

**Deepwater Horizon/Mississippi Canyon 252 Spill**

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**Work Plan for MC252 Oil Impacts to Fiddler Crabs and Periwinkles along the Gulf of Mexico**

Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment (NRDA). Each party reserves its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan. This plan will be implemented consistent with existing trustee regulations and policies. All applicable state and federal permits must be obtained prior to conducting work.

**APPROVED:**

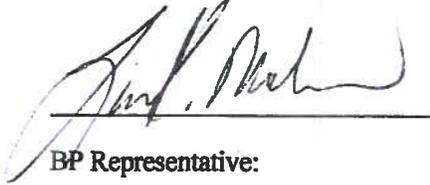
*For  
ROLAND  
GUILDAY*



Louisiana Trustee Representative:

3/28/2012

Date



BP Representative:

March 16, 2012

Date

*Jessica White for Lisa DiPinto*

NOAA Trustee Representative

3/16/2012

Date

(on behalf of all other trustees)

**Work Plan for  
MC252 Oil Impacts to Fiddler Crabs and Periwinkles along the Gulf of Mexico**

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This document presents a work plan for use in assessing the impacts of MC252 oil on the density, size distribution, and sex ratios of fiddler crabs and the density and size of periwinkles in coastal marshes along the Gulf of Mexico, particularly in Louisiana. The plan specifically addresses the following topics:

- I. Introduction and objectives.** This section describes the overall purpose and objectives for this fiddler crab and periwinkle work plan.
- II. Site selection.** This section describes the proposed approach to identifying sites for evaluation.
- III. Survey timing and frequency.** This section describes the proposed approach with respect to timing issues: when surveys can be executed and at what frequency subsequent monitoring may occur.
- IV. Field data collection methods.** This section describes how to establish transects and plots at the selected sites, specific activities and procedures pertaining to the characterization of fiddler crabs and periwinkles in salt marsh habitats, and case-wide protocols for use as part of this work plan, by reference.
- V. Post-survey management of data.** This section includes the procedures to be used in managing data after collection.
- VI. Data quality objectives and verification.**
- VII. Health and safety.** This section summarizes health and safety protocols applicable to this effort. It includes a number of procedures by reference, all of which should be carefully reviewed and adhered to by all team members.
- VIII. References**

**Appendix A – Acknowledgements**

**Appendix B – Fall 2011 Datasheets**

**Appendix C – Fall 2011 Quick Reference Guide**

**Appendix D – Budget**

## I. INTRODUCTION AND OBJECTIVES

This work plan provides a detailed practical methodology for collecting data on the potential effects of MC252 oil on fiddler crabs and periwinkles in coastal marshes along the Gulf of Mexico (GOM) as part of the NRDA for the MC252/Deepwater Horizon oil spill. The preliminary phase of this plan will be implemented in Fall 2011. This plan may be extended to 2012 and beyond by executing appropriate addenda. Data collected during the first sampling event may be used to refine the plan for future years. In particular, a review of the data collected during the initial phase of the survey will be executed to determine the usefulness of future seasonal studies. The plan also aims to provide information and data that can assist in identifying, designing and implementing further procedures as may be needed to complete the NRDA process for assessing the impact of MC252 oil on coastal fiddler crabs and periwinkles. The data collected under this plan may be used to monitor recovery of fiddler crabs and periwinkles to baseline. This plan draws upon survey results previously acquired under the "Sampling and Monitoring Plan for the Assessment of MC252 Oil Impacts to Coastal Wetland Vegetation in the Gulf of Mexico" (herein referred to as the Coastal Wetland Vegetation Plan, or CWVP on the datasheets). Results generated from this work plan may be combined with related efforts (e.g., aerial imagery/remote sensing, coastal wetland vegetation sampling, toxicity testing) to produce an overall understanding of the potential effects of the MC252/Deepwater Horizon spill on coastal wetland fauna. Each party reserves its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

All materials associated with the collection or analysis of samples under these protocols or pursuant to any approved work plan, including any remains of samples and including remains of extracts created during or remaining after analytical testing, must be preserved and disposed of in accordance with the preservation and disposal requirements set forth in Pretrial Orders ("PTOs") # 1, # 30, #35, # 37, #39 and #43 and any other applicable Court Orders governing tangible items that are or may be issued in MDL No. 2179 IN RE: Oil Spill by the Oil Rig "DEEPWATER HORIZON" (E.D. LA 2010). Destructive analytical testing of oil, dispersant or sediment samples may only be conducted in accordance with PTO # 37, paragraph 11, and PTO # 39, paragraph 11. Circumstances and procedures governing preservation and disposal of sample materials by the trustees must be set forth in a written protocol that is approved by the state or federal agency whose employees or contractors are in possession or control of such materials and must comply with the provisions of PTOs # 1, # 30, # 35, 37, #39 and #43.

The plan's objectives are to:

- A. Collect and evaluate data for the assessment of the potential effects of MC252 oil on coastal fiddler crabs and periwinkles; and

- B. Collect and evaluate data to assist in the design and implementation of additional assessment activities appropriate to the purposes of the plan.

This work plan is broadly applicable to all coastal fiddler crabs and periwinkles existing along the northern Gulf Coast shoreline. It is intended to capture fiddler crab data at the genus (*Uca*) level within marsh habitats and requires no distinction in site selection to be made among species that vary regionally. That is, different species of fiddler crabs are considered ecological equivalents in the context of the objective of this study which aims to assess ecosystem effects rather than differences in fiddler crab assemblages. Therefore, the monitoring design will not require modifications in order to accommodate such variation, and will allow for assessment of impacts on a broader spatial scale.

The procedures described in this document are focused on characterization of fiddler crabs and periwinkles residing in coastal marshes and refer to other protocols for general case-wide procedures (e.g., GPS use, photography guidance).

#### *Fiddler Crab*

As the most abundant and conspicuous invertebrate in most salt marshes, fiddler crabs are an appropriate organism on which to focus the study of marsh faunal injury (Montague 1980 in Fish and Wildlife Service 1989). Fiddler crabs are the most thoroughly studied of all shore crabs in North America (Barnwell and Thurman 1984 in Fish and Wildlife 1989), and fiddler crab literature is quite robust, comprehensively examining fiddler crab population dynamics, life history, and ecology. Fiddler crabs have been found to play a significant role in marsh ecosystems, primarily through their diet and burrow behavior. The presence of fiddler crabs indicates a greater diversity of other marsh organisms (Shields 1999), and fiddler crab densities can reflect the productivity of a wetland (Zhong 2006). Fiddler crab burrows provide a diversity of services to coastal marsh infauna including: 1) escape from predators; 2) mating and incubation site; and 3) high-tide refuge. Burrows also aerate the marsh sediment, increase soil drainage, and facilitate nutrient transport (Mouton and Felder 1996). Furthermore, the *Uca* genus has been widely shown to be sensitive to oil spills (Fucik et al. 1995 in Getter and Michel 2010). Because of their sensitivity to environmental contaminants such as oil, fiddler crabs have been previously identified as valuable environmental indicators (Zhong 2006).

Various fiddler crab species inhabit the northern GOM coast (Table 1), living in large clusters. Fiddler crab densities can reach up to 70-200 individuals per m<sup>2</sup> in salt marshes (Shields 1999). Because of the individual nature of burrow ownership among fiddler crabs, burrow density has been shown to closely estimate fiddler crab density in the GOM (Mouton and Felder 1996). Along with carapace width, sex, and species, this work plan will implement burrow counts, an established metric for species' density (Mouton and Felder 1996). Species will be recorded for informational purposes.

**Table 1:** Fiddler crab species found within the proposed study area (from Rosenberg 2007)

<b>Sub-Genus: Minuca</b>	
<b>Latin Name</b>	<b>Common Name</b>
<i>Uca longisignalis</i>	Gulf Marsh Fiddler Crab
<i>Uca minax</i>	Red-Jointed Fiddler Crab / Brackish Water Fiddler Crab
<i>Uca virens</i>	Mud Fiddler Crab
<b>Sub-Genus: Leptuca</b>	
<b>Latin Name</b>	<b>Common Name</b>
<i>Uca panacea</i>	Gulf Sand Fiddler Crab
<i>Uca spinicarpa</i>	Spined Fiddler Crab

### *Periwinkle*

The periwinkle is another common and conspicuous organism found in coastal salt marshes and, like the fiddler crab, is considered an indicator species of the health of the salt marsh habitat (Walters and Coen 1995). The most abundant periwinkle in the salt marshes of Louisiana is *Littoraria irrorata*. In areas dominated by short- and intermediate-form *Spartina alterniflora*, or saltmarsh cordgrass, this gastropod has been noted to routinely occur in densities of at least 100 individuals/m<sup>2</sup> (Silliman and Zieman 2001). Literature regarding the densities of periwinkles specifically within the salt marshes of Louisiana is sparse, although one study reports the density at 24 individuals/m<sup>2</sup> (Alexander 1979 in Silliman and Zieman 2001). Rasping detritivore specialists, periwinkles feed on organic matter on the marsh surface during low tide and ascend cordgrass stems to feed on standing-dead *S. alterniflora* and its associated microbial assemblages (Silliman and Zieman 2001) when water levels rise. Movement of individual organisms is limited, as periwinkles rarely move more than 5 meters per year (Vaughn and Fisher 1992). In addition to mortality, documented effects of oil on periwinkles are both physiological and behavioral in nature and include impaired escape response, impaired grazing, reduced recruitment, and compromised feeding patterns (Lee et al. 1981; Smith et al. 1984).

## II. SITE SELECTION

Fiddler Crab / Periwinkle salt marsh sites will be selected from those established as “herbaceous coastal wetland vegetation” sites under the Coastal Wetland Vegetation Plan. All sites will be within mainland-herbaceous *Spartina alterniflora*-dominated salt marshes. Sites will be chosen to represent the oiling extent categories described below. Oiling extent is defined as the ratio of the observed oil band height on the vegetation relative to the average vegetation height (expressed as a percentage). These reporting categories were established based on a review of SCAT data and quantitative information provided by earlier preassessment and assessment observations and include:

1. Unoiled: No oiling as reported from SCAT or other pre-assessment activity and no visible signs of oil documented on the vegetation, on or in the soil, or on the nearby water.
2. 90% to 100% Oiled (including sites within Northern Barataria Bay that are untreated): Vegetation, standing, prone, or stubble, with greater than 90% of the visible plant surface coated with oil; and with or without oil detectable on or in the soil.
3. 90% to 100% Oiled within Northern Barataria Bay, treated: Vegetation, standing, prone, or stubble, with greater than 90% of the visible plant surface coated with oil, with or without oil detectable on or in the soil and located in areas within Northern Barataria Bay that have been treated.

Published reports with data on the abundances (mean and standard deviations) of fiddler crabs along Louisiana marsh areas were initially reviewed to aid determination of the number of sites required to provide sufficient statistical power. For this purpose, statistical procedures and parameters consistent with those used for the Coastal Wetland Vegetation Plan were utilized. Based on this initial analysis, at least twelve sites within each oiling extent category will be selected from the existing Coastal Wetland Vegetation Plan study sites. Therefore, at least 36 sites will be included. Sites will be identified by the unique site code that was previously assigned to each site under the Coastal Wetland Vegetation Plan. New sites outside those identified under the Coastal Wetland Vegetation Plan may be established if it is determined that additional sites are required to achieve desired statistical power.

### **III. SURVEY TIMING AND FREQUENCY**

Under this Fiddler Crab / Periwinkle work plan, the initial assessment will be conducted in the fall of 2011. Revisiting sites as a result of weather conditions will be permitted only upon consensus of the parties responsible for executing this work plan. Results from the initial monitoring survey will be used to help determine the need for any future monitoring in order to assess the impacts of oil on fiddler crabs and periwinkles. Additional monitoring efforts may be proposed as addenda to this work plan.

