Ecological Interactions and Biodiversity of Kelp Forests

Middle School Life Science
Ecosystems/Biodiversity

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Overview

Kelp forests play a vital role of the health of our global oceans. These fragile biodiverse ecosystems provide the ideal ecosystem to look at ecological interactions among organisms, trophic structure, nutrient cycling, and overall ecosystem dynamics. Often time students who live near the coast get to experience the rock intertidal zone, but rarely do students get a chance to explore and understand what lies beneath the vastness of the ocean. This lesson will allow students to explore the kelp forest using basic concepts in ecology without having ever left the classroom.

Objectives

Students will:

- Engage in meaningful activities focus around kelp forest ecology and the role of kelp forests in maintaining the health of our local and global oceans
- Work cooperatively in small groups to research, brainstorm to while looking at ecological interactions in a kelp forest
- Work cooperatively as a group within the larger context of the class to connect concepts and organize their representation of a kelp forest food web
- Discuss ecological implications of changes in the kelp forest ecosystem

Vocabulary Included:

- Ecology
- Trophic Structure
- Food Chain
- Food Web
- Biodiversity
- Niche

Background

Kelp forests provide an important role in the health our global oceans. They are found pole to pole in nutrient-rich waters with water temperatures typically 20°C or less. Their dependence on light for photosynthesis restricts them to shallow coastal zones no greater than 40m in depth, an area often referred to as the subtidal

Materials

In addition to the MyHero film you will need the following materials:

- Notecards/thick paper
- Scissors
- String

Other Resources

Websites:

http://montereybay.noaa.gov/sitechar/kelpl.html

- Provides and overview of the CA Monterey Bay Kelp Forest Ecosystem, which is a model for healthy kelp forests

http://commons.wikimedia.org/wiki/ File: Kelp_forest_distribution_map.png

- Provides a map of global kelp forest distribution included in your presentation

http://life.bio.sunysb.edu/marinebio/kelpforest.html

- Provides a comparison of different kelp forests around the world

zone. These kelp forests rapidly grow, sometimes gaining up to 30cm per day, and provide a rich biodiverse ecosystem for some of the 800 species that call it home. Each species occupies it's own specific niche, or role within the environment. The balance of these interactions is what keeps the kelp forest healthy and in balance with the surrounding ocean environment. With more and more human exploitation of our ocean resources, our kelp forests and the species that reside within them have become threatened. To maintain their existence humans have resorted to restoration efforts.

Activities

(SEE LESSON PLAN TOOL FOR SPECIFICS)

1. Exploring Food Chains in the Kelp Forest Ecosystem
2. Developing Food Webs in the Kelp Forest Ecosystem
3. Discsussion of ecosystem changes/ Role of ecological niche

Standards

CA New Generation Science Standards (2014)

http://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp

LS2.A: Interdependent Relationships in Ecosystems

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Adaptations

This lesson is meant to give students a basic introduction into kelp forest ecosystem and basic ecological terminology. However there are several ways to extend or expand the lesson.

- If you live in an area where kelp is accessible it would be very beneficial to bring in a sample and allow students to examine it either macroscopically or microscopically. Looking at a kelp holdfast you will find multiple small critters and can further discuss biodiversity. **LS4.D: Biodiversity and Humans**
- You can further expand this issue of changes in kelp forest ecosystem by discussing human impacts: harvesting, overfishing, pollution, climate change. In addition, you can have them come up with solutions for how to ensure a healthy ecosystem and discuss the idea of restoration.**ETS1.B: Developing Possible Solutions**

Evaluation

The following questions will help you determine if your students gained appropriate understanding. For further assessment students could be tested on ecological terminology and asked to create a food chain/food web.

Q. Were students able to create accurate food chains and food webs?

Q. Were students able to have a good discussion about changes in the kelp forest ecosystem and how it would impact the environment and other species?

