolphin BSE stocks in the Gulf of Mexico.

Keywords: Common bottlenose dolphin, threat, bay sound estuary (BSE), prioritize, Texas



Word cloud generated from key words for project descriptions

Predictive spatial modeling of seasonal bottlenose dolphin (*Tursiops truncatus*) distributions in the Mississippi Sound

Pitchford, Jonathan, IMMS, 10801 Dolphin Lane, Gulfport, MS 39503, 228-896-9182, jpitchford@imms.org
Co-investigators: Victoria Howard, Jamie Shelley, Moby Solangi
Duration of Project: 2011 - 2013

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries

Objectives
Habitat use/distribution

Project Description

Spatial distribution models (SDMs) have been useful for improving management of species of concern in many areas. This study was designed to model the spatial distribution of bottlenose dolphins among seasons of the year in the Mississippi Sound (MS) within the northern Gulf of Mexico. Models were constructed by integrating presence locations of dolphins acquired from line-transect sampling from 2011–2013 with maps of environmental conditions for the region to generate a likelihood of dolphin occurrence for winter (Jan–Mar), spring (Apr–Jun), summer (Jul–Sep), and autumn (Oct–Dec) using maximum entropy. Models were successfully generated using the program MaxEnt and had high predictive capacity for all seasons (AUC > 0.8). Distinct seasonal shifts in spatial distribution were evident including increased predicted occurrence in deepwater habitats during the winter, limited predicted occurrence in the western MS Sound in winter and spring, widespread predicted occurrence over the entire region during summer, and a distinct westward shift of predicted occurrence in the autumn. The most important environmental predictors used in SDMs were distance to shore, salinity, and nitrates, but variable importance differed considerably among seasons. Geographic shifts in predicted occurrence likely reflect both direct effects of changing environmental conditions and subsequent changes in prey availability and foraging efficiency. Overall, seasonal models helped to identify preferred habitats for dolphins among seasons of the year that can be used to inform management of this protected species in the northern Gulf of Mexico.

Keywords: Bottlenose dolphin, distribution, GIS, estuary, habitat mapping

---

Fifteen years later: An updated evaluation of the impacts and evolution of marine mammal tourism with a focus on human-dolphin interactions in Panama City, Florida

Powell, Jessica, NMFS Southeast Regional Office, 263 13th Ave S, St. Petersburg, FL 33701, 727-824-5312, jessica.powell@noaa.gov
Co-investigators: Laura Engleby, Trevor Spradlin
Duration of Project: 06/01/2014 - 07/01/2015

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management

Project Description

Marine mammal tourism has grown dramatically over the past 20 years resulting in exploitive tourism throughout U.S. waters and intensifying concerns about sustainability and health of marine mammal populations and individuals. This is particularly true in Panama City, where boat operators illegally feed wild bottlenose dolphins in order to condition them to approach vessels and swimmers. Our study repeats and updates previous work sponsored by the Marine Mammal Commission (MMC) conducted by Samuels et al. (2000 and 2003) and Samuels and Bejder (1998 and 2004) to (1) provide an updated literature review on the impacts of human activities on marine mammals, and (2) replicate the Panama City field study to evaluate the current status of "swim-with-dolphin" and other dolphin-human interactions. An updated literature review will be useful to MMC and NMFS to help evaluate future management needs. In addition, a re-evaluation of the Panama City case study will provide an assessment of the long-term effects of tourism and provide important insights to managers and law enforcement officials who need to develop new strategies to address this hot-spot area where chronic feeding and harassment of wild dolphins takes place.

Keywords: Swim with dolphins, tourism impacts, feeding, harassment

Evaluating the Effectiveness of a Voluntary Program in Reducing Vessel Based Harassment in Key West, Florida

Powell, Jessica, 263 13th Ave S, St. Petersburg, FL 33701, 727-824-5312, jessica.powell@noaa.gov
Co-investigators: Laura Engleby, Nick Farmer
Duration of Project: 05/01/2005 - 09/01/2011

Focal species
Bottlenose dolphin

Focal habitats
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management

Project Description

A resident population of common bottlenose dolphins (*Tursiops truncatus truncatus*) inhabits the coastal waters near Key West, Florida. During the summer, dolphins are routinely sighted in a 16 km2 sand bottom area with clear, shallow water (1-6 m). This area is sheltered from wind and located less than 10 km northwest of several major harbors. The number of vessels conducting daily dolphin tours in this area increased from one operator in 1986 to 37 operators in 2004. To mitigate this potential increase for vessel-based harassment, a voluntary education program, Dolphin SMART, was developed with substantial tour operator involvement and was implemented in 2007. This program continues today. To evaluate the effectiveness of this program, behavioral studies were conducted prior to, during, and following implementation. Focal dolphin behavior was monitored and recorded across age and sex classes in three areas ('Tourism', 'Transit', and 'Remote') containing different levels of vessel traffic and tourism pressure. Results suggest that despite Dolphin SMART implementation, vessel interactions continue to significantly impact dolphin behavior. Dolphins observed within the 'Tourism' area traveled significantly more than animals observed in other areas ($p=0.02$). In the 'Tourism' area, there was a time-lagged (6 minute) impact of vessel presence on the number of dolphin groups ($p<0.05$), with the magnitude of vessel disturbance predicting group fission ($p<0.001$). There was also a time-lagged (9 minute) impact of the magnitude of vessel disturbance on group cohesion ($p<0.05$). In the 'Transit' area, a time-lagged (6 minute) effect of the magnitude of vessel disturbance was a significant predictor of changes in travel activity ($p<0.01$). No impacts of vessel disturbance were observed in the 'Remote' area. Harassment to dolphins still occurs near Key West despite the Dolphin SMART program, suggesting other mitigation measures are necessary to prevent further population or individual level impacts to the dolphins from tourism.

Keywords: Bottlenose dolphins, harassment, dolphin tours, tourism

---

Insights from Whaling Logbooks on Cetaceans in the Gulf of Mexico

Reeves, Randall, Marine Mammal Commission, 27 Chandler Lane, Hudson, Quebec J0P 1H0, Canada, 450-458-6685, rrreeves@okapis.ca
Co-investigators: Judy Lund, Tim Smith, Beth Josephson
Duration of Project: 2009 - 2011

Focal species
Bryde's whale
Short-finned pilot whale
Sperm whale

Focal habitats
Offshore/pelagic waters

Objectives
Conservation and management
Ecology

Project Description

Extracted data from 18th and 19th C. American whaling logbooks, tabulated and mapped catches and sightings of all species. See paper in Gulf of Mexico Science 29(1) (2011).

Keywords: Sperm whale, Bryde's whale, pilot whale, whaling

DWH Natural Resource Damage Assessment Studies for Bay, Sound and Estuary Bottlenose Dolphins Following the Deepwater Horizon Oil Spill

Schwacke, Lori, NOAA, 331 Fort Johnson Road, Charleston, SC 29412, 843-725-4821, lori.schwacke@noaa.gov
Website: response.restoration.noaa.gov/about/media/study-shows-gulf-dolphins-poor-health-following-deepwater-horizon-oil-spill.html
Co-investigators: Teri Rowles, NMFS; Keith Mullin, NMFS; Patricia Rosel, NMFS; Mandy Tumlin, LDWF; Willie McKercher, MS DEQ
Duration of Project: 05/01/2010 - 08/01/2015

Project Description

As part of the Natural Resource Damage Assessment (NRDA) following the Deepwater Horizon (DWH) oil spill, a series of studies including longitudinal photo-identification surveys, remote biopsy sampling, and capture-release health assessments, have been conducted for bottlenose dolphins in multiple Gulf of Mexico sites. While the most intensive efforts have been in Barataria Bay, Louisiana, a site which received some of the heaviest and most prolonged oiling, studies have also been conducted in Chandeleur Sound, Mississippi Sound, and St. Joseph Bay. In addition, Sarasota Bay has served as a reference site for the health assessment studies. The objective of the studies has been to investigate potential sub-lethal effects from the DWH oil spill and to estimate associated impacts on the dolphin stocks that were exposed to DWH oil. The studies have been conducted by a collaborative team including investigators from both NOAA offices (NOS and NMFS), as well as State agencies (Louisiana Department of Wildlife and Fisheries, Mississippi Department of Environmental Quality) and non-governmental organizations (National Marine Mammal Foundation, Chicago Zoological Society).

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Conservation and management
Cumulative effects
Ecosystem modeling
Epidemiology
Genetics/genomics
Gulf oil spill effects
Health and health assessment
Life history
Population dynamics
Reproductive biology
Strandings
Toxicology

Keywords: Deepwater Horizon, oil spill, dolphin-health, toxicity

---

Testing Tackle Modifications and Fish Descender Tools for reducing dolphin depredation and scavenging of sport fish

Shippee, Steve, Marine Wildlife Response, 1557 Hwy 98 West, Mary Esther, FL 32569, 850-516-7934, shippee3@cox.net
Co-investigators: Randall Wells, Chicago Zoological Society; Katie McHugh, Chicago Zoological Society
Duration of Project: 08/01/2014 - 02/01/2016

Project Description

Several depredation mitigation devices (DMDs) designed for attachment to terminal fishing tackle have been suggested as deterrents to discourage dolphins from taking hooked fish. Descender tools may offer a means to reduce dolphins' scavenging on discarded fish that are being returned to the seafloor. We are conducting in-situ tests of the applicability and effectiveness of using these devices aboard recreational fishing vessels as a means to reduce dolphin interactions that might have long-term effectiveness if accepted by the sport angler.

Focal species
Bottlenose dolphin

Focal habitats
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Fisheries interactions/gear research

Keywords: Depredation, scavenging, recreational fishing, dolphin interactions

Can simple tackle modifications and use of fish descenders decrease harmful fishery interactions with bottlenose dolphins?

Steve Shippee[1], Hannah Roth[1], Christina Toms[1,2], Chris Verlinde[3], Tim Doran[1], Randy Wells[4], and Katherine McHugh[4]

[1]Marine Wildlife Response, Mary Esther, FL
[2]University of Central Florida, Orlando, FL
[3]Florida Sea Grant, IFAS/University of Florida, Milton, FL
[4]Sarasota Dolphin Research Project of Chicago Zoological Society, Sarasota, FL

Poster abstract
Bottlenose dolphins interact frequently with recreational fishing at offshore reefs in the northern Gulf of Mexico resulting in potential harm to the animals and to fish stocks. Anglers complain that dolphins frequently depredate fish off hooks being reeled up from depth and scavenge on discarded fish that suffer from barotrauma and disorientation. Modified terminal tackle intended for bottom fishing rigs has been suggested as a method to reduce depredation, and fish descender tools are being promoted as a means to successfully return embolized reef fish to depth. We are conducting a study to measure the effectiveness of using these techniques to reduce dolphin interactions with recreational fishing and will evaluate: 1) tackle modifications (wires, shrouds, etc.) to deter depredation; 2) effectiveness of commercially available descender devices to mitigate dolphin scavenging of released fish; 3) applicability of using such devices in inshore fishing to alleviate dolphin interactions; and 4) acceptability of using these tools by sport anglers. The results of this study will benefit outreach efforts to encourage use of mitigation techniques that reduce dolphin interactions and enhance conservation of both dolphins and reef fish stocks.

Assessment of depredation by bottlenose dolphins (*Tursiops truncatus*) in the Northwest Florida and Alabama sport fishery

Shippee, Steve, Marine Wildlife Response, 1557 Hwy 98 West, Mary Esther, FL 32569, (850) 516-7934, shippee3@cox.net
Co-investigators: Randall Wells, Chicago Zoological Society
Duration of Project: 04/01/2008 - 09/01/2010

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Fisheries interactions/gear research
Foraging/diet
Habitat use/distribution
Strandings

Project Description
We recognized the need to gain an understanding of the dolphin community in this part of the Gulf Coast associated with fishery interactions (FI) and to answer questions about habitat use and foraging patterns. This study focused on observations of dolphins and FI on deep-sea trips and at fishing piers to define and characterize the extent of the problem. We were also interested in exploring potential mitigation strategies. Developing a partnership with the local stranding networks led to better monitoring for FI in stranded animals. The objectives were to: provide a general assessment of the scope of the FI problem with sport fishing (at deep-sea reefs and shoreline fishing piers) in the North Central Gulf Coast; determine the frequency of dolphin FI with sport fishing; differentiate between depredation and other forms of interactions; investigate possible relationships between FI and other variables; gauge economic impacts; seek mitigation techniques and solutions; and provide new tools and data for use by fisheries managers.

Keywords: Fishing interactions (FI), deep sea reefs, strandings, bottlenose dolphin, depredation

Littoral Acoustic Demonstration Center - Gulf Ecological Monitoring and Modeling (LADC-GEMM)

Sidorovskaia, Natalia, Dept. of Physics, University of Louisiana at Lafayette, UL BOX 44210, Lafayette, LA 70504-4210, 337-482-6274, nas@louisiana.edu
Co-investigators: George E. Ioup, University of New Orleans; Dave Mellinger, Oregon State University; ASV & Seiche Measurements
Duration of Project: 01/2015 – 12/2017
Websites: www.physics-louisiana.org/natalia-sidorovskaia-bio; www.ladcgemm.org

Project Description

The three year BP/GOMRI sponsored LADC-GEMM consortium (2015-2017) will continue passive acoustic monitoring of changes in regional distribution and abundance of several strategic species of marine mammals (endangered sperm whales, beaked whales, and dolphins). The operational area of interest will cover a 50 mi radius around the Gulf of Mexico (GoM) 2010 oil spill site. The LADC-GEMM consortium members include the University of Louisiana at Lafayette, the University of New Orleans, the University of Southern Mississippi, and Oregon State University. The consortium's expertise and experimental capabilities are extended through collaboration with Proteus Technologies LLC, R2Sonic LLC, ASV Ltd., and Seiche Measurements Ltd. The regional abundance estimates obtained from the newly collected acoustic data will be compared to ones derived from baseline data collected by LADC before and right after the spill. The LADC-GEMM consortium is in a unique position among those conducting passive acoustic studies in the GoM given its access to data unavailable elsewhere. Prior to the 2010 oil spill, LADC had conducted six broadband passive acoustic surveys in the GoM. In 2007 LADC conducted a two-week visual and acoustic survey of marine mammal activity just 9 miles and 23 miles from the spill site, giving LADC a unique pre-spill baseline dataset of marine mammal activity and anthropogenic soundscapes near the oil spill site. Earlier surveys had also been conducted at sites 50 miles from the incident site. In September 2010, LADC returned to those same survey sites to repeat underwater acoustic recordings, gathering data to support the first and possibly only comparisons of pre- and post-spill estimates of the marine mammal populations in the vicinity of the event based on their acoustic activity. The overall new project objectives are three-fold:

1) Establish a precedent of long-term ecosystem-centered passive acoustic monitoring (E-PAM) of the marine mammal recovery after the oil spill, based on previously collected baseline data, continued data collection utilizing advanced PAM technology, and development of population dynamics prediction models;
2) Design and test a new cost-effective PAM approach for near real-time detection, characterization, and monitoring of the impact of environmental changes of different magnitude and duration on deep diving GoM marine mammals by utilizing the integrated experimental capabilities of the consortium, which will include bottom-moored listening buoys, deep-diving Seagliders, and autonomous surface vehicles;
3) Develop an integrated acoustic data processing technique, which will allow in-depth understanding of the relations between observed/predicted abundance variations and underlying reasons decipherable from collected acoustic data, such as anthropogenic noise soundscapes, food supply, stock composition (adults versus calves, females versus males, etc.), and seasonal migrations.

The research outcomes will provide data on regional stock population health for several strategic species of marine mammals (endangered sperm whales, beaked whales, and dolphins) and will stipulate recommendations for needed mitigation efforts to improve various stock recoveries. The outcomes of the research will also aid in improving regulations, monitoring, and mitigation efforts for everyday industrial operations in the northern GoM.

Focal species
Atlantic spotted dolphin
Blainville's beaked whale
Cuvier's beaked whale
Dwarf sperm whale
Gervais' beaked whale
Killer whale
Pantropical spotted dolphin
Risso's dolphin
Short-finned pilot whale
Sperm whale
Spinner dolphin
Striped dolphin

Focal habitats
Offshore/pelagic waters

Objectives
Bioacoustics (hearing/communication)
Ecology
Ecosystem modeling
Gulf oil spill effects
Habitat use/distribution
Noise effects
Population dynamics

Keywords: ecosystem passive acoustic monitoring, sperm whales, beaked whales, dolphins, marine mammal abundance, population model, population growth rate

Dolphin acoustic and visual surveys on the West Florida Shelf

Simard, Peter, University of South Florida, College of Marine Science, 140 7th Ave. S., St. Petersburg, FL 33701, 727-348-5676, psimard@mail.usf.edu
Co-investigators: David Mann, Loggerhead Instruments; Shannon Gowans, Eckerd College; Chris Stallings, University of South Florida
Duration of Project: 06/01/2008 - 12/01/2020

Project Description
I use both boat-based visual surveys and autonomous acoustic recorders to determine spatial and temporal patterns of dolphins on the West Florida Shelf. Species mainly limited to bottlenose dolphins and Atlantic spotted dolphins. Study area has changed over the duration of the study (since 2008) but is currently from Tampa Bay to Clearwater, out to the 30m isobath. I also use autonomous acoustic recorders to monitor bottlenose dolphins in an adjacent inshore location (Boca Ciega, Tampa Bay) in collaboration with the Eckerd College Dolphin Project (Shannon Gowans). Finally, my research also involves acoustic recordings using a boat-based towed hydrophone during focal group follows of dolphins.

Keywords: Acoustic, distribution, bottlenose dolphin, Atlantic spotted dolphin, West Florida Shelf

Focal species
All Gulf of Mexico marine mammals
Atlantic spotted dolphin
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters
Offshore/pelagic waters

Objectives
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Ecology
Habitat use/distribution
Noise effects

Analysis of existing USGS manatee telemetry data for the northern Gulf of Mexico

Slone, Daniel, USGS Southeast Ecological Science Center, 7920 NW 71st St, Gainesville, FL 32653, 352-264-3551, dslone@usgs.gov
Co-investigators: James Reid, USGS; Susan Butler, USGS; Ruth Carmichael, DISL
Duration of Project: 3/2011 - 9/2012

Project Description
We propose to compile and analyze existing manatee telemetry data to produce habitat use and travel corridor maps for Apalachicola Bay, Wakulla, and other panhandle areas. Maps will feature low-speed use of habitat features, such as resting and feeding, and higher-speed use of travel corridors. We will compare maps of manatee use patterns with those of Florida Wildlife Research Institute aerial survey distribution data to ascertain correlations. Discrepancies between data types would point to areas to focus on in future aerial survey work, or tagging operations for more detailed telemetry studies. With all data types, correlate manatee use with measured oil spill coverage on SAV and emergent (marsh) vegetation, to indicate possible areas of forage impact, or manatee exposure to oil contamination.

Keywords: Manatee, seagrass, Deepwater Horizon, Gulf of Mexico

Focal species
Manatee

Focal habitats
Rivers/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Ecology
Ecosystem modeling
Gulf oil spill effects
Habitat use/distribution

Florida Manatee Movement and Habitat Use in the Northern Gulf of Mexico

Slone, Daniel, USGS Southeast Ecological Science Center, 7920 NW 71st St, Gainesville, FL 32653, 352-264-3551, dslone@usgs.gov
Co-investigators: James Reid, Susan Butler, Robert Bonde
Duration of Project: 6/2013 - 9/2017

Focal species
Manatee

Focal habitats
Rivers/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Ecology
Ecosystem modeling
Energy Industry interactions
Foraging/diet
Habitat use/distribution
Health and health assessment

Project Description

The overall goal of the project is to describe manatee movements and habitat use through the northern Gulf of Mexico to determine and aid in the management of manatee interactions with energy industry shipping and operations in the region. The area of interest for this study extends from the Suwannee River, Florida, west along the Gulf coast through Texas. Manatee distribution and habitat will be assessed through a comprehensive set of complementary research activities that together will provide information on spatial and temporal manatee use of the northern Gulf of Mexico, the health and disposition of individual manatees traversing the study area, and the extent and quality of the habitat that they may use. Several potential research actions involving multiple agencies and partners will be considered. Habitat characterization will begin with a survey of available data, especially from recent work that supported research following the 2010 Deepwater Horizon incident (REF). Areas of interest within the study area that do not have adequate data coverage will be targeted for aerial imagery interpretation, and field characterization. Temperature and salinity probes (Onset, Inc.) will be used to provide continuous logging of environmental parameters at selected sites to determine seasonal water temperature and salinity regimes across the study area. Photographs of manatees in the northern GOM will be compiled and matched to the Manatee Individual Photo-identification System (MIPS) database to document individual animal movements and fidelity, as well as prior sighting histories. Individual manatees will be captured for health assessments and radio tagging. Manatee captures typically involve nylon nets deployed by either land-based or open-water techniques on targeted manatees. Individual manatee health will be monitored, including temperature, respiration and pulse rate, and handling time will be kept to a minimum (less than one hour if possible). Assessed individuals will be released at or close to their original capture location. Additional data recorded upon capture will include morphometrics (total length and girths), sex and complete photographs consisting of scars or natural markings. During capture complete out-of-water monitoring and biological sampling will be performed by trained personnel under veterinary supervision. Captured manatees in the northern GOM will be tagged with GPS to record location, transmitter temperature, activity and dive periods, and other sensor data. Specific findings will include identification of habitat hotspots, site fidelity, characterization of large-scale moves or movement highways and characterization of foraging movements. With the addition of on-board readings from Time-Depth Recorders, or salinity and temperature sensors, the activity of manatees can be categorized into behavior types such as foraging, travelling, resting, drinking, or other types. Once a part of the underlying habitat has been described, the manatees' use of similar habitat can be used to predict locations of other similar habitat, which can then be verified through field sampling. This form of GIS interpretation, integrated with field sampling, will be used throughout the period of performance to create maps of functional habitat types, along with detailed assessments of the underlying habitat components (salinity, temperature, seagrass, wave activity, etc.) that contributes to manatee use (or lack of) the study area.

