EELGRASS MONITORING QUICK GUIDE

For detailed method instructions and information about eelgrass check out the full manual. Always review the full manual before you go out if you haven't done a survey in a while.

STEP 1 - LOCATE THE EELGRASS

The first step is to find the Eelgrass. When you find it make sure to record the GPS coordinates on your tracker, on a GPS or on paper.

STEP 2 – MAP THE EELGRASS

Map the outer edge of the Eelgrass bed. Use your tracker or a GPS and turn on a tracklog or take points as you walk or boat around the outside of the patch, or you can draw on a paper map.

STEP 3 – DESCRIBE THE EELGRASS BED ABOVE THE LOW TIDE (INTERTIDAL)

Describe the intertidal Eelgrass bed. Include if it is a fringe, flat, continuous or patchy, what percent of the ground it covers, and what the ground is like where it is growing (*e.g. mud, sand, rock etc.)*. Be sure to comment on disturbances, and take lots of photos.

STEP 4 – LAY OUT TRANSECTS AND COUNT THE SHOOTS

Figure out how many different groups of different sized Eelgrass you have in the intertidal area, each size group is a zone. You may have 1-3 zones. Typically the Eelgrass will be smaller closer to the land and larger closer to the water. Lay down a transect across each zone parallel to the shore.

Choose a random number from 0-10. Place your first quadrat in the 1st meter at your random number X 10 (e.g. if your number is 5 start at 50 cm). Place your second quadrat 2 meters from your first, and continue to place quadrats every 2 meters along the transect.

Count the total number of shoots, and the total number of reproductive shoots (those that had or have flowers or seeds) in each quadrat.

STEP 5 – MEASURE THE LEAF SIZE

In each of your quadrats measure the length and width of a leaf on 1-3 shoots. To make it random, make up a system for which shoot(s) you will measure, such as the one closest to the top right corner of the quadrat. Measure the second leaf from the outside.

STEP 6 - MEASURE THE WATER DEPTH (OPTIONAL)

Measure the water depth at the highest and lowest ends of the eelgrass patch from the boat. Record the time you measured the depths and later in the office you can figure out how deep the eelgrass is in relationship to the low tide (the elevation).

STEP 7 – MEASURE THE TURBIDITY (OPTIONAL)

Lower the Secchi disk from the edge of the boat and record the depth when you first can't see it. Note the time.

STEP 8 - WATER QUALITY (OPTIONAL)

Use a salinity meter or YSI Pro to measure salinity in the field, and/or take a water quality sample.

STEP 9 – MAP AND DESCRIBE THE EELGRASS BELOW THE LOW TIDE (SUBTIDAL)

Similar to Step 3, describe the subtidal eelgrass that you observe from the boat. You can also map it by taking way points around the deep edge of the patch. Include if it is a fringe, flat, continuous or patchy, what percent of the ground it covers, and what the ground is like where it is growing (*e.g. mud, sand, rock etc.)*. Be sure to comment on disturbances, and take lots of photos

Eelgrass Monitoring Manual

HA-MA-YAS STEWARDSHIP

Nanwakolas Council
1441 16th Ave
Campbell River, BC V9W 2E4
Telephone: (250) 286-7200
FAX: (250) 286-7222

TABLE OF CONTENTS

HOW TO USE THIS MANUAL

This manual outlines the methods for monitoring eelgrass. The document shows you how to start your survey and work through the datasheet step by step. In the appendix there is information about the importance of eelgrass and more detailed descriptions of how to find and identify eelgrass. The appendix also has an equipment list, a sample datasheet and a list of other sources of information.

MONITORING METHODS

WHAT TO MONITOR?

Step	Parameter	How	Why
1	Location	locate the eelgrass bed	to increase our understanding of where beds are to improve management of them
2	Mapping	map the area of the bed	to know the area of the bed and be able to detect change in area or range of the bed
3	General description (intertidal)	categorize the form, distribution and density, and substrate on which the bed occurs	to understand the health and stability of the bed
4	Shoot density	count flowering shoots and total shoots	understand the health of the bed and the amount of reproduction that is happening
5	Leaf size	measure the leaf width and length	understand the biomass of Eelgrass as described by the Leaf Area Index (LAI)
6	Depth distribution	measure with a rod from the boat or by a diver	understand and monitor the elevation range that the Eelgrass occurs at
7	Turbidity	measure with a Secchi disk from a boat	sediment load affects light availability to the plant and its health
8	Water quality	salinity, total suspended solids and Chloryphyll A	understand more about the aquatic habitat and why the bed may be in the condition that it is in
9	General description (subtidal)	categorize the form, distribution and density, and substrate on which the bed occurs	to understand the health and stability of the bed

GETTING STARTED

BACKGROUND STUDY REVIEW

Eelgrass beds occur in intertidal (the area between the lowest and highest tides) and subtidal (below the lowest tide) areas, on shallow mudflats and estuaries with gentle currents and few waves. Eelgrass prefers temperatures of 10-20°C, does better in clear water. For help identifying Eelgrass, see Appendix 2.

To start, see if there are ***known Eelgrass beds*** in your area. Previous studies and knowledge of your local Eelgrass beds may exist. Local resources where you can ask or look include your band's fisheries staff, your community marine plan or the Ha-ma-yas Plan, North Vancouver Island Marine Plan, elders, knowledge keepers, harvesters and others that spend a lot of time on the water. The local DFO office, marine conservation groups, the Community Mapping Network eelgrass or herring spawning data (www.shim.ca), iMap (http://www.data.gov.bc.ca/), and the BC Marine Conservation Atlas (http://bcmca.ca/) are other options.