Q. Did students get a basic understanding of kelp forest ecology and basic ecological terms?

LESSON PLAN TOOL: KELP FOREST EXPLORATION: GRADE LEVEL: 7th

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LESSON COMPONENTS/ (SUGGESTED LENGTH)	Activities ~ Supplementary Materials
I. Opening/ Motivation (10 MIN) ● Meaningful content ● Connections to real life/students' home culture ● Link past learning to new concepts ● Key vocabulary emphasized ● Introduce Essential Question	1. Q. What is a kelp forest and why is it important for ocean health? ● Have students think pair share ● Whole class share out ● Read overview and background provided 2. Review or introduce the following terms: ● Ecology ● Trophic Structure ● Food Chain ● Food Web ● Biodiversity ● Niche
II. Presentation (20 MIN) *(Instruction TO)* ● Modeling, visuals, demos, hands-on, gestures, body language ● Scaffolding- such as think-alouds. ● Interaction	3. Describe a kelp forest (see guideline) and compare to the nearby biome that students are most familiar with. Emphasize the biodiversity and the abundance of interactions between organisms. 4. Show the MyHero film (10 min): The Kelp Lady 5. Draw a basic trophic structure and food chain of a kelp forest (see handout) and have students draw as well 6. Discuss the importance of food chains and balance in a ecosystem 7. Q. How might the balance in a kelp forest be disrupted? ● Whole class share out
IV. Practice & Application (20-30 MIN) *(Instruction WITH)* ● Meaningful Activities ● Interaction ● Strategies	8. Give each student and organism card and have them find 2 other potential organisms in their food chain. Have students create a food chain with string (optional: have them also draw a trophic structure for their group) 9. Have each food chain create a larger food web by having each student in the chain link with one other. Al students should have at least 2 connections and a tangled web of string by the end. 10. Have one or two students (phytoplankton and algae/kelp) leave the web. Discuss the implications----disruption in biodiversity, ecosystem as a whole, and trophic structure.
IV. Independent Practice/Assessment (5 MIN) *(Instruction BY)* ● Feedback to students ● Assess student comprehension and learning throughout lesson.	11. Provide any feedback based on observations (how could have students more easily formed chains/webs)

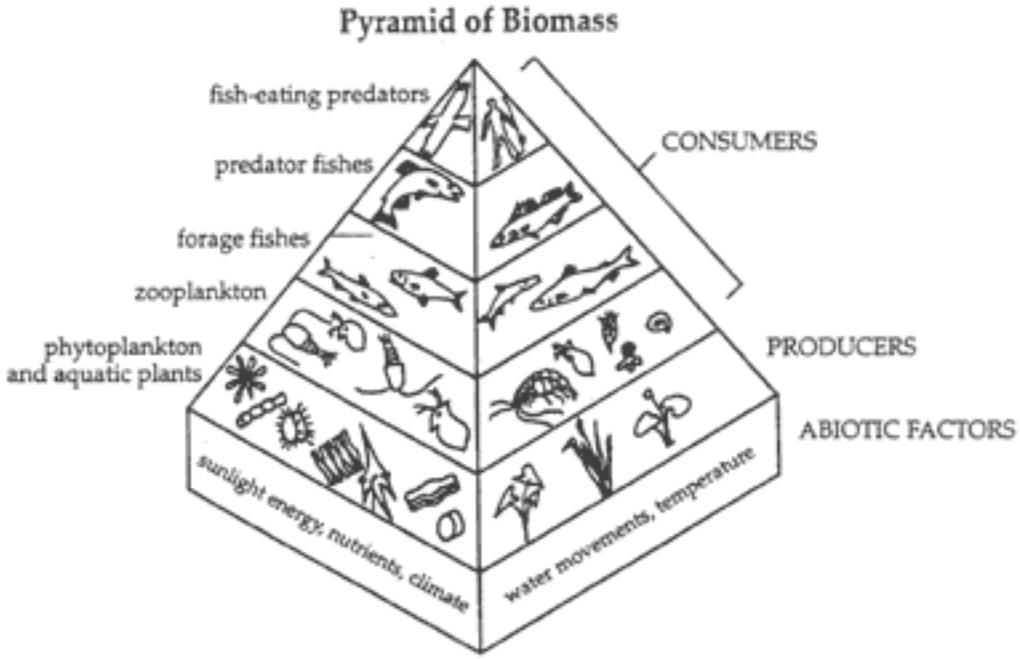
V. Closure (5 MIN) ● Review key vocabulary concepts ● Reflection ● Metacognition ● Revisit Essential Question	12. Review concepts/terms: ● Ecology ● Trophic Structure ● Food Chain ● Food Web ● Biodiversity ● Niche and the role of each organism in the ecosystem 13. Reiterate goal of activity/essential question(s) (Q. What is a kelp forest and why is it important for ocean health?) 14. Have students share out about local Eco Heros in their lives similar to Nancy Caruso in the film (for a longer assignment students could produce a video, art piece, or short story)
Materials and Resources	➢ Notecards with organism names /(diet) ➢ String

Adapted from the SIOP Model by Echevarria,Vogt and Short, 2008.

