ISLAND COUNTY / WSU

Beach Watchers

Beach Monitoring Procedures

TRAINING MANUAL FOR ISLAND COUNTY/ WASHINGTON STATE UNIVERSITY BEACH WATCHERS

Beach Monitoring Procedures

Revised April 2003

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Section 1

Introduction

The Beach Monitor Goal

The goal of the Beach Monitor is to collect baseline data over time at specific monitoring sites and to document changes, if any, to beach slope, substrate, and biodiversity, following the Beach Watcher monitoring guidelines and procedures.

Why WSU Beach Watchers Monitor the Beaches

- The health of Island County beaches and the health of Puget Sound are intimately interwoven. A major goal of our program is to watch over our beaches, monitor the changes they are undergoing, and determine what these changes might mean for Island County and the whole of Puget Sound.

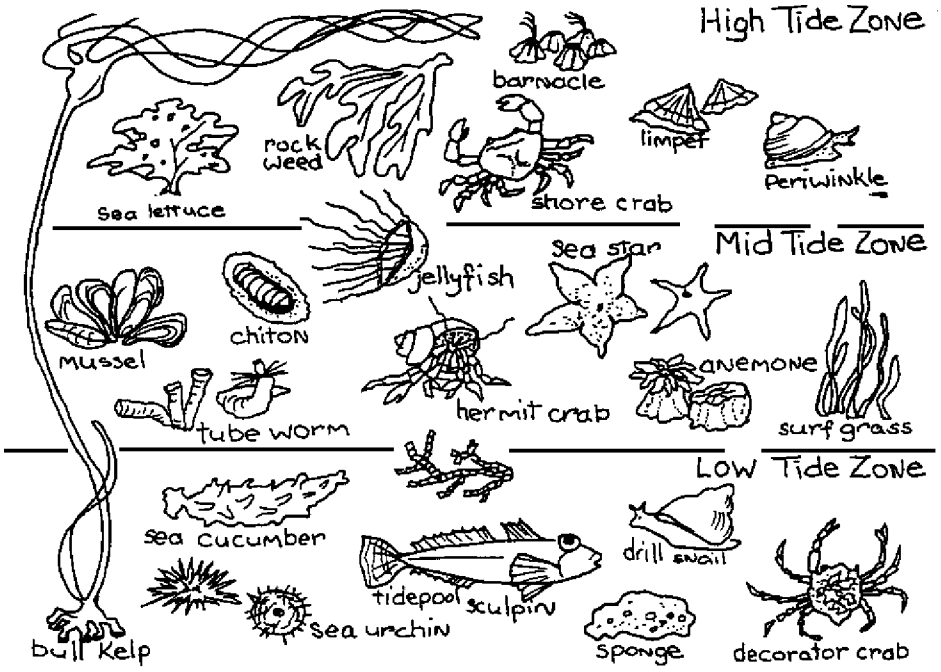
- We are the only group collecting baseline information about Island County beaches on an annual basis.

- This data is essential to determine if or how our beaches are changing. The impact on our beaches of any future natural or human-induced event cannot be measured without such data. Moreover, environmental questions posed by governmental agencies and interested groups cannot be scientifically answered without such data.

Other Thoughts About Our Intertidal Monitoring Activities…

The WSU Beach Watchers' program provides citizens an excellent opportunity to learn more about Island County beaches – about the plants and animals that live on a healthy beach and about factors or events that might cause changes on a beach, either suddenly, or over time. Beach Watchers have field tested,

standardized and streamlined monitoring procedures so that volunteers, regardless of backgrounds, are able to understand and follow the guidelines after their initial training. Yearly, since 1996, beach monitors have mapped beach profiles and recorded the densities of intertidal plants and animals at over thirty monitoring sites around Island County. The same monitoring procedures are applied to most types of beaches, from quiet mud flats to wave-impacted cobbled shorelines. The product, over time, is an expanding, quality-controlled baseline database of our county's beaches for use in the assessment of the health of our shorelines.



Section 2

Initial Beach Selection & Determination of Baseline Measurements

Beach monitoring consists of three simple components: 1. a profile map of the beach slope including an inventory of substrate and major groups of animals and seaweeds along the profile; 2. a survey of species density within quadrats placed at three tide levels; and 3. a list of species seen throughout the entire area.

Before monitoring begins, a preliminary site visit is made to establish the profile line, including its starting point, horizon point and the compass reading along the profile line. The locations of 3 transects which intersect the profile line at the +1 foot, 0 foot, and –1 foot tide levels, and the positions of quarter-meter quadrats along the transect lines, are also determined. A simple sketch of the beach site is drawn to illustrate these points (Figs. 1a & b).

Future monitoring at the site is based on the preliminary measurements.

Choosing a Site

Beach sites are chosen to reflect the diversity of shoreline habitat in Island County. Other factors such as beach ownership & access may need to be considered.

To Get Started

- New Beach Watchers setting up new sites will benefit from having an experienced monitor help them select an appropriate site and determine the baseline measurements.
- With the help of a tide table, select a day when the lowest daytime tide level is at –1 foot or lower.
- Request a tide graph printout for your beach for that day from the Beach Watcher office.(Beach Watchers use *Tides and Currents for Windows* software; other tide and current programs are also available).

- Take a camera with you to photograph starting point and profile and quadrat locations. Digital photos are preferred. If using another camera, request a digitized copy of your photographs when having your photos developed. Consider a throw-away panoramic camera for panoramic print photos. Make sure a camera and photographer are part of your team!

- Assemble field equipment (see Appendix A).

- Establish a starting point, permanent profile line, the positions of transects and quadrats, and the elevation of a permanent feature on or near profile line. Include these reference points and baseline measurements on a beach sketch and the preliminary site visit forms.

- Your beach will be given a salinity, substrate, and exposure category based on A Marine and Estuarine Habitat Classification System for Washington State.[1]

- The beach category as well as a tidal reference station will be added to your "Directions to Beach" form and entered into the Beach Watcher database.

Establishing the Permanent Profile Line

- Once on the beach, select a profile line – an imaginary line from the backshore to the water's edge and perpendicular to the shoreline. Use a distinctive starting point such as a seawall, a large erratic, or other permanent structure. If the structure does not lie directly on the profile line, take additional measurements and compass headings from the structure to the start of the profile line. The starting point should begin near the storm berm above the high tide line, or at the base of a bluff or sea wall, and should follow the shortest line possible from the starting point to the water's edge.

- It is important to document the exact location of your starting point and profile line so that you or another monitoring team will be able to locate it in the future. Stand on your newly selected permanent starting point and…

    - Find and record the latitude and longitude of your starting point with a global positioning system (GPS) if one is available.

    - If possible, pound a 4-foot rebar into the beach at or near the starting point. This could help in finding the starting point if other methods fail or are not available when you make future visits.

        - While standing at the starting point find 3 distinctive structures or landmarks and record the compass readings for each one (see Form 1). If possible, select landmarks close to you and at least 45 degrees apart. These compass readings will allow you to locate your starting point if a GPS reading was or is not now possible, the rebar not found, or you are otherwise unable to find your starting point by any other means.

[1] Dethier, M. N. 1990. A Marine and Estuarine Habitat Classification System for Washington State. Washington Natural Heritage Program, Dept. Natural Resources. 56 pp. Olympia, Wash.

  - Face the horizon and the shortest possible path to the water from your starting point. (in most cases a line perpendicular to the shoreline). This is your permanent profile line. Take a compass reading along this line. The compass heading will enable you to identify your profile line even in dense fog.

- Take photographs of the beach site, starting point and any other distinctive features. Panoramic photos of the entire stretch of beach are also desirable.

Elevation of a Permanent Feature On or Near the Profile Line

- To determine whether or not the elevation of the beach has changed from year to year, we measure the elevation of a permanent feature on or near the profile start point each time the beach is monitored.

- One of the following ways should work for you (Fig. 2). Whichever method you use must be documented carefully (Form 2) so that the same method can be followed by others in the future.

  - When the starting point is at the base of the structure (as at the base of a sea wall or erratic), simply measure straight down from the top of the structure to the beach surface. For example, measure from the top of a sea wall corner to the beach surface starting point.

  - To measure from an erratic:

    - Lay a profile pole on top of the erratic. Be sure it is level. Drop a plumb line from the pole along the side of the erratic to the beach surface. Measure the distance of the plumb line from pole to beach surface (see completed sample, Form 2). Record the direction (compass reading) of the profile pole placed on the erratic (see Fig. 2, vertical height measurement sketch).

  - Record the location of the structure in relation to the starting point and profile line

    - If the structure is on the profile line, measure the distance from the starting point to the point of elevation measurement

    - If the structure is not at the starting point and not on the profile:

      - Record the compass reading and the distance from starting point to point of measurement on the structure ***AND,***

      - Record the shortest distance from the structure to the profile line and then the distance from that point on the profile line to the starting point.

Permanent Transects

- Transects (lines that intersect the profile line and are parallel to the water's edge) are established at the +1 foot, zero foot, and –1 foot water levels. There are two ways to find the three tide levels.

Both methods require a tide graph for your beach for the day you monitor (see sample, Fig. 3). A rope marking the profile line is helpful.

- Determine from the tide graph the exact times of day the outgoing tide will be at +1 foot, zero foot, and –1 foot as the water retreats down the beach slope. At the designated times plant a reference stake at the water's edge. Then make the following measurements. In the future, use these measurements to locate the transect lines.

    1. Distance from the starting point to +1 foot
    2. Distance from +1 foot to zero foot
    3. Distance from zero foot to –1 foot

- Alternately, using the tide graph, wait for the lowest tide of the day and flag the spot on the profile line that is at the water's edge. Read the tide level from the graph. Then using two separated profile poles, work backwards to find and flag the –1 foot, 0 foot, and +1 foot points on the profile. (See "Section 3: Profiling" for instructions on measuring elevation change.) Flag these points, then measure and record the distance of the three tide levels from the starting point, as in the first method. In the future, use these measurements to locate the transect lines.

- Each time the beach is monitored, three (3) quarter-meter quadrats (50 cm x 50 cm) will be placed on each transect line to quantify the density or percent cover of all live seaweeds and invertebrates within the quadrats.

- Note: The number of quadrats (three) Beach Watchers include on each transect line was arrived at during a trial and error period of several years. Taking into consideration the number of summer low tide days, the average size of our monitoring teams, the number of beaches we monitor, and the amount of time it takes to complete the profile and quadrat work, our teams are at their limit with this number. As a result, our quadrats give us a "snapshot" of only the most abundant seaweeds and invertebrates on a particular site. Ideally, on a beach of particular interest and with a large monitoring team, the number of quadrats (and the number of transects) could be increased substantially to obtain a more accurate sampling of the entire community.

Sketch of Your Beach

- Make a simple sketch of the beach monitoring site that includes the starting point, profile line, transect lines and all baseline measurements collected on the preliminary site visit (see sample sketches, Figs. 1a & b).