Keywords: Manatee, habitat use, energy industry, movement, seagrass

Louisiana Marine Mammal and Sea Turtle Rescue Program

Smith, Suzanne, Audubon Nature Institute, 14001 River Rd, New Orleans, LA 70131, 504-235-3005, ssmith@auduboninstitute.org
Co-investigators: Dr. Elsburgh "Tres" Clarke; Dr. Robert MacLean
Website: www.auduboninstitute.com

Project Description
We are a rehabilitation facility, and also provide infrastructure and personnel for marine mammal necropsies.

Focal species
All Gulf of Mexico marine mammals

Abundance and site fidelity of dolphins in Mississippi Sound and adjacent waters

Solangi, Moby, Ph.D., IMMS, 10801 Dolphin Lane, Gulfport, MS 39503, 228-896-9182, solangim@aol.com
Co-investigators: Dr. Jonathon Pitchford, Dr. Eric Pulis, Dr. Andy Coleman
Duration of Project: 2002 - continuing
Website: www.imms.org

Project Description
The project is a multiyear study in the Mississippi Sound and adjacent waters to study population trends and site fidelity of bottlenose dolphins. This involves boat transect surveys and photo ID work.

Keywords: Population dynamics, site fidelity, stock assessment

Focal species
All Gulf of Mexico marine mammals

Focal habitats
Bays/sounds/estuaries

Objectives
Anatomy/taxonomy
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Cognition
Conservation and management
Cumulative effects
Ecology
Epidemiology
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Gulf oil spill effects
Habitat use/distribution
Health and health assessment
Life history
Noise effects
Parasitology
Population dynamics
Reproductive biology
Strandings
Toxicology

Bottlenose stranding response and research

Solangi, Moby Ph.D., IMMS, 10801 Dolphin Lane, Gulfport, MS 39503, 228-896-9182, solangim@aol.com
Co-investigators: Dr. Eric Pulis; Dr. Jonathon Pitchford; Dr. Delphine Shannon
Duration of Project: 1984 - continuing
Website: www.imms.org

Project Description
Respond to sick, injured, and dead bottlenose dolphins. Conduct necropsies. Rehabilitate and release sick injured dolphins, evaluate cause and effect relationships for mortality .

Keywords: Strandings, bottlenose dolphin, research, conservation, rehabilitation

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries

Objectives
Anatomy/taxonomy
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Cognition
Conservation and management
Cumulative effects
Ecology
Epidemiology
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Gulf oil spill effects
Habitat use/distribution
Health and health assessment
Life history
Noise effects
Parasitology
Population dynamics
Reproductive biology
Strandings
Toxicology

Correlation of the Broadband Spectral Characteristics of Bottlenose Dolphin Signatures with Dolphin Behavior in the Mississippi Sound

Stanic, Steve, USM / Southern Acoustics, stanic@cableone.net
Co-investigators: Bob Brown; Mobashir Solangi; Ted Kennedy
Duration of Project: 06/01/2008 - 06/01/2009

Project Description
A series of acoustic measurements and visual observations were made of Bottlenose dolphins in the Mississippi Sound. A portable acoustic monitoring system recorded dolphin echolocation clicks, wideband burst pulses and narrowband frequency modulated whistles. The signal spectra were correlated with observations of dolphin behavior. The results showed that when these dolphins are diving and traveling, the primary signals are short echolocation clicks. During what appeared to be social interactions, the signals were more complex broadband amplitude modulated whistles. MTS/IEEE Proceedings of Oceans'09. Oct 2009.

Keywords: Acoustics, spectral signatures, behavior

Focal species
All Gulf of Mexico marine mammals
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Noise effects

Ambient Noise Measurements in the Mississippi Sound

Stanic, Steve, USM / Southern Acoustics, stanic@cableone.net
Co-investigators: L. Newcomb; M. Solangi; D. Vanderpool
Duration of Project: 06/01/2007 - 07/01/2008

Focal species
All Gulf of Mexico marine mammals

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Bioacoustics (hearing/communication)
Noise effects

Project Description

During the spring, summer, and fall of 2004, underwater ambient noise measurements were conducted in the Mississippi Sound. The Naval Research Laboratory, Stennis Space Center (NRL–Stennis) and the Institute for Marine Mammal Studies (IMMS) collaborated in acquiring acoustic ambient noise data at eight (8) sites in the Mississippi Sound. The sites were chosen to represent sites of expected high anthropomorphic noise sources and a control site with few or no expected anthropomorphic noise sources. (Research supported by IMMS) J. Newconb, S. Stanic, A. Cranford, D. Vanderpool, and M. Solangi, "Ambient Noise Measurements in the Mississippi Sound," NRL/MR/7185-08-9117, 2008.

Keywords: Acoustics, ambient noise

Ambient noise measurements in and around the Gulfport Mississippi harbor and its potential influence on marine mammals

Stanic, Steve, USM / Southern Acoustics, stanic@cableone.net
Co-investigators: Bob Brown, Ted Kennedy, Mobashir Solangi
Duration of Project: 06/01/2007 - 07/01/2008

Focal species
All Gulf of Mexico marine mammals

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Bioacoustics (hearing/communication)
Noise effects

Project Description

This report documents the results of a pilot study designed to determine the feasibility of monitoring bottlenose dolphin 24 hours a day, 7 days a week at the entrance to the Gulfport harbor. The primary task concentrated on the measurement, and analysis, of noise recorded in this area. These measurements also have the potential to correlate changes in ambient noise levels, with dolphin population numbers in these areas. It also documents the activity of dolphins during the evening and early morning hours. S. Stanic, R. Brown, E. Kennedy, D. Malley, and M, Solangi, "Ambient noise Measurements in and around the Gulfport Harbor and it Potential Influence on Marine Mammals," NRL/MR/ 184-07-9049, (2007).

Keywords: Acoustics, ambient noise

Florida Marine Mammal Rescue, Carcass Salvage, Necropsy
Ward, Leslie, FWC / Fish & Wildlife Research Institute, 100 SE 8th Ave. St. Petersburg, FL 33701, 727-502-4732, leslie.ward@myfwc.com
Co-investigators: Martine de Wit, FWC; Andy Garrett, FWC; Kat Frisch, FWC
Duration of Project: 1985 - ongoing
Website: myfwc.com/research/manatee/

Project Description
The purposes of the FWC marine mammal (primarily manatees) carcass salvage and necropsy program are to characterize and record information to determine cause(s) of death and obtain information on morphology, life-history, and health. The statewide Florida program is a source of information used to determine and mitigate human-related causes of death and to investigate Unusual Mortality Events. FWC also receives calls from the public reporting marine mammals in distress. Field staff members respond to these calls and coordinate a network of personnel from various agencies and organizations to collaborate in conducting rescues and when necessary transport to rehabilitation facilities. FWC manages the Oceanaria Reimbursement Assistance Program for rescued, rehabilitated, and released Florida manatees. The Florida Legislature recently increased this program appropriation that helps support contracted and federally permitted manatee rehabilitation facilities in Florida in the care and treatment of sick, injured or orphaned Florida manatees.

Focal species
All Gulf of Mexico marine mammals
Manatee
Stranded marine mammals along Florida coast

Focal habitats
Rivers/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Anatomy/taxonomy
Conservation and management
Foraging/diet
Genetics/genomics
Health and health assessment
Life history
Strandings

Keywords: Stranding, necropsy, and rescue

Manatee Aerial Surveys
Ward, Leslie, FWC / Fish & Wildlife Research Institute, 100 SE 8th Ave. St. Petersburg, FL 33701, 727-502-4732, leslie.ward@myfwc.com
Co-investigators: Julien Martin, USGS; Holly Edwards, FWC
Duration of Project: 1985 - ongoing
Website: myfwc.com/research/manatee/projects/population-monitoring/

Project Description
FWC uses various survey designs to acquire information on manatee abundance, distribution, and habitat use.

Focal species
Manatee

Focal habitats
Rivers/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Gulf oil spill effects

Keywords: Aerial, survey, abundance, distribution, habitat

Photo-Identification and Genetic Monitoring of Florida Manatees

Ward, Leslie, FWC / Fish & Wildlife Research Institute, 100 SE 8th Ave. St. Petersburg, FL 33701, 727-502-4732, leslie.ward@myfwc.com
Co-investigator: Cathy Beck, USGS; Kari Rood, FWC; Mike Tringali, FWC
Duration of Project: 1980s - ongoing
Website: myfwc.com/research/manatee/projects/photo-identification/

Project Description
Manatee photo-identification in the Southeast U.S. is a multi-agency effort that includes USGS, FWC, and Mote Marine Lab (MML). A concerted photo-identification effort has been in place for decades. More recently, efforts from various institutions including USGS, UF, FWC, and MML were made to expand and refine the array of genetic tools for the Florida manatee. Individual identification allows monitoring of survival rates in capture-recapture and capture-recapture-recovery studies.

Keywords: Photo-identification, population, monitoring, genetics, survival rate

Focal species
Manatee

Focal habitats
Rivers/inland waters
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Conservation and management
Genetics/genomics
Life history
Population dynamics

Sarasota Dolphin Research Program

Wells, Randall, Chicago Zoological Society, c/o Mote Marine Lab, 1600 Ken Thompson Pkwy, Sarasota, FL 34242, 941-388-2705, rwells@mote.org
Co-investigators: Katherine McHugh; Jason Allen; Aaron Barleycorn
Duration of Project: 10/01/1970 - ongoing
Website: www.sarasotadolphin.org

Project Description
Long-term research on a resident population of bottlenose dolphins near Sarasota, Florida, initiated in 1970. Research examines biology, ecology, health and body condition, environmental contaminant concentrations, behavior and communication, natural history, life history, reproductive success, and human interactions. Research methods include photographic identification, health assessment, tagging and tracking, biopsy sampling, fish surveys, and focal animal behavioral observations. We also engage in the development and refinement of research techniques, such as telemetry. Research is focused in the multi-decadal, multi-generational, year-round resident Sarasota Bay dolphin community, which includes up to 5 concurrent generations of individuals up to 64 years of age, but also extends into surrounding bay, sound and estuary waters, as well as offshore in the Gulf of Mexico. The program also provides training opportunities in field and analytical techniques.

Keywords: Bottlenose dolphin, health assessment, tagging and tracking, photo-identification, environmental contaminants

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Bioacoustics (hearing/communication)
Conservation and management
Cumulative effects
Ecology
Ecosystem modeling
Energetics
Epidemiology
Fisheries interactions/gear research
Foraging/diet
Genetics/genomics
Gulf oil spill effects
Habitat use/distribution
Health and health assessment
Life history
Noise effects
Parasitology
Population dynamics
Reproductive biology
Strandings
Toxicology

Gulf of Mexico Dolphin Identification System (GoMDIS)

Wells, Randall, Chicago Zoological Society, c/o Mote Marine Lab, 1600 Ken Thompson Pkwy, Sarasota, FL 34242, 941-388-2705, rwells@mote.org
Co-investigators: Carolyn Cush, Chicago Zoological Society; Allison Honaker, Chicago Zoological Society; Jason Allen, Chicago Zoological Society
Duration of Project: 2011 - Ongoing
Website: www.sarasotadolphin.org

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Gulf oil spill effects
Habitat use/distribution
Population dynamics

Project Description
We manage the collaborative Gulf-wide bottlenose dolphin photo-identification catalog. PIs of photo-ID projects around the Gulf use GoMDIS as a repository for ID catalog images and accompanying metadata. Through an online interface, catalogs are accessible to all researchers who contribute images, to facilitate across-site matches, and ensure that data are archived for future research.

Keywords: Bottlenose dolphin, photographic identification, ranging patterns, site fidelity

---

Tagging and tracking of bottlenose dolphins in the Northern Gulf of Mexico

Wells, Randall, Chicago Zoological Society, c/o Mote Marine Lab, 1600 Ken Thompson Pkwy, Sarasota, FL 34242, 941-388-2705, rwells@mote.org
Co-investigators: Lori Schwacke, National Ocean Service; Teri Rowles, National Marine Fisheries Service; Eric Zolman, National Ocean Service
Duration of Project: 08/01/2011 - 04/01/2015
Website: www.sarasotadolphin.org

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Gulf oil spill effects
Habitat use/distribution
Population dynamics

Project Description
As part of the NRDA investigation of the potential impacts of the Deepwater Horizon oil spill, the Sarasota Dolphin Research Program provided tagging and tracking services. Satellite-linked tags were attached to bottlenose dolphins in Barataria Bay in 2011, 2013, and 2014, and in the Mississippi Sound in 2013. Dolphins were tracked for up to 260 days each.

Keywords: Bottlenose dolphins, satellite-linked tags, tracking, ranging patterns, distribution and habitat use

Enhancement of response, treatment and data collection from living and dead marine mammals stranded along the Texas coast

Whitehead, Heidi, Texas Marine Mammal Stranding Network, 4700 Avenue U, Galveston, TX, 77551, 832-385-7811, hwhitehead@tmmsn.org
Co-investigators: Sarah Piwetz and Dr. Richard Henderson, Texas Marine Mammal Stranding Network
Website: www.tmmsn.org

Project Description
The Texas Marine Mammal Stranding Network responds to an average of 150 stranded or injured marine mammal reports and conducts surveys for stranded marine mammals. Live stranded cetaceans are either euthanized or returned to designated rehabilitation facilities for assessment, treatment and release or placement. With enhanced diagnostic capabilities, live strandings receive targeted treatment and aid in determining initial cause of stranding. Using techniques of necropsy and clinical laboratory testing samples are collected and evaluated for use in assessing the incidence or prevalence of human induced injury or mortality and detection of emerging diseases.

Keywords: Stranding, rehabilitation, necropsy, disease

Focal species
All Gulf of Mexico marine mammals

Focal habitats
Texascoastal waters

Objectives
Conservation and management
Fisheries interaction/gear research
Gulf oil spill effects
Life history
Strandings

Towards a Gulf-wide Bird Monitoring Network: Identifying Objectives to Prioritize Action

Randy Wilson[1], John Tirpak[2], and Melanie Driscoll[3]
[1]U.S. Fish and Wildlife Service, 6578 Dogwood View Pkwy, Jackson, MS 39213, 601-965-4903 ext 300, randy_wilson@fws.gov
[2]U.S. Fish and Wildlife Service, 700 Cajundome Blvd, Lafayette, LA 70506, 337-266-8565, john_tirpak@fws.gov
[3]National Audubon Society, Gulf Coast Conservation/Mississippi Flyway, 6160 Perkins Road, Baton Rouge, LA 70808, 225-768-0820, mdriscoll@audubon.org, www.audubon.org

Project Description
Birds are a conspicuous and remarkable natural resource of the Gulf of Mexico. Hundreds of species and millions of individual birds are supported by barrier islands, beaches, marshes, near-shore and offshore waters and coastal forests. Although many avian monitoring projects have been implemented, scientist and conservationist lack a comprehensive and coordinated approach to monitoring avian resources across the northern Gulf of Mexico. To address this need, an ambitious plan is being developed by a small consortium of researchers, managers, coordinators, and administrators representing a subset of state and federal agencies, NGOs, universities, and partnerships across the northern Gulf of Mexico. This group has been working to define a vision and process for developing the role of bird monitoring in achieving integrated, efficient, and effective Gulf of Mexico management and recovery. To date we have identified the goals, objectives, and metrics of success for the program through a Structured Decision Making approach, and now have a mostly completed SDM decision tool by which we can judge the appropriateness of proposed monitoring packages. Specifically, this integrated monitoring program will serve multiple goals, including monitoring long term responses to anthropogenic and natural drivers, detecting unpredicted changes in status and trends, and detecting response to conservation and management actions. The monitoring plan is expected to be long term in nature, taxonomically diverse in scope, and to cover the Gulf of Mexico from freshwater to pelagic zones. The team anticipates using identified objectives to (1) facilitate communication regarding avian monitoring needs; (2) guide develop of a comprehensive, coordinated monitoring strategy; and (3) utilize the objectives and value models to develop a prioritization tool to assist funding agencies.

Impacts of the 2010 Deep Water Horizon Oil Spill on Estuarine Bottlenose Dolphin Populations in the West Florida Panhandle

Worthy, Graham, University of Central Florida, 4000 Central Florida Blvd, Bldg 20, Orlando, FL 32816, 407-823-4701, Graham.Worthy@ucf.edu
Co-investigators: Randall Wells, Chicago Zoological Society; Steve Shippee, Marine Wildlife Rescue
Duration of Project: 09/01/2010 - 12/31/2011

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Behavior/behavioral ecology
Conservation and management
Ecology
Ecosystem modeling
Foraging/diet
Habitat use/distribution
Strandings

Project Description

Our UCF team in partnership with staff of the Florida Fish and Wildlife Research Institute (FWRI) and the Sarasota Dolphin Research Program (SDRP) at Mote Marine Laboratory provided a rapid response study to evaluate the local bottlenose dolphin status in this region. We expanded on previous research that had been conducted in Choctawhatchee Bay to incorporate the Pensacola Bay segment of the area, and conducted a comprehensive Mark-Recapture effort over an 18 month period to create a photo-id catalog of individual dolphins for estimating dolphin abundance, habitat use, site fidelity, grand scale movement, and foraging patterns. In addition, we collected remote dart-biopsy samples from free-swimming dolphins inhabiting discrete segments of the habitat in order to elucidate foraging dynamics and genetic structure. Collections of putative prey species allowed analyses to be made of nutritional characteristics that would lead to a predictive model of diet composition of the apex predators (e.g. dolphins) and therefore potential food chain effects on their health.

Keywords: Dolphin abundance, northwestern Florida Panhandle, stable isotope, putative prey, Choctawhatchee Bay

---

Filling the gaps: Bottlenose dolphin population dynamics, structure, and connectivity in the Florida Panhandle

Worthy, Graham, University of Central Florida, 4000 Central Florida Blvd, Bldg 20, Orlando, FL 32816, 407-823-4701, Graham.Worthy@ucf.edu
Co-investigators: Christina Toms, University of Central Florida
Duration of Project: June 2013 - August 2016
Website: oceans4generations.wix.com/oceans4generations

Focal species
Bottlenose dolphin

Focal habitats
Bays/sounds/estuaries
Nearshore/coastal waters

Objectives
Conservation and management
Ecology
Foraging/diet
Genetics/genomics
Population dynamics

Project Description

The Florida Panhandle coastline has been exposed to numerous anthropogenic and ecological threats in the past few decades (e.g., chemical spills, pollution, infectious disease, and red tide events), including the Deep Water Horizon oil spill. This dissertation research focuses on the historically disturbed yet understudied Pensacola Bay area and neighboring systems. Project goals include (1) estimating survival, seasonal abundance, site-fidelity and residency patterns of bottlenose dolphin in the Pensacola Bay system using photo-ID mark-recapture methods over three years; and (2) evaluating fine-scale population structure, genetic diversity, and connectivity of dolphins between inshore and coastal waters in the Florida Panhandle (i.e., between Pensacola Bay, Choctawhatchee Bay, and a coastal zone); We are also evaluating and preparing to report on an outbreak of skin lesions associated with a record-breaking flood event in 2014.