BLUE BANDED GOBY (eats: Zooplankton)	SEA URCHIN (eats: Alage, kelp)
GIANT KELP, Algae (eats: The sun, eaten by most things)	PHYTOPLANKTON (eats: The sun, eaten by most things)
SEA STAR (eats particles of :Gumboot chiton, sponge)	DECORATOR CRAB (eats: Sponge, algae, kelp)

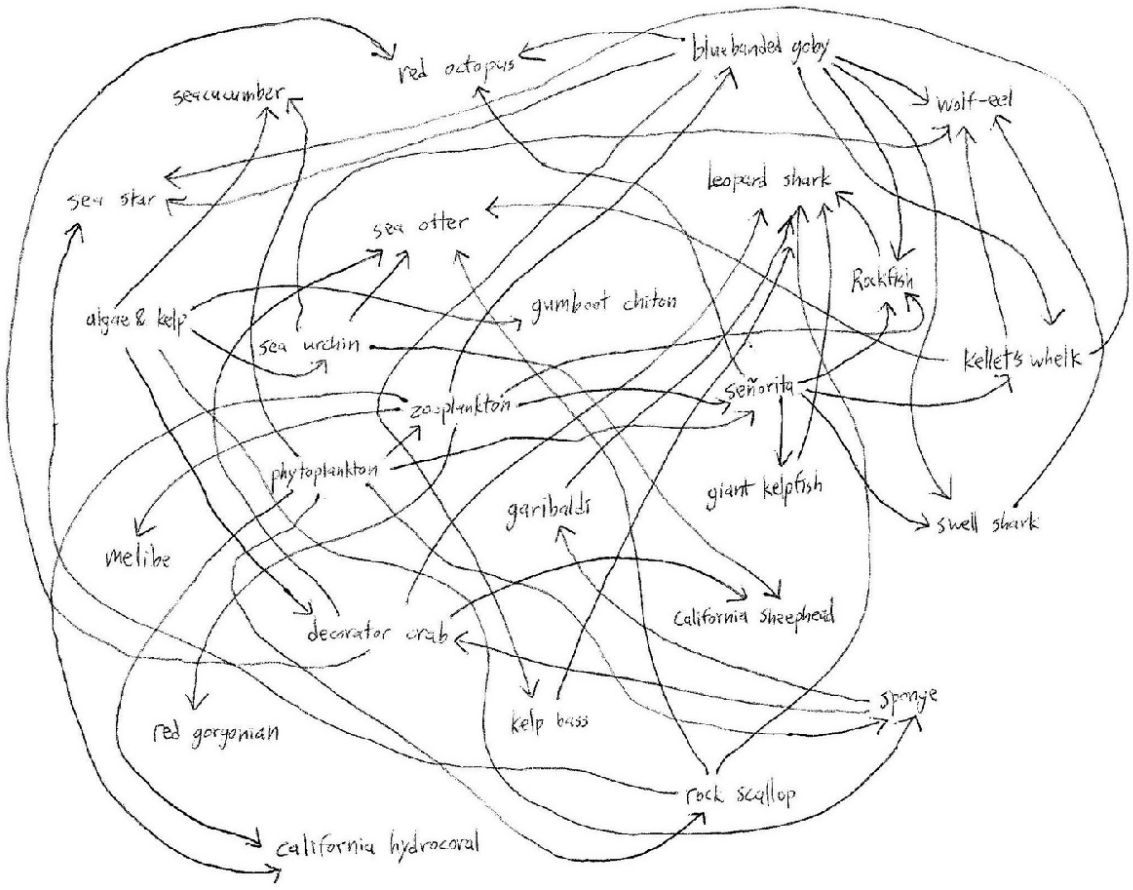
CALIFORNIA SHEEPHEAD (eats: Decorator crab, sea otter)	OTTER (eats: Sea urchins, decorator crab, rock scallop)
WOLF EEL (eats: Sea urchin, blue banded goby)	OCTOPUS (eats: Decorator crab, blue banded goby)
ROCK SCALLOP (eats: Phytoplankton)	LEOPARD SHARK (eats: Garibaldis, decorator crab)
SEA SPONGE (eats: Phystoplankton , kelp, algae)	KELP BASS (eats: Blue banded goby)

CA SEA LION (eats: kelp bass, garibaldis)	GARIBALDIES (eats: sponge)



greatneck.k12.ny.us

DETAILED FOOD WEB : The Kelp Forest


red octopus
blue banded goby
sea cucumber
wolf-eel
sea star
leopard shark
sea otter
Rockfish
algae & kelp
gumboot chiton
sea urchin
kellet's whelk
señorita
zooplankton
phytoplankton
giant kelpfish
garibaldi
swell shark
melibe
California sheephead
decorator crab
sponge
red gorgonian
kelp bass
rock scallop
California hydrocoral