Mississippi Canyon 252 Incident

Baseline Sediment and Water Collection and Analyses for NRDA Purposes in Florida Keys

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

APPROVED:

Joyce Mykey — June 29, 2010

BP Representative: Date:

NOAA/Trustee Representative: Date 6/29/10

Florida Keys Baseline Sampling Plan
for Water and Sediment

BACKGROUND

The Florida Keys extend approximately 220 nautical miles from the southern tip of the Florida peninsula, southwest to the Dry Tortugas. The Florida Keys National Marine Sanctuary, which surrounds the Keys, covers 2,900 square nautical miles of coastal waters, overlaps four national wildlife refuges, six state parks, and three state aquatic preserves. In addition, three national parks share boundaries with the Sanctuary.

The Florida Keys marine ecosystem supports over 6,000 species of plants, fishes, and invertebrates, including the nation's only living coral reef that lies adjacent to the continent. The area also includes extensive seagrass communities, mangrove islands and fringes, and some of the most significant maritime heritage and historical resources of any coastal community in the nation. In addition, the region's natural resources provide livelihoods for many of the nearly 80,000 residents, and provide recreation for visitors totaling approximately thirteen million visitor-days each year.

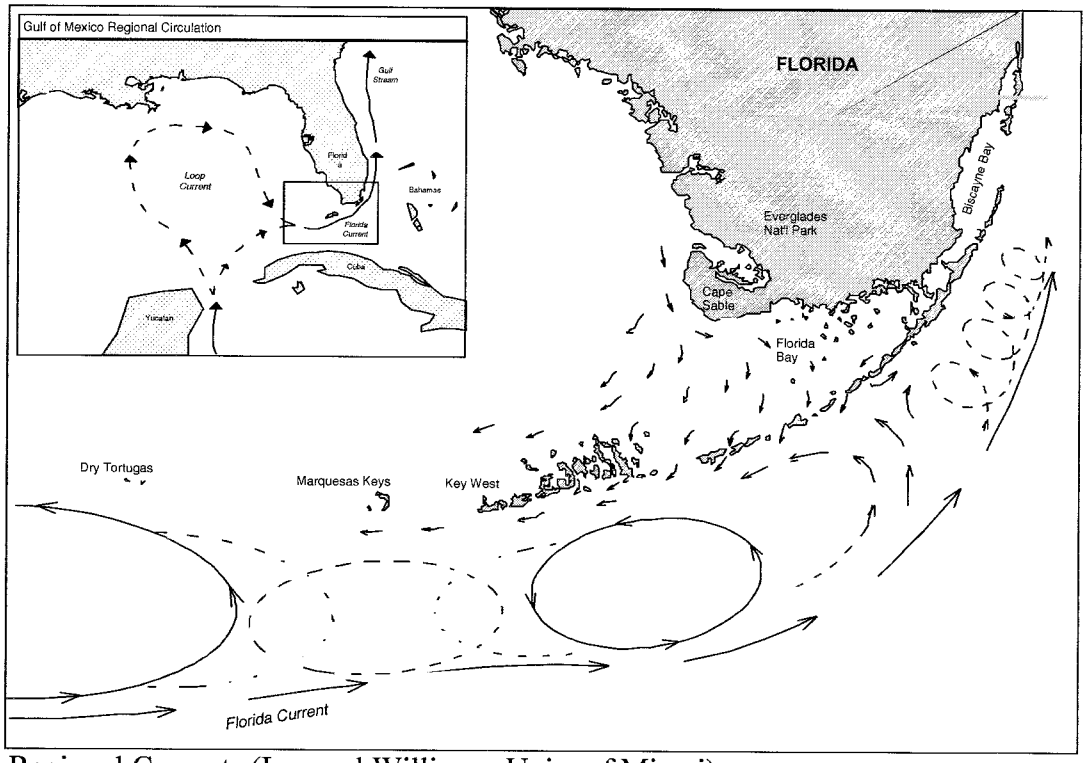
In order to proactively begin the steps of the Natural Resource Damage Assessment (NRDA) process, planning was initiated to determine the protocols and sampling sites that would be used for the collection of baseline water and sediment samples. The intention of this sampling event would be to represent conditions prior to any oil from the Deepwater Horizon spill affecting the Keys, should this occur. Toward this end, participants from 6 different agencies, one non-governmental organization, and one University developed this baseline sampling plan with the following objectives:

- The objective of the water and sediment sampling event is to determine the concentration of oil compounds in the sample matrices.
- The water and sediment sampling data generated using this plan will be interpreted in concert with other chemical and biological data.
- The sampling plan should be designed in order to collect baseline samples from sites representative of pre-oiling conditions, yet potentially in the path of the oil.
- To the extent possible, baseline samples should be representative of or reflect environmental conditions in a broad area.

In order to address issues related to cost and laboratory capacity, a list of 30 to 36 highest priority sites was targeted for development. The process to identify these sites was accomplished through in-depth discussions of site characteristics including ocean and coastal currents, representation of different habitat types, representation of typical environmental conditions, sensitivity of habitats, presence and utilization by threatened and endangered species, historical data available for sites, etc.

The discussion of ocean currents (see map below) focused on two general routes that oil from the Deepwater Horizon spill could potentially take to the Keys. Specifically, currents running along

the Southwest Florida Shelf could deliver water into the middle Keys or Backcountry. Important locations and habitats in this area include shallow seagrass banks, mangrove islands, and large natural flow channels. It was thought that sites of these types could accumulate oil or serve as transportation routes to other areas.



Regional Currents (Lee and Williams, Univ. of Miami)

Alternatively oil entrained in the Loop current in the Gulf of Mexico would tend to reach the Tortugas region first, where it could then be picked up by currents and eddies, that could gradually move oil eastward in a very indirect and diffuse route. Another possibility is that oil entering the Florida Current could move eastward quickly.

It was agreed that the Dry Tortugas and Marquesas Keys contain highly sensitive and productive habitats, which could potentially be directly affected by oil transported by the Loop current. For these reasons several sample sites were suggested for this area.

Oil entering the eddies could be carried in prevailing currents, possibly bypassing some areas of the Keys on the ocean side, however this would be difficult to precisely predict. It was determined that the sampling plan should include representation of shallow sites along the reef tract, and other nearshore areas, but the majority of sites should be intertidal, due to the sensitive and productive nature of these habitats and the fact that floating oil would be more likely to reach these areas.