Keywords: Abundance, residency, population genetics, population dynamics

Appendix C: Meeting Registrants

Baker, C. Scott
Oregon State University
Marine Mammal Institute
2030 SE Marine Science Dr
Newport, OR 97365
541-272-0560
scott.baker@oregonstate.edu
mmi.oregonstate.edu/c-scott-baker

Baran, Melody
cetaceans@cs.com

Barkaszi, Mary Jo
CSA Ocean Sciences
8502 SW Kansas Ave
Stuart, FL 33701
772-219-3000
mbarkaszi@conshelf.com
www.csaocean.com

Bell, Joel
Naval Facilities Engineering Command, Atlantic
6506 Hampton Blvd
Norfolk, VA 23508
757-322-4854
joel.t.bell@navy.mil

Bernard, Landry *(not able to attend)*
Gulf of Mexico Coastal Ocean Observing System/University of Southern Mississippi
1020 Balch Blvd
Stennis Space Center, MS 39529
228-688-3343
landry.bernard@gcoos.org

Biggs, Douglas
Texas A&M University
979-219-4163
d-biggs@tamu.edu

Bosyk, Jennifer
Bureau of Ocean Energy Management
381 Elden Street, HM3107
Herndon, VA 20170
703-787-1834
jennifer.bosyk@boem.gov

Brainard, Mike *(not able to attend)*
Mississippi Department of Marine Resources
1142 Bayview Avenue
Biloxi MD 39530
228-374-5000
Mike.brainard@dmr.ms.gov

Brenner, Jorge
The Nature Conservancy
205 N. Carrizo St
Corpus Christi, TX 78401
361-687-2209
jbrenner@tnc.org

Brookens, Tiffini
Marine Mammal Commission
4340 East-West Highway, Suite 700
Bethesda, MD 20814
301-504-0087
tbrookens@mmc.gov
www.mmc.gov

Butler, Susan
U.S. Geological Survey
7920 NW 71st Street
Gainesville, FL 32653
352-264-3557
sbutler@usgs.gov

Carmichael, Ruth H.
Dauphin Island Sea Lab
101 Bienville Blvd.
Dauphin Island, AL 36528
251-861-2141
rcarmichael@disl.org

Chan, Teresa
Environmental Law Institute
1730 M Street NW Suite 700
Washington, DC 20036
202 939-3848
chan@eli.org

Clark, Christopher W.
Cornell University and Planet OS
41 Hartwood Rd
Ithaca, NY 14850
607-227-7205
cwc2@cornell.edu
cclark@planetos.com

Cluck, Rodney E.
Bureau of Ocean Energy Management
381 Elden Street
Herndon, VA 20170
703-787-1087
Rodney.Cluck@boem.gov

Cornish, Vicki
Marine Mammal Commission
4340 East-West Highway, Room 700
Bethesda, MD 20814
301-504-0087
vcornish@mmc.gov
www.mmc.gov

Courbis, Sarah
Smultea Environmental Services
2833 SE 45th Ave
Portland, OR 97206
971-888-9226
sarah.courbis@smulteasciences.com

Cowan, Jean
NOAA Restoration Center
5304 Flanders Dr., Suite B
Baton Rouge, LA 70808-7206
(225) 757-5230
jean.cowan@noaa.gov

Cush, Carolyn
Sarasota Dolphin Research Program/
Chicago Zoological Society
1201 Elverton Court
Chesapeake, VA 23321
727-254-0062
cenglund@mote.org

Davenport, Theresa *(not able to attend)*
NOAA Restoration Center/ERT
1315 East-West Highway
Silver Spring, MD 20910
301-427-8694
theresa.davenport@noaa.gov

Dell'Apa, Andrea
NOAA National Marine Fisheries Service
andrea.dellapa@noaa.gov

Engleby, Laura
NMFS Southeast Regional Office
263 13th Ave S
St. Petersburg, FL 33701
727-824-5312
laura.engleby@noaa.gov

Engelhaupt, Dan
HDR
1209 Independence Blvd, Suite 108
Virginia Beach, VA 23455
757-354-6735
Daniel.Engelhaupt@hdrinc.com

Epperson, Deborah *(not able to attend)*
Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Boulevard MS-5432
New Orleans, LA 70123
504-736-3257
deborah.epperson@bsee.gov

John Ettinger
Gulf Coast Ecosystem Restoration Council
500 Poydras
New Orleans, LA 70113
504-444-3522
john.ettinger@restorethegulf.gov

Fazioli, Kristi
UHCL Environmental Institute of Houston
2700 Bay Area Blvd, Box 540
Houston, TX 77058
281-283-3792
fazioli@uhcl.edu

Fetherston, Elizabeth
Ocean Conservancy
600 1st Avenue North, Suite 301
Saint Petersburg, FL 33701
727-369-6615
efetherston@oceanconservancy.org

Finn, Michele
A.I.S., Inc.
25910 Canal Road, Suite O
Box 122
Orange Beach, AL 36561
617-276-6584
michelef@aisobservers.com
www.aisobservers.com

Foster-Taylor, Kellie *(not able to attend)*
NMFS Office of Protected Resources
1315 East-West Hwy, F/PR5
Silver Spring, MD 20910
301-427-8459
kellie.foster-taylor@noaa.gov

Fougeres, Erin
NMFS Southeast Regional Office
263 13th Ave S
St. Petersburg, FL 33701
727-824-5312
erin.fougeres@noaa.gov

Frasier, Kaitlin
Scripps Institution of Oceanography
Ritter Hall 200G
8635 Discovery Way
La Jolla, CA 92093
503-309-7590
kefrasier@ucsd.edu

Garrison, Lance
NOAA Fisheries, SEFSC
75 Virginia Beach Dr
Miami, FL 33149
305-361-4488
lance.garrison@noaa.gov

George, Pam
Gulf World Marine Park
15412 Front Beach Rd
Panama City Beach, FL 32413
850-258-4654
pam@gulfworldmarinepark.com

Gibeaut, Jim
Gulf of Mexico Research Initiative Information and Data Cooperative (GRIIDC)
Harte Research Institute
Texas A&M University - Corpus Christi
6300 Ocean Drive
Corpus Christi, TX 78412
361-825-2060
james.gibeaut@tamucc.edu

Gisiner, Bob
International Assoc. of Geophysical Contractors
1225 North Loop W, Suite 220
Houston TX 77008
713-957-8080
bob.gisiner@iagc.org

Glenn, Tré
Bureau of Ocean Energy Management
1201 Elmwood Park Blvd.
New Orleans, LA 70123
504-736-1749
tre.glenn@boem.gov

Gowans, Shannon *(not able to attend)*
Eckerd College
4200 54th Avenue South
St. Petersburg, FL 33711
727-864-8388
gowanss@eckerd.edu

Green, Rebecca
Bureau of Ocean Energy Management
1201 Elmwood Park Blvd. MS 676E
New Orleans, LA 70123
504-736-2740
rebecca.green@boem.gov

Grimes, D. Jay *(not able to attend)*
University of Southern Mississippi
Gulf Coast Research Laboratory
300 Laurel Oak Drive
Ocean Springs, MS 39564
228-818-8009
jay.grimes@usm.edu
www.usm.edu/gcrl/cv/grimes.jay/cv.grimes.jay.php

Gulland, Frances
Marine Mammal Center
2000 Bunker Road
Sausalito, CA 94965
415-640-3769
gullandf@tmmc.org

Hagedorn, Bruce *(not able to attend)*
U.S. Air Force
107 Highway 85 North
Niceville, FL 32578
850-882-8391
hagedorn@eglin.af.mil

Helm, Roger C.
U.S. Fish and Wildlife Service
5275 Leesburg Pike, MS: SA
Falls Church, VA 22041
703-346-0357
roger_helm@fws.gov

Hernandez, Allison
Bureau of Ocean Energy Management
1201 Elmwood Park Blvd
New Orleans, LA 70123
504-736-2765
allison.hernandez@boem.gov

Hildebrand, John
Scripps Institution of Oceanography
UCSD - 0205
La Jolla, CA 92037
858-534-4069
jhildebrand@ucsd.edu
www.cetus.ucsd.edu

Hohn, Aleta
NOAA Beaufort Laboratory
101 Pivers Island Rd
Beaufort, NC 28516
252-728-8797
aleta.hohn@noaa.gov

Holmes-Douglas, Secret
Gulf World Marine Park
15412 Fornt Beach Rd
Panama City Beach, FL 32413
850-258-6968
secret@gulfworldmarinepark.com

Howard, Matthew K., Ph.D.
Research Scientist
Department of Oceanography
Texas A&M University
College Station, TX 77843-3146
979-862-4169
mkhoward@tamu.edu

Ioup, George E., Ph.D.
University of New Orleans
Dept. of Physics
New Orleans, LA 70148
504-280-6715
geioup@uno.edu

Ioup, Juliette W.
University of New Orleans
Dept. of Physics
New Orleans, LA 70148
504-280-6715
jioup@uno.edu

Ireland, Darren
LGL Ecological Research Associates
4103 S. Texas Ave., Suite 211
Bryan, TX 77802
979-846-7000
direland@lgl.com

Kerr, Iain
Ocean Alliance
32 Horton Street
Gloucester, MA 01930
978-281-2814
kerr@whale.org
www.whale.org

Kirkpatrick, Barbara
Gulf of Mexico Coastal Ocean Observing System
3318 Fair Oaks Place
Sarasota, FL 34239
barb.kirkpatrick@gcoos.org
gcoos.tamu.edu

Bill Lang
21 Kingfisher Drive
Mandeville, LA 70448
985-626-3256
southmec@yahoo.com

Laws, Ben
NMFS Office of Protected Resources
1315 East West Hwy, F/PR1
Silver Spring, MD 20910
301-427-8425
benjamin.laws@noaa.gov

Lee, Christine *(not able to attend)*
Industrial Economics, Inc.
2067 Massachusetts Ave.
Cambridge, MA 21400
415-839-5118
clee@indecon.com

Litz, Jenny
NOAA Fisheries, SEFSC
75 Virginia Beach Dr
Miami, FL 33149
305-361-4224
jenny.litz@noaa.gov

London, Kaye
Bureau of Ocean Energy Management
1201 Elmwood Park Blvd.
New Orleans, LA 70123
504-736-2850
kaye.london@boem.gov

Love, Matt *(not able to attend)*
Ocean Conservancy
6160 Perkins Rd, Suite 120
Baton Rouge, LA 70808
225-590-5043
mlove@oceanconservancy.org

Martinez-Serrano, Ibiza
Universidad Veracruzano
Circ. Gonzalo Aguirre Beltran s/n
Zona Universitaria
Xalapa, Veracruz, Mexico 91090
52-228-842-1748
ibimartinez@uv.mx
www.uv.mx/personal/ibimartinez

Mate, Bruce R.
Oregon State University Marine Mammal Institute
2030 SE Marine Science Drive
Newport, OR 97365
541-867-0202
bruce.mate@oregonstate.edu
mmi.oregonstate.edu

McHugh, Katie
Chicago Zoological Society/
Sarasota Dolphin Research Program
c/o Mote Marine Laboratory
16000 Ken Thompson Pkwy
Sarasota, FL 34236
941-388-4441 x450
kmchugh@mote.org

Mengerink, Kathryn
Environmental Law Institute
9500 Gilman Drive, Mail Code 0202
La Jolla CA, 92093-0202
202-939-3825
mengerink@eli.org
www.eli-ocean.org

Milne, Stephanie
RPS
411 N Sam Houston Pkwy East, Suite 400
Houston, TX 77060
206-334-0862
stephanie.milne@rpsgroup.com

Moreno, Paula
Gulf Coast Research Laboratory
University of Southern Mississippi
703 East Beach Drive
Ocean Springs, MS 39564
228-818-8013
paula.moreno@usm.edu

Morteo, Eduardo *(not able to attend)*
Universidad Veracruzano
Calle Dr. Luis Castelazo Ayala s/n
Km 2.5 Carr. Xalapa-Veracruz, Col. Industrial Animas
Xalapa, Veracruz, Mexico 91190
52-228-841-89-10
eduardo.morteo@gmail.com
www.uv.mx/personal/emorteo

Mullin, Keith
NOAA NMFS Pascagoula Laboratory
3209 Frederic Street
Pascagoula, MS 39567
228-549-1632
Keith.D.Mullin@noaa.gov

Norris, Thomas
Bio-Waves Inc.
364 2nd Street, Suite #3
Encinitas, CA 92024
760-452-2575
thomas.f.norris@bio-waves.net
www.biowaves.net

Nowacek, Douglas *(not able to attend)*
Duke University
135 Duke Marine Lab Rd.
Beaufort, NC 28516
252-504-7566
dpn3@duke.edu

Perry, Ruth
Shell Exploration & Production Co.
150 N. Dairy Ashford, Suite 460H
Houston, TX 77079
281-450-7148
ruth.perry@shell.com

Phillips, Nicole
University of Miami, Cooperative Institute for Marine and Atmospheric Studies
NOAA Fisheries
646 Cajundome Blvd, Suite 219
Lafayette, LA 70506
337-291-3148
nicole.phillips@noaa.gov

Pitchford, Jonathan
Institute for Marine Mammal Studies
10801 Dolphin Lane
Gulfport, MS 39503
228-896-9182
jpitchford@imms.org

Plotkin, Pamela *(not able to attend)*
Texas Sea Grant at Texas A&M
730 Lamar Street
4115 TAMU
College Station, TX 77843
979-218-3023
plotkin@tamu.edu

Polito, Michael *(not able to attend)*
Louisiana State University
1239 Energy, Coast & Environment Building
Baton Rouge, LA 70803
225-578-9403
mpolito@lsu.edu
www.oceanography.lsu.edu/politolab

Porthouse, Jonathan
National Fish and Wildlife Foundation
301 Main Street, Suite 1650
Baton Rouge, LA 70801
225-347-5992
jonathan.porthouse@nfwf.org

Pulis, Eric E.
Institute for Marine Mammal Studies
10801 Dolphin Lane
Gulfport, MS 39503
218-230-8892
epulis@imms.org

Pyc, Cynthia
BP
cynthia.pyc@bp.com

Radford, Andy
American Petroleum Institute
1220 L Street NW
Washington, DC 20005
202-682-8584
radforda@api.org

Read, Andrew *(not able to attend)*
Duke University Marine Lab
135 Duke Marine Lab Road
Beaufort, NC 28516
252-504-7590
aread@duke.edu

Reeves, Randall
Marine Mammal Commission
27 Chandler Lane
Hudson, Quebec CAN J0P 1H0
450-458-6685
rrreeves@okapis.ca

Reid, James
US Geological Survey
7920 NW 71st Street
Gainesville, FL 32653
352-264-3546
jreid@usgs.gov

Robydek, Amanda
Eglin AFB Natural Resources/Leidos
107 Highway 85 North
Niceville, FL 32578
850-882-8395
amanda.robydek.ctr@us.af.mil

Rowles, Teri
NOAA NMFS Office of Protected Resources
1315 East-West Hwy
Silver Spring, MD 20910
301-427-8448
teri.rowles@noaa.gov

Ruder, Eric
Industrial Economics
eruder@indecon.com

Sarthou, Cynthia
Gulf Restoration Network
541 Julia Street, Ste 300
New Orleans, LA 70130
504-525-1528 ext 202
cyn@healthygulf.org

Schwacke, Lori
NOAA National Ocean Service
331 Fort Johnson Road
Charleston, SC 29412
843-725-4821
lori.schwacke@noaa.gov

Shepard, Andrew
Florida Institute of Oceanography
830 First St. S
Saint Petersburg, FL 33701
727-553-3374
sheparda@usf.edu

Shippee, Steve
Marine Wildlife Response
1557 Hwy 98 West
Mary Esther, FL 32569
(850) 516-7934
shippee3@cox.net

Simard, Peter *(not able to attend)*
University of South Florida
College of Marine Science
140 7th Ave. South
St. Petersburg, FL 33701
727-348-5676
psimard@mail.usf.edu

Simmons, Samantha
Marine Mammal Commission
4340 East-West Highway, Suite 700
Bethesda MD 20814
301-504-0087
ssimmons@mmc.gov

Simoniello, Chris
Gulf of Mexico Coastal Ocean Observing System
4740 14 Ave N
Saint Petersburg, FL 33713
727-322-1318
chris.simoniello@gcoos.org

Skrupky, Kimberly
Bureau of Ocean Energy Management
kimberly.skrupky@boem.gov

Slone, Daniel
USGS Southeast Ecological Science Center
7920 NW 71st St
Gainesville, FL 32653
352-264-3551
dslone@usgs.gov
profile.usgs.gov/dslone

Smultea, Mari
Smultea Environmental Services
P.O. Box 256
Preston WA 98050
707-362-5376
mari@smulteasciences.com
smulteasciences.com

Solangi, Moby Ph.D.
Institute for Marine Mammal Studies
10801 Dolphin Lane
Gulfport, MS 39503
228-896-9182
solangim@aol.com
www.imms.org

Stanic, Steve *(not able to attend)*
University of Southern MIssissippi / Southern Acoustics
stanic@cableone.net

Steckler, David
Entiat River Technologies
PO Box 256
Preston, WA 98050
253-218-7603
davesteckler@mysticetus.com
http://www.mysticetus.com

Stong, Bea
BP
501 Westlake Park Blvd.
Houston, TX 77079
281-504-4343
bea.stong@bp.com

Swann, LaDon
Mississippi-Alabama Sea Grant Consortium
Auburn University Marine Program
251-648-5877
swanndl@auburn.edu
masgc.org

Taylor, Cynthia
Sea to Shore Alliance
4411 Bee Ridge Rd #490
Sarasota, FL 34233
941-232-4587
ctaylor@sea2shore.org

Tillman, Michael F.
Marine Mammal Commission
249 Sea View Ct.
Encinitas, CA 92024
760- 652-1093
mftillman@mac.com

Tirpak, John
US Fish and Wildlife Service
700 Cajundome Blvd
Lafayette, LA 70506
337-266-8565
john_tirpak@fws.gov

Truchon, Stephen
Shell
3333 Highway 6 South
Houston, TX 77082
281-352-3622
stephen.truchon@shell.com

Trumble, Stephen
Baylor University
One Bear Place #97388
Waco, TX 76706
254-710-2128
stephen_trumble@baylor.edu
sites.baylor.edu/trumblelab/

Tsoflias, Sarah L.
Chevron North America E&P Company
1600 Smith Street
Houston, TX 77002
713-754-3171
stsoflias@chevron.com

Tumlin, Mandy
Louisiana Dept of Wildlife and Fisheries
2000 Quail Drive, Room 340
Baton Rouge, LA 70808
225-765-2377
mtumlin@wlf.la.gov

Usenko, Sascha
Baylor University
One Bear Place #97266
Waco, TX 76798
541-760-3855
Sascha_Usenko@baylor.edu
www.baylor.edu/mediacommunications/whale

Ward, Leslie
FWC/Fish & Wildlife Research Institute
100 SE 8th Ave.
St. Petersburg, FL 33701
727-502-4732
leslie.ward@myfwc.com
myfwc.com/research/manatee/

Watson, Stephanie
Gulf of Mexico Coastal Ocean Observing System (GCOOS)
stephanie.watson@gcoos.org
www.gcoos.org

Watwood, Stephanie
Naval Undersea Warfare Center
1176 Howell Street
Newport, RI 02841
401-832-4929
stephanie.watwood@navy.mil

Wells, Randall
Chicago Zoological Society
c/o Mote Marine Lab
1600 Ken Thompson Pkwy
Sarasota, FL 34242
941-388-2705
rwells@mote.org
sarasotadolphin.org

Whitehead, Heidi *(not able to attend)*
Texas Marine Mammal Stranding Network
4700 Avenue U
Galveston, TX 77551
832-385-7811
hwhitehead@tmmsn.org

Whitt, Amy
Azura Consulting LLC
8401 Memorial Ln, #7272
Plano, TX 75024-2291
870-919-2636
amy@azuraco.com
www.azuraco.com

Wilson, Randy
U.S. Fish & Wildlife Service
6578 Dogwood View Pkwy
Jackson, MS 39213
601-965-4903 ext 300
randy_wilson@fws.gov

Wingers, Noel
Alabama Marine Mammal Stranding Network/
Dauphin Island Sea Lab
101 Bienville Blvd.
Dauphin Island, AL 36528
251-861-2141 x7547
nwingers@disl.org

Wolinsky, Gary
Chevron Energy Technology Co
6001 Bollinger Canyon Rd
San Ramon, CA
925-842-7405
gawolinsky@chevron.com

Worthy, Graham
University of Central Florida
4000 Central Florida Blvd, Bldg 20
Orlando, FL 32816
407-823-4701
Graham.Worthy@ucf.edu

Würsig, Bernd *(not able to attend)*
Texas A&M University
200 Seawolf Pkwy.
OCSB Marine Biology
Galveston, TX 77581
281-799-6817
wursigb@tamug.edu
www.tamug.edu/mmbeg/

Young, Sharon
The Humane Society of the U.S.
22 Washburn St.
Sagamore Beach, MA 02562
508-833-0181
syoung@humanesociety.org

Marine Mammal Commission
An Independent Agency of the U.S. Government
4340 East-West Highway, Room 700
Bethesda, MD 20814
www.mmc.gov

The Honorable John C. Cruden
Assistant Attorney General for the Environment and Natural Resources Division
U.S. Department of Justice
950 Pennsylvania Avenue NW
Washington, DC 20530-0001

The Honorable Samuel D. Rauch III
Deputy Assistant Administrator for Regulatory Programs
National Marine Fisheries Service
1315 East-West Hwy, Silver Spring, MD 20910

RE: Joint Comments on the BP Consent Decree

Dear Mr. Cruden and Mr. Rauch:

On behalf of the undersigned members of the Gulf Future Coalition[1], we would like to thank the Department of Justice for its leadership in securing a settlement with BP and the Gulf states regarding natural resource damage claims and Clean Water Act civil claims. This settlement marks an important milestone for Gulf communities, and provides significant opportunities for comprehensive ecosystem restoration. We appreciate the opportunity to provide formal comments on the consent decree and the Draft Programmatic Damage Assessment Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS).

Public Engagement and Restoration

We appreciate the inclusion of important new requirements that BP must fulfill to monitor and publicly report on its efforts to improve the safety of drilling operations in the Gulf of Mexico. These requirements are critical to ensure that our coastal communities, and those that rely on the health of the Gulf for their livelihood, are provided with safeguards from future disasters.

While we appreciate your timely response to our request for an extension of the comment period, we disagree that it is has been in the best interest of the public keep the deadline as planned. Being there are two long and complex documents for interested parties across the Gulf to read, comprehend, and provide comment on, the 60-day comment period is unreasonable. Additionally, for individuals who make their living shrimping in Gulf Coast waters, the chosen comment period was at the height of the season. We are very concerned with the lack of translated materials provided at all meetings, particularly the failure to provide translation services at the Texas meeting in Galveston. These oversights do a tremendous disservice to the citizens of the Gulf Coast, of whom these restoration dollars are meant to benefit. These funds, particularly those related to the Natural Resource Damages

---

[1] The Gulf Future Coalition is a diverse gulf-wide network of conservation, community, human rights, and social justice organizations working together to ensure the Gulf of Mexico environment and communities are made whole from the BP *Deepwater Horizon* oil disaster.

are public funds. It is a disservice to the public when our trustees don't provide adequate opportunities for communities who were most impacted by the disaster.

We have significant concerns that the proposed governance structure in the Consent Decree and the PDARP/PEIS will prevent meaningful participation from Gulf Coast communities. In its current form, eight newly created Trustee Implementation Groups (TIGs) creates substantial hurdles for public engagement and participation in the TIG's planning process. As each TIG will develop its own engagement strategies, the public will be forced to follow eight individual NRD processes – each with their own timeline and decision-makers. Such a dispersed system may seriously prevent wide-ranging public engagement among rural, low-income, communities of color, and limited English members of the public. These individuals have an important stake in the outcomes of these proceedings, however, with the additional hurdles of tracking eight different processes with minimal resources, this system may not be able to support their engagement.