#### IV. FIELD DATA COLLECTION METHODS

##### **Transect Establishment**

The survey team shall proceed to the GPS coordinates of the selected site and establish a transect 20 meters to the left<sup>1</sup> of the transect previously established under the Coastal Wetland Vegetation Plan (Figure 1). This distance represents the closest possible representation of the Coastal Wetland Vegetation transect (main transect) while avoiding potential physical disturbances to the marsh surface from field observations being made along 1) the Coastal Wetland Vegetation transect (with plots usually offset by 3-4 meters from the main transect line) and 2) the marsh elevation RTK (Real-Time Kinematic) transects at distances of 10, 15, and 25 meters from the main transect along the shoreline. Placement of transects for the Fiddler Crab / Periwinkle study between the 15 and 25 meter RTK elevation transects will also provide some characterization of the topographic slope and relative elevation of each study site, two important landscape features affecting tidal elevation and flooding frequency, which in turn can influence distribution of fiddler crabs.

At each site, a Fiddler Crab / Periwinkle transect will be established that is approximately perpendicular to the shoreline and proceeds inland into the coastal wetland vegetation. This transect should fulfill the following criteria: (a) it should be in an area which is representative of the features of the Coastal Wetland Vegetation transect, both in terms of natural characteristics and in terms of oiling extent at the time of this survey; (b) it must end in the interior of the coastal wetland vegetation and not near another shoreline; and (c) it must be placed so as to avoid open-water areas (i.e., ponds). If these criteria cannot be met by placing the transect 20 meters to the left of the Coastal Wetland Vegetation transect, the Fiddler Crab / Periwinkle transect should be placed 20 meters to the right of the Coastal Wetland Vegetation transect. If neither of these locations is suitable, the transect may be extended up to an additional 25 meters on either side of the Coastal Wetland Vegetation transect (45 meters total distance from the Coastal Wetland Vegetation transect). In this case, a 2-meter buffer should always be maintained around the RTK transect that is currently established 25 meters from the Coastal Wetland Vegetation transect. The direction and distance of the Fiddler Crab / Periwinkle transect from the Coastal Wetland Vegetation transect will be recorded on the "Site Visit / Set-Up Datasheet" (Appendix B).

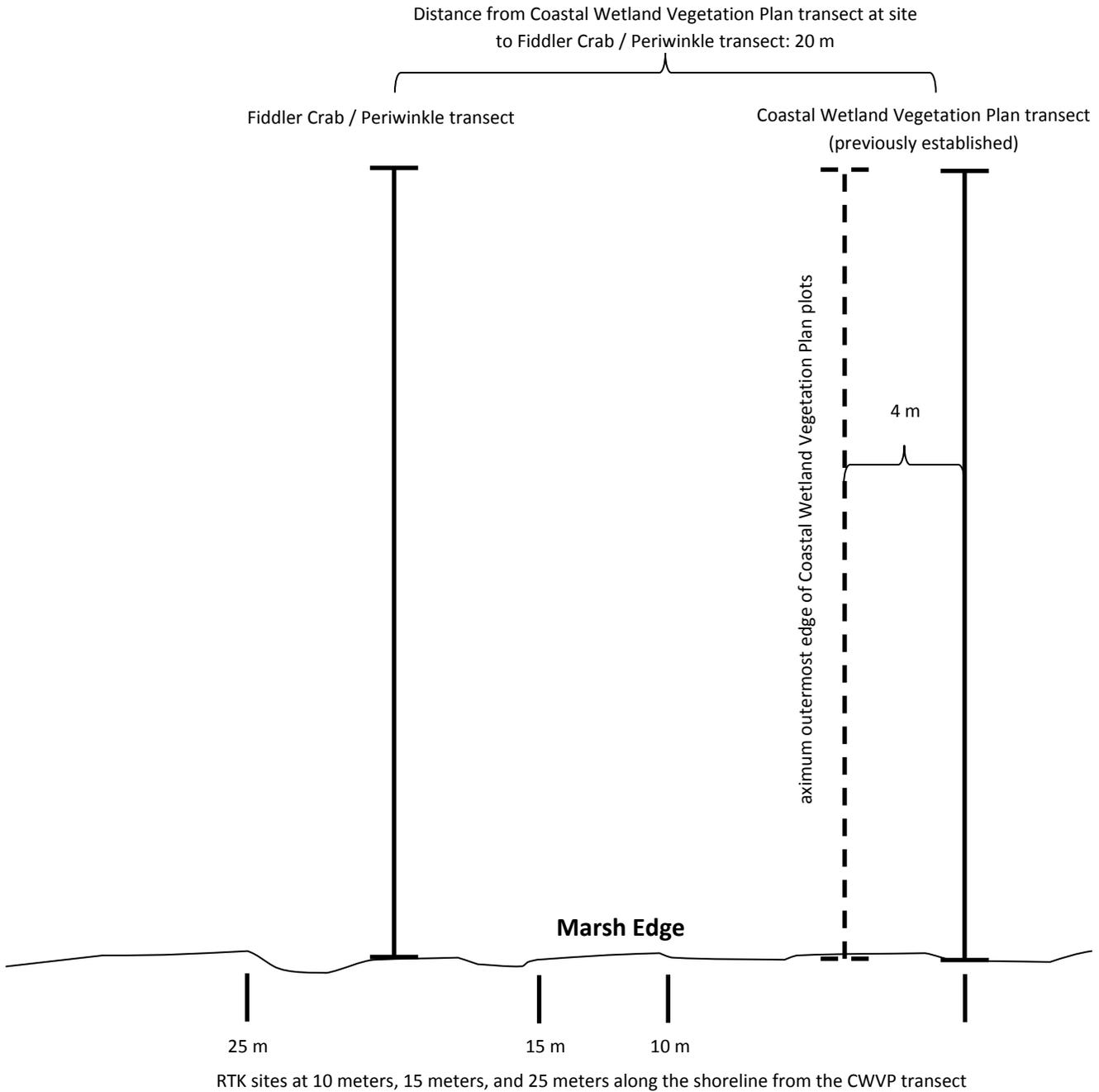
Each end of the Fiddler Crab / Periwinkle transect shall be staked using a 10 foot PVC pole. The GPS coordinates at both transect stakes (shoreline and inland) should be recorded on the "Site

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<sup>1</sup>All left/right directions used in this plan and its associated datasheets and quick reference guide are based on an inland-facing orientation. That is, the directions are from the perspective of one positioned such that the water is to her/his back.

Visit / Set-Up Datasheet.” The tops of the transect poles will be wrapped with colored duct tape to distinguish them from the Coastal Wetland Vegetation and RTK transects.

Unoiled marsh sites will be selected from those previously chosen to be similar (to the extent possible) in hydrogeomorphic setting, vegetation type, past environment history, etc., under the Coastal Wetland Vegetation Plan.



**Figure 1.** Transect location for Fiddler Crab / Periwinkle study in an herbaceous marsh area. Note the location of the transect in relation to the previously-established Coastal Wetland Vegetation Plan transect and RTK sites. Drawing is not to scale.

## **Plot Establishment**

### ***Oiled Sites***

Each transect will be divided into three zones with a pair of 0.25 m<sup>2</sup> plots established in each zone. If no erosion has been noted at the Coastal Wetland Vegetation Plan transect, the set-up will be as follows (Figure 2):

- Zone 1: center of plot located at 1.5 meters from the edge of the marsh.
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan.
- Zone 3: center of plot located 3 meters inland from the edge of the oiled zone<sup>2</sup> as determined for the site under the Coastal Wetland Vegetation Plan.

In this instance, the inland stake of the transect will be 4 meters beyond (landward of) the edge of the oiled zone.

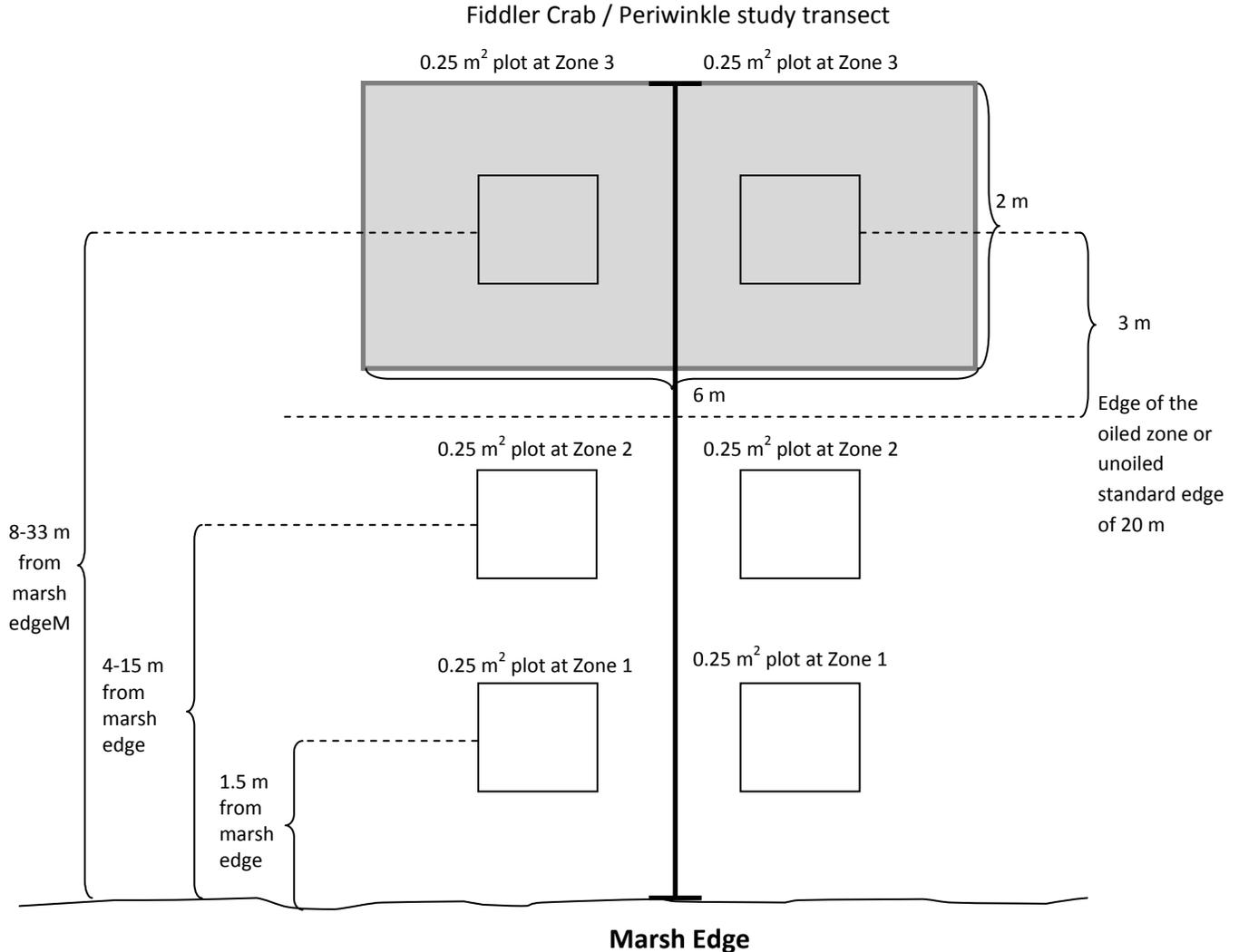
If erosion has occurred along the shoreline as noted under the Coastal Wetland Vegetation Plan, the distances at which the plots in each zone are placed will be adjusted to account for this erosion. The plots should parallel original conditions of the Coastal Wetland Vegetation transect as much as possible. Therefore, with erosion, the following adjustments will be made:

- Zone 1: center of plot located at 1.5 meters from the edge of the marsh, less the distance of noted shoreline erosion. If erosion is greater than 1.5 meters, the Zone 1 plots will be placed in the center of the distance from the marsh edge to the shoreline edge of the Zone 2 plot. Zone 1 plots will not be established if the distance between the shoreline and the shoreline edge of the adjusted Zone 2 plots is less than 1.5 meters (i.e., if Zone 1 and Zone 2 plots would be overlapping).
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan, less the distance of noted shoreline erosion.
- Zone 3: center of plot located 3 meters inland from the edge of the oiled zone<sup>2</sup> as determined for the site under the Coastal Wetland Vegetation Plan, less the distance of noted shoreline erosion.