- Determine where you want to place the quadrats on the transect lines, three per transect, and indicate the locations in the drawing. Beach Watchers use square (50 cm x 50 cm) quadrats made of wood or PVC pipe. Quadrats can be above or below the transect lines, but should be spaced equally apart on each transect, with the same spacing used in all three transects. Be sure to indicate the distance apart in the drawing. Several formats are possible and the design is left to the team

captain. Placement should be decided and sketched in before the first beach monitoring (See Figs. 1a & b).

- Indicate on the sketch how each quadrat is identified. Example: T3-Q1 would usually indicate the first of the three quadrats on the –1 foot transect (T3).

- A copy of the sketch will go in the report and you will need a copy with you on the beach when you monitor.

Directions to Beach Access and Starting Point

Concise directions to your beach need to be recorded on the form provided (see sample, Form 3). Fill in all the blanks and as briefly as possible describe how to access your beach area from the nearest major highway and then how to find your exact starting point from the beach access. This document guarantees that others will be able to find your monitoring site without you.

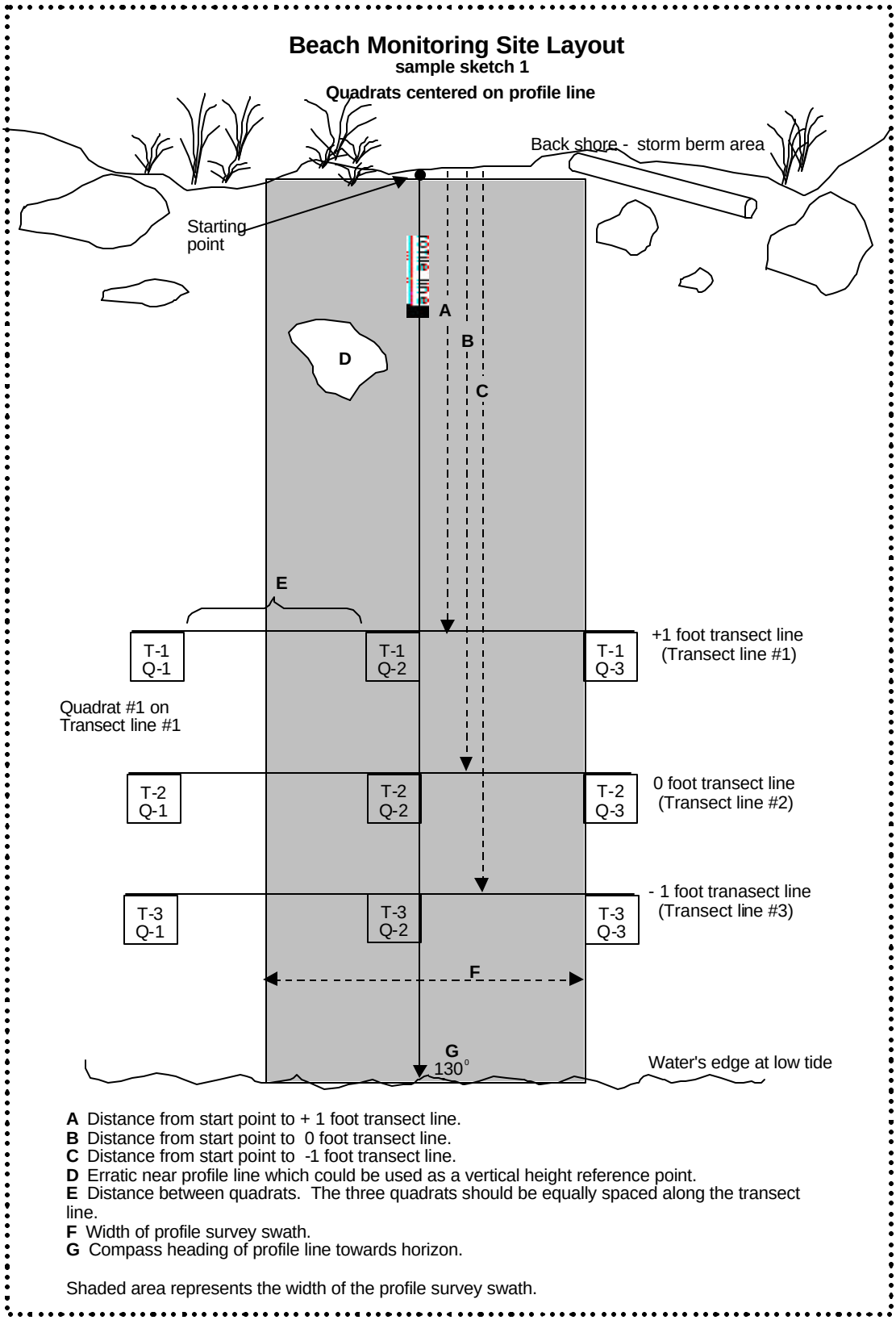


FIGURE 1a. Beach Monitoring Site Layout, Sample #1

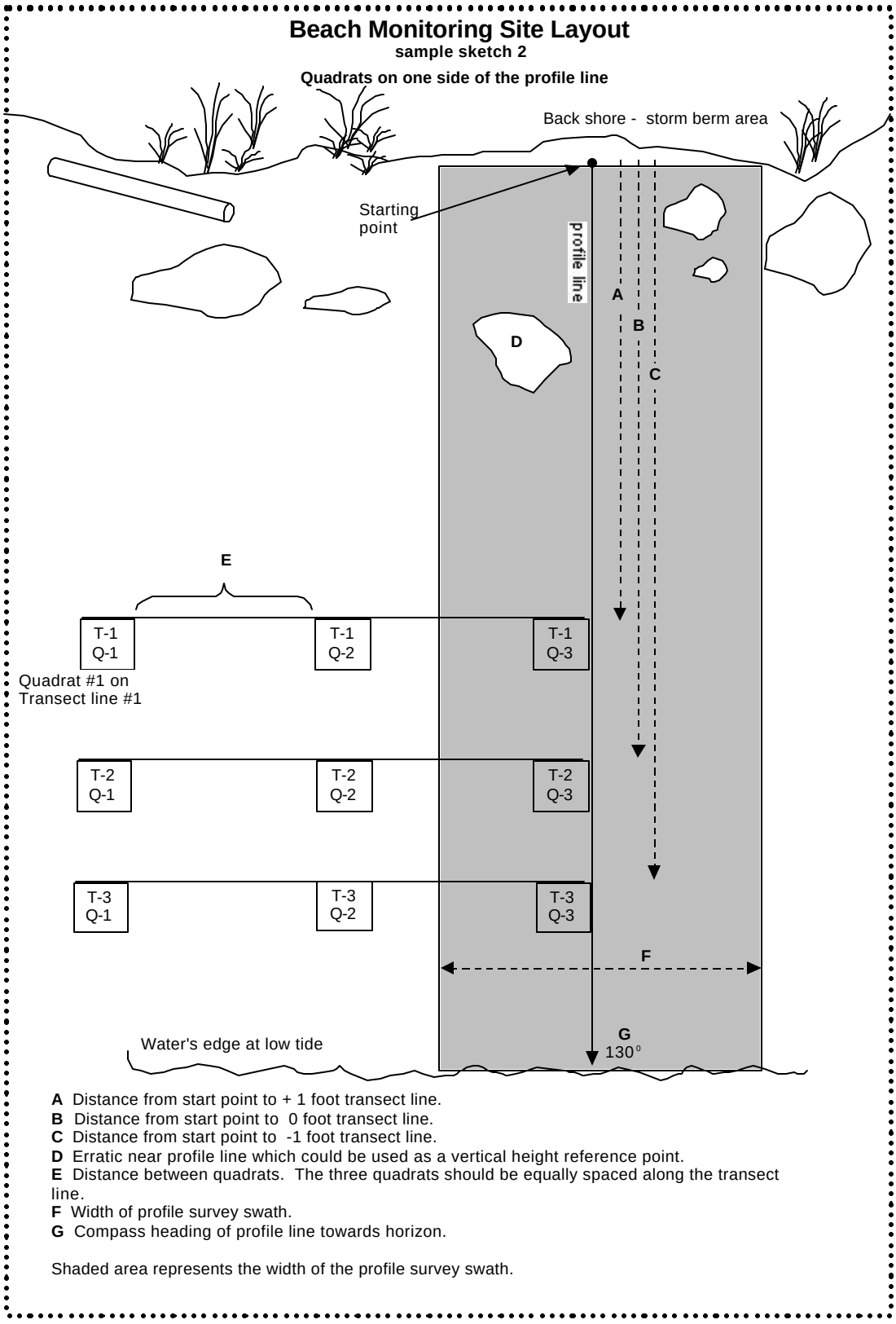
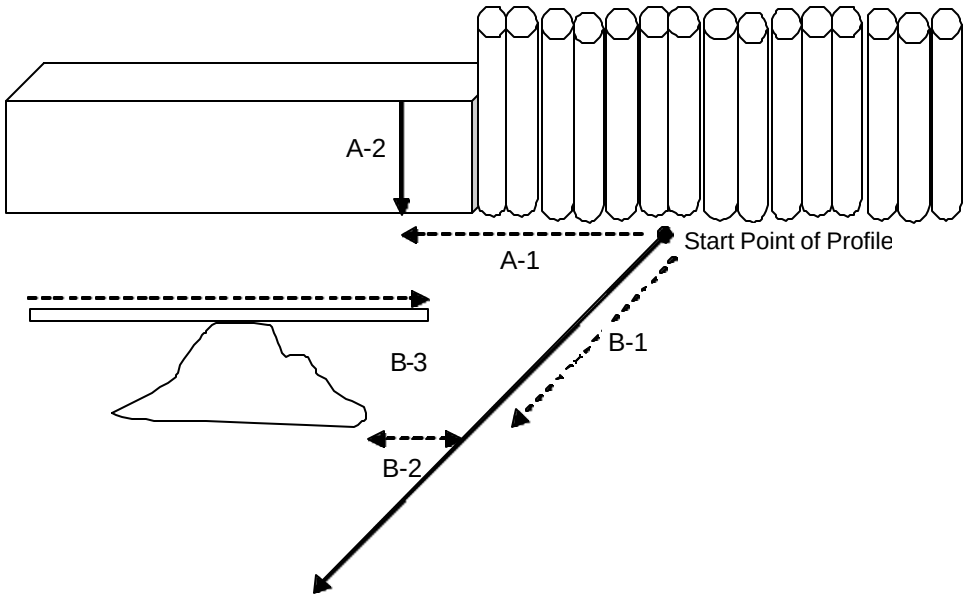


FIGURE 1b. Beach Monitoring Site Layout, Sample #2

Vertical Height Measurement of Permanent Structure



Two examples of vertical height measurements:

A Using a bulkhead or seawall

A-1 The direction and distance from the profile line to the seawall point of measurement.

A-2 The distance from the top of the seawall to the ground (vertical height).

B Using an erratic or other structure along the profile line

B-1 The distance from the profile line start point to the object.