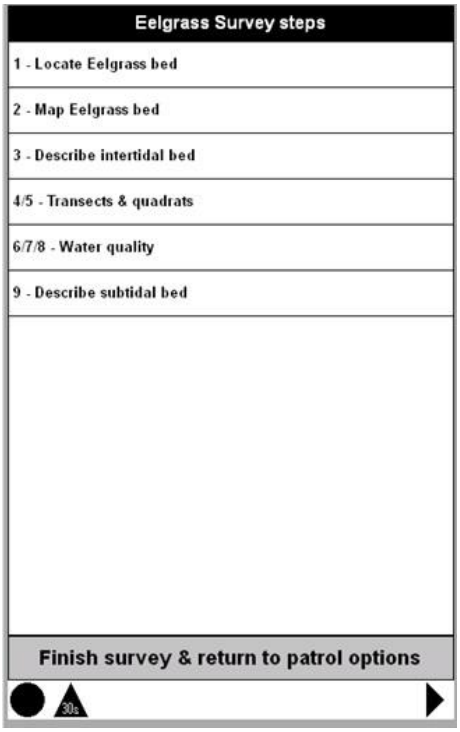
You can also find potential areas to locate ***new Eelgrass beds*** by looking on airphotos, satellite imagery (e.g. GoogleEarth), or depth/marine maps for estuaries and shallow areas. Areas where you have seen Eelgrass washed up on shore or know that herring like to spawn (other than spawn on kelp), are also good spots to look.

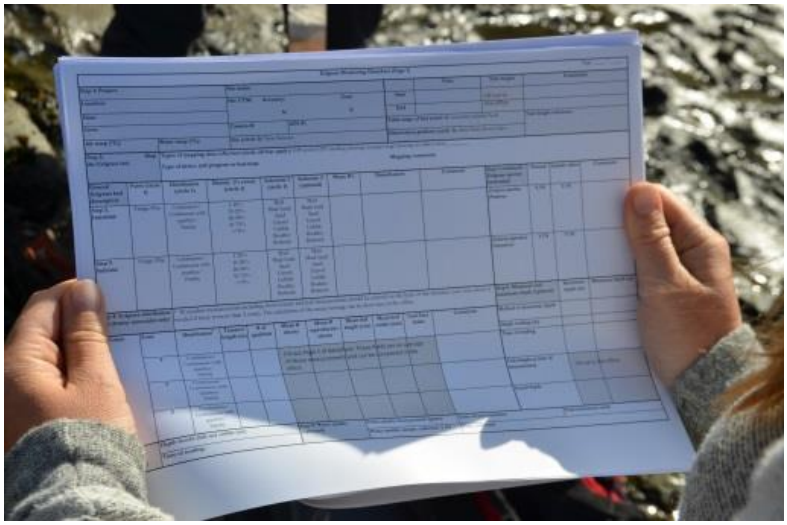
Plan your survey for the lowest tides possible to be able to identify and map Eelgrass beds above the low tide line (intertidal beds). Plan surveys for tides under one meter high. Start surveys two hours before the lowest tide, and continue for one hour after. Tide information can be found on the DFO website (http://tides.gc.ca/eng/data/predictions/2015).

If you want to survey for Eelgrass beds when the tide is not low, or if you are looking for Eelgrass beds that occur below the low tide line (subtidal beds), you may be able to do some mapping from the boat. If not you will need a diver or remote operated underwater vehicle (ROV).

METHODS – HOW TO FILL OUT THE DATA FORM

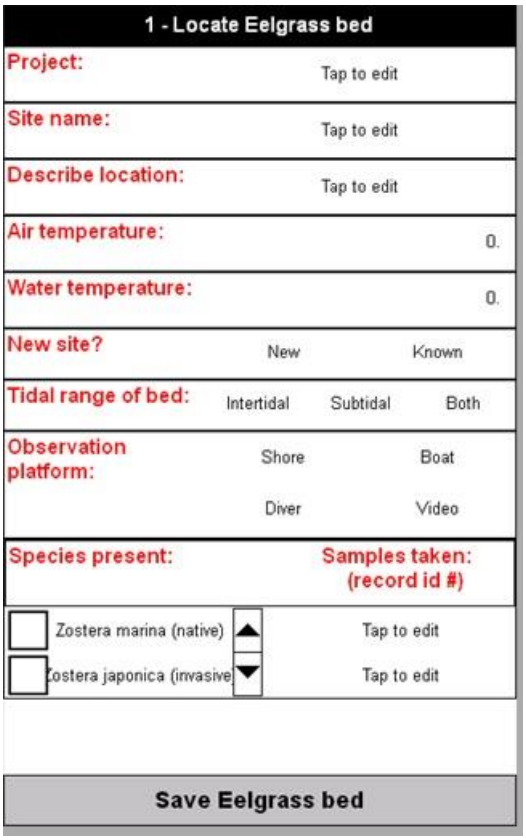
The data form should be filled out in cybertracker (figure on left). You can also use the paper form (photo on right) if cybertracker is not working. The first screen on the cybertracker shows the Eelgrass Survey steps. You will tap on each in order of steps. The bottom grey button on each screen returns you to the first screen (Eel Grass Survey steps).





STEP 1. LOCATE THE EELGRASS BED

Fill out the top of the datasheet or cybertracker step 1 tab including:

