BACK BAY SCIENCE CENTER

Eelgrass Studies and Restoration Module

ACTIVITY I: Morphology
ACTIVITY II: Photosynthesis
ACTIVITY III: Life Cycle

CALIFORNIA STATE CONTENT STANDARDS

Grades 6 – 8

6th Gr. Science:
- Ecology - 5a, e
- Investigation and Experimentation - 7b

7th Gr. Science:
- Cell Biology - 1b, d
- Genetics - 2a
- Evolution - 3a
- Structure and Function in Living Systems - 5f
- Physical Principles in Living Systems - 6d

Grades 9 – 12

Science - Biology/Life Sciences:
- Ecology - 6b, d, e
- Evolution - 8a, b
- Investigation and Experimentation: 1a, d, f
- AP Life Sciences: LS.2.2, 3.1, 3.3, 4.2

History/Social Science:
- 11th Gr. 11.11.5

EEI P and C: IIa; IVb, c
Ocean Literacy Principles**:** 1g; 3e,f; 4a; 5f; 6e

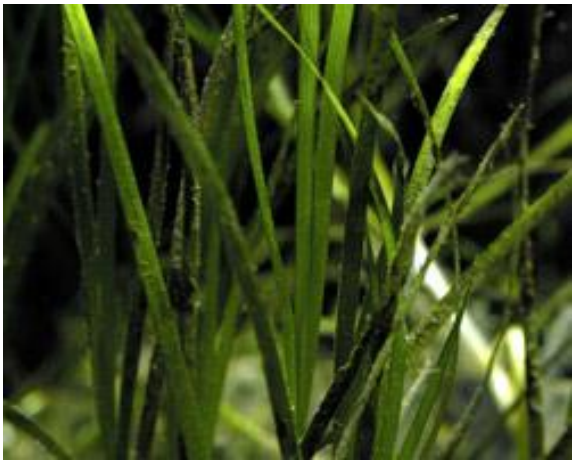
BACKGROUND INFORMATION

Eelgrass can be thought of as a keystone species of the ecosystem in Newport Bay. It is uniquely adapted to a submerged life-cycle. It is a primary producer of energy that nourishes other aquatic organisms. It maintains the health of the habitat by filtering toxins out of the water and sediments. Without the presence of eelgrass, the biome would quite likely wither.

Eelgrass is an aquatic plant adapted to a submerged life cycle. As with its terrestrial counterparts, eelgrass is able to convert sunlight into the chemical energy of glucose in the process of photosynthesis. Because it lives entirely in water, it is sensitive to the levels of resources that flow around it. In shallow areas where there is abundant light, the plants tend to be short with narrow blades. In areas of greater depth, the plants need to grow taller to reach a height where sufficient light will penetrate the water column to stimulate the chlorophyl for photosynthesis. Blades of plants in deeper waters tend

Background Information (Cont.)

to be broader to optimize surface area and absorption of sunlight. High levels of turbidity, whether caused by storms, dredging or upstream deposits decreases the reception of sunlight and so negatively impacts the plant. Tidal movement is a contributing factor to the health of eelgrass. Too much current can decimate an entire bed, but too little means that distribution of nutrients and sediments is not being maintained. Sediment that is too tightly packed excludes oxygen and makes it difficult for roots to take hold. Eelgrass can tolerate a wide range of salinity and temperatures, but extremes can have a negative impact. Eelgrass can reproduce asexually with vegetative shoots emerging from the rhizome of the plant. Sexual reproduction requires a temperature above 15°C. While each plant is monoecious, having both male and female reproductive parts, the male and female flowers mature at different times to prevent inbreeding, with the heavy male pollen strands remaining at greater depths of the water column and circulated to other plants.



As a primary producer, eelgrass supports the life of the other species that live within the ecosystem. As with its terrestrial counterparts, the eelgrass is able to produce food in the form of glucose from a combination of sunlight and water during photosynthesis.

Eelgrass supports the energy demands of herbivores, omnivores, and in turn carnivores. Unlike algae, eelgrass has roots that deposit oxygen, a by-product of photosynthesis, into the sediment, which assists benthic organisms.