B-2 The distance from the profile line (B-1) to the object.

B-3 The distance from your level measuring stick atop the object to the ground (vertical height).

B-4 The compass heading of your measuring stick.

FIGURE 2. Vertical Height Measurement of Permanent Structure.

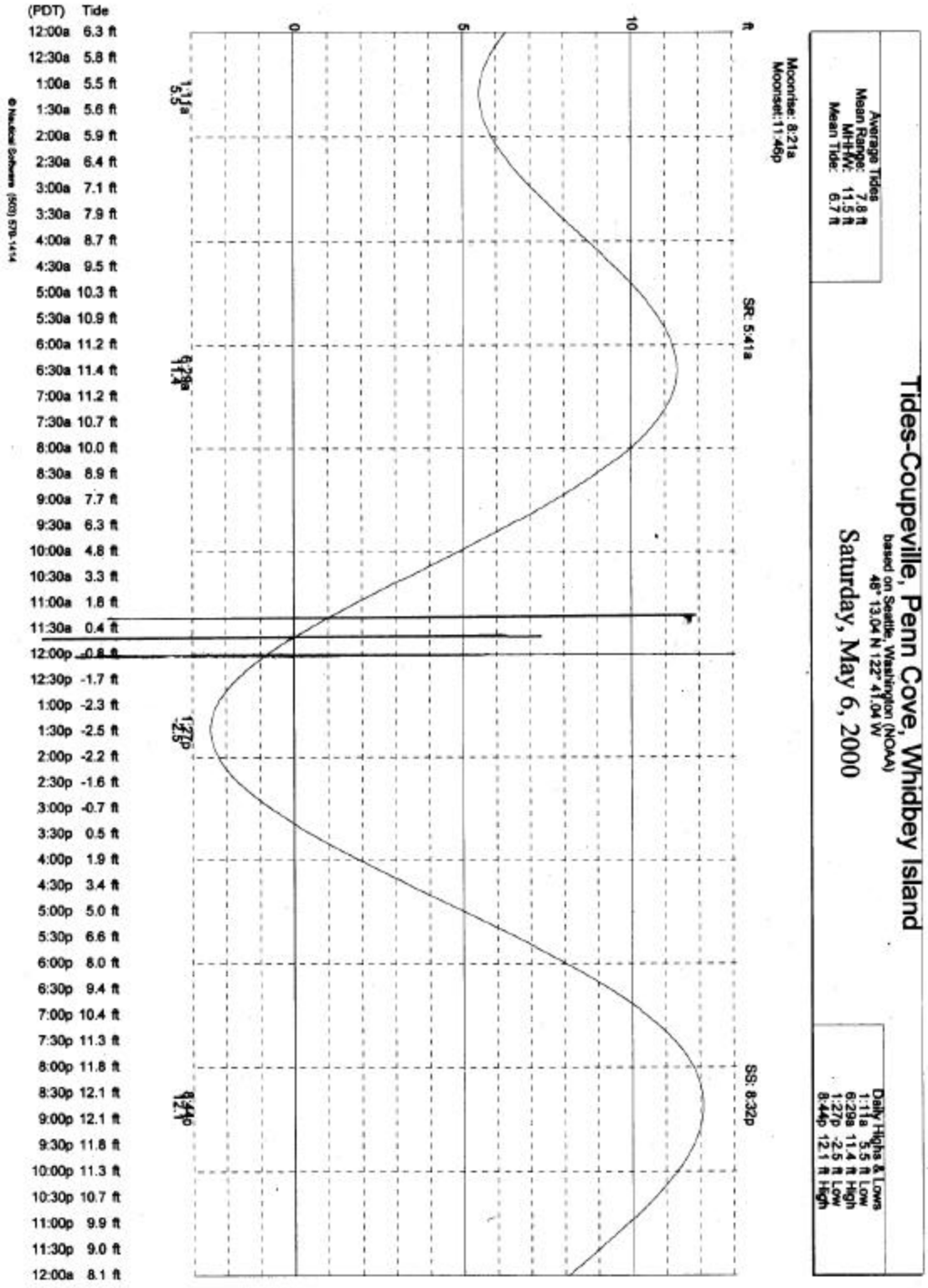


FIGURE 3. Sample Tide Graph Used in Initial Beach Selection & Baseline Measurements

FORM 1. Starting Point of Permanent Profile Line – sample completed form.

Starting Point of Permanent Profile Line (sample completed form)

BEACH SITE South Whidbey State Park

Beach Watcher(s) Susan King & Grace Hilliard

Date of Measurements 4/29/98

STARTING POINT -- 3 COMPASS READINGS

Compass Reading	Description of Point Sighted for Reading
1. 171.5°	Boat launch at Bush Point
2. 210°	South end of Marrowstone Island
3. 289.5°	Fort Worden Lighthouse (use binoculars!)

LONGITUDE 122^{o} 36.350

LATITUDE 48^{o} 03.518

FORM 2. Vertical Height of Permanent Structure – sample completed form.

Vertical Height of Permanent Structure Close To or On Profile Line (sample completed form)

Description of the structure you are measuring: It is the ONLY erratic near park stairs to beach. Head NW from stairs to erratic

Where is the structure in relation to your profile line? 1.5 feet NW of profile line at a compass reading of 125° (and 63.5 feet from starting point – heading 30°)

Compass reading: 125° **(to clarify the direction measurement was made)**

HEIGHT: 5.65 feet **(specify feet, inches, tenths, centimeters)**

Attach a photo or sketch below to show how the above measurement was made (see Fig. 2).

FORM 3. Directions to Beach – sample completed form.

Directions for Access to a Monitored Beach (sample completed form)

Name of beach South Lagoon Point **County** Island
Monitoring Team Leader Susan King **Phone** (360)555-1212
Nearest Town Greenbank **Nearest Body of Water** Admiralty Inlet

GPS Coordinates of Starting Point (if available)
GPS Brand Garmin **GPS Model** III Plus
Latitude 48° 03.518 **Longitude** 122° 36.350 **PDOP**

Directions to Beach Access (from major intersection or town):

¼ mile north of Greenbank turn west off Hwy 525 onto Smugglers Cove Road. After approximately 2 ½ miles turn west onto Westcliff Drive. Turn south on Lagoon View. Continue on and go down the hill where it becomes Salmon Street. Go to end of Salmon to S. Lagoon Point public beach access and parking.

Directions to Starting Point from Beach Access:

At the southern boundary of the public beach access face south. Use a Rolatape along the high tide line to measure 2,590 feet to starting point. The study area is at the base of a bluff approximately 45 feet high and lies midway between the last residence on the beach and the "bump" to the south. Starting point is at the northwest corner of a white boulder (small erratic) about 2 feet tall by 5 feet end to end and is marked by a rebar 0.3 feet west of northwest corner of the white boulder.

Compass Reading (magnetic) for Profile: 228.5°
(from starting point to horizon over the water)

Section 3

Profiling Your Beach

A profile study of the beach slope is a major component of beach monitoring. A wealth of information on beach slope and elevation, beach surface structure, and living organisms comes from each profile study.

Preliminary tasks – Team Leader

- Consult with your team members to choose a monitoring day. Subsequent annual monitoring of your site should be scheduled as close as possible to the original monitoring month, week and day.
- Using a tide chart for your monitoring site tide reference station, select a monitoring day with at least a –1.5 foot daytime tide, but preferably –2 foot or lower. Request, through the Beach Watchers office, a printout of a tide graph for your beach for the selected day of monitoring. Inform team members of the date chosen as early as possible.
- Provide all members of your team a list of the species previously found on your beach so they can have an opportunity to review them before the chosen monitoring day.
- Take time to carefully assemble all field equipment. Be certain that the length of rope between the profile poles is exactly 10 feet. See Field Equipment List, Appendix A.
- Be sure to take a copy of your beach sketch and the tide graph when you go to the beach site.

Field Profile Data Collection Procedures

- Plan your monitoring day to allow enough time (usually 2-3 hours) before lowest tide to complete profile monitoring and quadrat analysis.
- Review the type of data that you are asked for on the Field Data Sheet– Side A (Form 4a) before beginning the profile.
- Use a pencil to record data.
- Fill out all information asked for in top section of Field Data Sheet– Side B (Form 4b).

- Use the profile pole technique illustrated in Figures 4, 5 and 6 to move along your profile line. For each section surveyed, record on Side A of the Field Data Sheet the length of the section and your elevation reading (+ or –).

- Then record with a check mark all of the substrates, seaweed, and animals that apply within each profile section. Additional plants and animals not already included on the form can be added in one of the "other" columns. The width of the section or swath that you survey should remain constant along the profile and from year to year. This width should be documented on your beach sketch and at the top of the Field Data Sheet– Side B.

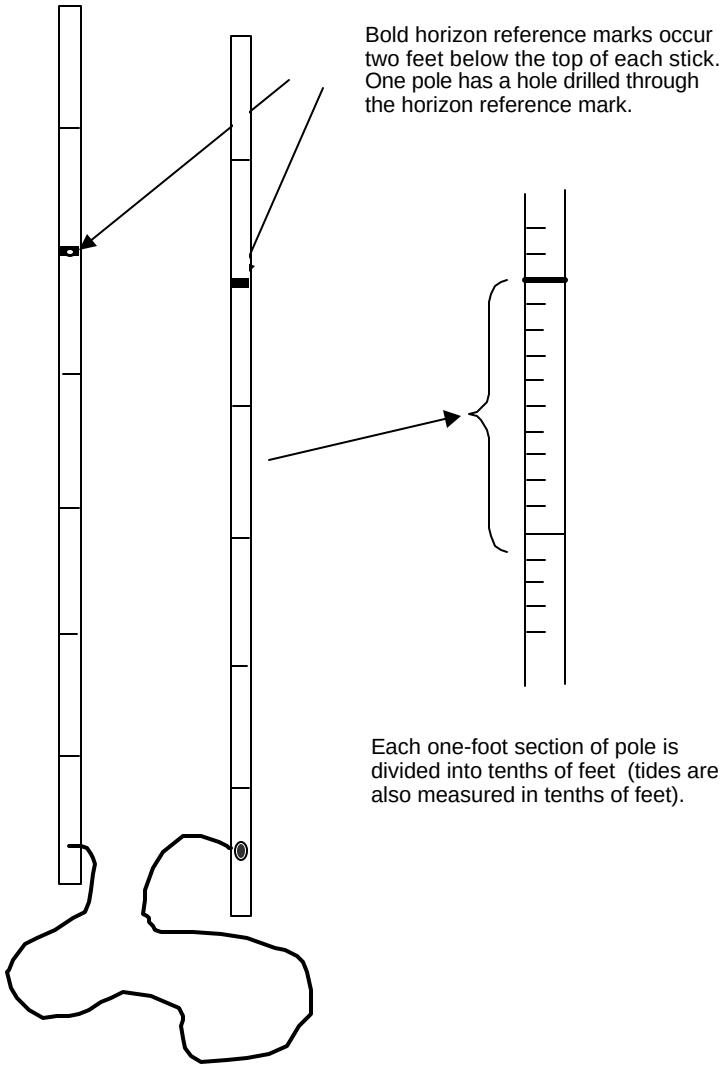
- Record on the Field Data Sheet– Side B the exact time of your last measurement at the water's edge (Profile End Time). The time should correspond to the lowest tide level of the day. This information will be used to plot a graph of the profile line. If you can't reach the water's edge at low tide (e.g., because the beach is too muddy), record the exact time and distance of your last measurement from the start point; and after the last profile recording on the Field Data Sheet– Side A, note why you stopped at that point.

