Mississippi Canyon 252 Spill
Oyster Monitoring
2012 Oyster Quadrat Abundance Monitoring

September 26, 2012

Introduction

A Technical Working Group ("Oyster TWG") of experts and trustee agency and BP representatives was assembled following the Mississippi Canyon 252 Spill to develop work plans appropriate to carry out both baseline (pre-injury) and post-impact assessments of oysters throughout the northern Gulf of Mexico. The Oyster TWG completed several sampling efforts from 2010 through the spring of 2012. Two of those plans, Amendment 2 to the Phase I – High Priority Sites Plan ("Phase I Amendment 2") and the 2011 Oyster Quadrat and Sediment Sampling Plan ("2011 Quadrat Plan") included quadrat sampling to measure adult and juvenile oyster abundance and biomass. The Trustees have decided to complete additional quadrat sampling in 2012 to monitor the oyster resource in the north-central Gulf of Mexico. This document presents the plan for completing diver-assisted oyster reef quadrat sampling in 2012 that will produce the monitoring data needed to assess the current state of oyster resource following the MC 252 spill.

Objective/Purpose

After reviewing data collected under the Phase I Amendment 2 and 2011 Quadrat Plans, continued quadrat sampling is warranted to estimate recovery of the oyster resource injured due to: 1) potential exposure of oysters to contaminants released into the environment as a result of the Deepwater Horizon Oil Spill; and/or 2) potential exposure of oysters to changes in water quality (e.g. salinity) resulting from actions undertaken by the state of Louisiana in response to the spill. Additional sampling may help further characterize potential impacts to oyster resources resulting from the opening of the Morganza and Bonnet Carre spillways by the Army Corps of Engineers in May 2011, and subsequent recovery from any injury.

In summer 2010, the oyster working group collected quantitative samples from oyster reefs as part of its Phase I Amendment 2 plan to assess potential injury to oysters and oyster habitat resulting from the Deepwater Horizon oil spill and response activities conducted by the state of Louisiana to address the spill. Field teams used diver-assisted quadrat sampling methods to obtain those quantitative samples, which were then processed to provide estimates of oyster

abundance and biomass by size class at a set of historically sampled locations across the Gulf of Mexico in Louisiana, Mississippi, Alabama, and Florida. The field effort also included collection of sediment samples for contaminant analysis at each site. In fall 2011, additional quadrat sampling was conducted to collect quantitative samples a year later at the same sites under the 2011 Quadrat Plan. The 2011 sampling was expanded to also include quadrat sampling at sites from the Transition Plan, which had not previously been sampled using quadrats. The plan also included collection of sediment samples for contaminant analysis at all sites.

The results of this plan will be used to support the assessment of any continued injury to oyster abundance and biomass, the recovery of oyster resource from previous injury, and to inform and support restoration planning efforts.

The Plan specifically addresses the following topics:

1. Approach and rationale: This section describes the overall purpose and need for abundance monitoring in 2012.

2. Health and safety: This section summarizes pertinent 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.

3. Site selection: This section describes the proposed approach to identifying sites for evaluation.

4. Estimated Study Cost: This section provides an estimate of the cost of implementing the 2012 abundance monitoring plan.

Approach and Rationale

As noted previously in the Phase I plan, quadrat sampling provides valuable data on abundance and biomass of oysters and related fauna because it achieves a highly quantitative sample (i.e. the area and effort of the sample are well defined).[1]

Preliminary data obtained from the Phase I Amendment 2 quadrat sampling show low or zero abundance values generally across much of the Phase I study area, including areas that may have been impacted by contaminants from the Deepwater Horizon spill, and/or from

[1] Quantitative sampling of oyster reefs is commonly accomplished by randomly placing on the reef a quadrat made of PVC that covers an area of a full meter square (1 m x 1 m), and then collecting all biota and other material encompassed within that quadrat up to a specified depth equivalent to about the size of one's hand.

freshwater diversions instituted by the state of Louisiana in 2010 in response to the spill. In addition, the preliminary results from dredge-based abundance assessments at Transition Plan sites show similarly low findings. These initial results, as well as potential impacts on oyster resources of freshwater from the Morganza and Bonnet Carre spillway openings in Spring 2011, warrant follow-up assessments of abundance and biomass metrics at the Phase I sites using quadrat sampling. Quadrat sampling at the Transition Plan sites would provide abundance and biomass per square meter values for these locations. This additional sampling will contribute to understanding of the geographical and temporal extent of injuries to the adult and juvenile oyster populations, and counts of spat-sized oysters from the quadrat samples will complement data on oyster settlement monitoring that the oyster working group has been collecting under the Phase I, Transition, and Spring 2011 plans.

Below is a summary of the key aspects of the 2012 Oyster Quadrat Abundance Monitoring Plan:

- The plan collects samples at locations previously mapped and sampled under the three prior DWH NRDA oyster plans. The set of sample sites includes 141 of the 149 previously samples sites from the Phase I and Transition Plans and includes 94 sites in Louisiana, 25 in Mississippi, 10 in Alabama, and 12 in Florida.

- Table 1 shows the metrics to be assessed and samples to be collected as part of the 2012 Oyster Quadrat Abundance Monitoring Plan. All samples will be taken in accordance with the protocols and standard operating procedures (SOPs) presented at the end of this document.

- Oyster abundance and biomass will be measured during one round of quadrat sampling. Quadrat sampling locations will be randomly selected from data on oyster reef locations from previous mapping efforts conducted under the Phase I or Transition Plans.

- Material collected from the quadrats will be bagged and sent to Dauphin Island Sea Lab (DISL) for abundance counts and biomass of oysters and other observed fauna.

<u>Estimated samples from this activity</u>

Field teams under this plan will sample up to 141 sites located across the northern Gulf of Mexico, where the term “site” refers to a sample grid cell as previously defined under either the Phase I or Transition Plans. Table 2 summarizes sampling activity in the 2012 Oyster Quadrat Abundance Monitoring Plan. Assuming adequate oyster resource exists and is accessible to the dive sampling teams, the target number of samples resulting from this activity

is 564 oyster quadrats (4 per sample site) that will be analyzed for abundance and biomass measurements at Dauphin Island Sea Lab.

Health and Safety

- The team leader and field crew parties should have completed all applicable health and safety training as directed by NOAA or state agency oil spill policy.
- All field team members must complete the NOAA safety training and documentation requirements as set forth in "Safety Requirements for All Personnel Working on NOAA-led NRDA teams for MS Canyon 252 Incident" (NOAA Safety Documentation Requirements.doc).
- All field team members should read all of the documents in the Safety directory on the case's NOAANRDA.org site.
    - 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.
- Field teams must adhere to all procedures set forth in the most recent version of the MC252 Site Safety Plan ("NRDA_Ops_Safety Plan_08 04 11.docx").
- Any encounters with protected species are to be reported to the appropriate authorities. Field crews are also to follow any guidance or BMPs provided by federal, states, or tribal historic preservation officers to avoid potential impacts to protected species or to historic or cultural resources. Any affected historic or cultural resources are to be reported to the appropriate authorities as described in such guidance or BMPs.
- Diving: SCUBA or surface-assisted diving, where used for sampling, will be conducted in accordance with the most recent version of the Job Hazard Analysis for diving in the Field Ops Safety Plan, currently "Field Ops Safety Plan, Appendix A: Job Hazard Analyses." All divers will have SCUBA and scientific diver certification.