In this instance, the inland stake of the transect will be 4 meters beyond (landward of) the erosion-adjusted edge of the oiled zone.

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<sup>2</sup> The length of the transect established under the Coastal Wetland Vegetation Plan defines the edge of the oiled zone at that site.



**Figure 2.** Transect and plot design for fiddler crab and periwinkle measurements in an herbaceous marsh area for an oiled or unoiled site with no noted erosion. Distance from transect line to edge of each plot is 1 meter. The shaded block represents the area designated for fiddler crab capture in Zone 3. Though not represented, this same size block applies for both Zones 2 and 1. Drawing is not to scale.

***Unoiled sites***

In unoiled sites, transect lengths and the placement of plots along these transects are intended to match the positioning of plots along transects in oiled areas as closely as reasonably achievable. Towards this goal, and to mimic the procedure followed under the Coastal Wetland Vegetation Plan, the erosion-unadjusted length of the Fiddler Crab / Periwinkle transect should be 4 meters beyond (landward of) the length of the transect established under the Coastal Wetland Vegetation Plan for the site.

If no erosion has occurred at the site, the set-up will proceed as follows:

- Zone 1: center of plot located at 1.5 meters from the edge of the marsh.
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan.
- Zone 3: center of plot located 3 meters inland from the transect length at the site as determined under the Coastal Wetland Vegetation Plan.

Similar to the adjustments made for oiled sites experiencing erosion, unoiled sites will have a slightly altered set-up if erosion has been noted for the site under the Coastal Wetland Vegetation Plan. In such a case, the following adjustments will be made:

- Zone 1: center of plot located at 1.5 meters from the edge of the marsh, less the distance of noted shoreline erosion. If erosion is greater than 1.5 meters, the Zone 1 plots will be placed in the center of the distance from the marsh edge to the shoreline edge of the zone 2 plot. Zone 1 plots will not be established if the distance between the shoreline and the shoreline edge of the adjusted Zone 2 plots is less than 1.5 meters (i.e., if Zone 1 and Zone 2 plots would be overlapping).
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan, less the distance of noted shoreline erosion.
- Zone 3: center of plot located 3 meters inland from the transect for the site as determined under the Coastal Wetland Vegetation Plan, less the distance of noted shoreline erosion.

In this final case, the total transect length will be 4 meters beyond the transect length under the Coastal Wetland Vegetation Plan, less the distance of noted shoreline erosion.

### ***All sites***

At both the oiled and unoiled sites, the three zones will be established using 5-foot PVC poles (½” diameter) at each corner. Additionally, a pair of plots will be established within each zone, with the inner edge of each plot measuring 1 meter from the transect. Plots will be established by placing 5 foot PVC poles (¾” diameter) on the outside corners of each plot. The shoreward left PVC post should be higher than the other three to provide guidance for walking in the field and for reestablishing plots.

If, because of erosion, overlap exists between fiddler crab collection Zones 1 and 2, Zone 2 will take precedence. Zone 1 will be reduced in size such that Zone 2 may follow the zone dimension criteria of a centered 6 meter by 2 meter area. The reduction in size of Zone 1 will be noted on the datasheets. The shoreline limit of the crab collection area for Zone 1 will be the scarp edge. As above, if this criterion causes a reduction in the size of the collection zone from the specified zone dimensions described above, the change in size will be recorded on the datasheets.

Data collection in each plot should only proceed if no water is present within the plot. If water is present, the plot may be returned to later to collect data once water has receded from the marsh at this location. In such a case, the plot will have two site characteristics datasheets: one completed and one noting water present on the marsh. The schedule of sites to be sampled will be arranged such that the chance of water on the marsh is minimal at each site.

The appearance of all sites and plots will be thoroughly documented using digital photographs. GPS readings will be recorded for the lower left corner of each plot (facing inland, the left-hand shoreward corner) and should be recorded on the appropriate plot datasheet. Detailed photographic and GPS logs will be maintained as described in the latest MC252 NRDA guidance (available on [www.noaanrda.org](http://www.noaanrda.org)).

### **Plot Characteristics**

For each 0.25m<sup>2</sup> plot the following observations and measurements will be recorded using a standard field datasheet:

- Visual estimate of percent cover, thickness, and character of surface oil
- Visual estimate of vegetative and periwinkle oiling
- Presence / absence of dead and dead and oiled periwinkles
- Visual estimate of percent cover by vegetation
- General description of the soil type
- Topographic descriptors

For each 2 meter by 6 meter zone, the following observations will be made and recorded using a standard field datasheet:

- Visual estimate of fiddler crab oiling
- Presence / absence of dead and dead and oiled fiddler crabs

The following criteria will be used for guiding visual estimates of each of the plot and zone characteristics categories:

1. Oiling extent
  - a. Sediment surface oiling coverage
    - i. Enter information into the "Plot Characteristics Datasheet."
    - ii. Visual estimation of sediment oiling coverage will proceed in 1% increments up to 5% and 5% increments thereafter.
    - iii. Oiling coverage will focus only on the amount of surface area covered by oil and will not include other characteristics (e.g., oiling color, depth, etc.).
    - iv. Note: estimates will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus value determined.

- b. Sediment surface oil thickness
  - i. Enter information into the “Plot Characteristics Datasheet.”
  - ii. Pooled = fresh oil or mousse >1 cm thick.
  - iii. Cover = oil or mousse from >0.1 cm to <1 cm on any surface.
  - iv. Coat = visible oil <0.1 cm, which can be scraped off with fingernail.
  - v. Stain = visible oil, which cannot be scraped off with fingernail.
  - vi. N/A = not applicable; no oil observed.
  - vii. Note: evaluations will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus assessment determined.
- c. Sediment surface oil character
  - i. Enter information into the “Plot Characteristics Datasheet.”
  - ii. Fresh = liquid oil.
  - iii. Mousse = emulsified oil.
  - iv. Surface Oil Residue = non-cohesive, oiled surface sediment, including surface oil residue balls and surface oil residue patties.
  - v. Tar = highly weathered oil, of tarry, nearly solid consistency.
  - vi. Asphalt = cohesive, heavily oiled surface sediments (mainly in oyster shell deposit areas).
  - vii. N/A = not applicable; no oil observed.
  - viii. Note: evaluations will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus assessment determined.
- d. Fiddler crab oiling index:
  - i. Enter information into the “Fiddler Crab Abundance Datasheet.”
  - ii. 0 = no oil present on any of the collected fiddler crabs.
  - iii. 0.5 = oil present on <5% of collected fiddler crabs.
  - iv. 1 = oil present on 5%-25% of collected fiddler crabs.
  - v. 2 = oil present on 25%-50% of collected fiddler crabs.
  - vi. 3 = oil present on >50% of collected fiddler crabs.
  - vii. Note: estimates will be made by the individual(s) responsible for the crab capture within the zone for which the data is being recorded. The person (people) designated to capture crabs and make this assessment should rotate between trustee and BP representatives.
- e. Periwinkle oiling index:
  - i. Enter information into the “Plot Characteristics Datasheet.”
  - ii. 0 = no oil present on any of the collected periwinkles.
  - iii. 0.5 = oil present on <5% of collected periwinkles.
  - iv. 1 = oil present on 5%-25% of collected periwinkles.
  - v. 2 = oil present on 25%-50% of collected periwinkles.
  - vi. 3 = oil present on >50% of collected periwinkles.

- vii. Note: estimates will be made by the individual(s) responsible for the periwinkle collection within the plot for which the data is being recorded. The person (people) designated to capture periwinkles and make this assessment should rotate between trustee and BP representatives.
- f. Vegetation oiling extent index:
  - i. Enter information into the "Plot Characteristics Datasheet."
  - ii. 0 = no oil evident anywhere in the plot.
  - iii. 0.5 = oil intermittently present on plant stems.
  - iv. 1 = oil present on 5% - 25% of plant stems.
  - v. 2 = oil present >25% - 50% of plant stems.
  - vi. 3 = oil present on > 50% of plant stems.
  - vii. Note: estimates will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus value determined. Vegetation oiling extent index should be determined by the presence/absence of oil observed on a percentage of stems within a plot, not by oiling degree.
- 2. Vegetation condition index (considering all plant leaf area within the plot)
  - a. Enter information into the "Plot Characteristics Datasheet."
  - b. 0 = stem and leaf chlorosis not exceeding a slight mottling or occasional yellowing.
  - c. 0.5 = vegetation having an intense speckled chlorosis.
  - d. 1 = vegetation green but with considerable chlorosis (<50% chlorosis).
  - e. 2 = vegetation having >50% yellowing (chlorosis) of leaves and stems.
  - f. 3 = vegetation dead; no green aboveground tissue visible.
  - g. Note: estimates will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus value determined. Vegetation condition index should be determined on live tissue (green or yellow tissue) only, unless all vegetation is dead (vegetation condition index = 3.0).
- 3. Visual estimation of the species composition (including live and dead coverage of vegetation present)
  - a. Enter information into the "Plot Characteristics Datasheet."
  - b. This is to include at a minimum:
    - i. Total (live plus dead) percent vegetative cover.
    - ii. Dead percent vegetative cover (i.e., total dead percent vegetative cover in plot).
    - iii. Live percent vegetative cover by species.
    - iv. Dead percent vegetative cover by species.
    - v. Wrack percent cover\*.
    - vi. Oil Boom percent cover\*.
    - vii. Debris percent cover (i.e., debris that is not wrack or oil boom)\*.

\*Note: transect placement and subsequent plot placement within a transect should attempt to minimize the occurrence of these items in a plot to the extent possible.

- viii. Vegetation stature (standing – ST, or laid over – LO).
- c. Practical aspects of implementation:
  - i. When possible, vegetation should be “stood up” by the field team to allow for a more accurate estimate of coverage. In areas where it is not possible to stand vegetation up (e.g., heavy oiling) then cover will be estimated with vegetation laid over. In this case, a note will be made to this effect in the datasheet, and a correction factor generated from additional laid-over, unoiled plots will be employed during interpretation.
  - ii. Visual estimation will proceed in 1% increments up to 5%, and in 5% increments thereafter.
  - iii. Greater than 100% cover may occur because of canopy overlap of species.
  - iv. Note: estimates will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus value determined.
  - v. Estimates of “dead vegetative cover,” whether at the whole plot or at the species level, should include any dead leaves that are attached to stems in the plot (whether the stem is totally dead or not), as well as any portions of dead stem tissues or stubble as long as they are rooted in the plot.

#### 4. Soil type

- a. Enter information into the “Plot Characteristics Datasheet.”
- b. Primary soil type = substrate most observable in the plot
- c. Secondary soil type = substrate second-most observable in the plot
- d. Note: evaluations will be independently generated by one BP representative, if available, and at least one trustee representative, discussed, and a consensus assessment determined.

#### **Fiddler Crab Burrow Counts**

For each 0.25 m<sup>2</sup> plot the following observations and measurements will be recorded using a standard field datasheet:

- Number of burrows with a diameter greater than or equal to 3 mm.
- Diameter of all fiddler crab burrows which are at least 3mm in diameter.

The diameter of the fiddler crab burrows will be measured using a 15 cm transparent ruler. Measurement will be made of the diameter of the hole visible just below the substrate surface (characterized by a dark hole apparent when viewing the burrow from above). Burrows are sometimes flared at the substrate surface; this flared area will not be included in the burrow diameter measurement.

### **Fiddler Crab Individual Measurements**

Individual crabs will be collected by hand within each zone (the zone is defined as a 2 meter by 6 meter band centered on the zone's two plots and the transect) and recorded for measurement of the following parameters:

- Carapace width
- Sex (male/female)
- Species

Crabs will be collected from the upper reaches of burrows into which they have retreated or as they run for burrows or other cover. Where possible, small depressions will be made into the marsh surface and crabs will be herded into the depression, to facilitate their collection.