This proposed unstructured and uncoordinated process places a enormous burden on the American public. It can reasonably be perceived that this proposed structure is an effort to decrease transparency and public participation. The Trustees must provide a consistent restoration planning process across TIGs that will not require enormous expenditures of time and treasure from the public to participate.

In response, we suggest the consent decree and DRDARP be revised to support a multi-tiered approach to public engagement:

- The Trustee Council should develop strong standard operating procedures (SOPs) requiring each Trustee Implementation Group to develop common approaches, coordinated timelines and resources for engaging the public in developing draft restoration plans, in order to ensure inclusive participation. SOPs should promote steps to reach populations such as low income, minority, rural and limited English proficient communities and commercial and subsistence fishers across the coast which face hurdles to accessing public engagement opportunities and are disproportionately impacted by the health of coastal ecosystems. The public should be able to review and provide input on the Trustee Council's SOPs, including procedures for public engagement.

- The Trustee Council should require the Government Accountability Office to audit the restoration activities and monies spent by federal, state, and local municipalities to ensure compliance of expenditures under the Consent Decree.

- The Trustee Council should promote engagement strategies beyond public meetings to support comprehensive dialogue about restoration. In particular, the consent decree and DRDARP should create a public advisory committee to facilitate sustained input from representatives of the public at-large and key stakeholder groups on the planning, evaluation, fund allocation, and conduct of restoration activities. Such a committee, and relevant sub-committees could ensure key interests across the Gulf Coast states including commercial and subsistence fishers, conservationists, recreational users, socially vulnerable and native stakeholders relevant to the various TIGs are informed, involved and can help educate broader constituencies about the decision making process going forward.

- Terms should be added to the Consent Decree to promote the use of local workers and firms within NRD restoration. As cited in the DRDARP, local hiring is one of the top concerns of local residents during previous phases of public hearings on NRD.[2] Terms should include a requirement to post new job opportunities created by contractors, or relevant subcontractors, as a part of NRD funded restoration work with relevant state and local workforce development agencies nearest the site of such work if state law does not already require such postings. Additionally, contractors should be required to consider workers referred to contractors and subcontractors by these local workforce agencies. Such terms would align with

[2] TBD

the language under the RESTORE Act, recent state laws in Florida, Louisiana and Mississippi and examples in federal contracting.[3]

- The Trustee Council and TIGs should ensure adequate funding for public engagement. In particular, the Council should consider allocating a portion of the resources currently committed for administration under the regional restoration TIG to promoting public engagement across TIGs.

There is substantial concern that the proposed governance structure segments the responsibility of achieving ecosystem restoration that threatens the Trustees' ability to coordinate and reduces accountability. This proposal places an unjust burden on the public by increasing the time and effort required to meaningfully engage and participate in restoration planning and implementation.

Open Ocean Allocation

We are pleased that $8.1 billion has been allocated toward NRD, and that $1.24 billion of the NRD allocation is dedicated to restoration and enhancement of the open ocean. The BP oil disaster began off the shore of Louisiana, 5,000 feet below sea level. The sea life that depends on our the health of our oceans, such as sea turtles, marine mammals, finfish, and sea birds, were all exposed to massive amounts of oil and dispersants. The oil disaster began in our coastal waters, and the open ocean is in dire need of comprehensive restoration. Emerging information regarding the impacts to our ecosystem signifies troubling outcomes for our marine environment, which emphasizes the need for meaningful restoration in the open ocean. Inclusion of the open ocean allocation will allow for restoration of the Gulf Coast's premier fisheries and ocean habitats, both of which are essential to the health of the economy in the region.

However, we are concerned that the proposed governance structure for the administration of Natural Resource Damage (NRD) funds and implementation of restoration under the Draft Programmatic Damage Assessment Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS) will be extremely costly and make it difficult to plan and implement restoration activities to achieve the Gulf-wide and ecosystem-scale goals set by the Trustees.

While we appreciate the dedicated funding for blue water restoration, we are disappointed with the broad definition and terms of funding for the open ocean allocation. The consent decree defines Open Ocean as "restoration activities for resources primarily in the ocean and Federal Trustee administrative and preliminary planning activities across Restoration Areas."[4] By this definition, projects and associated costs that do not address ocean resources will be able to be drawn from this account. This is proposal is unjustifiable considering the plethora of damages specified in the PDARP/PEIS for ocean resources and habitats.

Additionally, four of the early restoration projects that address lost recreational use have been reclassified as open ocean projects.[5] These projects include nearly $7 million for roadway enhancements (bike and pedestrian lanes) at Davis Bayou in Mississippi, $545,000 for trail enhancement at Bon Secour National Wildlife Refuge in Alabama, more than $10 million for a "beach enhancement project which involves removing fragments of asphalt and road-based material that are scattered widely over the Fort Pickens, Santa Rosa, and Perdido Key areas of Gulf Islands

[3] "Resources and Ecosystem Sustainability, Tourist Opportunities, And Revived Economies of the Gulf Coast States Act of 2011". Senate Report 112-100. http://www.gpo.gov/fdsys/pkg/CRPT-112srpt100/html/CRPT-112srpt100.htm; "Mississippi Jobs First Act of 2012", Mississippi Code 800.00-800.04 http://www.sos.ms.gov/ACProposed/00019129b.pdf; "Louisiana First Hiring Act", Chapter 27 of Subtitle III of Title 39 of the Louisiana Revised Statutes of 1950, R.S. 39:2211 through 2214 http://www.legis.la.gov/legis/ViewDocument.aspx?d=877313; "Job Orders- Department of Economic Opportunity" Florida Department of Economic Opportunity http://www.floridajobs.org/PDG/TrainingPresentations/wp_basics/Job_Orders_Part1.ppt

[4] Consent Decree, Appendix 2 at §2.1.1.

[5] Bike & Ped Lane GUIS MS ($6,996,751), Bon Secour NWR Trail, AL ($545,110), Beach Enhancement G.I. National Seashore ($10,836,055), Gulf Islands National Seashore Ferry Project ($4,020,000). See Appendix 2 Table 2 of Consent Decree at: http://www.justice.gov/enrd/file/780686/download

National Seashore, in Florida,"[6] and more than $4 million for the "purchase of up to three pedestrian visitor ferries for use between the City of Pensacola, Pensacola Beach, and the Fort Pickens area of Gulf Islands National Seashore in Florida."[7]

As we examine and evaluate the types of projects conducted in previous phases of restoration, we are alarmed that these four projects have been reclassified as open ocean projects. None of the above listed projects occur in the open ocean and do not fit the definition[8] provided by consent decree. This sets a dangerous precedent for future funding of projects in any component, where Trustees are able to pull funds from restoration accounts that do not benefit the stated resources. Additionally, of the Of the $832 million[9] allocated for early restoration, only $20 million has been allocated to restoring marine resources injured in this oil disaster.[10] Classifying recreational use projects as one that address injuries to the open ocean reduces the amount of funding available to restore and improve the our marine environment. The offshore ecosystem is where the disaster occurred and where resources to address significant injuries must still be directed. Funding these projects may be suitable under different allocations; however, they are inappropriate for the open ocean allocation. We recommend that the consent decree and its related documents consider an alternative, applicable allocation for these projects, either from their respective implementation state or from the region-wide allocations.

The NRD Final Allocation table provides additional details on where the NRD money will be spent. "Administrative Oversight and Comprehensive Planning" accounts for $150 million of the open ocean funding. [11] It is unclear if the $150 million amounts to the total allocation for "Federal Trustee administrative and preliminary planning activities across Restoration Areas," as explained in the open ocean definition. This clarification is crucial as it could indicate additional monies are removed offshore restoration. Is the $150 million the final allocation total for Federal Trustee planning and oversight? Could additional funding from other portions of the open ocean allocation also be used for Federal Trustee planning and oversight? Should federal administrative and planning costs exceed $150 million, where will the funding be derived from? With the costly administration expenditures of the proposed governance structure,[12] how will the Trustees ensure there will be adequate monetary support to develop and implement a comprehensive suite of restoration projects for the open ocean resources?

Due to the significant concerns outlined above, we are frustrated and troubled that funding for open ocean restoration will be spent on overhead costs for other restoration components and on reclassified, previously approved, land-based recreational projects. We implore the Department of Justice to revise the definition of Open Ocean in the consent decree to guarantee the proper use of the funds in that allocation. Further, the consent decree must make explicit that administrative costs should absolutely not exceed the $150 million allocated, and should only pertain to costs related to staffing and travel. The open ocean allocation must not be used for Federal Trustee planning costs across restoration areas.

Suggested definition of "Open Ocean":

---

[6] Phase III Early Restoration Fact Sheet, Gulf Islands National Seashore Beach Enhancement Project, available at http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/BeachEnhancementFactsheet4.pdf.

[7] Phase III Early Restoration Fact Sheet, Gulf Islands National Seashore Ferry Project, available at http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/FerryFactsheet4.pdf.

[8] "Restoration activities for resources primarily in the ocean and Federal Trustee administrative and preliminary planning activities across Restoration Areas." Consent Decree, Appendix 2 at §2.1.1.

[9] In September 2015, Trustees approved Phase IV of early restoration bringing the total approved to be spent to $832 million from the $1 billion BP pledged for early restoration. See http://www.gulfspillrestoration.noaa.gov/2015/09/latest-round-of-early-restoration-projects-approved/.

[10] Early restoration included a bycatch-reduction project estimated to cost $20 million. Consent Decree, Appendix 2, Table 2.

[11] Consent Decree at Appendix 2.1; Table 5.10-1 Draft PDARP/PEIS at page 5–103.

[12] Consent Decree, Appendix 2: Agreement Among the United States and the Gulf States Relating to Natural Resource Restoration; Draft PDARP/PEIS at page 7-4.

"Open Ocean" consists of restoration activities occurring in the ocean or activities that create, enhance, or improve marine resource management, scientific research, or monitoring of natural resources in the ocean and Federal Trustee administrative activities, capped at $150 million, across Restoration Areas.

Thank you for your consideration of these requests; please let us know if we can provide additional information or assistance. For additional information, please contact Jordan Macha at the Gulf Restoration Network (jordan@healthygulf.org).

Sincerely,

The undersigned organizations from the Gulf Future Coalition:

Action Communication and Education Reform Inc., Duck Hill, MS
Alliance Institute, New Orleans, LA
Earth Ethics, Pensacola, FL
Galveston Baykeeper, Galveston, TX
Gulf Islands Conservancy Inc., Biloxi, MS
Gulf Restoration Network, New Orleans, LA
Louisiana Environmental Action Network, Baton Rouge, LA
Lower Mississippi Riverkeeper, Baton Rouge, LA
Mind Power Collective, New Orleans, LA
Mobile Bay Sierra Club, Mobile, AL
Mondo Bizarro, New Orleans, LA
Oasis Earth, Anchorage, AK
On Wings of Care, New Orleans, LA
Operation Homecare, Mobile, AL
Pelican Coast Conservancy, Mobile, AL
Public Lab, New Orleans, LA
Synergy Strategic Communications, Mobile, AL
Vanishing Earth, New Orleans, LA

Robin Rorick
Group Director
Midstream and Industry Operations

1220 L Street, NW
Washington, DC 20005-4070
USA
Telephone 202-682-8083
Fax 202-682-8051
Email rorickr@api.org
www.api.org

Deepwater Horizon Natural Resource Damage Assessment Trustees
c/o U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

4 December 2015

Deepwater Horizon Natural Resource Damage Trustees,

The American Petroleum Institute (API) is a national trade association that represents over 625 members involved in all aspects of the oil and natural gas industry, including the exploration and production of both onshore and offshore Federal resources. The U.S. oil and natural gas industry supports 9.8 million U.S. jobs and 8 percent of the U.S. economy, delivering tens of millions per day in revenue to our government. API members provide most of the nation's energy and are backed by a growing grassroots movement of more than 25 million Americans.

API provides this letter in response to the draft Programmatic Damage Assessment and Restoration Plan and draft Programmatic Environmental Impact Statement for the Deepwater Horizon Oil Spill dated October 2015. API strongly supports the protection of the marine environment and restoration of the resources following an oil spill. API believes in utilizing all tools in the toolbox under the right circumstances to minimize harm to the environment and other shared values and would like the opportunity, at some point in the future, to engage in dialogue with NOAA and other government agencies to better understand the scientific assumptions and conclusions contained in these documents.

Thank you for your attention to this letter. We look forward to your response and should you have any questions or wish to discuss this in further detail, please contact myself or Ray Bradley at 202.682.8186 or bradleyr@api.org.

Sincerely,

Robin Rorick
Group Director, Midstream & Industry Operations
American Petroleum Institute

December 4, 2015

From: Stephanie Fernandez
2402 30th St
Anacortes, WA 98221

To: Natural Resources Damage Assessment Trustees

Reference: Comments on the Draft Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS) for the Deepwater Horizon Oil Spill

Dear Trustees,

Thank you for the time, energy, and expense you have collectively invested in assessing damages to natural resources from the Deepwater Horizon Oil Spill/Explosion (BP Spill) occurring in the Gulf of Mexico in 2010, and for estimating the monetary cost of restoring public trust resources to their previous states. The Deepwater Horizon incident brought months of continuous gushing that released 134 million gallons of oil from the sea floor and into the three-dimensional pelagic environment of the ocean from the abyssal zone to the photic zone, flowing shoreward into many estuaries of national significance, floating onto over 1300 miles of beaches and shorelines, and evaporating into the air that marine mammals and sea turtles breathe, along with an additional 1.84 million gallons of dispersant applied throughout the water column and at the sea surface. The event is the most catastrophic manmade environmental disaster in the history of the United States. It is really hard to imagine that the assessment of the damages is complete or that the monetary value proposed to settle the public claims for natural resource damages is the total amount required to fully restore the public trust resources of the Gulf region, considering this restoration plan considers injuries to such a wide array of resources, including everything from brown pelicans to soft corals, sea turtles, marshes, oysters, sperm whales, 21 other species of marine mammals, and more (water column resources). Many species of animals (from sperm whales to small marsh periwinkles), plants (e.g., phytoplankton on smooth cord grass), and many other species that have yet to even be discovered were killed, injured, or impaired for life. This value cannot be truly estimated.

In reviewing the proposed restoration plan it seems that it is almost impossible to have comprehensively assessed the damage and accurately estimated the value of compensation required to restore the Gulf. The attempt is admirable and I realize that we as a nation must move forward on restoration after five years. As stated in the plan it will not be fruitful for the Gulf to have to wait 20 years or more for a complete assessment. Nevertheless, my comments here focus on the apparent insufficiency of a significant component of the plan: its consideration for the lives of the largest and most charismatic animals in the Gulf. These are the sperm whales and their toothed cousins (dolphins) and un-toothed cousins (baleen

whales). The amount of funding allocated for the restoration of marine mammals, and the restoration approaches considered for these species, seem paltry and insufficiently evaluated given the damages to marine mammals outlined in the injury assessment chapter, which are compounded in the context of previously depleted populations due to whaling and human impacts so severe that special federal legislation was passed to protect them (the Marine Mammal Protection Act). One pelagic species of marine mammal in the Gulf is protected under the Endangered Species Act, the sperm whale. Estimating damage to the sperm whale population and proposing methods of restoration for it and its habitat must certainly be challenging given how very little is known about sperm whale life history or physiology, or about rates of global recovery from whaling. More is known about the damage to bottlenose dolphin populations in the Barataria-Terrebonne estuaries, and the trustees' assumptions related to similar toxicity impacts affecting sperm whales and other species of marine mammals in the Gulf are reasonable.

The injury assessment states that 1,100 marine mammals were observed in the surface slick. Humans in the vicinity donned respirators and HAZMAT suits, and even they suffered adverse respiratory affects. The NRDA trustees have estimated tens of thousands of dolphins and whales were exposed in the described "contaminated prime marine mammal habitat in the estuarine, nearshore, and offshore waters of the northern Gulf of Mexico." It is known that marine mammals inhaled or aspirated liquid oil and this caused death in stranded dolphins. Other routes of exposure and evidence of injury are documented. 1,000 dolphins and whales were found stranded. The annual average of strandings increased four fold. The offshore and more pelagic species likely did not strand and no bodies were seen or recovered. How were the numbers of their mortalities or sublethal injuries estimated? It can only be surmised that the offshore and more pelagic species of whales and dolphins living in the "prime" marine mammal habitat affected by the spill also have lung disease, adrenal disease, and poor body condition from the extreme exposures resulting from the Deepwater Horizon event.

Data for strandings following DWH reflect the largest and longest lasting marine mammal unusual mortality event on record in the northern Gulf of Mexico. The injury assessment report states that dolphin and whale populations living offshore were generally less affected than bay, sound, and estuary dolphins. How can this be known? How was this data evaluated? These populations are smaller, congregate in the area affected by the spill, are dependent on the full spectrum of offshore water column habitats, and their bodies are much less likely to strand. The public is generally unaware that 22 species of marine mammals are found in the northern Gulf or that the Gulf hosts resident sperm whales; very few people have even heard of a Bryde's whale. The pelagic environment where most species of the impacted whales and dolphins live is far from shore, requiring a full day to reach in seas that are frequently unpredictable. Most people will never see this part of the Gulf. Despite this, the public holds whales in high regard and there is global pressure to protect all whales and dolphins from fisheries and harvesting, to release captive

killer whales, to stop the capture of whales and dolphins for aquariums, and to participate in whale watching. It is highly unlikely the NRDA trustees have evaluated this true value to the public of whales and dolphins.

Please consider the following requests for integration of additional restoration approaches into the proposed plan, revisions of proposed allocations of funds for restoration, and contingency for failure of the Trustees' proposed approaches for restoration of marine mammal populations:

A. **Establishment of a Gulf Sperm Whale/Pelagic Ecosystem National Marine Sanctuary of significant size**

This sanctuary will serve as a truly pelagic sanctuary for the remaining estimated 700 resident sperm whales in the Gulf of Mexico, providing safe haven for the Gulf's largest and most endangered marine mammal species, which is the most dependent on the full spectrum of depths and habitats in the offshore water column. Sperm whales rest at the surface, dive to and feed in depths over one mile, and are most frequently found associated with the interface between cold-core and warm-core eddies along the 1,000m isobath. There is very good data for sperm whale feeding and calving aggregations in the Gulf from the research conducted under the "Gulf Cet" program funded by the former Minerals Management Service (now BOEM). With data from Gulf Cet and the expertise of marine mammal researchers involved in this research it would be easy to establish appropriate boundaries for the Gulf Sperm Whale National Marine Sanctuary.

The Gulf is unique in that it hosts a resident population of sperm whales, which is considered strategically important in the global restoration of this species. It is not evident in the NRDA assessment and restoration plan that the impact of the spill on the global population of sperm whales has been calculated or addressed. It is important that this damage is calculated and added to the monetary valuation of the damage to sperm whales.

A Gulf Sperm Whale National Marine Sanctuary will protect many other species of marine mammals, billfish, tuna, and other species known to spawn in similar areas associated with features on the bottom, water column chemistry and currents, and eddy/gyre features. While such water column features can move slightly from season to season or year to year, it is possible to identify the areas in which they typically occur, offering the greatest protections to the species associated with them (see the attached map showing my proposal for an area that could be considered). It is vital that these areas be protected from human impacts and the formation of this marine protected area will also address all of the goals and methods listed in the restoration plan for marine mammals (see below). A large component of direct restoration for pelagic species will have to be a protected area for them specifically free of fishing, unnatural sound, and oil and gas exploration and development impacts. These species need a place free from the many

threats that exist in the Gulf of Mexico: potential future oil spills, unnatural sound, drilling, dead zones, pollution, ship strikes, etc.; a "no-human zone," no oil zone, and/or research only zone.

Scientific data exists to support establishing a truly pelagic sanctuary, and the sperm whale is the perfect "poster child" for such a sanctuary. This approach would turn what is now an exceptionally vague proposed restoration plan, incorporating limited tools, into something profound and meaningful for the pelagic environment that was damaged drastically by the DWH oil spill. Using the NMSA to designate a protected area would provide a mechanism through which all of the other proposed restoration strategies for marine mammals could be accomplished, giving back to the sperm whales what BP and oil exploration took away from them. As identified in the PDARP, several areas between the Mississippi Canyon and the DeSoto Canyon have known high densities of sperm whales likely because of localized and highly productive habitats. Setting aside an area for the protection of the sperm whale will have cascading impacts of improved protection and restoration for many pelagic species of fishes, cephalopods, and invertebrates.

B. **<u>The creation of the Sperm Whale and Pelagic Ecosystem Interpretive Center on-shore</u>**

A specialized, high tech facility provided for the interpretation to the public of sperm whale life histories and population dynamics, and of the pelagic environment generally, creates the capacity to educate the American public about the complex pelagic environment that very few people are ever able to directly witness. The offshore Gulf has fueled the economy through fisheries (tuna to anchovies), shipping, and oil and gas. People need to understand why, as well as what animals live there and how humans impact them. The depths of the Gulf are generally unknown to the public. The lives of sperms whales are extreme by any measure of comparison to other animals on earth and in the oceans. Sperm whales spend their lives regularly going where humans cannot, in an environment humans spend great amounts of money to minimally explore. Through interpretation of the story of the lives of sperm whales, people can gain an understanding of the abyssal zone, migrations of species through the water column (e.g., the deep scattering layer), migrations of dispersed males to Antarctica, and even more basic and essential principals such as the differences between the aphotic, mesophotic, and photic zones of the ocean, or the important roles sperm whales play for other species deep in the water column and connecting the surface and the deep ecosystems. This center should be located in a location or locations accessible to the greatest numbers of people in the Gulf of Mexico region, such as the metropolitan areas with the largest populations in Houston, New Orleans, and Tampa.

