Pre-spill Assessments of Coastal Habitat Resources:

Volume II:
Quick Response Protocols

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Field Protocols

This section contains the detailed sampling protocols and instructions for sandy beach, rocky intertidal and wetland habitats, including printable data sheets. Training is required before these protocols can be applied. Individuals should become familiar with the protocols before employing them in the field.

A. Sandy Beach Habitat

The following pages consist of printable materials for inclusion in the "Go-Kit." These sandy beach protocols are not as developed as the rocky intertidal and wetland protocols as explained in Volume 1. The instructions included in this volume are potential protocols that could be developed with further research.

Chemical Analysis

Samples for chemical analysis should be analyzed for PAH (polynuclear aromatic hydrocarbons) concentration and oil fingerprint analysis. PAHs are analyzed for NRDA instead of total (petroleum) hydrocarbons because most of the toxicity in oil results from the PAHs. The standard method used for PAH analysis for NRDA is the Modified EPA Method 8270 (GC/MS), expanded to include the alkylated homologs, using 1ppb detection levels for all samples. (EPA 2001)

The same 10g sample can be analyzed for PAH concentration and oil fingerprint analyses. PAH analysis will likely be performed on all replicates collected, while fingerprinting will be done on only a few of the samples as many replicates are not needed to identify the oil present. Indicate on each sample label which analyses will be performed.

All equipment that is in contact with samples for chemical analysis must be solvent-rinsed prior to sampling. Solvent-rinsing involves rinsing equipment with methylene chloride or acetone; if acetone is used, then a second rinse with pentane or hexane is required. If aluminum foil is used for sampling, make sure the dull side is solvent-rinsed and store with the clean sides folded together. Aluminum foil can also be cleaned by heating at 450°C for over one hour instead of the solvent-rinse. If cleaning/rinsing equipment in the field, first wash with soap & hot water, then rinse with warm distilled water, then rinse with solvents (above). All solvents must be stored in glass or Teflon containers, not plastic. (USFWS 2006)

All equipment in direct contact with samples should be made of inert materials such as glass, Teflon, high quality stainless steel or HDPE (high-density polyethylene). Avoid direct contact between samples and PVC, natural or neoprene rubber, nylon, polystyrene, galvanized metal, brass, copper, lead, other metal materials, soda glass, paper tissues, talcum powder, and painted surfaces. (EPA 2001)

These requirements apply to the aluminum foil, stainless steel shovel, and sieve for sand crab samples. Aluminum foil (enough for all samples) are pre-rinsed and included in the Kit. While the shovel and sieve are pre-rinsed, they would need to be re-rinsed in the field between collection of each sample for decontamination. For the purposes of this rapid pre-spill protocol the sand crab sampling equipment will not be solvent-rinsed in the field between samples; instead, the shovel will be wiped thoroughly with paper towel between samples, and the paper towel will then be placed in a plastic bag for later proper

disposal. Solvent rinsing in the field is not practical given the time constraints of pre-spill sampling and the amount of information that would be given up during that time. We decided to maintain the inclusion of sand crab collection for tissue samples given their importance as bioaccumulators. OSPR will need to decide the legal importance of solvent-rinsing between samples, and if necessary the protocol can be adjusted.

Sampling Equipment

Weatherproof (e.g., "Rite in the Rain"®) paper will be used for all data sheets. Data labels were ordered perforated instead of Rite in the Rain because tearing or cutting the labels can be logistically difficult for a rapid protocol. If there is enough time, pre-cutting weatherproof sample labels would work well.

U.S. Environmental Protection Agency, EPA. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823-B-01-002. Office of Science & Technology, Office of Water. Washington, DC. October. <URL: http://www.epa.gov/waterscience/cs/collection.html >

U.S. Fish & Wildlife Service. 2006. National Oil Spill Contingency Plan. Appendix S. Division of Environmental Quality. October. <URL: http://www.fws.gov/contaminants/FWS_OSCP_05/FWSContingencyTOC.htm#S>

Sandy Beach Habitat Protocols

Additional Data Sheets

Sample Labels

Chain of Custody Form

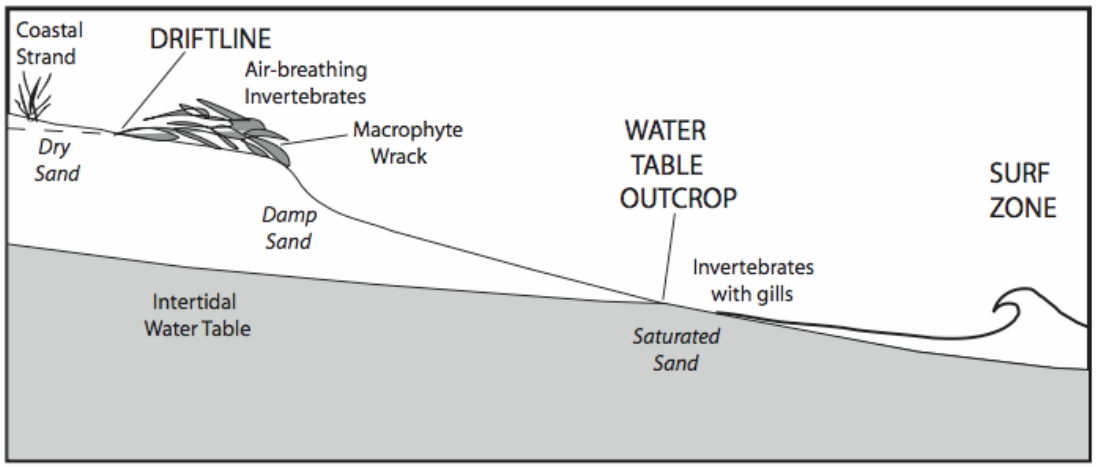


Figure 1. Profile of an exposed sandy beach showing the intertidal and supralittoral zones. The relative locations of major invertebrate types, accumulations of macrophyte wrack and ephemeral coastal strand vegetation are indicated. Air-breathing invertebrates can include talitrid amphipods, oniscoidean isopods, insects and arachnids. Invertebrates of the damp and saturated sand zones can include hippid crabs, isopods, amphipods, bivalves, gastropods, and polychaetes (Dugan, J.E. and D.M. Hubbard. 2006 Ecological responses to coastal armoring on exposed sandy beaches. Shore and Beach. 74(1): 10-16)**.**

Sandy Beach Habitat Go-Kit Equipment list:

- ☐ Data sheet: General Log
- ☐ Data sheet: Photo Log
- ☐ Data sheet: Photo & Beach Characteristics
- ☐ Data sheet: Wrack & Tar Survey
- ☐ Data sheet: Sand Crab
- ☐ Data form: Photo Form (laminated)
- ☐ Data form: Chain of Custody
- ☐ Data labels: Sand Crab
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Empty digital card
- ☐ Clipboard
- ☐ Compass
- ☐ Measuring wheel
- ☐ 1 meter PVC pipe
- ☐ Stainless steel shovel
- ☐ Sieve: Polyethylene, 3mm mesh
- ☐ Polyethylene gloves (3 pairs)
- ☐ Aluminum foil: solvent-rinsed (3)
- ☐ Ziploc bags: quart-sized (6)
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Evidence tape
- ☐ Grease pencil or dry erase marker (2)
- ☐ Pencil – mechanical (3)

1. Sandy Beach Habitat Beach Characteristics

a. General Log

- Fill out General Log data sheet at least once per site area sampled (where data are collected).
- Take GPS waypoint of the site access point.
- Time estimate for filling out General Log is roughly 5 minutes.
- Note: Bird and Mammal list should be modified to fit the region.

b. Pan & Transect Photographs

- Take a photograph of the GPS unit with the time displayed to link photos to GPS coordinates and start a track file, hitting "mark" at each photo location to ensure a waypoint is recorded at that location.
- Take a minimum of one pan photo at the access point. Take a minimum of 2 sets of pan photographs per site area sampled with transects – at least one at the top of the first transect and one at the bottom of the last transect (more can be taken if required to characterize the area).
- For pan photos, in circular motion, starting at magnetic North, and in clockwise direction take 8-10 photographs using the *ocean* horizon as the upper boundary of the camera viewfinder. Photographs should overlap slightly so each set comprises a complete 360° view of the site.
- Fill out the Photo Form with grease pencil or dry erase marker before and after each set of pan photos and take a photograph of the form to indicate the start and end of each set.
- Take 4 transect photos (to save time, may take the GPS point at only the top of the transect):
  1. Top of transect facing offshore
  2. Bottom of transect facing onshore
  3. At primary wrack line facing downcoast
  4. At primary wrack line facing upcoast
- Take photos as needed to best characterize the site/transect, such as landmarks and overview photos.
- Record on the Photo Log the location information for each set of photos taken.

c. Beach Characteristics

- Determine length of beach to survey and decide number and spacing of transects before setting first transect.
- Use distance measuring wheel, starting at the landward boundary or beach backing (e.g., dune, bluff, parking lot, etc.) and indicate the zero point on the data sheet.
- Walk perpendicular to the ocean, measuring and recording the beach characteristics indicated on the data sheet.
- Repeat for each transect, a *minimum* of 3 transects per kilometer.

Equipment:

- ☐ Data sheet: General Log
- ☐ Data sheet: Photo Log
- ☐ Data sheet: Beach Characteristics
- ☐ Data form: Photo Form (laminated)
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Measuring wheel
- ☐ Clipboard
- ☐ Grease pencil or dry erase marker
- ☐ Pencil

1. a. Sandy Beach Habitat General Log for _____spill

Team Leader_____ Recorder_____ Sampler_____

GENERAL INFORMATION	Date (dd/mm/yy)	Time (24h standard/daylight):____to___
Segment ID	Swell/Surge: _____ft	Rain:_____in/hr
Site Name/#	Wind: _____dir _____sp	Recent Rain: date_____ amt_____

SITE	Length of Beach Surveyed _____ m

GPS (Record in decimal degrees, NAD83 datum):	GPS Location Description:
Start: LAT _____ LONG _____	
End: LAT _____ LONG _____	

SHORELINE TYPE	Select only ONE Primary (P) and ANY Secondary (S) types present		
	Rocky Cliffs		Riprap
	Exposed Man-made Structures		Exposed Tidal Flats
	Wave-cut Platforms		Sheltered Rocky Shores
	Fine-Medium grained Sand Beaches		Sheltered Man-made Structures
	Coarse-grained Sand Beaches		Sheltered Tidal Flats
	Mixed Sand and Gravel Beaches		Wetlands
	Gravel Beaches		Other _____

BIRDS AND MAMMALS	(maximum # seen at any one time during the sampling)			
Pelican	Great Egret	Lg Shorebird	Elephant Seal	CA Sea Lion
Cormorant	Snowy Egret	Sm Shorebird	Sea Otter	Harbor Seal
Gull	Oystercatcher	Other Birds	Dog	
Tern	Blue Heron			

Bird/Mammal Notes:_____

_____

DEBRIS AND POLLUTANTS	(magnitude at site: Ø = None, H = High, M = Medium, L = Low):			
Plant Wrack: _____	Driftwood: _____	Shells: _____	Trash: _____	Oil/Tar: ____

Dead Animals (birds, fish, invertebrates, mammals):_____

HUMANS	(max. # seen at any one time during sampling not including spill cleanup; note behavior)	Reef:____	Sand:____

_____

PHOTOGRAPHS	Record location on data sheet. Check when taken: Pan ☐ ☐ Access Point ☐
COMMENTS:	Ecological/Recreational/Cultural/Other Issues

_____

_____

_____

_____

SKETCH OF AREA	Note transects, pan photos, access point, landmarks, etc.

SHORELINE TYPE DESCRIPTIONS
(From NOAA. 2000. Shoreline Assessment Manual. HAZMAT Report No. 2000-1.)

Exposed Rocky Cliffs

- The intertidal zone is steep (greater than 30° slope), with very little width.
- Sediment accumulations are uncommon and usually ephemeral, because waves remove the debris that has slumped from the eroding cliffs.
- There is strong vertical zonation of intertidal biological communities.
- Species density and diversity vary greatly, but barnacles, snails, mussels, seastars, limpets, sea anemones, shore crabs, polychaetes, and macroalgae are often very abundant.

Exposed, Solid Man-Made Structures

- This shoreline type consist of solid man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- They are constructed of concrete, wood, or metal.
- Often there is no exposed substrate at low tide, but a wide range of habitats may be present .
- They are built to protect the shore from erosion by waves, boat wakes, and currents, and thus are exposed to rapid natural removal processes.
- Attached animals and plants are sparse to moderate.

Exposed Wave-Cut Platforms

- The intertidal zone consists of a flat rock bench of highly variable width.
- The shoreline may be backed by a steep scarp or low bluff.
- There may be a beach of sand- to boulder-sized sediments at the base of the scarp.
- The platform surface is irregular and tidal pools are common.
- Small amounts of gravel can be found in the tidal pools and crevices in the platform.
- These habitats can support large populations of encrusting animals and plants, with rich tidal pool communities.

Fine-Grained Sand Beaches

- These beaches are generally flat and hard-packed.
- Though they are predominately fine sand, there is often a small amount of shell hash.
- There can be heavy accumulations of wrack present.
- They are utilized by birds and turtles for nesting and feeding.
- Upper beach fauna are generally sparse, although amphipods can be abundant; lower beach fauna can be moderately abundant, but highly variable.

Medium-to-Coarse-Grained Sand Beaches

- These beaches have relatively steep beach faces and soft substrates.
- Coarse-sand beaches can undergo rapid erosion/deposition cycles, even within one tidal cycle.
- The amount of wrack varies considerably.
- They are utilized by birds and turtles for nesting and feeding.

Mixed Sand and Gravel Beaches

- These beaches are moderately sloping and composed of a mixture of sand and gravel.
- Because of the mixed sediment sizes, there may be zones of pure sand, pebbles, or cobbles.
- There can be large-scale changes in the sediment distribution patterns depending upon season, because of the transport of the sand fraction offshore during storms.
- Because of sediment desiccation and mobility on exposed beaches, there are low densities of attached animals and plants.
- The presence of attached algae and animals indicates beaches that are relatively sheltered, with the more stable substrate supporting a richer biota.

Gravel Beaches

- Gravel beaches are composed of sediments ranging in size from pebbles to boulders. The gravel-sized sediments can be made up of shell fragments.

- They can be very steep, with multiple wave-built berms forming the upper beach.
- Attached animals and plants are usually restricted to the lowest parts of the beach, where the sediments are less mobile.
- The presence of attached algae, mussels, and barnacles indicates beaches that are relatively sheltered, with the more stable substrate supporting a richer biota.

Riprap

- Riprap is composed of cobble- to boulder-sized blocks of granite, limestone, or concrete.
- Riprap structures are used for shoreline protection and channel stabilization (jetties)
- Attached biota are sparse.

Exposed Tidal Flats

- Exposed tidal flats are broad intertidal areas composed primarily of sand and minor amounts of shell and mud.
- The dominance of sand indicates that currents and waves are strong enough to mobilize the sediments.
- They are usually associated with another shoreline type on the landward side of the flat, though they can occur as separate shoals; they are commonly associated with tidal inlets.
- Biological utilization can be very high, with large numbers of infauna, heavy use by birds for roosting and foraging, and use by foraging fish.

Sheltered Rocky Shores

- These are bedrock shores of variable slope (from vertical cliffs to wide, rocky ledges) that are sheltered from exposure to most wave and tidal energy.
- Wide shores may have some surface sediments, but bedrock is the dominant substrate type
- Species density and diversity vary greatly, but biota are often very abundant.

Sheltered, Solid Man-Made Structures

- These structures are solid man-made structures such as seawalls, groins, revetments, piers, and port facilities
- Most structures are constructed of concrete, wood, or metal, and their composition, design, and condition are highly variable.
- Often there is no exposed beach at low tide, but a wide variety habitats may be present.
- Attached animal and plant life can be moderate to high.

Sheltered Tidal Flats

- Sheltered tidal flats are composed primarily of mud with minor amounts of sand and shell.
- They are present in calm-water habitats, sheltered from major wave activity, and are frequently backed by marshes.
- The sediments are very soft and cannot support even light foot traffic in many areas.
- They can be sparsely to heavily covered with algae and/or seagrasses.
- They can have very heavy wrack accumulations along the high-tide line.
- There can be large concentrations of shellfish, worms, and snails on and in the sediments.
- They are heavily utilized by birds and fish for feeding.

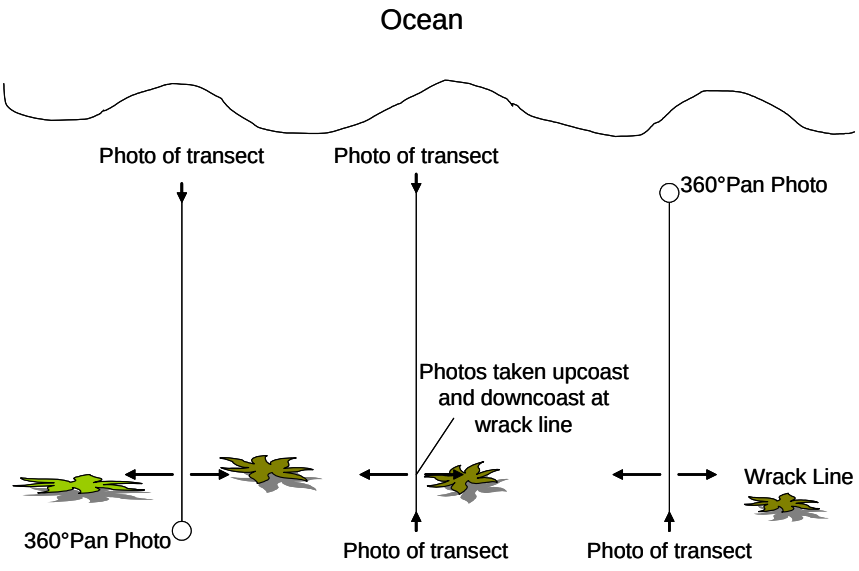
Salt-and Brackish-Water Marshes

- These marshes contain vegetation which tolerates water salinity down to about 5 ppt.
- Width of the marsh can vary widely, from a narrow fringe to extensive areas.
- Sediments are composed of organic-rich muds except on the margins of barrier islands where sand is abundant.
- Exposed areas are located along waterbodies with wide fetches and along busy waterways.
- Sheltered areas are not exposed to significant wave or boat wake activity.
- Resident flora and fauna are abundant with numerous species with high utilization by birds, fish, and shellfish.