Collected individuals will be placed in a large bucket, labeled (using tape and a black marker) with the appropriate zone number and 'UM' to indicate the specimens are unmeasured. A very small amount of a seawater/non-chlorinated freshwater mixture should be added to the bucket. Crab collection will occur for 30 person-minutes per zone (e.g., three team members may catch crabs concurrently for 10 minutes each in the same zone). Each individual crab will be identified to species, sexed, and the carapace width (the lateral dimension across the back) measured using calipers. A quality control check shall be performed on the calipers prior to use at each site, as detailed in Appendix C. After measurement, crabs will be kept in a separate large, clean bucket, labeled (using tape and a black marker) with the appropriate zone number and 'M' to indicate measured species until all crabs from all zones have been measured. Again, a very small amount of a seawater/non-chlorinated freshwater mixture will be placed in the bucket with the crabs. All crabs will be returned to the marsh habitat within the zone from which they were collected. Crabs will be released only once crab capture for all three zones has taken place to avoid double counting, particularly in zones that may be closely situated to one another. Buckets should be rinsed well with seawater before being reused.

### **Periwinkle Abundance and Size**

The same 0.25 m<sup>2</sup> plot described above for the count and measurement of fiddler crab burrow sizes will be used to delineate the area for collection, counting, and measurement of the size of periwinkles. All periwinkles within the 0.25 m<sup>2</sup> plot will be gathered (from both the ground and on the vegetation rooted in the plot) and placed into a small, clean bucket, labeled (using tape and a black marker) with the appropriate plot number and 'UM' to indicate unmeasured individuals. Snail shell length will be measured along its longest axis using calipers. Once a snail's shell measurement has been made, the snail will be moved to another small, clean bucket labeled (using tape and a black marker) with the appropriate plot number and 'M' to indicate measured individuals. All periwinkles will be returned to the marsh habitat within the plot from which they were collected.

### **Decontamination Procedures**

Because both unoiled and oiled sites will be visited under this work plan, a decontamination procedure has been developed for field gear. Oiled field gear will be cleaned with a laboratory-grade detergent (e.g., Alconox) at the end of each day. In the event that a team visits several sites in a day that are oiled, equipment will be wiped down between sites and cleaned with the detergent at the end of the day. If a team visits an oiled site followed by a clean site on the same day, the detergent will be used on the field gear in between sites.

### **Other General Survey Methods**

Field staff will receive training prior to each field effort.

Several case-wide protocols and associated forms have been developed for common activities, including:

- Chain of Custody procedures and documentation;
- Sample collection forms;
- GPS setup and use;
- Field photography guidance;
- Photologger forms; and
- Data management.

All field team members should familiarize themselves with these documents, available in the Data Management section of the Resource Catalog of [noaanrda.org](http://noaanrda.org)<sup>3</sup>, prior to commencing fieldwork. As needed, team members should participate in NRDA data management training to learn about these protocols and to have any questions answered.

Copies of all appropriate forms and datasheets, including those mentioned above as well as those specific to the current sampling plan, should be assembled as part of the equipment needed for the day's activities. Sample and data transfer/upload procedures should be followed after completion of the day's field work activities.

### **Photography Procedure**

For each site, the first photo should be of a whiteboard with the site ID written. Following the placement of shoreline and inland stakes marking the Fiddler Crab / Periwinkle transect, five site photographs will be taken. The first photograph should be taken from the shoreline stake facing directly toward the inland stake. The second photograph should be taken from the inland stake facing directly toward the shoreline stake. The third and fourth photographs should be taken at the shoreline stake facing parallel to the shoreline in both directions. The fifth photograph should be taken from



just offshore (1-2 m) with both the shoreline and interior stake in the frame of the photograph. A whiteboard should also be employed noting Site ID and date. Photos should be obtained utilizing a camera with a minimum of 10 MP resolution.

Following the establishment of 3 pairs of plots (a total of 6 plots) along the transect, two photographs should be taken of each plot to document site conditions. Plot photographs should be taken prior to any organism collection or burrow counting. A whiteboard with the site ID, plot ID, and date should be placed in the shoreward left-hand corner just outside of the plot boundary and should be visible in each picture. The first photograph, designated as the 90° photo, should be taken with one's back to the shoreline and from directly above the plot, ensuring that the whole plot and whiteboard are visible. The second photograph, designated as the 45° photo, should be taken facing the plot from the transect line, aligning oneself with the center of the plot.

In summary, during the first visit to each site, a total of 18 photographs should be taken (Table 2): 1 identification photograph, 5 transect photographs, and 2 photographs of each plot in each of the 3 pairs of plots (i.e., 2 photographs x 3 pairs x 2 plots).

**Table 2:** Location and number of photographs to be taken at each site visited

<b>Location of Photographs</b>	<b>Number of Photographs</b>
<i>Site:</i>	
ID Photograph	<b>1</b>
<i>Transect:</i>	
Transect Photographs	<b>5</b>
<i>Zone 1 Plots (2 plots):</i>	
<i>Photographs per Plot:</i>	2
Total Photographs:	<b>4</b>
<i>Zone 2 Plots (2 plots):</i>	
<i>Photographs per Plot:</i>	2
Total Photographs:	<b>4</b>
<i>Zone 3 Plots (2 plots):</i>	
<i>Photographs per Plot:</i>	2
Total Photographs:	<b>4</b>
<b>TOTAL</b>	<b>18</b>

## **V. POST-SURVEY MANAGEMENT OF DATA**

At the conclusion of field activities, data from the field datasheets will be entered into the appropriate electronic spreadsheet as soon as practicable after the fieldwork. Chain of custody forms must be completed rigorously. Photographs and GPS tracks shall be managed in accordance with case-wide protocols. Appendices B and C contain further information on these topics.

## **VI. DATA QUALITY OBJECTIVES AND VERIFICATION**

The data quality objectives (DQOs) of the observation and measurement data to be collected as described in this work plan are to:

- i. Characterize the effects of MC252 oil on fiddler crab density, size, and sex ratios;  
and
- ii. Characterize the effects of MC252 oil on periwinkle density and size

Specific data types relevant to achieving these DQOs have been described in this work plan and include the following field observations and field measurements for post-impact oiled and unoiled areas (sites).

### Field Observations:

- Visual observations of oiling and site topography
- GPS and survey methods to delineate 0.25 m<sup>2</sup> plots
- Photographs

### Field Measurements:

- Periwinkle abundance (counts) and size (shell length)
- Fiddler crab abundance (counts and burrow counts), size (carapace width), species, and sex (male/female)

Field observations and field measurements will be verified using the procedures outlined in the Field Observation and Measurement Data Verification and Post-Processing Addendum to the MC252 Data Validation Plan. The representativeness of the site locations identified for field observation and measurement data collection of fiddler crab and periwinkle metrics is consistent with the sampling design previously described in the Coastal Wetland Vegetation Plan.

## VII. HEALTH AND SAFETY

1. Team leader and field crew parties should have completed all applicable health and safety training as directed by NOAA or state agency oil spill policy.
2. All field team members must complete the NOAA safety training and documentation requirements set forth in “Safety Requirements for All Personnel Working on NOAA-led NRDA teams for MS Canyon 252 Incident” (02 - Safety Documentation Requirements.doc in the Resource Catalog on the case’s website, [REDACTED]).
3. All field team members should read all of the documents in the Safety directory of the Resource Catalog of noaanrda.org. Exception: if site collection activities do not include use of a boat or helicopter, then familiarity with the safety documents for these vehicles is not required.
4. Each field team must submit a plan (via the Whiteboard maintained by NRDA Field Ops), not later than the night prior to going into the field. This plan must specify:
  - Team leader;
  - Names of all team members;
  - Sampling location(s) –use the grid coordinates provided in the site Safety Maps (available in the Safety section of the Resource Catalog of noaanrda.org);
  - What kind of sampling they are doing;
  - Expected arrival time at sampling area (daily);
  - Expected departure from sampling area (daily);
  - Team deployment date;
  - Team return date.

This information may be reported in one of two ways:

- Fill out the Excel spreadsheet “04 - Team Member Information Form – Sampling and Safety.xls (available in the Safety section of the Resource Catalog of noaanrda.org) and send it to [REDACTED] Please use one tab for each team.
  - If you cannot submit this spreadsheet electronically, you can call in and report the information using this number: [REDACTED]
5. Field teams must adhere to all procedures set forth in the MC252 Site Safety Plan (“NRDA MC 252 Site Safety Plan\_6.22.10.pdf” and 12/8/2010 and 1/28/11 revisions, available in the Resource Catalog of noaanrda.org).
  6. If participating in a cruise: Each cruise may have additional required health and safety procedures, which must be observed.
  7. The safety procedures outlined here are subject to change at the direction of the Deepwater Horizon NRDA Field Operations team. Such changes will be applicable to field teams under this plan without the need for an amendment to this plan.

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**APPENDIX A. Acknowledgements**

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**APPENDIX B.      Fall 2011 Datasheets**

**Marsh Fiddler Crab and Periwinkle Plan – Site Visit / Set-Up Datasheet**

Page \_\_\_ of \_\_\_

**1** Date \_\_\_\_\_ Time (24hr) \_\_\_\_\_ Site ID \_\_\_\_\_ Team ID \_\_\_\_\_  
Site ID Photo: \_\_\_\_\_

**2** Data Recorder / Affiliation \_\_\_\_\_

**3** Other Team Members / Affiliations \_\_\_\_\_

**4** Direction from CWVP Transect<sup>1</sup> (circle one): Left / Right Distance from CWVP Transect (m): \_\_\_\_\_m

**5** Distances from Shoreline to the Midpoint of Plots in Each Zone (m):

	Fiddler Crab / Periwinkle (FCP)	Erosion Adjusted?
Zone 1:	_____m	Yes / No
Zone 2:	_____m	Yes / No
Zone 3:	_____m	Yes / No

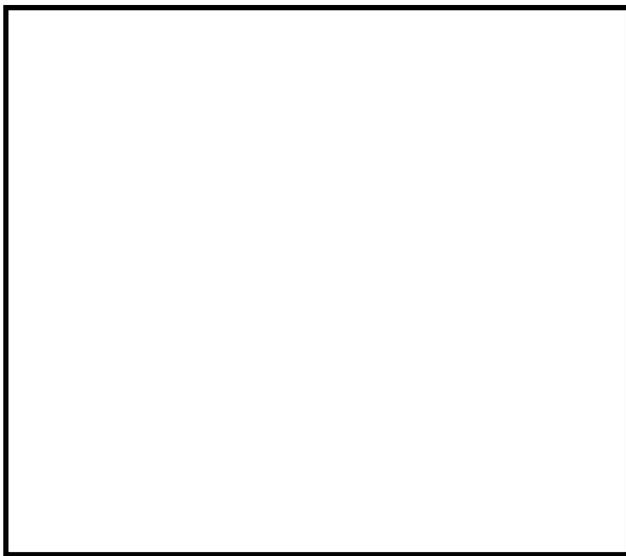
**6** Total Transect Length ( m): \_\_\_\_\_m

**7** Shoreline Stake: Way Pt. #: \_\_\_\_\_ Latitude (DD): \_\_\_\_\_ Longitude (DD): - \_\_\_\_\_

Inland Stake: Way Pt. #: \_\_\_\_\_ Latitude (DD): \_\_\_\_\_ Longitude (DD): - \_\_\_\_\_

**8** Photos: Shoreline stake looking inland: \_\_\_\_\_ Inland stake looking shoreward: \_\_\_\_\_  
Shoreline stake looking right: \_\_\_\_\_ Shoreline stake looking left: \_\_\_\_\_ Offshore (1-2m) looking inland: \_\_\_\_\_