Site Selection

The plan collects samples at locations previously mapped and sampled under the three prior DWH NRDA oyster plans. This includes Transition Plan locations in Louisiana and Mississippi that were characterized as known oyster habitat (i.e., they included either oyster reef mapped prior to the DWH spill or they were identified by State biologists to have a high probability of productive oyster habitat). It also includes Phase I sampling sites that were historically sampled prior to the DWH spill across all four states.

The set of sample sites includes 141 of the 149 previously samples sites from the Phase I and Transition Plans and includes 94 sites in Louisiana, 25 in Mississippi, 10 in Alabama, and 12 in

Florida. Of the 149 original sites, 6 sites located in CSA 7 were excluded from this sampling plan and 2 additional sites were dropped due to section 106 review. These sites includes both non-randomly selected set of historically sampled 200 meter x 200 meter grid cells from the Phase I plan as well as from the randomly selected sample of the 600 meter x 600 meter grid cells (sites) from the Transition Plan. Finally, it includes a small set of Transition Plan grid cells in Louisiana characterized by higher frequencies of observed surface oiling in the months following the MC252 spill. Figures 1 through 9 display the sites included in the 2012 Oyster Abundance Monitoring Plan.

Table 1. Proposed Monitoring Metrics

Metric	Proposed Frequency of Sampling
Effect Metrics	
Oyster abundance (qualitative)	One event
Exposure metrics	
Oiling observations (qualitative)	Collected on each site visit

Table 2. Summary of oyster sampling procedures, maximum number of sites and replicates

Metric	Method	Potential # of sites				Est. Samples per event	Freq. of sampling	Total # of samples (estimate)
		LA	*MS*	*FL*	*AL*			
Adult and Juvenile Density	Quadrat	94	25	12	10	4 quadrats	1	564

Figure 1: 2012 Oyster Quadrat Abundance Monitoring Locations in Louisiana (CSA 1N)

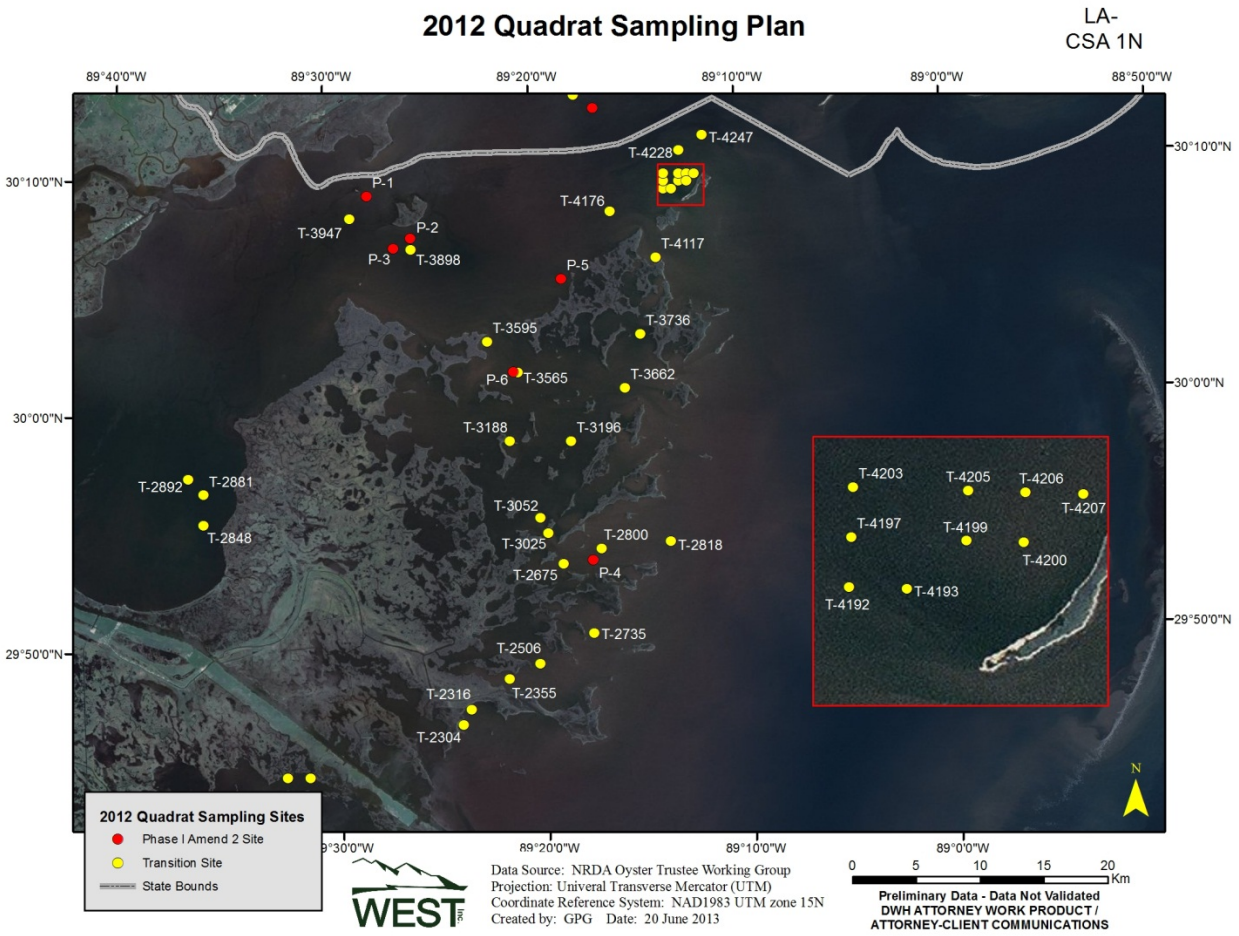


Figure 2: 2012 Oyster Quadrat Abundance Monitoring Locations in Louisiana (CSA 1S)

Figure 3: 2012 Oyster Quadrat Abundance Monitoring Locations in Louisiana (CSA 3)