Sampling sites were not selected from the bay side of the Upper Keys, because any oil coming into this area would have to cross Everglades National Park, and the National Park Service is developing a sampling plan for this area.

While considering individual site characteristics, an evaluation was also performed to ensure that selected sites were well distributed. Two strata were applied to the Keys, with one stratum being the partitioning of the Keys by region, and the second being a backcountry to offshore gradient. This resulted in 4 regions (Upper Keys, Middle Keys, Lower Keys, and Marquesas- Dry Tortugas), and four habitat areas (Backcountry, Intra/Inter Island, Inshore/ Mid-Channel, and Offshore Deep Reef). The intent of this sampling design process was to capture a cross-section of representative sites across the Keys. A review of the table below and the map in the Appendix confirms that selected sites are well distributed.

	Upper Keys	Middle Keys	Lower Keys	Marquesas - Dry Tortugas
Backcountry/Gulf Side		1	3	2
Intra/Inter Island	1	3	3	3
Inshore-Mid-channel	1	2	4	3
Offshore-Deep Reef	4	2	2	

Individual site justifications follow later in this document, listing the characteristics which led to the selection of each of the selected sites. Depending on tide levels, it is estimated that 18 of the sediment sample sites should be intertidal, and 16 should be subtidal.

SAFETY

Prior to mobilization, all samplers will participate in pre-sampling briefing(s). All personnel will be Hazwoper trained and will participate in any other training modules required by Incident Command. Float plans will be filed with the IC for each day's activities on the water. All necessary PPE will be used.

SAMPLING

During the actual sampling activities, the latest approved sampling protocols for water sampling, sediment sampling, and sample handling will be strictly followed (see Appendix for NRDA specific protocols).

At each of the 34 sampling sites, 1 grab sample for water and 1 composite sediment sample will be collected. The sediment sample will be a composite of 3 subsamples taken at the site. All water and sediment samples will be analyzed for all parameters listed in the final approved protocols, except BTEX/ VOA samples will not be collected. Field duplicates and blanks will each be collected at the greater of either a 10% frequency, or at least one per sampling team. This is estimated to result in 4 or 5 each, duplicate and blank samples.

LABELLING, SHIPPING, AND DOCUMENTATION

Prepare sample labels following sample ID protocol provided in the instructions from the trustee data management team.

Take precautions to avoid cross-contamination of the site from oil on boots and shovels.

Affix sample ID labels to each container and cover with clear tape wrapped around the entire container circumference.

Preserve all original field notebooks, which should be signed and dated. If crossing out or correcting any entries, date and initial when making the changes. Documentation is critical; original records will be gathered and kept on file by the trustees.

Record the presence of oil, weather conditions, etc. in field notes. Record GPS coordinates for each sample. Take photographs of the sampling locations and sample collection itself if possible; make sure each photograph or series can be later associated with the corresponding sampling locations (e.g. through use of GPS Photolink software or by keeping a detailed photo log). Do not delete or alter any photos (see separate NRDA Field Photography Guidance).

Ship known oil-contaminated samples separate from non-contaminated or low contaminated samples to reduce risk of cross-contamination.

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

COSTS

Trustee and other agency services to be provided during the sampling events include a boat, driver, and one additional staff person, for each of 8 sampling teams. Approximately 2 - 3 days will be needed to complete the sampling plan.

Estimated costs:

Boat, driver, and 2 samplers = $1000/ day
$1000/ day x 8 boats x 2 days = $16,000

Travel for 8 agency staff to assist in the sampling event
8 staff x $150/day x 3 days = $3600

Miscellaneous sampling consumables (ice, bubble wrap, coolers, etc.) = $500

Estimated Total: $20,100

These costs do not include lab analysis.

DATA SHARING

Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT) and to ENTRIX (on behalf of BP). The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure FTP drop box maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO and to ENTRIX. Thereafter, the DMT will validate and perform quality

assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Quality Assurance Project Plan, after which time the validated/QA/QC'd data shall be made available to all trustees and ENTRIX. Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Quality Assurance Project Plan and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. The LADP shall not be released by the DMT, LOSCO, BP or ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and ENTRIX."

Florida Keys NRDA Sampling Site Justifications
Water and Sediment

Sampling sites are organized by region Upper Keys, Middle Keys, Lower Keys, and West of Key West to the Dry Tortugas. All of these sites are located within the Florida Keys National Marine Sanctuary (FKNMS). Several areas also have additional state or federal management designations beyond just being located within the FKNMS, and these are noted in parentheses after the site name.

Upper Florida Keys

Carysfort Light (Sanctuary Preservation Area)

- Coral habitat; subtidal sample site
- One of the northeastern most fore-reef areas within the Monroe County portion of the Florida Keys National Marine Sanctuary.
- Isolated reef area / lower visitor impacts located adjacent to the Dagny Johnson Key Largo Hammock Botanical State Park – significant buffering from the impacts of any adjacent development.
- As a fore-reef area, one of the sites that may be more readily impacted as the Florida Current tends to "hug" the curve in the Keys before being directed north.
- Highly diverse coral communities
- Well studied through years of marine ecological and water quality monitoring and research

Basin Hill Shoals (John Pennekamp Coral Reef State Park)

- Mixed coral, sand habitat; subtidal sample site
- This area in John Pennekamp Coral Reef State Park is a series of small, shallow patch reefs that are in good condition.
- Collecting sediment samples will not be difficult due to the depth.
- Basin Hill Shoals is offshore of Dagny Johnson Key Largo Hammock Botanical State Park where there are only a few outparcels not in state ownership, so impacts from land use are minimal.
- Since Carysfort Yacht Club was purchased by the state, these reefs have had minimal impacts from boaters because of their northern location.
- Basin Hill Shoals was not as adversely affected by the cold water bleaching event of this winter as other areas within the park and suffered minimal coral mortality during this event.
- During the surveys that were conducted 5/5/10 and 5/6/10, numerous queen conch were observed.

Dry Rocks or Grecian (Key Largo National Marine Sanctuary & Sanctuary Preservation Area)

- Coral habitat; subtidal sample site
- Protected fore reef area lying landward of other fore reef development like French or Molasses Reefs.

