Science Lesson 13: Survey of Biofilm Communities

Hawaii DOE Content Standards:
Science standards: 1, 2, 3, 4, 8

Key concepts:
Community structure, biodiversity, health.

Performance indicators: After completing this lesson, students will . . .

- install and collect the sampling rack
- survey the discs, effectively utilizing the stereomicroscopes
- accurately identify the macro-organisms on the disc
- precisely count the species in the grid area

Note to the student:
"When you have completed this lesson you will be able identify and define a Biofilm community, and you will be able to use a stereomicroscope to conduct a quantitative and qualitative survey of the Biofilm sample disc."

Activity at a glance:
Biofilm discs are acrylic discs measuring about 10 cm in diameter. The discs are installed suspended in the ocean or estuarine embayment at known depths for one to four months and then collected for examination under a steromicroscope. The discs can be reinstalled for further growth and examination, or cleaned, or replaced for data replication.

Time:
The time for the survey activity varies but ample time up to four hours should be allotted the first time if both qualitative and quantitative surveys are to be accomplished. Travel time to and from the collection site will be a major factor in the timing of the activity.

Prerequisite skills:
Students should have a basic idea of the operations of a stereomicroscope, scientific random sampling method, and the use of books to identify biological organisms.

Skills to be introduced:
Students will learn to apply the quantitative survey method to a microscopic sample and identify marine invertebrates by class, order, genus and species.

Assessment:
Assessment should include appropriate journal, scientific report and drawing and photographic activities to be included in a final portfolio.

Vocabulary: Biofilm, stereomicroscope, quantitative survey, marine invertebrate, micro and macro algae.

Materials:

Biofilm disk suspended in the ocean for three to four months, Stereomicroscopes, buckets, observation bowls, aerators, marine invertebrate, marine algae, and plankton identification books.

Activity Overview

1. The racks are constructed of Biofilm discs hung on a rope installed in the ocean or an estuarine embayment at known depths. Biofilm discs are acrylic discs measuring about 10 cm in diameter. The discs are installed for one to four months and then collected for examination under a microscope.
2. The orientation of the discs should be horizontal to the rope installed vertically from the seafloor. The rope is installed with a weight on one end and a float on the other. Alternately the rope can be hung from a dock or permanent buoy. The discs should be separated on the rope by a spacer 1 to two inches thick. The discs and spacers should both have holes in the center large enough so that they can be easily removed from the rope after the encrusting film has grown.
3. Once collected the discs should be numbered by site, rack, and depth. This label is to be used in data collection. The disc should remain submerged in the source water. Buckets should be brought when collecting the discs for this purpose. An aquarium aerator should be used to keep the samples fresh if there will be an extended time between collection and observation. Observation of the disks should take place not longer than three hours after collection.
4. Each disc is placed in a glass bowl of source water for observation under the stereoscopes. Bowls that fit the disc and microscope should be obtained prior to sample collection. The observer is given thirty minutes to conduct a qualitative survey of the disc. Each species present should be identified and named scientifically. It is important to have sufficient identification texts available for students particularly if they are unfamiliar with marine invertebrates and algae. Make sure the student observes the side of the disc with more growth first. Then flip the disk and repeat the qualitative survey with a shorter time interval. It may be helpful to have one scope connected to a projector so that the class can quickly identify the most common organisms together.
5. Be careful when handling the disc as some organisms are non-sessile and can be easily removed from the disc. After the qualitative survey, place transparent numbered grids over the heavy growth side of the disc. Select random numbers for grid choice and then zoom in to frame the grid and count the numbers of individuals of each species in the known grid area.

This is the quantitative survey procedure. Select one or more indicator species to focus on and reduce counts.

6. Enter the data in the computer table with pre programmed functions to obtain statistical information about each sample. Use statistical modeling to discuss sample sites.

Cultural Values

Malama
Respect reciprocity relationships and responsibility
Pono
Correct doing
Laulima
Working together
Kokua
Taking initiative, service, clean up maintenance
Lokahi
Unity, harmony, leadership skills

Adaptations/Extensions

Slides can be made from the biofilm slime to survey marine microorganisms including phytoplankton and zooplankton to be examined on a compound microscope. Photographs of bacteria and their descriptions can be introduced as the fundamental building block of marine food webs and habitats. Water quality can be conducted at the site and multiple sites and depths can be chosen to show growth in variable conditions.

Background, teaching suggestions, resources:
The Biofilm survey is conducted as far away as Norway and as close as Maui. The Maryland Sea Grant program has been a central player in the support and networking of school groups conducting Biofilm research. On the web at www.mdsg.umd.edu.

Connections to other curricula or lessons
The quantitative survey is similar to the quantitative coral reef survey. A discussion of biodiversity, scaling, and ecological interdependence should follow the lesson.

Safety

Safety around collection sites is paramount. If a boat is used proper floatation devices should be provided for all students.