C. <u>Design, development, and commissioning of the Gulf Sperm Whale and Pelagic Ecosystem research vessel, an offshore vessel dedicated to</u>

studying marine mammal population growth in the pelagic environment

The study of the pelagic environment takes specialized talents and technologies, and is truly multidisciplinary. With the establishment of the Gulf Sperm Whale National Marine Sanctuary there must be a mechanism for the natural resource managers, researchers, and others to access the sanctuary and the pelagic environment of the northern Gulf. It will be necessary to invest substantial time in assessing the growth or decline of populations, health of the marine mammals (fecundity and mortality and dispersion), and learn further about the life histories of the sperm whales and other marine mammals in the Gulf. One cannot assess the recovery and restoration of the marine mammals and other pelagic species without consistent, long-term assured access to the pelagic environments of the Gulf.

D. Review of the proposed monetary allocation by the NRDA of $144 million for the restoration of marine mammals.

This allocation should be adjusted by adding an allocation of $70 million for the sole purpose of establishing and managing the Gulf Sperm Whale National Marine Sanctuary, and adding a $100 million endowment dedicated to sustained research, restoration, and adaptive management in the Gulf Sperm Whale National Marine Sanctuary, lasting at least the life time of an average sperm whale, bringing the total to $314 million in funds to restore the marine mammals of the northern Gulf.

Reassessment of the NRDA valuation of damages to sperm whales and other marine mammals is requested on the following grounds.

1. The sperm whale population is globally significant. These resident sperm whales raise their young in highly structured social groups. The males ultimately disperse and travel to Antarctica and throughout the world's oceans. A loss of a male sperm whale from DWH is a much bigger loss than just its loss to the Gulf. With already globally reduced populations, each male is essential to genetic diversity at global level. The same is the case with a female sperm whale because if one female becomes infertile the entire global population is impacted with reduced fecundity as a whole. If the sperm whales have similar problems as the bottlenose dolphins, scientists won't know if fecundity (or morbidity) has been affected until at least 2018.

2. Sperm whales can dive to depths more than twice as deep as the DWH wellhead, and therefore the oil and increased contaminant concentrations on the bottom surrounding the wellhead are affecting the habitats where they feed. Of all the species impacted by the DWH it will be the hardest to assess the impact on the sperm whales. The current draft restoration

plan does not appear to have considered or assessed the value of the feeding grounds of sperm whales, which is particularly problematic given their endangered status.

3. It is shocking to read the extremely low NRDA estimation of $144 million allocated to restore the populations of marine mammals in the Gulf of Mexico. Based on the material presented in the plan, almost 1.4 million lost cetacean years resulted from the spill, and the allocation provides only ~$104 per lost cetacean year. The numbers of individual marine mammals impacted is estimated in the tens of thousands of dolphins and whales, with one affected species, the sperm whale, being listed as endangered under the ESA, protected by the Marine Mammal Protection Act, and protected by the International Whaling Commission's global ban on harvest. Using the abundance estimate for sperm whales in the northern Gulf of Mexico provided in the introduction to the marine mammal injury assessment (page 4-590; 763 individuals), and the mortality estimate of 6% of the population of sperm whales killed as provided in table 4.9-6, about 46 sperm whales were directly killed by the spill (this figure would be more than doubled if the pre-spill abundance estimate of 1635 from tables 4.9-5 and 4.9-12 is accurate; the reason for this discrepancy in abundance estimates should be explained). A humpback whale in Australia is estimated to be valued at $1.25 million for the whale watching tourism industry. Using just that ecotourism value as a proxy for the value of a single sperm whale could yield a value for the loss of sperm whales alone of at least $57.5 million, which is over one third of the proposed marine mammal allocation but reflects a value for only one species of the 22 populations assessed. How was the value of a sperm whale calculated? Certainly the public would value the opportunity to see a sperm whale similarly to seeing a humpback whale, were the public more generally aware of this injury. How was the value of each sperm whale, dolphin, and other whale or dolphin species evaluated? A captive male killer whale has a reported value of $7 million dollars to an aquarium.

4. Given that $70 million is allocated to the states for the restoration of the inshore bottlenose dolphin populations (almost half of the total marine mammal allocation, disregarding the $19M allocated region-wide, some of which will almost certainly be spent inshore), the allocation for offshore species restoration seems exceptionally low. Additionally, it seems that there is not a reported value on the life of a bottle nosed dolphins when it seems easy to find out the value of them to wildlife watchers with dolphin watching occurring across Gulf estuaries and their ever present appearance in aquarium shows. These whales and dolphins, inshore and offshore (all species represented across the 22 populations assessed), will all have the same future problems with reduced fecundity and increased rates of mortality further hindering their recovery.

5. $540 million is allocated in the plan to address lost human uses of the Gulf of Mexico. There is absolutely no way that humans have lost more "uses" of the Gulf than sperm whales, bottlenose dolphins, and other species of whales/dolphins. Not one beach-goer or fisher lost his or her life breathing the fumes, became infertile from the toxins, or gave birth to a stillborn child. Marine mammals suffered all these effects. If humans lived in an area where contaminants were causing a 46% reduction in reproductive viability, the area would be declared a Superfund site and people would be removed. How will the trustees assure marine mammals live in an environment that is not toxic? Injury assessment identifies specific habitat areas where marine mammals congregate, but the restoration plan doesn't acknowledge this. It is very questionable that so much more is allocated for restoration of human uses across the same four states where only $144 million has been allocated for the species that are the apex predators and utilize all components of the three dimensional ocean from the offshore depths and surfaces to near shore estuaries.

6. The allocation for marine mammals did not consider what it will really take to restore the populations of marine mammals that were injured. How were the numbers / dollar values estimated by species or by individual. Tens of thousands of whales and dolphins are estimated to have been exposed to the oil toxic fumes. These species exchange almost all of their oxygen in their breaths at the water surface, thereby exposing their lungs and other internal organs to the highly toxic fumes at the surface more directly than any other species. It doesn't appear that even their commercial value has been estimated. Marine mammals values could be easily estimated to be much higher than assessed based on their very high commercial value from aquarium entertainment and education, wildlife watching, or even previous whaling values.

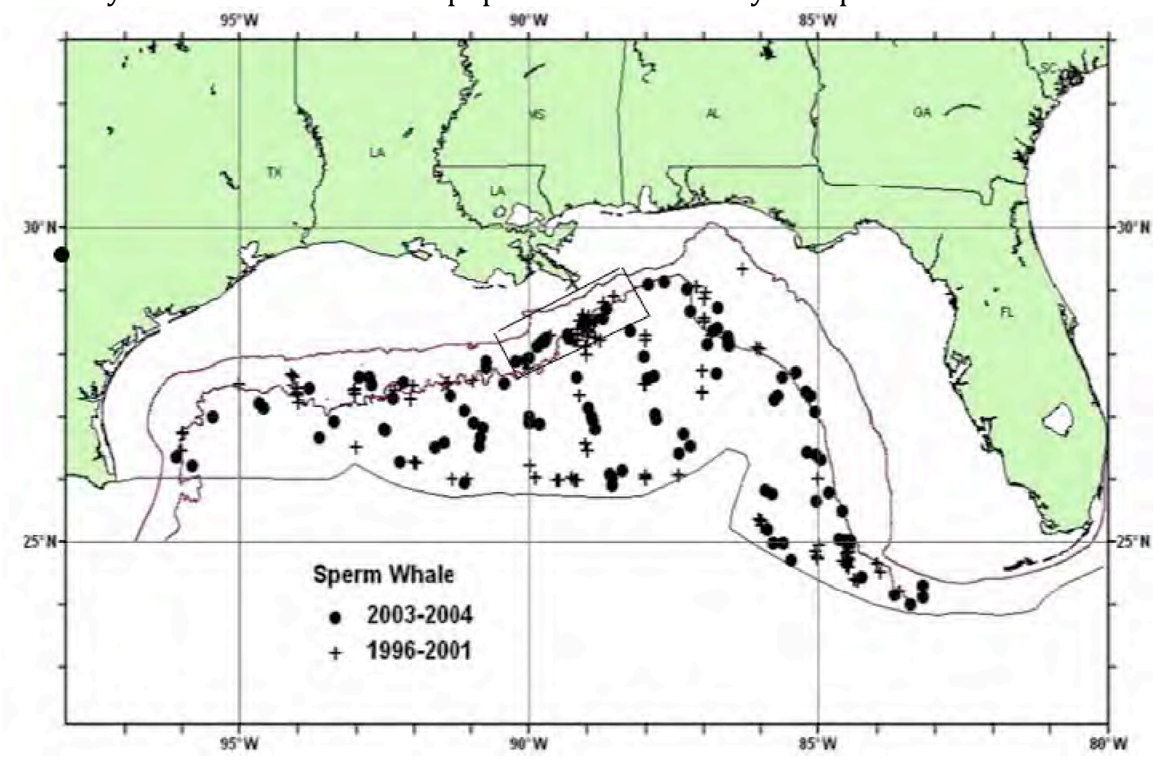
Lastly, the restoration plan for marine mammals appears to primarily address items that NOAA and NMFS are already required to address through management of fisheries and the public trust resources. No part to the plan appears to directly restore the populations of marine mammals impacted from the oil spill itself. The tools listed include collaborative partnerships with fishers to reduce their impacts and accidental takings (this is not an impact of the spill and does need to be done but, it is not likely to restore sperm whale populations numbers taking 29 years to restore).

Another listed tool is providing more funding to marine mammal stranding networks for researching causes of death, possible rehabilitation of dolphins, and necropsies. Most stranded whales and dolphins are near shore inhabitants and it is very unlikely much will be learned about the more pelagic populations. And it is

very unlikely a sperm whale might be rehabilitated and released back into the wild. There is not any disagreement that stranding networks are poorly funded and require more funding, but even a 7-fold increase in their funding will not restore populations of marine mammals. While this approach may contribute important information to understanding why (particularly coastal) marine mammals die, it is not a proactive restoration approach contributing to active restoration of populations impacted by the spill.

Were takings under the MMPA /Endangered species Act protections enforced under separate settlements or added to the value assessed for injury under the NRDA? If they are included in the NRDA assessment, the proposed allocation appears even more insufficient.

In summary, the proposed plan does not meet the Trustees' obligations to compensate the public for the loss of these resources by restoring marine mammal populations. The plan doesn't include any thing substantial toward active restoration of these populations and should incorporate the concepts identified above to provide more substantial refuge and protection to these populations on a more permanent basis, particularly in light of the uncertainty related to the recovery of the marine mammal populations affected by the spill.



Proposed Gulf Sperm Whale National Marine Sanctuary is outlined in the box above. See attached summary document regarding sperm whale distribution and selection of the boxed area as the sanctuary.

December 4, 2015

From: Bernd Würsig
2402 Creekridge Dr.
Pearland, TX 77581

To: Natural Resources Damage Assessment Trustees

Reference: Comments on the Draft Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS) for the Deepwater Horizon Oil Spill

Dear Trustees,

Thank you for the time, energy, and expense you have collectively invested in assessing damages to natural resources from the Deepwater Horizon Oil Spill/Explosion (BP Spill) occurring in the Gulf of Mexico in 2010, and for estimating the monetary cost of restoring public trust resources to their previous states. The Deepwater Horizon incident brought months of continuous gushing that released 134 million gallons of oil from the sea floor and into the three-dimensional pelagic environment of the ocean from the abyssal zone to the photic zone, flowing shoreward into many estuaries of national significance, floating onto over 1300 miles of beaches and shorelines, and evaporating into the air that marine mammals and sea turtles breathe, along with an additional 1.84 million gallons of dispersant applied throughout the water column and at the sea surface. The event is the most catastrophic manmade environmental disaster in the history of the United States. It is really hard to imagine that the assessment of the damages is complete or that the monetary value proposed to settle the public claims for natural resource damages is the total amount required to fully restore the public trust resources of the Gulf region, considering this restoration plan considers injuries to such a wide array of resources, including everything from brown pelicans to soft corals, sea turtles, marshes, oysters, sperm whales, 21 other species of marine mammals, and more (water column resources). Many species of animals (from sperm whales to small marsh periwinkles), plants (e.g., phytoplankton on smooth cord grass), and many other species that have yet to even be discovered were killed, injured, or impaired for life. This value cannot be truly estimated.

In reviewing the proposed restoration plan it seems that it is almost impossible to have comprehensively assessed the damage and accurately estimated the value of compensation required to restore the Gulf. The attempt is admirable and I realize that we as a nation must move forward on restoration after five years. As stated in the plan it will not be fruitful for the Gulf to have to wait 20 years or more for a complete assessment. Nevertheless, my comments here focus on the apparent insufficiency of a significant component of the plan: its consideration for the lives of the largest and most charismatic animals in the Gulf. These are the sperm whales and their toothed cousins (dolphins) and un-toothed cousins (baleen

whales). The amount of funding allocated for the restoration of marine mammals, and the restoration approaches considered for these species, seem paltry and insufficiently evaluated given the damages to marine mammals outlined in the injury assessment chapter, which are compounded in the context of previously depleted populations due to whaling and human impacts so severe that special federal legislation was passed to protect them (the Marine Mammal Protection Act). One pelagic species of marine mammal in the Gulf is protected under the Endangered Species Act, the sperm whale. Estimating damage to the sperm whale population and proposing methods of restoration for it and its habitat must certainly be challenging given how very little is known about sperm whale life history or physiology, or about rates of global recovery from whaling. More is known about the damage to bottlenose dolphin populations in the Barataria-Terrebonne estuaries, and the trustees' assumptions related to similar toxicity impacts affecting sperm whales and other species of marine mammals in the Gulf are reasonable.

The injury assessment states that 1,100 marine mammals were observed in the surface slick. Humans in the vicinity donned respirators and HAZMAT suits, and even they suffered adverse respiratory affects. The NRDA trustees have estimated tens of thousands of dolphins and whales were exposed in the described "contaminated prime marine mammal habitat in the estuarine, nearshore, and offshore waters of the northern Gulf of Mexico." It is known that marine mammals inhaled or aspirated liquid oil and this caused death in stranded dolphins. Other routes of exposure and evidence of injury are documented. 1,000 dolphins and whales were found stranded. The annual average of strandings increased four fold. The offshore and more pelagic species likely did not strand and no bodies were seen or recovered. How were the numbers of their mortalities or sublethal injuries estimated? It can only be surmised that the offshore and more pelagic species of whales and dolphins living in the "prime" marine mammal habitat affected by the spill also have lung disease, adrenal disease, and poor body condition from the extreme exposures resulting from the Deepwater Horizon event.

Data for strandings following DWH reflect the largest and longest lasting marine mammal unusual mortality event on record in the northern Gulf of Mexico. The injury assessment report states that dolphin and whale populations living offshore were generally less affected than bay, sound, and estuary dolphins. How can this be known? How was this data evaluated? These populations are smaller, congregate in the area affected by the spill, are dependent on the full spectrum of offshore water column habitats, and their bodies are much less likely to strand. The public is generally unaware that 22 species of marine mammals are found in the northern Gulf or that the Gulf hosts resident sperm whales; very few people have even heard of a Bryde's whale. The pelagic environment where most species of the impacted whales and dolphins live is far from shore, requiring a full day to reach in seas that are frequently unpredictable. Most people will never see this part of the Gulf. Despite this, the public holds whales in high regard and there is global pressure to protect all whales and dolphins from fisheries and harvesting, to release captive

killer whales, to stop the capture of whales and dolphins for aquariums, and to participate in whale watching. It is highly unlikely the NRDA trustees have evaluated this true value to the public of whales and dolphins.

Please consider the following requests for integration of additional restoration approaches into the proposed plan, revisions of proposed allocations of funds for restoration, and contingency for failure of the Trustees' proposed approaches for restoration of marine mammal populations:

A. <u>Establishment of a Gulf Sperm Whale/Pelagic Ecosystem National Marine Sanctuary of significant size</u>

This sanctuary will serve as a truly pelagic sanctuary for the remaining estimated 700 resident sperm whales in the Gulf of Mexico, providing safe haven for the Gulf's largest and most endangered marine mammal species, which is the most dependent on the full spectrum of depths and habitats in the offshore water column. Sperm whales rest at the surface, dive to and feed in depths over one mile, and are most frequently found associated with the interface between cold-core and warm-core eddies along the 1,000m isobath. There is very good data for sperm whale feeding and calving aggregations in the Gulf from the research conducted under the "Gulf Cet" program funded by the former Minerals Management Service (now BOEM). With data from Gulf Cet and the expertise of marine mammal researchers involved in this research it would be easy to establish appropriate boundaries for the Gulf Sperm Whale National Marine Sanctuary.

The Gulf is unique in that it hosts a resident population of sperm whales, which is considered strategically important in the global restoration of this species. It is not evident in the NRDA assessment and restoration plan that the impact of the spill on the global population of sperm whales has been calculated or addressed. It is important that this damage is calculated and added to the monetary valuation of the damage to sperm whales.

A Gulf Sperm Whale National Marine Sanctuary will protect many other species of marine mammals, billfish, tuna, and other species known to spawn in similar areas associated with features on the bottom, water column chemistry and currents, and eddy/gyre features. While such water column features can move slightly from season to season or year to year, it is possible to identify the areas in which they typically occur, offering the greatest protections to the species associated with them (see the attached map showing my proposal for an area that could be considered). It is vital that these areas be protected from human impacts and the formation of this marine protected area will also address all of the goals and methods listed in the restoration plan for marine mammals (see below). A large component of direct restoration for pelagic species will have to be a protected area for them specifically free of fishing, unnatural sound, and oil and gas exploration and development impacts. These species need a place free from the many

threats that exist in the Gulf of Mexico: potential future oil spills, unnatural sound, drilling, dead zones, pollution, ship strikes, etc.; a "no-human zone," no oil zone, and/or research only zone.

Scientific data exists to support establishing a truly pelagic sanctuary, and the sperm whale is the perfect "poster child" for such a sanctuary. This approach would turn what is now an exceptionally vague proposed restoration plan, incorporating limited tools, into something profound and meaningful for the pelagic environment that was damaged drastically by the DWH oil spill. Using the NMSA to designate a protected area would provide a mechanism through which all of the other proposed restoration strategies for marine mammals could be accomplished, giving back to the sperm whales what BP and oil exploration took away from them. As identified in the PDARP, several areas between the Mississippi Canyon and the DeSoto Canyon have known high densities of sperm whales likely because of localized and highly productive habitats. Setting aside an area for the protection of the sperm whale will have cascading impacts of improved protection and restoration for many pelagic species of fishes, cephalopods, and invertebrates.

B. **<u>The creation of the Sperm Whale and Pelagic Ecosystem Interpretive Center on-shore</u>**

A specialized, high tech facility provided for the interpretation to the public of sperm whale life histories and population dynamics, and of the pelagic environment generally, creates the capacity to educate the American public about the complex pelagic environment that very few people are ever able to directly witness. The offshore Gulf has fueled the economy through fisheries (tuna to anchovies), shipping, and oil and gas. People need to understand why, as well as what animals live there and how humans impact them. The depths of the Gulf are generally unknown to the public. The lives of sperms whales are extreme by any measure of comparison to other animals on earth and in the oceans. Sperm whales spend their lives regularly going where humans cannot, in an environment humans spend great amounts of money to minimally explore. Through interpretation of the story of the lives of sperm whales, people can gain an understanding of the abyssal zone, migrations of species through the water column (e.g., the deep scattering layer), migrations of dispersed males to Antarctica, and even more basic and essential principals such as the differences between the aphotic, mesophotic, and photic zones of the ocean, or the important roles sperm whales play for other species deep in the water column and connecting the surface and the deep ecosystems. This center should be located in a location or locations accessible to the greatest numbers of people in the Gulf of Mexico region, such as the metropolitan areas with the largest populations in Houston, New Orleans, and Tampa.

C. <u>Design, development, and commissioning of the Gulf Sperm Whale and Pelagic Ecosystem research vessel, an offshore vessel dedicated to</u>

studying marine mammal population growth in the pelagic environment

The study of the pelagic environment takes specialized talents and technologies, and is truly multidisciplinary. With the establishment of the Gulf Sperm Whale National Marine Sanctuary there must be a mechanism for the natural resource managers, researchers, and others to access the sanctuary and the pelagic environment of the northern Gulf. It will be necessary to invest substantial time in assessing the growth or decline of populations, health of the marine mammals (fecundity and mortality and dispersion), and learn further about the life histories of the sperm whales and other marine mammals in the Gulf. One cannot assess the recovery and restoration of the marine mammals and other pelagic species without consistent, long-term assured access to the pelagic environments of the Gulf.

D. Review of the proposed monetary allocation by the NRDA of $144 million for the restoration of marine mammals.

This allocation should be adjusted by adding an allocation of $70 million for the sole purpose of establishing and managing the Gulf Sperm Whale National Marine Sanctuary, and adding a $100 million endowment dedicated to sustained research, restoration, and adaptive management in the Gulf Sperm Whale National Marine Sanctuary, lasting at least the life time of an average sperm whale, bringing the total to $314 million in funds to restore the marine mammals of the northern Gulf.

Reassessment of the NRDA valuation of damages to sperm whales and other marine mammals is requested on the following grounds.

1. The sperm whale population is globally significant. These resident sperm whales raise their young in highly structured social groups. The males ultimately disperse and travel to Antarctica and throughout the world's oceans. A loss of a male sperm whale from DWH is a much bigger loss than just its loss to the Gulf. With already globally reduced populations, each male is essential to genetic diversity at global level. The same is the case with a female sperm whale because if one female becomes infertile the entire global population is impacted with reduced fecundity as a whole. If the sperm whales have similar problems as the bottlenose dolphins, scientists won't know if fecundity (or morbidity) has been affected until at least 2018.