- Record on Field Data Sheet– Side B the Tide Height at End Time (calculated from Tide Graph).

- If it's not possible to do quadrats on your beach, now is the time to obtain all monitors' signatures on the Field Data Sheet– Side B before leaving the beach.

FIGURE 4. How to Use Profile Poles (photo)

The Profile Poles



Two seven-foot profile poles (made from finished 1 X 2 lumber)

The poles are divided into seven one-foot sections and attached at the bottom with a ten-foot length of rope or heavy cord. A bold horizon reference mark is placed two feet below the top of each pole. The reference marks, along with the actual horizon line will be used to measure changes in elevation. One reference mark has a small (1/8') "peep" hole drilled into it.

FIGURE 5. The Profile Poles

The Profile Procedure

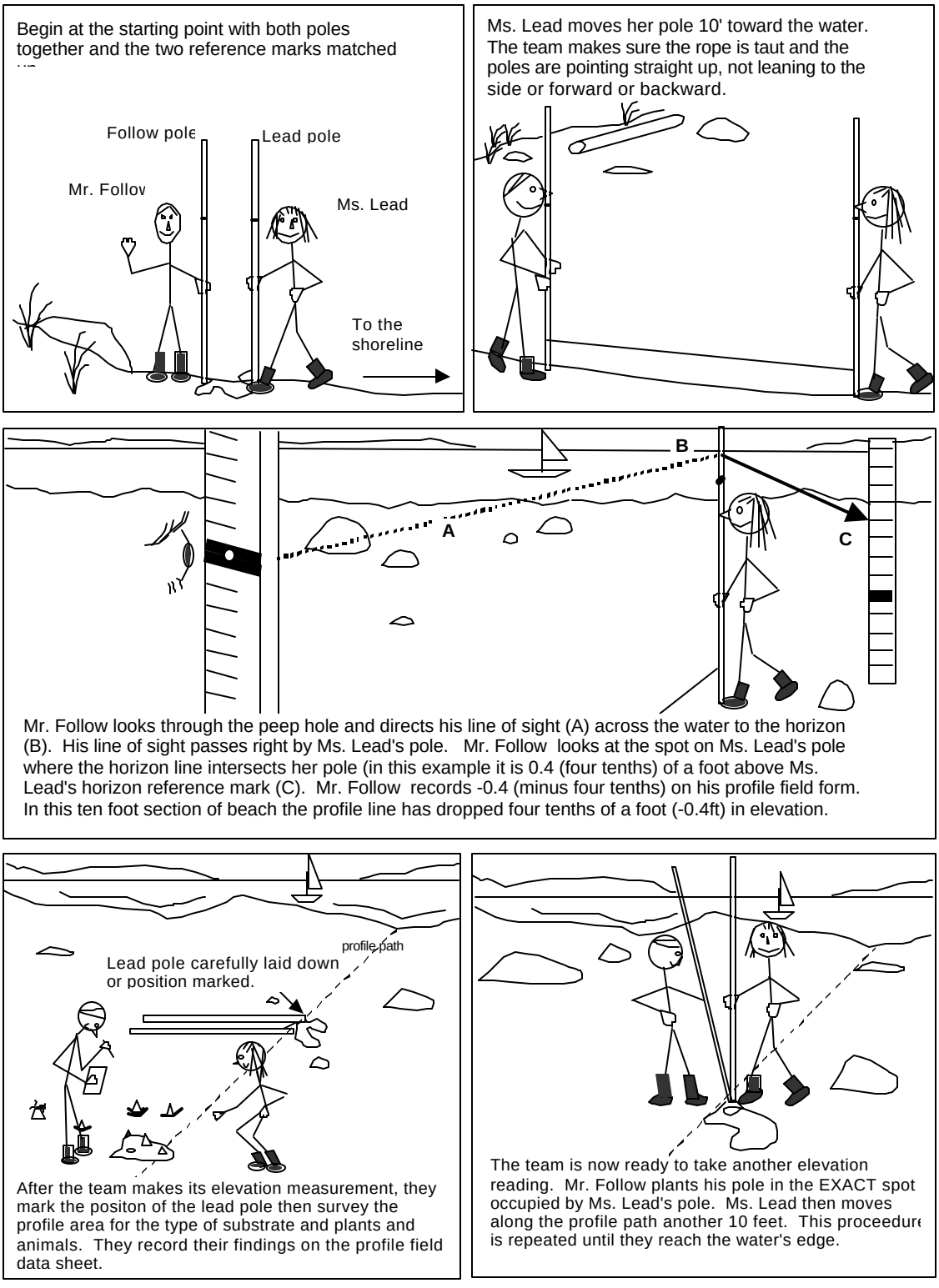


FIGURE 6. The Profile Procedure

FORM 4a. Field Data Sheet – Side A (PROFILE)

SIDE A **Profile data sheet** Page of *** **Please complete additional information on the back of this form**

Directions: In column **A** record the number of feet traveled for each reading. Column **B** is the running total of column **A**. Column **C** is the actual profile reading (be sure to include + or -). Check the substrates, seaweeds, and animals found within each profile section.

	A	B	C	Substrate (check all that apply)							Seaweeds and Invertebrates (check all that apply)																												
Entry (1,2,3, etc.)	Length of survey section	Cumulative Distance (optional)	+ or - Survey Reading	Ground shell debris	Clay/Silt	Sand (.002" - .08")	Gravel (.08" - 2")	Cobbles (2" - 10")	Boulders (>10")	Erratics (BIG ROCKS!)	Amphipods	Anemones	Barnacles	Chitons	Clams	Crabs	Fish	Insects	Isopods	Limpets	Mussels	Nudibranchs	Sand Dollars	Sea Cucumbers	Seastars	Snails	Urchins	W Flat Worms	W Nemerteans	W Polychaetes	Green Seaweeds	Red Seaweeds	Brown Seaweeds	Seagrass	Arachnid	Shrimp	Other
1	10	10	-0.9			X					X							X																			
2	10	20	-0.1			X	X				X							X								X											
3	10	30	-0.7			X	X				X															X					X				X		
4	10	40	-0.5			X	X	X	X		X		X						X	X																	
5	10	50	-0.9			X		X			X		X			X										X					X						
6	10	60	-0.1			X					X		X													X					X						
7	10	70	-1.2			X				X	X		X			X	X			X					X	X			X		X						
8	10	80	-0.8			X	X	X			X		X			X				X	X					X					X	X					
9	10	90	-0.7			X	X	X					X							X	X					X			XX		X						
10	10	100	-0.1			X		X					X							X						X					X						
11	10	110	-1.3			X	X	X					X						X	X	X				X						X						
12	10	120	-0.5			X	X	X					X	X					X	X	X							X	X		X						
13	10	130	-0.4			X	X	X	X			X	X				X		X	X	X					X			X	X	X						
14	10	140	0.3			X	X	X	X			X	X						X	X	X					X		X				X	X			X	
15	10	150	0.2			X	X	X	X			X	X							X												X					
16	10	160	-0.5			X	X	X					X	X		X				X	X					X					X	X					
17	10	170	-0.8			X	X	X					X		X	X			X	X									X		X		X			
18	10	180	-0.6				X												X	X						X			X	X	X	X				
19	10	190	-0.3				X		X				X									X			X	X			X	X			X	X			
20	10	200	-0.4				X		X			X	X						X											X			X	X			
21	10	210	-0.5				X		X				X					X								X					X	X	X				

FORM 4b. Field Data Sheet – Side B (QUADRAT)

SIDE B Quadrat Data Sheet Page_ *2* _of_*2*__

Beach ***Ledgewood***
Date ***6-20-2001***
Monitors ***Jan Holmes, Cheryl Bradkin, Mary Jo Adams, Mary Kehl***
Width of profile swath ***20 feet***
Profile end time_____
Tide height at end time (tide chart) ***–2.7 ft***
Bivalve sample dig Yes ***X*** No___
Species list Yes ***X*** No___
Quadrat photo Yes ***X*** No ___
Vertical height measure____***2.25 ft***___

this space is equal to one percent of the area of a quadrat.

Temperature: Air ***65F*** Water ***12C***
Barometric Pressure _____
Weather ***clear and sunny***
Bull kelp beds ***Yes***
Seagrass beds ***Zostera, Phyllospadix***
Ulva: Not seen___patchy ***X*** dense____
Backshore vegetation ***cleared***
Red tide ***No***
New bulkhead ***Yes, wood pilings***
Erosion/slides ***~100 ft away***
Spartina ***No***

Quadrat Analysis **Seaweeds and seagrasss** Record as **percent cover** (%)

Enter tide height	Species	Ulva	Enteromorpha	Mastocarpus (branching)	Porphyra						
T1 **+1** Ft.	Q1		**25%**								
	Q2	**35%**	**6%**								
	Q3	**5%**	**20%**								
T1 **+1** Ft.	Q1	**3%**		**12%**							
	Q2		**7%**	**15%**	**8%**						
	Q3	**1%**		**20%**							
T1 **+1** Ft.	Q1										
	Q2				**5%**						
	Q3										

Quadrat Analysis **Invertebrates** Record as **number (#) of animals in quadrat ***

Enter tide height	Species	Balanus glandula	Nucella lamelosa	Anthopleura elegantissima	Flattworm	Pisaster				
T1 **+1** Ft.	Q1	**2%**								
	Q2	**50%**		**45%**						
	Q3	**35%**								
T1 **+1** Ft.	Q1	**12%**	**6**	**10%**						
	Q2				**1**					
	Q3	**3%**	**7**							
T1 **+1** Ft.	Q1					**1**				
	Q2		**1**							
	Q3									

* Barnacles, mussels, sponge, bryozoans, colonial ascidians, & *Anthopleura elegantissima* are counted as percent cover.

Signatures of all Monitors, comments, and bivalve dig:
Cheryl Bradkin Jan Holmes *Mary Kehl* Mary Jo Adams

Section 4

Using Quadrats to Assess Species Abundance

The plants and animals that live on our beaches have special physical and biological needs. They are most often found in locations or "zones" which satisfy those needs. Zonation is caused by tides and other factors which influence the ability of the organisms to survive. The high intertidal zones are influenced by physical factors such as exposure, temperature, and salinity, whereas lower intertidal zones are determined by biological factors such as availability of food and predation pressure.