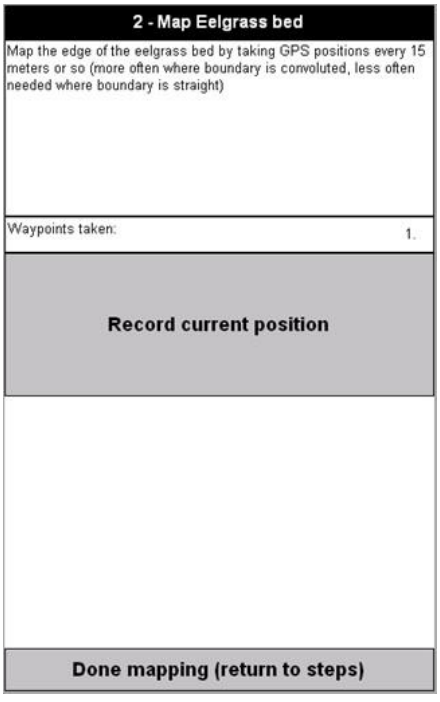


- **Project** – fill this out if the survey is for a specific project, for example Phillips Arm Resource Assessment.
- **Site name** – give your site a unique name, for example PHA-EG01 for Phillips Arm, Eelgrass site 1. This is the same name you will call your GPS file.
- **Location** – describe the location of the Eelgrass bed, for example 300 m west of the dock at Phillips Arm estuary.
- **Date** and **crew**.
- **Site UTM** (*or latitude/longitude*) – fill out the UTM's for the site. Include the GPS **accuracy**, the **zone** and the easting (**E**) and northing (**N**) (*or E and W*). *Make sure your GPS projection is set to NAD 83, UTM (*or lat/long*).
- **Camera #** and **GPS#** - record information about the camera and GPS you are using so that the photos and GPS data you collect can be tied to your datasheet.
- Record the **Air temperature** and **Water temperature**.
- **Site** – circle *New* if this is the first time this site has been surveyed and *Known* if this site has been surveyed before, by you or another group.
- Record the survey **Start Time** of the survey (and **End Time** when finished). You can figure out the approximate **Tide height** of your survey when you get back to the office by looking at the tide height at the time you started and ended your survey at this website: http://tides.gc.ca/eng/data/predictions/2015. Your **Tide height reference** used to determine the tide height would then be *DFO tide chart*.
- The **Tidal range of bed** will be *intertidal* (above the low tide line), *subtidal* (below the low tide line) or *both* (both below and above the low tide line).
- The **Observation platform** is where you surveyed the Eelgrass bed from. This can be the shore, boat, diver or video. You will most often use the shore and sometimes a boat.
- Identify if the **Eelgrass species** is *Zostera marina* (the native one) or *Zostera japonica* (the invasive one). There will probably only be *Zostera marina.*

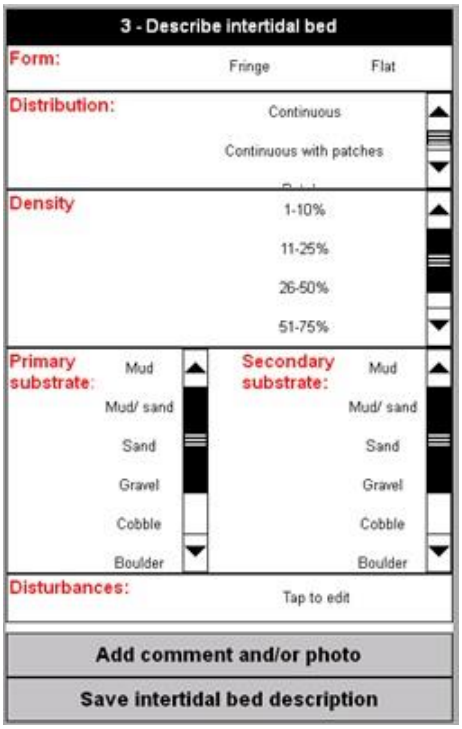
See Appendix 2 for help with ID. If you are not sure which species it is, you can collect a sample in a ziplock bag, label it with the site name and location, date, and your name. Store the sample in the fridge. You can send it to Cynthia Durance for ID (precid@shaw.ca).

Map the outer edge of the eelgrass bed. One person may need to walk ahead and scout the edge before mapping. If possible, you should map the Eelgrass bed both on your GPS and on a paper map.

- **Types of mapping data collection:** Describe the ways that you map the outside of the Eelgrass bed. Some options include:
    i. taking *GPS points* every 15 m around the outside edge, by using your *GPS tracklog* to make a line that outlines the bed
    ii. by *drawing on a paper map*, or by *drawing on a tablet* in a GIS program
    iii. Other - record any *other* way that you map the Eelgrass bed.
- Record the **Type of device and program or basemap** that you use for your mapping data collection. Include the make and model of your GPS or tablet, and the program that you used, or the type of paper map that you used (e.g. NTS map sheet, marine chart, GoogleEarth or orthophoto).
- Record the *site name* in your data file name or on the paper map.
- The edge of the Eelgrass bed is where there is less than 1 shoot per m^2. If the Eelgrass bed is patchy, map all of the patches together for as far as you can see with your bare eyes.

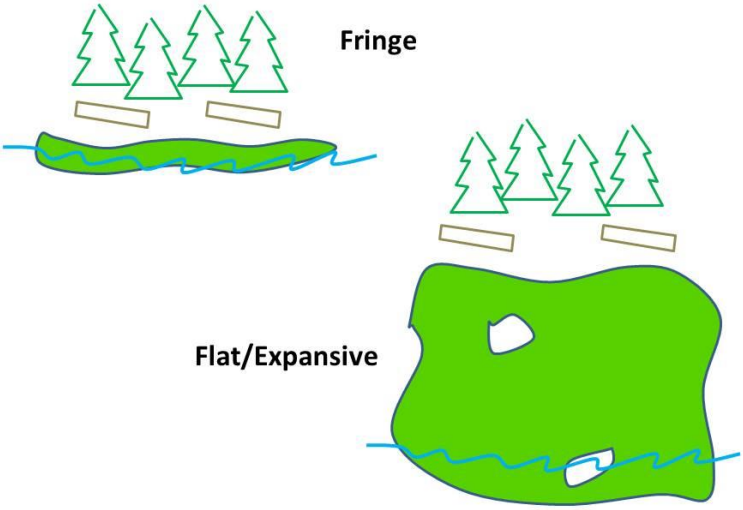


STEP 3. DESCRIBE THE EELGRASS BED



Describe the *intertidal* eelgrass beds first, and then at the end of the survey when you are back on the boat and the tide is coming up, describe the subtidal eelgrass beds. If it is too deep to see, you may need to come back to the beds another day at low tide to get a better view of the lower boundary of the beds. Record the **Form**, **Distribution**, **Density**, **Substrate type**, **Photographs**, and **Comments**.