- Diverse marine ecology having well developed reef structure with surrounding hard bottom and seagrass environments

Adams Cut

- Man-made channel sand-silt substrate; subtidal sample site
- This is the only access channel from oceanside to bayside in Key Largo except for the north and south ends of the island.
- Water flowing through the cut from the bayside enters into John Pennekamp Coral Reef State Park at Largo Sound, which is a shallow seagrass bed surrounded on the north, east, and south sides by mangroves.
- From there the current flows out through South Sound Creek, North Sound Creek, and to a lesser extent, Taylor Creek, all of which are bordered by mangroves.

Rodriguez Key

- Seagrass habitat; shallow subtidal sample site
- Rodriguex Key is a mangrove island at the southern boundary of John Pennekamp Coral Reef State Park.
- Located on the southeast side of Rodriguez Key is a Goniolithon/Porites patch, which supports a host of juvenile fish and invertebrate organisms.
- The island is otherwise surrounded by seagrass and bare substrate.
- This site was selected as an alternative to Molasses Reef, because it is in the same general area but sediment and water samples can be taken in the intertidal or shallow subtidal zone.

Conch Reef

- Mixed coral, sand, hardbottom habitat; subtidal sample site
- Location of the NOAA National Undersea Research Center project administered by the University of North Carolina
- The site represents a huge source of long-term data for a broad range of research and monitoring topics which would allow a better pre- and post-spill understanding of potential oil spill impacts

Middle Florida Keys

Anne's Beach

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample site
- Anne's Beach is a beach area on the west end of Lower Matecumbe Key, which allows intertidal sediment sample collection at low tide.
- This beach is an area that has significant recreational use, and it is located adjacent to US1.
- Previously Tennessee Reef was identified as a sampling site, but during the final planning for the sampling it became apparent that the substrate at the site is predominantly composed of rubble and hardbottom, and the site is 12' – 15' deep. Given this depth and the coarse nature of the substrate at Tennessee Reef, it was decided that Anne's Beach was an appropriate alternative sampling site within the same general region.

Lignumvitae Key (Lignumvitae Key Botanical State Park)

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample site
- These seagrass flats are subjected to currents from both the oceanside and bayside.
- This exposure to current flow makes the seagrass flats more vulnerable to potential impacts from oil contamination.
- There are currently 19 seagrass restoration sites within the 10,000 acres of the park with at least six new sites slated for restoration this year.
- In addition to seagrass beds, numerous coral species are found in this area.

Long Key Point (Long Key State Park)

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample site
- This area of the park is close to the current that flows through the Channel Five bridge.
- It is an isolated area of the park that has had multiple exotic removal projects to treat Australian pine, Scaevola, and latherleaf.
- Due to the removal of the exotic pine trees, the beach has widened over the years and has turtle nesting activity.
- The seagrass flats off of Long Key Point are in great condition, and are one of the few places that sawfish have been identified in the Keys.
- The coastal berm behind the beach is the location of the reintroduced Sargent's Cherry Palm (Pseudophoenix sargentii), which is an endangered species found only at Long Key and on Elliott Key in Biscayne National Park.

Long Key Beach (Long Key State Park)

- Sandy beach habitat; intertidal sample site
- A long narrow sandy beach which could receive impacts from waters passing through the Long Key or Channel 5 Channels
- Virtually the entire island is currently protected as a State Park, thus provides significant resource protection to avian species in particular and a large hammock and mangrove area
- Outstanding turtle nesting area which could be impacted should spill material arrive in the area

Old Sweat Bank/Long Key Pass

- Seagrass habitat; subtidal sample site
- Old Sweat Bank (north of Long Key, FL) is just north of the Long Key Bridge. It is very shallow, contains lush sea grass beds and is in the middle of the strong tidal currents associated with the ebb and flow of waters to and from Florida Bay.
- This bank area supports flats fishing and other activities.
- The Long Key Channel is one of the several major channels in the middle and lower Keys which allow the major flow-through of water from the Gulf (Southwest Florida Shelf) to the ocean.
- It has a high probability of being hit by oil should it ever get into the general region of Long Key Bridge.

Curry Hammock Beach (Curry Hammock State Park)

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample site
- Although the beach at Curry Hammock is relatively small, this site offers advantages for baseline data collection because of the seagrass flats offshore, and the adjacent mangroves south of the beach as well as those that surround Deer Key.
- Current flow to the south of the park would bring water from the bayside that would potentially affect this area.

Red Bay Bank/ Knights Key

- Seagrass habitat; subtidal sample site
- These banks are just north of the Seven Mile Bridge near Marathon.
- Moser Channel provides a major flow through Seven-Mile Bridge connecting southwest Florida shelf with Atlantic Ocean.Shallow bank with seagrass.
- Has been monitored due to boat groundings.
- They are very shallow, contain lush sea grass beds and are in the middle of the strong tidal currents associated with the ebb and flow of waters to and from Florida Bay.
- These banks support flats fishing and other activities.
- They have a high probability of being hit by oil should it ever get into the general region of Seven Mile Bridge.

Boot Key

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample site
- Boot Key is a largely undeveloped island adjacent to Boot Key Harbor on the south side of Marathon.
- The ocean side of Boot Key has a shoreline lined with mangroves, and may allow collection of an intertidal sediment sample.
- Due to its central geographic location, and the currents observed on ocean and bay sides of the Island, Boot Key is also an important site.
- Sombrero Reef is near Boot Key, and was identified as a sampling location in initial planning discussions. Sombrero Reef does not have exposed sediment at low tide, and ultimately was thought to be too deep for the purposes of this sampling event. Therefore in the final planning discussion, Boot Key was identified as an acceptable alternative sampling site.

Lower Florida Keys

Cumulatively the islands, shoreline, and intertidal areas along the margins of the Back Country represent the first intersection of any potential oil spill material passing through the Keys from the West Florida Shelf. The areas selected represent a broad cross section of the shoreline interface with the tidal and sub-tidal. These areas include seagrass meadows, hard bottom substrates, sand and mud bottom, shallow patch reefs (though hugely damaged by long term bleaching and recent cold spells), fringing mangroves communities and sand and rocky shorelines. Most of the islands in the Great White Heron National Wildlife Refuge are also designated as Wilderness. The Back Country represents outstanding avian roosting, feeding, resting and breeding sites in the Florida Keys (many of avian species are listed as either

Federally and/or State Threatened or Endangered) as well as important foraging habitats for all sea turtle species, and brooding and nursery habitat for numerous game fish and crustaceans.