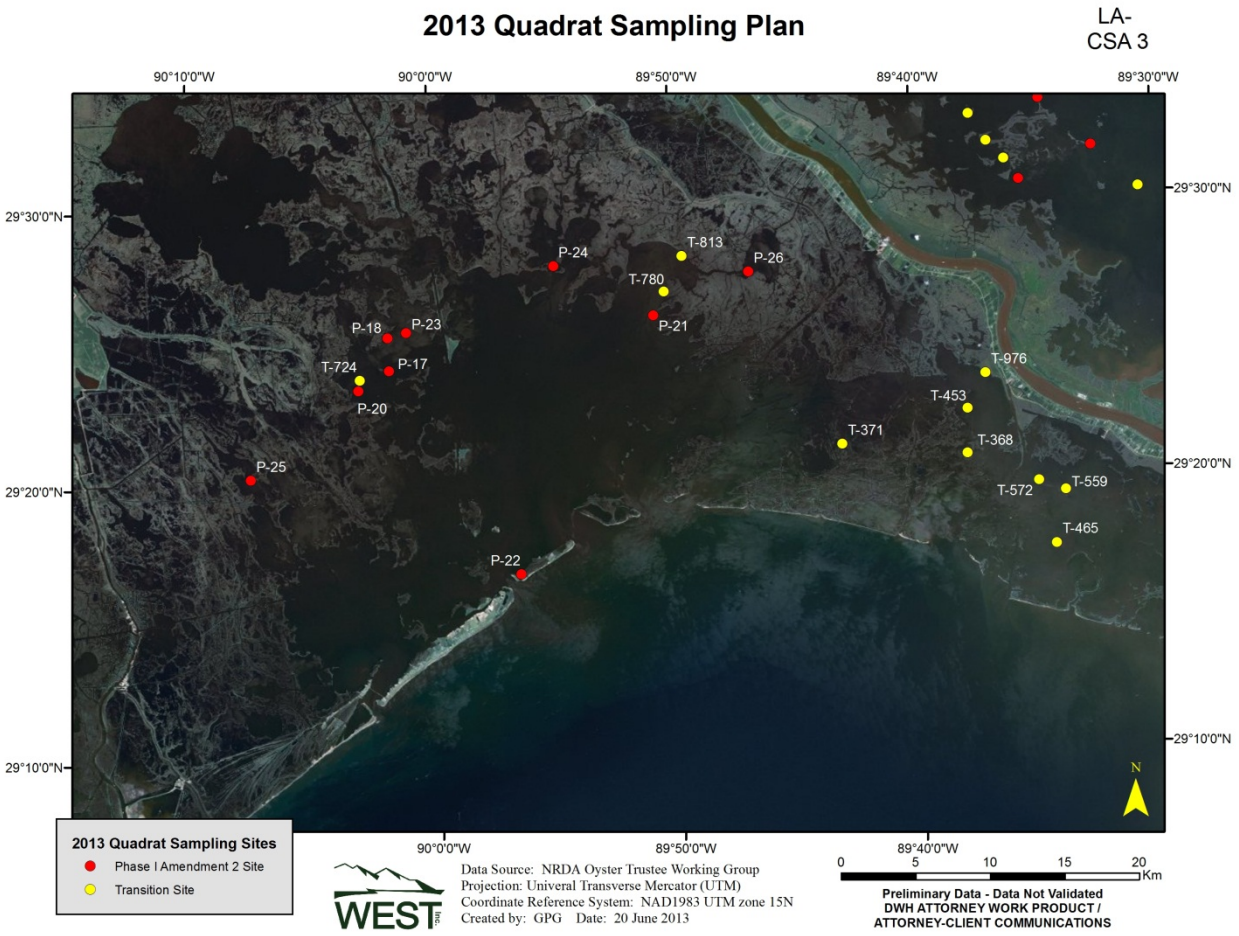


Figure 4: 2012 Oyster Quadrat Abundance Monitoring Locations in Louisiana (CSA 4 and 5)

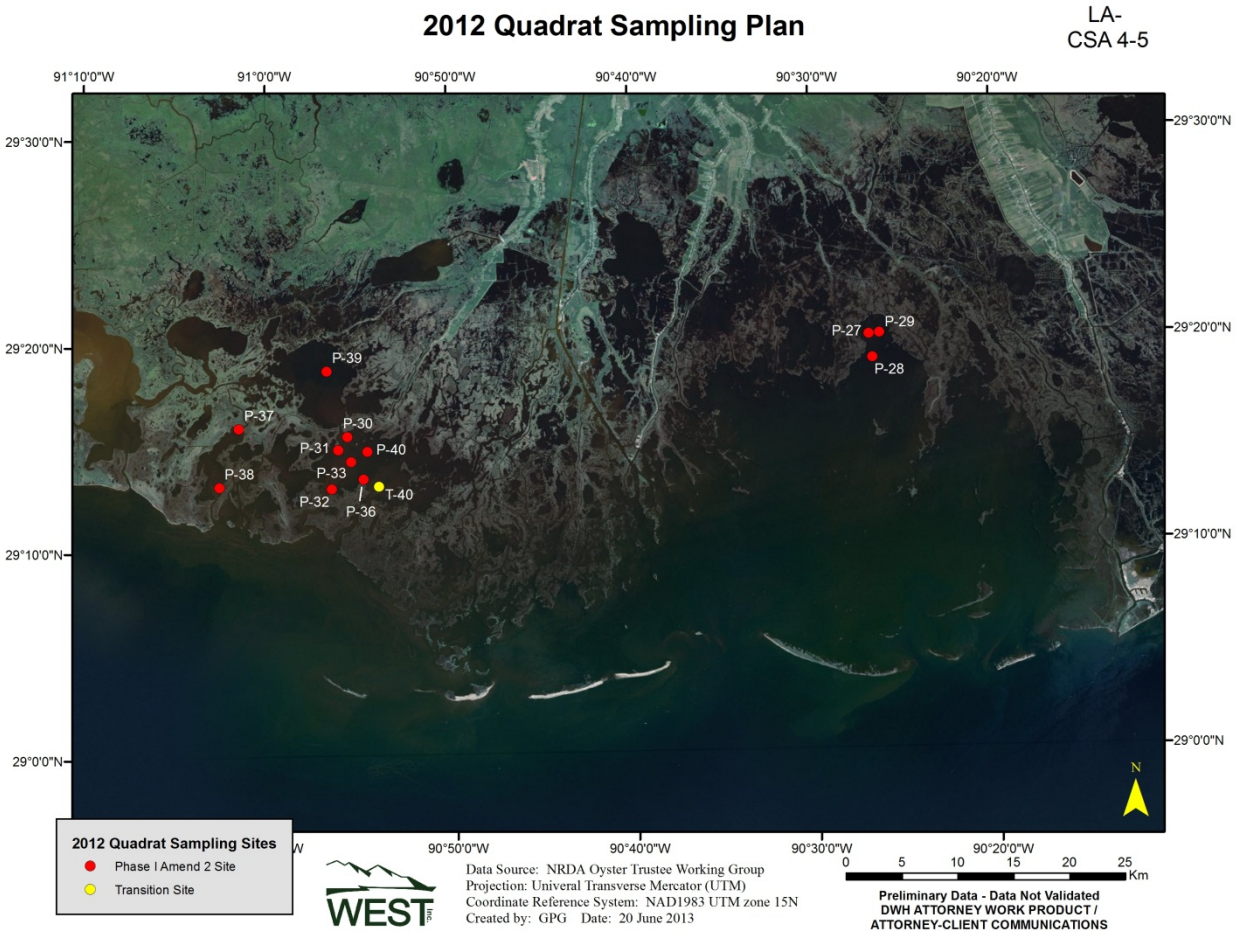


Figure 5: 2012 Oyster Quadrat Abundance Monitoring Locations in Louisiana (CSA 6 and 7)