1. b. Sandy Beach Habitat Photo Log

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Photographer(s): _____ Camera Model: _____

Photo Type/Description (e.g., Pan #1; Transect 1 offshore; Overview, etc.)	Photo GPS Location		Location Description / Comments
	LAT	LONG	



1. c. Sandy Beach Habitat Beach Characteristics Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____ Sampler: _____
Recorder: _____

Beach Groomed? Check: Yes_____ No_____ Unknown_____

		Transect 1	**Transect 2**	**Transect 3**
Record waypoints in decimal degrees (NAD 83 datum) and compass heading in degrees.				
GPS Coordinates, Onshore end		Lat.: _____ Long.:	Lat.: _____ Long.:	Lat.: _____ Long.:
Compass Heading of Transect				
Mark the beach backing present for each transect.				
Beach Backing	Bluff			
	Dune			
	Bluff with dune			
	Estuary			
	Urban			
	Seawall			
	Other:			
Measure and record the widths (m) of each *applicable* intertidal zone. Indicate zero point (location where starting the measuring wheel; i.e., landward boundary, e.g., toe of primary foredune, etc.). Note if zone is above zero point.				
Measurements	Zero point (describe)			
	Extreme Driftline (wrackline)			
	24-hr Highest Driftline			
	Water Table Outcrop			
	Low Swash Line (wet line) (pace or estimate)			
	Overall Intertidal Width (total)			
	Other:			

1. Sandy Beach Habitat Photo Form

DATE_____

SPILL_____ TIME_____

SITE

_____

PARAMETER

_____

(Circle) BEGIN / END

2. Sandy Beach Habitat Wrack & Tar Survey

Two protocols are included for an estimation of wrack.

a. Line-intercept method for wrack and band transect method for tar.

- Walk the shore normal transect that was created with the measuring wheel while taking beach measurements, starting at the water table outcrop (wet line) and ending at the zero point.
- Measure the length of wrack that intersects one edge of the measuring wheel track and put a tick mark in the box for the corresponding length category on the data sheet, repeating for every clump of wrack that intersects the transect line.
- Record all tar within 1 meter (either side) of wheel transect. Use 1 meter PVC pipe to determine the 1m band width. The 2m band can be flexible if a lot of tar/oil is present, but specify on the data sheet the band width that is used if modified.
- Continue until past upper wrack line and record total length of transect.
- Repeat for a minimum of 2 more transects per 1 kilometer stretch of beach.
- Transects should be representative of the beach section and not too close together (for example, 10 m apart)
- Wrack numbers will be totaled for an estimate of cover and composition.

b. Upper wrack line estimate

- Locate upper wrack line and estimate and record length of beach surveyed.
- Estimate and record approximate width, % cover and depth of wrack within the specified length of beach.
- Take photos to document as time and need dictate and record photos in Photo Log.
- Repeat in sections as appropriate.

Equipment:

- ☐ Data sheet: Wrack & Tar Survey
- ☐ GPS unit
- ☐ Measuring wheel
- ☐ 1 meter PVC pipe
- ☐ Clipboard
- ☐ Pencil

2. a. Sandy Beach Habitat Wrack & Tar Survey Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____ Sampler: _____
Recorder: _____

	Wrack intercept length										
Transect 1	2mm	4	8	16	32	64	12cm	24	1m	2	Length of Transect: ___
Macrocystis											
Phyllospadix											
Egregia											
Zostera											
Brown											
Red											
Green											
Wood											
Terrestrial plant											
Feather / Animal											
Trash											
TAR (diameter class, in 2m band)											

Transect 2	2mm	4	8	16	32	64	12cm	24	1m	2	Length of Transect: ____
Macrocystis											
Phyllospadix											
Egregia											
Zostera											
Brown											
Red											
Green											
Wood											
Terrestrial plant											
Feather / Animal											
Trash											
TAR (diameter class, in 2m band)											

Transect 3	2mm	4	8	16	32	64	12cm	24	1m	2	Length of Transect: ____
Macrocystis											
Phyllospadix											
Egregia											
Zostera											
Brown											
Red											
Green											
Wood											
Terrestrial plant											
Feather / Animal											
Trash											
TAR (diameter class, in 2m band)											

2. b. Sandy Beach Habitat Wrack & Tar Survey Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____ Sampler: _____
Recorder: _____

Length of beach surveyed:_____ m

Wrack: Width: _____ m % Cover: _____ Depth (include units): _____

Length of beach surveyed:_____ m

Wrack: Width: _____ m % Cover: _____ Depth (include units): _____

Length of beach surveyed:_____ m

Wrack: Width: _____ m % Cover: _____ Depth (include units): _____

Length of beach surveyed:_____ m

Wrack: Width: _____ m % Cover: _____ Depth (include units): _____

Length of beach surveyed:_____ m

Wrack: Width: _____ m % Cover: _____ Depth (include units): _____

3. Sandy Beach Habitat Sand Crab Collection

Sand crabs will be collected within the same site area as the beach measurements and wrack and tar survey. Crabs will be collected where they occur in the swash zone. Do not walk around in the active swash before sampling; all crabs will leave the area.

- Wear polyethylene gloves throughout the process, changing gloves between samples.
- Using a stainless steel shovel, remove shovelsful of sand as you walk in the swash zone (wet sand) and toss the contents to spread on the sand. Collect any sand crabs by hand using gloves. Once an aggregation of crabs is located concentrate your efforts there, pouring the shovel contents into the sieve and extracting *Emerita* crabs until enough crabs have been collected or if not enough crabs are found keep moving and shoveling within the swash zone.
- Collect enough crabs for a 10g sample. For large crabs (carapace length = 20 mm or more) 8-10 animals per sample is sufficient. For small animals 4-10 mm, much larger numbers of individuals are needed per sample to make up approximately 10-20 grams of wet tissue.
- Place crabs in aluminum foil (onto dull side), fold edges in and place in Ziploc bag.
- Place sample label and first Ziploc bag into second Ziploc bag.
- Place in cooler with ice packs.
- Attach evidence tape to each sample bag.
- Fill out chain of custody form.
- Repeat for a minimum of 3 samples per site area, with each spaced at least 5 m apart.

Equipment

- ☐ Data sheet: Sand Crab
- ☐ Data labels: Sand Crab
- ☐ Data form: Chain of custody
- ☐ Stainless steel shovel
- ☐ Sieve: Polyethylene, 3mm mesh
- ☐ Polyethylene gloves (3 pairs)
- ☐ Aluminum foil: solvent-rinsed (3)
- ☐ Ziploc bags: quart-sized (6)
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Evidence Tape
- ☐ Pencil

3. Sandy Beach Habitat Sand Crab Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____ Sampler: _____
Recorder: _____

Sample ID: _____

Species: _____ Number of crabs: _____

Number of shovel scoops sieved for this sample: _____

Location: _____

Sample ID: _____

Species: _____ Number of crabs: _____

Number of shovel scoops sieved for this sample: _____

Location: _____

Sample ID: _____

Species: _____ Number of crabs: _____

Number of shovel scoops sieved for this sample: _____

Location: _____

3. Sandy Beach Habitat Sand Crab Labels

Sand Crab Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Species________________________

Replicate number_____ of _____

Sand Crab Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Species________________________

Replicate number_____ of _____

Sand Crab Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Species________________________

Replicate number_____ of _____

Sand Crab Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Species________________________

Replicate number_____ of _____

Sand Crab Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Species________________________

Replicate number_____ of _____

Sand Crab Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Species________________________

Replicate number_____ of _____

DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page_____ of _____

Sampler Ph #	Send Results To	Lab Number
Address	Address	Field Number
City Zip CA	City Zip CA	Lab Storage
	Copies To	Spill Title
Date Required/Reason	Address	Suspect
Shipped Via	City Zip	Index-PCA

☐ Fish & Wildlife Loss Date:_____ Region:_____

☐ DFG Code Violation:_____

☐ Suspected or Potential Problem

☐ Routine Analysis

Analysis Requested >>>

Water Temp: F or C pH: DO: mg/L Conductivity: u mhos/cm

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)						Petroleum	Sample Type: Water	Sample Type: Filtered Water	Sample Type: Soil	Sample Type: Tissue	Number of Containers: Plastic	Number of Containers: Glass	Number of Containers: VOA Vial		Preservation: Temp	Preservation: Acid	

Problem Description

Suspect/Incident Location

Comments/Special Instructions

Pollution Action Kit: Yes☐ No☐

Glove Size: Large ☐ Medium ☐

Hazmat Shipper Requested: Yes☐ No☐

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date

LAB COPIES: WHITE, CANARY, PINK SUBMITTER: GOLDENROD FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1995 Nimbus Road
Rancho Cordova, CA 95670

X

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA 95670

B. Rocky Intertidal Habitat

The following pages consist of printable materials for inclusion in the "Go-Kit." Introductory materials and descriptions are included in this section.

Rocky Intertidal Habitat Introduction

The rocky intertidal protocol consists of five basic protocols. It starts with completing a general log, taking 360° pan photographs and filling out a species log for each set of pan photos. A timed search of abalone or sea stars will be performed at the same location, and these protocols will be performed a minimum of every 200 meters within the entire rocky intertidal potential spill area of "interest." Mussels will be collected for tissue analysis at every other general log sampling location. In addition, photo transects will be performed at a frequency of two sets per NRDA segment.

To aid and accelerate the overall sampling process, flags will be marked and set out after completing the species log to indicate where the timed search, mussel collection and photo transects will be done. A second, third or fourth sampler can then go behind the initial sampler and complete the last three protocols.

Sampling Equipment

Grey PVC will be used for the quadrat instead of white PVC to prevent underexposure of darker areas within the quadrat.

Weatherproof (e.g., "Rite in the Rain"®) paper will be used for all data sheets. Data labels were ordered perforated instead of Rite in the Rain because tearing or cutting the labels will be too much of a hassle for this rapid protocol. If there is sufficient time, pre-cutting weatherproof sample labels would also work well.

Chemical Analysis

Samples for chemical analysis should be analyzed for PAH (polynuclear aromatic hydrocarbons) concentration and oil fingerprint analysis. PAHs are analyzed for NRDA instead of total (petroleum) hydrocarbons because most of the toxicity in oil results from the PAHs. The standard method used for PAH analysis for NRDA is the Modified EPA Method 8270 (GC/MS), expanded to include the alkylated homologs, using 1ppb detection levels for all samples.

(Source: U.S. Environmental Protection Agency, Office of Science & Technology, Office of Water. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823-B-01-002. October 2001. http://www.epa.gov/waterscience/cs/collection.html.)

The same 10g sample can be analyzed for PAH concentration and oil fingerprint analyses. PAH analysis will likely be performed on all replicates collected, while fingerprinting will be done on only a few of the samples as many replicates are not needed to identify the oil present. Indicate on each sample label which analyses will be performed.

All equipment that is in contact with samples for chemical analysis must be solvent-rinsed prior to sampling. Solvent-rinsing involves rinsing equipment with methylene chloride or acetone; if acetone is used, then a second rinse with pentane or hexane is required. If aluminum foil is used for sampling, make sure the dull side is solvent-rinsed and store with the clean sides folded together. Aluminum foil can also be cleaned by heating at 450°C for over one hour instead of the solvent-rinse.

(Source: U.S. Fish & Wildlife Service, Division of Environmental Quality. National Oil Spill Contingency Plan. Appendix S. Revised October 2006. http://www.fws.gov/contaminants/FWS_OSCP_05/FWSContingencyTOC.htm#S)

Rocky Intertidal Habitat Instructions

1. Rocky Intertidal Habitat General Log & Pan Photographs

A data sheet should be filled out as frequently as needed in order to capture the characteristics of the surveyed section of coast. As a guideline, this should be approximately every 200 meters for a fairly uniform coast or every 100 m or less if habitat is varied.

Mark locations with flag suitable for Timed Search, Mussel Tissue, and Photo Transect protocols, flags should be marked with T for the Timed Search, M for Mussel Tissue, and P for Photo Transect protocols.

2. Rocky Intertidal Species Log

A data sheet should be filled out for every pan photograph taken in rocky intertidal habitat.

3. Rocky Intertidal Habitat Timed Search

A search for abalone and seastars should be performed at the same frequency as the General Log. If multiple rocky outcroppings are present within a given segment, perform one additional search.

4. Rocky Intertidal Habitat Mussel Tissue

Mussels should be sampled during every other General Log or at the discretion of the Team Leader.

5. Rocky Intertidal Habitat Photo Transect

Photo sampling should be performed twice per segment assigned.
Habitat must be 30 contiguous meters of coastal length.
Priority locations would be Areas of Special Biological Significance (ASBS), areas high on the Environmental Sensitivity Index (ESI), previous study locations, and high oiling probability areas.

Equipment list:

- ☐ Data sheet: General Log
- ☐ Data sheet: Photo Log
- ☐ Data sheet: Species Log
- ☐ Data sheet: Timed Search
- ☐ Data sheet: Mussel
- ☐ Data labels: Mussel
- ☐ Data sheet: Photo Transect
- ☐ GPS
- ☐ Digital Camera
- ☐ Empty digital card
- ☐ Marine Epoxy
- ☐ Flags
- ☐ Caliper or laminated ruler
- ☐ Stopwatch
- ☐ Chalk (Forestry)
- ☐ Polyethylene gloves
- ☐ Aluminum foil: solvent-rinsed
- ☐ Ziploc bags: gallon-sized
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Compass
- ☐ Transect tape: 50m
- ☐ Transect tape: 100m
- ☐ Quadrat of grey PVC: 0.5m x 0.75m
- ☐ Evidence Tape
- ☐ Zip ties
- ☐ Clipboards
- ☐ Pencil – mechanical (5)

Rocky Intertidal Habitat Protocols

1. Rocky Intertidal Habitat General Log & Pan Photographs

- Fill out General Log datasheet. Time estimate = roughly 5 minutes. (Note: Bird and Mammal list should be modified to fit the region.)
- Take a photograph of the GPS unit with the time displayed to link photos to GPS coordinates and start a track file, hitting "mark" at each photo location to ensure a waypoint is recorded at that location.
- Take one pan photograph at the access point (if haven't already) and take a minimum of one pan photo per site area sampled (site = area where data are collected, e.g., photo transects, timed search).
- Pan photographs: place drop of marine epoxy (embed a colorful zip-tie for ease in relocating) in a central location and record location with GPS.
- Pan photographs: in circular motion, starting facing magnetic North, and in clockwise direction take 8-10 photographs using the *ocean* horizon as the upper boundary of the camera viewfinder. Photographs should overlap slightly so each set comprises a complete 360° view of the site.
- Record location with GPS and fill out pan photo location information on Photo Log.
- Place orange cone where pan photographs are taken and take a photo of that location for easy reference.
- Repeat pan photograph procedure if habitat is more varied.
- Take general site photos of places likely to be affected by oil for a before/after comparison if not otherwise captured by pan photographs, or other photos to characterize the site as needed or landmarks etc. to locate the site, and note each set of photos on Photo Log.

Equipment

- ☐ Data sheet: General Log
- ☐ Data sheet: Photo Log
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Marine Epoxy
- ☐ Brightly colored zip-ties
- ☐ Flags
- ☐ Clipboard
- ☐ Pencil

1. Intertidal Habitat General Log for _____spill

Team Leader_____ Recorder_____ Sampler_____

GENERAL INFORMATION	Date (dd/mm/yy)	Time (24h standard/daylight):___to___
Segment ID	Swell/Surge: _____ft	Rain:_____in/hr
Site Name/#	Wind: _____dir _____sp	Recent Rain: date_____ amt_____
SITE	Total Length _____m	Length Surveyed _____m

GPS (Record in decimal degrees, NAD83 datum):	GPS Location Description:
Start: LAT _____ LONG _____	
End: LAT _____ LONG _____	

SHORELINE TYPE	Select only ONE Primary (P) and ANY Secondary (S) types present		
	Rocky Cliffs		Riprap
	Exposed Man-made Structures		Exposed Tidal Flats
	Wave-cut Platforms		Sheltered Rocky Shores
	Fine-Medium grained Sand Beaches		Sheltered Man-made Structures
	Coarse-grained Sand Beaches		Sheltered Tidal Flats
	Mixed Sand and Gravel Beaches		Wetlands
	Gravel Beaches		Other _____

BIRDS AND MAMMALS	(maximum # seen at any one time during the sampling)			
Pelican	Great Egret	Lg Shorebird	Elephant Seal	CA Sea Lion
Cormorant	Snowy Egret	Sm Shorebird	Sea Otter	Harbor Seal
Gull	Oystercatcher	Other Birds	Dog	
Tern	Blue Heron			

Bird/Mammal Notes:_____

_____

DEBRIS AND POLLUTANTS	(magnitude at site):			
Plant Wrack: _____	Driftwood: _____	Shells: _____	Trash: _____	Oil/Tar: ____

Dead Animals (birds, fish, invertebrates, mammals):_____

HUMANS	(maximum # seen at any one time during the sampling not including spill cleanup; note behavior below)	Reef:____	Sand:____

_____

PHOTOGRAPHS	Record location on data sheet. Check when taken: Pan ☐ ☐ Access Point ☐
COMMENTS:	Ecological/Recreational/Cultural Issues

_____

_____

_____

_____

SKETCH OF AREA	Include photo transect locations, pan photos, landmarks, etc.

SHORELINE TYPE DESCRIPTIONS
(From NOAA. 2000. Shoreline Assessment Manual. HAZMAT Report No. 2000-1.)

Exposed Rocky Cliffs

- The intertidal zone is steep (greater than 30° slope), with very little width.
- Sediment accumulations are uncommon and usually ephemeral, because waves remove the debris that has slumped from the eroding cliffs.
- There is strong vertical zonation of intertidal biological communities.
- Species density and diversity vary greatly, but barnacles, snails, mussels, seastars, limpets, sea anemones, shore crabs, polychaetes, and macroalgae are often very abundant.

Exposed, Solid Man-Made Structures

- This shoreline type consist of solid man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- They are constructed of concrete, wood, or metal.
- Often there is no exposed substrate at low tide, but a wide range of habitats may be present .
- They are built to protect the shore from erosion by waves, boat wakes, and currents, and thus are exposed to rapid natural removal processes.
- Attached animals and plants are sparse to moderate.

Exposed Wave-Cut Platforms

- The intertidal zone consists of a flat rock bench of highly variable width.
- The shoreline may be backed by a steep scarp or low bluff.
- There may be a beach of sand- to boulder-sized sediments at the base of the scarp.
- The platform surface is irregular and tidal pools are common.
- Small amounts of gravel can be found in the tidal pools and crevices in the platform.
- These habitats can support large populations of encrusting animals and plants, with rich tidal pool communities.

Fine-Grained Sand Beaches

- These beaches are generally flat and hard-packed.
- Though they are predominately fine sand, there is often a small amount of shell hash.
- There can be heavy accumulations of wrack present.
- They are utilized by birds and turtles for nesting and feeding.
- Upper beach fauna are generally sparse, although amphipods can be abundant; lower beach fauna can be moderately abundant, but highly variable.

Medium-to-Coarse-Grained Sand Beaches

- These beaches have relatively steep beach faces and soft substrates.
- Coarse-sand beaches can undergo rapid erosion/deposition cycles, even within one tidal cycle.
- The amount of wrack varies considerably.
- They are utilized by birds and turtles for nesting and feeding.

Mixed Sand and Gravel Beaches

- These beaches are moderately sloping and composed of a mixture of sand and gravel.
- Because of the mixed sediment sizes, there may be zones of pure sand, pebbles, or cobbles.
- There can be large-scale changes in the sediment distribution patterns depending upon season, because of the transport of the sand fraction offshore during storms.
- Because of sediment desiccation and mobility on exposed beaches, there are low densities of attached animals and plants.
- The presence of attached algae and animals indicates beaches that are relatively sheltered, with the more stable substrate supporting a richer biota.