East Bahia Honda Key (Great White Heron National Wildlife Refuge)

- Mangrove shoreline habitat; shallow subtidal sample site
- Extensive flats, and, depending on winds and currents, water funneling in through either Moser or Bahia Honda Channel.
- A pair of bald eagles has nested on the island for the past 5 years.
- East Bahia Honda Key is the most important island for nesting white-crowned pigeons (WCPI) in the Great White Heron NWR, based on nest surveys from 2000-2009, with more than 700 nesting pairs in a single nesting season. Because of its location, the island provides WCPI to exploit widespread upland feeding areas (regardless of wind speed and to some degree wind direction) which may differ temporally in food production.
- East Bahia Honda Key is the easternmost island in the backcountry and is situated along the Middle Keys Lower Keys Boundary.
- It is ringed by mangroves and shallow sea grass flats.
- If oil becomes entrained onto the southwest Florida Shelf, typical prevailing currents will be likely to bring oil into the region of Florida Bay represented by East Bahia Honda Key.

Bahia Honda Beach (Bahia Honda State Park)

- Sandy beach habitat; intertidal sample site
- The beach at Bahia Honda is one of the few naturally occurring beaches in the Keys.
- The beach itself supports many rare species including nesting sea turtles (loggerhead, hawksbill and green), sea lavendar (Argusia gnaphaloides), Cuban clustervine (Jacquemontial havanensis), and inkberry (Scavolia plumerii).
- There is a freshwater interdunal swale, a unique habitat in the Keys, that is found between the primary and secondary dune ecostyems.
- This beach also supports numerous shorebirds.
- Regular surveys are conducted to document shorebird activity during shorebird nesting season as well as year round. Piping plovers and Wilson's plovers have been documented on the beach and least terns have been documented feeding in the nearshore waters.
- Current flow through Spanish Harbor Channel and Ohio Bahia Honda Channel would affect this area. The nearshore waters support numerous organisms including seagrass, coral, fish and queen conch.

Looe Key Reef (Sanctuary Preservation Area and Research Only Area)

- Coral habitat; subtidal sample site
- Looe Key is located at the approximate location of the landward moving waters of the Portales Gyre. As such, it may be one of the first spots potentially impacted by oil advected from the Florida Straits into Florida Keys waters.
- Extremely well studied site represented a large number of research, monitoring, and restoration projects
- Collectively, Looe Key has deep, fore, and back reef

Upper Harbor Key and Flats (Great White Heron National Wildlife Refuge)

- Seagrass habitat; subtidal sample site
- Harbor Key is the northeasternmost island located in the Lower Keys region. It is ringed by mangroves, shallow seagrass flats and is also adjacent to an extensive lush hardbottom community that supports large numbers of spiny lobsters and juvenile fishes.
- If oil becomes entrained onto the southwest Florida Shelf, typical prevailing currents will be likely to bring oil into the Harbor Key area of the Lower Keys. A "sentinel" site for water moving south from the southwest Florida shelf. Area was bathed by "black water" in 2002.
- Huge flats are an important low tide foraging area for an array of wading birds. Severely damaged by Hurricane Wilma, Upper Harbor Key still harbors nesting great white herons, a pair of nesting bald eagles, and roosting magnificent frigate birds and brown pelicans.

Raccoon Key (Great White Heron National Wildlife Refuge)

- Mangrove shoreline habitat; shallow subtidal sample site
- Represents well known example of an interior back country island.
- This island and the area south of the Content Keys represent a vast, shallow flats and seagrass area in the Lower Keys.
- To the extent that the area is monitored, it is shallow and confined.
- If spill material becomes entrained in these areas it may tend to get caught and accumulate.
- White-crowned pigeon colony every year since 2000.

Sawyer Keys/ Kemp Channel (Great White Heron National Wildlife Refuge)

- Sandy shoreline habitat; intertidal sample site
- Nesting green and loggerhead turtles
- A premier site for nesting great white herons, yellow-crowned night herons.
- Network of mangrove-lined creeks, hard-bottom communities, and sand flats
- The only series of refuge islands closed as an entire unit to public entry
- High-density migrant shorebird aggregations on intertidal flats
- Harbors the second largest colony of nesting white-crowned pigeons in Great White Heron NWR

Snipe Keys (Great White Heron National Wildlife Refuge)

- Sandy shoreline habitat; intertidal sample site
- A maze of extremely narrow dissected tidal creeks course through scores of tiny mangrove-lined islands. If entered by oil, this complex network of creeks and tiny islands would be highly vulnerable to long-term contamination. Clean-up would be incredibly difficult.
- Beach habitat on north side.
- Extensive intertidal flats border parts of the islands

Boca Chica Beach (Boca Chica Naval Air Station)

- Sandy beach habitat; intertidal sample site
- Boca Chica beach represents a long, well protected beach, mangrove, and dune hammock regime which runs from Lower Sugarloaf Key to the western extent of Boca Chica Key
- Boca Chica beach is contiguous with the Western Sambos Ecological Reserve within which a large number of research and monitoring projects have been carried since the inception of the FKNMS
- Boca Chica Channel represents one of the lesser channels allowing flow from the Gulf to the ocean.

Western Sambo (Ecological Reserve)

- Mixed coastal (seagrass, sand, coral, hardbottom) habitat; shallow subtidal sample site
- The Western Sambos Ecological Reserve represents a diverse combination of seagrass, mud, sand and hard bottom communities leading from shore to the Western Sambos fore reef area.
- Research carried out in the Ecological Reserve is largely resource based and could provide complementary data to that collected through the NRDA

Northwest Channel Bank

- Sand and seagrass habitat; subtidal sample site
- Major flow way connecting southwest Florida shelf with Atlantic Ocean.
- A large, broad shallow bank with expansive areas of seagrass and shallow water flats
- Flats are an important low tide foraging area for an array of wading birds.