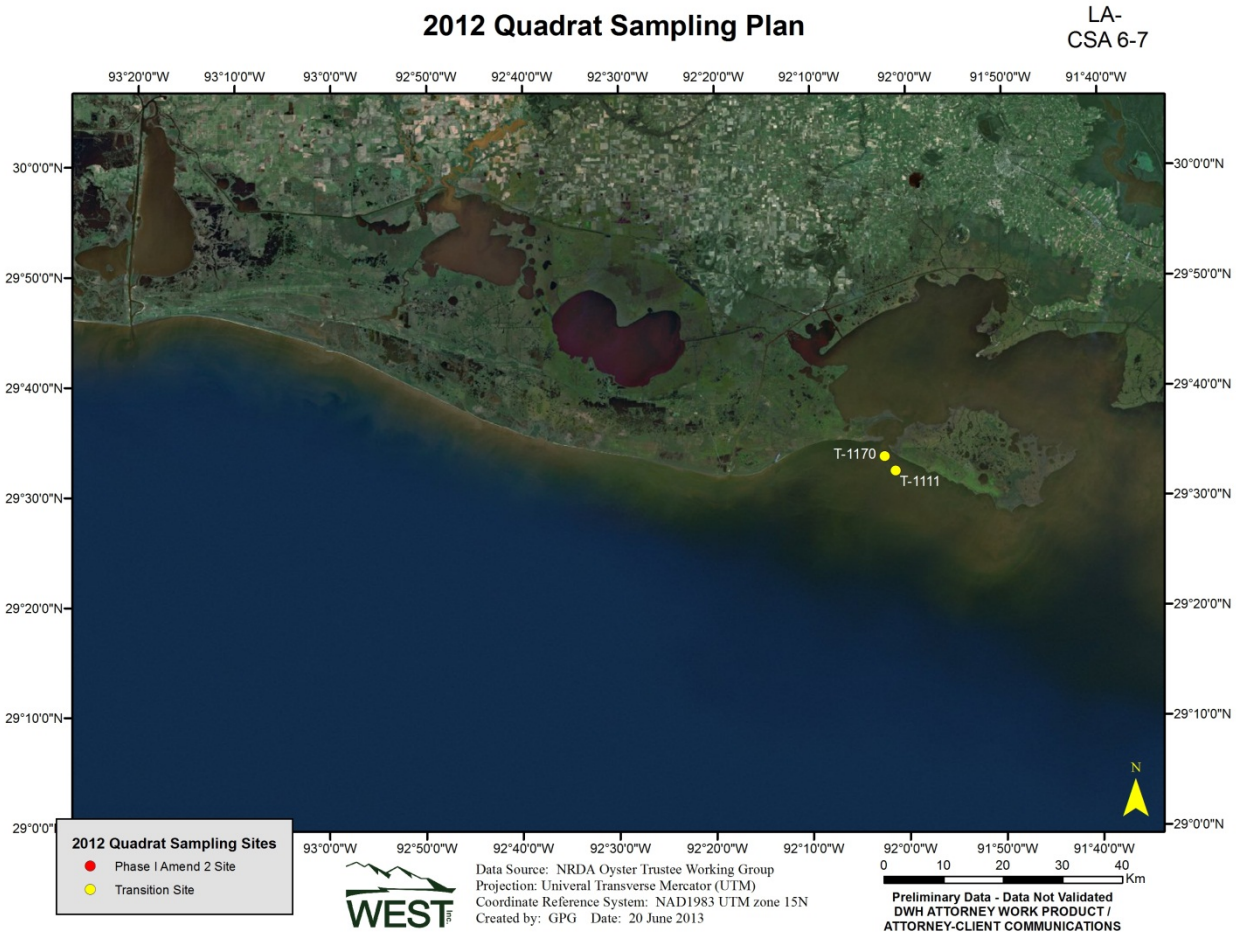


Figure 6: 2012 Oyster Quadrat Abundance Monitoring Locations in Mississippi

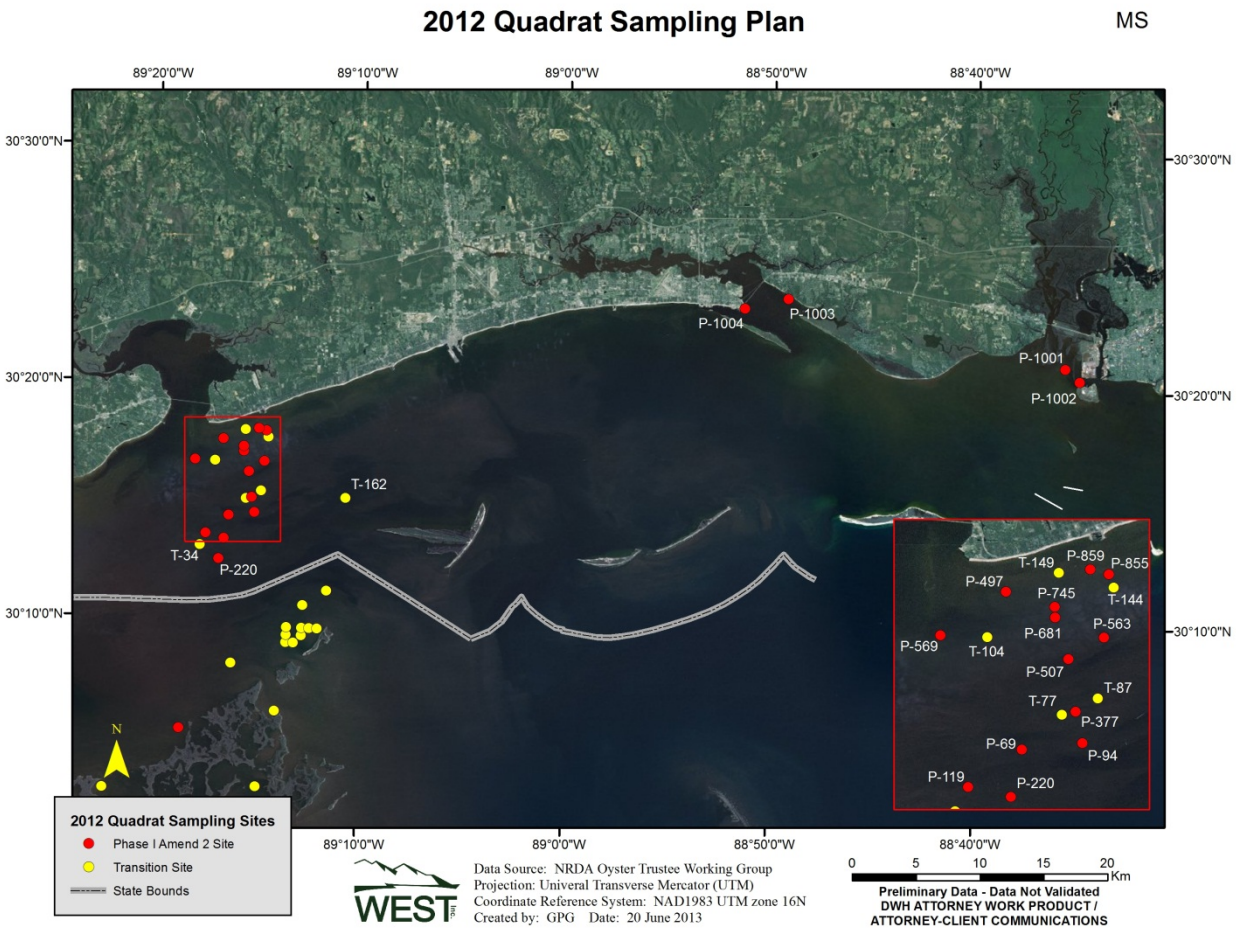