**9** Bearing to Inland Stake: \_\_\_\_\_°



Drawing Legend	
<input type="checkbox"/>	Paired L/R Plots
<b>SS</b>	Shoreline Stake
<b>IS</b>	Inland Stake
-----	Transect
- - - - -	Marsh Edge
~~~~~	Water Line

<sup>1</sup>All left/right directions are based on an inland-facing orientation. That is, the directions are from the perspective of one positioned such that the water is to her/his back.

**Notes:**

**Sign Off:**

	<b>Date</b>	<b>Time</b>
		<b>(24hr)</b>
Responsible Party Representative/Affiliation: _____		
State Representative/Affiliation: _____		
Federal Representative/Affiliation: _____		

Marsh Fiddler Crab and Periwinkle Plan – Plot Characteristics Datasheet				Page ____ of ____		
<b>1</b>	Date _____	Time (24hr) _____	Site ID _____	Team ID _____		
<b>2</b>	Data Recorder / Affiliation _____					
<b>3</b>	Other Team Members / Affiliations _____					
<b>4</b>	<b>Plot ID (circle one):</b> L-1 / L-2 / L-3 / R-1 / R-2 / R-3					
<b>5</b>	<b>Water on Marsh:</b> Yes / No (If water is present, no further data to be collected at this time)					
<b>Oiling Impact Extent</b>						
<b>6</b>	Sediment Surface Oiling Coverage: _____%					
<b>7</b>	Sediment Surface Oil Thickness (circle one): <b>Pooled Cover Coat Stain N/A</b>					
<b>8</b>	Sediment Surface Oil Character (circle one): <b>Fresh Mousse Surface Oil Residue Tar Asphalt N/A</b>					
<b>9</b>	Vegetation Condition Index (circle one): 0 0.5 1 2 3					
<b>10</b>	Vegetation Oiling Extent Index (circle one): 0 0.5 1 2 3					
<b>11</b>	Oiling Height (cm): _____ cm* (Highest point on stem from sediment surface)					
<b>Plotwide Vegetation Information</b>						
<b>12</b>	Total Vegetative Cover (%): _____			<b>16</b>	Debris Cover (%): _____	
<b>13</b>	Total Dead Cover (%): _____			<b>17</b>	Boom Cover (%): _____	
<b>14</b>	Wrack Cover (%): _____			<b>18</b>	Dominant Species Average Live Canopy Height (cm): _____	
<b>15</b>	Photos: 45°: _____ 90°: _____ Way Pt: _____			<b>19</b>	Vegetation Stature: (ST = standing; LO = laid over) _____	
<b>20</b>	<b>Cover by Species</b>					
<b>Species Name (Scientific)</b>		<b>Live Cover (%)</b>	<b>Dead Cover (%)</b>	<b>Additional Information</b>		
<i>Spartina alterniflora</i>						
<i>Juncus roemerianus</i>						
<i>Phragmites australis</i>						
<i>Avicennia germinans</i>						
<i>Distichlis spicata</i>						
<i>Spartina patens</i>						
<i>Salicornia sp.</i>						
<i>Batis maritime</i>						
<i>Aster sp.</i>						
<i>Borrchia frutescens</i>						
<i>Paspalum vaginatum</i>						
<b>Plotwide Soil and Topography Information</b>						
<b>21</b>	Primary Soil Type (circle one):		<b>Shell</b>	<b>Sand</b>	<b>Mud</b>	<b>Peat</b>
	Secondary Soil Type (circle one):		<b>Shell</b>	<b>Sand</b>	<b>Mud</b>	<b>Peat N/A</b>
<b>22</b>	Presence of Erosional Scarps: <b>Yes / No</b>					
<b>23</b>	Maximum Vertical Relief (cm): _____ cm					
<b>Notes:</b>						

**Sign Off:**

**Date      Time**

Responsible Party Representative/Affiliation: \_\_\_\_\_  
 State Representative/Affiliation: \_\_\_\_\_  
 Federal Representative/Affiliation: \_\_\_\_\_





**Marsh Fiddler Crab and Periwinkle Plan**  
**Fiddler Crab Abundance – SUPPLEMENTAL DATASHEET ONE**

Page \_\_\_\_ of \_\_\_\_

**1** Date \_\_\_\_\_ Time (24hr) \_\_\_\_\_ Site ID \_\_\_\_\_ Team ID \_\_\_\_\_

**2** Data Recorder / Affiliation \_\_\_\_\_

**3** Other Team Members / Affiliations \_\_\_\_\_

**4** Zone ID (circle one): **1 (edge)** / 2 / 3

**Fiddler Crab Capture and Release**

**5** Total Number of Fiddler Crabs Captured in Zone: \_\_\_\_\_

<b>6</b>	<b>Specimen Number</b>	<b>Sex (M/F/UNK)</b>	<b>Carapace width</b>	<b>Species<sup>1</sup></b>	<b>Specimen Number</b>	<b>Sex (M/F/UNK)</b>	<b>Carapace width</b>	<b>Species<sup>1</sup></b>
	41				61			
	42				62			
	43				63			
	44				64			
	45				65			
	46				66			
	47				67			
	48				68			
	49				69			
	50				70			
	51				71			
	52				72			
	53				73			
	54				74			
	55				75			
	56				76			
	57				77			
	58				78			
	59				79			
	60				80			

<sup>1</sup>Use the following abbreviations for fiddler crab species:

*Uca longisignalis*    **LONG**            *Uca panacea*            **PANA**            *Uca virens*            **VIRE**  
*Uca minax*            **MINA**            *Uca spinicarpa*        **SPIN**            *Unknown*            **UNK**

**Notes:**

**Sign Off:** \_\_\_\_\_ **Date** \_\_\_\_\_ **Time (24hr)** \_\_\_\_\_

Responsible Party Representative/Affiliation: \_\_\_\_\_

State Representative/Affiliation: \_\_\_\_\_

Federal Representative/Affiliation: \_\_\_\_\_



**Marsh Fiddler Crab and Periwinkle Plan**  
**Periwinkle Abundance – SUPPLEMENTAL DATASHEET THREE**

Page \_\_\_\_ of \_\_\_\_

**1** Date \_\_\_\_\_ Time (24hr) \_\_\_\_\_ Site ID \_\_\_\_\_ Team ID \_\_\_\_\_

**2** Data Recorder / Affiliation \_\_\_\_\_

**3** Other Team Members / Affiliations \_\_\_\_\_  
\_\_\_\_\_

**4** Plot ID (circle one): L-1 / L-2 / L-3 / R-1 / R-2 / R-3

**Fiddler Crab Burrow Counts and Measurements**

**5** Total Number of Periwinkles in Plot: \_\_\_\_\_

<b>6</b>	<b>Periwinkle Number</b>	<b>Snail Shell Length (To 0.5 mm)</b>	<b>Periwinkle Number</b>	<b>Snail Shell Length (To 0.5 mm)</b>	<b>Periwinkle Number</b>	<b>Snail Shell Length (To 0.5 mm)</b>	<b>Periwinkle Number</b>	<b>Snail Shell Length (To 0.5 mm)</b>
	41		66		91		116	
	42		67		92		117	
	43		68		93		118	
	44		69		94		119	
	45		70		95		120	
	46		71		96		121	
	47		72		97		122	
	48		73		98		123	
	49		74		99		124	
	50		75		100		125	
	51		76		101		126	
	52		77		102		127	
	53		78		103		128	
	54		79		104		129	
	55		80		105		130	
	56		81		106		131	
	57		82		107		132	
	58		83		108		133	
	59		84		109		134	
	60		85		110		135	
	61		86		111		136	
	62		87		112		137	
	63		88		113		138	
	64		89		114		139	
	65		90		115		140	

**Notes:**  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Sign Off:** \_\_\_\_\_ **Date** \_\_\_\_\_ **Time (24hr)** \_\_\_\_\_

Responsible Party Representative/Affiliation: \_\_\_\_\_

State Representative/Affiliation: \_\_\_\_\_

Federal Representative/Affiliation: \_\_\_\_\_

**APPENDIX C.      Fall 2011 Quick Reference Guides**

Fiddler Crab / Periwinkle Plan Data Collection Quick Reference Guidance  
Plan ID: Work Plan for MC252 Oil Impacts to Marsh Fiddler Crabs and Periwinkles

General Fiddler Crab / Periwinkle Work Plan Guidance

1. **Planning and Logistics**

The day's sites, launch times, and intake locations will be posted on the NRDA Field Ops Fiddler Crab / Periwinkle Team Tracking Whiteboard.

2. **NRDA Field Operations Safety Information**

At the beginning of the day, be sure to check in with NRDA Field Ops on the 700 MHz radio or by cell phone, providing notification once you are on the water. Turn the spot tracker on by depressing the "on" button (top button) until it blinks green. Then depress and hold the "bootprint" button until it blinks green. When done properly, the GPS light will blink green intermittently and the "sent" light will begin blinking green momentarily. **ONLY USE LITHIUM BATTERIES IN SPOT TRACKERS.** Be sure to notify NRDA Field Ops of any changes to the personnel onboard prior to departing the dock. Call in to NRDA Field Ops for a midday check and when you are off the water. This is your float plan. Any deviations from this instruction will result in a USCG violation and breach of standard safety protocol for the entire project.

3. **GPS Logs**

All teams will be issued a Garmin Map 76, Map 60, or similar device. Before leaving the dock, turn on your GPS. Once satellite signal has been acquired, take a picture of your location screen with time (collect two photos if not on the same screen). Clear unit of all previous way points or tracks, then turn on track log. Collect GPS waypoints at each plot location and at each shoreline stake. Note: GPS operation is a trustee function.

4. **Data Intake**

Data intake personnel will download files from all electronic equipment (GPSs and cameras) and will scan the original datasheets produced in the field. **All information and samples will be relinquished to the sample intake crews under proper chain-of-custody documentation.** Original datasheets will be maintained by a Louisiana state representative. Following data uploading, the data intake team can supply each member of the sampling team with an electronic copy of the transfer to be placed on a USB thumb drive provided by the sampler if requested. Be sure to upload datasheets and track logs even when no data were able to be collected. Include at least one datasheet (crossed out and initialed with day and time) to document that the site visit was conducted.

**Fiddler Crab / Periwinkle – Site Visit / Set-Up Datasheet (Fall 2011 – v1)**

Teams will be supplied with a site location map illustrating the position of the Coastal Wetland Vegetation Plan site that will inform the location of the Fiddler Crab / Periwinkle transect. In addition, teams will be provided with the GPS coordinates, plot distances from the shoreline for each zone, and oiling extent, if applicable, and distance of shoreline erosion recorded for the site under the Coastal Wetland Vegetation Plan. Teams will select an appropriate location for the Fiddler Crab / Periwinkle transect at the Coastal Wetland Vegetation Plan site and will proceed with the layout of the transect and paired plots as depicted in Figure 1 of this Quick Reference Guide and Figure 2 of the Fiddler Crab / Periwinkle Work Plan and as described in item 5 below.

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record as the time of arrival to the site. *Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.*  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Site ID Photo:** record the photo number of the whiteboard labeled with the Site ID and Date. *Note: Photos should be obtained utilizing a camera with a minimum of 10MP resolution.*  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Direction from CWVP Transect:** record the offset direction (either right or left) from the Coastal Wetland Vegetation Plan transect to the Fiddler Crab / Periwinkle transect. *Note: the initial location of the transect is 20 m to the left of the Coastal Wetland Vegetation Plan (CWVP) transect. If transect establishment criteria (the transect should closely replicate the natural characteristics and oiling extent of the CWVP transect at the time of the survey, the transect must end in the interior of the coastal wetland vegetation, and the transect should be placed to avoid open-water areas such as ponds) cannot be met, the Fiddler Crab / Periwinkle transect may be set 20 meters to the right of the Coastal Wetland Vegetation transect. If neither of these locations is acceptable, the Fiddler Crab / Periwinkle transect may be further offset in either direction relative to the Coastal Wetland Vegetation transect by up to a maximum of 25 meters (45 meters total distance from the Coastal Wetland Vegetation transect), leaving a 2 meter buffer around the RTK transect currently established 25 meters from the Coastal Wetland Vegetation transect.*  
*Additional Note: All left/right directions are based on an inland-facing orientation. That is, directions are from the perspective of one positioned such that the water is to her/his back.*  
**Distance from CWVP Transect:** record the distance between the Coastal Wetland Vegetation Plan transect and the Fiddler Crab / Periwinkle transect. The distance between the two transects should be 20m unless particular transect establishment criteria cannot be met. In such a case, the distance may be extended up to an additional 25m.
5. **Distances from Shoreline to the Midpoint of Plots in Each Zone:** record the distances from the shoreline to the midline of plots in each of the three zones and note whether or not this value reflects an adjustment for erosion. Use the following key to guide the determination of these distances for oiled and unoiled plots, with or without erosion:

*Oiled, No Erosion:*

- Zone 1: center of plot located at 1.5 m from the edge of the marsh.
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan.