Fort Zachary Taylor Beach (Fort Zachary Taylor State Park)

- Sand beach habitat; intertidal sample site
- Although this is a small area, it is a critical location due to current flow because of its location in Key West. Turtle nesting has been documented for this site and several nests were recorded during the 2009 nesting season. The seagrass beds off of the beach are in great condition due to their depth, and corals are thriving on the boulder piles that protect the beach from erosion. Some of these corals were transplanted from nearby seawalls.

Sand Key (Sanctuary Preservation Area)

- Coral habitat; subtidal sample site
- Sand Key is located at the approximate western end of the Pourtales Gyre, a potentially important current feature which could entrain oil. The site hasa small offshore sand island from which samples can be taken in the intertidal zone or in the immediate adjacent shallow subtidal zone.

West of Key West to the Dry Tortugas

Marquesas Keys (3 sites) (Key West National Wildlife Refuge & Wilderness)

- Sandy shoreline habitats; intertidal sample sites
- island with internal lagoon and surrounded by seagrass and hard bottom habitats. Entrances into interior of island on north and south sides.

- High biological productivity and diversity. A "reference" site because of its remoteness and high quality.
- Ongoing systematic transects and in-water trapping of sea turtles since 2003 by the Inwater Research Group (IRG) have shown that Key West NWR waters harbor a globally significant, demographically diverse population of green, loggerhead and hawksbill turtles. The area is a tremendously important as developmental habitat for maturing sea turtles.
- Among other important IRG findings was the discovery of a significant population of large, sub-adult green turtles west of the Marquesas, a size class that was thought to be absent in Florida -- further reason to be justifiably concerned about the Marquesas.
- Endangered species include nesting green, loggerhead and hawksbill turtles, piping plover, Garber's spurge.
- Five islands harbor the imperiled Miami blue butterfly (candidate species).
- Large number of juvenile green turtles in interior lagoon.
- Islands harbor nesting wading birds and large seasonal magnificent frigate bird roosts.
- Network of narrow deepwater channels and large (~1-km) opening on the west-central side of island may funnel oil into the interior lagoon
- All of the 14 islands are bordered on one or more sides by extensive sea grass meadows and intertidal flats.
- These habitats, also present in interior lagoon, provide important low-tide foraging habitat for wading birds, and at the lowest tides, shorebirds.
- Important fall stopover area for peregrine falcons, northern harriers and other raptors
- Important shallow water fishery -- premier shallow water site for flats guides
- Pristine patch reef on south side of island.

<u>Boca Grande Key (Key West National Wildlife Refuge & Wilderness)</u>

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample site
- Endangered species, including piping plover, Garber's spurge, nesting green and loggerhead turtles. Occasional roosting site for roseate tern. Miami blue butterfly (candidate species)
- Highest known concentration of reddish egrets (including 4 satellite-tagged birds) in the lower FL Keys. Nesting bald eagles, black-necked stilts, least terns (2006-2007) and great white herons.
- Interior lagoon, particularly the smaller intertidal portion, harbors large concentrations of post-breeding least terns (July-August), and migrant shorebirds.
- Larger interior lagoon harbors brown pelicans year-round and 70-100 wintering white pelicans
- Important fall stopover area for peregrine falcons, northern harriers and other raptors
- Second largest population of mangrove terrapins in the lower FL Keys. The terrapins' spend considerable time on the island's interior in the shallow mud flats.
- Oil entering the shallow lagoon through the Hurricane Wilma-created breach on the island's south side would devastate the critical foraging areas of shorebirds, wading birds, and mangrove terrapins.

<u>Cottrell Key (Key West National Wildlife Refuge & Wilderness)</u>

- Seagrass habitat; shallow subtidal sample site
- Sole brown pelican nesting colony in the refuge – active rookery every year since 1986 – fewer than 20 pairs the past two years. Active rookery in 2010.
- Largest cumulative number of great white heron nests 1986-2009—rookery active every year since 1986.

Garden Key/ Bush Key / Long Key area (2 Sites)(Dry Tortugas National Park)

- Sandy shoreline (coastal vegetation, seagrass) habitat; intertidal sample sites
- This location is a likely end point for oil entrained in the Tortugas Gyre and reflects several critical habitats, including mangroves, coral reefs, and seagrasses.
- Additionally, this area is used by a variety of migratory birds including roseate terns and least terns nest along the beaches of Bush Key.
- The islands are surrounded by seagrass meadows and hard bottoms.
- Major bird rookery for brown noddys.
- Only nesting area in the Florida Keys for magnificent frigate birds.

West Side Loggerhead Key/ Little Africa

- Sandy beach habitat; intertidal sample site
- The Tortugas Bank is a highly diverse coral reef formation.
- A number sites have been well studied by a number of state and federal agencies
- The area may have been impacted by the "black water" event of 2002. As such it will be important to track cumulative impacts to the area should they occur.
- The site is known as one of the best patch reef areas that can be snorkeled in the Florida Keys

APPENDIX

MS Canyon 252 (Deepwater Horizon) Oil Spill 5-14-2010 version

Shoreline Sediment Sampling Protocols for NRDA

Sampling Objectives

The focus of this document is collection of sediment samples by hand / hand tools (i.e. without use of specialized sampling devices or equipment) in the intertidal zone. Sediment samples may be collected to support various objectives during a natural resource damage assessment. Samples may be taken to investigate an exposure pathway; to investigate levels at which biota in sediment are exposed; to assist in evaluations of weathering and fingerprinting of oil; to measure sediment characteristics for interpreting chemical and biological results; and for other reasons. These protocols do not address sediment sampling objectives; prior to collecting samples a plan should be drawn up that clearly establishes specific sampling objectives including the types (e.g. depth of sample, composite versus discreet) and locations of samples to be collected. These protocols support natural resource damage assessments by providing the procedures that ensure sample integrity and the reliability of chemical characterizations as evidence in a damage assessment case. For detailed step-by-step instructions on how to collect various types of samples, refer to you sampling plan or other agreed upon SOPs.

Sample Volumes Required for Common Analyses

Type of Analysis Sample Volume

PAHs (including alkylated PAHs), TPH/THC, and Two each 250 mL (8oz) glass jars filled ¾ full;
TOC (Alternatively, one 500 ml (16 oz) jar filled ¾ full)

Grain Size 100 g in resealable (e.g. Ziploc) bag or 4 oz jar

Sampling Equipment/Containers and Collection Methods

• Collect shoreline sediment samples (wearing clean nitrile or other non-contaminating gloves) by scooping sediment into the sample container using a clean utensil (e.g. wooden tongue depressor, spoon). To avoid potential cross-contamination, use pre-cleaned disposable utensils or wrap utensils in foil and discard foil between samples.