- Eelgrass beds **Form** as either a *fringe* or narrow band along the shoreline, or as *flat,* expansive beds on tidal flats.

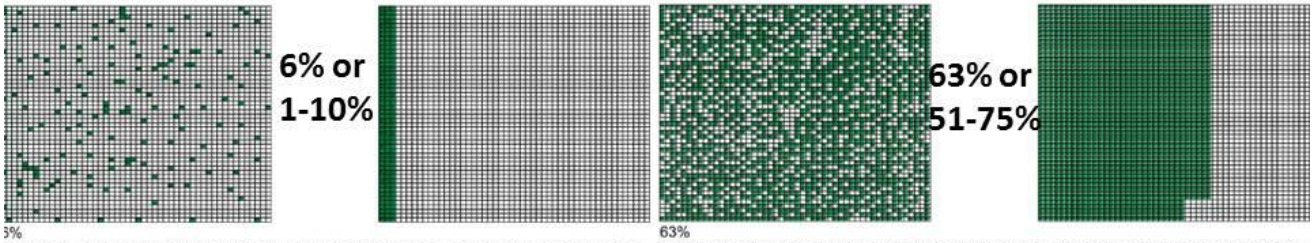


- Eelgrass bed **Distribution** may be *Continuous*, *Continuous with bare patches*, or *Patchy*.

Modified from Precision 2002

- Estimate the **Density** of the Eelgrass bed by estimating the % cover.

Use these diagrams to help you estimate the density of the Eelgrass bed in percent cover

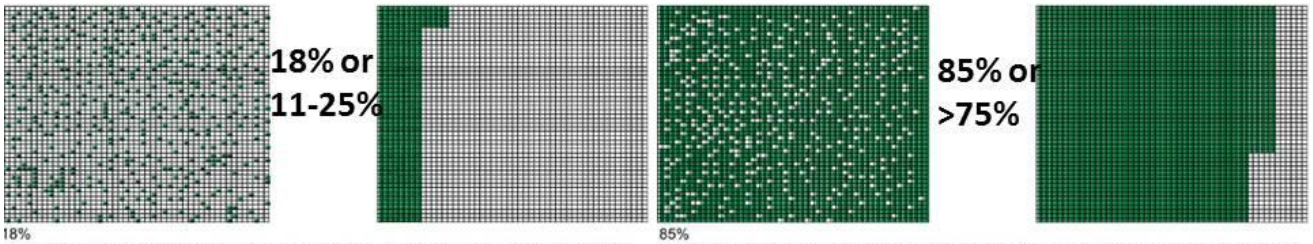


6%

Figure 7.1 Six percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as 1-10% cover on the datasheet.

63%

Figure 7.4 Sixty-three percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as 51-75% cover on the datasheet.

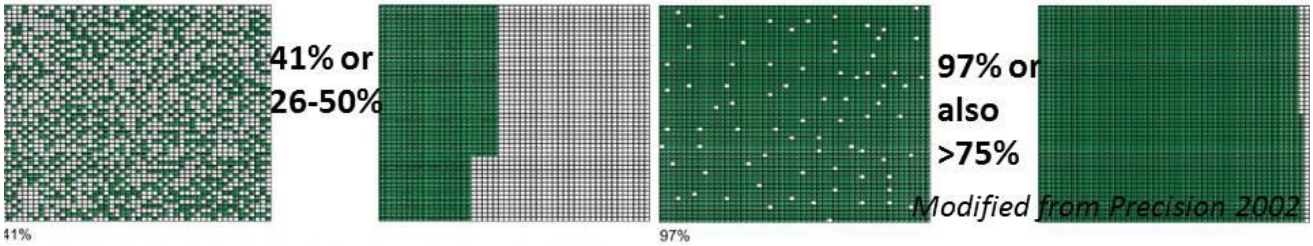


18%

Figure 7.2 Eighteen percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as 11-25% cover on the datasheet.

85%

Figure 7.5 Eighty-five percent of the squares are shaded. The squares are randomly located in the first diagram (a) and are grouped in the second (b). This represents an area that would be classified as >75% cover on the datasheet.