- Zone 3: center of plot located 3 m inland from the edge of the oiled zone<sup>4</sup> as determined for the site under the Coastal Wetland Vegetation Plan.

*Oiled, Erosion*

- Zone 1: center of plot located at 1.5 m from the edge of the marsh less the distance of noted shoreline erosion. If erosion is greater than 1.5 m, the zone 1 plots will be placed in the center of the distance from the marsh edge to the shoreline edge of the zone 2 plot. Zone 1 plots will not be established if the distance between the shoreline and the shoreline edge of the adjusted zone 2 plots is less than 1.5 m (i.e. if zone 1 and zone 2 plots would be overlapping).
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan less the distance of noted shoreline erosion.
- Zone 3: center of plot located 3 m inland from the edge of the oiled zone as determined for the site under the Coastal Wetland Vegetation Plan less the distance of noted shoreline erosion.

<sup>4</sup> The length of the transect established under the Coastal Wetland Vegetation Plan defines the edge of the oiled zone at that site.

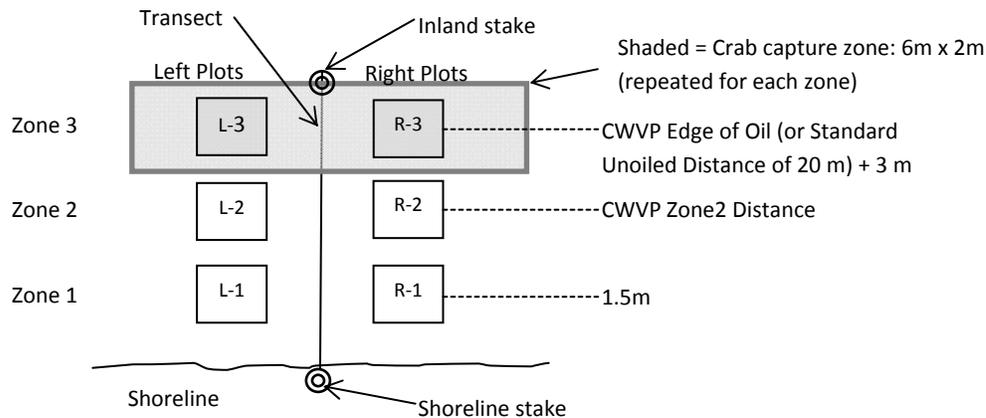
*Unoiled, No Erosion*

- Zone 1: center of plot located at 1.5 m from the edge of the marsh.
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan (10 meters).
- Zone 3: center of plot located 3 m inland from the transect length established under the Coastal Wetland Vegetation Plan.

*Unoiled, Erosion*

- Zone 1: center of plot located at 1.5 m from the edge of the marsh less the distance of noted shoreline erosion. If erosion is greater than 1.5 m, the zone 1 plots will be placed in the center of the distance from the marsh edge to the shoreline edge of the zone 2 plot. Zone 1 plots will not be established if the distance between the shoreline and the shoreline edge of the adjusted zone 2 plots is less than 1.5 m (i.e. if zone 1 and zone 2 plots would be overlapping).
- Zone 2: center of plot located at the same distance from the marsh edge as the Zone 2 plot established under the Coastal Wetland Vegetation Plan (10 meters) less the distance of noted shoreline erosion.
- Zone 3: center of plot located 3 m inland from the transect length as determined under the Coastal Wetland Vegetation Plan less the distance of noted shoreline erosion.

6. **Total Transect Length:** record the total length of the transect taking care to adjust for erosion if necessary. For unoiled sites, the standard transect length is 24 m.
7. **Shoreline Stake:** a Garmin 76/60 or similar GPS will be utilized to collect the waypoint, latitude, and longitude at the shoreline stake. The waypoint should be recorded with the site ID and point description (example: 1553-SS denotes the shoreline stake at site 1553). **Inland Stake:** a Garmin 76/60 or similar GPS will be utilized to collect the waypoint, latitude, and longitude at the inland stake. The waypoint should be recorded with the site ID and point description (example: 1553-IS denotes the inland stake at site 1553).
8. **Photos:** record the photo number of the following photos: one photo from the shoreline stake looking inland, one photo from the inland stake looking shoreward, one photo one to two meters offshore looking inland, one from the shoreline stake looking right (with one's back to the water), and one photo from the shoreline stake looking left (with one's back to the water). A whiteboard should also be employed with the following information: Site ID and Date. *Note:* Photos should be obtained utilizing a camera with a minimum of 10MP resolution.
9. **Bearing:** obtain a rough bearing from shoreline stake to inland stake. **Site sketch:** draw a crude site sketch including shoreline, transect, plots, and any other points of future interest (sketch should be similar to Figure 1) using the notations provided in the "Drawing Legend."



**Figure 1:** Fiddler crab / Periwinkle transect setup. PVC stakes will mark either end of the transect (10 foot poles; 1¼" diameter), the four corners of each of the 3 zones (5 foot poles; ¾" diameter), and the four corners of each of the 6 plots (5 foot poles; ½" diameter). For the plots, the shoreward left PVC post should be higher than the other three to provide guidance for walking in the field and for reestablishing plots.

**Fiddler Crab / Periwinkle – Plot Characteristics Datasheet (Fall 2011 – v1)**

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record as the time of arrival to the site. *Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.*  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Plot ID:** Consult Figure 1 in this guidance and select the corresponding Plot ID. There will be one Site Characteristics Datasheet completed for each Plot ID.
5. **Water on Marsh:** indicate whether or not water is present on the marsh. If water is present on the marsh within the plot observed, no data can be collected in this plot. Other plots without water present may be sampled at this time. The plot may be returned to later to collect data once water has receded from the marsh at this plot. In such a case, the plot will have two site characteristics datasheets: one completed and one noting water present on the marsh.
6. **Sediment Surface Oiling Coverage:** estimate of percentage of visible oiled sediment observed.
7. **Sediment Surface Oil Thickness:** estimate the thickness of the sediment surface oil using the following definitions for the descriptors:
  - Pooled: Thickness >1 cm
  - Cover: Thickness from >0.1 cm to ≤1 cm on any surface
  - Coat: Visible oil ≤0.1 cm, which can be scraped off with fingernail
  - Stain: Visible oil, which cannot be scraped off with fingernail
  - N/A: Not applicable (no oil noted in #6, Sediment Surface Oiling Coverage)
8. **Sediment Surface Oil Character:** estimate the character of the sediment surface oil using the following definitions for the descriptors:
  - Fresh: Liquid oil
  - Mousse: Emulsified oil
  - Surface Oil Residue: Non-cohesive, oiled surface sediments, including surface oil residue balls and surface oil residue patties
  - Tar: Highly weathered oil, of tarry, nearly solid consistency
  - Asphalt: Cohesive, heavily oiled surface sediments (mainly in oyster shell deposit areas)
  - N/A: Not applicable (no oil noted in #6, Sediment Surface Oiling Coverage)
9. **Vegetation Condition Index:**
  - 0 = Stem/leaf chlorosis not exceeding a slight mottling or occasional yellowing.
  - 0.5 = Vegetation having an intense speckled chlorosis.
  - 1 = Vegetation green but with considerable chlorosis (<50% chlorosis).
  - 2 = Vegetation having >50% yellowing (chlorosis) of leaves and stems.
  - 3 = Vegetation dead; no green aboveground tissue visible.*Note: Vegetation Condition Index should be determined on live tissue only, unless all vegetation is dead (Vegetation Condition Index = 3.0).*
10. **Vegetation Oiling Extent Index:**
  - 0 = No oil evident anywhere in the plot.
  - 0.5 = Oil intermittently present on plant stems.
  - 1 = Oil present on 5%-25% of plant stems.
  - 2 = Oil present on 25%-50% of plant stems.
  - 3 = Oil present on >50% of plant stems.*Note: Oiling index should be determined by the presence/absence of oil observed on a percentage of stems within the plot, not by oiling degree.*
11. **Oiling Height:** highest point of observed oil on vegetation (recorded in centimeters). For laid over vegetation, if vegetation can be stood up, oiling height should be measured from base of stem to the highest point observed on stem. If vegetation is heavily oiled and cannot be stood up or is oiled stubble, enter HO (heavily oiled) instead of measurement.
12. **Total Vegetative Cover:** estimate of percentage of ALL vegetative cover observed within the plot.
13. **Total Dead Cover:** estimate of percentage of DEAD vegetative cover (brown leaf matter) observed within the plot.
14. **Wrack Cover:** estimate of percentage of **vegetative** wrack cover within the plot.
15. **Photos:** record the photo number of the following photos. 45°: collect facing the plot from the transect line, aligning oneself with the center of the plot; 90°: collect with one's back to the shoreline and from directly above the plot. Photos should be obtained prior to beginning any specimen collection or burrow measurements. A whiteboard should also be employed with the following information: Site ID, Plot ID, and Date. The whiteboard should always be placed in the shoreward left-hand corner just outside of the plot boundary for consistency. A photo scale should be included in each plot photo.  
*Note: photos should be obtained utilizing a camera with a minimum of 10 MP resolution.*

- Way point:** using the Garmin 76/60 or similar GPS, collect a waypoint at the shoreline left corner of the plot. Waypoints should be recorded with the site ID and point description (example: 1553-R-1 denotes the right plot in zone 1 at site 1553).
16. **Debris Cover:** estimate of percentage of debris cover within the plot (boards, trash, etc.).
  17. **Boom Cover:** estimate of percentage of boom cover within the plot, if present.
  18. **Dominant Species Average Live Canopy Height:** average LIVE CANOPY height of DOMINANT species in centimeters. *Note: not total height measurement; does not include inflorescence.*
  19. **Vegetation Stature:** ST = standing; LO = laid over.
  20. **Cover by Species:** identify each species with an estimation of percentage of live and dead cover relative to the entire plot. *Note: acceptable to be >100% due to overlapping species within canopy. This percentage should be absolute cover and may also be greater than total cover. For example: total live cover = 60%, species A = 50%, species B = 15%.*
  21. **Primary Soil Type:** indicate the substrate type most present the plot.  
**Secondary Soil Type:** indicate the substrate type second most present within the plot.
  22. **Presence of Erosional Scarps:** note whether erosional scarps occur within the plot. An erosional scarp is defined as an extremely steep slope or cliff created through erosion.
  23. **Maximum Vertical Relief:** estimate the maximum vertical relief within the plot by measuring the vertical distance between the lowest and highest points in the plot. Record the answer to the nearest centimeter. To measure, using 2 30 cm rulers, put one ruler vertically in the deepest part of the plot, then place the second ruler horizontally on the highest part of the plot. (The highest part of the plot should be determined by the base sediment rather than vegetative debris present in the plot). The correct reading is where the horizontal ruler intersects the vertical ruler.

**Fiddler Crab / Periwinkle – Fiddler Crab Abundance Datasheet (Fall 2011 – v1)**

Note: if erosion has occurred such that overlap would exist between zone 1 and zone 2 crab collection zones, zone 2 will take precedence. Furthermore, the shoreline limit of the crab collection area for zone 1 will be the scarp edge. If either of these criteria causes a reduced zone 1 crab collection area, please note these changes in size in the "Notes" section of this datasheet.

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record the time of arrival to the site. Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Zone ID:** Consult Figure 1 in this guidance and select the corresponding zone ID. There will be one fiddler crab abundance datasheet completed per zone.
5. **Fiddler Crab Oiling Index:** from observing the fiddler crabs collected in the zone, determine a fiddler crab oiling index to characterize the zone based on the following:
  - 0 = No oil present on any of the collected fiddler crabs.
  - 0.5 = Oil present on <5% of collected fiddler crabs.
  - 1 = Oil present on 5%-25% of collected fiddler crabs.
  - 2 = Oil present on 25%-50% of collected fiddler crabs.
  - 3 = Oil present on >50% of collected fiddler crabs.
6. **Dead Fiddler Crabs Observed in Zone:** indicate whether dead fiddler crabs were observed within the 6 m x 2 m collection zone.  
**Dead and Oiled Fiddler Crabs Observed in Zone:** indicate whether dead fiddler crabs with observable oil on them were seen within the 6 m x 2 m collection zone.
7. **Caliper Number:** record the caliper number used for fiddler crab carapace width.  