Gravel Beaches

- Gravel beaches are composed of sediments ranging in size from pebbles to boulders. The gravel-sized sediments can be made up of shell fragments.

- They can be very steep, with multiple wave-built berms forming the upper beach.
- Attached animals and plants are usually restricted to the lowest parts of the beach, where the sediments are less mobile.
- The presence of attached algae, mussels, and barnacles indicates beaches that are relatively sheltered, with the more stable substrate supporting a richer biota.

Riprap

- Riprap is composed of cobble- to boulder-sized blocks of granite, limestone, or concrete.
- Riprap structures are used for shoreline protection and channel stabilization (jetties)
- Attached biota are sparse.

Exposed Tidal Flats

- Exposed tidal flats are broad intertidal areas composed primarily of sand and minor amounts of shell and mud.
- The dominance of sand indicates that currents and waves are strong enough to mobilize the sediments.
- They are usually associated with another shoreline type on the landward side of the flat, though they can occur as separate shoals; they are commonly associated with tidal inlets.
- Biological utilization can be very high, with large numbers of infauna, heavy use by birds for roosting and foraging, and use by foraging fish.

Sheltered Rocky Shores

- These are bedrock shores of variable slope (from vertical cliffs to wide, rocky ledges) that are sheltered from exposure to most wave and tidal energy.
- Wide shores may have some surface sediments, but bedrock is the dominant substrate type
- Species density and diversity vary greatly, but biota are often very abundant.

Sheltered, Solid Man-Made Structures

- These structures are solid man-made structures such as seawalls, groins, revetments, piers, and port facilities
- Most structures are constructed of concrete, wood, or metal, and their composition, design, and condition are highly variable.
- Often there is no exposed beach at low tide, but a wide variety habitats may be present.
- Attached animal and plant life can be moderate to high.

Sheltered Tidal Flats

- Sheltered tidal flats are composed primarily of mud with minor amounts of sand and shell.
- They are present in calm-water habitats, sheltered from major wave activity, and are frequently backed by marshes.
- The sediments are very soft and cannot support even light foot traffic in many areas.
- They can be sparsely to heavily covered with algae and/or seagrasses.
- They can have very heavy wrack accumulations along the high-tide line.
- There can be large concentrations of shellfish, worms, and snails on and in the sediments.
- They are heavily utilized by birds and fish for feeding.

Salt-and Brackish-Water Marshes

- These marshes contain vegetation which tolerates water salinity down to about 5 ppt.
- Width of the marsh can vary widely, from a narrow fringe to extensive areas.
- Sediments are composed of organic-rich muds except on the margins of barrier islands where sand is abundant.
- Exposed areas are located along waterbodies with wide fetches and along busy waterways.
- Sheltered areas are not exposed to significant wave or boat wake activity.
- Resident flora and fauna are abundant with numerous species with high utilization by birds, fish, and shellfish.

1. b. Intertidal Habitat Photo Log

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Photographer(s): _____ Camera Model: _____

List each set of pan photographs and any others taken at the site area, such as access point, landmarks, or overview photos.

Photo Type/Description (e.g., Pan #1; Overview,)	Photo GPS Location		Location Description / Comments
	LAT	LONG	

2. Rocky Intertidal habitat Species log

- Species list on data sheet should be modified to fit the region.
- Record on the data sheet the presence/absence (check box) and appearance of all species present. Indicate species not looked for (if unknown, etc.) by filling in ND (No Data) or cross out entirely.
- The Species Log should take no more than 10 minutes to fill out (including extra site reconnaissance).
- Data sheet should be filled out at the end of sampling each site area, after species have been looked for/noticed while performing the other sampling in the same area.

Equipment

- ☐ Data sheet: Species Log
- ☐ GPS
- ☐ Clipboard
- ☐ Pencil

2. Intertidal Habitat Species Log

Team Leader_____ **Recorder**_____ **Sampler**_____

GENERAL INFORMATION	Date (dd/mm/yy):	Time (24h standard/daylight) : hrs to hrs
Segment ID		
Site Name/#		
GPS Location	LAT _____ LONG _____	
Pan Photograph taken	_____yes _____no	

Abundance (**P**=Present, **A**=Absent, **ND=**No Data)
Appearance (**ND**=No Data √=Healthy **F**=Fertile/Flowers **B**=Bleached **D**=Damaged)

Species	Common Name	Abundance			Appearance	Notes
ALGAE/PLANTS		P	A	ND		
Cladophora columbiana						
Ulva/Enteromorpha	Sea lettuce					
Egregia menziesii	Feather boa kelp					
Eisenia arborea						
Endarachne/Petalonia						
Fucus gardneri	Northern rockweed					
Halidrys dioica/Cystoseira spp.						
Hesperophycus californicus	Olive rockweed					
Laminaria spp						
Pelvetiopsis limitata	Dwarf rockweed					
Sargassum muticum						
Scytosiphon spp.						
Silvetia compressa	Golden rockweed					
Endocladia muricata	Turfweed					
Chondracanthus canaliculatus						
Mastocarpus papillatus	Turkish washcloth					
Mazzaella affinis						
Mazzaella spp.(= Iridaea spp.)	Iridescent weed					
Porphyra sp.						
Phyllospadix scouleri	Flat and wide (2-4mm) leafs					
Phyllospadix/torreyi	Cylindrical and wiry leafs					
INVERTEBRATES						
Anthopleura elegantissima/sola	Green anemone					
Phragmatopoma californica	Honeycomb tube worm					
Mytilus californianus and galloprovenciallis	California mussel					
Littorina spp	Periwinkle					
Limpets						
Haliotis cracherodii	Black abalone					
Tegula spp	Snail					
Chthamalus spp/Balanus spp						
Tetraclita rubescens	Pink barnacle					
Pollicipes polymerus	Gooseneck barnacle					
Pisaster ochraceus	Ochre seastar					
Asterina miniata	Bat star					
Strongylocentrotus purpuratus	Purple sea urchin					
Hemigrapsus spp						
Pachygrapsis crassipes	Striped shore crab					
Pagurus spp.	Hermit crabs					
Ligia occidentalis	Rock louse					

2.b Rocky Intertidal Habitat Species Log PAGE 2

Abundance (**P**=Present, **A**=Absent, **ND=**No Data)
Appearance (ND=No Data √=Healthy **F**=Fertile/Flowers **B**=Bleached, **D**=Damaged)

Species	Common Name	Abundance			Appearance	Notes
		P	A	ND		

3. Rocky Intertidal Habitat Timed Search for Abalone and Seastar

- Define a search region (rectangular if possible) using GPS waypoints, marine epoxy, and photographs of the four corners of the search area.
- Using calipers, measure radial size of *Pisaster ochraceus* (Ochre seastar) and length of *Haliotis cracherodii* (Black Abalone) to nearest 10mm and mark with chalk to avoid re-sampling individuals. NOTE: If there will be many animals and limited time, size categories can be used instead of actual size measurements to speed up the sampling.
- Search for 10 minutes and record searched area in m^2.

Equipment

- ☐ Data sheet: Timed Search
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Marine Epoxy
- ☐ Caliper or laminated ruler
- ☐ Stopwatch
- ☐ Chalk (Forestry)
- ☐ Clipboard
- ☐ Pencil

3. Rocky Intertidal Habitat Timed Search for Abalone and Seastar Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader_____ Recorder_____ Sampler_____

Waypoints record in decimal degrees (Make sure GPS is set to decimal degrees and NAD 83 datum)

	Inshore	Offshore
Downcoast	photograph number_____	photograph number_____
	LAT_____ LONG_____	LAT_____ LONG_____
Upcoast	photograph number_____	photograph number_____
	LAT_____ LONG_____	LAT_____ LONG_____

Area searched_____m^2

Black Abalone	
Length (mm)	**Number**
5	
10	
15	
20	
25	
30	
35	
40	
50	
60	
70	
80	
90	
100	
110	
120	
130	
140	
150	
160	
170	
All	

Ochre Seastars	
Radius (mm)	**Number**
5	
10	
20	
30	
40	
50	
60	
70	
80	
90	
100	
110	
120	
130	
140	
150	
160	
170	
180	
190	
200	
All	

4. Rocky Intertidal Habitat Mussel Tissue

- Find a monolayer cluster of mussels. (Do not collect near silver bolts if found; they designate permanent monitoring locations).
- Photograph overview and close-up and record location with GPS.
- Wearing polyethylene gloves, remove 20 individual mussels of 5-8cm in size, or enough for a 10g sample.
- Wrap mussels in solvent-rinsed aluminum foil (dull side) and place in Ziploc bag.
- Place label and 1st Ziploc bag into a second Ziploc bag.
- Place bag and break instant icepack in soft-sided cooler.
- Attach evidence tape to each sample bag.
- Fill out chain of custody form.
- Repeat as needed, changing gloves between samples.

Equipment

- ☐ Data sheet: Mussel
- ☐ Data labels: Mussel
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Polyethylene gloves (3 pairs)
- ☐ Aluminum foil: solvent-rinsed (3)
- ☐ Ziploc bags: gallon-sized (6)
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Evidence Tape
- ☐ Pencil

4. Rocky Intertidal Habitat Mussel Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader_____ Recorder_____ Sampler_____

Sample ID	Mussel Species	Number collected	Photo #
	GPS location: LAT	LONG	

Sample ID	Mussel Species	Number collected	Photo #
	GPS location: LAT	LONG	

Sample ID	Mussel Species	Number collected	Photo #
	GPS location: LAT	LONG	

Sample ID	Mussel Species	Number collected	Photo #
	GPS location: LAT	LONG	

Sample ID	Mussel Species	Number collected	Photo #
	GPS location: LAT	LONG	

4. Rocky Intertidal Habitat Mussel Labels

Mussel Label

Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species__________________________
Number of mussels_______ Photo #s_________
GPS location: LAT___________________
LONG_____________________

Mussel Label

Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species__________________________
Number of mussels_______ Photo #s_________
GPS location: LAT___________________
LONG_____________________

Mussel Label

Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species__________________________
Number of mussels_______ Photo #s_________
GPS location: LAT___________________
LONG_____________________

Mussel Label

Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species__________________________
Number of mussels_______ Photo #s_________
GPS location: LAT___________________
LONG_____________________

Mussel Label

Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species__________________________
Number of mussels_______ Photo #s_________
GPS location: LAT___________________
LONG_____________________

Mussel Label

Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species__________________________
Number of mussels_______ Photo #s_________
GPS location: LAT___________________
LONG_____________________

5. Rocky Intertidal Habitat Photo Transect

- Locate stretch of rocky coast at least 30m in length. If reef is not a relatively flat reef 30m in length, see alternative photoplot layout below.
- Using the 50m transect tape mark off a distance of 30m above the mean high tide level where living organisms are first detected, place marine epoxy (embedding a brightly colored zip tie for ease in relocating location)on the upcoast and downcoast edges of the 30m length (known as the base transect). Photograph locations, and record locations with GPS.
- Obtain compass headings for base and sampling transects. Sampling transects are placed perpendicular to the ocean.
- At 3m increments starting at 0m along the base transect, use the 100m transect tape to run a sampling transect from the upper intertidal to the ocean along the previously recorded compass heading. This will produce 11 sampling transects (see Figure 1).
- Take a photograph of each sampling transect, facing offshore.
- Divide the total sampling transect distance into tenths and at each distance take a photograph.
- Frame each photograph with a quadrat of 0.5m x 0.75m, inside dimensions, oriented as seen in Figure 2. The shorter edge of the quadrat should be parallel with the sampling transect tape and the leading edge of the quadrat should not extend past the sampling distance.

Alternative photoplot layout

- If rocky area does not fit the standard 30m transect configuration (steep short reef, reef not oriented parallel to shore, rip-rap, etc.), then photoplots should be arrayed in three lines along reef contour, one is high zone, one in mid, and one in low zone.
- Place the quadrat perpendicular to the rock surface and take photo. Take a total of 120 photos, 40 photos per contour. Note: on vertical surfaces one person must hold the quadrat while a second person takes the photos.
- Sketch the general locations and orientations of all 120 photos at the bottom of the data sheet
- Record at least 2 GPS waypoints and describe locations and indicate on sketch on data sheet.

Equipment

- ☐ Data sheet: Photo Transect
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Marine Epoxy
- ☐ Compass
- ☐ Transect tape: 50m
- ☐ Transect tape: 100m
- ☐ Quadrat of grey PVC: 0.5m x 0.75m inside dimensions
- ☐ Brightly colored zip ties
- ☐ Pencil

Figure 1.

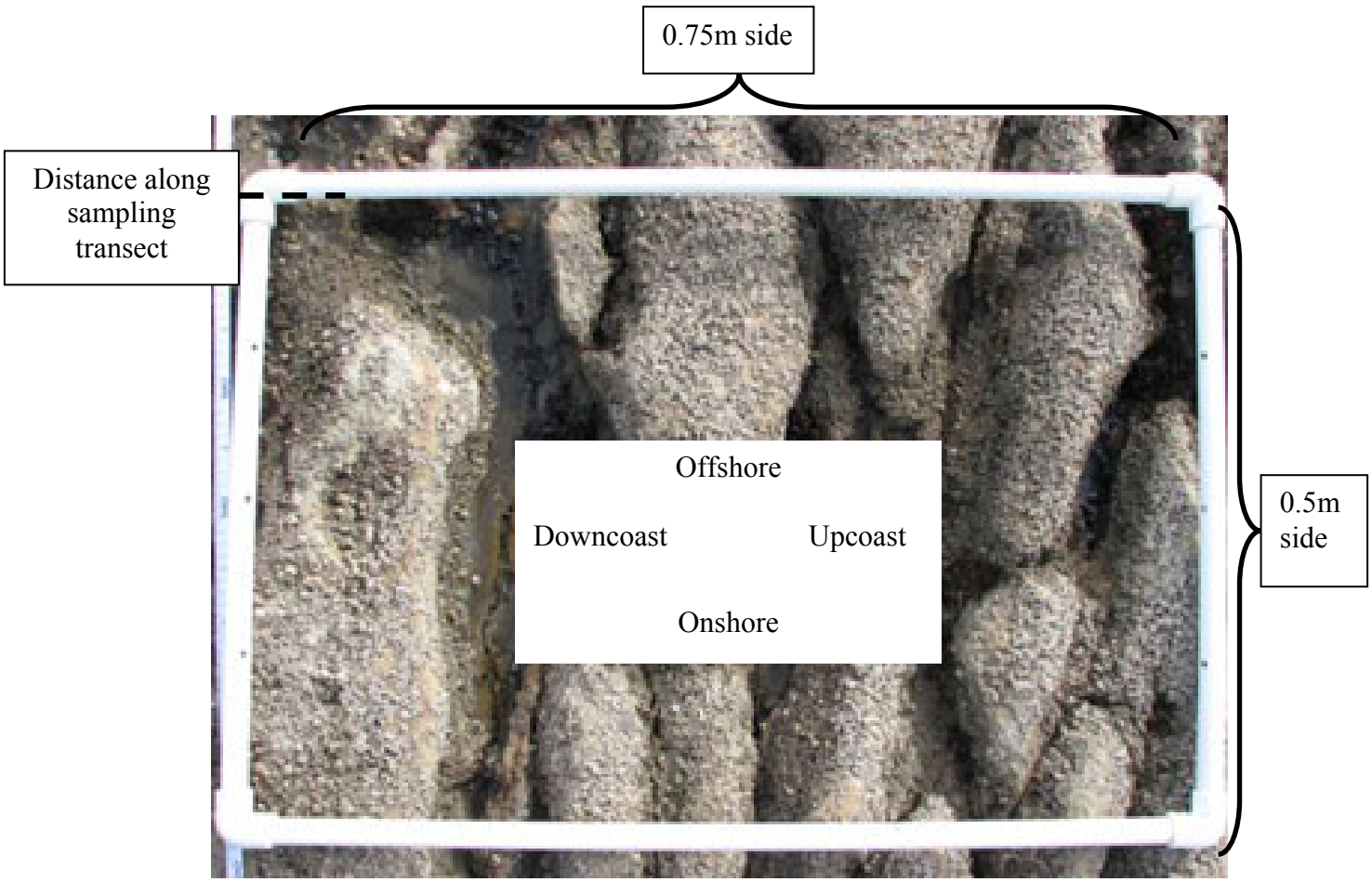


Figure 2.

5. Rocky Intertidal Photo Transects Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____ Recorder: _____
Sampler: _____

Waypoints record in decimal degrees (Make sure GPS is set to decimal degrees and NAD 83 datum)
Compass headings record in degrees.

Downcoast	Photograph number_____	Upcoast	Photograph number_____
	LAT_____ LONG_____		LAT_____ LONG_____
Downcoast to Upcoast heading		_____	
Sampling Transect heading		_____	

Beginning Photograph Number_____

Base Transect	Sampling Transect Length	Distance along sampling transect									
		1	2	3	4	5	6	7	8	9	10
Example	45m	4.5	9	13.5	18	22.5	27	31.5	36	40.5	45
0m											
3m											
6m											
9m											
12m											
15m											
18m											
21m											
24m											
27m											
30m											

Ending Photograph Number_____

Notes_____
_____
_____
_____

DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page_____ of _____

Sampler Ph #	Send Results To	Lab Number
Address	Address	Field Number
City Zip CA	City Zip CA	Lab Storage
	Copies To	Spill Title
Date Required/Reason	Address	Suspect
Shipped Via	City Zip	Index-PCA

☐ Fish & Wildlife Loss Date:_____ Region:_____

☐ DFG Code Violation:_____

☐ Suspected or Potential Problem

☐ Routine Analysis

Water Temp: F or C pH: DO: mg/L Conductivity: u mhos/cm

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)						Petroleum	Sample Type: Water	Sample Type: Filtered Water	Sample Type: Soil	Sample Type: Tissue	Number of Containers: Plastic	Number of Containers: Glass	Number of Containers: VOA Vial		Preservation: Temp	Preservation: Acid	
																						X

Problem Description

Suspect/Incident Location

Comments/Special Instructions

Pollution Action Kit: Yes☐ No☐

Glove Size: Large ☐ Medium ☐

Hazmat Shipper Requested: Yes☐ No☐

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date

LAB COPIES: WHITE, CANARY, PINK **SUBMITTER: GOLDENROD** FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1995 Nimbus Road
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Water Pollution Control Lab
2005 Nimbus Road
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C. Wetland Habitat

The following pages consist of printable materials for inclusion in the "Go-Kit." Introductory and guidance materials, decision charts and matrices are included in this section.

Wetland Habitat Introduction

The wetland protocol consists of a "core" protocol and additional protocols. The core protocol was designed to maximize the amount of information gathered in a small period of time. The core is to be repeated at multiple locations in a large wetland if time permits, and at one or two locations in a small wetland. Five locations, or sites, are recommended for sampling in a large wetland before moving on to the additional protocols in order to cover a substantial portion of the wetland. Covering more of the wetland with the core protocol will increase the likelihood of the location of impact having been pre-sampled with some basic information gathered, rather than spending hours at one location completing all protocols. Priority locations for sampling in large wetlands include high-oiling-probability areas, areas representative of the wetland habitat and relatively easy access areas.

