

## **Protocols for Plankton, Intertidal, and Subtidal Benthos (Macrofauna in Sediments [infauna] and on Sediments [Epifauna])**

Chris Deacutis  
Narragansett Bay Estuary Program

\*Procedures to follow are specified in the NOAA Spill Guidance (draft) for each environmental component, with modifications, where needed by the PI, depending on available equipment and environmental conditions. Detailed guidelines can be found at:

Plankton: Ch 11, pp 1-12

Subtidal Benthos: Ch 6, pp 1 -12  
(Incl epifauna & infauna)

Intertidal Benthos: Ch 5, pp 1 -14  
(Incl epifauna & infauna)

Sections in red indicate topics which require additional information or input from others.

### **Collection of Ephemeral Data Related to Sampling (plankton, etc.)**

#### **Objective:**

This activity is considered work under 15 CFR 990.43. The objective is to enable the Natural Resource Trustees to determine whether there is sufficient evidence of spill impact to pursue a NRDA response for the specific habitats and biological communities described below. All efforts will be directed towards gathering data that attempts to answer the question "Has the spill impacted specific marine species or groups of species in the area," with specific emphasis on populations deemed of great concern to the state of RI and the trustees. Examples might be lobster populations, including all life stages exposed to the spill.

#### **Justification:**

The collection of such ephemeral data as described above is part of this effort by the Trustees to capture information that is essential for them to decide whether to conduct more comprehensive biological and chemical assessment and restoration planning. These data will potentially include samples for analytical assessment of site related media and biota, and aerial photography of the site and the watershed immediately downstream.

1) Analytical data of site related media (water, soil/sediment, product) and biota are necessary in order to attempt to preserve time-critical information describing the basic source-pathway-receptor relationship. These media and biota samples will be collected from multiple locations in affected waters, including (reference) controls (outside areas that the incident is suspected to have affected) as discussed below. Analytical services will be conducted by RIOST and/or contractor (see RIOST Oil Sampling Protocols).

2) Aerial photography is necessary to create accurate base maps of the area because existing maps are inadequate; document the extent and degree of remaining contamination on shorelines and slopes; document the existing types and condition of vegetation; document physical disturbance caused by the oil spill and response actions; and provide an inventory of

affected wildlife habitat on and near the site. Vertical aerial photography will provide a synoptic snapshot of the impacted area and current condition of vegetation and the amount of wildlife habitat present. This information will assist the Trustees in determining whether natural resources or services have been exposed and whether additional sampling and assessment work is warranted for those resources.

### **Procedures (Overall Principles):**

Biological samples as well as physical pertinent data (Temp./Salinity/Oxygen) should be collected simultaneously or as close in time as feasible. Where oil-related chemical samples are needed, every effort will be made to have local chemistry samples obtained simultaneous or within a reasonable period as that of the biological sampling. In addition, suitable digital photos of surface and near-shore oiled zones should be taken if applicable.

The basic design of the sampling will be to develop baseline (nonimpacted) biological datasets and impacted zone datasets by sampling in a similar non-impacted habitat zone just up-current and/or upwind (dependant on the circumstances) of the spill in zones that may be at risk, followed by sampling in the oil-impacted zone. If a habitat is about to be impacted, pre-oil samples and digital photography should be taken to record pre-exposure versus post-exposure condition.

Results of biological communities present and observable condition (moribund etc.) will be compared. Emphasis will be on presence / absence and, where feasible, some level of quantification of abundance in terms of catch per unit effort for the sampling device(s) used. Relative differences between areas impacted by oil and not yet impacted will be compared to examine potential species losses due to the spill. Because of high heterogeneity of certain biological groups (e.g., plankton), a minimum of 3 “clean” sites and 3 of the oiled habitat type will be sampled to allow comparisons. It is also recommended that certain stations used in the past as sampling sites for the species of concern be sampled as historical reference sites in the days following these procedures to allow comparison w/ historical data sets.

### **SAMPLING PROCEDURES**

Specific sampling procedures will follow the draft “Guidelines for the Scientific Study of Oil Spill Effects” being developed by the Petroleum Environmental Research Forum (PERF Project 94-10). As noted in that document’s history section (p. 2), these guidelines will not be considered rigid requirements but aides in producing scientifically valid data to support assessment of oil spill related impacts to biological populations at risk. PI’s will have latitude based on available equipment and environmental conditions to adapt valid strategies which will provide such data to the state. Because not all populations are considered “restoration” candidates, *emphasis will be on restoration candidate species and their critical associated prey species of importance* based on the best professional judgment of state technical staff and the trustees. Data related to populations not directly linked to restoration candidates (e.g., Anchovy larvae) will be taken where it does not interfere with enumeration and quantification of the “critical” species. This does *NOT* mean the state is advocating a view that only commercially valuable species and their prey are important, but is rather a basis for “sampling triage” where personnel and equipment and time may be limiting. Other researchers are encouraged to undertake studies to look at more complex assessments at the community and ecosystem level as long as the trustees and the US Coast Guard agree to their presence and activities in spill-impacted areas, most likely after the initial spill responses targeted by RIOST.