41%

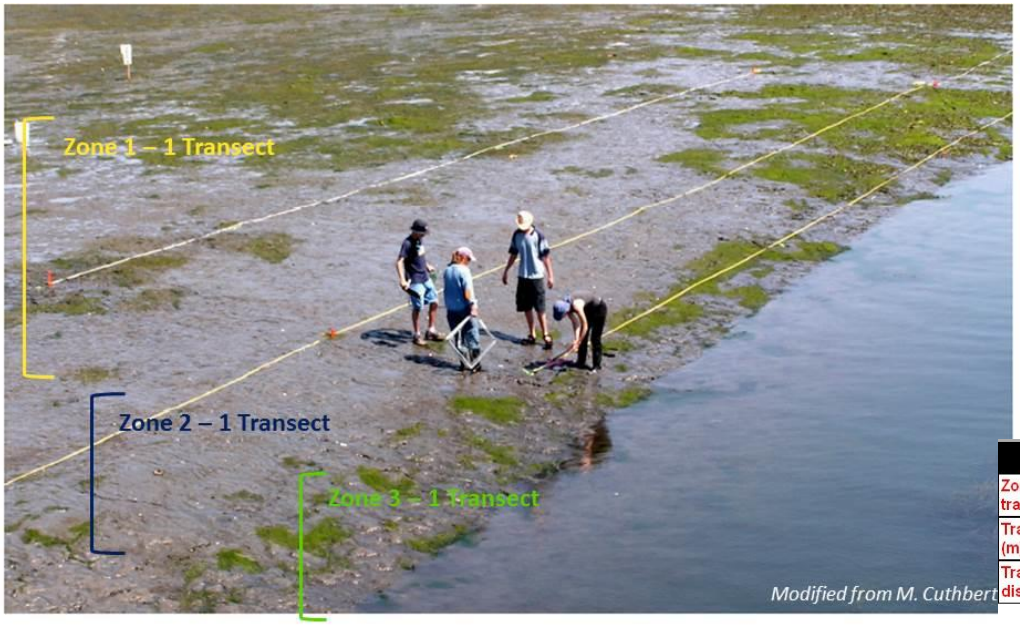
97%

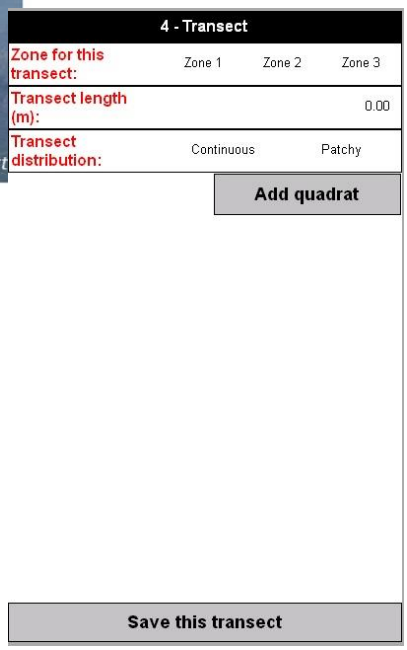
- Record the dominant **Substrates** in order with the most common substrate first and the next most common substrate second.

Substrate	Size (mm)	Description
Mud	>0.5	smooth feel
Mud/Sand		
Sand	>2	gritty feel
Gravel	2-64	pea to softball
Cobble	64-256	softball to basketball
Boulder	256-4000	larger than a basketball
Bedrock	>40000	boulders over 4 m wide and bedrock

- Take lots of **Photographs** including close up macro photos (include the sheath) and site context photos. Include an object such as a pencil for scale.
- Record your observations of **Disturbances** such as scouring or excess sediment, and other **Comments** on condition such as if it has lots of algae or appears unhealthy, backshore structures or land use, possible threats, wildlife use, and other things you might see.

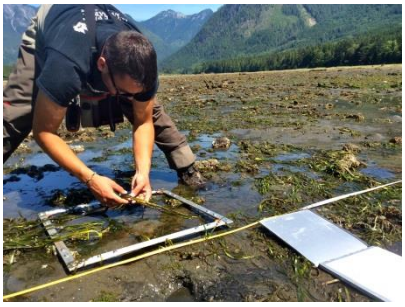
- Record the number of **Zones** in the Eelgrass bed. Zones are identified by major changes in the size of the Eelgrass plants and the density of the plants.
    i. *Zone 1* is at the highest point in the intertidal and will have the smallest plants with the highest density,
    ii. *Zone 2* will be in the lower intertidal,
    iii. and *Zone 3* is at the lowest elevation in the intertidal and will likely go below the low tide line. It will have the largest plants with the lowest density. Zone 3 may be under water where you can't sample.



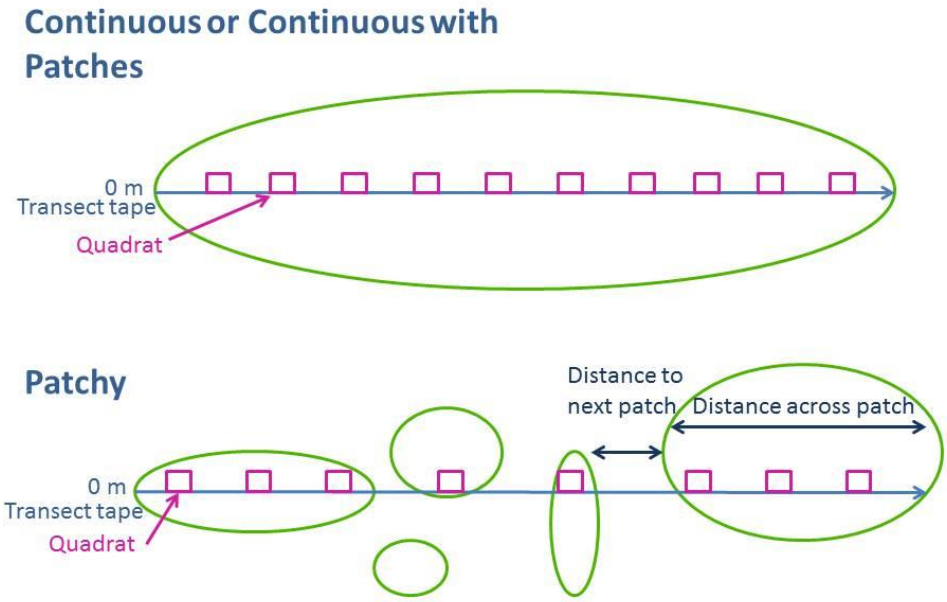


- Lay out transects (lines) in each zone that is over 4 meters wide. The transects should be laid out parallel to shore and span the entire length of the Eelgrass bed, up to 60 meters. Record each **Transect length**.
- Determine if you have an Eelgrass **Distribution** that is *Continuous* (single patch), *Continuous with patches* (single patch with holes) or *Patchy* (several discrete patches with densities of less than 1 plant per m^2 dividing them).

- Next you will collect stem counts and leaf measurements from 0.25 m^2 quadrats (squares) laid out along the transects. How the quadrats are placed will depend on whether the Eelgrass bed has a *continuous* (or *continuous with patches*) or *patchy* distribution.
    i. Continuous: Choose a random number from 1-10. This will be your start point from 0. For example, if you choose 2, start your quadrat at 20 cm along the transect tape. From here place a quadrat every 2 m. So in this example you'd have a quadrat at 20 cm, 2 m 20 cm, 4 m 20 cm etc. If possible, lay out 30 quadrats on each transect. Lay the quadrat out on the shore side of the transect tape. Record the **Number of quadrats**.