The core protocol consists of completing a general log data sheet of basic site information, taking 360° pan photographs, 100 close-range photos of vegetation and 50 close-range photos of snails. Vegetation photos will be scored in the lab for estimates of percent cover and possibly species richness, depending on the quality of the photos and the familiarity to the area and to the vegetation of the person scoring the photos.

The additional, more extensive protocols will be implemented as time permits. They consist of collection of benthic macroinvertebrates for population density estimates; sediment collection for grain size, salinity and organic content measures as well as chemical analysis; bivalve tissue samples for chemical analysis; bivalve population density survey; snail tissue collection for chemical analysis; snail proportion of live/dead estimate; fish seining for presence/absence or population survey and/or tissue sample collection for metabolites in bile; bird survey; and if a 24-hour time period is available, a crab survey and insect survey for population density and species richness estimates.

Most of the protocols are designed around a "base transect" of 30 meters, with the exception of the bivalve, fish and bird surveys. If the core protocol only, and not any of the additional protocols, is to be done at a location, the transect tape will not be laid out in order to save time. Distances will be estimated while walking. (The length of one's pace can be measured in the parking area before sampling if necessary).

What can be sampled is dependent on the tide, the type of wetland, the wetland size, the number of people present, and the time period available.

Chemical Analysis

Samples for chemical analysis should be analyzed for PAH (polynuclear aromatic hydrocarbons) concentration and oil fingerprint analysis. PAHs are analyzed for NRDA instead of total (petroleum) hydrocarbons because most of the toxicity in oil results from the PAHs. The standard method used for PAH analysis for NRDA is the Modified EPA Method 8270 (GC/MS), expanded to include the alkylated homologs, using 1ppb detection levels for all samples. (EPA 2001)

The same 10g sample can be analyzed for PAH concentration and oil fingerprint analyses. PAH analysis will likely be performed on all replicates collected, while fingerprinting will be done on only a few of the samples as many replicates are not needed to identify the oil present. Indicate on each sample label which analyses will be performed.

All equipment that is in contact with samples for chemical analysis must be solvent-rinsed prior to sampling. Solvent-rinsing involves rinsing equipment with methylene chloride or acetone; if acetone is used, then a second rinse with pentane or

hexane is required. If aluminum foil is used for sampling, make sure the dull side is solvent-rinsed and store with the clean sides folded together. Aluminum foil can also be cleaned by heating at 450°C for over one hour instead of the solvent-rinse. If cleaning/rinsing equipment in the field, first wash with soap & hot water, then rinse with warm distilled water, then rinse with solvents (above). All solvents must be stored in glass or Teflon containers, not plastic. (USFWS 2006)

All equipment in direct contact with samples should be made of inert materials such as glass, Teflon, high quality stainless steel or HDPE (high-density polyethylene). Avoid direct contact between samples and PVC, natural or neoprene rubber, nylon, polystyrene, galvanized metal, brass, copper, lead, other metal materials, soda glass, paper tissues, talcum powder, and painted surfaces. (EPA 2001)

These requirements apply to all aluminum foil for snail, bivalve, and fish samples if collected, as well as to the corers for sediment samples and the shovel and sieve for bivalve samples. Aluminum foil and sediment corers (enough for all samples) are pre-rinsed and included in the Kit. The bivalve equipment consists of only one stainless steel shovel and one sieve. While they are pre-rinsed, they would need to be rinsed between the collection of each sample for decontamination. For the purposes of this rapid pre-spill protocol the bivalve sampling equipment will not be solvent-rinsed in the field between samples; instead, the shovel will be wiped thoroughly with paper towel between samples, and the paper towel will then be placed in a plastic bag for later proper disposal. Solvent rinsing in the field is not practical given the time constraints of pre-spill sampling and the amount of information that would be given up during that time. We decided to maintain the inclusion of bivalve collection for tissue samples given their importance as bioaccumulators and given the ease of sampling bivalves. OSPR will need to decide the legal importance of solvent-rinsing between samples, and if necessary the protocol can be adjusted.

Sampling Equipment

Weatherproof (e.g., “Rite in the Rain”®) paper will be used for all data sheets. Data labels were ordered perforated instead of Rite in the Rain because tearing or cutting the labels will be too much of a hassle for this rapid protocol. If there is sufficient time, pre-cutting weatherproof sample labels would work well.

U.S. Environmental Protection Agency, EPA. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823-B-01-002. Office of Science & Technology, Office of Water. Washington, DC. October. <URL: http://www.epa.gov/waterscience/cs/collection.html >

U.S. Fish & Wildlife Service. 2006. National Oil Spill Contingency Plan. Appendix S. Division of Environmental Quality. October. <URL: http://www.fws.gov/contaminants/FWS_OSCP_05/FWSContingencyTOC.htm#S>

Wetland Habitat Protocol Overview

A few considerations must be made before deciding what to sample in a wetland habitat in a pre-spill situation. Several factors affect what can be collected for this protocol in each unique set of circumstances. Among these factors are the type of wetland, the tide level, the amount of time available before the oil hits, and the number of people present.

Tables are included in the following pages as a quick reference guideline for the sample parameters.

The tide levels table shows whether each parameter can be assessed at a low, medium or high tide level. Generally, tide levels during spring tides (as opposed to neap tides) were considered for the purposes of this table. Low tide is optimal for most samples, and at high tide only few may be included. This table may guide in determining which parameters are sampled first given whether the tide is rising or receding.

The wetland types table shows which parameters may be sampled in a salt marsh and estuary, both large and small. As a point of reference, an example of a large salt marsh is Point Mugu; small salt marsh – Malibu Lagoon; a large estuary – Elk Horn Slough; a small estuary – Topanga.

A matrix was created for each of the four wetland types. These matrices take into consideration the time and number of people available to sample under optimal conditions, such as when tide is not a factor and time is used as efficiently as possible.

Each cell in the matrix shows which wetland samples can be collected given the number of people present and the time frame available. The first time period given is only a 1/2-hour while the rest are subsequent hours because of the likelihood of only having a 1/2-hour to sample. Each sample type is given a letter to better fit in the grid.

The samples were decided upon in each cell based on the amount of time it takes one person to complete the sample collection (sample times listed below the matrix). For example, with 3 people for 2 hours, one person could collect the core protocol at 4 sites, while the second person could collect benthic invertebrates and sediment at one site, and the third person could collect the core at a fifth site, bivalves, snails at one site, and a bird survey.

The bold line indicates a decision line. Below and to the left of the line, the team leader would likely follow the matrix. There aren't any other options within those cells if five different sites are to be sampled with the core protocol in a large salt marsh. Above and to the right of the line, the team leader may decide to collect a different combination of samples than the ones listed in the matrix. For example, with 4 people for 3 hours, perhaps the team leader would elect to sample the core protocol at five sites, benthic invertebrates, sediment and snails at three sites, and bivalves at 4 sites, leaving out the fish and bird surveys to sample the additional protocols at more than one site.

A guide worksheet is included to aid the team leader in deciding and organizing what to sample where and how many people to send. Notes can be taken on this worksheet while looking through the guide tables and a final plan can be organized and formulated.

In addition, a final field sample log is included with the data sheets to record the number of sites sampled and number of replicates collected for each parameter. This log is a final record of the information that was gathered and the number of samples that were collected so that all of the information is in one place, not only on each sample label, for future reference. GPS coordinates will be recorded from insect sample labels only because this is the only parameter that does not have an associated data sheet. Also, the names of everyone present will be recorded on the field sample log.

Tide Level

Parameter	Tide level		
	Low	**Medium**	**High**
Vegetation photos	Optimal	only if visible	NO (not exposed)
Snail photos	Optimal	NO (not exposed)	
Benthic invertebrates	Optimal	only if top of corer is above water after inserting* **	
Sediment	Optimal		
Bivalves	Optimal		
Snail collection	Optimal	If can reasonably collect under water – best judgement	
Fish	NO	O.K.	Optimal
Birds	O.K.	Optimal as tide is receding	NO (not for shorebirds)
Crabs	Optimal (for setting traps)	O.K.	O.K.
Insects	Optimal (for setting traps)	O.K.	O.K.

*If collecting benthic invertebrates at a medium tide when the substrate is not exposed, the samples can still be collected if the 5cm line on the core can be seen underwater and the top of the core is above the water when inserted 5cm. Collect the water in the core along with the sample. Note the tide level and water depth so that post-spill sampling can occur at a similar water depth so as not to affect the before/after comparison. Two 1L sample jars may be needed per sample to compensate for the water volume and to leave enough space in each jar to add the ethanol.

**If collecting sediment at medium tide when the substrate is not exposed, do not collect the water along with the sample; pour off the water from the top of the corer before putting the soil in the sample bag – only a negligible amount of fine sediment particles may be lost when pouring the water from the core.

Wetland Type

	Salt marsh		Estuary	
Parameter	Large	Small	Large	Small
Vegetation photos	✓	May require altering transect scheme (e.g., 2 rows of 25)	*	NO
Snail photos	✓	If present	If present	NO
Benthic invertebrates	✓	✓	✓	✓
Sediment	✓	✓	✓	✓
Bivalves	✓	✓	✓	**
Snail collection	✓	If present	If present	NO
Fish	✓	✓	✓	✓
Birds	✓	✓	✓	✓
Crabs	✓	If present	If present	NO
Insects	✓	✓	✓	NO

*In a large estuary, if the substrate beneath the vegetation is too soft to walk on and would result in sinking, for example often where *Spartina* is present, then vegetation photos cannot be taken in that location.

**Test the salinity of the water in a small estuary before sampling for bivalves if uncertain of whether salinity levels are too low. If the salinity is less than 20ppt, then choose another location or do not sample bivalves because they cannot survive at low salinities and will likely not be found.

Large Salt Marsh or Estuary

People	1/2	1	2	3	4	5	6	7	8	overnight
10	Core: 5 sites, A & B	Core: 5 sites; A @ 2; B, C, D, E & F								
9	Core: 5 sites, A & C	Core: 5 sites; A, B; C @ 2; D, E & F								
8	Core: 5 sites & A	Core: 5 sites; A, B, C, D, E & F								
7	Core: 5 sites C & D	Core: 5 sites; A, B, C, D & E	Core: 5 sites; A & B @ 2, C, D, E & F							
6	Core: 5 sites & C	Core: 5 sites; A, B, C, D & F	Core: 5 sites; A & B @ 2, C, D, E & F							
5	Core @ 5 sites	Core: 5 sites; A, B & C	Core: 5 sites; A, B, C, D, E & F							
4	Core @ 4 sites	Core: 5 sites; A & C	Core: 5 sites; A, B, C, D & E	Core: 5 sites; A, B, C, D, E & F						
3	Core @ 3 sites	Core @ 5 sites & C	Core: 5 sites; A, B, C, D & F	Core: 5 sites; A, B, C, D, E & F						
2	Core @ 2 sites	Core @ 4 sites	Core @ 4 sites; A & B	Core: 5 sites; A, B, C, D & F	Add more sites for A, B, C & D -->					
1	Core	Core @ 2 sites	Core @ 4 sites	Core @ 5 sites & C	Core: 4 sites; A, B & C	Core: 5 sites; A, B & C	Core: 5 sites; A, B, C, D & F	Add more sites for A, B, C & D -->		G, H

Time (hrs)

"Core: 5 sites; A @ 2; B, C, D, E & F" means the Core protocol would be done at 5 separate sites within the wetland. Protocol A could be done at two separate sites (of the 5), and protocols B, C, D, E and F could all be done at one site (likely one of the sites where A was done).
Other combinations (e.g., Core @ 5 sites; A & C @ 3; B & D @ 2) are also valid and are up to the team leader's discretion.

		Time to sample:	Location:	
	Core (General Log, GPS, Pan, Veg. & Snail Photos)	30min	Core, A, B, D, G, H	all sampled at same location
A	Benthic Invertebrates	1hr	F	possibly at same location as above,
B	Sediment	1hr		but not neccessarily
C	Bivalves	30min	C	near opening of large channel or
D	Snail Collection	30min		lagoon with sandy substrate
E	Fish	1-2hrs	E	in tidal creeks
F	Bird Survey	30min		
G	Crabs	overnight		
H	Insects	overnight		

Small Salt Marsh

People	1/2	1	2	3	4	overnight
5	Core, A, C & D	Core, A, B, C, D & F	Core, A, B, C, D, E & F			
4	Core, A & C	Core, A, B, C, D & F	Core, A, B, C, D, E & F			G, H
3	Core, C & D	Core, A, B & C	Core, A, B, C, D, E & F			G, H
2	Core & C	Core, A & C	Core, A, B, C, D & F	Core, A, B, C, D, E & F		G, H
1	Core	Core & C	Core, A & B	Core, A, B, C & D	Core, A, B, C, D & F	G, H

Time (hrs)

Time to sample:

Core	(Gen. Log, GPS, Pan, Veg. & Snail Photos)	30min
A	Benthic Invertebrates	1hr
B	Sediment	1hr
C	Bivalves	30min
D	Snail Collection	30min
E	Fish	1-2hrs
F	Bird Survey	15min
G	Crabs	overnight
H	Insects	overnight

Small Estuary

People	1/2	1	2	3	4
6	Core, A, B, C & F	Core, A, B, C, E & F			
5	Core, A, C & F	Core, A, B, C, E & F			
4	Core, A, C & F	Core, A, B, C, E & F			
3	Core, C & F	Core, A, B, C & F	Core, A, B, C, E & F		
2	Core, C & F	Core, A, B, C & F	Core, A, B, C, E & F		
1	Core* & F	Core, C & F	Core, A, C & F	Core, A, B, C & F	Core, A, B, C, E & F

Time (hrs)

*Core for small estuary consists of 3-4 pan photos and a General log taking ~ 15 minutes, no vegetation photos.

Wetland Habitat Decision WorksheetSpill: _____ Date:_____ Team Leader: _____

	In	Out			
Tide:	L/M/H	L/M/H	_____' at ___:___	Size:	Sm/Med/Lg

Type: Salt marsh Estuary

Total # People: _____ Total Time estimate: _____

		# of Sites	People		Time to sample	Hour: 1 2 3 4 5 6 7 8
1. a. Vegetation Photos	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
b. Snail Photos	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
2. Benthic Invertebrates A	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
3. Sediment Cores B	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
4. Bivalves C	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
5. Snail Collection D	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
6. Fish E	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
7. Bird Survey F	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
8. Crabs G	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	
9. Insects H	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____	

Notes:

Example Wetland Habitat Decision Worksheet Spill: _____ Date:_____ Team Leader: _____

Tide: In L/(M)/H Out L/M/H _____' at ___:___

Type: (Salt marsh) Estuary

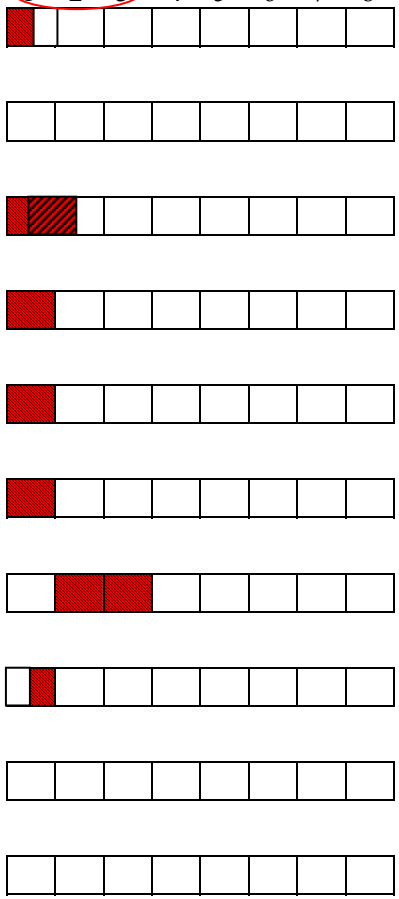
Size: Sm/Med/(Lg)

Total # People: __10___

Total Time estimate: __3 hrs.__

		# of Sites	People		Time to sample
1. a. Vegetation Photos	☑	__5__	RG @ #1&2 ___ @ ___	ND @ #3-5 ___ @ ___	0.5 – 0.75 hrs.
b. Snail Photos	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____
2. Benthic Invertebrates A	☑	__3__	RA @ _#1 SL_ @ _#3	RG @ _#2 ___ @ ___	1 – 1.5 hrs.
3. Sediment Cores B	☑	__2__	DW @ _#1 ___ @ ___	MH @ _#2 ___ @ ___	__1 hr._
4. Bivalves C	☑	__3__	JP_ @ _A_ JP&JC@ C	JC_ @ _B_ ___ @ ___	__1 hr._
5. Snail Collection D	☑	__3__	JD_ @ #1&2 ___ @ ___	KW @ _#3 ___ @ ___	0.5 – 1 hr.
6. Fish E	☑	__3__	RA,SL @ a DW,MH @ a	ND,JD,RG @ b JP,JC,KW @ c	1.5 – 2 hrs.
7. Bird Survey F	☑	__1__	KW @ _#6 ___ @ ___	___ @ ___ ___ @ ___	__0.5 hr._
8. Crabs G	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____
9. Insects H	☐	_____	___ @ ___ ___ @ ___	___ @ ___ ___ @ ___	_____

Hour: (1) (2) (3) 4 5 6 7 8



Notes:

Wetland Habitat Protocols

Wetland Habitat Core Protocols

Wetland Habitat Additional Protocols

Wetland Habitat Overnight Protocols

Additional Data Sheets

Wetland Habitat Go-Kit Equipment list:

- ☐ Data sheet: General Log
- ☐ Data sheet: Photo Log
- ☐ Data form: Photo Form (laminated)
- ☐ Data sheet: Vegetation & Snail Photos
- ☐ Data sheet: Benthic Invertebrate
- ☐ Data labels: Benthic Invertebrate
- ☐ Data sheet: Sediment
- ☐ Data labels: Sediment
- ☐ Data sheet: Bivalve
- ☐ Data labels: Bivalve
- ☐ Data sheet: Snail
- ☐ Data labels: Snail
- ☐ Data form: Chain of Custody (6)
- ☐ Clipboards
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Empty digital card
- ☐ Compass (2)
- ☐ Camera Monopod
- ☐ Pin flags (2)
- ☐ Polyethylene gloves (25 pairs)
- ☐ Aluminum foil: solvent-rinsed (30 + 2 extra)
- ☐ Ziploc bags: quart-sized (60 +6 extra)
- ☐ Ziploc bags: gallon-sized (20 + 2 extra)
- ☐ Disposable instant ice bags or blue ice packs: 5”x7” (8)
- ☐ Soft-sided cooler: 14”x12”x7” (2)
- ☐ Transect tape: 50m
- ☐ Soil corers – solvent-rinsed, polyethylene (10)
- ☐ Wooden dowel (10)
- ☐ Wooden handles (10)
- ☐ Invertebrate Corer: 10.5cm diameter, 5cm depth marked
- ☐ Stainless steel shovel
- ☐ Sieve: Polyethylene, 3mm mesh
- ☐ Refractometer
- ☐ Disposable plastic pipettes (10)
- ☐ 10% Buffered formalin (at vehicle, not in field)
- ☐ 1L plastic sample jars: wide-mouth (20) (at vehicle)
- ☐ Distilled water in squirt bottle, one at vehicle, one for field
- ☐ Kimwipes
- ☐ Evidence tape
- ☐ Shop towels or paper towels
- ☐ Ruler
- ☐ Binoculars
- ☐ Fish seine/block net
- ☐ Gee Minnow Traps: 9” x 17.5” with ¼” mesh (50)
- ☐ Insect traps (10): double-sided yellow sticky traps, 6.3” x 7.5”
- ☐ Insect trap holders
- ☐ Wax paper
- ☐ Clear packing tape (at vehicle)
- ☐ Grease pencil or dry erase marker
- ☐ Sharpie
- ☐ Pencil – mechanical (6)
- ☐ Eraser
- ☐ Backpack
- ☐ Plastic bags for single-use core disposal
- ☐ Quadrat: 0.75m x 0.5m, PVC

1. Wetland Habitat Core Photo Protocol

Setup:

Set up the monopod for *your* camera so that a 0.75m x 0.5m area can be taken for each photo. Adjust the monopod height or adjust the camera zoom to the 0.375m² area on the ground. If you adjust the zoom, make sure that it is consistent throughout the photo sampling.