Figure 7: 2012 Oyster Quadrat Abundance Monitoring Locations in Alabama

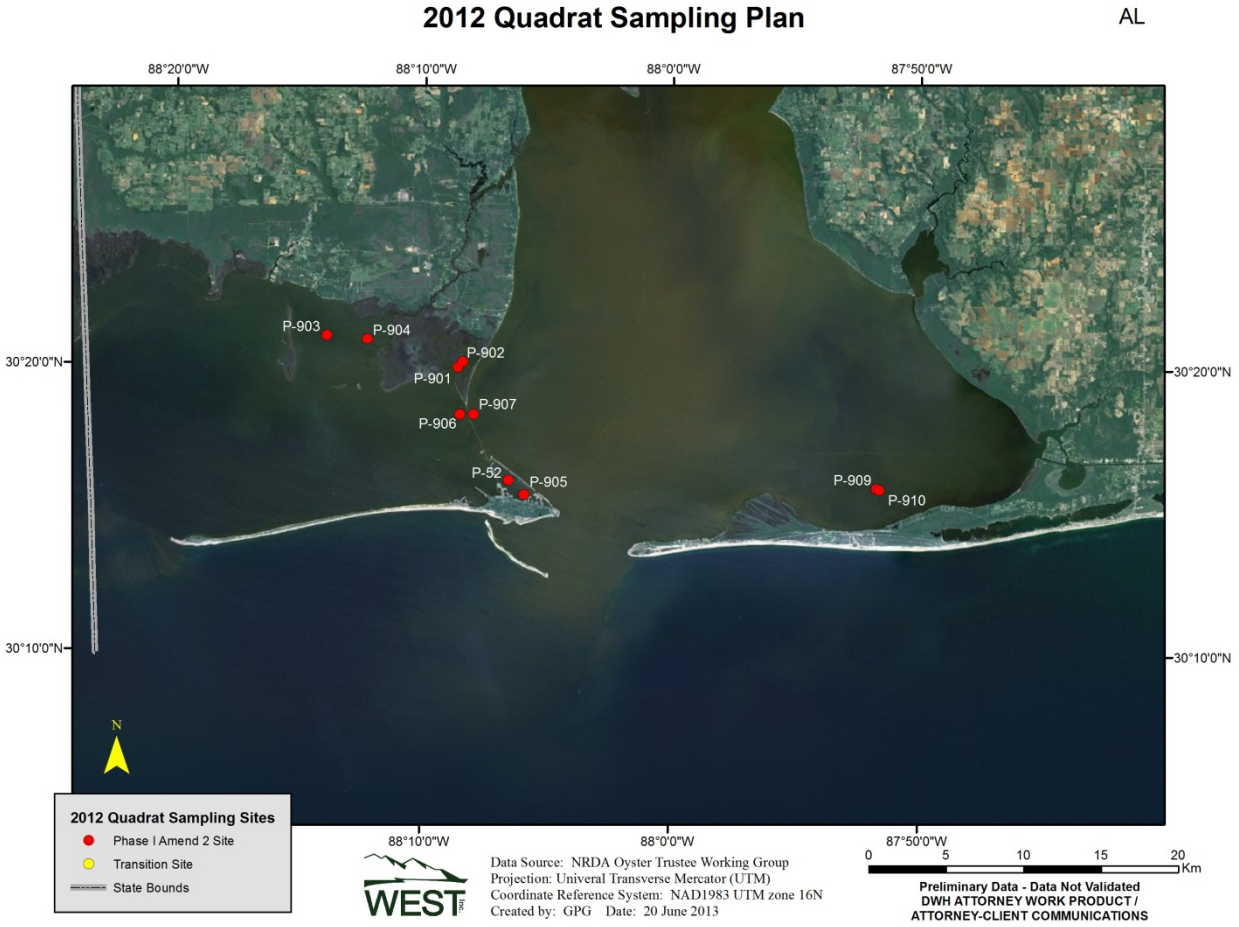


Figure 8: 2012 Oyster Quadrat Abundance Monitoring Locations in Florida (East)