Eelgrass is an important contributor to the filtering function of an estuary that benefits water quality and clarity. Because eelgrass has roots that absorb nutrients from the sediment layers, these nutrients are taken into the organism and processed out of the water. We can see that eelgrass is taking in nutrients during periods of rapid growth, eutrophication, after an influx of increased nutrient load in the water. On a physical and mechanical level, objects can also become enmeshed in the network of shoots, keeping them out of the flowing water. It

is important to remember that while eelgrass functions as the basis of a

a thriving estuarine ecosystem, the species is susceptible to human impact. There is a carrying capacity beyond which the plants cannot function. Two areas of particular concern are nutrient load in the water and turbidity. Both of these are manageable through awareness and behavioral changes. Nutrient load can be tackled on an individual level by choosing to plant native rather than non-native or ornamental plants. This has a significant impact because local soils won't require enrichment from fertilizers and other amendments that then end up in the estuary. It also decreases the amount of off-season watering which in-turn brings other toxins through the storm drains. The other area of concern is turbidity which is increased by dredging and construction along the watershed. These are both areas where the public can express their concern. Research and experience have demonstrated that loss of significant portions of eelgrass habitat result in decreases in dissolved oxygen and water clarity, and increases in temperature and suspended sediments. These changes lead to a loss of food, shelter and biodiversity within the entire biome.

EXTENSIONS

1. After the field trip, assess the collected Student Worksheets. Use the grading rubrics and answer keys provided to evaluate the scientifici accuracy of the drawings and the degree of comprehension of the answers to the discussion questions.
2. Discuss the activities and discussion questions in the Eelgrass Investigation Lab with students in class.

TEACHER GUIDE – Eelgrass Studies and Restoration

ACTIVITY I: Eelgrass Morphology

OBJECTIVES:

Students will be able to:

1. Identify at least five morphological parts of a mature eelgrass plant and their functions.
2. Describe three key features of a seagrass that distinguish it from seaweed (or algae).

MATERIALS:

Live eelgrass
Scissors
Preserved mature eelgrass plants
Microscopes
Slides with eelgrass leaf cuttings
Photographs or pictures of Eelgrass in its various life stages
Student worksheets: Morphology
Pens/colored pencils
Answer key for morphology and photosynthesis activities

KEY TERMS:

Adaptation Algae Angiosperm Aquatic Benthic Biodiversity Chloroplast Chlorophyll Clarity Ecosystem Estuarine Flowering Shoot Holdfast Inflorescence Lateral Shoot Marine Meristem Microhabitat Monoecious Morphology Node Non-Vascular Organism Osmosis Primary Producer Photosynthesis Rhizome Seagrass Seaweed Senescent Sheath Shoot Spore Submerged Substrate Terrestrial Vascular Vegetative Vegetation Wetland *Zostera marina*

TEACHER GUIDE – Eelgrass Studies and Restoration

ACTIVITY II: Photosynthesis in an Eelgrass Plant

OBJECTIVES:

Students will be able to:

1. Identify and roughly sketch photosynthetic plant cells and their chloroplasts.
2. Describe the role photosynthesis plays in a single eelgrass plant as well as the entire eelgrass habitat.

KEY TERMS:

Adaptation Algae Angiosperm Aquatic Benthic Biodiversity Chloroplast Chlorophyll Clarity Ecosystem Estuarine Flowering Shoot Holdfast Inflorescence Lateral Shoot Marine Meristem Microhabitat Monoecious Morphology Node Non-Vascular Organism Osmosis Primary Producer Photosynthesis Rhizome Seagrass Seaweed Senescent Sheath Shoot Spore Submerged Substrate Terrestrial Vascular Vegetative Vegetation Wetland *Zostera marina*

MATERIALS:

Live eelgrass
Scissors
Preserved mature eelgrass plants
Microscopes
Slides with eelgrass leaf cuttings
Student worksheets: Photosynthesis in an Eelgrass Plant
Pens/colored pencils
Answer key for photosynthesis activities

TEACHER GUIDE – Eelgrass Studies and Restoration

ACTIVITY III: Eelgrass Life Cycle

OBJECTIVES:

Students will be able to:

1. Identify eelgrass plants at different stages of growth and reproduction.
2. Identify and describe the morphological traits of the two distinct types of eelgrass found in Newport Bay, and how these traits better adapt them to each of these microhabitats (e.g. deep vs. shallow water, soft mud vs. sandy silt, and high vs. low wave energy).

KEY TERMS:

Adaptation Algae Angiosperm Aquatic Benthic Biodiversity Chloroplast Chlorophyll Clarity Ecosystem Estuarine Flowering Shoot Holdfast Inflorescence Lateral Shoot Marine Meristem Microhabitat Monoecious Morphology Node Non-Vascular Organism Osmosis Primary Producer Photosynthesis Rhizome Seagrass Seaweed Senescent Sheath Shoot Spore Submerged Substrate Terrestrial Vascular Vegetative Vegetation Wetland *Zostera marina*

MATERIALS:

Preserved mature eelgrass plants
Photographs or pictures of Eelgrass in its various life stages
Student worksheets: Eelgrass Life History, Eelgrass Reproduction
Pens/colored pencils
Answer key for Life History, Reproduction activities
POSTERS: What Is Eelgrass? Eelgrass Life History