Distinct zonation patters are most apparent on vertical faces of rocky shorelines. Zonation patterns in other areas will vary depending on geographic location, tidal rangers and degree of exposure. Beach Watchers record general categories of plants and animals from the splash (highest tide)zone to the lower low tide zone, and density of individual plant and animal species in the mid – lower tidal zones (plus one foot, zero foot, and minus one foot tide heights). In the lower tide zones, we establish lines ("transects") parallel to the water's edge. Along each line, we place three quarter-meter (50 cm x 50 cm) quadrats. Within each quadrat we record density or percent cover of live plant or animal species.

Procedure for Placement of Quadrats

- Using the beach layout sketch (Figs. 1a & b), measure to and flag the points where the +1 foot, 0 foot and –1 foot transects intersect the profile line.

- Follow the beach sketch for quadrat placement.

Procedure for Quadrat Analysis

- Prior to evaluating the quadrat contents, remove debris, shells, and unattached seaweeds.

- Photograph the quadrat with the appropriate quadrat identification card (T2-Q1) and a Beach ID card (e.g., "Ala Spit 7/3/00") lying just outside and beside the quadrat. Use a digital camera or have your photos transferred to disk during development.

- Record in the Quadrat Analysis Sections of the Field Data Sheet Side B (Fig. 4b) all organisms to lowest taxonomic level possible. Refer to the EZ ID list (Form 5) of common seaweeds and invertebrates found at Beach Watcher sites, or to other identification guides for your area[2].

- For seaweeds and sea grasses: Estimate the percent coverage of seaweeds & sea grasses. Estimating percent cover may be difficult if the plants or animals are sparsely scattered. Try to visualize how much area they would cover if they were packed close together. Other "helpers" for estimating percent cover, -use a card or piece of paper with a window cutout that is 25cm X 25cm (1% of the quarter meter quadrat0. –Have each team member estimate % cover, then record the average of the estimates.

- For invertebrates: Record the number of each animal species when possible. For dense populations such as barnacles and mussels, or for colonial and aggregating animals such as sponges, bryozoans, compound ascidians and some species of anemones, record percent cover.

- Note: On days when the lowest tide is –1.5 feet or higher, it is important to collect data at the –1 foot transect level as soon as possible after the transect has been exposed, to give the team enough time to do a thorough job of identification. It may be necessary to temporarily stop the profile mapping, (make sure you flag the spot where you left off) and resume the profile just before low tide, then finish up with the 0 foot and +1 foot quadrats as the tide is coming in.

Diversity of Burrowing Bivalves and Related Infauna

Monitoring sites with substrate favorable to burrowing bivalve communities (usually some combination of sand, mud and gravel) are sampled for the presence or absence of recreational and commercial harvest clams.

- Along each transect select a small area that does not overlap your quadrat locations.

- Limiting yourself to the dimensions of a quadrat, remove one full shovel's depth from the selected site. Note that some deep burrowing bivalves (larger butter and horse clams) will be missed.

[2] Beach Watcher monitors use a variety of field identification guides and abbreviated keys to identify seaweeds and invertebrates (see references under section "Compiling a species list for a beach." Plants and animals identified by Beach Watchers have not been verified by taxonomists.

- Record to the lowest taxonomic level possible the different kinds of organisms found in your sample. In addition to bivalves, record any other community members such as polychaete worms, mud shrimp and other burrowing invertebrates. We are looking for diversity of animals in these samples. Do NOT count the numbers of each species.

- Return the removed beach material to the hole.

Before Leaving the Beach

- Obtain the signatures of all monitors on the lower part of the Field Data Sheet Side B before leaving the beach

FIGURE 7. Species Density Determination (group using quadrat)

FORM 5. Genera and Species to Know for Quadrat Data

2003 Revised EZID list for WSU Beach Watchers' Beach Monitors

The following species were those most frequently encountered by monitoring teams between 1996 and 2001.

	Scientific name	Common name
anemones	***Anthopleura elegantissima***	aggregating anemone
	Metridium senile	plumose anemone
	worms are in three major groups	
worms	**flatworms**	
	round worms (nemerteans)	
	segmented worms (polychaetes)	
chiton	***Mopalia* spp.**	hairy or mossy chiton
limpets	***Lottia digitalis***	ribbed or finger limpet
	Lottia pelta	shield limpet
	Tectura scutum	plate limpet
	Tectura persona	mask limpet
snails	***Littorina* spp.** *(skutulata, sitkana)*	periwinkles
	Nucella lamellosa	frilled or smooth dogwinke
	Nucella emarginata	emarginate dogwinkle
mussel	***Mytilus* spp.**	pacific blue mussels
amphipod	***Traskorchestia traskiana***	beach hopper
isopod	***Idotea wosnesenskii***	rockweed isopod
	Gnorimosphaeroma oregonense	pill bug
crabs	***Cancer maenas****	green crab
	Hemigrapsus nudus	purple shore crab
	Hemigrapsus oregonensis	hairy shore crab
	Pagurus spp.	hermit crabs
shrimp	***Heptacarpus spp.***	broken back shrimp
barnacles	***Balanus crenatus***	acorn barnacle
	Balanus glandula	acorn barnacle
	Semibalanus cariosus	thatched or haystack barnacle

	Scientific name	Common name
arachnid	***Neomolgus littoralis***	red velvet mite
sea stars	***Evasterias troschelli***	mottled star
	Leptasterias hexactus	six-rayed star
	Pisaster ochraceus	purple star
urchin	***Strongylocentrotus droebachiensis***	green urchin
green seaweed	***Acrosiphonia* spp.**	green rope
	***Enteromorpha* spp.**	sea hair or string lettuce
	***Ulva* spp.**	sea lettuce
	filamentous green (including species of *Ulothrix, Urospora, Cladophora*)	
brown seaweed	***Alaria marginata***	ribbon kelp
	Fucus spp.	rock weed
	Nereocystis luetkeana	bull kelp
red seaweed	**filamentous red** (including species of *Antithamnion, Polysiphonia, Bangia*, *Microcladia, Ceramium* and other fine, filamentous or profusly branching small algas of the order Ceramiales)	
	Endocladia muricata	nail brush
	Mastocarpus papillatus (Gigartina)	turkish wash cloth
	M. papillatus (Petrocelis form)	tar spot
	Hildenbrandia rubra	rusty rock
	Neorhodomela larix	black pine
	Porphyra spp.	laver
	branching coralline	
	encrusting coralline	
seagrass	***Phyllospadix spp.***	surfgrass
	Zostera marina	eelgrass
	Zostera japonica	eelgrass
	Spartina sp.	

*Green crab - not currently found in Puget Sound, but an invasive species thought to be moving northward from the Southern Washington coastline.

Section 5

Reports & Data Management

Team captains are responsible for turning in all field forms, quadrat photos and species lists to the Beach Watchers office at Admiralty Head Lighthouse **in a timely manner**. The Team Captain should keep a copy of everything submitted. All field data sheets are stored in loose-leaf Field Data Binders at the Lighthouse – a separate binder for each beach. Monitoring data is also stored in the Beach Watcher monitoring database (Microsoft Access). Hard copies of monitoring reports from individual beaches are available from the Lighthouse. A "read only" version of the Beach Watcher database will be available to interested parties.

To do – before submitting each report to the Beach Watcher office

- Check sketches, descriptive information, data sheet(s), etc. for legibility.
- Review and label slides with site, date and quadrat identification.
- Include any anecdotal or other information that cannot be reported on the Field Data Sheet, such as photographs, descriptions and sketches of unidentified invertebrates and seaweeds.

Items to be included in each field data binder—General

- Directions to access the beach site and starting point, the three compass readings at the starting point, description of the vertical height measurement method with the baseline vertical height measurement, and any other site information such as local history, a list of nearshore plants, etc.
- Photos of site, including the starting point. Photos should be labeled (location, date, subject matter , etc.).
- Sketch of the site that shows the following
    - Baseline measurements including compass readings, distances to transects, & width of swath surveyed along the profile line.
    - Starting point

  - Location of transects in relation to the profile line, placement of quadrats, and distance between quadrats
  - Location of permanent structures in the study site (bulkheads, erratics), especially the one used for vertical height measurement

- Methods or beach studies unique for your site

Items to be included in each binder—For each site visit

- Fully completed Field Data Sheet(s) – including signatures of all monitors
- Tide graph for beach site for day of monitoring
- Slides of each quadrat, filed in slide-holder sheets, with each slide labeled with site, date, transect-quadrat number, and tide level.
- Bivalve sample dig data, if collected.
- Anecdotal notes.
- Species list (See Section 7: Compiling a Species List), with the extent of area surveyed for species indicated A species list of the general area will catch organisms not found along the profile line or within the quadrats. The area covered is up to the discretion and time constraints of the team. Species lists can also be done on a separate day.

Items to be included in each binder—Optional (but encouraged)

- List of Shoreline plants observed.
- Additional photographs; historical, anecdotal, and geological information.
- Documentation of new bulkheads, natural or man-made disturbances.

The Beach Monitoring Database (Or, what happens next?)

Beach Watcher field data is entered into the Beach Watcher database. Summary data is available to all Beach Watchers, governmental agencies and other interested groups. Appendix B shows summary profile and quadrat data for one representative beach. In the near future, monitoring information will also be available on the Beach Watcher web site.

Section 6

Quality Control

As volunteers, we want our donated time to be meaningful and provide usable results. We want our valuable time to be well spent and we want to follow good monitoring procedures.

To assure that our data is accurately and consistently collected and recorded, Beach Watchers follow standard procedures with minimal variation of methods among sites and among monitors. On monitoring day most teams are accompanied by at least one person experienced at identifying marine biota. In addition, identification classes are held each spring, giving team members an opportunity to review species found on their beach in prior years. After field data is turned in, coordinators of the monitoring program review all field data sheets and oversee data entry into the database.

Opportunities to make our monitoring data available to others is a priority – through the monthly *Beach Log* newsletter, Beach Watcher meetings, public displays or presentations, or on our web site. In all cases we want to ensure that the information we share is accurate to the best of our abilities as trained volunteers.

Section 7

Compiling a Species List for a Beach

A species list of plants and animals found near your monitoring site adds to the information collected in profile and quadrat studies. It can be compiled the day that you monitor, on a separate day, or over the course of several months. Many animals and seaweeds have seasonal habits or cycles in which they may be less "visible" during certain times of the year. By adding to your list over time, you are more likely to see the entire biotic community of your beach. The area covered is up to the discretion of the team members, but should at least include the width of your profile swath. It's preferable, however, to cover as much area on either side of the profile as possible as long as you do not cross into a salinity, substrate or exposure category different from your monitoring site.

Some hints for doing a species list:

- Identify plants and animals to the lowest taxonomic level possible. If you are not certain of the genus or species, then follow your entry with a question mark. Photograph any plant or animal you can't firmly identify and jot down a description of it (habitat, size, color, etc). This will help you when you look it up in an ID guide or consult someone who can help you identify it.

- Have fun with the species list while learning about the plants and animals on your beach. Think of it as an ongoing treasure hunt!.