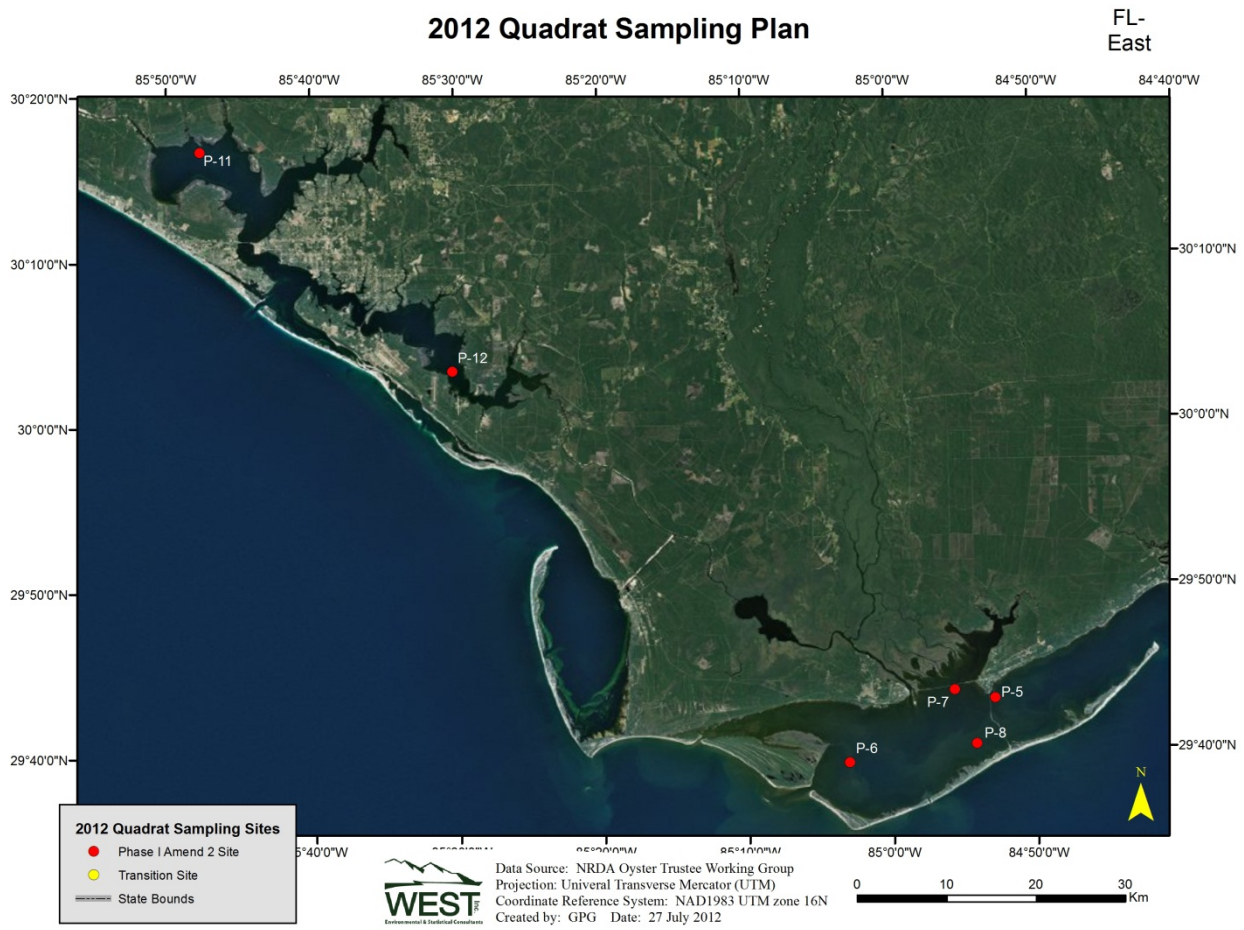
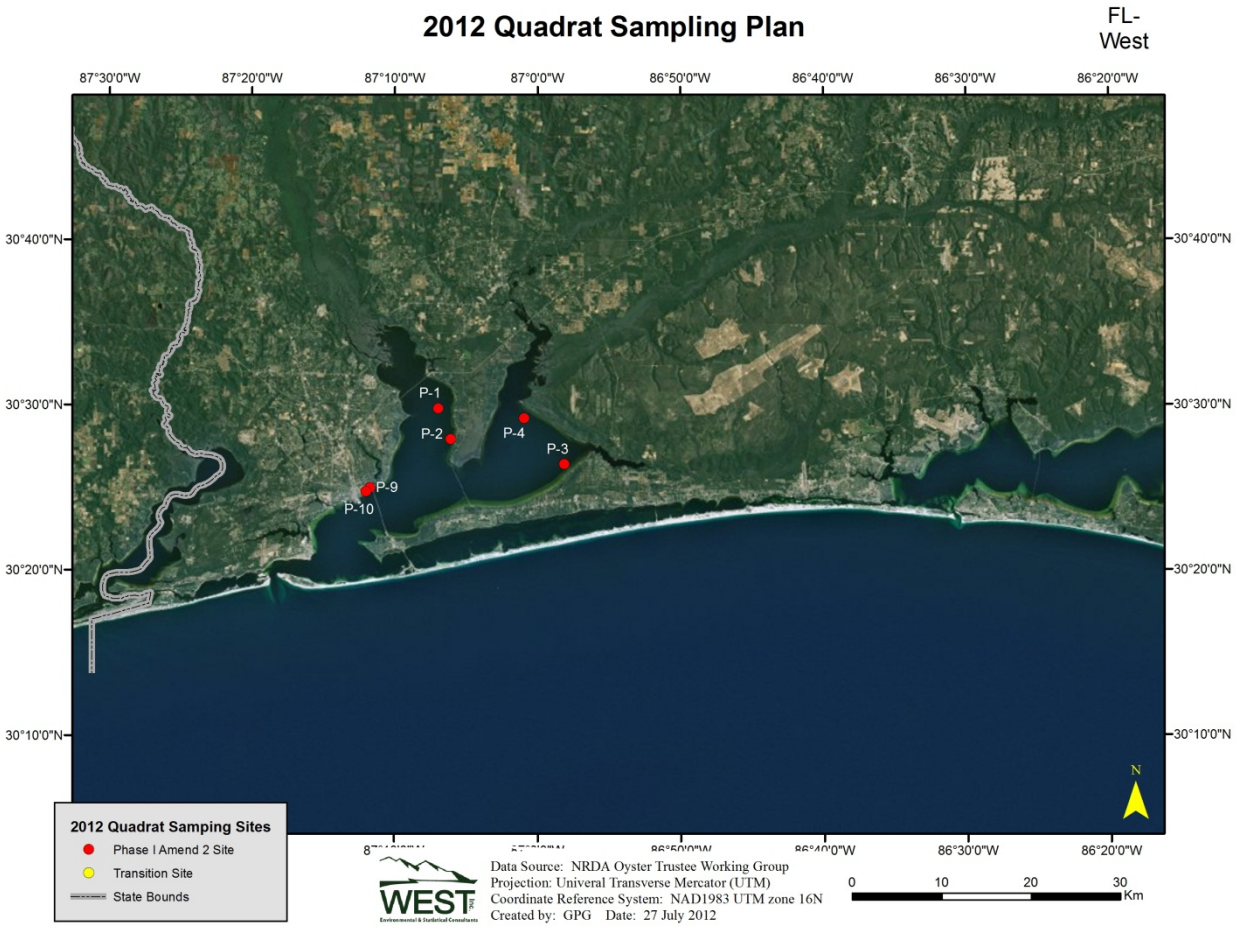


Figure 9: 2012 Oyster Quadrat Abundance Monitoring Locations in Florida (West)



Appendix A: Detailed Standard Operating Procedures (SOPs)

A. Juvenile and Adult Oysters (Settled Life Stages)

Field Sampling

Samplers should complete the **2012 Quadrat Abundance Monitoring Plan – Site Visit Form,** the **2012 Quadrat Abundance Monitoring Plan – Quadrat Form,** and the **2012 Quadrat Abundance Monitoring Plan – Site Summary/Signature Form.** A unique sample ID should be given to each sample and prominently marked on the form according to the Oyster Sample Naming Convention (Appendix B). Sample codes should be recorded in the **2012 Quadrat Abundance Monitoring Plan – Quadrat Form** datasheets and also in the **NRDA Sample Collection Form – Tissue/Wrack** (available on www.noaanrda.org)**.**

1. *Site Description*

- Measure / Record:
    - Site name (e.g., OYS-T-LA-A-465)
    - Cell number (GCID, e.g., 0020)
    - Time of day and date.
    - Tidal depth (intertidal or subtidal)
        - If subtidal, estimate the depth in meters (record units) at the time of sampling.
        - Describe reef conditions – recent harvest, oiling, covered in mud, fouled, etc.

