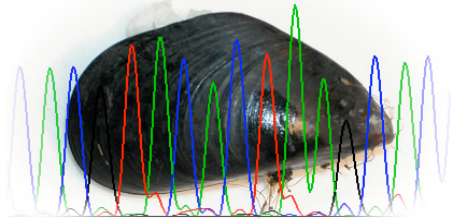


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Marine Biotechnology and Bioinformatics for Teachers

**MARINE BIOTECHNOLOGY & BIOINFORMATICS FOR TEACHERS**  
**MOSS LANDING MARINE LABS NSF ITEST GRANT**  
**PROJECT-BASED LEARNING LESSON PLAN**  
**MUSSEL ECOLOGY**

## Mussel Ecology

Project Based Lesson Plan for Sixth through Twelfth Grade (Marine Science)

### Designed by

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### Background

This is a marine biology lesson that will introduce students to the habitat and environment of the marine mussel. During the lesson students will collect mussels using random sampling techniques at a dock and observe its environment. An emphasis is put on human factors that may have effect the mussel habitat. Students will make connections between the mussel as an intermediate species in the food chain and the affects of being a filter feeder in a marine environment that is surrounded by human influences. Extension of this lesson includes toxicology study in mussels, species identification through DNA analysis, and dissection.

**Description of Audience:** This project-based learning activity is designed for middle school and high school biological science or ecology classes.

**State Standards:** This biotechnology/bioinformatics project-based multimedia learning activity fulfills the following State of California Science Standards:  
6<sup>th</sup> Grade Ecology

- 5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept:
  - a. Students know energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism through food webs.
  - b. Students know matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. c. Students know populations of organisms can be categorized by the functions they serve in an ecosystem. d. Students know different kinds of organisms may play similar ecological roles in similar biomes.
  - e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.
    - Standard A: Develop abilities and understanding in field of scientific inquiry
    - Standard C: Expand understanding of life sciences
    - Standard F: Explore an important issue of science in a social perspective

•GRADES NINE THROUGH TWELVE—BIOLOGY/LIFE SCIENCES Ecology

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:
  - a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
  - b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
  - c. Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.

**National Standards:** This biotechnology/bioinformatics project-based multimedia learning activity fulfills the following National Science Standards:

- Standard A: Develop abilities and understanding in field of scientific inquiry
- Standard C: Expand understanding of life sciences
- Standard F: Explore an important issue of science in a social perspective

## Components

### Schedule:

This lesson was completed in one day. It can be broken into class periods on sequential days. Following is an example of a one-day schedule:

24-Jul	Monday	Topic	Location
	9:00 AM	Overview & intros & ice-breaker	Computer lab
	10:15 AM	Transportation to the sampling site	MLML Dock
	10:30 AM	Intro to site safety and sampling procedure	MLML Dock
	11:00 AM	Go to Moss Beach, Intro Journal, Beach Cleanup	Computer lab
	12:00 PM	Back to CSUMB (Lunch)	
	1:00 PM	KWL, power point, create student projects	Computer lab
	2:45 PM	Break	
	3:00 PM	Reflection	Computer lab
	4:00 PM	Modification of Lesson	Computer lab
	4:30 PM	Evaluation	Computer lab
	5:00 PM	END	

### Division of Labor:

The tasks are:

Planning: All teachers

Power point creation: Michael and Rick (all edit)

Supplies list: Laurie (all edit)

Standards and Lesson Plan: Laurie (all edit)

Field Guide: Emily (all edit)

Ice Breaker: All

Dock Talk: Emily and Rick  
Demo at Dock: Michael and Laurie  
Random Sampling: Students in Pairs/ 1st group Dock 1, 2<sup>nd</sup> Group Dock 2, 3<sup>rd</sup> Group Dock 3 (waiting for room to sample)  
Field Guide Introduction and Beach talk: Laurie and Emily  
Beach Explorations: All Students and Teachers  
Beach Cleanup: All Students and Teachers  
Photography and STEM Correlation: Emily  
Mussel Gross Anatomy: Rick  
Power point and Major Concepts Discussion: All Teachers  
KWL: All Students  
Writing in Journals: All Students  
Final Projects and Presentation: All Students in small groups. Share tasks such as computer lay-out or artist, researcher, manager, leader  
Overseers: All Teachers

### **Research and Production Plan:**

This lesson is designed to give students field experiences in two biologically diverse environments that are populated by the mussel. Students will collect mussels using random sampling techniques and use the in a later dissection and DNA extraction lesson. Students will be introduced to the mussel food web and draw conclusions on the affect of humans are having on the mussel food chain. Through observations at a boat dock and a coastal beach, students will be able to visualize the interconnectedness of organisms and develop an understanding of the importance of biodiversity and the effects of pollution on an ecosystem. In the field, student will fill out a field guide and use this notetaker to help them with their final projects. In the computer lab, teachers will present on mussel anatomy, mussel ecology, and local environmental pressures to build background information. Students will also complete a KWL chart as an informal assessment of the lesson. The final assessment will be student-based projects. Students will choose one of two questions: "What impacts do humans have on mussels" and "What role does the mussel have in the environment?" Students may answer the question by:

Creating a rap or poem  
Creating a PowerPoint  
Creating an iMovie  
Drawing a poster  
Writing an essay

Students will present their final product to the class at the end of the day. These concepts align with California State Standards for the Sixth, as well as Ninth through Twelfth Grade Standards for Ecology, Biology and Life Science.

**Materials and Equipment List:** In conducting this project, the following equipment, materials and supplies are needed:

• Supplies

1. stapler and staples
2. clipboards (1 per student)
3. string or yarn
4. pencils attached to clipboards
5. transect tape
6. bucket
7. baggies one per mussel
8. Sharpie Marker
9. Baby Wipes for cleaning hands
10. large white paper
11. markers, colored pencils or crayons (6 sets or as many as possible)
12. 1 dry erase marker

13. Student field guides
14. Clear plastic trash bags for beach cleanup
10. Computers with Power Point Program
11. Digital cameras
12. vans for transport

**Releases List:** Remember, if students are using copyrighted photographs or videos they should give credit to the original author. In some instances students must have permission to photograph individuals, be sure to have release forms ready to use.

## **Description**

This is an outdoor sampling and observation lesson that exposes students to the ecology of a mussel. Students will observe the human and predatory impacts in an ecosystem. Students have a follow-up in the classroom that includes a powerpoint presentation, discussions and an opportunity for both research and a creative product. The students will dissect the mussels on the next day.

## **Sharing Student Learning**

The lesson concludes with a student based project that asks students to answer one of two questions: "What impacts do humans have on mussels" and "What role does the mussel have in the environment?" Students can answer the question by:

- Creating a rap or poem
- Creating a PowerPoint
- Creating an iMovie
- Drawing a poster
- Writing an essay

Students will present their final product to the class.. Concepts align with California State Standards for the Sixth, as well as Ninth through Twelfth Grade Standards for Ecology, Biology

## **Assessment**

Students will be formally assessed on their group presentations. Students will be informally assessed through the KWL chart.

## **Career Connection**

The following careers can be tied to this activity:

Biological technician, biostatistician, wildlife biologist, environmental health scientist, and environmental science and protection technician, teacher, college professor.