



Activity 13 - Waters of Life - Eelgrass and a Community of Creatures

<u>PURPOSE:</u>	To discover the diversity of plants and animals that thrive in eelgrass beds and explore the adaptations of eelgrass to life in the intertidal zone of the estuary.
<u>TIME REQUIRED:</u>	prep – 1 hour; field study 1-2 hours.
<u>SUBJECTS:</u>	Science, English, Math
<u>MATERIALS NEEDED:</u>	TIDES student kits, 25cm x 25 cm quadrats, 100cm x 100cm nested quadrats, eelgrass % cover standardization guide, 2-3 dip nets, 100 m measuring tape, eelgrass fact and photo sheets, eelgrass PowerPoint presentation, eelgrass video series
<u>VOCABULARY:</u>	Percent cover, quadrat, reproductive, rhizome, seagrass , shoot, transect, vegetative.

Outcomes:

- 1) Students will be able to describe several adaptations that eelgrass plants possess allowing them to thrive within their niche in the estuarine environment.
- 2) Students will be able to name several animals and plants that benefit from eelgrass beds and describe the ways in which these plants and animals benefit.
- 3) Students will be able to identify several activities which threaten eelgrass beds and suggest possible remedies.
- 4) Students will use a simple, widely accepted monitoring technique to assess the relative health of eelgrass beds.

Life Science

- Organism structure & functions
- Traits of an organism passed on
- Population change in the environment

History and Nature of Science

- How scientists investigate

Scientific Inquiry

- Ask questions to support scientific inquiry
- Design scientific investigation
- Collect data
- Analyze data

Science in Personal and Social Perspectives

- Acting on personal and social issues.

Background: Seagrasses are a group of rooted, flowering plants distributed throughout the worlds oceans and estuaries. Eelgrass is one of the seagrasses commonly found in Pacific Northwest estuaries where it provides important habitat for a diversity of animals and many kinds of epiphytic plants. In



this activity, the class will use techniques designed to minimize impacts on eelgrass beds while studying them first hand to understand the unique adaptations these plants possess and explore ways in which scientists monitor seagrasses as an indicator of the overall health of the estuary.

An eelgrass fact sheet is provided for the use of the teacher and students. This sheet provides a description of the plant, information on distribution and abundance, effects of light and turbidity, ecological importance, sediment and nutrient dynamics, description of human impacts, and information on monitoring and restoration efforts. Photographs, videos, and PowerPoint presentation are also included to further improve students understanding and comprehension of the value of this plant.

Preparation: This activity may be conducted as a stand alone field study or incorporated into a full day field trip using other units of the TIDES curriculum. Activities 10, 11, and 12 are recommended for a full day experience depending upon the tide predictions for the day planned for the field work.

A low tide of -1.0 ft. (below MLLW) or less is usually acceptable for this activity provided the class is ready to begin sampling as soon as the ebbing tide reveals the upper edges of the eelgrass bed. For a successful experience, plan for a minimum of one hour to conduct the sampling activity without interference from the flooding tide.

Review Activity 8 in the TIDES curriculum with your class prior to the field trip and allow adequate time for the class to identify field study tasks and assign roles. The class should assemble all field equipment necessary prior to the field trip and clearly identify who will be responsible for making sure all items are properly cared for and returned in good shape.

Students should be prepared for weather conditions which may be noticeably cooler along the coast due to wind chill, fog, and the maritime influence of the ocean. If possible, students should wear rubber knee boots for all intertidal field trips. Hip waders are also useful for at least one or two students so that specimens can be collected using dip nets in the submerged portions of the eelgrass meadows. If knee boots are not possible, old sneakers are an acceptable substitute provided a change of shoes is available immediately following the field trip. **CAUTION:** Sandals and bare feet are **NOT RECOMMENDED** for any intertidal field trips. The risk of serious laceration from numerous sharp objects such as shells, woody debris, and rusty remnants of fishing gear should be taken very seriously and any students not respecting this requirement should be given an alternative assignment out of the intertidal zone.