2. *Physical/Chemical Parameters*

- Measure and record:
    - Bottom and surface salinity
    - Bottom and surface water temperature
    - Bottom and surface dissolved oxygen (at subtidal sites only)
    - Ambient air temperature
    - Weather conditions
    - Oiled condition (None, Sheen, Scattered Deposits, Surface substantially covered, Surface completely covered or Deep Deposits).

After completing the above steps, move on to oyster sampling within the gridcell in accordance with the sampling methods below.

4. *Oyster Quadrat Sampling*

- Collect four individual quadrat samples per grid cell. Field teams will be provided with up to eight randomly generated contact points per grid cell. These contact points will be generated as a random sample of points from oyster reef transect segments identified in the mapping exercise.
- Determine coordinates via GPS. Ensure that you are within 5 meters of the contact point provided by NOAA NRDA Field Ops.
- Place 1 m^2 PVC quadrat frame directly at arm's length at a random spot (choose random side of boat to drop quadrat by pulling from a hat or spinning a compass) at the contact point. Do not favor abundant or sparse areas.
- Drop quadrat and have diver descend to depth (unless quadrat is in shallow water that does not require diving).
- Using tools when applicable, harvest all oysters 3-4 cm down into the reef (approximately the depth of a diver's gloved hand). You should not have to dig into the mud.[2]
- Place all material from the quadrat in burlap sack. When the quadrat collection is complete, secure sample to buoyed line.
- Divers are to signal to on-boat team that the quadrat has been collected. When divers are clear, on boat team pulls up the sample.
- Observe resource in the bag, and note the number of live oysters from the quadrat with respect to target collection goal. If necessary, dump collected material on tray to inspect.
- Return all material to burlap sack and close sack.
- Place the burlap sack in a plastic contractor bag.
- Samples should be tagged with an external (flagging tape with permanent marker) and internal tag (flagging tape with permanent marker) that prominently denotes sample code.
- The sample code should be constructed of the location ID, date, matrix, sample team leader code, grid cell id, and sample number along with information regarding sample type (for details, see the Oyster Sample ID Naming Convention, Appendix B).
- Hold animals on ice until delivered to intake team.
- Contact points should not be skipped. Retain all quadrat sample material and submit all quadrat samples to the intake lab.

5. *Photographs*

[2] Collection of all material encompassed within the quadrat to a depth of approximately the size of a diver's gloved hand, as recommended in the SOP, will capture the preponderance of live and recently dead material present.

See **NRDA Field Photography Guidance** (available onwww.noaanrda.org) for camera preparation and set-up prior to going into the field. –

- Photograph the operating GPS screen showing the date and time to synchronize the photos with the GPS track.
- Photograph site to describe oiling conditions.
- Collect a close-up photo of the reef showing individual oysters
- Photograph the entire reef.
- **DO NOT DELETE ANY PHOTOS**
- Document the pictures taken on the Oyster Reef Sampling Form
- Additionally, complete the NOAA NRDA Trustees Sampler Photo Logger form

6. *Collection and Disposition*

The individual who collected the sample should be noted on the field data form. If more than one person is involved, list the field party leader and the person who entered the data (if different).

Lab Processing

7. *Sample Processing: Abundance*

Samples will be brought to a non-field location for processing. Samples should be kept in a cooler with ice. Samples should be processed within 96 hours to ensure accurate characterization of live and dead oysters.

Regardless of sample method, both live and dead oysters should be enumerated by size category.

- Measure shell height (SH).
    - Using rulers (when oyster category is easily determined) and calipers (when fine scale separation of categories is needed to measure the distance from the umbo (small tapered end of the oyster) to the maximum limit of the shell.
    - Measure dead oysters in the same way.
        - Dead oysters are oysters that have no living tissue but are still in their articulated form (i.e., the shells are still hinged but no living oyster tissues is present also called “boxes”). These oysters will often appear opened or “gaped”.
        - If the oyster is gaped and tissue appears to be undergoing decomposition, these oysters should be enumerated as a separate category
- Classify oysters by size:

- spat (between 0.4 and 1 inch [10 - 25 mm] shell height),
- seed or juvenile oysters (between 1 and 3 inches [25 – 75 mm]),
- market size or "legal" oysters (> 3 inches [75 mm] shell height].

- Identify and enumerate associated biota.
  - Identifications and counts should be entered on separate lines under the "Other Species" category on the Oyster Reef Sample Form. Associated fauna should be archived with the quadrat sample.

8. *Sample Processing: Biomass*

- Weigh living material:
  - Weighed in aggregate by size category.
  - Similarly, dead oysters should be weighed by category. Finally, associated species should be identified and weighed by taxon.
  - Dead oyster still with tissue will be classified as dead and weighed separately.

Equipment List

i. 8 PVC quadrats
ii. 3 sets of calipers and rulers
iii. Spring scales (0-10g, 10-100g, 100 – 1000g, and 0-10 kg)
iv. Digital camera with extra batteries
v. GPS with extra batteries
vi. Nitrile gloves (size M and L)
vii. Small shovel / tool for separating oysters
viii. Waterproof data sheets (chain-of-custody, sample tracking, photo log, oyster reef sample form)
ix. Waterproof labels or tags
x. Waterproof pens
xi. Flagging tape for external tags
xii. Burlap sacks for sample storage.
xiii. Plastic contractor-grade construction bags
xiv. YSI multimeter for DO, salinity

B. SOP for Decontamination Procedures for Sampling Equipment
Adapted from "the Standard Operating Procedure Decontamination Procedures for Sampling Equipment MC252 Fish Technical Work Group Plans," August 24, 2011

1. Scope and Applicability

This Standard Operating Procedure (SOP) describes equipment and field procedures necessary to properly decontaminate equipment utilized for the MC252 2012 Oyster Quadrat Abundance Monitoring Plan. This process is designed to minimize the potential for constituent migration and/or cross contamination. This procedure does not apply to personnel decontamination.

2. Summary of Method

The objective of this monitoring program is to determine and quantify the abundance and biomass of oysters in previous sampled locations. Decontamination procedures appropriate to the oil-related chemicals being assessed may improve the prevention of cross contamination. This SOP presents an adaptive approach to decontamination that ensures sufficiency of decontamination while minimizing the use of and personnel exposure to solvents.