**Pass QC on ¼ in. Drill Bit:** indicate whether the calipers passed the quality control (QC) check when measuring a ¼ in. drill bit (performance standard is 6.25 to 6.45 mm). Note: This QC check should be performed prior to caliper use at each site. The actual caliper reading from the QC check should be recorded in your field notebook. For each zone, note whether the calipers passed the site QC check.
8. **Total Number of Fiddler Crabs Captured in Zone:** record the number of fiddler crabs collected and measured from the zone.  
**Supplemental Datasheet One Completed:** if more than 40 fiddler crabs exist within the zone, the data for the additional fiddler crabs must be recorded on Supplemental Datasheet One.
9. **Specimen Number:** following the collection and placement of fiddler crabs into a bucket (labeled with tape and black marker as 'UM' to indicate unmeasured specimens followed by the specific zone number) by a single individual for 30 minutes (or equivalent, e.g., three team members may catch crabs concurrently for 10 minutes each) in the specified zone, remove the crabs one at a time. Each fiddler crab removed from the bucket will represent a new specimen number in the chart. Once all information has been acquired for a specimen, place the crab into a separate bucket (labeled with tape and black marker as 'M' to indicate measured specimens). All buckets into which fiddler crabs are placed should have a very small amount of a salt water / non-chlorinated fresh water mixture. Following the completion of crab collection from all zones, measured crabs can be placed back in the zone from which they were collected. Buckets should be rinsed well with seawater before being reused. When collecting the crabs, maintain a consistent, even pace throughout the entire 30 minute collection period. Also, avoid running crabs into pools of standing oil during the capture process.  
**Sex (M/F/UNK):** sex is most readily determined by the extreme cheliped asymmetry present in males. Having one cheliped distinctly larger than the other indicates a male specimen. If there are missing chelipeds and/or a sex determination cannot be made with certainty, 'UNK' should be recorded to indicate a specimen of unknown sex.  
**Carapace width:** using a pair of calipers, the largest width of the carapace (the lateral dimension across the back) will be measured. If using digital calipers, recorded the entire output on the display; otherwise, record to the nearest 1 mm. If conditions exists (such as a carapace being broken) such that an accurate measurement cannot be made, record 'N/A' in the field.  
**Species:** using the provided Fiddler Crab Field Guide, determine the species of the crab specimen, recording the species using the abbreviation provided:

<i>Uca longisignalis</i>	<b>LONG</b>	<i>Uca panacea</i>	<b>PANA</b>	<i>Uca virens</i>	<b>VIRE</b>
<i>Uca minax</i>	<b>MINA</b>	<i>Uca spinicarpa</i>	<b>SPIN</b>	Unknown	<b>UNK</b>

**Fiddler Crab / Periwinkle – Fiddler Crab Burrow Counts and Periwinkle Abundance Datasheet (Fall 2011 – v1)**

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record the time of arrival to the site. *Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.*  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Plot ID:** Consult Figure 1 in this guidance and select the corresponding Plot ID. There will be one Fiddler Crab Burrow Counts and Periwinkle Abundance Datasheet per Plot ID.
5. **Total Number of Fiddler Crab Burrows (>3 mm) in Plot:** record the total number of fiddler crab burrows counted in the 0.25m<sup>2</sup> plot which have a diameter opening of at least 3 mm.  
**Supplemental Datasheet Two Completed:** if more than 40 burrows with diameters of at least 3 mm exist within the plot, the data for the additional burrows must be recorded on Supplemental Datasheet Two.
6. **Burrow No.:** begin counting burrows on one side of the 0.25m<sup>2</sup> plot. Move a length of string across the plot while counting or use two sets of sticks to assist in monitoring areas previously counted and avoid double-counting. If more than 40 burrows with a diameter of at least 3 mm are present in the plot, continue recording data on the “Fiddler Crab Burrow Count and Periwinkle Abundance Supplemental Datasheet.” Information for all burrows with diameters of at least 3 mm in the plot should be recorded.  
**Diameter:** Using a 15 cm ruler, measure the diameter of all burrows with at least a 3 mm burrow diameter in the 0.25m<sup>2</sup> plot to the nearest 1 mm. Measurement will be made of the diameter of the hole visible just below the substrate surface (characterized by a dark hole apparent when viewing the burrow from above). Burrows are sometimes flared at the substrate surface; this flared area will not be included in the burrow diameter measurement.
7. **Total Number of Periwinkles in Plot:** record the total number of periwinkles collected from the 0.25m<sup>2</sup> plot.  
**Supplemental Datasheet Three Completed:** If more than 40 snails exist within the plot, the data for the additional specimens must be recorded on Supplemental Datasheet Three.
8. **Caliper Number:** record the caliper number used for snail shell length.  
**Pass QC on ¼ in. Drill Bit:** indicate whether the calipers passed the quality control (QC) check when measuring a ¼ in. drill bit (performance standard is 6.25 to 6.45 mm). *Note: This QC check should be performed prior to caliper use at each site. The actual caliper reading from the QC check should be recorded in your field notebook. For each plot, note whether the calipers passed the site QC check.*
9. **Periwinkle Oiling Index:** from observing the periwinkles collected in the plot, determine a periwinkle oiling index to characterize the plot based on the following:
  - 0 = No oil present on any of the collected periwinkles.
  - 0.5 = Oil present on <5% of collected periwinkles.
  - 1 = Oil present on 5%-25% of collected periwinkles.
  - 2 = Oil present on 25%-50% of collected periwinkles.
  - 3 = Oil present on >50% of collected periwinkles.
10. **Dead Periwinkles Observed in Zone:** indicate whether dead periwinkles were observed within the 6 m x 2 m collection zone.  
**Dead and Oiled Periwinkles Observed in Zone:** indicate whether dead periwinkles with observable oil on them were seen within the 6 m x 2 m collection zone.
11. **Periwinkle Number:** collect all periwinkles found within the 0.25m<sup>2</sup> plot, both on the marsh substrate and on the vegetation rooted in the quadrat, and place them in one of the smaller buckets labeled ‘UM’ with tape and a black marker to indicate that the organisms are unmeasured followed by the plot number from which the organisms were collected. If more than 40 periwinkles are present in the plot, continue recording data on the “Fiddler Crab Burrow Count and Periwinkle Abundance Supplemental Datasheet.” Information for all periwinkles found in the plot should be recorded. When collecting the periwinkles, be careful not to knock any organisms off the vegetation and into any oil.  
**Snail Shell Length:** for each periwinkle, use a pair of calipers to measure the shell length (the longest axis of the shell) to the nearest 0.5 mm and record this for the corresponding specimen number. Once a snail’s shell measurement has been made, remove the snail from the ‘UM’ bucket and place it in one of the smaller buckets labeled ‘M’ with tape and black marker to indicate measured snails. Once all snails in a plot have been measured, place them back in the plot from which they were collected.

**Fiddler Crab / Periwinkle – Fiddler Crab Abundance SUPPLEMENTAL DATASHEET ONE (Fall 2011 – v1)**

Note: This datasheet is only to be completed for any zone for which more than 40 fiddler crabs were collected.

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record the time of arrival to the site. Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Zone ID:** Consult Figure 1 in this guidance and select the corresponding Zone ID. This datasheet will only be completed for a zone in which greater than 40 fiddler crabs were collected.
5. **Total Number of Fiddler Crabs Captured in Zone:** record the total number of fiddler crabs captured in the 6 m x 2 m zone.. This number should match that recorded on line 7 of the “Fiddler Crab Abundance Datasheet.”
6. **Specimen Number:** use this table to continue recording data for fiddler crabs within the zone if more than 40 were collected. Information for all fiddler crabs collected in the zone during the 30 minute catching period should be recorded.  
**Sex (M/F/UNK):** sex is most readily determined by the extreme cheliped asymmetry present in males. Having one cheliped distinctly larger than the other indicates a male specimen. If there are missing chelipeds and/or a sex determination cannot be made with certainty, ‘UNK’ should be recorded to indicate a specimen of unknown sex.  
**Carapace width:** using a pair of calipers, the largest width of the carapace (the lateral dimension across the back) will be measured. If using digital calipers, recorded the entire output on the display; otherwise, record to the nearest 1 mm. If conditions exists (such as a carapace being broken) such that an accurate measurement cannot be made, record ‘N/A’ in the field.  
**Species:** using the provided Fiddler Crab Field Guide, determine the species of the crab specimen, recording the species using the abbreviation provided:

<i>Uca longisignalis</i>	<b>LONG</b>	<i>Uca panacea</i>	<b>PANA</b>	<i>Uca virens</i>	<b>VIRE</b>
<i>Uca minax</i>	<b>MINA</b>	<i>Uca spinicarpa</i>	<b>SPIN</b>	Unknown	<b>UNK</b>

**Fiddler Crab / Periwinkle – Fiddler Crab Burrow Counts SUPPLEMENTAL DATASHEET TWO (Fall 2011 – v1)**

Note: This datasheet is only to be completed for any plot for which more than 40 fiddler crab burrows exist.

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record the time of arrival to the site. Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Plot ID:** Consult Figure 1 in this guidance and select the corresponding Plot ID. This datasheet will only be completed for a plot which is found to have greater than 40 fiddler crab burrows.
5. **Total Number of Fiddler Crab Burrows (≥3 mm) in Plot:** record the total number of fiddler crab burrows (with at least a 3 mm diameter) counted in the 0.25m<sup>2</sup> plot. This number should match that recorded on line 5 of the “Fiddler Crab Burrow Counts and Periwinkle Abundance Datasheet.”
6. **Burrow No.:** use this table to continue recording data for burrows of at least 3 mm in diameter within the plot if more than 40 exist. Information for all burrows present in the plot should be recorded.  
**Diameter:** Using a 15 cm translucent ruler, measure the diameter of all burrows at least 3 mm in diameter at the widest point of each burrow opening (at the substrate surface) in the 0.25m<sup>2</sup> plot to the nearest 1mm.

**Fiddler Crab / Periwinkle – Periwinkle Abundance SUPPLEMENTAL DATASHEET THREE (Fall 2011 – v1)**

*Note: This datasheet is only to be completed for any plot for which more than 40 periwinkles are collected.*

1. **Date:** record in the following format: mm/dd/yy  
**Time (24 hr):** record the time of arrival to the site. *Note: Louisiana observes daylight savings time. Please be aware of the time of year and time changes.*  
**Site ID:** actual site number to be referenced on all data sheets and samples. Previously provided by NRDA Field Operations under the Coastal Wetland Vegetation Plan.  
**Team ID:** assigned by NRDA Field Operations for the purpose of radio communications and field assignments.
2. **Data Recorder / Affiliation:** trustee (state or federal representative) responsible for entering data on data sheet for that site. After the name, record the affiliation. The affiliation should include your home institution. Example: Jane Doe (Atkins/NOAA).
3. **Other Team Members / Affiliations:** include the names and affiliations of additional parties involved with data collection for that site. The affiliation should include your home institution. Example: John Doe (Weston/OPCR), Jim Doe (Entrix)