2. Sperm whales can dive to depths more than twice as deep as the DWH wellhead, and therefore the oil and increased contaminant concentrations on the bottom surrounding the wellhead are affecting the habitats where they feed. Of all the species impacted by the DWH it will be the hardest to assess the impact on the sperm whales. The current draft restoration

plan does not appear to have considered or assessed the value of the feeding grounds of sperm whales, which is particularly problematic given their endangered status.

3. It is shocking to read the extremely low NRDA estimation of $144 million allocated to restore the populations of marine mammals in the Gulf of Mexico. Based on the material presented in the plan, almost 1.4 million lost cetacean years resulted from the spill, and the allocation provides only ~$104 per lost cetacean year. The numbers of individual marine mammals impacted is estimated in the tens of thousands of dolphins and whales, with one affected species, the sperm whale, being listed as endangered under the ESA, protected by the Marine Mammal Protection Act, and protected by the International Whaling Commission's global ban on harvest. Using the abundance estimate for sperm whales in the northern Gulf of Mexico provided in the introduction to the marine mammal injury assessment (page 4-590; 763 individuals), and the mortality estimate of 6% of the population of sperm whales killed as provided in table 4.9-6, about 46 sperm whales were directly killed by the spill (this figure would be more than doubled if the pre-spill abundance estimate of 1635 from tables 4.9-5 and 4.9-12 is accurate; the reason for this discrepancy in abundance estimates should be explained). A humpback whale in Australia is estimated to be valued at $1.25 million for the whale watching tourism industry. Using just that ecotourism value as a proxy for the value of a single sperm whale could yield a value for the loss of sperm whales alone of at least $57.5 million, which is over one third of the proposed marine mammal allocation but reflects a value for only one species of the 22 populations assessed. How was the value of a sperm whale calculated? Certainly the public would value the opportunity to see a sperm whale similarly to seeing a humpback whale, were the public more generally aware of this injury. How was the value of each sperm whale, dolphin, and other whale or dolphin species evaluated? A captive male killer whale has a reported value of $7 million dollars to an aquarium.

4. Given that $70 million is allocated to the states for the restoration of the inshore bottlenose dolphin populations (almost half of the total marine mammal allocation, disregarding the $19M allocated region-wide, some of which will almost certainly be spent inshore), the allocation for offshore species restoration seems exceptionally low. Additionally, it seems that there is not a reported value on the life of a bottle nosed dolphins when it seems easy to find out the value of them to wildlife watchers with dolphin watching occurring across Gulf estuaries and their ever present appearance in aquarium shows. These whales and dolphins, inshore and offshore (all species represented across the 22 populations assessed), will all have the same future problems with reduced fecundity and increased rates of mortality further hindering their recovery.

5. $540 million is allocated in the plan to address lost human uses of the Gulf of Mexico. There is absolutely no way that humans have lost more "uses" of the Gulf than sperm whales, bottlenose dolphins, and other species of whales/dolphins. Not one beach-goer or fisher lost his or her life breathing the fumes, became infertile from the toxins, or gave birth to a stillborn child. Marine mammals suffered all these effects. If humans lived in an area where contaminants were causing a 46% reduction in reproductive viability, the area would be declared a Superfund site and people would be removed. How will the trustees assure marine mammals live in an environment that is not toxic? Injury assessment identifies specific habitat areas where marine mammals congregate, but the restoration plan doesn't acknowledge this. It is very questionable that so much more is allocated for restoration of human uses across the same four states where only $144 million has been allocated for the species that are the apex predators and utilize all components of the three dimensional ocean from the offshore depths and surfaces to near shore estuaries.

6. The allocation for marine mammals did not consider what it will really take to restore the populations of marine mammals that were injured. How were the numbers / dollar values estimated by species or by individual. Tens of thousands of whales and dolphins are estimated to have been exposed to the oil toxic fumes. These species exchange almost all of their oxygen in their breaths at the water surface, thereby exposing their lungs and other internal organs to the highly toxic fumes at the surface more directly than any other species. It doesn't appear that even their commercial value has been estimated. Marine mammals values could be easily estimated to be much higher than assessed based on their very high commercial value from aquarium entertainment and education, wildlife watching, or even previous whaling values.

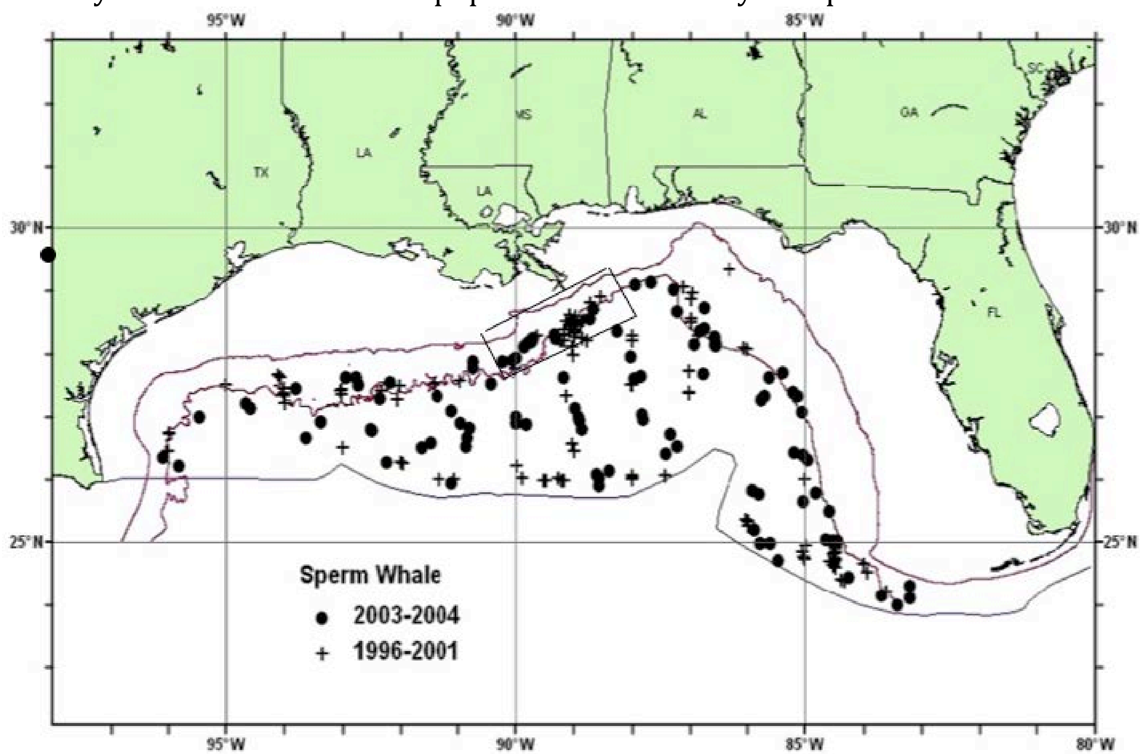
Lastly, the restoration plan for marine mammals appears to primarily address items that NOAA and NMFS are already required to address through management of fisheries and the public trust resources. No part to the plan appears to directly restore the populations of marine mammals impacted from the oil spill itself. The tools listed include collaborative partnerships with fishers to reduce their impacts and accidental takings (this is not an impact of the spill and does need to be done but, it is not likely to restore sperm whale populations numbers taking 29 years to restore).

Another listed tool is providing more funding to marine mammal stranding networks for researching causes of death, possible rehabilitation of dolphins, and necropsies. Most stranded whales and dolphins are near shore inhabitants and it is very unlikely much will be learned about the more pelagic populations. And it is

very unlikely a sperm whale might be rehabilitated and released back into the wild. There is not any disagreement that stranding networks are poorly funded and require more funding, but even a 7-fold increase in their funding will not restore populations of marine mammals. While this approach may contribute important information to understanding why (particularly coastal) marine mammals die, it is not a proactive restoration approach contributing to active restoration of populations impacted by the spill.

Were takings under the MMPA /Endangered species Act protections enforced under separate settlements or added to the value assessed for injury under the NRDA? If they are included in the NRDA assessment, the proposed allocation appears even more insufficient.

In summary, the proposed plan does not meet the Trustees' obligations to compensate the public for the loss of these resources by restoring marine mammal populations. The plan doesn't include any thing substantial toward active restoration of these populations and should incorporate the concepts identified above to provide more substantial refuge and protection to these populations on a more permanent basis, particularly in light of the uncertainty related to the recovery of the marine mammal populations affected by the spill.



Proposed Gulf Sperm Whale National Marine Sanctuary is outlined in the box above. See attached summary document regarding sperm whale distribution and selection of the boxed area as the sanctuary.

December 4, 2015

Ms. Courtney Groeneveld
Communications Specialist
Habitat Restoration Division
National Marine Fisheries Service
1315 East-West Highway
SSMC3, 14th Floor F/HC3
Silver Spring, MD 20910

Submitted Electronically via https://parkplanning.nps.gov/commentForm.cfm?documentID=68459 and gulfspill.comments@noaa.gov

RE: Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement

Dear Ms. Groeneveld:

The National Ocean Policy Coalition ("Coalition") is an organization of diverse interests representing sectors and entities that support tens of millions of jobs, contribute trillions of dollars to the U.S. economy, and seek to ensure that actions under the National Ocean Policy ("NOP") Executive Order[1] are implemented in a manner that best benefits the National interest, including protection of the commercial and recreational value of the oceans, marine-related natural resources, and terrestrial lands of the United States.

Since its founding in 2010, one of the Coalition's primary efforts has been to identify and recommend practical and reasonable alternatives to the coastal and marine spatial planning ("CMSP") intiaitive within the NOP because of its potential to result in unncessary restrictions or prohibitions on commercial and recreational activities through zoning plans, new and costly constraints on regulatory options, and the establishment of protected areas outside of statutorily authorized entities and processes. To that end, we have encouraged alternative planning processes that promote clear authority, meaningful stakeholder participation, transparency, and non-binding advisory products.[2]

---

[1] *See* July 19, 2010 Executive Order on Stewardship of the Ocean, Our Coasts, and the Great Lakes, *available at* https://www.whitehouse.gov/files/documents/2010stewardship-eo.pdf. The Final Recommendations of the Interagency Ocean Policy Task Force adopted by the Executive Order are available at https://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf.

[2] *See e.g.* Nov. 3, 2014 NOPC Comments on Options for the Northeast Regional Ocean Plan, *available at* https://gallery.mailchimp.com/6bb66fed099f6eb4e4253667e/files/11_3_14_NOPC_Comments_to_NE_RPB.pdf; and Nov. 20, 2014 NOPC Comments on Mid-Atlantic Regional Ocean Action Plan Options, Status of the Mid-Atlantic Regional Ocean Assessment, and Interim Plan for Stakeholder Engagement, *available at* https://gallery.mailchimp.com/6bb66fed099f6eb4e4253667e/files/NOPC_Comments_to_MidA_RPB_11_20_14_.pdf.

The Coalition's concerns have been underscored by the decisions of the Northeast and Mid-Atlantic Regional Planning Bodies to draft marine plans based on ecological features that some believe warrant additional zoning measures and protection, outside the normal regulatory process.[3]

Given that the NOP requires federal agencies to engage in CMSP regardless of Regional Planning Body or state participation,[4] the Coalition has also been monitoring National Ocean Policy/CMSP implementation activities of relevance to all regions, including those where all states choose not to participate in a regional planning body for CMSP.

Developments outside the Regional Planning Body context that have highlighted the potential for the NOP/CMSP effort to inject uncertainty into legal and regulatory procedures, thereby affecting economic and societal interests, include but are not limited to the following:

- NOP Implementation Plan's call for "protect[ing] significant natural and cultural marine and Great Lakes areas and sufficient habitat to ensure maintenance of ecosystem processes;"[5]
- Interior Department reference to CMSP as "a new paradigm and planning strategy for coordinating all marine and coastal activities and facility constructions with the context of a national zoning plan;"[6]
- Interior Department citation to the NOP as justification in part to exclude commercial activity across a large swath of U.S. waters through at least 2017;[7] and
- Language in the Updated Framework for the National System of Marine Protected Areas of the United States stating that "effective regional collaboration" for marine protected areas should include linkages to Regional Planning Bodies, and that the MPA Center "may contribute to regional planning efforts and efforts by individual MPA programs to identify and fill important conservation gaps that may be effectively filled through the establishment of new MPAs and MPA networks"[8]

---

[3] *See e.g.* November 2015 Draft Northeast Ocean Plan Outline Chapter 3 Addendum, Pages 1-4, *available at* http://neoceanplanning.org/wp-content/uploads/2015/11/Northeast-Ocean-Plan-Chapter-3-Addendum.pdf; Draft Components of Important Ecological Areas Under Consideration by EBM Work Group and Northeast RPB, *available at* http://neoceanplanning.org/wp-content/uploads/2015/11/Draft-Components-of-IEAs.pdf; Mid-Atlantic Regional Ocean Action Plan Draft Outline, Page 1, http://www.boem.gov/Draft-OAP-outline-September-2015/; and Mid-Atlantic Regional Planning Body Draft Interjurisdictional Coordination Actions, Pages 9-10, *available at* http://www.boem.gov/Draft-MidA-RPB-IJC-Coordination-Actions-September-2015/.

[4] *See e.g.* July 19, 2010 Executive Order on Stewardship of the Ocean, Our Coasts, and the Great Lakes, Section 6, *available at* https://www.whitehouse.gov/files/documents/2010stewardship-eo.pdf, and National Ocean Policy Implementation Plan, Page 26, *available at* https://www.whitehouse.gov//sites/default/files/national_ocean_policy_implementation_plan.pdf.

[5] *See* April 2013 NOP Implementation Plan, Page 22, *available at* https://www.whitehouse.gov//sites/default/files/national_ocean_policy_implementation_plan.pdf.

[6] *See* Draft Programmatic Environmental Impact Statement, Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017, U.S. Interior Department, Bureau of Ocean Energy Management, November 2011, Page 4-54 and 4-58, available at http://www.boem.gov/uploadedFiles/BOEM_2012-2017_OCS_Oil_and_Gas_Leasing_Draft_Programmatic_EIS.pdf.

[7] *See* "Salazar Announces Revised OCS Leasing Program," Press Release, December 1, 2010, available at http://www.doi.gov/news/pressreleases/Salazar-Announces-Revised-OCS-Leasing-Program.cfm.

[8] *See* Framework for the National System of Marine Protected Areas of the United States of America, Pages 23 and 27, *available at* http://marineprotectedareas.noaa.gov/nationalsystem/framework/final-mpa-framework-0315.pdf.

In this instance, the Coalition is concerned about language in the Natural Resource Damage Assessment Trustees' Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement ("PDARP/PEIS") that references spatial planning (without defining or addressing it with specificity) as well as the potential establishment or expansion of marine protected areas.

As NOAA notes, the purpose of the Natural Resource Damage Assessment ("NRDA") process such as the one being conducted in this instance is to address the impact of one specific event.[9] Thus, the PDARP/PEIS and NRDA process underway should be limited accordingly and not used to set policy, influence regulatory activities, or apply to other scenarios. The inclusion of the NOP Executive Order in a list of "Other Laws and Executive Orders" underscores the Coalition's concerns about making unwarranted reference to a far more expansive policy.[10]

Specifically, in addressing the restoration of marine mammals, the Draft PDARP/PEIS includes the following statements regarding spatial planning, which we interpret to convey the same intent as CMSP or other language that could lead to zoning efforts that would be beyond the context and scope of the process underway:

- Recovery of marine mammals "necessitates a portfolio of restoration approaches that…includes…spatial planning…"
- "Critical needs for identifying priority threats include…spatial planning."
- "Monitoring and scientific support for adaptive management of restoration approaches would include…development of spatial planning information management tools (e.g. GIS maps, databases, and statistical models)…"
- "…information is needed to…prioritize those [marine mammal] stocks in need of additional restoration, adaptive management, or conservation actions using spatial planning tools."
- "Updated information with finer spatiotemporal resolution is needed to develop and distribute more accurate spatial planning and decision support tools to further inform restoration, define restoration activities, and monitor the effectiveness of all the restoration activities."
- "There could be efficiencies in developing spatial planning tools by coordinating with other efforts such as sea turtle geospatial planning."[11]

The Draft PDARP/PEIS further notes that one goal of marine mammal restoration would be to implement an integrated portfolio of restoration approaches, one of which is the measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals.[12] In another example where the PDARP/PEIS moves beyond the limited scope and purpose of the NRDA process underway, it is further noted that this approach "may involve…implementing spatial planning and

[9] *See* Damage Assessment, *available at* http://www.gulfspillrestoration.noaa.gov/assessment/ (accessed Dec. 3, 2015).

[10] *See* Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement (Draft PDARP/PEIS), Page 6-232, *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-6_Environmental-Consequences2.pdf.

[11] *See* Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement, Pages 5-66, 5-69, 5-70, and 5-71, *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf.

[12] *See Id.* at 5-66 and 5-69.

decision support tools" and that the cominbation of information on marine mammals and their habitats "will be incorporated into…spatial planning tools for use in environmental impact assessment, operational planning, and permitting by federal agencies."[13]

Another identified marine mammal restoration approach is the protection and conservation of marine, coastal, estuarine, and riparian habitat.[14] The Draft PDARP/PEIS notes that establishment or expansion of protections for marine areas (marine protected areas) is a technique that could be employed to implement such an approach.[15]

As to restoration of mesophotic and deep benthic communities, the Draft PDARP/PEIS includes a goal to actively manage valuable communities to protect against multiple threats and a restoration approach focused on protection and management.[16] In stating that "spatially based management provides a framework for addressing key threats," the Draft PDARP/PEIS notes that marine protected areas "can restrict oil and gas activities, limit types of fishing gear, restrict anchoring…"[17]

Further expanding on the mesophotic and deep benthic community protection/management restoration approach, the Draft PDARP/PEIS notes that establishing protections could include expanding existing management or designating new areas for management and that "projects that manage and prevent future injuries from known threats can often have more certain outcomes and be more cost-effective than projects designed to create these resources."[18] In discussing implementation considerations, it references federal statutes and mechanisms including the National Marine Sanctuaries Act, Antiquities Act, no-activity zones, and habitat areas of particular concern.[19]

Since the issuance of the NOP Executive Order in July 2010, the Coalition and many other groups have been concerned that NOP/CMSP implementation could, among other things, upend the regulatory process by forcing agencies to comply with marine spatial plans developed outside congressionally-authorized processes, potentially leading to inappropriate restrictions on access for a myriad of human use activities that are critical to the nation's economic and societal health. In addition to economic implications, since it has not been authorized by Congress and given the mandate for federal implementation, significant uncertainty also remains with regard to potential NOP/CMSP impacts on legal certainty under existing statutory and regulatory processes.

If it is in fact the intent to refer to spatial planning under the NOP, the Coalition strongly urges the Trustees to avoid the potential for the restoration plan to add to those uncertainties and concerns by removing all references to spatial planning. The need for doing so is magnified by the fact that most of the public and many decision-makers remain unaware of the NOP/CMSP initiative, and since the Gulf Coast states have elected not to form a Regional Planning Body to participate in the effort during the five years that the NOP has been in place. Given the entirety of these circumstances, the Draft PDARP/PEIS is not an appropriate mechanism for furthering the NOP/CMSP in the Gulf of Mexico.

---

[13] *See Id.* at 5-295.
[14] *See Id*. at 5-69.
[15] *See Id*. at 5-236-237 and 5-239, and Page 6-36, *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-6_Environmental-Consequences2.pdf.
[16] *See* Draft PDARP/PEIS, Page 5-79, *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf.
[17] *See Id*. at 5-80.
[18] *See Id.* at 5-313. *See also* 5-80.
[19] *See Id*. at 5-315.

To the degree that the Trustees do not intend to refer to the NOP/CMSP when mentioning "spatial planning" and decide to maintain such references in the final product, the PDARP/PEIS should describe in detail the spatial planning activities and processes that are intended to be referenced and carried out and the specific statutory and regulatory authorities that would permit their use, and allow additional opportunities for the public to comment on those draft activities and processes.

With regard to the references to the establishment or expansion of marine protected areas, and in light of previous and ongoing linkages between CMSP and marine protected areas (see above), the Coalition also urges the Trustees to clarify that any such establishment or expansion would be developed and implemented only to the extent that they are specifially authorized by statute.

The Coalition also urges the Trustees to remove the reference to the potential use of the Antiquities Act (see above) to establish protected areas. The need for doing so is underscored by language in the Draft PDARP/PEIS noting the continuing availability of public comment opportunities to ensure public participation and engagement in restoration activities,[20] recent developments in the Northeast that have highlighted deficiencies in transparency and public engagement surrounding potential Antiquities Act designations,[21] and the fact that the Antiquities Act does not include public comment and engagement requirements.[22]

Lastly, in making protection of coastal, estuarine, and riparian habitats and mesophotic and deep benthic communities the focus of restoration approaches, the Draft PDARP/PEIS presents marine protected areas as the sole mechanism for action, with a conclusion that mesophotic and deep benthic communities "would particularly benefit from a preventive restoration project because they are sessile and therefore susceptible to threats such as oil and gas activities, fishing activities, and marine debris."[23] Given the limited scope and purpose of the NRDA process underway, such statements and related recommendations that could be used to influence or establish policy, regulations, or other federal decision-making activities should be removed from the PDARP/PEIS.

To the extent that marine protected areas are addressed in the final draft, the Coalition urges the Trustees to identify them as a potential means to accomplish a particular goal or objective, which would be established through a public process, and not as protection for the sake of protection absent appropriate justification, procedural grounding, and a measurable outcome.

---

[20] *See Id.* at 5-80, 5-108 and 5-315.