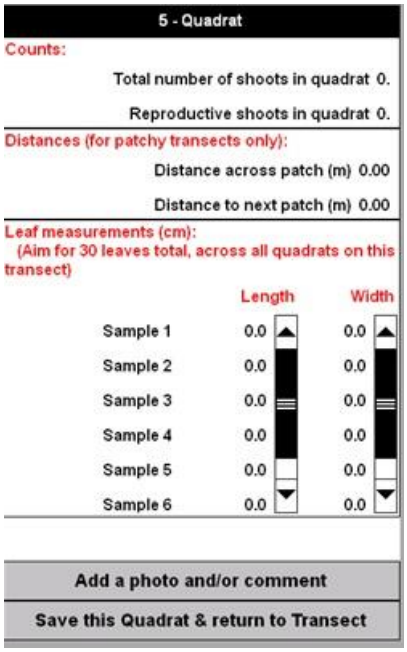


    ii. Patchy: Lay out as many quadrats per patch as possible, spacing them by 2 m and keeping them away from the edge of the patch. So for example in a patch that is 1 m^2 you will have 1 quadrat, and a patch that is 6 m^2 you will have two quadrats. As you go, record the **Distance across each patch**, as well as the **Distance to the next eelgrass** patch. The distances across each patch and to the next patch are recorded on page 2 of your datasheet.



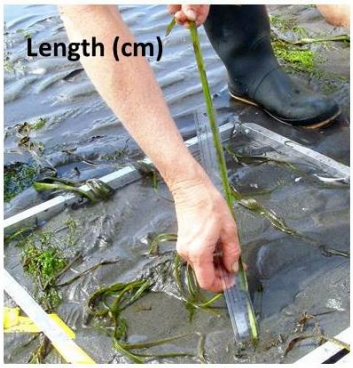
- **Fill out a copy of page two of your datasheet for each transect that you complete** in each of your zones.
- On *Page 2* of your datasheet, write down the **Project, Site name, Date, Location and Zone** again incase this page gets separated from Page 1.

- Count the **Total number of shoots in each quadrat** and the **number of reproductive shoots** (have or had flowers or seeds) in each quadrat (see Appendix 2 for photographs and a description of vegetative vs. reproductive shoots).
- *Later* in the office, add up the total number of shoots from each quadrat and divide by the number of quadrats for an average or mean number of shoots per quadrat. Do the same for the reproductive stems. This will be entered on Page 1 of the datasheet.



STEP 5. LEAF MEASUREMENTS

- Measure the leaf length and width of up to three shoots in each quadrat. The goal is to measure 30 shoots, so if you have 30 transects, measure 1 shoot per quadrat, if you have 15 quadrats, measure 2 shoots per quadrat and if you have 10 or fewer quadrats, measure 3 shoots per quadrat.
    i. **Length** is measured in centimeters (cm) from the base of the sheath to the tip.
    ii. **Width** is measured in millimeters (mm) near the middle of the leaf.



    iii. Choose to measure the 1-3 shoots that are located the nearest to the upper right corner of the quadrat, the upper left corner of the quadrat, and the lower left corner of the quadrat so that the shoots are randomly chosen. Take the measurements on the second leaf blade in from the outside of the sheath.
    iv. *Later,* in the office, add up the total length and divide it by the number of stems measured – this is your **Mean leaf length**. Do the same to calculate the **Mean leaf width**. Enter the mean leaf length and width on Page 1.
    v. *Later,* in the office, calculate the **Leaf Area Index (LAI)** by multiplying the mean leaf length x the mean leaf width x the mean number of shoots.

STEP 6. MINIMUM AND MAXIMUM DEPTH (OPTIONAL)

Several methods can be used to map the minimum and maximum depths of an Eelgrass bed.

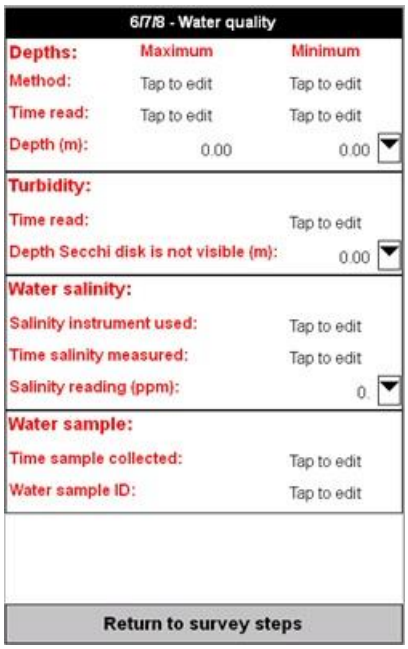
a. **Methods to determine depth** include a *diver with a depth gauge*, *a diver with a boat and meter tape* or *a rod*. The measured depth can be compared to the tide height at the time of the measurement to calculate the elevation.
b. The **Maximum depth** will be easiest measured at low tide. Locate the deepest edge of the eelgrass bed and use one of the above methods to measure the depth. Record the **Depth reading** in meters (m), and the **Time of reading**. *Later* in the office, fill in the **Tide height at time of measurement** and calculate the **Actual depth** from these measurements. The **Minimum depth** can be measured as the water reaches the upper edge of the Eelgrass bed noting the **Time of reading.**

STEP 7. TURBIDITY (OPTIONAL)

- Lower the Secchi disk from the boat until you can't see it. Record the **Depth** in meters(m) **when the Secchi disk disappears**. Slowly pull the Secchi disk back up. Also record the **Time** that the reading was taken.