You may also want to prepare the class by providing them with the included eelgrass fact sheet and photos to review as an advance assignment. A short PowerPoint presentation is also included for use prior to the field trip or this may be used after the field trip as a review of the experience. In either case, the students should be encouraged to add personal experience and observation in the field to the information presented. Discovery is a powerful and effective means of helping your students to retain and personalize the information presented.

Activity Description: Before the class has left the shoreline discuss the appropriate etiquette associated with sampling life in the intertidal. This includes respecting all forms of life found in the intertidal zone by using open hand techniques for holding and observing, confining walking to non-sampling areas and avoiding trampling of eelgrass beds, and returning all observed animals and plants to locations in the intertidal where they were found.



Proceed to a point where the class has reached the upper edge of the nearest eelgrass bed and begin with establishment of a starting point for a transect. Establish the transect along the edge of the eelgrass bed taking care to avoid incorporating too much of the main body of the eelgrass bed into the sample line. This technique will reduce trampling and will achieve a satisfactory result for the activity.

Assign plot locations in intervals of ten meters and use a random number assignment technique such as the simple one described below to identify which location each student team will sample. For a higher resolution sample, you may elect to have the students sample each location along the transect since the overall sample size will be limited by the length and position of the transect.

Students should work in teams of two and provide their data using the form contained in this activity. Ultimately, one data form for the entire class effort needs to be compiled. This can be accomplished by the teacher asking students to submit data during the activity and keeping the master record or assigning a student to this task.

A sample data form with examples of data entries is included to show what the collected data should look like. Within the data sheet is a series of four entries in shaded boxes calling for an exact count of a 100m x 100m (a full square meter) as well as, a 25cm x 25cm area, a 50cm x 50cm area contained within the full meter quadrat. This method uses a device called a nested quadrat to explore the issue of accuracy in predicting larger trends from small amounts of data.

Student teams are assigned a location along the 100 m transect at either a 5m (>10 teams) or 10m (<10 teams) interval depending on the number of teams. Students will then use a method of generating random numbers to select sampling locations (see methods below).

Random numbers and their importance

Scientific research attempts to the highest degree possible to eliminate bias when sampling so that an accurate representation of a population is obtained. In order to do this, the locations for sampling should be selected using a method that reduces or eliminates bias such as the use of random numbers to identify sampling plot locations along a transect.

One method for generating random numbers is to simply have two students count to three and indicate by the number of fingers on their hands collectively what the sum is. This sum is arrived at by adding together the number of digits each student tosses and typically is sufficient since students cannot predict what number of digits the other team member will show. (see pictures)

Another method of selecting plot locations using random numbers is to generate a table of random numbers using an internet-based program that can develop this for you prior to the class. Student teams are then simply assigned a location along the transect based on the series of numbers generated by the random number generator.

Sampling eelgrass shoot density and cover

Student teams are now ready to begin collecting data. This is a good time to remind students that poorly collected or shoddy data is not useful and that the care with which they collect their data will ultimately determine the value of the study.



The teams should work quickly and efficiently to count the eelgrass shoots at the base of each plant and minimize disturbance of the plants. Depending upon the season, each team may want to note the number of reproductive shoots (see photo) in their quadrat as a part of their data collection effort.

Estimated cover is an acceptable means of collecting information about plant populations when sheer numbers of plants or the large size of the sample preclude exact counts of plants. The technique of estimating percent coverage is used on marshes and a % cover standardization sheet is included to give students a guide for estimating percent cover of eelgrass within a given quadrat. The individuals of the team should each make an estimate and then share their estimate and come to agreement about the number that will be recorded.