Response will be to attempt to access biological samples w/in 24-48 hrs of the spill notification. Care will be taken to avoid passing sampling gear through the slick, and different duplicate nets should be used w/in impacted zone and outside in order to ensure avoidance of contamination. Equipment used in the spill area should be rinsed between samples w/ a solvent rinse. All sample jars should be solvent – rinsed glass w/ Teflon lids or (more likely) – aluminum foil rinsed w/ solvent and placed below lid w/ dull side toward sample / inside of bottle. All samples should have GPS coordinates and time/date of sampling associated w/ them. All samples should follow chain-of-custody procedures, with paperwork to show sign-off, etc., as they are transferred to others.

**For plankton sampling:** sampling will be by paired bongo net, phytoplankton net (fine mesh), or pumped samples filtered through nets of known mesh size for plankton samples. If possible, samples should cover the whole water column in the (minimum) 3 reference and 3 impacted stations. Samples will be preserved in 5% buffered formalin or 70% alcohol or other accepted preservative, depending on species of interest. In addition, an optical counter, if available, will be used to gain some better quantitative particle size information in conjunction with the plankton net data. Species enumeration of the samples should concentrate on species of significance to the state based on experience of species usually present and preliminary examination of samples, and including discussion and recommendation to the on-site coordinator for biological field sampling.

\*\*\*\* (Jim Quinn -- what is the best recommendation for nylon mesh nets? Grace & Paul – what are typical net materials ? ) \*\*\*\*\*

**For benthos sampling** (samples will concentrate on macrobenthos)

#### **Intertidal:**

The following protocol will be used in very broad areas with organisms present (impacted and non impacted).

Perform randomly placed quadrat sampling up to the wrack line along segments of shoreline parallel to the shore by tidal zone / similar habitat (depending on homogeneity of the shoreline and oil coverage) (e.g., low tide zone – within 1 hr low tide; mid intertidal; upper tidal-wrack line area) with at least 3 control / ref sites + 3 oiled segments / tidal zone. Digital photos and/or videos and visual estimates of oil coverage should be recorded for ALL the sites (including reference sites). Photos of quadrats with a centimeter ruler scale reference and photos showing placement of quadrat along the shore should be taken. Take at least 3 quadrat samples (0.25 m<sup>2</sup> or 1 m<sup>2</sup> depending on the number of organisms – several 0.063 m<sup>2</sup> quadrats can be used for high density coverage biomass estimates) randomly within these intertidal zones by using a 30 m tape marked off in meters aligned parallel to the water line along a particular depth contour of the intertidal (high, mid and lower), and randomly choosing which meter to put the quadrat in. Plan to sample lower intertidal within 1 hour of low tide. This means that a time schedule for the site visit should be coordinated with tidal considerations. If not feasible to get to site in daylight at low tide within the 24-48h time period we are considering for RIOST, begin sampling at the lowest feasible tidal zone first. Mid and upper intertidal sampling should follow. In order to do this correctly, several teams should be deployed simultaneously to different sites to ensure the same intertidal zones have been sampled around the same tide. Teams should be given protocols and walked through the sampling prior to deployment to make sure they do sampling the same way. If feasible, over the course of the event, teams should be swapped out so each does at least 1 oil impacted and 1 ref site in order

to further eliminate any team- specific sampling technique differences (but make sure oiled equipment is kept with “oil impacted” sampling).

For best estimate of percent cover of high densities of organisms within a quadrat – use the “point contact estimation” procedures (Element 5 Intertidal Biota, Method 5.6 of the “Guidelines for the scientific study of oil spill effects”). This involves a .25 m<sup>2</sup> quadrat of dark grey PVC , a .25 m<sup>2</sup> plexiglas sampling plate w/ 3 adjustable legs and 150 evenly spaced *numbered* holes with size-matched pointed metal rods. The plate is positioned over the quadrat parallel to the ground, and 50 rods are placed through 50 randomly-chosen holes (a random number table should always be provided to all teams). See method for particulars on counting technique. A min of 5 of these types of quads should be taken for decent percent cover quantification.