A list of helpful references for identification of species may be found in Appendix C.

FORM 6. Intertidal Species Checklist (sample completed form)

	Intertidal Species Check List		* EZID Species		
	sponge		**snail**		**amphipod**
	Cliona celata		*Acmaea mitra*		*Caprella sp.*
X	*Halichondria sp.*		*Alia carinata*	*	*Traskorchestia traskiana*
X	*Haliclona sp.*	X	*Amphissa sp.*		
	Mycale adhaerens		*Calliostoma canaliculatum*	X	**crab**
	Myxilla incrustans	X	*Calliostoma ligatum*		*Cancer gracilis*
	Oplitaspongia pennata		*Ceratostoma foliatum*		*Cancer magister*
		X	*Crepidula sp.*		*Cancer oregonensis*
	hydroid		*Fusitriton oregonensis*		*Cancer productus*
	Obelia sp.	X*	*Littorina sp.*	*	*Carcinus maenas*
	Proboscidactyla flavicirrata	*	*Littorina scutulata*		*Cryptolithodes sitchensis*
	Tubularia sp.	*	*Littorina sitkana*		*Hemigrapsus*
	Velella velella	X*	*Nucella sp. / eggs (e)*	*	*Hemigrapsus nudus*
			Nucella canaliculata	*	*Hemigrapsus oregonensis*
	jellyfish	*	*Nucella emarginata*		*Lophop;anopeus bellus*
	Aurelia aurita	*	*Nucella lamellosa*		*Oregonia gracilis*
	Cyanea capillata		*Olivella biplicata*	*	*Pagurus sp.*
			Polinices lewisii		*Pagurus armatus*
	stalked jellies		*Searlesia dira*		*Pagurus beringanus*
	Haliclystus sp.		*Tegula funebralis*	X	*Pagurus granosimanus*
	Thaumatoscyphus hexaradiatus				*Pagurus hirsutiusculus*
			nudibranch / eggs(e)		*Petrolisthes eriomerus*
	anemone		*Aeolidia papillosa*		*Pinnixa sp.*
	Anthopleura artimisia		*Anisodoris nobilis*		*Pugettia sp.*
X*	*Anthopleura elegantissima*		*Archidoris montereyensis*	X	*Pugettia gracilis*
	Anthopleura xanthogrammica	X	*Hermissenda crassicornis*		*Pugettia producta*
	Balanophyllia elegans		*Onchidoris bilamellata*		*Scyra acutifrons*
	Epiactis prolifera		*Rostangea pulchra*		*Telmessus cheiragonus*
*	*Metridium senile*		*Triopha catalinae*		
	Ptilosarcus gurneyi				**shrimp**
	Urticina coriacea		***abalone***		*Callianassa californiensis*
	Urticina crassicornis		*Haliotis kamtschatkana*	*	*Heptacarpus sp.*
					Pandalus sp.
	ctenophore		**rock scallop**		*Upogebia pugettensis*
	Bolinopsis sp.		*Hinnites giganteus*		
	Pleurobrachia bachei				**isopod**
			oyster		*Gnorimosphaeroma oregonense*
	chiton		*Crassostrea gigas*	*	*Idotea wosnesenskii*
	Cryptochiton stelleri				*Idotea resecata*
	Katharina tunicata		**clam**		*Ligia pallasii*
	Lepidochitona dentiens		*Bankia setacea*		*Limnoria lignorum*
	Lepidozona cooperi		*Chlamys hastata*		
	Lepidozona mertensii	X	*Chlamys rubida*		**barnacle**
*	*Mopalia sp.*		*Clinocardium nuttallii*		*Balanus sp.*
	Mopalia ciliata		*Macoma balthica*	*	*Balanus crenatus*
	Mopalia lignosa		*Macoma inquinata*	X*	*Balanus glandula*
	Mopalia muscosa	X	*Macoma nasuta*		*Balanus nubilus*
	Tonicella lineata		*Macoma secta*	X	*Chthamalus dalli*
			Mya arenaria		*Pollicipes polymerus*
	limpet		*Mya truncata*	X*	*Semibalanus cariosus*
	Lottia sp.		*Nutallia obscurata*		
*	*Lottia digitalis*		*Orobitella rugifea*	*	**roundworm/Nemertean**
	Lottia instabilis		*Panopea abrupta*		*Cerebratulus sp.*
	Lottia paradigitalis	X	*Pododesmus cepio*		*Micrura verrilli*
*	*Lottia pelta*		*Protothaca staminea*		*Tubulanus polymorphus*
*	*Tectura personna*	X	*Saxidomus giganteus*		*Tubulanus sexlineatus*
*	*Tectura scutum*		*Solen sicarius*		*Amphiphorus sp.*
			Tapes japonica (philippinarum)		*Emplectonema gracile*
	mussel		*Transenella tantilla*		
*	***Mytilu* s spp.**		*Tresus capax*	*	***flatworm***
	Mytilus trossulus		*Zirfaea pilsbryi*	X	*Freemania litericola*
	Mytilus californicus				*Kaburakia excelsa*
					Notoplana sanguinea

*	**polychaete**		**bryozoan**		**red seaweed**
	Abarenicola pacifica		*Bugula sp.*		*coralline red algae*
	Axiothella rubrocineta		*Membranipora membranacea*	X*	*branching coralline algae*
	Cirratulus spectabilis			*	*encrusting coralline algae*
	Cirriformia spirabrancha		**tidepool copepod**	*	*filamentous red algae*
	Dodecaceria fewkesi		*Tigriopus californicus*		*Ahnfeltia plicata*
X	*Eudistylia vancouveri*				*Ahnfeltiopsis pacifica*
	Eudistylia polymorpha		**tunicate**		*Antithamnion (and similar species)*
X	*Euzonus sp.*		*Aplidium californicum*		*Bangia sp.*
	Halosydna brevisetosa		*Boltenia villosa*	X	*Bossiella sp.*
	Harmothoe imbricata		*Corella willmeriana*		*Calliarthron sp.*
	Hemipodus borealis		*Pyura haustor*		*Callophyllis edentata*
	Lumbrineris sp.		*Styela gibbsii*		*Callophyllis flabellulata*
	Nereis vexillosa				*Ceramium sp*
X	*Notomastus tenuis*		**fish**		*Constantinea sp.*
	Pectinaria sp.		*flatfish*		*Corallina sp.*
	Pista elongata		*blenny eels: gunnels and pricklebacks*		*Cryptopleura lobulifera*
	Potamilla occelata		*Anoplarchus (cockscomb prickleback)*		*Cryptopleura rupretchiana*
	Sabellaria cementarium		*Apodichthys flaudus (penpoint gunnel)*	*	*Endocladia muricata*
	Schizobranchia insignis		*Clinocottus sp.*		*Gigartina exasperata*
	Serpupa vermicularis		*Gobiesox maeandricus*		*Gracilariopsis lemaneiformis*
	Spirorbis sp.		*Oligocottus maculosus (tidepool sculpin)*		*Gymnogongrus chiton (G. platyphyllus)*
	Thelepus crispus				*Gymnogongrus linearis*
			green seaweed		*Halosaccion glandiforme*
	sipuncula	*	*Acrosiphonia coalita*	*	*Hildenbrandia sp.*
	Phaseolosoma agassizii	X	*Cladophora columbiana*		*Hymenena flabelligera*
			Codium fragile	X	*Laurencia spectabilis*
	sea star	X*	*Enteromorpha sp.*		*Lithothamnion sp.*
*	*Evasterias troschelii*		*Kornmania leptoderma (K. zostericola)*		*Mazzaella splendens (Iridaea cordata)*
	Leptasterias hexactus		*Prasiola meridionalis*	X*	*Mastocarpus papillatus (Gigartina papillata)*
	Henricia leviuscula	***X****	*Ulva sp.*	*	*Mastocarpus encrusting stage (tar spot)*
*	*Pisaster ochraceus*		*Ulvaria obscura (U. fusca)*		*Microcladia sp.*
X	*Pycnopodia helianthoides*		*Urospora penicilliformes*		*Microcladia borealis*
	Solaster dawsoni				*Microcladia coulteri*
	Solaster stimpsoni		**brown seaweed**	*	*Neorhodomela larix (Rhodomela larix)*
			Agarum fimbriatum		*Odonthalia sp.*
	brittle star	*	*Alaria marginata*		*Odonthalia floccosa*
	Amphiopholis squamata		*Analipus japonica*		*Odonthalia washingtonensis*
	Ophiopholis aculeata	X	*Coilodesme californica*		*Petrocelis sp.*
			Colpomenia peregrina		*Plocamium cartilagineum*
	urchin		*Costaria costata*		*Polysiphonia*
X*	*Strongylocentrotus droebachiensis*		*Cymathere triplicata*		*Porphyra sp.*
	Strongylocentrotus purpuratus		*Cystoseira geminata*		*Prionitis lanceolata*
			Desmarestia		*Prionitus lyallii*
	sea cucumber	X	*Desmarestia aculeata*	X	*Rhodymenia pertussa*
	Cucumaria miniata		*Desmarestia ligulata*		*Sarcodiotheca gaudichaudii*
	Eupentacta quinquesemita	X	*Desmarestia viridis*		*Schizymenia sp.*
	Parastichopus californicus		*Egregia menziesii*		*Smithora naiadum*
	Psolus chitonoides	*	*Fucus sp.*		
			Fucus distichus		
	sand dollar		*Fucus spiralis*		**seagrass**
	Dendraster excentricus		*Hedophyllum sessile*	*	*Phyllospadix scouleri*
			Laminaria groenlandica		*Zostera japonica*
	arachnid		*Laminaria saccharina*	X*	*Zostera marina*
X*	*Neomolgus littoralis*		*Laminaria setchellii*		
			Leathesia difformis	*	*Spartina sp.*
	octopus	*	*Nereocystis luetkeana*		
	Octopus dofleini		*Pelvetiopsis limitata*		
	Octopus rubescens		*Pleurophycus gardneri*		
			Pterygophora californica		
	brachiopod		*Ralfsia sp.*		
	Terebratalia transversa		*Sargassum muticum*		
			Scytosiphon lomentaria		

Beach Monitoring Appendices

Field Equipment

Supplied by Beach Watchers

- Bucket to hold equipment
- Rope, 100 feet
- Set of flagged stakes
- Two survey poles with a 10-foot rope span
- Quadrat
- Quadrat Identification Cards –laminated
- Field Identification guide
- Hand Magnifying Lens
- Thermometer
- Ruler, 6”
- Compass
- Measuring tape, 100 feet
- Field Data Sheets on waterproof paper