Take a photograph of a 0.75m x 0.5m quadrat placed flush on the ground, at the vehicle not in the vegetation, to be used to later "frame" the photos back in the lab to score for percent cover and abundance counts within that quadrat area.

Measure your pace before getting to the site so that you can accurately walk 30m along the base transect, 2.5m between photos and 2m between sampling transects, as the vegetation and snail photo distances will be paced rather than measured directly.

The vegetation data sheet should be modified to list the appropriate species in your region.

If 2 people are sampling the core protocol, 1 person can fill out the general log, take GPS points and pan photos while the 2nd person takes the vegetation photos.

a. General Log

- Fill out General Log data sheet for every 30m portion of wetland habitat sampled.
- Time estimate for filling out General Log is roughly 5 minutes.
- Note: Bird and Mammal list should be modified to fit the region.

b. Pan Photographs

- Take a photograph of the GPS unit with the time displayed to link photos to GPS coordinates and start a track file, hitting "mark" at each photo location to ensure a waypoint is recorded at that location.
- Take one pan photograph at the access point. Take at least 1 pan photo for every 30m portion of wetland habitat sampled.
- In circular motion, starting facing magnetic North, and in clockwise direction take 8 – 10 photographs using the horizon as the upper boundary in the camera viewfinder (horizon level stays the same throughout the set of pan photos). Photographs should overlap slightly so each set comprises a complete 360° view of the site.
- Fill out the Photo Form with grease pencil or dry erase marker before and after each set of pan photos and take a photograph of the form to indicate the start and end of each set.
- Take other photos if needed, to best characterize the site, such as landmarks or overview photos.
- Record on the Photo Log the location information for each set of photos taken.

c. Vegetation Photos

For smaller wetlands, the area photographed can be altered from 30m x 10m to an area that fits that particular site if necessary, with photos spaced at least 2.5m apart.

The camera timer can be set for single image shooting (continuous not recommended) during both vegetation and snail photo sampling. It prevents having to bend and reach for the shutter release button when taking the photo. A 4 or 5 second timer is recommended (can usually custom set the time). During the 4 or 5 seconds after pressing the shutter release, the sampler can adjust the monopod and hold level to the ground using the bullseye level.

- Find ~30m "base transect" area adjacent and parallel to creek or lagoon edge. Place pin flag at each end to be visible in photo of base transect. Place more permanent marker such as rebar to mark the location to return to after the spill.
- Take GPS waypoints at each end of base transect and photos of each end and record on data sheet.
- Place the camera securely on the monopod.
- Fill out the Photo Form and take a photograph to indicate the start of the vegetation photos (Do Not zoom in to the page).
- Make sure camera is zoomed out to the widest extent for the vegetation photos and lower the automatic ISO setting, if possible, for a larger depth of field.
- Record compass heading parallel to the "base transect"/ vegetation edge and record heading 90° perpendicular. These are the directions to walk during the vegetation photo sampling. Don't recheck the angle at every turn (takes too much time), but choose a target in the distance to walk toward.
- Starting at one end of the "base transect," ~0.5m from the edge of the vegetation, take first photograph by setting the timer (~4 seconds) and lining up the monopod level with the ground using the bullseye level on the top of the monopod. Make sure the monopod stand is *in front* of your feet.
- Walk ~2.5m, parallel to the "base transect." Continue until 10 photos have been taken.
- Turn 90° and walk ~2m (may adjust to 5m if the wetland conditions indicate it would be better to sample over a larger area), then turn another 90° and continue the next set of 10 photos, spaced ~2.5m apart, parallel to the base transect and the line previous walked. See Figure 1.
- Repeat in 10 lines of 10 photos for a total of 100 photos.
- Fill out a second Photo Form and take a photo of the page to indicate the end of the vegetation photos.
- Fill out the Vegetation Photo Data Sheet and circle all plant species observed in the ~30m x 10m area.

d. Snail Photos

If benthic invertebrates or soil cores will be collected in same area, start with snail photos first so that area will not be affected before photographing.

- Find ~75m stretch of mudflat area with snails (may be at earlier veg. photo transect area; if not in earlier sampling area, place pin flags, take GPS waypoint at each end and photos of each end and record on data sheet).
- If 75m of contiguous mudflat cannot be found for 50 photos, take 25 photos on each side of the creek.
- Set camera securely on monopod.
- Fill out the Photo Form and take a photograph to indicate the start of the snail photos (Do Not zoom in to the page).
- Make sure camera is zoomed out to the widest extent for the snail photos.
- Stand at edge of vegetation and take first photograph of the mudflat by setting the timer (~4 seconds) and lining up the monopod level with the ground using the bullseye level on the top of the monopod. Make sure the monopod stand is in front of your feet.
- Move along the edge of the vegetation approximately 1m and take the next photo of the mudflat. Repeat with ~1m between photos for 50 photos.
- If algae is covering > 25% in the photo, then skip that 0.25m² area of mudflat and move on to the next. Instead of skipping a section, can extend out a little further into the mudflat to avoid algae.
- Fill out the Photo Form with grease pencil or dry erase marker and take a photograph to indicate the end of the snail photos.
- Fill out the Snail Photo Data Sheet.

Equipment:

- ☐ Data sheet: General Log
- ☐ Data sheet: Photo Log
- ☐ Data sheet: Vegetation & Snail Photos
- ☐ Data form: Photo Form
- ☐ Clipboard
- ☐ GPS unit
- ☐ Digital Camera
- ☐ Compass
- ☐ Camera Monopod
- ☐ Pin flags
- ☐ Grease pencil or dry erase marker
- ☐ Pencil – mechanical

Figure 1. Vegetation and snail photo transect illustration.

1. a. Wetland Habitat General Log **Spill Name**____

Team Leader_____ **Recorder**_____ **Sampler**_____

GENERAL INFORMATION	Date (dd/mm/yy)	Time (24h standard/daylight):___to___
Segment ID	Swell/Surge: _____ft	Rain:_____in/hr
Site Name/#	Wind: _____dir _____sp	Recent Rain: date_____ amt_____
GPS (decimal degrees, NAD83): LAT _____ LONG _____		

SHORELINE TYPE	Select only ONE Primary (P) and ANY Secondary (S) types present				
	Fine-Medium grained Sand Beaches		Rocky Cliffs		Salt marsh
	Coarse-grained Sand Beaches		Sheltered Rocky Shores		Riparian/Riverine
	Mixed Sand and Gravel Beaches		Wave-cut Platforms		Estuary
	Gravel Beaches		Exposed Tidal Flats		Coastal Lagoon
	Exposed Man-made Structures		Sheltered Tidal Flats		Other _____
	Sheltered Man-made Structures		Riprap		

BIRDS, MAMMALS AND REPTILES	(maximum # seen at any one time during the sampling)			
Pelican	Great Egret	Lg Shorebird	Other Birds	CA Sea Lion
Cormorant	Snowy Egret	Sm Shorebird	Sea Otter	Harbor Seal
Gull	Oystercatcher	Belding's Savannah Sparrow	Elephant Seal	Snake
Tern	Blue Heron	Clapper Rail	Saltmarsh harvest mouse	Dog

Dead birds: _____

Dead fish, invertebrates, mammals, reptiles:_____

Bird/Mammal/Reptile Notes:_____

_____

DEBRIS AND POLLUTANTS	(magnitude at site: Ø = None, H = High, M = Medium, L = Low):			
Plant Wrack: _____	Driftwood: _____	Trash _____	Shells: _____	Oil/Tar: _____

HUMANS (maximum # seen at any one time during the sampling not including spill cleanup; note behavior below)

_____

_____

PHOTOGRAPHS Record location on data sheet. Check when taken: Pan ☐ ☐ Access Point ☐

COMMENTS: Ecological/Recreational/Cultural Issues

_____

_____

_____

_____

SKETCH OF AREA Note locations of pan photographs, "base transect," landmarks, etc.

SHORELINE TYPE DESCRIPTIONS
(From NOAA. 2000. Shoreline Assessment Manual. HAZMAT Report No. 2000-1.)

Exposed Rocky Cliffs

- The intertidal zone is steep (greater than 30° slope), with very little width.
- Sediment accumulations are uncommon and usually ephemeral, because waves remove the debris that has slumped from the eroding cliffs.
- There is strong vertical zonation of intertidal biological communities.
- Species density and diversity vary greatly, but barnacles, snails, mussels, seastars, limpets, sea anemones, shore crabs, polychaetes, and macroalgae are often very abundant.

Exposed, Solid Man-Made Structures

- This shoreline type consist of solid man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- They are constructed of concrete, wood, or metal.
- Often there is no exposed substrate at low tide, but a wide range of habitats may be present .
- They are built to protect the shore from erosion by waves, boat wakes, and currents, and thus are exposed to rapid natural removal processes.
- Attached animals and plants are sparse to moderate.

Exposed Wave-Cut Platforms

- The intertidal zone consists of a flat rock bench of highly variable width.
- The shoreline may be backed by a steep scarp or low bluff.
- There may be a beach of sand- to boulder-sized sediments at the base of the scarp.
- The platform surface is irregular and tidal pools are common.
- Small amounts of gravel can be found in the tidal pools and crevices in the platform.
- These habitats can support large populations of encrusting animals and plants, with rich tidal pool communities.

Fine-Grained Sand Beaches

- These beaches are generally flat and hard-packed.
- Though they are predominately fine sand, there is often a small amount of shell hash.
- There can be heavy accumulations of wrack present.
- They are utilized by birds and turtles for nesting and feeding.
- Upper beach fauna are generally sparse, although amphipods can be abundant; lower beach fauna can be moderately abundant, but highly variable.

Medium-to-Coarse-Grained Sand Beaches

- These beaches have relatively steep beach faces and soft substrates.
- Coarse-sand beaches can undergo rapid erosion/deposition cycles, even within one tidal cycle.
- The amount of wrack varies considerably.
- They are utilized by birds and turtles for nesting and feeding.

Mixed Sand and Gravel Beaches

- These beaches are moderately sloping and composed of a mixture of sand and gravel.
- Because of the mixed sediment sizes, there may be zones of pure sand, pebbles, or cobbles.
- There can be large-scale changes in the sediment distribution patterns depending upon season, because of the transport of the sand fraction offshore during storms.
- Because of sediment desiccation and mobility on exposed beaches, there are low densities of attached animals and plants.
- The presence of attached algae and animals indicates beaches that are relatively sheltered, with the more stable substrate supporting a richer biota.

Gravel Beaches

- Gravel beaches are composed of sediments ranging in size from pebbles to boulders. The gravel-sized sediments can be made up of shell fragments.

- They can be very steep, with multiple wave-built berms forming the upper beach.
- Attached animals and plants are usually restricted to the lowest parts of the beach, where the sediments are less mobile.
- The presence of attached algae, mussels, and barnacles indicates beaches that are relatively sheltered, with the more stable substrate supporting a richer biota.

Riprap

- Riprap is composed of cobble- to boulder-sized blocks of granite, limestone, or concrete.
- Riprap structures are used for shoreline protection and channel stabilization (jetties)
- Attached biota are sparse.

Exposed Tidal Flats

- Exposed tidal flats are broad intertidal areas composed primarily of sand and minor amounts of shell and mud.
- The dominance of sand indicates that currents and waves are strong enough to mobilize the sediments.
- They are usually associated with another shoreline type on the landward side of the flat, though they can occur as separate shoals; they are commonly associated with tidal inlets.
- Biological utilization can be very high, with large numbers of infauna, heavy use by birds for roosting and foraging, and use by foraging fish.

Sheltered Rocky Shores

- These are bedrock shores of variable slope (from vertical cliffs to wide, rocky ledges) that are sheltered from exposure to most wave and tidal energy.
- Wide shores may have some surface sediments, but bedrock is the dominant substrate type
- Species density and diversity vary greatly, but biota are often very abundant.

Sheltered, Solid Man-Made Structures

- These structures are solid man-made structures such as seawalls, groins, revetments, piers, and port facilities
- Most structures are constructed of concrete, wood, or metal, and their composition, design, and condition are highly variable.
- Often there is no exposed beach at low tide, but a wide variety habitats may be present.
- Attached animal and plant life can be moderate to high.

Sheltered Tidal Flats

- Sheltered tidal flats are composed primarily of mud with minor amounts of sand and shell.
- They are present in calm-water habitats, sheltered from major wave activity, and are frequently backed by marshes.
- The sediments are very soft and cannot support even light foot traffic in many areas.
- They can be sparsely to heavily covered with algae and/or seagrasses.
- They can have very heavy wrack accumulations along the high-tide line.
- There can be large concentrations of shellfish, worms, and snails on and in the sediments.
- They are heavily utilized by birds and fish for feeding.

Salt-and Brackish-Water Marshes

- These marshes contain vegetation which tolerates water salinity down to about 5 ppt.
- Width of the marsh can vary widely, from a narrow fringe to extensive areas.
- Sediments are composed of organic-rich muds except on the margins of barrier islands where sand is abundant.
- Exposed areas are located along waterbodies with wide fetches and along busy waterways.
- Sheltered areas are not exposed to significant wave or boat wake activity.
- Resident flora and fauna are abundant with numerous species with high utilization by birds, fish, and shellfish.

1. b. Wetland Habitat Photo Log

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Photographer(s): _____ Camera Model: _____

List each set of pan photographs and any others taken at the site area, such as access point, landmarks, or overview photos.

Photo Type/Description (e.g., Pan #1; Overview,)	Photo GPS Location		Location Description / Comments
	LAT	LONG	

1. c. & d. Wetland Habitat Vegetation & Snail Photo Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____ Photographer: _____
Recorder _____ Camera _____

c. Vegetation Photos

Record GPS coordinates and compass directions for vegetation photo sampling. Take photo of each end of transect.
Set GPS waypoints to record in decimal degrees and NAD 83 datum.
Compass headings record in degrees.

Downcoast	LAT_____	LONG_____	Photograph #_____
Upcoast	LAT_____	LONG_____	Photograph #_____
Down – Upcoast ("Base Transect") heading	_____		
"Sampling Transect" heading	_____		

Circle all species observed while walking in photograph area.

Species code**:**

Salicornia virginica
Salicornia bigelovii
Salicornia subterminalis
Salicornia sp.
Frankenia grandifolia
Jaumea carnosa
Suaeda californica
Batis maritima
Distichlis spicata
Limonium californica
Cuscuta sp.
Juncus sp.
Scirpus sp.
Typha sp.
Spartina foliosa
Atriplex triangulates
Cressa truxellensis
Salix sp.
Carpobrotus sp. (ice plant)
Cordylanthus maritimus maritimus (salt marsh bird's beak – endangered)
Unknown
Other: _____
_____

d. Snail Photos

Record GPS coordinates and compass directions for snail photo sampling.
Set GPS waypoints to record in decimal degrees and NAD 83 datum.
Compass headings record in degrees.

Downcoast	LAT_____	LONG_____	Photograph #_____
Upcoast	LAT_____	LONG_____	Photograph #_____
Down – Upcoast ("Base Transect") heading	_____		

Notes:
_____
_____
_____
_____

1. b., c. & d. Wetland Habitat Photo Form

DATE_____

SPILL_____ **TIME**_____

SITE

_____

PARAMETER

_____

(Circle) BEGIN / END

2. Wetland Habitat Benthic Invertebrate Collection – Protocol A

If snails are to be photographed in the same mudflat area, wait until all photos are taken before collecting cores so as not to alter the area for the photos.

Time can be saved by filling out information (e.g., site name, spill name, recorder, etc.) on all replicate labels for a sample just prior to collection. Sample-specific information (e.g., time, replicate number) can be filled in before placing the label in the bag with the sample.

- In the exposed mudflat area adjacent to where the vegetation photos were collected (and where snails were photographed) set out the 30m base transect along the edge of the vegetation.
- Collect 20 invertebrate cores spaced 1.5m apart, starting at 1m on the base transect.
- Cores may be collected up to 1m from the edge of the transect tape and may contain vegetation roots.
- Use 10.5cm diameter core and push into the substrate to a depth of 5cm.
- Put on glove and reach below and along edge of core, placing hand underneath sample (to support mud sample and prevent it from falling out). If substrate is particularly wet mud, place hand into quart-sized Ziploc bag and use "bagged" hand to support sample.
- With one hand beneath core and other on top holding handle and plugging hole with thumb, lift up the core.
- Place the sample into a gallon-sized Ziploc bag. Use gloved hand to scoop out sample if necessary. (If used, place the quart-sized bag from step 5 (to later be rinsed of excess mud and included in the sample) into the Ziploc bag containing the sample).
- Place the data label and first Ziploc bag containing the sample into a second Ziploc bag.
- Place sample in cooler and break instant ice packs.
- Fill in hole created by core with surrounding sediment as much as possible.
- Repeat procedure for 20 cores.
- Back at the vehicle, transfer samples from Ziploc bags to 1L jars. Use distilled water in squirt bottle to rinse sample off of Ziploc bags into jars.
- Don't fill the jar more than 2/3 full with course sample material or more than ½ full with sand or mud.
- Add 95% ethanol solution to sample jars to cover the rest of the sample.
- After lid has been screwed on tightly, gently tip the jar once to allow ethanol to reach entire sample.
- Attach sample label to jar with clear packing tape, covering entire label. Write sample number on top of lid with Sharpie and cover with clear packing tape (Sharpie can rub off with contact with ethanol).
- Attach evidence tape to lid and jar of each sample. Fill out chain of custody form.