Following an estimate of percent cover, the team should accurately count the number of shoots contained within the sample plot. Once the count is completed and the data has been recorded, the team should move on to the next plot. This work should continue until each team has had an opportunity to collect data from at least three plots and preferably more. In this way, the teams will begin to understand the natural variability that occurs in eelgrass beds and in other populations of plants and animals. Later analysis of the data will demonstrate the “patchy” nature of populations and can be related to environmental conditions through additional collection of other types of data such as water quality information.

Collection of other specimens for on-site viewing

Eelgrass beds host a diversity of life ranging from microscopic epiphytes and eggs to cryptically colored isopods specially adapted to grasp the narrow leaf blades of the plant. The first hand experience of discovering this life through careful observation is a powerful way of understanding the phenomenon of biological richness. However, care must be taken to minimize impacts to this sensitive and important habitat. The best means of observing this diversity is to collect representative samples for observation at the collection location and immediate release. Photo records using digital cameras are an excellent way of collecting images for later use and documenting the experience without destroying the individuals collected.

To collect an interesting array of life, two simple methods may be employed. Using a dip net gently swept around and through the eelgrass beds when they are partially sub-merged, the collector can typically find a variety of isopods, shrimp, and other invertebrates that use the eelgrass for cover and forage. Extreme care should be taken to avoid uprooting the plants or disrupting the sediment around the base of the shoots since this may destroy or smother the eelgrass. Any animals collected should immediately be placed in a shallow tub of cool water for observation and then returned to the eelgrass bed once observations are complete. Occasionally, individual larger organisms such as crabs or fish may be caught and because eelgrass beds are an essential part of the nursery function that estuaries perform, if large numbers of any crabs or fish are encountered, a minimal collection should be made of one or two individuals as naked eye observation will suffice to assist student comprehension of the value of the habitat.

A second method of observation involves seeking wrack or washed up eelgrass blades and plants that have been carried by tidal currents or other disturbances. These rafts of plant material are often tangled with a variety of other living and non-living debris and provide floating platforms for a diversity of animals. The wrack moves along with the tide and depending on the level of the water may be deposited on unvegetated flats or trapped by the salt marsh plants where the nutrients are recycled into the marsh sediments.



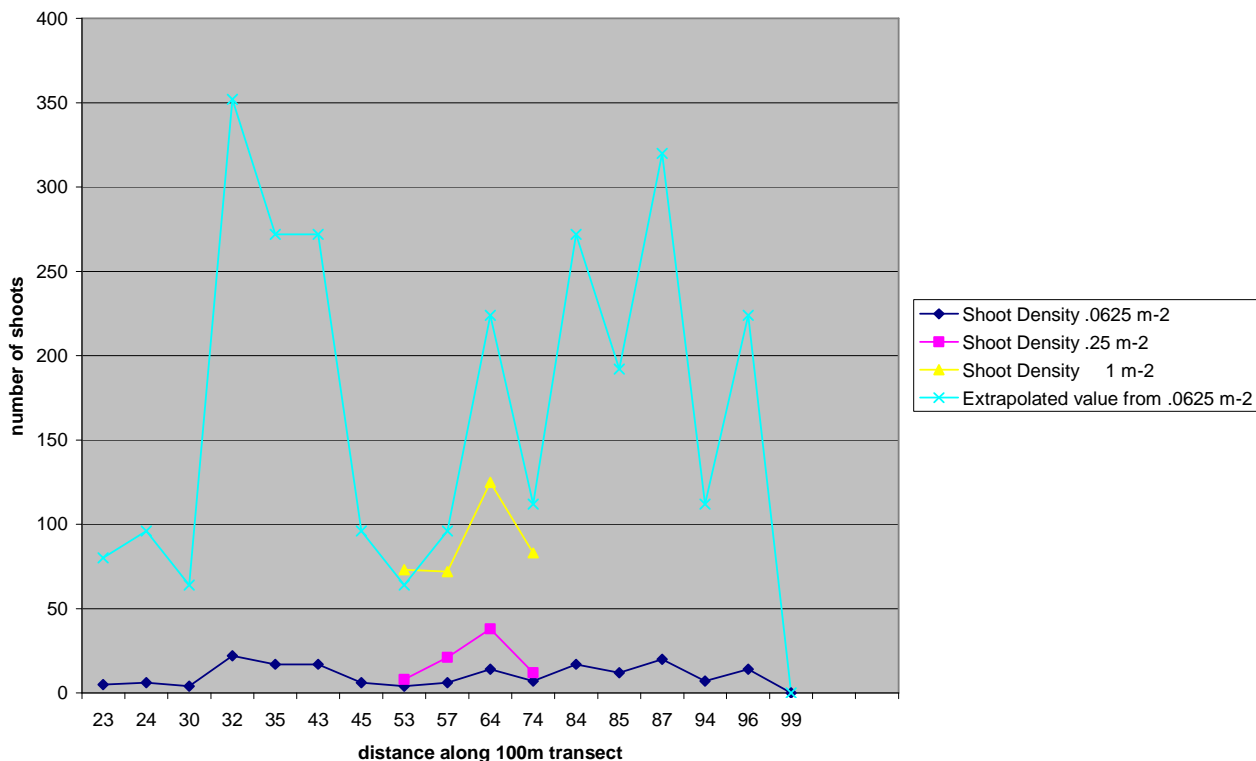
Collections of wrack often yield interesting results that will provide the students with plenty of life to study and decrease the impacts to the living eelgrass community. Furthermore, the wrack can be brought to shore and studied using field scopes and hand lenses, and then returned to the estuary for the tides to distribute as they will.