[21] *See e.g.* Sept. 15, 2015 Letter from Fishing Community Members, Fisheries Survival Fund, and Northeast Seafood Coalition to President Barack Obama, *available at* http://www.savingseafood.org/wp-content/uploads/2015/09/NE-Marine-Monument-Letter-Petition-9-15-15.pdf?utm_source=Petition+on+Cashes+Ledge+Monument&utm_campaign=Obama+threatens+MSA+veto&utm_medium=email, and Gloucester Times, "Lawmakers press Obama on monument plan," Oct. 14, 2015, *available at* http://www.gloucestertimes.com/news/local_news/lawmakers-press-obama-on-monument-plan/article_3a890587-53fb-5bfc-8274-e67654b5fe6c.html.

[22] *See* 54 U.S.C. § 320301, *available at* https://www.law.cornell.edu/uscode/text/54/320301-.

[23] *See* Draft PDARP/PEIS at 5-313 to 5-316, *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-5_Restoring-Natural-Resources1.pdf.

As the Draft PDARP/PEIS acknowledges but does not fully evaluate, designation or expansion of a protected area "may restrict some activities within certain areas."[24]

Highlighted by the potential for socioeconomic impacts, any decision to establish or expand a marine protected area must be the result of a statutorily-authorized, well-informed, and case-by-case process and assessment that considers a range of potential actions (including those not related to marine protected areas), is grounded in sound science and strong user group and public engagement, and avoids pre-determined outcomes and judgements. The Draft PDARP/PEIS text should be revised accordingly.

The Coalition appreciates your consideration of the comments herein and the opportunity to provide comments on the Draft PDARP/PEIS.

Sincerely,

Brent D. Greenfield

Brent Greenfield
Executive Director
National Ocean Policy Coalition

---

[24] *See* Draft PDARP/PEIS at 6-38, *available at* http://www.gulfspillrestoration.noaa.gov/wp-content/uploads/Chapter-6_Environmental-Consequences2.pdf.

December 4, 2015

Natural Resource Damage Assessment and Restoration
Trustee Council
U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

Dear NRDA Trustee Council,

The signatories to this letter represent a coalition heavily engaged in addressing the damages from the largest oil spill in US history and how those efforts interface with long-term coastal restoration planning and implementation. The impacts from the oil spill were unprecedented – surface oil slick extended 15,300 square miles, oil was detected over 43,300 square miles of the ocean, 1,300 miles of shoreline and 12,500 acres of sand beach habitat were contaminated. Accordingly, the restoration activities must also be unprecedented.

We applaud those who have worked very diligently on the Draft Programmatic Damage Assessment and Restoration Plan (PDARP) and Draft Programmatic Environmental Impact Statement (PEIS). Your work in developing a vision and a restoration plan that fairly addresses an endlessly complex ecosystem and the impacts to this spill is evident. Focusing on ecosystem linkages and connectivity provides a system-based approach to restoration that will lead to large-scale benefits across the Gulf of Mexico (GoM). It is important that we acknowledge and recognize that restoration does not know political boundaries, therefore restoration benefits, especially when accruing at large spatial scales, can have cascading benefits throughout the northern GoM. Striking a balance that addresses resource injuries through holistic systems-based restoration, as the PDARP does by "evaluating injuries to representative ecological processes and linkages," builds the most rational framework to guide the long-term investment of the BP settlement.

Overall, the draft PDARP/PEIS has done an excellent job of assessing the impacts of the Deepwater Horizon oil spill on various components of the northern GoM ecosystem, the direct resource injuries and their compensatory restoration measures, types and impacts of compensatory restoration action, and broad-scale programmatic restoration alternatives. The focus of the PDARP on coastal habitats is wholly justified since it is the interface between the ocean and the land systems. Coastal habitats are the incubator for marine and estuarine organisms and nurture the biological richness of the GoM. Coastal habitats are, furthermore, where most people interact with the Gulf and where great economic value is realized.

In our view, the PDARP/PEIS complies with the basic requirements of the Oil Pollution Act of 1990 and the National Environmental Policy Act and associated regulations, and it should be finalized without delay so restoration can begin in earnest. Therefore, the comments below, organized by sections of the PDARP/PEIS, are intended only to make minor improvements

Support for Alternative A

In a tight timeframe for preparing the draft PDARP/PEIS, the Trustee Council has marshalled massive amounts of scientific data and analyses to support its findings and recommended courses of action. The PDARP alternative portfolios consider key ecological factors like linkages, as well as factors such as resiliency and sustainability. The investments range across resource groupings and supporting habitats in order to maximize the likelihood of appropriately compensating the public for all the resources and services injured by the spill. The investment of funds focuses on restoring Louisiana coastal marshes as an essential element of the preferred alternative. This focus is key given both the extensive impacts to Louisiana marsh habitats and species and the critical role that these habitats play for many injured resources across the GoM and the overall productivity of the Gulf. Coastal and nearshore habitat restoration is the most appropriate and practicable mechanism for restoring the ecosystem-level linkages disrupted by the spill.

We fully support the selection and implementation of Alternative A (Preferred Alternative), described as "Comprehensive Integrated Ecosystem Restoration", which recognizes the ecological interconnectivity of the northern GoM ecosystems and emphasizes that broad ecosystem benefits can be realized through coastal habitat restoration in combination with resource-specific restoration. Accordingly, Alternative A specifies the need to focus restoration efforts on broad, regional scale projects to benefit areas and resources known to have been injured by the spill. Alternative A recognizes that essential drivers of Gulf restoration, such as river inflows and restored estuarine functions, underlie the coastal processes that support a wide array of habitats, organisms, and coastal lifestyles, specifically emphasizing the central importance of restoration of the Mississippi River delta and the need for major investments in Mississippi River sediment diversions as a central strategy for wetland restoration. We strongly agree with this focus in the context of the broader restoration strategy outlined in Alternative A.

The Trustees should coordinate with all available funding mechanisms and programs from the Deepwater Horizon oil spill to define comprehensive restoration goals and targets, considering the future without action, project synergies and conflicts, and real-world constraints such as limited funding, time and sediment. We support the adaptive approach described in the PDARP which includes iterative planning, implementation and monitoring to optimize restoration results that shift over time in response to scientific data. We recommend the Trustee Council work with these other programs to establish an over-arching Science Advisory Committee (SAC) to provide independent technical guidance on the use of best available science in the development, implementation and evaluation of ecosystem restoration of the northern GoM. The SAC would help ensure that science is integrated into comprehensive restoration by providing input on restoration objectives and priorities, strategies and performance metrics; evaluating progress toward restoration goals via monitoring and other adaptive management mechanisms; and identifying restoration gaps, conflicts and opportunities for coordination with other programs. The SAC can also help develop a scientific review process to be used by the Trustee Implementation Groups to evaluate and select projects for inclusion in Alternative A to ensure that the projects, as a collective whole, support comprehensive ecosystem restoration of the northern GoM.

Restoration of the Mississippi River Delta

The Deepwater Horizon oil spill caused widespread damage to northern GoM ecosystem resources. As the PDARP recognizes, its impact was most severe in coastal Louisiana given the proximity of estuaries in and around the Mississippi River Delta (MRD) to the spill, the penetration of the oil into Delta estuaries and the deteriorated condition, and thus vulnerability, of the Delta's barrier islands and wetlands. The ongoing deterioration and loss of the Delta's wetlands, which has been exacerbated by the oil spill, will have significant adverse consequences for the recovery of the northern GoM ecosystem, its fisheries and wildlife from the oil spill. Noting these circumstances, the PDARP recognizes that a) sustaining MRD wetlands that otherwise would erode and subside and b) rebuilding already lost wetlands in shallow, open water would not only have benefits for the Delta itself but would have more broad benefits to the entire northern GoM and its estuaries.

The PDARP identifies sediment diversions and other projects in Louisiana's Coastal Master Plan as approaches to advance restoration of the MRD ecosystem. We strongly support the allocation of significant NRDA funding for these projects. Investing a large portion of settlement funds, including but not limited to NRDA funds, to advance Delta ecosystem restoration, specifically through the construction and operation of sediment diversions, will have major and long-term benefits for the well-being of the entire northern GoM ecosystem as well as the resources and productivity of the Delta itself. This is a reasonable strategy to redress uncompensated damage to Delta wetlands and northern GoM biological resources impacted by the BP Oil Spill on a regional scale.

Sediment Diversions as a Primary Restoration Tool

The Mississippi River and its Delta has a profound influence on the Gulf of Mexico ecosystem. The river has shaped the coastline, affects ocean circulation, and supplies large quantities of fresh water, sediments, and nutrients that influence a large part of the northern Gulf of Mexico ecosystem. The deltaic wetlands support the trophic interactions throughout the Gulf and provide habitat and nursery groups for a wide variety of important species. The PDARP soundly recognizes that controlled sediment diversions that reconnect the Mississippi River with its Delta are a primary tool for preserving and restoring Delta wetlands. The PDARP states, "Diversions of Mississippi River water into adjacent wetlands have a high probability of providing…large-scale benefits for the long-term sustainability of deltaic wetland systems" and "help restore injured wetlands and resources by reducing widespread loss of existing wetlands through 1) reintroducing nutrients and freshwater into salt-stressed, nutrient starved ecosystems, and 2) increasing sediment deposition to partially offset RSLR and help build new habitats." The importance of diversions to the PDARP's restoration strategy supports and reinforces findings of the November 2004 Louisiana Coastal Area Ecosystem Restoration Final Report of the US Army Corps of Engineers, the Gulf Coast Ecosystem Restoration Task Force Strategy and Louisiana's 2012 Coastal Master Plan.

In addition, the draft PDARP/PEIS accurately points out that river diversions not only have a capacity to build land in subsiding areas, but can also "provide indirect benefits to coastal wetlands across a larger area of the deltaic plain through the re-introduction of large quantities of fine sediment to the shallow coastal environment." The scope and ecological significance of these "indirect benefits" can be enormous, especially since the large amounts of fine-grained silts and clays that diversions can convey deep into receiving basins will sustain existing wetlands that would otherwise erode and subside.

While all Gulf coast estuaries and coastal wetlands are subject to the stress of sea level rise, coastal Louisiana's Deltaic region is under far greater stress, with coastal subsidence and sediment starvation compounding the consequences of sea level rise. Redirecting water and sediment of the Mississippi River into its Deltaic basins via diversions presents a unique opportunity for ecosystem sustainability and restoration that is not available elsewhere in the northern Gulf region. Taking advantage of the sediment resources of the Mississippi River therefore represents the premier restoration opportunity for the northern GoM ecosystem.

The PDARP points out that the long-term benefits of the types of restoration activities described in Alternative A, including construction and operation of river diversions, generally far outweigh any short-term adverse impacts; it also appropriately calls for monitoring and adaptive management to ensure that benefits are maximized and unintended impacts are minimized.

Governance

The NRDA Trustees have proposed a distributed governance structure that delegates restoration decision-making to the level of the Trustee Implementation Groups (TIGs) while maintaining the

Federal Trustee Council for a number of broader administrative functions, including "to ensure coordination and efficiency across the TIGs by establishing procedures and practices needed to standardize or provide for consistency of some TIG activities." We believe this structure has potential to serve as a good foundation for restoration decision-making and implementation. To provide for effective governance, efficient delivery, and optimal coordinated use of NRDA funds, we urge the Trustees to include the following refinements and clarifications in the final PDARP.

The Trustee Council recognizes the need to update their existing Memoranda of Understanding (MOU) and to develop Standard Operating Procedures (SOP) for adoption and adherence by each of the TIGs. Many essential restoration planning and coordination details hinge on these documents. However, the expected content of the documents is not elaborated in the PDARP, making meaningful comment on many aspects of the governance structure impossible. Given that the procedures and practices articulated in the SOP will guide restoration activities across the Gulf for many years to come, this is a critical juncture for soliciting public feedback. We therefore recommend that the PDARP commit to an additional public comment period to allow for needed public input regarding the MOUs and SOPs. In the cases where individual TIGs elect to develop supplemental MOUs and SOPs, these documents also should be subject to a public comment period before being finalized.

We believe that the decision-making structure set forth in the PDARP, with restoration plans developed and projects selected at the level of the TIG, will increase efficiency in decision-making and accelerate implementation of critical restoration efforts around the Gulf. We also agree that TIG flexibility to "phase" project implementation is important and appropriate, given the 15-year payment schedule. However, the decentralized governance structure set forth in the PDARP necessitates proactive and formalized efforts to coordinate between TIGs and across other restoration programs (e.g., RESTORE and NFWF), to ensure that a Gulfwide perspective on restoration is not lost. The full Trustee Council is responsible for ensuring this coordination, and the PDARP provides for the Council to "designate dedicated support staff, as necessary, for conducting its business." However, it fails to articulate the specific channels or processes that the Trustees will employ to promote coordination and ensure that restoration activities are not siloed. More detail on the topic of coordination should be provided in the final PDARP, as well as in the SOP.

To ensure crucial regional coordination and informed restoration decision-making, we recommend several enhancements to the governance structure proposed in the PDARP.

- TIG restoration plans should be shared with the full Trustee Council on a frequent and defined basis. This process would provide an opportunity for TIGs to exchange ideas, share best management practices, and consider how their intended activities fit into the larger restoration landscape; it also could provide a space for communication of ongoing and planned activities to other Gulf of Mexico restoration programs, including the RESTORE Council and NFWF.

- The Trustee Council should be responsible for completion of program reviews that examine whether projects are adequately coordinated and on track to meet goals, and the PDARP directs the Trustee Council to undertake such reviews approximately every five years. We believe a biennial review would help to prevent missed coordination opportunities and would provide for more nimble adaptive management. These program reviews could also serve as a resource to inform and engage the public.
- Additionally, coordination and consistency between TIGs should be ensured through development of a set of high-level project selection criteria for adoption across all restoration areas. Given the overlap in resources being restored, a common set of project selection criteria is appropriate and necessary. These selection criteria should include such considerations as level of scientific review and presence of a project in an existing comprehensive plan. We recommend that the full Trustee Council develop these criteria for inclusion in the SOP. Each TIG should be free to build upon this baseline, supplementing or adding to the criteria as appropriate to guide work in its particular restoration area.
- Strategic restoration planning also is needed to assist in identification of opportunities to coordinate and leverage restoration efforts. We recommend that TIG preparation of strategic restoration plans – currently optional – be made mandatory in the final PDARP and built into project restoration plans where possible. Further, strategic planning would compel TIGs to give thought to project sequencing, and the order of injury restoration. The PDARP does indicate that previous regional restoration plans may be considered in selection of projects. We recommend that in the state of Louisiana, projects currently identified in the Coastal Master Plan and/or the Louisiana Oil Spill Coordinator's Office Regional Restoration Planning Program be considered first as to avoid unnecessary costs toward development of new projects.

We have identified a number of other decision-points where additional clarity is needed. In the final PDARP, we recommend that the Trustees define the management levels and expertise of employees who will be designated to sit on the TIGs. Additionally, the operation of the Unknown Conditions and Adaptive Management TIG is still somewhat unclear, and we suggest the Trustees specify the process that this TIG will use to identify and prioritize unforeseen needs as they accrue.

Regarding budgeting and financial management, the final PDARP should clarify the intended use of the administrative oversight and comprehensive planning allocations. The first restoration plans developed in each TIG should include a financial plan that details how the TIGs will use the administrative and planning allocation over the lifetime of the program. These financial plans should make clear whether staff payments will be derived only from this allocation, or if the Trustees are envisioning charging staff time directly to projects.

The Individual Trustee Agencies are tasked with identifying and budgeting for long-term maintenance needs of each project "over its intended lifespan." We feel that information regarding what a project's lifespan entails is critical to make this determination. The PDARP provides that the responsibility of long-term project maintenance can be delegated to third-parties at the Implementing Trustee's discretion. We have concerns that paying third parties for "long-term" maintenance may be very costly, and we would respectfully suggest that cost-control measures and contracting standards be identified, and that third parties be further defined (e.g. municipalities, NGOs, landowners, levee boards, private corporations, individuals). We also suggest the PDARP specify additional parameters for the types of maintenance activities that could be eligible to receive this funding for long-term maintenance.

Finally, we appreciate that an opportunity for public comment will be provided on each draft restoration plan and NEPA analysis. However, we urge the Trustees to further define and solidify the opportunities for public participation throughout the restoration process, including in project identification. We are encouraged to see that updates on implementation progress will be provided to the public by the Trustee Council from one central online Restoration Management Portal. We urge the Trustees to use this platform to track and communicate both TIG and Gulfwide progress toward restoration, in a format comprehensible to the general public. We also suggest that the Trustees clarify how the Restoration Management Portal will work in conjunction with the Gulfwide environmental data management system that will be funded with $37 million from another portion of the BP settlement.

Injury Assessment

The PDARP addresses and recognizes the cumulative impacts of the oil spill by using a holistic ecosystem restoration approach based on available information. We recognize, however, that many specifics of the injuries have not been fully measured and that some are certainly under-recognized. The PDARP should clarify that the Trustee's injury assessment represents a snap-shot of the currently-known dimensions of overall injuries, that research is ongoing to more fully realize impacts, and that monitoring dollars put in place by the settlement will help further elucidate those impacts. We recommend that the Council note the limitations of the analysis, clearly describe the factors that were included in the injury calculations, and describe anticipated future work to understand and monitor injuries. Attachment A to this letter identifies a number of issues related to gaps and uncertainties in the existing science, as well as clarifications that we recommend be addressed through implementation of the PDARP and ongoing monitoring.

Moving Forward

Again, we commend the Council for developing this thoughtful path forward to address the issues and injuries identified through the Natural Resource Damage Assessment process. The undersigned organizations appreciate the opportunity to provide these comments, and we urge the Council to consider and adopt the recommendations above. We believe the PDARP, including the Comprehensive Integrated Ecosystem Restoration approach outlined in Alternative A, will provide the a blueprint for critical restoration work under NRDA, including key investments in sediment diversions, to address priority resource needs post-spill. Our organizations look forward to timely approval and implementation of the PDARP, and to continuing our work with the Council and its members to advance its restoration goals.

Sincerely,

National Audubon Society • Coalition to Restore Coastal Louisiana • Environmental Defense Fund • Lake Pontchartrain Basin Foundation • Louisiana Wildlife Federation • National Wildlife Federation • Restore or Retreat

ATTACHMENT A

Wetland Habitat Assessment

The recognition of the importance of the nearshore ecosystem as a critical component in the health of not only nearshore environments, but the GoM as a whole, is an important observation and its emphasis warranted. Although the nearshore environmental injury assessment was thorough, we had some concerns, especially the injury and impact to wetland habitat and the organisms that use them. We are concerned that in some regions, especially Louisiana, shoreline impacts were underestimated by up to 40% due to the use of 2008 shoreline maps to assess impacts. This is a large underestimation and there is no explanation for how assessment of impacts accounted for the discrepancy between 2008 and 2010 shorelines. It is unclear if the damages reported in the PDARP accounted for this and were increased by 40%.

In addition, most of the injury assessment documents reference miles of shoreline for injury assessment, but some specific cases, assess oiling spanning into the marsh, not just along the edge. The latter could generate a measure of impact area, not just linear miles of shoreline. It seems that assessing damage by linear miles does not account for oil pushed back into low lying marsh during high tides and fronts. We are concerned that the use of linear miles instead of area underestimates damages experienced in wetland habitats. This would especially affect the assessment of damages in Louisiana, given that 95% of oiled wetlands occurred in Louisiana.

In addition to concerns about wetland habitat injury assessment, we are also concerned about how damage to the vegetation was assessed. First, although the uptake of oil and oil by-products were assessed for submerged aquatic vegetation, this same affect was not assessed for marsh vegetation. With oil exposed to the sun and other decomposers/weatherers of oil, it is likely that the oil that was deposited in the wetlands was broken down in to smaller constituents that are present in the oil. Some of these constituents could be biologically available for plant uptake, affecting important plant processes such as photosynthesis, reproduction, growth and vegetative expansion (asexual reproduction). There is no indication if this was studied and no explanation of why it was studied in SAV and not wetland vegetation. If it was studied and no effect found, or if there is evidence that wetland vegetation does not uptake oil, this should be stated clearly in the PDARP. Plant uptake of oil and oil by-product could be a long-term injury that affects many generations of plants, that were not accounted for. Second, only damage and reduction to aboveground biomass was assessed, whereas belowground biomass was ignored. Reductions in belowground biomass can affect nutrient uptake, soil stabilization, oxygenation of soils and vegetative expansion. The lack of consideration of reduction or effect to belowground biomass, again leads to an underestimation of actual wetland injury and impacts from the Deepwater Horizon oil spill.

Wildlife Assessment
The wildlife of the Gulf of Mexico are irreplaceable natural resources that serve important roles in the environment and are highly valuable to the public. Because sea turtles and marine mammals of the Gulf are, in general, highly migratory and inhabit a broad range of habitats, the Deepwater Horizon oil spill and subsequent response activities impacted these animals through several pathways. As a result, tens of thousands of endangered and threatened sea turtles were injured or lost due to unrealized reproduction and the adverse health effects of the oil spill on marine mammals contributed to the largest and longest unusual mortality event on record in the northern Gulf. Without restoration, sea turtles and mammals could take decades to recover. Recovery and restoration of the Gulf's wildlife requires the use of a multi-pronged approach that prioritizes restoration and improvement in quality of a range of habitat used by the injured animals and their food sources as well as identifying and addressing species-specific stressors and threats. We commend the Trustees for recognizing the need for an integrated portfolio of approaches for the recovery and restoration of wildlife that emphasizes the benefits that restoring coastal and nearshore habitats would have for many of the affected species in the northern GoM.

We appreciate that the PDARP recognizes the importance of cascading effects among trophic levels, as this further justifies the need for a strategy of ecosystem recovery (Alternative A). The connection between injured or impacted animals and other organisms in the ecosystem that were not directly affected can influence complex population dynamics across multiple trophic levels. An emphasis placed on restoring the nearshore ecosystems as the best and most comprehensive way to restore injured animal populations, and therefore the health of the GoM ecosystem, shows the important role these ecosystems play in supporting the vast web of organisms that reside in or visit the GoM, many of which are commercially and recreationally important.