• Avoid or remove stones, sticks, and other debris; do not include visible oil or tar balls (see separate protocol for collection of oil samples if that is the intent).

• Sediment samples for PAHs and TPH/THC should be placed in glass containers with Teflon-lined lids, certified clean for semi-volatile analysis. Grain size samples may be placed in a plastic bag or small jar.

• Each sediment sample for PAHs and TPH/THC may be placed in one 500 ml (16 oz) jar filled ¾ full, or in two 250 ml (8 oz) glass jars filled ¾ full (to facilitate shipping and handling). If sample volume is split between two containers, both containers should receive the same sample ID (label the first container, "XYZ...1 of 2" and the 2nd container, "XYZ...2 of 2") and recorded on a single line of the CoC form.

• If placing sediment in more than one jar, or if compositing samples from more than one location, the sample must be mixed before placing in the jar(s). This should be performed in a disposable aluminum pan, on aluminum foil, or on other disposable, non-contaminating material.

• Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.

Preservation/Holding Times

• Immediately place all sediment samples into coolers and keep on ice until prepared for shipment.

• Sediment samples should be shipped for arrival at the lab within 7 days of collection. Sediment samples that will not be analyzed within 7 days of collection must be frozen for long term storage by the lab (with the exception of grain size samples, which should not be frozen).MS Canyon 252 (Deepwater Horizon) Oil Spill 5-14-2010

Labeling / Documentation / Other Considerations

- Prepare sample labels following sample ID protocol provided in the instructions from the trustee data management team.
- Take precautions to avoid cross-contamination of the site from oil on boots and shovels.
- Affix sample ID labels to each container and cover with clear tape wrapped around the entire container circumference.
- Preserve all original field notebooks, which should be signed and dated. If crossing out or correcting any entries, date and initial when making the changes. Documentation is critical; original records will be gathered and kept on file by the trustees.
- Record the presence of oil, weather conditions, etc. in field notes. Record GPS coordinates for each sample. Take photographs of the sampling locations and sample collection itself if possible; make sure each photograph or series can be later associated with the corresponding sampling locations (e.g. through use of GPS Photolink software or by keeping a detailed photo log). Do not delete or alter any photos (see separate NRDA Field Photography Guidance).
- Ship known oil-contaminated samples separate from non-contaminated or low contaminated samples to reduce risk of cross-contamination.
- See related NRDA protocol documents for specific sample shipping and notification/ sampling documentation instructions.

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Protocols For Collecting NRDA Samples SUBTIDAL SEDIMENTS

Sampling Objectives

- To determine the concentration and source of oil compounds in sediments.
- To measure sediment characteristics for interpreting chemical and biological results.
- To document the presence or absence of sunken oil.

Sample Volume by Analytical Method (see back page for description and suggested detection limits)
AHC by GC/FID 250 mL; or 1/2pint; or 8 oz
PAH by GC/MS-SIM 1/2pint; or 8 oz (same sample as above)
TOC 10 g ; or 10 mL
Grain size 100 g; or less than 4 oz (separate sample)

Sampling Equipment/Containers

- Any sediment sampling device which meets the following requirements can be used:

-creates a minimum bow wake when descending
-penetrates the sediments below the desired sampling depth
-closes to form a leak-proof seal after the sediment sample is taken
-prevents sediment washout and disturbance when ascending

- Common sampling devices include: modified van Veen grab; Ekman grab; box dredge.
- Sediment samples for AHC and PAH should be placed in glass containers, certified-clean to be organic-free (solvent rinsed), with Teflon- or aluminum foil-lined lids. For TOC, they can be placed in soap-cleaned glass or plastic containers. For grain size, Ziploc or Whirl-Pak bags can be used.

Sample Collection Methods

- Decon all sampling gear before using and between sampling stations. First wash with laboratory-grade detergent and clean water.
- In oiled areas, decon all sampling equipment and supplies between samples.
- Avoid contamination from surface slicks if present.
- Lower and retrieve the sampling device at a controlled speed of ~1 foot per second.
- The device should contact the bottom gently; only its weight or piston mechanism should be used to penetrate the sediment. It is important to minimize disturbance to the surface floc which is likely to contain oil contaminants.
- Inspect the sample to make sure that it meets the following criteria:

-the sampler is not overfilled; the sediment surface is not pressed against the sampler top.
-overlying water is present, indicating minimal leakage.
-sediment surface is undisturbed, indicating lack of channeling or sample washout.
-the desired penetration depth is achieved (e.g., 4-5 cm for a 2 cm sample).

- Siphon off the overlying water near one side of the sampler.
- Using a flat scoop, accurately collect the top 2 cm, avoiding sediments in contact with the sides of the sampler. Use a new scoop for each station. Collect other intervals, per the sampling plan.
- On each trip, try to sample control and least oiled areas first, then the most contaminated areas.
- A field/trip blank should be prepared by opening a sample container (jar) and allowing it to stand open for the time it takes to collect field samples (3-5 minutes). Ideally, kiln-fired sand supplied by the laboratory can be transferred (poured or scooped) from one container to another and returned to the lab as a field blank, but if this is not possible, the open jar technique is acceptable.

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• Record the sample no. on both the label and lid. Record the following on the field log sheet: sample no.; date/time; location; gps coordinates, water depth; penetration depth; surface sediment characteristics: texture, color, biota, debris, sheens, odor, etc.; vertical changes in sediment characteristics

Preservation/Holding Times

• Immediately place all sediment samples in a cooler and keep at 4°C . Freeze samples for chemical analysis by the end of each day. Refrigerate samples for TOC and grain size (do not freeze).

• Use packing material, such as bubble wrap, around containers to prevent breakage.

• Sediment samples can be held frozen in the dark for several years without loss of sample integrity.

• Sediment extracts can be held at 4°C in the dark for 40 days without loss of sample integrity.