STEP 8. WATER QUALITY (OPTIONAL)

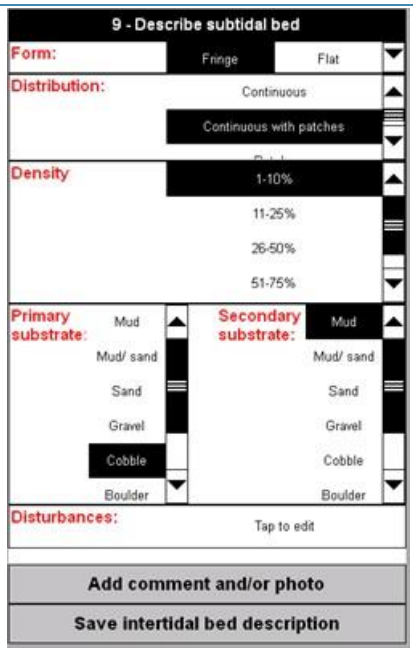
Includes salinity, total suspended solids (TSS), Chlorophyll A.



- Salinity tells you how salty the water is. TSS shows how clear the water is. Chlorophyll A tells you about how much algae is growing in the water which shows how much can live there.
- Salinity can be measured in the field with a salinometer or an YSI pro+. Record the **Salinity** in parts per million (ppm), and the **Time.**
- Total Suspended Solids (TSS) and Chlorophyll A can be measured in a lab. Contact the professional lab well ahead of time to determine the containers and shipping needs. Sampling methods can be found in provincial or state manuals. Generally you will need to ensure that you use a sterile container and keep the samples cool and out of sunlight. Record the site, time, date and crew on the container. Record if a **Water quality sample** was collected, and the **Time collected,** on the datasheet**.**

STEP 9. DESCRIBE THE SUBTIDAL EELGRASS BEDS

It will be easiest to do this from the boat at low tide. Take waypoints every 15 m (because it may be hard to keep a steady track) and connect them later in the office. Snorkeling, diving, or an underwater camera could also be used. Record the same information as for intertidal beds (Step 3).



SOURCES

Seagrass Syllabus: A Training Manual for Resource Managers
http://www.seagrasswatch.org/Info_centre/Publications/syllabus/seagrass_syllabus.pdf

Methods for Mapping and Monitoring Eelgrass Habitat in British Columbia. Draft 4. December 2002.
http://www.cmnbc.ca/sites/default/files/Methods%20for%20Mapping%20and%20Monitoring%20Eelgrass%20Habitat%20in%20British%20Columbia,%202002.pdf

Eelgrass Mapping and Monitoring Volunteer Pocket Guide. Draft April 2007.
http://www.birdsonthebay.ca/pdf%20files/eelgrass_lami_guide.pdf

Resources

Community Mapping Network
http://www.cmnbc.ca/atlas_gallery/eelgrass-bed-mapping

Seagrass Conservation Working Group
http://seagrassconservation.org/
https://www.facebook.com/Seagrass-Conservation-Working-Group-137404612990808/timeline/

BC Marine Conservation Atlas
bcmca.ca

MaPP Marine Planning Portal

mapp.seasketch.org

APPENDIX 1: WHAT IS EELGRASS AND WHY IS IT IMPORTANT?

WHAT IS EELGRASS?

- Eelgrass is a flowering marine plant that grows along our coast. Eelgrass forms large beds below the high water mark. You can find it where rivers meet the sea, and in other shallow coastal areas.

- *Zostera marina* is the most common Eelgrass in B.C. There are about 60 species of related seagrasses in the world.

- Eelgrass beds have root networks. Eelgrass grows mostly during the spring and summer when there is more light and it is warmer. They reproduce from the growing roots, from root pieces breaking off and drifting to a new place, and from seeds.

- Eelgrass beds are one of the most productive and naturally diverse places on the planet. They support fish and wildlife, improve water quality and capture carbon from the air. They also have many traditional uses.

WHY IS EELGRASS IMPORTANT?

TRADITIONAL USE

ECOLOGICAL VALUE

- ***Wildlife*** – Eelgrass beds are feeding areas for birds (e.g. Brant goose) and feed many smaller creatures (e.g., sea urchins, clams and crabs). Salmon (including juvenile Chinook, Coho, and Chum Salmon), and other marine fishes grow up or hide in eelgrass beds. They form the base of an important food web.

- ***Clean water*** – Eelgrass filters pollutants, silt and sand from the water, and stabilizes the bottom. This keeps the shore strong and helps stop it from washing away.

- ***Blue carbon*** (the carbon captured by the world's oceans and coasts) – Eelgrass takes carbon dioxide (CO_2) from the water and releases oxygen into the ocean sediments and water. Too much CO_2 is bad for the ocean.

WHAT DOES EELGRASS NEED TO GROW WELL?

- ***Light*** for food production (photosynthesis),
- *muddy or sandy* ***bottom*** to grow in,
- ***nutrients*** for growth,
- the right ***salinity,***
- and a little bit of ***disturbance*** to make room for new groups or for the clump to expand.

WHAT THREATENS EELGRASS BEDS?

- Eelgrass beds grow in places that people also like to use, such as river mouths and shallow waters. Many of these areas are used for industries, such as log booming grounds, marinas, breakwaters, mills and other factories. These industries:
    - can make the shore weak and cause dirt and rock to wash into the water
    - scour or dredge the ocean bottom, and
    - pollute the water. All of these things damage eelgrass beds.

- Global climate change also threatens eelgrass beds because of the increase in ocean water temperature, sea level rise, and cause more and larger damaging storms.

WHY SHOULD WE MONITOR EELGRASS BEDS?

- It is important to monitor Eelgrass beds to track changes in their distribution and abundance and to detect potential impacts of activities such as logging and log booming, shoreline developments, and other human use (e.g., trampling), or other factors.

- Eelgrass beds are good show how healthy the area is, so monitoring them can help us understand what is happening to other things that live there, such as salmon or sea urchins.