\*\*\*\*\**(Looking for suggestions on this – which method used for North Cape lobster estimate along beaches Mark Gibson coordinated?) and what if random distribution at non-impacted site but clumped (due to death and tidal movement of dead) at impacted site? OK to sample 2 different ways? Do BOTH ways at each? How useful is digital photography to attempt megafauna counts under such situations?*

If biological resource impacts at impacted sites are very heterogeneous / clumped but obviously different from clean sites (i.e., no dead lobsters etc. at clean, but high density winrows of dead at impacted), the following protocol might be used.

Random quadrats may not be best method. Instead, take photos or high quality (2.5-5 megapixel) digital photos showing the distribution of impacted organisms at ALL sites. Include a meter stick in photos for scale. Estimate width and number of clumps or winrows /0.5 km of beach. Use randomly palced 1 m<sup>2</sup> quadrat counts within winrows along the major axis of the winrow (measure width of winrow at quadrat sampled area), keying macrofauna to species. Subsamples of various dead organisms should be taken and sealed in solvent – cleaned glass containers or baggies and placed on ice for proof of oil-association with death. Intertidal position along the beach/shore front should be recorded and photographed, w/ background reference marks included in the photos if available.

All teams should maintain contact with each other and the Coordination Center to ensure they are using appropriate and equivalent sampling techniques. If available, a benthic ecological statistician should be consulted to check on most appropriate reasonable method to get quantitative estimates of dead and moribund organisms.

### **Subtidal Habitats:**

Because quadrat-type subtidal sampling usually requires divers, it is not expected that such sampling will be used during the first 48 hours of a spill. However, sampling using a submersible camera with laser rangefinder for organism size estimates coupled to a GPS system may be used along a transect line to get crude estimates of density of macro and megafauna. Stratified random sampling transects should be chosen from a nautical chart basemap using a randomization protocol prior to sampling, with an equal number of samples inside the oil impacted zone and outside of the zone. GIS-based methods developed by EMAP/NCA, with stratification by depth and bottom type would be useful for developing the sampling framework. Latitude/longitude by DGPS should be recorded for each transect. Every effort should be made to choose reference or unimpacted sites with comparable bottom topography and habitat type using available GIS benthic and sediment coverages. These transects should include sites in the vicinity of any sediment samples taken for chemistry. A

small benthic sled or dredge or small benthic grab (modified Smith McIntyre, van Veen or other sampler) could be used to attempt to get some of the benthic organisms noted in video as voucher samples.

### **Personnel:**

The candidate personnel below are likely to be contacted by the state of RI if the RIOST is activated in the event of an oil spill in RI marine waters. It is not a final or exclusive list, but rather a list of local experts who have indicated a willingness to aid in the collection and/or analyses of biological samples as described above, based on their personal knowledge and expertise. It is assumed their participation will be funded through funds provided by oil-spill related accounts.

### **Plankton**

Dr. Grace MacPhee, URI (zooplankton) tel : 874-6175 [gracemac@gso.uri.edu](mailto:gracemac@gso.uri.edu)

Dr. Paul Hargraves, URI (phytoplankton) tel: 874-6241 [pharg@gso.uri.edu](mailto:pharg@gso.uri.edu)

DEM F&W staff w/ expertise ???

### **Benthos** (intertidal & subtidal)

Sheldon Pratt URI (all benthos) tel: 874-6699 [spratt@gso.uri.edu](mailto:spratt@gso.uri.edu)

Dr. Candace Oviatt URI tel: 874-6661 [coviatt@gso.uri.edu](mailto:coviatt@gso.uri.edu)

David Taylor ???(GSO) – other experienced grad students???

RIDEM F&W staff

Mark Gibson	Jason McNamee
Art Ganz	Scott Olszewski
Chris Powell	Dick Satchwill

(other staff members as needed based on recommendation of M. Gibson.

Some staff likely to be involved with shellfish and finfish issues not discussed here (e.g., Tim Lynch, Najih Lazar etc.)

### **Equipment**

For sampling see the methods sections of the “Guidelines for the scientific study of oil spill effects.” Typical equipment needs for intertidal will be grey PVC quadrats 0.25 m<sup>2</sup>, yellow tape in 30m segments marked of in meters, sampling plastic bags or clean jars, 5 Megapixel Digital Camera , DGPS unit for each field team, field waterproof notebooks, etc.

Boats:

At least 2 boats (for potential simultaneous sampling in and out of spill area ) of  $\geq 22'$ . Larger boats preferable for deeper water. Winch system needed on all boats for bongo nets, dredges, etc.

Budget:

Approximately \$ 40,000 - \$ 50,000 for equipment plus more if boat rental needed

Does NOT include hourly rate for expert participants. This would likely push budget to \$80,000 - \$100,000 minimum.