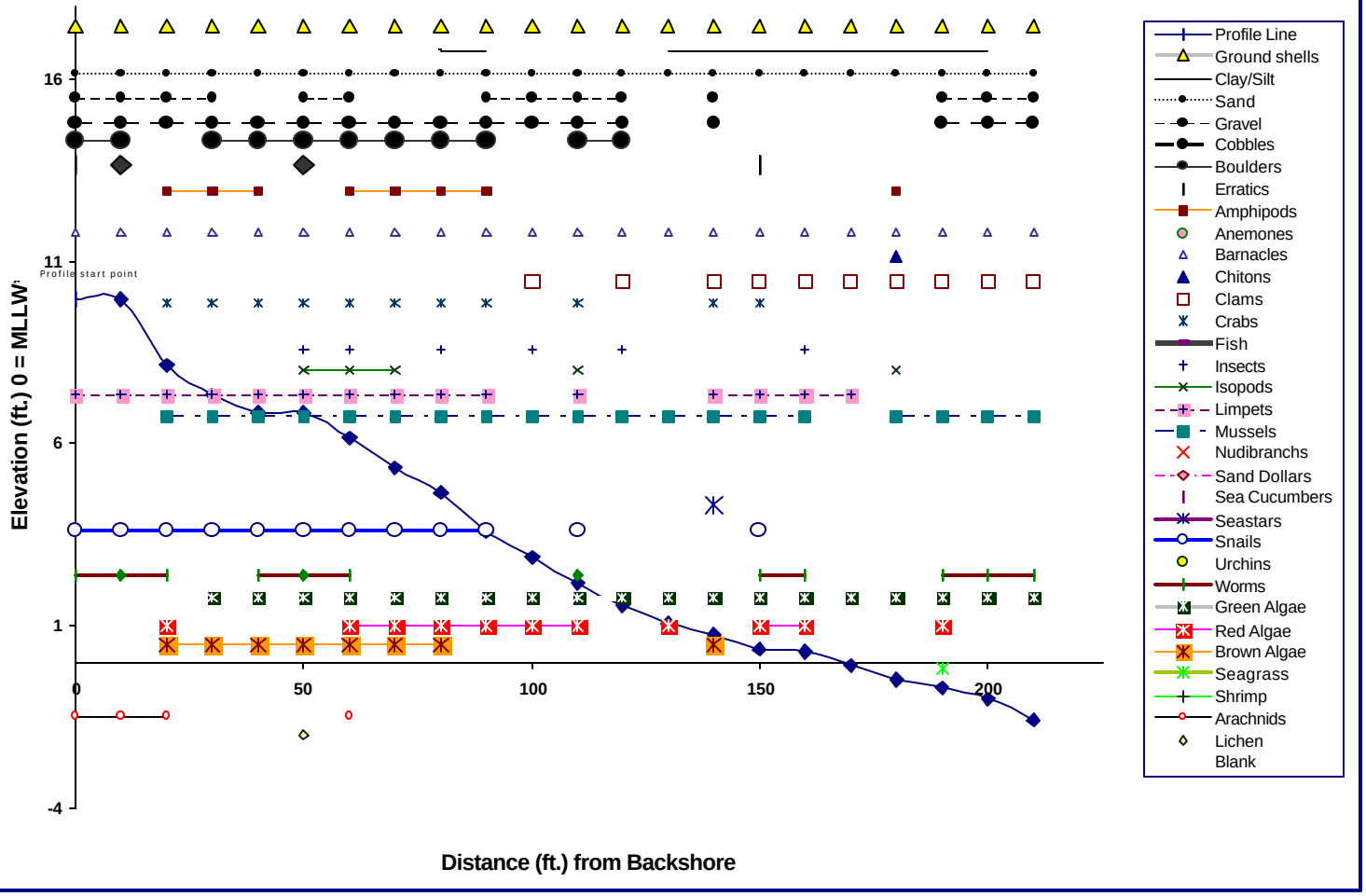
Supplied by Team Members

- Notebook / clipboard
- Pencils (at least 2)
- Camera, digital preferred – or photos transferred to disk during development
- Shovels
- Tide graph computer printout (Available from Lighthouse office)
- Species list from previous years
- Sketch of beach with baseline measurements

Optional Supplies

- Sight level (hand held transit)
- Plastic garbage bag to lay gear on
- Panoramic camera (disposable type)
- Seaweed collecting permit
- Ziplock bags for seaweed samples
- Level for vertical height measurement
- Plumb line for vertical height measurement
- Umbrella
- Gardening knee pads (highly recommended)
- Refractometer (salinity measurement)

Coupeville Town Park Profile and Surface Composition 6-15-2002



The profile line begins from a permanent fixed starting point near the backshore and terminates at the water's edge. The last profile measurement is made at the lowest tide height of the day.

To facilitate comparisons among beach profiles, the profile chart legend is standardized for all Beach Watcher profiles and includes the most common groups of organisms found intertidally around IslandCounty.

Y axis applies to the profile line only. Other legend symbols are shown as they appear at a given distance along the profile.

*MLLW (Mean Lower Low Water) is the average of the *lower* of the two low tides arriving on shore most days, and designated as a zero foot (0') tide on tide and nautical charts.

Island County WSU Beach Watchers Baseline Monitoring Program

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Video

Life at the Edge of the Sea. Thirteen/WNET, 1998. *This is part of the Nature Video Library Series. It was filmed off the coast of British Columbia so many of local species are included. It is available through Sno-Isle Libraries and lasts 55 minutes.* ***Highly recommended!!***

****Complete Taxonomic Keys**

Start Point of Permanent Profile Line

BEACH SITE_____

Beach Watcher(s) _____

Date of Measurements _____

STARTING POINT -- 3 COMPASS READINGS

Compass Reading	Description of Point Sighted for Reading
1.	
2.	
3.	

LONGITUDE _____

LATITUDE _____

Vertical Height of Permanent Structure Close To or On Profile Line

BEACH SITE _____

Beach Watcher(s) _____

Date of Measurements _____

Description of the structure you are measuring: _____

_____

_____

_____

Where is the structure in relation to your profile line? _____

_____

_____

_____

Compass reading: _____(to clarify the direction measurement was made)

HEIGHT: _____(specify feet, inches, tenths, centimeters)

Attach a photo or sketch below to show how the above measurement was made.

Directions for Access to a Monitored Beach

Name of beach_____County_____

Monitoring Team Leader _____Phone_____

Nearest Town _____Nearest Body of Water _____

GPS Coordinates of Starting Point (if available)

GPS Brand_____GPS Model_____

Latitude_____Longitude_____PDOP_____

Directions to Beach Access (from major intersection or town):

Directions to Starting Point from Beach Access:

Compass Reading (magnetic) for Profile:_____
(from starting point to horizon over the water)

APPENDIX D-4. FIELD DATA SHEET

SIDE A **Profile data sheet** Page ___of ___ *** **Please complete additional information on the back of this form**

Directions: In column A record the number of feet traveled for each reading. Column B is the running total of column A. Column C is the actual profile reading (be sure to include + or -). Check the substrates, seaweeds, and animals found within each profile section.

	A	B	C	Substrate (check all that apply)							Seaweeds and Invertebrates (check all that apply)																											
Entry (1,2,3, etc.)	Length of survey section	Cumulative Distance (optional)	+ or - Survey Reading	Ground shell debris	Clay/Silt	Sand (.002" - .08")	Gravel (.08" - 2")	Cobbles (2" - 10")	Boulders (>10")	Erratics (BIG ROCKS!)	Amphipods	Anemones	Barnacles	Chitons	Clams	Crabs	Fish	Insects	Isopods	Limpets	Mussels	Nudibranchs	Sand Dollars	Sea Cucumbers	Seastars	Snails	Urchins	W Flat Worms	W Nemerteans	W Polychaetes	Green Seaweeds	Red Seaweeds	Brown Seaweeds	Seagrass	Arachnid	Shrimp	Other
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SIDE B **Quadrat Data Sheet** Page____of____

Beac h_____
Date_____
Monitors

Width of profile swath_____
Profile end time_____
Tide height at end time (tide chart)
Bivalve sample dig Yes___ No___
Species list Yes___ No___
Quadrat photo Yes_ _ No ___
Vertical height measure_____

this space is equal to one percent of the area of a quadrat.

Temperature: Air Water
Barometric Pressure _____
Weather_____
Bull kelp beds_____
Seagrass beds_____
Ulva: Not seen___ patchy ___ dense____
Backshore vegetation_____
Red tide_____
New bulkhead_____
Erosion/slides_____
Spartina_____

Quadrat Analysis **Seaweeds and seagrass**s Record as **percent cover** (%)

Enter tide height	Species								
T1 Ft.	Q1								
	Q2								
	Q3								
T1 Ft.	Q1								
	Q2								
	Q3								
T1 Ft.	Q1								
	Q2								
	Q3								

Quadrat Analysis **Invertebrates** Record as **number (#) of animals in quadrat ***

Enter tide height	Species					
T1 Ft.	Q1					
	Q2					
	Q3					
T1 Ft.	Q1					
	Q2					
	Q3					
T1 Ft.	Q1					
	Q2					
	Q3					

* Barnacles, mussels, sponge, bryozoans, colonial ascidians, & *Anthopleura elegantissima* are counted as percent cover.

Signatures of all Monitors, comments, and bivalve dig:

2003 Revised EZID list for WSU Beach Watchers' Beach Monitors

The following species were those most frequently encountered by monitoring teams between 1996 and 2001.

	Scientific name	Common name
anemones	***Anthopleura elegantissima***	aggregating anemone
	Metridium senile	plumose anemone
	worms are in three major groups	
worms	**flatworms**	
	round worms (nemerteans)	
	segmented worms (polychaetes)	
chiton	***Mopalia* spp.**	hairy or mossy chiton
limpets	***Lottia digitalis***	ribbed or finger limpet
	Lottia pelta	shield limpet
	Tectura scutum	plate limpet
	Tectura persona	mask limpet
snails	***Littorina* spp.** *(skutulata, sitkana)*	periwinkles
	Nucella lamellosa	frilled or smooth dogwinke
	Nucella emarginata	emarginate dogwinkle
mussel	***Mytilus* spp.**	pacific blue mussels
amphipod	***Traskorchestia traskiana***	beach hopper
isopod	***Idotea wosnesenskii***	rockweed isopod
	Gnorimosphaeroma oregonense	pill bug
crabs	***Cancer maenas****	green crab
	Hemigrapsus nudus	purple shore crab
	Hemigrapsus oregonensis	hairy shore crab
	Pagurus spp.	hermit crabs
shrimp	***Heptacarpus spp.***	broken back shrimp
barnacles	***Balanus crenatus***	acorn barnacle
	Balanus glandula	acorn barnacle
	Semibalanus cariosus	thatched or haystack barnacle

	Scientific name	Common name
arachnid	***Neomolgus littoralis***	red velvet mite
sea stars	***Evasterias troschelli***	mottled star
	Leptasterias hexactus	six-rayed star
	Pisaster ochraceus	purple star
urchin	***Strongylocentrotus droebachiensis***	green urchin
green seaweed	***Acrosiphonia* spp.**	green rope
	***Enteromorpha* spp.**	sea hair or string lettuce
	***Ulva* spp.**	sea lettuce
	filamentous green (including species of *Ulothrix, Urospora, Cladophora*)	
brown seaweed	***Alaria marginata***	ribbon kelp
	Fucus spp.	rock weed
	Nereocystis luetkeana	bull kelp
red seaweed	**filamentous red** (including species of *Antithamnion, Polysiphonia, Bangia*, *Microcladia, Ceramium* and other fine, filamentous or profusly branching small algas of the order Ceramiales)	
	Endocladia muricata	nail brush
	Mastocarpus papillatus (Gigartina)	turkish wash cloth
	M. papillatus (Petrocelis form)	tar spot
	Hildenbrandia rubra	rusty rock
	Neorhodomela larix	black pine
	Porphyra spp.	laver
	branching coralline	
	encrusting coralline	
seagrass	***Phyllospadix spp.***	surfgrass
	Zostera marina	eelgrass
	Zostera japonica	eelgrass
	Spartina sp.	