Analytical Methods

• Aliphatic hydrocarbons (SHC or AHC). Often referred to as total petroleum hydrocarbons, but most methods do not differentiate among petroleum, pyrogenic, and biogenic hydrocarbons. AHC by GC-FID (total area of FID gas chromatogram of combined f_1 and f_2 fractions after column chromatography) is often the preferred method because of the low detection limit (2 ppm versus 100-1000 ppm for other THC methods) and the direct measurement of hydrocarbons. This method does not detect low boiling compounds (below n-C_8). For NRDA, AHC analyses generally will not provide the data needed to support calculation of toxic effects from PAH exposure, and will have to be corrected to equivalent PAHs. The AHC results, however, can be used to track oil weathering and map extent of exposure to benthic resources. Detection limits are usually higher than those needed for benthic injury assessment. Sample prep may require extra steps to remove lipids which may interfere with the analysis.

• Polycyclic aromatic hydrocarbons (PAH). Since most of the toxicity in oil is due to the PAHs, it is often the preferred analysis for NRDA. The analytes must include the alkyl-substituted PAH homologs, in addition to the standard PAH "priority pollutants." This method is referred to as Modified EPA Method 8270, because the list of PAHs is expanded to include the alkylated homologs, using GC/MS in the selected ion monitoring mode. Detection levels should be 1 ppb for individual PAHs to support injury assessment using toxicity thresholds. Important: Have the lab also run the source oil.

• Biomarkers (S/T). Sterane/triterpane biomarkers are "fossil" compounds unique to the oil formation that are very resistant to weathering, persisting for decades after some events. These compounds provide a secondary and confirming line of evidence in forensic oil identification. These data are also generated by the 8270 method.

Other Considerations

• Be aware of sources of contamination on the sampling vessel (exhaust fumes, engine cooling systems, oily surfaces). Work up-wind of any exhausts. Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.

• Collect background samples from clean sites representative of pre-oiling conditions, as well as areas not yet oiled but in the potential path of the oil.

• Use a physical or mental model of the extent of benthic contamination to determine the number and location of samples. Minimum guidelines are at least three samples per area of relatively uniform exposure or distinct waterbody. Also, sample along exposure gradients at regular intervals proportionate to the exposure area.

• Present chemical results on a dry-weight basis.

• Collect separate splits for infauna or bioassay, so they can be correlated with chemical results.04/ 30/ 2010

Key References

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Edited 30 Apr 2010, wbd/jrp

Shallow Subsurface Water Sampling Protocol for NRDA (5-14-10)

Sampling Objectives

The focus of this document is collection of water samples by hand (i.e. without use of specialized sampling devices or equipment) in the shallow subsurface either by wading from shore or from a vessel. Water samples may be collected to support various objectives during a natural resource damage assessment. Samples may be taken in proximity to oiled biota to investigate an exposure pathway; beneath floating oil to determine the degree to which constituents are being released into the water column; to support exposure and transport modeling; to assist in evaluations of weathering and fingerprinting of oil; and for other reasons. This protocol does not address water sampling objectives; prior to collecting samples a plan should be drawn up that clearly establishes specific sampling objectives including the types and locations of samples to be collected. This protocol supports natural resource damage assessments by establishing the procedures that ensure sample integrity and the reliability of chemical characterizations as evidence in a damage assessment case. For detailed step-by-step instructions on how to collect various types of samples, refer to you sampling plan or other agreed upon SOPs.

Sample Volumes Required for Common Analyses

PAHs (including alkylated PAHs) and TPH/THC 1 liter (collect two replicate 1-liter jars per station if possible)

Sampling Equipment/Containers and Collection Methods

- Collect samples (wearing clean nitrile or other non-contaminating gloves) directly into the sample container from the water, to minimize risks of cross-contamination.
- Collect 1 liter water samples in glass containers with Teflon lined lids, certified clean for semi-volatile analysis. Amber glass is preferred to reduce light exposure, but not required. Leave headspace of about 1 inch; do not leave for prolonged periods in the light.
- To collect VOA samples, prior coordination with the receiving lab is recommended. Typically, 40-ml VOA vials preserved with 0.2 ml HCl should be obtained in advance from the lab; if not possible, obtain from a supplier that certifies them clean and pre-preserved for volatile analysis. When collecting VOA sample, fill vials so that they have no headspace or air bubbles remaining after lid is replaced.
- If oil or sheen is present, decontaminate everything that contacts the oil or sheen after each collection. Wash with laboratory-grade detergent and clean water, with a triple clean water rinse (distilled water from a local store is OK).
- Collect subsurface samples to characterize constituents present in particulate and/or dissolved state in the water column. Do not take samples from water surface to characterize water column concentrations (see separate protocol for collection of oil samples if the intent is to characterize floating oil).
- Containers for subsurface samples must be deployed and retrieved with the lid sealed so that the sample does not inadvertently include water surface constituents. Remove and replace the lid only at the sampling depth.
- Clear surface slicks prior to immersing sample container, but carefully so that the surface oil is not dispersed into the water column. Sweeping the area with sorbents is effective.
- On each trip, try to sample least oiled areas first, then more contaminated areas subsequently.

Preservation/Holding Times

- Immediately place all water samples into coolers and keep on ice (but do not freeze).
- 1 liter samples for PAHs and TPH/THC: These samples should be extracted by the lab within 7 days of collection. No preservative should be added. Keep samples at 4°C, and ship to the lab daily (if feasible) to maximize available time for processing by lab.
- 40 ml vials for VOA: These samples should be analyzed by the lab within 14 days of collection (and are only valid if pre-preserved vials are used as described above). Keep samples at 4°C, and ship to the lab daily (if feasible) to maximize available time for processing by lab.