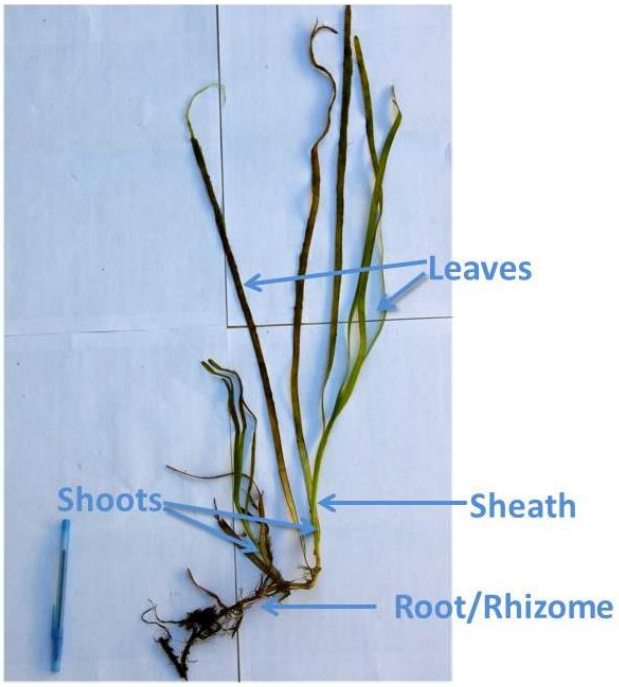
- Monitoring helps us to understand Eelgrass and the things that damage it, as well as the things that need it.

- All of this information can be used to direct conservation and management.

APPENDIX 2: IDENTIFICATION

HOW TO IDENTIFY EELGRASS

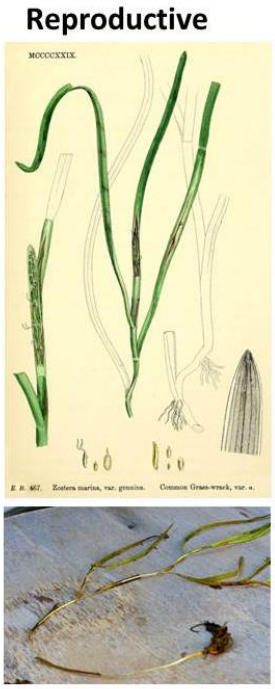
EELGRASS PARTS

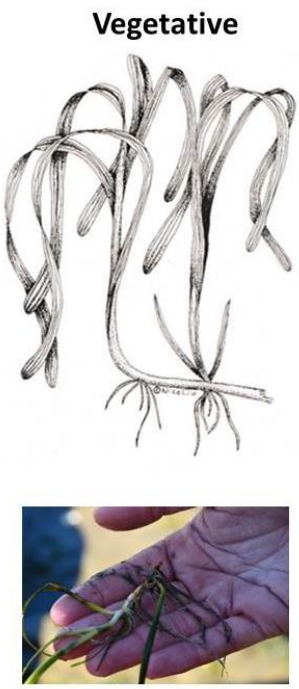


VEGETATIVE AND REPRODUCTIVE SHOOTS

- ***Reproductive*** or flowering shoots are often more branched. In July in our area you can often see flowers or seeds. Later in the summer, you may only see the old hard stems that remain after the flowers are gone, the seeds are grown, and the shoot has grown old.

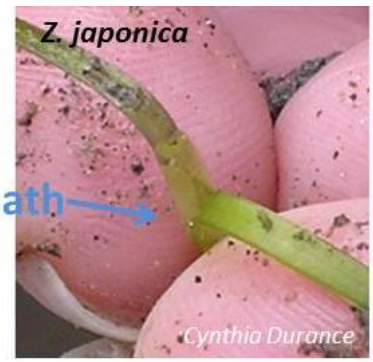
- ***Vegetative*** shoots rise from the root. There may be many leafy shoots coming from the root.





- The native Eelgrass, Pacific Eelgrass (*Zostera marina*), is the most common one found here. An invasive species of Eelgrass, Japanese Eelgrass (*Zostera japonica*), also lives here. It can take over places where Pacific Eelgrass normally grows. *Z. marina* is usually much larger and occurs deeper. For both kinds, leaf length and width increases with depth, and they both may be found in the intertidal zone. Here are some ways to tell them apart:

	***Zostera marina* - Native**	***Zostera japonica* - Invasive**
Size	larger	smaller
Leaf veins	3	5 or more
Location	located in low intertidal and sub-tidal zone	located in intertidal and shallow subtidal, but not in low subtidal
Sheath	entire sheath, closed at the base, sheath will tear when lower leaves are pulled in opposite directions	sheath is open at the base, sheath will part, but not tear when leaves are pulled in opposite directions



APPENDIX 3: EQUIPMENT LIST

Below is a basic list of equipment you will need, and safety and personal gear items you will need to consider.

Type	Item	Comments
Survey	Eelgrass Field Datasheets, pencils and notebook	example in back, waterproof recommended
	maps/orthophotos	for identifying beds and drawing the Eelgrass beds on
	tide table	http://tides.gc.ca/eng/data/predictions/2015
	GPS or tablet with mapping software	for delineating the beds
	camera	underwater compatible
	3 50-100 meter transect tapes	for transects across the eelgrass bed
	meter stick/ruler	to measure leaf length and width
	50 x 50 cm quadrat (0.25m^2)	quadrat can be constructed from metal or pvc piping
	thermometer	to measure water and air temperature
	watch	to record times of arrival, departure and specific measurements
	survey rod (optional)	to measure water depths
	secchi disk (optional)	for measuring turbidity
	salinometer or YSI+ (optional)	to measure salinity
	sterile water tight container (optional)	for collecting water samples
Transportation and personal	waders, rubber boots, neoprene booties or old running shoes	footwear and clothing appropriate for the water level and mudflats
	snorkel gear or dive (optional)	if the water is above 1 m or if you are mapping subtidal beds
	boat (optional)	depending on site location, follow appropriate Transport Canada regulations
Safety	Level 1 first aid kit	dependant on crew size, may need higher level of first aid kit
	satellite phone/ SPOT	required by WCB
	check in procedure	
	safety plan	
	marine radio	if you are working or travelling in a boat

APPENDIX 4. SAMPLE DATA FORM

EXTRA PHOTOS