4. **Plot ID:** Consult Figure 1 in this guidance and select the corresponding Plot ID. This datasheet will only be completed for a plot which is found to have greater than 40 periwinkles.
5. **Total Number of Periwinkles in Plot:** record the total number of periwinkles collected from the 0.25m<sup>2</sup> plot. This number should match that recorded on line 7 of the “Fiddler Crab Burrow Counts and Periwinkle Abundance Datasheet.”
6. **Periwinkle Number:** use this table to continue recording data for periwinkles found within the plot if more than 40 were collected. Information for all periwinkles in the plot should be recorded.  
**Snail Shell Length:** for each periwinkle, use a pair of calipers to measure the shell length (the longest axis of the shell) to the nearest 0.5 mm and record this for the corresponding specimen number. Once a snail’s shell measurement has been made, remove the snail from the ‘UM’ bucket and place it in one of the smaller buckets labeled ‘M’ with tape and black marker to indicate measured snails. Once all snails in a plot have been measured, place them back in the plot from which they was collected.

**Fiddler Crab / Periwinkle – Equipment Checklist**

- |                                                                            |                                                                         |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <input type="checkbox"/> GPS (Garmin 76/60 or equivalent)                  | <input type="checkbox"/> Work gloves (1 pair per team member)           |
| <input type="checkbox"/> Digital camera                                    | <input type="checkbox"/> Nitrile gloves (1 box per team)                |
| <input type="checkbox"/> Spot tracker                                      | <input type="checkbox"/> Tyvek suits (1 per team member)                |
| <input type="checkbox"/> 700 MHz radio                                     | <input type="checkbox"/> Knee boots (1 pair per team member)            |
| <input type="checkbox"/> 700 MHz radio charger                             | <input type="checkbox"/> Boot covers (1 per team member)                |
| <input type="checkbox"/> VHF radio                                         | <input type="checkbox"/> Ear protection (1 pair per team member)        |
| <input type="checkbox"/> VHF radio charger                                 | <input type="checkbox"/> First-aid kit                                  |
| <input type="checkbox"/> Compass                                           | <input type="checkbox"/> Coolers (3 per team)                           |
| <input type="checkbox"/> Backpacks (1 per team)                            | <input type="checkbox"/> Tarp (1 per team)                              |
| <input type="checkbox"/> Pocket knife                                      | <input type="checkbox"/> Scrub brushes (2 per team)                     |
| <input type="checkbox"/> Personal flotation devices (1 per individual)     | <input type="checkbox"/> Heavy duty paper towels (3 rolls)              |
| <input type="checkbox"/> Safety forms (HASP, TSA, JSA)                     | <input type="checkbox"/> Handiwipes (1 pack)                            |
| <input type="checkbox"/> Waterproof set of datasheets (1 copy per team)    |                                                                         |
| <input type="checkbox"/> Quick Reference Guide (1 laminated copy per team) |                                                                         |
| <input type="checkbox"/> Site map with GPS coordinates                     |                                                                         |
| <input type="checkbox"/> Field notebook with waterproof paper              | <input type="checkbox"/> PVC – 10' long, 1¼" diameter (3 per site)      |
| <input type="checkbox"/> Fiddler Crab Field Guide                          | <input type="checkbox"/> PVC – 5' long, ¾" diameter (28 per site)       |
| <input type="checkbox"/> Clipboard                                         | <input type="checkbox"/> PVC – 5' long, ½" diameter (14 per site)       |
| <input type="checkbox"/> Dry erase board                                   | <input type="checkbox"/> 0.25m <sup>2</sup> quadrats (3 per site)       |
| <input type="checkbox"/> Dry erase markers                                 | <input type="checkbox"/> Pole driver                                    |
| <input type="checkbox"/> Black permanent markers                           | <input type="checkbox"/> Trowel shovel (2 per team)                     |
| <input type="checkbox"/> Pencils                                           | <input type="checkbox"/> One-meter measuring stick                      |
| <input type="checkbox"/> Rite in the Rain pens                             | <input type="checkbox"/> Tape measure (50m)                             |
| <input type="checkbox"/> Extra lithium ion battery (for camera)            | <input type="checkbox"/> Tape measure (8m)                              |
| <input type="checkbox"/> Pack of AA lithium batteries                      | <input type="checkbox"/> Standard size drill bits                       |
| <input type="checkbox"/> Pack of AAA batteries                             | <input type="checkbox"/> 15-cm translucent ruler (1 per team member)    |
| <input type="checkbox"/> Electrical tape (1 roll per team)                 | <input type="checkbox"/> 30-cm ruler (4 per team)                       |
| <input type="checkbox"/> Colored duct tape (2 rolls per team)              | <input type="checkbox"/> Wire fiddler crab ticklers (1 per team member) |
| <input type="checkbox"/> Flagging tape (1 roll per team)                   | <input type="checkbox"/> Aquarium net (1 per team member)               |
| <input type="checkbox"/> Knee boards (1 per team member)                   | <input type="checkbox"/> Plastic cups                                   |
| <input type="checkbox"/> Walk boards (3 per team)                          | <input type="checkbox"/> Small sheets of thick plastic (3" x 6")        |
|                                                                            | <input type="checkbox"/> Twine or string                                |
|                                                                            | <input type="checkbox"/> Counters (1 per team member)                   |
|                                                                            | <input type="checkbox"/> Digital calipers (2 pairs per team)            |
|                                                                            | <input type="checkbox"/> Vernier calipers (1 pair per team)             |
|                                                                            | <input type="checkbox"/> 2 gallon bucket with lid (6 per team)          |
|                                                                            | <input type="checkbox"/> 5 gallon bucket with lid (6 per team)          |

## **Equipment Checklist for Fiddler Crab Monitoring Plan**

1. PVC poles (2 per site, 1 1/4", 10-ft length) for marking the transect
2. PVC poles (24 per site, 3/4", 5-ft length) for marking the plots
3. PVC poles (12 per site, 1/2", 5-ft length) for marking the zones
4. Pole driver
5. 0.25 m<sup>2</sup> quadrats, with increment markings
6. GPS (Garmin 76/60 or equivalent)
7. Digital camera
8. Extra batteries (lithium AA, AAA, lithium ion, and any other size required by field equipment)
9. Compass
10. Spot tracker
11. 700 MHz radio w/ charger
12. VHF radio w/ charger
13. Flagging tape
14. Trowel shovel
15. One-meter measuring sticks
16. Tape measure (50 m & 8 m)
17. White boards
18. Dry erase markers
19. Counters
20. Vernier calipers (0.02 mm gradations)
21. Digital calipers (0.01 mm gradations)
22. 15 cm translucent ruler
23. 30 cm rulers
24. At least one drill bit of known size
25. Wire fiddler crab "tickler"
26. Aquarium nets
27. Small plastic cups
28. Thin sheets of plastic
29. Tape (electrical and colored duct)
30. Heavy duty paper towels
31. Twine/string
32. Safety forms (HASP, TSA, JSA)
33. Waterproof datasheets
34. Clipboard
35. Field notebook with waterproof paper
36. Permits
37. Quick Reference Guides
38. Site map with GPS coordinates
39. Fiddler Crab Field Guide
40. Pencils, write in the rain pens
41. Black permanent marker
42. Knee boards
43. Walk boards
44. Personal floatation device (PFD)
45. Work gloves
46. Nitrile gloves
47. Tyvek suits
48. Boot covers
49. Handiwipes
50. Knee boots
51. Ear protection
52. Backpack
53. Tarp
54. Scrub brushes
55. Coolers
56. First-aid kit
57. Pocket knife/multi-tool
58. 3.5 gallon bucket with lid
59. 5 gallon bucket with lid
60. Sun screen
61. Bug spray
62. Rain gear
63. Drinking water/snacks
64. Sunglasses
65. Hat
66. Dinner knives

**APPENDIX D.      Budget**

**[Attached]**

Fiddler Crab/Periwinkle Study Budget  
9/26/2011

**Fiddler Crab/Periwinkle Study - Fall 2011**

<b>Labor<sup>1,2</sup></b>					
Position	Number	Rate (\$/hr)	Days	Hours	Cost
<i>Federal</i>					
Principal Investigator	1				\$14,400
Field chief	1				\$48,000
Field team leads	3				\$108,000
Backup sampler training	1				\$4,800
<i>Federal contractor labor costs</i>					\$175,200
<i>State</i>					
Manager SR	1				\$4,992
Biologist SR	2				\$73,094
Biologist MID	1				\$23,338
Environmental Scientist SR	1				\$37,277
Environmental Engineer MID	2				\$49,094
Financial/Cost Analysis MID	1				\$3,757
Health and Safety Offices MID	1				\$195
Manager MID	1				\$5,007
<i>State contractor labor costs<sup>3</sup></i>					\$196,754
<b>Labor Total</b>					<b>\$371,954</b>

<b>Travel</b>					
	Unit	Rate (\$/unit)	Days	Number <sup>4</sup>	Cost
<i>Federal</i>					
Meals	day	\$71	20	4.5	\$6,390
Lodging	day	\$131	20	4.5	\$11,790
Airplane	trip	\$500	N/A	5	\$2,500
Car Rental	day	\$55	20	4	\$4,400
Gasoline for rental vehicle	day	\$50	20	4	\$4,000
<i>Federal contractor travel costs</i>					\$20,680
<i>State</i>					
Meals	day	\$52	N/A	132	\$6,864
Lodging	day	\$131	N/A	132	\$17,292
Car Rental	day	\$55	N/A	66	\$3,630
Gasoline for rental vehicle		\$50	N/A	27	\$1,350
POV Mileage as approved	miles	\$0.51	N/A	600	\$306
<i>State contractor travel costs</i>					\$29,442
<b>Travel Total</b>					<b>\$50,122</b>

Fiddler Crab/Periwinkle Study Budget  
9/26/2011

<b>Other Direct Costs</b>				
	Unit	Rate (\$/unit)	Number	Cost
Bay boat rental <sup>5</sup>	per day	\$1,800	60	\$108,000
Airboat rental <sup>5</sup>	per day	\$1,500	60	\$90,000
HAZWOPER training (24 hour)	per field person	\$250	5	\$1,250
<i>Equipment<sup>6</sup></i>				
GPS (Garmin 76/60 or equivalent)	each	\$250	3	\$750
Digital camera	each	\$370	3	\$1,110
Spot tracker	each	\$110	3	\$330
700 MHz radio w/ charger	each	\$1,250	3	\$3,750
VHF radio w/ charger	each	\$270	3	\$810
Other non-consumable equipment	per team	\$1,167	3	\$3,500
Consumable supplies	per team, per season	\$1,800	3	\$5,400
<b>ODCs Total</b>				<b>\$214,900</b>

<b>Total Costs Year 0, Fall 2010</b>	<b>\$636,976</b>
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<sup>1</sup> Assumes 2 days for training, 14 field days, 2 weather (contingency) days, and 2 travel days

<sup>2</sup> All NOAA and State Trustee labor costs are recoverable under NRDA but are not calculated here.

<sup>3</sup> The proposed State Trustee labor costs include 2 persons per team. If the study is conducted cooperatively and BP provides one person per team, the State also will supply only one person per team.

<sup>4</sup> Federal Travel Number column reflects number of individuals, so total cost = unit cost \* days \* number. State Travel Number column reflects total number of items, so total cost = unit cost \* number.

<sup>5</sup> Trustees will only seek reimbursement for costs they paid for out-of-pocket.

<sup>6</sup> Trustees will only seek reimbursement for costs they paid for out-of-pocket. Wherever feasible, in-stock DWH NRDA equipment will be used instead of purchasing new equipment.