Labeling / Documentation / Other Considerations

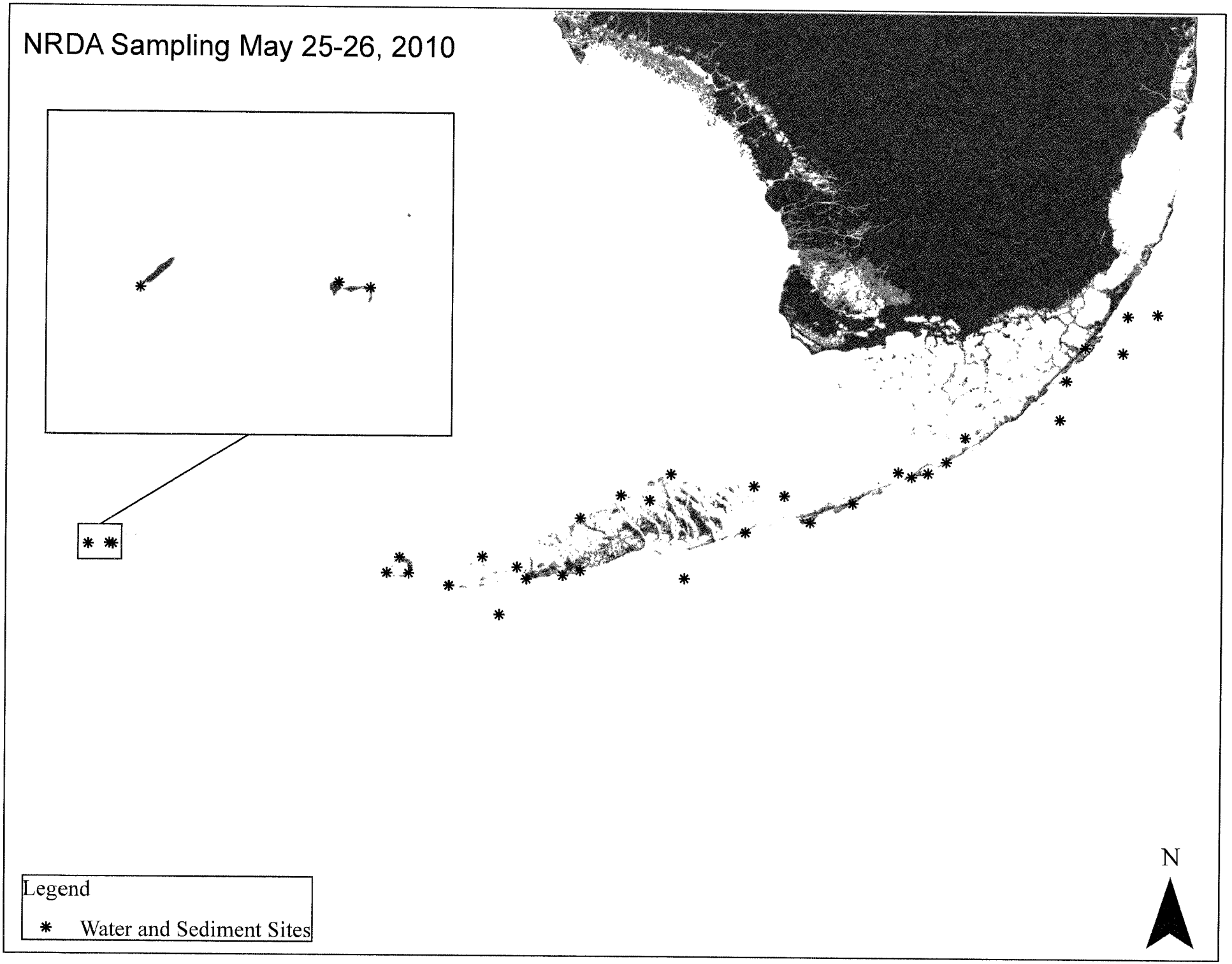
- Prepare sample labels following sample ID protocol provided in the instructions from the trustee data management team.
- If collecting a replicate water sample at each location as recommended above (i.e. as a backup in case of breakage or loss of containers during shipment and handling), both containers should receive the same sample ID (label the first container, "XYZ...1 of 2" and the 2nd container, "XYZ...2 of 2") and both should be entered on the same line on the CoC form. If a sample is collected as a *duplicate* (not a replicate), it should receive a unique sample ID and be recorded on a separate line on the CoC form.
- Affix sample ID labels to each container and cover with clear tape wrapped around the entire container circumference.
- Preserve all original field notebooks, which should be signed and dated. If crossing out or correcting any entries, date and initial when making the changes. Documentation is critical; original records will be gathered and kept on file by the trustees.
- Record the presence of oil slicks, weather, wave conditions, etc. in field notes, which might suggest mixing of surface oil during sampling. Record GPS coordinates for each sample. Take photographs of the sampling locations and sample collection itself if possible; make sure each photograph or series can be later associated with the corresponding sampling locations (e.g. through use of GPS Photolink software or by keeping a detailed photo log). Do not delete or alter any photographs, the numbering sequence of photos uploaded from your camera must not have any gaps (see separate NRDA Field Photography Guidance).
- If collecting samples from a vessel, be aware of potential sources of contamination on the vessel (e.g. exhaust fumes, oily surfaces). Work up-wind of any exhausts. Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.
- Ship known oil-contaminated samples separate from non-contaminated or low contaminated samples to reduce risk of cross-contamination.
- See related NRDA protocol documents for specific sample shipping and notification/ sampling documentation instructions.
- Record the sample no. on both the label and lid. Record the following on the field log sheet: sample no.; date/time; location; gps coordinates, water depth; penetration depth; surface sediment characteristics: texture, color, biota, debris, sheens, odor, etc.; vertical changes in sediment characteristics

Preservation/Holding Times

- Immediately place all sediment samples in a cooler and keep at 4°C . Freeze samples for chemical analysis by the end of each day. Refrigerate samples for TOC and grain size (do not freeze).
- Use packing material, such as bubble wrap, around containers to prevent breakage.
- Sediment samples can be held frozen in the dark for several years without loss of sample integrity.
- Sediment extracts can be held at 4°C in the dark for 40 days without loss of sample integrity.

Other Considerations

- Be aware of sources of contamination on the sampling vessel (exhaust fumes, engine cooling systems, oily surfaces). Work up-wind of any exhausts. Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.
- Collect background samples from clean sites representative of pre-oiling conditions, as well as areas not yet oiled but in the potential path of the oil.
- Use a physical or mental model of the extent of benthic contamination to determine the number and location of samples. Minimum guidelines are at least three samples per area of relatively uniform exposure or distinct waterbody. Also, sample along exposure gradients at regular intervals proportionate to the exposure area.
- Present chemical results on a dry-weight basis.
- Collect separate splits for infauna or bioassay, so they can be correlated with chemical results


NRDA Sampling May 25-26, 2010
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