Equipment:

- ☐ Data sheet: Benthic Invertebrate
- ☐ Data labels: Benthic Invertebrate
- ☐ Data form: Chain of custody
- ☐ Nitrile or Polyethylene gloves
- ☐ Ziploc bags: quart-sized (2)
- ☐ Ziploc bags: gallon-sized (20 + 2 extra)
- ☐ Transect tape: 50m
- ☐ Invertebrate Corer: 10.5cm diameter, 5cm depth marked
- ☐ Shop towels or paper towels
- ☐ 95% Ethanol solution (at vehicle, not in field)
- ☐ 1L plastic sample jars: wide-mouth (at vehicle)
- ☐ Distilled water in squirt bottle (at vehicle)
- ☐ Clear packing tape (at vehicle)
- ☐ Evidence Tape
- ☐ Sharpie
- ☐ Pencil
- ☐ Backpack

A solution of 95% ethanol and 3% glycerin should be used to preserve the infauna samples. If ethanol is not available, samples can be put on ice, but must be preserved within several hours. If preservation materials are not available, then the invertebrate samples should not be collected.

2. Wetland Habitat Benthic Invertebrate Collection

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder _____ Sampler: _____

Core diameter (cm): _____ Core depth (cm): _____

Volume of sample (cm^3): _____ Number of cores collected: _____

3. Wetland Habitat Sediment Collection – Protocol B

Sediment cores should be collected next to benthic invertebrate samples in mudflats. Cores for sediment characteristics and chemical analysis should be collected together along the 30m transect.

Time is saved by collecting cores for chemical analysis and cores for soil characteristics at the same time along the transect. For instance, if sediment cores are collected at 1m, 4m, 7m, 10m, etc. along the transect, collect both sets of sediment cores at 1m before moving on to the 4m mark. Pre-cleaned cores and gloves need to be used for the chemical analysis samples. Collect that sample first, then the same core and gloves can be used for the soil characteristics sample collection at the same location. Move 3m then collect the next set of sediment cores with a new pre-cleaned core and new set of gloves.

Time can also be saved by filling out information (e.g., site name, spill name, recorder, etc.) on all replicate labels for a sample just prior to collection. Sample-specific information (e.g., time, replicate numbers) can be filled in before placing the label in the bag with the sample.

If a freezer is unavailable for preservation of samples, then only samples for grain size and salinity analyses may be collected.

- Wear polyethylene gloves throughout process, changing gloves before *each* chemical analysis sample.
- Collect 10 sets of sediment cores spaced 3m apart starting at 1m on the base transect, near the benthic invertebrate core previously sampled in the same area.
- Push corer straight down into soil to depth of >5cm. Slide wooden handle into corer. Plug hole at top of corer and pull up.
- Slide handle out of corer and use wooden dowel to push sample out onto dull side of aluminum foil, collecting only the **top 5cm** (measure with ruler or transect tape). Repeat for **1** more core next to first, placing on same piece of foil.
- Homogenize the sample by pushing together with edges of foil, then wrap so completely covered.
- Place aluminum foil with sample in Ziploc bag.
- Place sample label and first Ziploc bag into second Ziploc bag.
- Place in cooler with ice packs.
- At same location on the base transect, collect next set of cores for characteristics analyses, using same corer and gloves as the chemical analysis sample just collected.
- Push core straight down into soil to depth of >10cm. Plug hole at top of corer and pull up.
- Using wooden dowel, push sample out on top of Ziploc bag. Collect the **top 10cm** (measure with ruler or transect tape) and place into quart-sized Ziploc bag. Repeat for **2** more cores next to first.
- Place all 3 cores in same Ziploc bag, homogenizing the sample, then place label and first bag into second Ziploc bag.
- Place in cooler with ice packs.
- Fill in holes created by cores with surrounding sediment as much as possible.
- Move 3m along the base transect, change gloves, corer and dowel and repeat for 10 replicates each of chemical analysis and soil characteristics samples.
- Attach evidence tape to each sample bag.
- Fill out chain of custody form.

Equipment:

- ☐ Data sheet: Sediment
- ☐ Data labels: Sediment
- ☐ Data form: Chain of custody
- ☐ Polyethylene gloves (10 + 1 extra, pairs)
- ☐ Ziploc bags: quart-sized (20 + 2 extra)
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Soil corers – solvent-rinsed, polyethylene (10)
- ☐ Wooden dowel (10)
- ☐ Wooden handles (10)
- ☐ Aluminum foil: solvent-rinsed (10 pieces + 1 extra)
- ☐ Evidence Tape
- ☐ Ruler
- ☐ Pencil
- ☐ Backpack

3. Wetland Habitat Sediment Collection

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder _____ Sampler: _____

Chemical analysis:

Core diameter (cm): _____ Core depth (cm): _____

Number of samples collected: _____

Soil characteristics:

Core diameter (cm): _____ Core depth (cm): _____

Number of samples collected: _____

4. Wetland Habitat Bivalve Survey & Tissue Collection – Protocol C

Use a refractometer to check salinity levels at the intended bivalve sample sites before collection if salinity levels may be too low (e.g., in a small estuary). If the salinity is less than 20ppt, then choose another location or do not sample bivalves because they cannot survive at low salinities and will likely not be found.

A minimum of 10g of tissue is required per sample for chemical analysis on bivalves. Collect 10 individual clams per sample if available; the actual number to be collected will depend on the size of the clams. If clam widths are of 20mm or greater and at least 10 individuals have been found then they should still be collected. However, if few clams are found and they are smaller than 20mm, then bivalve tissues cannot be analyzed and no clams should be collected.

A minimum of only 3 replicates per site are needed for tissue analysis, but more (6+) are required for a more accurate estimate of bivalve population density.

Time can be saved by filling out information (e.g., site name, spill name, recorder, etc.) on all replicate labels for a sample just prior to collection. Sample-specific information (e.g., time, depths, replicate numbers) can be filled in before placing the label in the bag with the sample.

If a freezer is unavailable for preservation of samples, then bivalve tissue samples cannot be collected.

- Find appropriate area near mouth of large tidal creek or lagoon with sandy substrate (likely not within the 30m transect area chosen for the other samples). Can collect where substrate is submerged.
- Test salinity of the water by collecting with pipette and dropping several drops onto refractometer. Hold up to the light and take reading. If 20ppt or higher, continue. Rinse off site water with distilled water bottle and wipe refractometer dry with Kimwipe.
- Take GPS waypoint and record on data sheet and sample labels.
- Wear polyethylene gloves throughout process, changing gloves between samples.
- Use stainless steel shovel and push it into the substrate with the weight of the sampler as deep as possible between 5cm and 45cm depths. Note and record the depth.
- Pull up sample and drop into sieve.
- Repeat, collecting 2 more samples with shovel no more than 1m apart from first and composite into same sieve.
- Record the 3 depths to the nearest 5cm on the sample label and data sheet.
- Sieve the 3 composited cores in the nearest creek/lagoon water. Sift through the substrate and count the number of bivalves collected. Record on the data sheet.
- Randomly (not size-biased) collect 10 clams of the same species, or enough for a 10g sample. Rinse the sediment off each clam with site water if necessary or with distilled water in squirt bottle if available.
- Place bivalves onto pre-cleaned aluminum foil (dull side) and wrap so that they are completely covered.
- Place the aluminum foil with the sample into a Ziploc bag.
- Place sample label and first Ziploc bag into second Ziploc bag. Attach evidence tape to sample bag and place in cooler with instant ice packs.
- Repeat procedure for 6 or more replicates, as time permits, spaced 2-3m apart.
- Clean the shovel and sieve by rinsing with ___ between each sample.
- Fill out chain of custody form for the tissue samples.

Equipment:

- ☐ Data sheet: Bivalve
- ☐ Data labels: Bivalve
- ☐ Data form: Chain of custody
- ☐ Clipboard
- ☐ GPS unit
- ☐ Polyethylene gloves (10)
- ☐ Aluminum foil: solvent-rinsed (10)
- ☐ Ziploc bags: quart sized (20)
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Stainless steel shovel
- ☐ Sieve: Polyethylene, 3mm mesh
- ☐ Refractometer
- ☐ Disposable plastic pipettes
- ☐ Distilled water in squirt bottle
- ☐ Kimwipes
- ☐ Evidence Tape
- ☐ Pencil

4. Wetland Habitat Bivalve Survey

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder _____ Sampler: _____

Count and record number of bivalves in each set of 3 composited cores. If none, record Ø. Cross out additional (i.e., not sampled) replicates in table. Record each site number and GPS coordinates below table.

Site Name/ID	Replicate Number																			
	1		2		3		4		5		6		7		8		9		10	
	Depth	N	Depth	N	Depth	N	Depth	N	Depth	N	Depth	N	Depth	N	Depth	N	Depth	N	Depth	N
1	1		1		1		1		1		1		1		1		1		1	
	2		2		2		2		2		2		2		2		2		2	
	3		3		3		3		3		3		3		3		3		3	
2	1		1		1		1		1		1		1		1		1		1	
	2		2		2		2		2		2		2		2		2		2	
	3		3		3		3		3		3		3		3		3		3	
3	1		1		1		1		1		1		1		1		1		1	
	2		2		2		2		2		2		2		2		2		2	
	3		3		3		3		3		3		3		3		3		3	
4	1		1		1		1		1		1		1		1		1		1	
	2		2		2		2		2		2		2		2		2		2	
	3		3		3		3		3		3		3		3		3		3	
5	1		1		1		1		1		1		1		1		1		1	
	2		2		2		2		2		2		2		2		2		2	
	3		3		3		3		3		3		3		3		3		3	

Site # & GPS coordinates: _____

_____

_____

5. Wetland Habitat Snail Collection – Protocol D

Snails will be collected for tissue analysis and live/dead estimate. The count of live versus dead snails will take place in the lab before prepping tissue samples.

Time can be saved by filling out information (e.g., site name, spill name, recorder, etc.) on all replicate labels for a sample just prior to collection. Sample-specific information (e.g., time, replicate numbers) can be filled in before placing the label in the bag with the sample.

- Locate same 75m stretch along mudflat where snails were previously photographed.
- Wear polyethylene gloves throughout process, changing gloves between samples.
- In first 0.75m x 0.5m "quadrat" area, collect 40 snails (*Cerithidea californica*).
- Start at a random point in roughly the middle of the chosen area and collect the nearest 40 snails, radiating out from the central point chosen.
- Place all 40 snails onto pre-cleaned aluminum foil (dull side) and wrap so that they are completely covered. Use two sheets of aluminum foil if necessary, folding the edges over.
- Place the aluminum foil with the sample into a Ziploc bag.
- Place sample label and first Ziploc bag into second Ziploc bag.
- Attach evidence tape to sample bag and place in cooler with instant ice packs.
- Skip 7m along the mudflat edge and collect the next sample of 40 snails. Continue for a total of 10 samples, 7m between each sample.
- Fill out chain of custody form.
- Snail tissue will be prepped in the lab, where the live/dead proportion of each sample will be made.

Equipment:

- ☐ Data sheet: Snail
- ☐ Data labels: Snail
- ☐ Data form: Chain of custody
- ☐ Polyethylene gloves (10 + 1 extra, pairs)
- ☐ Aluminum foil: solvent-rinsed (10 pieces + 1 extra)
- ☐ Ziploc bags: quart sized (20 + 2 extra)
- ☐ Soft-sided cooler: 14"x12"x7"
- ☐ Disposable instant ice bags or blue ice packs: 5"x7"
- ☐ Evidence Tape
- ☐ Pencil

If a freezer is unavailable to store the 10 samples, then snails cannot be collected for tissue sample analysis, but the live/dead estimate can be made in the field instead: Collect the same 40 snails per sample, but place into a Ziploc bag with site water. Label each bag with Sharpie (temporary) to keep track of samples. Wait and watch snails emerge from shells, or look for visible operculum at opening of shell. Count and record number of live and dead snails for each sample. Release snails when finished.

5. Wetland Habitat Snail Survey

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder _____ Sampler: _____

Record waypoints (decimal degrees, NAD 83 datum) at each end of the sample area and take photo of opposite end.

GPS:	LAT:	LONG:	Photo #:
	LAT:	LONG:	Photo #:

Snail Species: _____ Number of snails per sample: _____

Number of samples: _____

If Live/Dead estimate is made in the field: Tally and circle the total number of live and dead snails.

Replicate #	Live	Dead
Example	~~llll llll llll llll llll~~ lll (28)	~~llll llll~~ ll (12)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Notes:

6. Wetland Habitat Fish Seine – Protocol E

Using block net or seine (depending on size of wetland and tidal creeks), catch, identify and count fish species for an abundance survey. If there is not enough time or equipment available, a valuable fish survey can be conducted by walking a small beach seine throughout potential fish habitat and recording the identities of all fish species found. And/or collect for chemical analysis of PAH metabolites in bile.

If a freezer is unavailable to store samples before analysis, then fish tissue samples cannot be collected.

- Take GPS waypoint of block net location or of starting and stopping locations if seining.
- Two samplers each holding one end of the seine net, walk through the fish habitat.
- Record on the data sheet the (number if appropriate and) species of all fish caught, wearing polyethylene gloves while handling fish if collecting for tissue analysis, changing gloves between samples.
- Collect enough fish to obtain 10g of tissue for chemical analysis.
- Wrap each sample in solvent-rinsed aluminum foil and place in Ziploc bag.
- Place label and first Ziploc bag into second Ziploc bag.
- Attach evidence tape to sample bag and place in cooler with ice packs.
- Release the rest of the fish back into the water.
- Fill out chain of custody form.

Equipment:

- ☐ Data sheet: Fish
- ☐ Data labels: Fish
- ☐ Data form: Chain of custody
- ☐ GPS unit
- ☐ Clipboard
- ☐ Polyethylene gloves
- ☐ Aluminum foil: Solvent-rinsed
- ☐ Ziploc bags: gallon-sized
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Evidence tape
- ☐ Fish seine/block net
- ☐ Waders
- ☐ Pencil

6. a. Wetland Habitat Fish Seine Data Sheet – Species Presence Only

Date: ____________________ Time: ______________ Spill Name: _________________________
Segment ID: _________________________ Site Name/#: ______________________________
Team Leader: ____
Recorder ______________________________ Samplers: _______________________________

Describe area surveyed and Record GPS coordinates (decimal degrees, NAD 83 datum) of the starting and ending locations of the area surveyed in Location box.

Location	Fish Species	Check if present
Tidal creek #1from mouth to 50m upstream, etc. (*Draw location on General Log sketch*)	*Fundulus parvipinnis*	
	Gillichthys mirabilis	
	Leptocottus armatus	
	Atherinopsis affinis.	
	Cytomatogaster aggregata	
	Paralabrax spp.	
	Other: (List or "Unknown 1")	
	Fundulus parvipinnis	
	Gillichthys mirabilis	
	Leptocottus armatus	
	Atherinopsis affinis.	
	Cytomatogaster aggregata	
	Paralabrax spp.	
	Other:	
	Fundulus parvipinnis	
	Gillichthys mirabilis	
	Leptocottus armatus	
	Atherinopsis affinis.	
	Cytomatogaster aggregata	
	Paralabrax spp.	
	Other:	
	Fundulus parvipinnis	
	Gillichthys mirabilis	
	Leptocottus armatus	
	Atherinopsis affinis.	
	Cytomatogaster aggregata	
	Paralabrax spp.	
	Other:	

6. b. Wetland Habitat Fish Seine Data Sheet – Abundance

Date: ______________________ Time: ________________ Spill Name: ____________________________
Segment ID: ____________________________ Site Name/#: __________________________________
Team Leader: ____
Recorder _________________________________ Samplers: ___________________________________

Record GPS coordinates (decimal degrees, NAD 83 datum) of the starting and ending locations of the area surveyed.

Location:	Lat.: ___________________________ Long.:	Lat.: ___________________________ Long.:
Location:	Lat.: ___________________________ Long.:	Lat.: ___________________________ Long.:
Location:	Lat.: ___________________________ Long.:	Lat.: ___________________________ Long.:

Location	Pass # / Replicate #	Fish Species	Total Count	Fish Species	Total Count
Mouth to 10m upstream or tidal creek #1, #2, etc. (*draw on Log map*)	1	*Fundulus parvipinnis*	95	*Atherinopsis affinis.*	1
		Gillichthys mirabilis	10	Unknown 1	2
		Staghorn sculpin	5	Unknown 2	3

7. Wetland Habitat Bird Survey – Protocol F

a. Dead Bird Survey

A timed search of a large area or a search of an entire specified area will be performed. Survey will probably not consist of search in salt marsh vegetation, but possibly only on edge.

- Take GPS waypoint of starting location and record compass heading of general direction walked.
- Starting at specified location, walk the edge of the wetland vegetation or bank, searching both on the nearby mudflat and/or open water with binoculars and within the visible vegetation.
- Record the number, species (or bird type), and level of decomposition of each dead bird on the data sheet.
- Continue until specified time or location is reached.
- Take GPS waypoint of ending location and record on data sheet.

b. Live Bird Survey

- If time permits, record number of live birds observed along with the dead bird survey, following the same procedure above.

Equipment:

- ☐ Data sheet: Bird Survey
- ☐ GPS unit
- ☐ Clipboard
- ☐ Compass
- ☐ Watch
- ☐ Binoculars
- ☐ Spotting scope (optional, if available)
- ☐ Pencil

7. Wetland Habitat Bird Survey Data Sheet – for "Specialist" Bird Surveyor

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder _____ Sampler: _____
Approximate Area or Distance surveyed _____

Record GPS coordinates (decimal degrees, NAD 83) of the starting and ending locations or the four general corner boundaries of the area surveyed. Record compass direction (degrees) walked, if applicable.

Lat.: _____ Long.:	Lat.: _____ Long.:	Compass Heading:
Lat.: _____ Long.:	Lat.: _____ Long.:	

Record tally or total number observed. If no birds observed at all during survey, record Ø at top of columns next to "Dead" or "Live." If dead bird survey conducted but not live bird survey, cross out entire "Live" columns.

Species	**Dead**	**Live**	**Species (cont.)**	**Dead**	**Live**
Example	~~IIII IIII~~ I or (II)	25	Example	II (2)	~~_____~~
Great Blue Heron			Turkey Vulture		
Snowy Egret			Red-tailed Hawk		
Great Egret			Osprey		
Unknown Wader			Unknown Raptor		
Willet			Western Gull		
Marbled Godwit			California Gull		
Black-necked Stilt			Gull spp.		
American Avocet			Least Tern		
Dowitcher			American Skimmer		
Greater Yellowlegs			Unknown Waterbird		
Lesser Yellowlegs			Mallard		
Unknown Lg Shorebird			Northern Pintail		
Killdeer			Green-winged Teal		
Sandpiper spp.			Surf Scoter		
Dunlin			Unknown Waterfowl		
Semipalmated Plover			Other (List):		
Black-bellied Plover					
Unknown Sm Shorebird					
Belding's Sav. Sparrow					
Unknown Song Sparrow					
Black Phoebe					
Unknown Landbird					

7. Wetland Habitat Bird Survey Data Sheet – for "Generalist" Bird Surveyor

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder _____ Sampler: _____
Approximate Area or Distance surveyed _____

Record GPS coordinates (decimal degrees, NAD 83) of the starting and ending locations or the four general corner boundaries of the area surveyed. Record compass direction (degrees) walked, if applicable.