Although the toxicity of oil and other effects were studied in a variety of specific species, the PDARP fails to extrapolate these findings to a broader set of species within those guilds or trophic levels, much less the entire ecosystem. For example, a species of amphipod was used to represent burrowing soil organisms, and although 407 metric tons of the amphipod were removed due to oiling, no predictions of injury to other similar species is made. This connection is consistently not made for all of the representative species and therefore greatly underestimated the damages to organisms and many trophic levels.

Bird Assessment
Given the central importance of MRD-generated habitats on coastal bird populations across the Gulf, we applaud numerous positive restoration opportunities highlighted by the PDARP that would benefit birds, including the restoration and enhancement of nesting and foraging habitat,

coastal wetlands, dunes and beaches, and islands and headlands. Recognizing that these are some of the habitats most disturbed by human activity, we particularly support the inclusion of direct bird protection through stewardship and beach vegetation management as restoration scenarios (increase and decrease where appropriate). We suggest that beach vegetation be managed strategically within and across bays and regions, ideally by a central entity, to ensure the optimal mix of early successional and later successional beach habitats to support nesting birds and other wildlife. We would like to also see bay island restoration more prominently highlighted as a restoration tool. These projects are expensive for the amount of land they construct, but provide critical and irreplaceable nesting sites for a couple dozen species of colonial waterbirds including several of great conservation concern.

We are also pleased to see a substantial amount of money set aside for bird restoration, as well as monitoring. Given the extensive perturbations across the Gulf of Mexico that will span decades, it is critical that we employ efficient, long-term monitoring to understand the overall health of birds (and other wildlife) over decades of intense change and disturbance in the ecosystem. Habitat restoration may be counterbalanced by economic development, and it is important to understand the cumulative impacts on our natural resources. Additionally, as beneficial as it will be in the long run, restoration represents a perturbation in the system, and we have an opportunity to understand these cumulative and interacting perturbations in a more comprehensive way.

Ultimately, it is important that monitoring appropriately assesses recovery so that restoration dollars can be utilized for the greatest impact. Additionally, long-term monitoring is critical to trigger release of some of the adaptive management money set aside in the settlement in the event of detection of chronic or emerging impacts to birds. We are also pleased that the Trustees have identified the Gulf of Mexico Bird Monitoring Working Group (5.5.12.4) for adopting standardized protocols. We encourage the Trustee Council and RESTORE Council to also work closely with this group that has created a structured decision-making value model to ensure available monitoring funding is used in the most effective and impactful manner possible. The Trustees should support monitoring that effectively counts birds, and those that assess genomic, physiological, and reproductive injuries that are ongoing.

We are, however, concerned that a mix of projects to restore "in excess of tens of thousands of individual birds…" (section 5.10) will not restore the full damage to birds from the disaster. The Trustees express that "mortalities for this modeled injury were likely *towards the higher end of this range* [51,000 to 102,400]" (section 4.7); however this estimate is explicitly acknowledged by the Trustees to not assess all injured bird groups. In fact, the damage estimate explicitly leaves out secretive marsh birds, many birds nesting on the interior of island colonies, and the non-lethal impacts including poor health, protracted exposure, and delayed effects. The Trustee's estimate of damage is an order of magnitude lower than a peer-reviewed, published estimate of direct mortality. We expect that at a minimum 100,000 birds must be recovered through direct bird restoration, while emphasizing that justice for our nation's birds would be reached by restoring several times that 'higher end of range' number. Additionally, we would encourage the trustees to, at the very least, incorporate some of the estimates available in technical reports to reach a quantification of bird injury that is more inclusive than the currently published range.

Dispersant

There was little mention of the use of dispersant and how it may have affected nearshore environments or organisms. This is a large oversight. If dispersant was studied in nearshore environments and none was found or no effect was found then this should be mentioned. There are numerous laboratory studies that have taken place investigating the effects of dispersant and none were reported, for wetlands or organisms. Many laboratory studies were used to confirm the toxicity of the oil and therefore quantify injury, but it was not indicated that this was done for dispersant. Injury from the dispersant should be included in the injury assessment or an explanation of why it was not included should be provided. This could also result in the underestimation of injury to nearshore ecosystems and animal populations.

11-19-2015

Tôi Tên là THACH VAN TRẦN.
Số pin Tôi "01055945" P.N Deep water "100091168"
Tôi cầu xin giúp Tôi mở Hồ Sơ "BP" Làm ơn
Vì 2011 tôi có luật sư nhận tôi Bị luật sư giả mạo
chữ ký tôi nói tôi không cần "DeepWater HORIZON
court supervised settlement program exclusions Depaurtment.
cho nên người ta không cho tôi tiền
tôi cầu xin Làm ơn coi lại giúp tôi "mở" Hồ Sơ "BP"
giúp tôi
Kể từ ngày qua mỹ tôi không Biết tiếng anh cho
tôi đi làm Biển cực khổ mà vẫn không có tiền
mà còn mất nợ muốn đi làm trên Bờ vì không
Biết tiếng anh Và không có nghề nên tôi đi làm
Biển cũng không có Tiền, tôi Bị luật sư Hại tôi
Tôi tin chương trình "BP" Làm ơn giúp Tôi
"Mở Hồ Sơ lại giúp tôi" Làm ơn coi lại giúp Tôi.
Tôi Xin anh chị Việt Nam giúp tôi dịch Lại thơ
này giúp tôi Vì Tôi không Biết ~~Biết~~ tiếng Mỹ
cũng không Biết sài máy làm phi To Làm ơn có gì
gởi Thơ tôi theo địa chỉ 12211 CORONA LN Houston TX
77072 điện thoại Tôi "832 870 4389" mọi sự Làm
ơn giúp ơn tôi rất cám ơn giúp tôi.

Thach

11 - 15 - 2015

Mến thân chương trình "BP" làm ơn giúp Tôi

Tôi Tên ROSE LE = Số PIN "01041840" = Sáu aưng "Deepwater 100091209"

Tàu Tên "catheRine" số tàu 1032635

Tôi đã có tàu này 14 năm Rồi Bây giờ tôi mới

đổi? tên năm 2011 tên tàu "T-RAIN" số tàu vẫn cũ 1032635

Địa chỉ Bây giờ 12291 CORONA LN. Houston TX 77072

"Tôi Rất cầu xin "BP" mở lòng Từ Bi giúp Tôi mở

Hồ sơ lại" Vì từ Trước tới giờ tôi không có Đồng nào

cho tôi 1ngày tôi Bị Luật sư giả mạo chữ ký tôi

nói là tôi không cần tiền " DeepWater HORIZON court supervisor

settlement program EXCLUSIONS Department - cho nên người ta

đã không cho tôi. Rất oan cho tôi "tôi Rất Đau lòng

Từ ngày Đổ Dầu ra 2010 năm đó tôi không làm ra

tiền được Vì đi Đánh Tôm không có mà phải Bỏ Dầu

Bị lỗ lại nữa Tàu Bị Hư không có Tiền trả nợ nhà

Bank Và Bảo Hiểm, cho tới Bây giờ tôi vẫn còn mắc

nợ, tôi rất là đau lòng Và lo Buồn Vì tôi nghĩ

tôi qua đây ở mỹ tôi không Biết tiếng anh không Biết

sài máy cầm phiếu to không Biết chữ tiếng anh, chúng

tôi chỉ Biết làm nghề Biển này, nghề này rất là

cực khổ, tôi mượng nợ để đổ dầu đi đánh Tôm

mà, Trong lòng rất là lo, không Biết có Tôm hay

không, tôi ~~cứ~~ cứ cầu nguyện Chúa Ban cho Tôi

ngày này Bình an Và mọi Sự may mắn để có Tiền

trả nợ Và lo Sửa tàu, tôi không nghĩ Luật Sư

lại Hại Tôi tới Bây giờ tôi không có tiền gì cả.

Tôi cầu xin ơn trên "BP" giúp tôi" xin mở lại Hồ Sơ"

Tôi cầu xin giúp tôi, Tôi rất là cám ơn,

Tôi cầu xin anh chị nào Việt Nam giúp tôi, dịch ra

tiếng "Mỹ giúp ~~tôi~~, có gì Điện thoại tôi 281 725 4901

Tôi rất cám ơn anh chị = làm ơn giúp tôi

Rosele

KING KREBS & JURGENS PLLC

COUNSELORS AT LAW

201 ST. CHARLES AVENUE
45TH FLOOR
NEW ORLEANS, LA 70170
TELEPHONE: (504) 582-3800
FAX: (504) 582-1233

HENRY A. KING (1)
PATRICIA A. KREBS (1)
GEORGE B. JURGENS III
ROBERT J. BURVANT (1)
J. GRANT COLEMAN, LLM (2)(4)
ERIC E. JARRELL
LEN R. BRIGNAC (1)(3)(5)
TIMOTHY S. MADDEN
ROBERT J. STEFANI (1)(2)(7)

JAMES D. BERCAW
LINDSAY A. LARSON III
DAVID A. STRAUSS (1)(8)
JEFFREY M. BURMASTER
DOUGLAS P. MATTHEWS
MICHAEL L. VINCENZO
CHRISTIAN A. GARBETT (1)
JOHN A. CANGELOSI
ADAM P. MASSEY

JOSEPH A. DEVALL, JR
SUSAN E. DINNEEN (2)(10)
MICHAEL J. CERNIGLIA (11)
BRENT M. BURNS
R. DANIEL SERIO, JR.
CAROLYN S. BUCKLEY
REED M. COLEMAN (12)

FABIAN M. NEHRBASS
NICOLE M. BABB
LAURA E. AVERY
BRIAN A. CLARK
ANDREW J. REBENNACK
Of Counsel:
JOSEPH R. MESSA (6)
JOANNE MANTIS (9)
SARAH MONSOUR

(1) ALSO ADMITTED IN TEXAS
(2) ALSO ADMITTED IN WASHINGTON, D.C.
(3) ALSO ADMITTED IN FLORIDA
(4) TAX LAW SPECIALIST CERTIFIED BY THE LOUISIANA BOARD OF LEGAL SPECIALIZATION
(5) REGISTERED PATENT ATTORNEY
(6) ALSO ADMITTED IN GREECE
(7) ALSO ADMITTED IN NEW YORK
(8) ALSO ADMITTED IN ILLINOIS
(9) ADMITTED IN TEXAS ONLY
(10) ALSO ADMITTED IN MARYLAND
(11) ALSO ADMITTED IN COLORADO
(12) ALSO ADMITTED IN ALABAMA

Michael Louis Vincenzo
Attorney at Law
mvincenzo@kingkrebs.com
504.582.3810 Direct

December 4, 2015

VIA CERTIFIED MAIL NO. 7010 1060 0000 3843 0850
RETURN RECEIPT REQUESTED

Assistant Attorney General
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
U.S. Department of Justice
Washington, DC 20044–7611
(Re: DJ # 90-5-1-1-10026)

VIA CERTIFIED MAIL NO. 7010 1060 0000 3843 0836
RETURN RECEIPT REQUESTED

Natural Resource Damage Assessment
U.S. Fish and Wildlife Service
P.O. Box 49567
Atlanta, GA 30345

VIA CERTIFIED MAIL NO. 7010 1060 0000 3843 0843
RETURN RECEIPT REQUESTED

EES Case Management Unit
Environment and Natural Resources Division
United States Department of Justice
P.O. Box 7611
U.S. Department of Justice
Washington, DC 20044–7611
(Re: DJ # 90-5-1-1-10026)

Re: *U.S. v. BP Exploration and Production et al.*, Civil No. 10–4536 (E.D. La.) (centralized in MDL 2179: In Re: Oil Spill by the Oil Rig ''Deepwater Horizon'' in the Gulf of Mexico, April 20, 2012), D.J. Ref. 90–5–1–1–10026.

Comment of Plaquemines Parish and the Town of Grand Isle to the Proposed Consent Decree Among Defendants BP Exploration & Production Inc. ("BPXP"), The United States of America and the States of Alabama, Florida, Louisiana, Mississippi and Texas

To Whom It May Concern:

Attached hereto are the comments of The Parish of Plaquemines and the Town of Grand Isle to the Proposed Consent Decree Among Defendants BPXP, The United States of America and the States of

Alabama, Florida, Louisiana, Mississippi and Texas. An electronic submission of these comments was made this same date through the Department of Justice.

Please advise if you have any questions.

With best regards, I remain,

Very Truly Yours,

Michael Louis Vincenzo

MLV/db
Attachment

cc: Joel Loeffelholz (via email) (w/attach)
David Landry (via email) (w/attach)
Scott Bickford (via email) (w/attach)
Henry A. King (via email) (w/attach)
David Colvin (via email) (w/attach)

U.S. v. BP Exploration and Production et al, Civil No. 10–4536 (E.D. La.) (centralized in MDL 2179: *In Re: Oil Spill by the Oil Rig ''Deepwater Horizon'' in the Gulf of Mexico,* April 20, 2012), D.J. Ref. 90–5–1–1–10026.

COMMENTS BY THE PARISH OF PLAQUEMINES AND THE TOWN OF GRAND ISLE TO THE PROPOSED CONSENT DECREE AMONG DEFENDANTS BP EXPLORATION & PRODUCTION INC. ("BPXP"), THE UNITED STATES OF AMERICA, AND THE STATES OF ALABAMA, FLORIDA, LOUISIANA, MISSISSIPPI AND TEXAS

NOW COMES Plaquemines Parish Government ("Plaquemines Parish") and the Town of Grand Isle ("Grand Isle"), in accordance with the Court's Order dated October 5th, 2015, hereby submit the following comments ("Comments") to the proposed Consent Decree Among Defendant BP Exploration & Production Inc. ("BPXP"), the United States of America, And the States of Alabama, Florida, Louisiana, Mississippi, and Texas ("Gulf States").

Plaquemines Parish and Grand Isle previously appeared at the public hearing held in New Orleans on October 22, 2015 and submitted comments regarding the Consent Decree and the PDARP-PEIS into the record of this matter. The following Comments supplement the previous comments raised by Plaquemines Parish and Grand Isle at the October 22, 2015 public hearing.

The purpose of these Comments is to request that the Consent Decree be amended to include certain clarifying language which more acutely reflects the intent of the parties to the Consent Decree as well as the permissible legal scope of the covenants contained therein.

Proposed Amendments to Certain Definitions and Provisions of the Consent Decree

Plaquemines Parish and Grand Isle propose the following revisions to the Consent Decree:

1. <u>Definition of "Gulf State" or "Gulf States"</u>

The Consent Decree's current definition of "**Gulf State**" or "**Gulf States**" presently reads as follows:

y. "**Gulf State**" or "**Gulf States**" means one or more of the States of Alabama, Florida, Louisiana, Mississippi, and Texas.

Plaquemines Parish and Grand Isle request that the this definition be amended to clarify the fact, as expressed in other sections of the Consent Decree, that "**Gulf State**" or "**Gulf States**" do not include Local Government Entities. The suggested revised definition would be as follows:

y. "**Gulf State**" or "**Gulf States**" means one or more of the States of Alabama, Florida, Louisiana, Mississippi, and Texas. This definition expressly excludes Local Government Entities (as defined in paragraph 74 below).

2. <u>Definition of "Natural Resource" and "Natural Resources"</u>

The Consent Decree's current definition of "**Natural Resource**" and "**Natural Resources**" Presently reads as follows:

dd. "**Natural Resource**" and "**Natural Resources**" means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, sediment, habitat, supporting ecosystem, and/or any other such resources at any time belonging to, managed by, held in trust by, appertaining to, regulated by, assessed as part of the Deepwater Horizon Natural Resource Damages assessment, or otherwise controlled by the United States (including resources of the exclusive economic zone; "system unit resources" as defined by 54 U.S.C. § 100721(3); "park system resources" as defined by 16 U.S.C. § 19jj(d); and marine "sanctuary resources" as defined by 16 U.S.C. § 1432(8)), any Gulf State, and/or any Trustee.

Plaquemines Parish and Grand Isle request that this definition be amended to: (1) remove the words "at any time" in order to clarify that "**Natural Resource**" and "**Natural Resources**" subject to the Consent Decree do not include properties which may have once belonged to the

United States or a Gulf State but where title was transferred prior to the effective date of the Consent Decree; and (2) to move the clause "assessed as part of the Deepwater Horizon Natural Resource Damages assessment" to the end of the paragraph to clarify that **"Natural Resource"** and **"Natural Resources"** consist of those resources actually assessed as part of the Natural Resource Damages assessment. The suggested revised definition would be as follows:

> dd. **"Natural Resource"** and **"Natural Resources"** means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, sediment, habitat, supporting ecosystem, and/or any other such resources belonging to, managed by, held in trust by, appertaining to, regulated by, or otherwise controlled by the United States (including resources of the exclusive economic zone; "system unit resources" as defined by 54 U.S.C. § 100721(3); "park system resources" as defined by 16 U.S.C. § 19jj(d); and marine "sanctuary resources" as defined by 16 U.S.C. § 1432(8)), any Gulf State, and/or any Trustee assessed as part of the *Deepwater Horizon* Natural Resource Damages assessment.

3. Savings Provision

Paragraph 67 of the Consent Decree currently reads as follows:

> 67. Savings Provision. Except as provided in Paragraph 66, other than the Project Stipulations entered into pursuant to the Framework Agreement, these covenants not to sue do not affect rights under any written agreement or settlement, existing as of July 2, 2015 to which any instrumentality of the United States and any of the BP Entities are both a party.

Plaquemines Parish and Grand Isle request that this definition be amended to clarify that Local Government Entities are expressly excluded from the Consent Decree by adding the following sentence:

> Further, these covenants not to sue do not affect the rights of any Local Government Entity (as defined in paragraph 74 below).

The suggested revised paragraph 67 would read as follows:

> 67. Savings Provision. Except as provided in Paragraph 66, other than the Project Stipulations entered into pursuant to the Framework Agreement, these covenants not to sue do not affect rights under any written agreement or settlement, existing as of July 2, 2015 to which any instrumentality of the United States and any of the BP Entities are both a party. Further, these covenants not to sue do not affect the rights of any Local Government Entity (as defined in paragraph 74 below).

4. **Instrumentalities**

Paragraph 74 of the Consent Decree currently reads as follows:

> 74. Instrumentalities. All references to the Gulf States in this Section XIII and Paragraph 5 shall include each and every of the five Gulf States and, respectively, all State Trustees, all branches, agencies, associations, authorities, boards, bureaus, councils, departments, educational institutions or systems, components, public benefits corporations, or other instrumentalities of any kind, administrators, elected or unelected officials, officers or delegates (other than in their individual capacities), attorneys, or other agents of any kind of each of the Gulf States, provided however that a reference to a Gulf State shall not include counties, parishes, municipalities, or any other local governmental or local political subdivisions authorized by law to perform local governmental functions.

Plaquemines Parish and Grand Isle request paragraph 74 be amended to specify the definition of Local Government Entities and to clarify that Local Government Entities are expressly excluded from the Consent Decree by adding the following text:

> (collectively "Local Government Entities"). Nothing in this Consent Decree shall be deemed to constitute a waiver of any rights or claims of Local Government Entities provided for under the OPA, general maritime law, or other applicable statute or law.

Plaquemines Parish and Grand Isle also request paragraph 74 be amended to omit the term in "this Section XIII and Paragraph 5" to clarify that the definition of Gulf States has one meaning throughout the entirety of the Consent Decree.

The suggested revised paragraph 74 would read as follows:

> 74. Instrumentalities. All references to the Gulf States shall include each and every of the five Gulf States and, respectively, all State Trustees, all branches, agencies, associations, authorities, boards, bureaus, councils, departments, educational institutions or systems, components, public benefits corporations, or other instrumentalities of any kind, administrators, elected or unelected officials, officers or delegates (other than in their individual capacities), attorneys, or other agents of any kind of each of the Gulf States, provided however that all references to a Gulf State shall not include counties, parishes, municipalities, or any other local governmental or local political subdivisions authorized by law to perform local governmental functions (collectively "Local Government Entities"). Nothing in this Consent Decree shall be deemed to constitute a waiver of any rights or claims of Local Government Entities provided for under the OPA, general maritime law, or other applicable statute or law.

Respectfully Submitted,
MARTZELL & BICKFORD

/s/Scott R. Bickford
SCOTT R. BICKFORD, T. A. (#1165)
LAWRENCE J. CENTOLA, III (#27402)
usdcedla@mbfirm.com
338 Lafayette Street
New Orleans, LA 70130
(504) 581-9065 Telephone
(504) 581-7635 Fax
Special Counsel for the Parish of Plaquemines, the Town of Grand Isle and their Subdivisions and Districts

AND

/s/David Landry
DAVID L. LANDRY (#7978)
The Law Office of David L. Landry
2landry@cox.net
1214 Parasol Place
Pensacola, Florida 32507
(850) 492-7240

Special Counsel for the Parish of Plaquemines and its Subdivisions and Districts

AND

/s/Henry King
HENRY A. KING (#7393)
MICHAEL L. VINCENZO (#23965)
King, Krebs & Jurgens, PLLC
hking@kingkrebs.com
mvincenzo@kingkrebs.com
201 St. Charles Avenue, 45th Floor
New Orleans, LA 70170
504-582-3800 Telephone
504-582-1233 Fax
Special Counsel for the Parish of Plaquemines and its Subdivisions and Districts

s/David L. Colvin
DAVID L. COLVIN (#4353)
COLVIN LAW FIRM
davec@dcolvinlaw.com
230 Huey P. Long Avenue
Gretna, LA 70053
504-367-9001 Telephone
504-367-0650 Fax
Counsel for The Town of Grand Isle and Grand Isle Independent Levee District