Once the trip objectives are accomplished, the students should account for all equipment and return all specimens to the eelgrass meadows being sure to take any last photographs of the site for later use in presentations or as a part of a final report.

Post activity analysis: The data collected will be most useful for analysis and interpretation if it is graphed using a program such as Excel. The first step is to put the data in tabular form and then identify the parameters that are to be compared. Extrapolated data is derived by multiplying the value for the .0625 m² plot by a factor of 16 to derive an estimate of the shoot density for a 1 m² plot. These values should be carefully entered in the corresponding row for the sample from which they were derived.

A suggested graph is included comparing the density of shoots along the length of the transect. Also included in this graph is a line representing an interpolation of the data collected from the .0625 m² plots and a comparison to the actual data collected from the nested quadrats. The variance is obvious, however, further analysis involving the development of standard deviations or error bars for the data would illustrate the point further and may be helpful if this is within the capabilities of the class.

Z. marina shoot density





To put the activity in context, students may wish to review the studies provided within the resources appendix of the TIDES curriculum. Studies conducted by South Slough NERR staff and other investigators from the Pacific Northwest show the variability of eelgrass within estuaries along the west coast and further amplify the value of this unique plant within the inter-tidal and sub-tidal zones of our bays.

Follow up ideas: SeagrassNet is an international project to monitor seagrass health throughout the world and classes conducting serious efforts using the TIDES curriculum on a frequent basis may want to consider using the protocols and project design identified in this program to contribute to a citizen-based scientific research endeavor.

Teachers and classes using the TIDES curriculum may wish to share their data with the scientists and staff at the South Slough NERR. The data and information collected by classes that are meticulous about investigating eelgrass is welcomed by the Reserve and may provide useful clues to the overall health of estuaries in the Pacific Northwest. Relatively small amounts of research and monitoring are focused on estuaries and correspondingly little is known about the overall condition of these extremely interesting and valuable ecosystems. Contributions made by classes can help to shape a better understanding for the South Slough NERR staff of the health of our estuaries.

Finally, teachers may want to make the monitoring of a particular estuary and a particular eelgrass bed an annual activity. This can provide a long-term data set which is more useful in ultimately understanding the variability and potential impacts to eelgrass communities over time. If this type of long term study is desirable, a carefully planned approach to ensure consistency and spatially reference the location through GPS (Global Positioning System) and other means is strongly encouraged.