Lat.: _____ Long.:	Lat.: _____ Long.:	Compass Heading:
Lat.: _____ Long.:	Lat.: _____ Long.:	

Record the abundance range of birds observed by placing a check or "X" in the appropriate box. If no birds are observed at all during survey, record Ø at top of columns next to "Dead" or "Live." If dead bird survey is conducted but not live bird survey, cross out entire "Live" columns.

Dead		**Live**				
Bird Type	Total Count	**Bird Type**	1-10	10-50	50-100	> 100
Wader (e.g., Great Blue Heron, Snowy Egret)		**Wader** (e.g., Great Blue Heron, Snowy Egret)				
Large Shorebird (e.g., Willet, Marbled Godwit)		**Large Shorebird** (e.g., Willet, Marbled Godwit)				
Small Shorebird (e.g., Sandpiper spp., Killdeer)		**Small Shorebird** (e.g., Sandpiper spp., Killdeer)				
Landbird (e.g., Black Phoebe, Belding's Savannah Sparrow)		**Landbird** (e.g., Black Phoebe, Belding's Savannah Sparrow)				
Raptor (e.g., Osprey, Red-tailed Hawk)		**Raptor** (e.g., Osprey, Red-tailed Hawk)				
Waterbird (e.g., Gull spp., Least Tern)		**Waterbird** (e.g., Gull spp., Least Tern)				
Waterfowl (e.g., Mallard, Northern Pintail)		**Waterfowl** (e.g., Mallard, Northern Pintail)				
Unknown		Unknown				
Other (List):		Other (List):				

8. Wetland Habitat Crab Traps – Protocol G

If a 24-hour time period is available, crab traps will be set out in the salt marsh vegetation and mudflats for abundance data collection.

- Take GPS waypoint of roughly each "corner" of crab trap location area.
- Place roughly one handful of dry dog food in each trap as bait.
- Close trap. Attach zip tie to string and trap closure to secure trap.
- Return 24 hours later.
- Identify each crab to species, measure its carapace at the greatest width to the nearest mm and record.
- Record sex of each crab. If female, record whether gravid.
  Male and female crabs can be distinguished by the shape of their abdomen: the male's is triangular in shape and the female's is more round in shape.
  Gravid females have small black eggs visibly protruding from their abdomen.
- Release each crab after measuring.

Equipment:

- ☐ Data sheet: Crab
- ☐ GPS unit
- ☐ Clipboard
- ☐ Caliper or Ruler
- ☐ Gee Minnow Traps: 9" x 17.5" with ¼" mesh (50?)
- ☐ Kibbles and Bits™ dry dog food (bait)
- ☐ Pencil

Species Descriptions:

Pachygrapsus crassipes: has darker coloration than *Hemigrapsus* or *Uca* crabs. Its carapace has shades of red, purple or green and is striped or lined. The margins of the carapace are one-lobed.

Hemigrapsus oregonensis: smaller than *Pachygrapsus*, its carpace has a dull yellow to green coloration, with a four-lobed margin. Also has very hairy legs.

Uca crenulata: much smaller than *Pachygrapsus* and males have a specialized enlarged claw.

8. Wetland Habitat Crab Traps Data Sheet

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder: _____ Sampler: _____
Time Traps Deployed_____ Time Collected_____

GPS coordinates (decimal degrees, NAD 83 datum) of the four general corner boundaries of the area surveyed.

Lat.: _____ Long.:	Lat.: _____ Long.:
Lat.: _____ Long.:	Lat.: _____ Long.:

Measure width of crab carapace to nearest mm and record in appropriate species box. If none, record Ø. Record other species if known.

Location (Site)	Trap # / Replicate #	Crab Species (P = *Pachygrapsus sp.,* H = *Hemigrapsus sp.* U = *Uca*) & Width (mm)		Total #
Example	1	P 25, 27, 30, 18, 32, 25, 28, 33, 19, 20, 32, 41, 30, 22, 29	H 12, 15	P 15 H 2
		Other (Record presence, if any): e.g., Gillichthys, Fundulus, Unknown		U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U
		P	H	P H
		Other:	U	U

9. Wetland Habitat Insect Survey – Protocol H

If a 24-hour time period is available, insect sticky traps will be set out in the salt marsh vegetation and mudflats for abundance and richness data collection in the lab.

If a freezer is unavailable to store samples before analysis, then insect traps cannot be collected.

- Label each sticky trap with abbreviated site name and trap number (replicate number) with Sharpie.
- In area where vegetation photos were taken, space (N) traps ___m apart.
- Attach trap to stand and remove backing on both sides of trap.
- Set in ground so that bottom of trap is touching top ~1cm of vegetation, but a minimum of 10cm off the ground.
- Take GPS waypoints and record on data labels.
- Collect traps approximately 24 hours later, attaching wax paper to both sides of each trap.
- Put each trap in a Ziploc bag. Place label and first Ziploc bag into second Ziploc bag.
- Attach evidence tape to sample bag and place in cooler with ice packs.
- Fill out chain of custody form.

Equipment:

- ☐ Data sheet: Insect
- ☐ Data labels: Insect
- ☐ Data form: Chain of custody
- ☐ GPS unit
- ☐ Ziploc bags: gallon-sized (20+?)
- ☐ Disposable instant ice bags or blue ice packs: 5”x7”
- ☐ Soft-sided cooler: 14”x12”x7”
- ☐ Insect traps (10): double-sided yellow sticky traps, 6.3” x 7.5”
- ☐ Insect trap holders
- ☐ Wax paper
- ☐ Evidence Tape
- ☐ Sharpie
- ☐ Pencil

9. Wetland Habitat Insect Survey

Date: _____ Time: _____ Spill Name: _____
Segment ID: _____ Site Name/#: _____
Team Leader: _____
Recorder: _____ Sampler: _____

Date/Time Traps Deployed _____ Date/Time Collected _____

Number of Traps _____

GPS coordinates (decimal degrees, NAD 83 datum) of the four general corner boundaries of the area surveyed.

Lat.: _____ Long.:	Lat.: _____ Long.:
Lat.: _____ Long.:	Lat.: _____ Long.:

Wetland Habitat Field Sample Log

Date: _____ Spill: _____ Team Leader: _____

Team Members (List all present, first & last names): _____

_____

_____

Samples collected or surveyed (Fill in all that apply):

	List Sample Sites	# Replicates per Site (if applicable)	# Samples per Site for each analysis (if applicable)	
General Log	_____			
Pan Photographs	_____	_____		
Vegetation Photos	_____	(50)		
Benthic Invertebrates	_____	(20)		
Sediment Characteristics	_____	(10)	PAH	Fingerprint
Sediment Chemical Analysis	_____	(10)	_____	_____
Bivalve Survey	_____	_____		
Bivalve Tissue	_____	_____	_____	_____
Snail Photos	_____	(50)		
Snail Tissue	_____	(10)	_____	_____
Fish	_____			
Fish Tissue	_____	_____		
Birds	_____			
Crabs	_____	_____		
Insects	_____	_____		

2. Wetland Habitat Benthic Invertebrate Labels

Benthic Invertebrate Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Depth of sample (cm)______________

Replicate number_____ of _____

Benthic Invertebrate Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Depth of sample (cm)______________

Replicate number_____ of _____

Benthic Invertebrate Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Depth of sample (cm)______________

Replicate number_____ of _____

Benthic Invertebrate Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Depth of sample (cm)______________

Replicate number_____ of _____

Benthic Invertebrate Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Depth of sample (cm)______________

Replicate number_____ of _____

Benthic Invertebrate Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Depth of sample (cm)______________

Replicate number_____ of _____

3. Wetland Habitat Sediment Labels

Sediment Label
Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
(Check one) Characteristics___ Chemical Analysis___
Analysis (if any): PAH____ Oil Fingerprint____
# of cores_______ Depth (cm)_________
Replicate number_____ of _____

Sediment Label
Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
(Check one) Characteristics___ Chemical Analysis___
Analysis (if any): PAH____ Oil Fingerprint____
# of cores_______ Depth (cm)_________
Replicate number_____ of _____

Sediment Label
Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
(Check one) Characteristics___ Chemical Analysis___
Analysis (if any): PAH____ Oil Fingerprint____
# of cores_______ Depth (cm)_________
Replicate number_____ of _____

Sediment Label
Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
(Check one) Characteristics___ Chemical Analysis___
Analysis (if any): PAH____ Oil Fingerprint____
# of cores_______ Depth (cm)_________
Replicate number_____ of _____

Sediment Label
Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
(Check one) Characteristics___ Chemical Analysis___
Analysis (if any): PAH____ Oil Fingerprint____
# of cores_______ Depth (cm)_________
Replicate number_____ of _____

Sediment Label
Sample ID____________
Date: ___________ Time: __________
Spill Name___________________________
Segment ID___________________________
Site Name/# __________________________
Team Leader__________________________
Recorder_____________________________
Sampler______________________________
(Check one) Characteristics___ Chemical Analysis___
Analysis (if any): PAH____ Oil Fingerprint____
# of cores_______ Depth (cm)_________
Replicate number_____ of _____

4. Wetland Habitat Bivalve Labels

Bivalve Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Analysis: PAH____ Oil Fingerprint____

Depth(s) of sample (cm)______________

Replicate number_____ of _____

Bivalve Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Analysis: PAH____ Oil Fingerprint____

Depth(s) of sample (cm)______________

Replicate number_____ of _____

Bivalve Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Analysis: PAH____ Oil Fingerprint____

Depth(s) of sample (cm)______________

Replicate number_____ of _____

Bivalve Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Analysis: PAH____ Oil Fingerprint____

Depth(s) of sample (cm)______________

Replicate number_____ of _____

Bivalve Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Analysis: PAH____ Oil Fingerprint____

Depth(s) of sample (cm)______________

Replicate number_____ of _____

Bivalve Label

Sample ID____________

Date: ___________ Time: __________

Spill Name___________________________

Segment ID___________________________

Site Name/# __________________________

Team Leader__________________________

Recorder_____________________________

Sampler______________________________

Analysis: PAH____ Oil Fingerprint____

Depth(s) of sample (cm)______________

Replicate number_____ of _____

5. Wetland Habitat Snail Labels

Snail Label

Sample ID_____________
Date: ___________ Time: __________
Spill Name____________________________
Segment ID____________________________
Site Name/# ___________________________
Team Leader___________________________
Recorder______________________________
Sampler_______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species____________________________
Replicate number_____ of _____

Snail Label

Sample ID_____________
Date: ___________ Time: __________
Spill Name____________________________
Segment ID____________________________
Site Name/# ___________________________
Team Leader___________________________
Recorder______________________________
Sampler_______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species____________________________
Replicate number_____ of _____

Snail Label

Sample ID_____________
Date: ___________ Time: __________
Spill Name____________________________
Segment ID____________________________
Site Name/# ___________________________
Team Leader___________________________
Recorder______________________________
Sampler_______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species____________________________
Replicate number_____ of _____

Snail Label

Sample ID_____________
Date: ___________ Time: __________
Spill Name____________________________
Segment ID____________________________
Site Name/# ___________________________
Team Leader___________________________
Recorder______________________________
Sampler_______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species____________________________
Replicate number_____ of _____

Snail Label

Sample ID_____________
Date: ___________ Time: __________
Spill Name____________________________
Segment ID____________________________
Site Name/# ___________________________
Team Leader___________________________
Recorder______________________________
Sampler_______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species____________________________
Replicate number_____ of _____

Snail Label

Sample ID_____________
Date: ___________ Time: __________
Spill Name____________________________
Segment ID____________________________
Site Name/# ___________________________
Team Leader___________________________
Recorder______________________________
Sampler_______________________________
Analysis (Check): PAH____ Oil Fingerprint____
Species____________________________
Replicate number_____ of _____

6. Wetland Habitat Fish Labels

Fish Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name______________________________
Segment ID______________________________
Site Name/#: ____________________________
Team Leader_____________________________
Recorder________________________________
Samplers__________________________________
Species______________________________
Replicate number_____ of _____
Seine Location______________________________

Fish Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name______________________________
Segment ID______________________________
Site Name/# _____________________________
Team Leader_____________________________
Recorder________________________________
Samplers__________________________________
Species______________________________
Replicate number_____ of _____
Seine Location______________________________

Fish Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name______________________________
Segment ID______________________________
Site Name/# _____________________________
Team Leader_____________________________
Recorder________________________________
Samplers__________________________________
Species______________________________
Replicate number_____ of _____
Seine Location______________________________

Fish Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name______________________________
Segment ID______________________________
Site Name/# _____________________________
Team Leader_____________________________
Recorder________________________________
Samplers__________________________________
Species______________________________
Replicate number_____ of _____
Seine Location______________________________

Fish Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name______________________________
Segment ID______________________________
Site Name/# _____________________________
Team Leader_____________________________
Recorder________________________________
Samplers__________________________________
Species______________________________
Replicate number_____ of _____
Seine Location______________________________

Fish Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name______________________________
Segment ID______________________________
Site Name/# _____________________________
Team Leader_____________________________
Recorder________________________________
Samplers__________________________________
Species______________________________
Replicate number_____ of _____
Seine Location______________________________

9. Wetland Habitat Insect Labels

Insect Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name_____________________________
Segment ID_____________________________
Site Name/# ____________________________
Team Leader____________________________
Recorder_______________________________
Sampler________________________________
Replicate number_____ of _____

Insect Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name_____________________________
Segment ID_____________________________
Site Name/# ____________________________
Team Leader____________________________
Recorder_______________________________
Sampler________________________________
Replicate number_____ of _____

Insect Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name_____________________________
Segment ID_____________________________
Site Name/# ____________________________
Team Leader____________________________
Recorder_______________________________
Sampler________________________________
Replicate number_____ of _____

Insect Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name_____________________________
Segment ID_____________________________
Site Name/# ____________________________
Team Leader____________________________
Recorder_______________________________
Sampler________________________________
Replicate number_____ of _____

Insect Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name_____________________________
Segment ID_____________________________
Site Name/# ____________________________
Team Leader____________________________
Recorder_______________________________
Sampler________________________________
Replicate number_____ of _____

Insect Label

Sample ID______________
Date: ____________ Time: ___________
Spill Name_____________________________
Segment ID_____________________________
Site Name/# ____________________________
Team Leader____________________________
Recorder_______________________________
Sampler________________________________
Replicate number_____ of _____

DFG REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page_____ of _____

Sampler	Ph #	Send Results To	Lab Number
Address		Address	Field Number
City	Zip	City / CA / Zip	Lab Storage
	CA	Copies To	Spill Title
Date Required/Reason		Address	Suspect
Shipped Via		City / Zip	Index-PCA

☐ Fish & Wildlife Loss Date:_____ Region:_____

☐ DFG Code Violation:_____

☐ Suspected or Potential Problem

☐ Routine Analysis

Water Temp: F or C pH: DO: mg/L Conductivity: umhos/cm

Analysis Requested >>>

Sample Identification/Location (Draw map on separate sheet if necessary)	Collection Date	Collection Time	Petroleum Fingerprint	Trace Elements (Specify Below)	Pesticides (Specify Below)	Petroleum	Sample Type: Water	Sample Type: Filtered Water	Sample Type: Soil	Sample Type: Tissue	Number of Containers: Plastic	Number of Containers: Glass	Number of Containers: VOA Vial	Preservation: Temp	Preservation: Acid

Problem Description

Suspect/Incident Location

Comments/Special Instructions

Pollution Action Kit: Yes☐ No☐

Glove Size: Large ☐ Medium ☐

Hazmat Shipper Requested: Yes☐ No☐

Samples Relinquished By (Signature)	Print Name	Date	Received By (Signature)	Print Name	Date

LAB COPIES: WHITE, CANARY, PINK SUBMITTER: GOLDENROD FG 1000 (Rev. 9/01)

Pesticide Investigations Lab
1701 Nimbus Road
Rancho Cordova, CA 95670

Petroleum Chemistry Lab
1995 Nimbus Road
Rancho Cordova, CA 95670

X

Water Pollution Control Lab
2005 Nimbus Road
Rancho Cordova, CA 95670

Laboratory Protocols

Suggested laboratory procedures for the processing and analysis of samples are presented. If OSPR currently has other protocols in place and in use, those can be used. These are recommended lab methods, but other procedures are also valid, keeping in mind that the before and after spill methods be consistent. These methods are presented here for easy reference.

Benthic Macroinvertebrates

Sample preservation, sieving and rinsing

The samples preserved in formalin are poured into a #35 (0.5mm) fine sieve with a container, larger than the sieve, underneath to catch the formalin as it is poured along with the sample from the 1L jar. The formalin is then drained and decanted into waste containers under a fume hood. Wear protective gear and follow all safety requirements while handling formalin. The detritus, rocks and organisms, which became an aggregate in the first bottle, are gently broken apart in the #35 sieve under warm water. After the rinses, the sample is placed into a clean 500 ml Nalgene® bottle. An ethanol and Rose Bengal stain mixture is created by adding Rose Bengal to a container with 95% ethanol and agitating it thoroughly. The ethanol stained with Rose Bengal is then poured into the bottle containing the sample to completely cover specimens for preservation during storage.

Sorting

The sample preserved in ethanol is poured into the #35 (0.5mm) sieve while the ethanol is caught beneath the sieve and decanted into a waste container. The stained samples are rinsed of excess stain with additional ethanol. Sub-samples are put into clean Petri dishes with distilled water added to cover the sample and are viewed under a microscope at 8x power to separate the organisms into distinct taxonomic groups. Each invertebrate should be classified to the lowest taxonomic level possible. Each group is sorted into 1ml vials containing a single taxon; more abundant taxa fill multiple vials. Each vial is labeled with the sample ID number and filled with ethanol for preservation. After the organisms have been sorted, all individuals are then counted. If organisms are not intact, only the portions including heads are included in the final count so as not to double count individuals.

Total abundance for each taxon is calculated per sample and divided by the volume of sample. Results are generally reported as a mean density of invertebrates, as number of individuals per m^3.

Sediment

Grain Size

(Modified from Bouyoucos, G.J. 1962. Hydrometer method improved for making particle size analyses of soils. Agronomy Journal 54: 464-465.)

Note: The test is sensitive to temperature. Have containers with distilled water set out the day prior to the analysis to acclimate to room temperature.

50g of dry weight is required for each sample.