*Green crab - not currently found in Puget Sound, but an invasive species thought to be moving northward from the Southern Washington coastline.

APPENDIX D-6. INTERTIDAL SPECIES CHECKLIST

	Intertidal Species check list		*** EZID Species**		
	sponge		**snail**		**amphipod**
	Cliona celata		*Acmaea mitra*		*Caprella sp.*
	Halichondria sp.		*Alia carinata*	*	*Traskorchestia traskiana*
	Haliclona sp.		*Amphissa sp.*		
	Mycale adhaerens		*Calliostoma canaliculatum*		**crab**
	Myxilla incrustans		*Calliostoma ligatum*		*Cancer gracilis*
	Oplitaspongia pennata		*Ceratostoma foliatum*		*Cancer magister*
			Crepidula sp.		*Cancer oregonensis*
	hydroid		*Fusitriton oregonensis*		*Cancer productus*
	Obelia sp.	*	*Littorina sp.*	*	*Carcinus maenas*
	Proboscidactyla flavicirrata	*	*Littorina scutulata*		*Cryptolithodes sitchensis*
	Tubularia sp.	*	*Littorina sitkana*		*Hemigrapsus*
	Velella velella	*	*Nucella sp. / eggs (e)*	*	*Hemigrapsus nudus*
			Nucella canaliculata	*	*Hemigrapsus oregonensis*
	jellyfish	*	*Nucella emarginata*		*Lophop;anopeus bellus*
	Aurelia aurita	*	*Nucella lamellosa*		*Oregonia gracilis*
	Cyanea capillata		*Olivella biplicata*	*	*Pagurus sp.*
			Polinices lewisii		*Pagurus armatus*
	stalked jellies		*Searlesia dira*		*Pagurus beringanus*
	Haliclystus sp.		*Tegula funebralis*		*Pagurus granosimanus*
	Thaumatoscyphus hexaradiatus				*Pagurus hirsutiusculus*
			nudibranch / eggs(e)		*Petrolisthes eriomerus*
	anemone		*Aeolidia papillosa*		*Pinnixa sp.*
	Anthopleura artimisia		*Anisodoris nobilis*		*Pugettia sp.*
*	*Anthopleura elegantissima*		*Archidoris montereyensis*		*Pugettia gracilis*
	Anthopleura xanthogrammica		*Hermissenda crassicornis*		*Pugettia producta*
	Balanophyllia elegans		*Onchidoris bilamellata*		*Scyra acutifrons*
	Epiactis prolifera		*Rostangea pulchra*		*Telmessus cheiragonus*
*	*Metridium senile*		*Triopha catalinae*		
	Ptilosarcus gurneyi				**shrimp**
	Urticina coriacea		***abalone***		*Callianassa californiensis*
	Urticina crassicornis		*Haliotis kamtschatkana*	*	*Heptacarpus sp.*
					Pandalus sp.
	ctenophore		**rock scallop**		*Upogebia pugettensis*
	Bolinopsis sp.		*Hinnites giganteus*		
	Pleurobrachia bachei				**isopod**
			oyster		*Gnorimosphaeroma oregonense*
	chiton		*Crassostrea gigas*	*	*Idotea wosnesenskii*
	Cryptochiton stelleri				*Idotea resecata*
	Katharina tunicata		**clam**		*Ligia pallasii*
	Lepidochitona dentiens		*Bankia setacea*		*Limnoria lignorum*
	Lepidozona cooperi		*Chlamys hastata*		
	Lepidozona mertensii		*Chlamys rubida*		**barnacle**
*	*Mopalia sp.*		*Clinocardium nuttallii*		*Balanus sp.*
	Mopalia ciliata		*Macoma balthica*	*	*Balanus crenatus*
	Mopalia lignosa		*Macoma inquinata*	*	*Balanus glandula*
	Mopalia muscosa		*Macoma nasuta*		*Balanus nubilus*
	Tonicella lineata		*Macoma secta*		*Chthamalus dalli*
			Mya arenaria		*Pollicipes polymerus*
	limpet		*Mya truncata*	*	*Semibalanus cariosus*
	Lottia sp.		*Nutallia obscurata*		
*	*Lottia digitalis*		*Orobitella rugifea*	*	**roundworm/Nemertean**
	Lottia instabilis		*Panopea abrupta*		*Cerebratulus sp.*
	Lottia paradigitalis		*Pododesmus cepio*		*Micrura verrilli*
*	*Lottia pelta*		*Protothaca staminea*		*Tubulanus polymorphus*
*	*Tectura personna*		*Saxidomus giganteus*		*Tubulanus sexlineatus*
*	*Tectura scutum*		*Solen sicarius*		*Amphiphorus sp.*
			Tapes japonica (philippinarum)		*Emplectonema gracile*
	mussel		*Transenella tantilla*		
*	***Mytilu* s spp.**		*Tresus capax*	*	***flatworm***
	Mytilus trossulus		*Zirfaea pilsbryi*		*Freemania litericola*
	Mytilus californicus				*Kaburakia excelsa*
					Notoplana sanguinea

APPENDIX D-6. INTERTIDAL SPECIES CHECKLIST

*	**polychaete**		**bryozoan**		**red seaweed**
	Abarenicola pacifica		*Bugula sp.*		*coralline red algae*
	Axiothella rubrocineta		*Membranipora membranacea*	*	*branching coralline algae*
	Cirratulus spectabilis			*	*encrusting coralline algae*
	Cirriformia spirabrancha		**tidepool copepod**	*	*filamentous red algae*
	Dodecaceria fewkesi		*Tigriopus californicus*		*Ahnfeltia plicata*
	Eudistylia vancouveri				*Ahnfeltiopsis pacifica*
	Eudistylia polymorpha		**tunicate**		*Antithamnion (and similar species)*
	Euzonus sp.		*Aplidium californicum*		*Bangia sp.*
	Halosydna brevisetosa		*Boltenia villosa*		*Bossiella sp.*
	Harmothoe imbricata		*Corella willmeriana*		*Calliarthron sp.*
	Hemipodus borealis		*Pyura haustor*		*Callophyllis edentata*
	Lumbrineris sp.		*Styela gibbsii*		*Callophyllis flabellulata*
	Nereis vexillosa				*Ceramium sp*
	Notomastus tenuis		**fish**		*Constantinea sp.*
	Pectinaria sp.		*flatfish*		*Corallina sp.*
	Pista elongata		*blenny eels: gunnels and pricklebacks*		*Cryptopleura lobulifera*
	Potamilla occelata		*Anoplarchus (cockscomb prickleback)*		*Cryptopleura rupretchiana*
	Sabellaria cementarium		*Apodichthys flaudus (penpoint gunnel)*	*	*Endocladia muricata*
	Schizobranchia insignis		*Clinocottus sp.*		*Gigartina exasperata*
	Serpupa vermicularis		*Gobiesox maeandricus*		*Gracilariopsis lemaneiformis*
	Spirorbis sp.		*Oligocottus maculosus (tidepool sculpin)*		*Gymnogongrus chiton (G. platyphyllus)*
	Thelepus crispus				*Gymnogongrus linearis*
			green seaweed		*Halosaccion glandiforme*
	sipuncula	*	*Acrosiphonia coalita*	*	*Hildenbrandia sp.*
	Phaseolosoma agassizii		*Cladophora columbiana*		*Hymenena flabelligera*
			Codium fragile		*Laurencia spectabilis*
	sea star	*	*Enteromorpha sp.*		*Lithothamnion sp.*
*	*Evasterias troschelii*		*Kornmania leptoderma (K. zostericola)*		*Mazzaella splendens (Iridaea cordata)*
	Leptasterias hexactus		*Prasiola meridionalis*	*	*Mastocarpus papillatus (Gigartina papillata)*
	Henricia leviuscula	*	*Ulva sp.*	*	*Mastocarpus encrusting stage (tar spot)*
*	*Pisaster ochraceus*		*Ulvaria obscura (U. fusca)*		*Microcladia sp.*
	Pycnopodia helianthoides		*Urospora penicilliformes*		*Microcladia borealis*
	Solaster dawsoni				*Microcladia coulteri*
	Solaster stimpsoni		**brown seaweed**	*	*Neorhodomela larix (Rhodomela larix)*
			Agarum fimbriatum		*Odonthalia sp.*
	brittle star	*	*Alaria marginata*		*Odonthalia floccosa*
	Amphiopholis squamata		*Analipus japonica*		*Odonthalia washingtonensis*
	Ophiopholis aculeata		*Coilodesme californica*		*Petrocelis sp.*
			Colpomenia peregrina		*Plocamium cartilagineum*
	urchin		*Costaria costata*		*Polysiphonia*
*	*Strongylocentrotus droebachiensis*		*Cymathere triplicata*		*Porphyra sp.*
	Strongylocentrotus purpuratus		*Cystoseira geminata*		*Prionitis lanceolata*
			Desmarestia		*Prionitus lyallii*
	sea cucumber		*Desmarestia aculeata*		*Rhodymenia pertussa*
	Cucumaria miniata		*Desmarestia ligulata*		*Sarcodiotheca gaudichaudii*
	Eupentacta quinquesemita		*Desmarestia viridis*		*Schizymenia sp.*
	Parastichopus californicus		*Egregia menziesii*		*Smithora naiadum*
	Psolus chitonoides	*	*Fucus sp.*		
			Fucus distichus		
	sand dollar		*Fucus spiralis*		**seagrass**
	Dendraster excentricus		*Hedophyllum sessile*	*	*Phyllospadix scouleri*
			Laminaria groenlandica		*Zostera japonica*
	arachnid		*Laminaria saccharina*	*	*Zostera marina*
*	*Neomolgus littoralis*		*Laminaria setchellii*		
			Leathesia difformis	*	*Spartina sp.*
	octopus	*	*Nereocystis luetkeana*		
	Octopus dofleini		*Pelvetiopsis limitata*		
	Octopus rubescens		*Pleurophycus gardneri*		
			Pterygophora californica		
	brachiopod		*Ralfsia sp.*		
	Terebratalia transversa		*Sargassum muticum*		
			Scytosiphon lomentaria		