3. Equipment and Supplies

- PPE (including disposable Neoprene gloves, chemical splash goggles; see Section 4.0 below for additional information including safe work practices)
- Small dry chemical Fire Extinguisher (BC or ABC Rated - 5 lb or larger)
- Bristled Brushes compatible with the solutions being used
- Low Phosphate Detergent (Alconox or Liquinox), diluted in accordance with instructions provided with the product.
-
- Distilled/DI water
- Designated solvent-compatible container for collection of decon waste/rinsates
- Secondary containment vessel such as a cooler that can be closed to reduce the likelihood of spills and reduce volatilization
- Clean Ambient/Tap water source
- Wash/rinse tubs compatible with the solutions being used
- Specified area of vessel for decon away from other contaminant sources and other personnel
- If collecting a rinsate blank, small container appropriate for the collection
- Field documentation materials

4. Health and Safety

Health and safety hazards associated with this procedure can be mitigated by the following engineering, administrative, and PPE controls:

HAZARD	CONTROL(S)
Bodily injury due to pinch points or dropped equipment	• Leather gloves and steel-toe boots should be worn while equipment is being handled • Equipment safety features (e.g., lock pins) should be engaged while equipment is being handled
Vapor inhalation	• Perform decon only in well-ventilated areas • Remain upwind of decon work • Advise other workers in the area of the nature of your task and ask them to remain upwind
Skin irritation	• Don proper chemical-resistant gloves (disposable Neoprene 5ml or greater thickness) • • Promptly wash any areas of skin which may have encountered contact with oil or rinsate and always wash after completing work with hazardous materials
Eye contact	• Do not use wash bottle near face
Fire	• 5- or 10-pound dry chemical fire extinguisher (Type BC or Type ABC) should be readily accessible during the decon process
Solvent spill	• Place equipment to be decontaminated in containers to capture rinsate
Environmental detriment	• Maintain solid used materials (e.g., paper towels, disposable gloves, etc.) in a bucket or other container to prevent litter • Promptly replace lids onto rinsate buckets and secondary containers

NOTE: The above information was determined from job hazard analysis of the work tasks

5. Decontamination Procedures

Levels of Decontamination Procedures and their Selection

All equipment and non-disposable materials that directly contact a sample medium shall be must undergo Level 1 Decontamination (see below) or be pre-cleaned by the manufacturer, in compliance with the protocols described here.

The Level 1 Decontamination procedure shall be the default decontamination procedure for all nondisposable equipment, followed by Level 2 Decontamination when applicable. The observation of oil in the general vicinity of the sampling does not necessitate Level 2 Decontamination but Level 2 Decontamination can be used at the field crew's discretion.

If Level 1 and Level 2 Decontamination procedures are not successful (i.e. visible oil is still observed on the equipment or the equipment rinsate) or if the equipment is heavily oiled, the sampling team will discontinue use of the contaminated equipment. During data intake, the team will transfer the equipment to Dade Moeller for proper disposal.

Level 1- Default decontamination procedure

Scrub[3] all equipment and parts with a dilute detergent mixture and rinse with deionized or distilled water. Inspect the equipment and rinse water for signs of residual oil, other contaminants, or incomplete decontamination.

Level 2 – Inspection and secondary decontamination

Whenever, after the Level 1 Decontamination procedure, there remains some evidence of incomplete decontamination and residual oil (i.e. sheen in rinse water, dark spots on net, etc.) the field team shall repeat Level 1 decontamination.

After the Level 1 Decontamination procedure is repeated, the equipment and rinse shall again be inspected. If after visual inspection there remains evidence of incomplete decontamination and residual oil (i.e. sheen in rinse water, dark spots on the net, etc.) the team shall discontinue the use of contaminated equipment. Dade Moeller will collect contaminated equipment during data intake and dispose of such equipment as appropriate.

Specific Protocols

These protocols are to be followed for all sampling apparatus (e.g., quadrats etc.).

All sampling devices between sample collections

- Collect the samples following the Work Plan's sampling protocol
- Wash and scrub with a clean mixture of distilled/DI water and low phosphate detergent
- Rinse equipment with distilled/DI water
- Inspect devices and rinse water; if sheen or oil is observed, repeat the above steps; if not, decontamination is complete

[3] The full decontamination process using detergent washing procedures is described below.

- If sheen or oil is observed after a second decontamination with water and detergent, discontinue use of equipment and turn over contaminated equipment to Dade Moeller for disposal during data intake.

6. Storage and Disposal of Chemicals and Chemical Waste

Rinsates will be handled following the specific guidelines listed below:

Rinsates Containing Oil

- Collect all rinsates in the designated compatible container with the appropriate label on the side
- Place rinsate containers in a secondary containment system to reduce the likelihood of spills and prevent volatilization
- All rinsates containing oil will be transported by authorized persons to the appropriate waste disposal site
- All rinsates will be captured in the same container.[4]

Rinsates Containing Water and/or Low-phosphate Detergents

- Rinsates containing only low phosphate detergents and water will also be containerized and given to Dade Moeller during data intake for proper disposal.
- Place rinsate containers in secondary containment during transportation and storage to reduce the likelihood of spills

[4] Diluting the rinsate from level 2 with the rinsate from level 1 is a key safety factor, reducing both concentration and volatility.

Appendix B: OYSTER SAMPLE ID NAMING CONVENTION

NOAA NRDA Sample Format:

- **LocationCode – DateCode - Matrix Leader# GCID#-Sample#SampleType**
    - 6-digit Location code (from maps located on www.noaanrda.org. These should be the NRDA Grid location code rather than the SCAT location code);
    - 5-digit date: year letter and mmdd (A=2010, B=2011, C=2012);
    - Matrix letter (T = Tissue);
    - Two or three digit leader code;
    - Four digit GCID code; and
    - Sample number and sample type.
- We will be numbering each sample sequentially *within each GCID and by sample type* (e.g., each GCID will have four quadrats numbered 01Q through 04Q). This information will go in the "Sample #" section at the end of the NOAA NRDA required tag.
- Grid Cell ID – the Grid Cell ID number (e.g., 0024, 3989) will be added to the sample ID immediately preceding the sample number so that the site can be identified. The Grid Cell number is not unique across states, but with the state abbreviation embedded in the location code the value is unique. *Use leading zeros to ensure that the GCID is always four digits.*
- Tissue Subtype – In addition, because there are several different tissue sample types collected across oyster plans, we will add an identifier after the sample number that will indicate the sample type for tissue samples. For this plan, only quadrat samples are collected.
    - Q = quadrat sample;
    - L = larval sample (add LS for surface, LM for mid water column or LB for bottom); and
    - SP = settlement plate.
- All additional information describing the samples will be recorded in the "Sample Notes" field of the NOAA NRDA sample collection forms. This additional information differs by sample type.
    - Quadrat oysters

- Site Name
- Quadrat Number

Example: **LAAM24-C0801-TA10024-01Q**

Sample ID Components	*Components from Example*	*Interpretation*
Location Code	LAAM24	NRDA Gridcell LAAM24
Date	C0801	August 1, 2012
Matrix	T	Tissue
Leader Code	A1	Team leader A1
Site ID	0024	Site 0024
Sample Number and Type	01Q	First quadrat sample taken at that site visit

Lab Teams

The labs will track the sample ID changes, splits and composites in a sample bridge template and upload to noaanrda.org site, under instruction from the data management TWG. In addition, the labs will upload result information to the www.noaanrda.org site on a frequency agreed upon by the lab and the data management TWG.