(1) Weigh out enough wet sample, in a previously weighed Petri dish, to obtain at least 50g dry wt. of the sample.
(2) Place wet samples in an oven at 50° Celsius.
(3) Samples are considered dry when weighing on at least two different occasions (roughly 24 hours apart) yields a maximum difference of weight of less than 0.2g.
(4) Weight of dried sample is determined by subtracting the dry weight of the Petri dish from the weight of the sample + Petri dish.
(5) Carefully crush (not grind) dried sample until sample bits are approximately 3mm in diameter. This is a gentle crushing, meant to break up the grains but not alter the grain-size.
(6) Remove all twigs, shells, rocks and roots over 2mm in size.
(7) Place 50g of the moderately crushed sample into a 500mL beaker, and label the beaker with the sample ID number. (repeat for all samples)
(8) Prepare a Sodium Metaphosphate solution (it adds ion charge to sediments):
   (a) Add 50g of sodium metaphosphate to 1L of distilled water.
   (b) When adding sodium metaphosphate, continuously mix the water vigorously. Only add the chemical in *small* incremental amounts, allowing each to fully dissolve before adding the next increment. Note: it is easier to dissolve the chemical powder if the powder is briefly mixed with a stirrer beforehand, so no clumps are present.
   (c) Make sure sodium metaphosphate is completely dissolved, with none sticking to the bottom of the beaker in clumps.
(10) Once the solution is prepared, add 100ml to each sample beaker. (1L of solution can be used for 10 samples – repeat step #9 as necessary.)
(11) Add approximately 200ml of distilled water to each beaker.
(12) Place beakers on a shaker table at 125rpm for at least 24 hrs. If after the first 24hrs there are still clumps, keep beakers on the shaker for another 24hrs.
(13) Transfer contents of beaker to a 1L cylinder (marked at the 1L volume level), and use distilled water in wash bottle to break up and wash all particles out of beaker into the cylinder. Make certain *all clumps are broken up* by hand (clumps overestimate sand content). Label each cylinder with the sample ID number.
(14) Add distilled water, from the containers set out to room temperature, into each cylinder until the total volume in each cylinder is 1L. Be *accurate*! To gain accuracy use distilled water from rinse bottles for the last few milliliters. (Adding water from the same containers to all cylinders ensures that the water temp., and thus water densities, will be the same for all of the cylinders.)
(15) Make (and label) a blank by adding 5g sodium metaphosphate to 1L of distilled water, mixing vigorously until no clumps. Pour into a cylinder. (The following steps are the same for all cylinders, including the blank).

(16) Take temperature of water in the first cylinder: temperatures must be between 16.5 and 24.4 degrees Celsius for results to be accurate. Rinse the thermometer with distilled water after each reading.
(17) Place parafilm over the top of the first cylinder. Mix the contents *thoroughly* by inverting the cylinder several times until all of the soil is suspended in solution. Note the time after setting the first cylinder back down, to be able to repeat in 2 hrs. (not necessary to record the time after every cylinder, just keep track of the order, unless there's a long period of time between samples).
(18) Immediately after placing the cylinder back down on the countertop, start timing an interval of 40seconds. Remove the parafilm and *gently* lower the hydrometer into the cylinder (with about 10 seconds left to go).
(19) Record the hydrometer reading after 40 seconds, at the upward curve of the meniscus. (If bubbles are present: blow gently on the surface of the liquid just before the 40 second interval is up. This helps reduce the amount of bubbles and yields a more accurate reading.) If too many bubbles are still present to obtain an accurate reading, then replace the parafilm, re-shake, and repeat the 40 second interval.
(20) Rinse hydrometer with distilled water before starting on the next sample cylinder. Once a sample reading has been taken, DO NOT SHAKE THE CYLINDER AGAIN, before the 2 hr reading. If the sample is shaken again, then the procedure must be repeated for the sample, starting from step #16.
(21) Take hydrometer reading 2 hrs later, again rinsing between samples.
(22) Take temperature (2hr temp reading) for the same sample.
(23) Take all the 2 hr measurements in the same sample order as they were initially measured.
(24) To calculate grain sizes for % sand, % silt and % clay, use these equations:

Corrected hydrometer reading= Hydrometer Reading – Hydrometer reading of blank

[(temperature – 20degrees)*0.35]+Corrected reading = Temperature adjusted hydrometer reading (TAHR)

(TAHR at 40sec*volume (in Liters))/grams of dry soil = % silt and clay

100 - %silt and clay = % sand

(TAHR at 2hrs* volume (in Liters))/grams of dry soil = % clay

% silt and clay - %clay = % silt

Salinity

(Sally Hacker method)

(1) Place the wet sample into a clean Petri dish and weigh them together to obtain gross wet weight.
(2) Place the Petri dish into a drying oven maintained at 50°C until the sample is dry. Samples are considered dry when weighing on at least two different occasions (roughly 24 hours apart) yields a maximum difference of weight of less than 0.2g.

(3) Measure and record the Petri dish and dried sediment weight. (Subtract this gross dry weight from the gross wet weight to determine the sample's water content.)
(4) Remove all twigs, shells, rocks, and roots over 2 mm in greatest dimension from the dried sample.
(5) Employ a mortar and pestle to grind each soil sample into a fine powder.
(6) Weigh approximately 5-10 grams of each sample and place separately into a 150mL beaker.
(7) Add 20g (or 20ml) of distilled water.
(8) Swirl mixture around in beaker until all sediment is thoroughly wet (check the bottom of the beaker for dry sediment).
(9) Let beakers stand undisturbed/unshaken for 30 minutes, measured from the time the first beaker was shaken and set down.
(10) Using a plastic pipette, take a small sample of water from a beaker with as little sediment as possible. Take care to avoid scum on top of water surface as well as settled sediment on the bottom of the beaker. Place 2-3 drops on the refractometer. Make sure the entire refractometer surface is covered with water and that there are no air bubbles on the surface (once the plastic flap is down). Be certain that refractometer is calibrated before using.
(11) Note: take water samples from each beaker in the order the beakers were initially mixed.
(12) Take reading (ppt-scale on the right) under a bright light. The measurement is taken from the top of the white portion (of the field of view), where it meets the above blue portion. If there is too fuzzy a boundary to record an accurate measurement, continue with step #10, making sure no sediment is taken up while pipeting the water sample, since sediment obscures the light. Repeat steps #8-9 if necessary.
(13) Between samples, rinse off the refractometer with distilled water from a rinse bottle and wipe completely dry using a Kim wipe. Use a new pipette for each sample.

Equation for original soil salinity:

Original salinity (ppt or g/kg) = Salinity of subsample (ppt or g/kg) x 20g H_2O / grams H_2O in subsample)

Grams H_2O in subsample = (dry weight of subsample (g) x total wet weight of soil (g) / total dry weight of soil (g)) – dry weight of subsample (g)

Organic Matter Content

This method utilizes combustion of dried and ground samples at 400ºC. When clay content is high, burning at temperatures above 400ºC can overestimate the organic content because clay soils can lose structural water at high temperatures (Zedler 2001). This method was chosen over other methods that burn at higher temperatures for shorter periods of time.

Samples must be frozen since collection and must be dried for this procedure.

(1) Weigh out enough wet sample, in a previously weighed Petri dish, to obtain 15g dry weight of sample.

(2) Place wet samples in oven at 50 degrees Celsius.
(3) Samples are considered dry when weighing on at least two different occasions (roughly 24 hours apart) yields a maximum difference of weight of less than 0.2g.
(4) Weight of dried sample is determined by subtracting the dry weight of the Petri dish from the weight of the sample + Petri dish.
(5) Grind the dry sediment sample into a fine powder.
(6) Measure and record (to four significant digits) weight of small crucible. (Crucibles should be fired in a kiln before analyses and should not be touched with bare hands; oils from hands will change the weight of the crucibles.) Tare scale.
(7) Place approximately 15g of fully crushed sample into the crucible. Measure and record weight of sediment to four significant digits.
(8) Heat crucibles in a kiln/muffle furnace at 400 degrees Celsius for 10 hrs.
(9) Unload the kiln without touching the crucibles (use tongs or gloves). Quickly load crucibles into desiccators using the tongs. Leave the samples in the closed desiccators for a couple hours to cool, if needed.
(10) Remove the crucibles one at a time, using tongs, and weigh. Be as quick as possible because the dried samples will begin to absorb moisture from the air when the dessicator is opened.
(11) To obtain post-firing sediment weight, subtract the original weight of the crucible from the post-firing sediment + crucible weight.
(12) Percent organic material = (sediment weight after kiln / sediment weight before kiln)*100

Zedler, J.B. (ed.). 2001. *Handbook for Restoring Tidal Wetlands*. CRC Press LLC. Boca Raton, FL

Insects

Insect abundance and diversity are determined by scanning each side of the insect trap board under a dissecting microscope. Each side of the traps is counted and recorded separately, but usually counts are added per trap. Each insect should be classified to the lowest taxonomic level possible. All insects should be classified according to Order, most according to Family. The entire area of the traps is scanned to count the total number per group of insects present. For traps with large numbers of only a few groups (e.g. families), the traps can be scanned starting in the upper left corner with all insects identified and counted in each viewed section. For traps with a diverse collection of insect groups, the entire trap can be scanned multiple times counting only one group at a time.

Vegetation and Snails

Vegetation percent cover and snail abundance will be scored in the lab digitally from photos taken in the field instead of collecting the data directly from a quadrat in the field. A photo "framer" can be created and set over the images, for example in PowerPoint, as a proxy for the quadrat to score the photos within a 0.375m² area.

Vegetation will be scored by using a point-contact method that involves overlaying a grid of points onto each photo and identifying the plant species beneath each point. The Multi-Agency Rocky Intertidal Network's (MARINe) photoplot scoring protocol can be used (Engle 2005). In addition, all species visible in the photos should be noted, not only the ones under the points.

Snail photos will be zoomed in on the computer and each individual snail counted. Snails that are clearly visible above the surface are included in the count, even if part or most of the snail is beneath the surface. For snails on the edges of the quadrat area, count if greater than half of the length of the snail appears to be inside the quadrat. If two snails are half in, count as one, etc., using best judgement.

Engle, J. M. 2005. Unified Monitoring Protocols for Multi-Agency Rocky Intertidal Network (November 2005 Update). MMS OCS Study 05. Coastal Research Center, Marine Science Institute, University of California, Santa Barbara, California. MMS Cooperative Agreement No. 14-35-0001-30761, 1-77.

Appendices

1. Monopod Specifications

Materials:

¾-inch schedule 40 PVC pipe, cut to 0.85m
Threaded ¾-inch schedule 40 PVC pipe, cut to 0.3m (only need one threaded end)
Aluminum pipe flange for ¾“ pipe, ¼“ holes
Unthreaded ¾-inch PVC 90° elbow
Bullseye level, with screw mount, 13/16” diameter, 9/16” height (mcmaster.com)
Flat Phillips-head wood screw, 1½“ x #8 diameter
Cap nut, 10-24
Thumb screw, ¼ – 20 x 1½”
Coupling nut, $^{5}/_{16}$” – 18, 1” long
Rubber washer, ¾“ OD, ⅜”ID
Rubber washer, 1½“ OD, $1^{3}/_{16}$” ID
Super glue (Seal-All® waterproof, quick-dry, gas & oil-resistant, all-purpose adhesive)
Sandpaper (3M: 130N, 120, or coarser)

Cut both PVC pipes to length. Screw threaded PVC into pipe flange. Secure both PVC pipes into elbow joint with superglue, first roughing inside edge of elbow joint and end of each PVC pipe with sandpaper. *****Before gluing the pipe with the flange attached, make sure it is “straight,” (i.e., turned so that the mounted camera will face directly downward). Once glue has dried, drill a small hole (smaller than the diameter of the wood screw) in exactly the top of the horizontal PVC near the elbow joint. Attach the threaded disc of the 2-part level by lining up and drilling in wood screw to hold level mount disc in place. Do not tighten all the way, leave a little wiggle (unless you can ensure while drilling that the mount will be exactly level). Screw the vial housing part of the level onto the disc. Set the monopod on a level surface. Line up the bullseye level so that it is exactly level and superglue around the base. Superglue the cap nut onto the protruding end of the wood screw. Superglue the rubber washers onto the pipe flange with the large one surrounding the middle hole and the small one surrounding the mounting hole. To mount camera, screw the coupling nut onto the thumb screw, line up the camera on the pipe flange end, and secure the camera with the thumb screw.

The height of this monopod (length of PVC of 0.85m) was constructed based on utilizing a Canon PowerShot S2IS on the highest resolution (2592 x 1944) with a zoom lens of 6.0 – 0.72mm. This height works for this camera, but might not work for others, depending on what the focal length of the lens is when it is at its widest angle. The proper height must be checked before the PVC pipe is cut, and adjusted if necessary so the picture captures exactly the right area.

2. Supply List

w = wetland protocol, r = rocky intertidal protocol, s = sandy beach protocol

Supply List	Supplier	Order #	Price	Unit	Quantity	Total for 1 "site"
Polyethylene gloves (w - 25 pairs, r & s - 3 pairs) - 100/pk, med. & lrg.	Fisher Scientific	19-181-535 & 19-181-536	9.16	Pack	2	18.32
1L plastic sample jars: wide-mouth (w - 20) (at vehicle) - wide-mouth polypropylene bottles, case of 24	Fisher Scientific	02-896F	157.96	Case	1	157.96
Distilled water in squirt bottle, (w - one at vehicle, one for field) - Nalgene squirt bottle, 16oz., 6/pack	Fisher Scientific	03-409-10CC	30.90	Pack	1	30.90
Kimwipes - 4 x 8", 280/pack (w)	Fisher Scientific	S47299	2.65	Pack	1	2.65
Disposable plastic pipettes (w - 10) - 3mL, 500/pk	Fisher Scientific	S304679	21.50	Pack	1	21.50
Refractometer (w)	Fisher Scientific	13-946-27	209.99	Each	1	209.99
95% Ethanol (w - at vehicle, not in field)	Fisher Scientific					
Glycerin (w – at vehicle, not in field) for ethanol/glycerin preservation solution	Fisher Scientific					
Compass (w – 2, r – 1, s – 1) - Silva	Forestry Suppliers	37064	8.95	Each	4	35.80
Transect tape: 50m (w – 1, r – 1) - Keson open-reel fiberglass tape	Forestry Suppliers	39945	36.50	Each	2	73.00
Transect tape: 100m (r) - Keson open-reel fiberglass tape	Forestry Suppliers	39986	71.50	Each	1	71.50
Shovel (w, s) – D-handle Garden & Nursery Spade, 4 ¾" x 16", 27" handle	Forestry Suppliers	33896	26.50	Each	2	53.00
Distance measuring wheel (s) – Keson, meters/decimeters	Forestry Suppliers	39026	49.46	Each	1	49.46
Stopwatch – (r) - Digital, water-resistant, up to 59 min., w/ 39" strap & battery	Forestry Suppliers	92637	21.75	Each	1	21.75
Binoculars – (w) Swift, 8x Magnification, 40mm Diameter Obj. Lens, 472´ Field at 1,000 yds., 14´ Close Focus, 22 oz. weight	Forestry Suppliers	91201	79.95	Each	1	79.95
Perforated paper for Data Labels (w & r) - 6/pg	lasercutsheet.com	23-0118	14.88	Ream	1	14.88
Pre-washed corers (w - 10) - 1" polyethylene pipe, 1.049" inner diameter, 10' long, cut into 11" long cores	McMaster-Carr	4884K92	18.00	Each	1	18.00
Wooden dowel (w - 10) - 1" diameter, 48" long, cut to 12" rods, 2/pack	McMaster-Carr	9683K61	9.40	Pack	2	18.80
Corer handles - Cedar dowel (w - 10) - 11/32" diameter, 32" long, cut to 8"	McMaster-Carr	3907K21	3.30	Each	3	9.90
Sieve– (w, s) polyethylene, 0.1" mesh, 36" wide, cut-to-length per foot	McMaster-Carr	9314T26	1.46	Foot	3	4.38
Sieve frame (w, s) – Wooden dowels – maple dowel rod, 7/8" diam., 48" length	McMaster-Carr	97015K21	5.08	Each	3	15.24
Evidence tape – (w, r & s) Tamper seal labels, 2½" x ½," 50/pkg.	McMaster-Carr	20195T3	10.91	Pkg.	2	21.82
Flags – (r) - 4" x 5" with 30" long steel wire stakes, 100/pkg.	McMaster-Carr	57015T4	8.94	Pkg.	1	8.94
Caliper – (r) - Economy caliper, 0-105mm, 6" overall length	McMaster-Carr	2287A22	11.39	Each	1	11.39

Supply List	Supplier	Order #	Price	Unit	Quantity	Total for 1 "site"
0.5m x 0.75 m quadrat of grey PVC – (w, r) - ¾," schedule 80, 10' long, unthreaded	McMaster-Carr	6803K13	15.90	Each	1	15.90
Pipe fittings - 90° elbow, gray PVC, schedule 80, for ¾" pipe	McMaster-Carr	6826K13	2.45	Each	4	9.80
PVC pipe – 1 meter for band transect (s) – ¾ “, 5’ long, schedule 40	McMaster-Carr	48925K92	2.64	Each	1	2.64
Marine Epoxy – (r) - Underwater 2-part epoxy, 1:1 mix, 24oz.	McMaster-Carr	7521A12	23.90	Each	1	23.90
or Marine Epoxy - Z-spar Splash Zone 2-part epoxy, 2QT (purchased alongside MARINe project?)	West Marine	201087	145.00	Each	1	
Ruler – (w) Westcott United clear plastic ruler - 12" long, inches & mm	Office Max	J145012	0.37	Each	1	0.37
Clear packaging tape (w - at vehicle) – 48mm width, 30 yd. L, w/ dispenser	Office Max	A8OM99405	1.19	Roll	1	1.19
Sharpies – (w, r & s) Fine point permanent marker, black	Office Max	N230001	5.40	DZ	1	5.40
Pencil – mechanical (w – 6, r – 5, s – 3) - Bicmatic Grip, 0.5mm, Assorted, 5/pack	Office Max	N4MPFGP51	1.97	Pack	2-3	3.94 - 5.91
Eraser - Paper Mate Union, gray/white, medium	Office Max	N670522	0.50	Each	1	0.50
Clipboard (w – 5, r – 3, s – 2) - Saunder brand	Office Max	F705612	0.58	Each	10	5.80
Gee Minnow Traps: 9" x 17.5" with ¼" mesh, 1" opening, 6/carton (w – 50?)	Sterling Net & Twine Co.	G40M	54.90	Carton	5	274.50
Invertebrate Corer: (w) Standard PVC Clam Gun, 4” (~10cm) diameter, 30” length, 5cm depth marked	Jack’s Country Store	30430	11.95	Each	1	11.95
Aluminum foil: solvent-rinsed (w - 30 + 2 extra, r – 3, s – 3)			0.99	Box	1	0.99
Ziploc bags: quart-sized (w – 60, s – 6)			2.69	Box	3	8.07
Ziploc bags: gallon-sized (w - 40 + 2 extra, r – 6)			2.99	Box	2	5.98
Shop towels or paper towels			1.99	Roll	1	1.99
Chalk - Chalkboard chalk (r)			1.00	Box	1	1.00
Disposable instant ice bags or blue ice packs: 5”x7” (w – 8, r & s – 4)			10.00		8	80.00
Soft-sided cooler: 14”x12”x7” (w – 2, r & s – 1)			20.00	Each	4	80.00
Backpack (w – 1, r & s – 1)			30.00		3	90.00
Pens						
GPS unit (w & r)						
Digital Camera (w & r)						
Fish seine/block net (w)						
Yellow sticky insect traps - Silva Giant, 12.6" x 7.5", two- sided, 18/pkg, cut in half to 6.3" x 7.5" (w)	Biocontrol Network	231701	29.95	Pkg.		
Insect trap holders - Yellow sticky trap wire stakes (under "Item size") 10/pkg. (w)	Planet Natural	None	3.50	Pkg.		
Wax paper (w)						
Camera monopod (w) – see Appendix 1			20.00			