Learning Outcomes
Global Kelp Location

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Grade Levels:

This lesson can be used with grades 5-12

Lesson Duration:

Preparation and computer lab time: 2 - 40 minute class periods.
Follow-up and extensions: 1 - 40 minute class period

Materials:

Computers with My World GIS Software
Lesson handouts for students
Activity recording sheets and World Maps

Optional:

Lab materials
Globes
Additional videos or pictures of the kelp forest.

Lesson Overview:

Kelp forests are important biological habitats for many fish and invertebrates. They produce oxygen and food products for humans. Like all plants, kelp requires both light and nutrients to grow. They prefer water that is cool and nutrient-rich. These plant-like algae, which are anchored to the bottom by a holdfast or haptera, prefer a rocky seafloor on which to anchor. In ideal conditions giant kelp can grow 10-12 inches per day. In this lesson students will look for ideal locations for kelp forest growth. These locations occur a where there are combinations of physical factors including water depth, temperature, wave action and nutrient availability.

In this lesson students use My World GIS to look for connections between Physical and Biological factors in the ocean. The lesson begins with students reading a short paragraph about the needs of the kelp forest. They then predict where in the ocean kelp forests should exist. After this prediction students begin by examining ocean depth for suitable kelp forest habitat. In the second part of the lesson, students look at ocean temperature and select regions of water that is cold enough for kelp forest life. In part 3, students look at upwelling regions and view a short explanatory video clip of how upwelling occurs. Upwelling helps to bring nutrient rich waters to the kelp forest so students are asked to in part 4, connect upwelling and the kelp forest.

Key Questions

- ✓ How does the physical environment affect the biological environment?
- ✓ What are the factors that control the location of kelp forests?

Goals

GIS and Map Skills

Students who complete this project will be able to:

Open a MyWorld GIS project
Turn layers on and off
Create selections using the Analyze mode
Use the Zoom tools
Use the Identify tool
Turn legends on and off
Edit a layer's appearance
Use the Link tool

Content Knowledge

Students who complete this project will know:

Kelp forest locations and their relationship to
Ocean depth
Upwelling zones
Ocean temperature zones
Global wind patterns and their relationship to upwelling

Prerequisite Background Knowledge

Students should have a basic understanding of kelp and ocean plants. Reading materials and activities to achieve this understanding can be found in JASON XIV – From Shore to Sea, or on Web sites, listed below.
Students will also need to have had some introduction to physical oceanography.

California Standards

Subject : Science
Grade : Nine thru Twelve
Strand : Life Sciences
Substrand 6 : Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:

Ecology
STAR California Standards Test
Standard:
6b
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.

Subject : Science
Grade : Nine thru Twelve
Strand : Earth Sciences

Substrand 5 : Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept:

STAR California Standards Test
Standard:
5d
Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.

Student Activity:

See separate document. – Global Kelp Location

Assessment:

My World Skills Assessment
Venn Diagram of Kelp Habitat Factors in the lesson
Discussion of Kelp Forests and Terrestrial Forests

Extensions:

A complete suite of lessons entitled "Forests Under the Sea" by Paul Sperry can be found here: http://teachnet-lab.org/santab2003/sperry/index.htm

Student research projects on life in the kelp forest an example described here: http://projects.edtech.sandi.net/grant/kelpbeds/kelpbeds_-_teacher_page.htm

Activities from the Monterey Bay Sanctuary: http://www.mbnms-simon.org/sections/kelpForest/education.php?sec=kf

Build a kelp forest model from COAST : http://www.coast-nopp.org/resource_guide/elem_mid_school/ma_habitats_acts/kelp.html

Teacher Background and Supplemental Resources:

Books and Print Resources:

JASON XIV – From Shore to Sea: A complete unit on the Kelp Forest of the Channel Islands.

Life In A Kelp Forest
by Mary Jo Rhodes, David Hall

The Hidden Forest
by Jeannie Baker

The Amber Forest: Beauty and Biology of California's Submarine Forest by Ronald H. McPeak

Kelp Forests (Monterey Bay Aquarium Natural History Series)

Hands-On Activities:

JASON online at the Texas Instruments Web site.

JASON: Mixing Soil And Water--Let's Settle This. Discusses turbidity and light penetration.

Upwelling Mini- lab
http://www.oceanoasis.org/teachersguide/activity6.html

What do Algae Eat? Chemistry and nutrient connection from SBC_LTER
http://sbc.lternet.edu/outreach/downloads.html

Web Links:

Kelp Forests:
Site with links http://www.pcds.org/share/sci8/usefullinks/kelp_forest.htm

Monterey Bay Aquarium Kelp Cam - http://www.mbayaq.org/efc/kelp.asp

Monterey Bay Aquarium Field Guide -
http://www.mbayaq.org/efc/living_species/default.asp?hOri=0&hab=5&inhab=479

Kelp Forests, Rainforests of the Sea -
http://www.lincoln.smmusd.org/staff/Vanderveen_Web/Ecology/Kelp%20Reading/kelpreadings.htm

Ocean Realm - http://www.pbs.org/oceanrealm/seadwellers/

Kelp Watch - http://www.geol.utas.edu.au/kelpwatch/facts_i.html

Australian Museum Online - Who Lives in Kelp Forests
http://www.amonline.net.au/factsheets/kelp_forests.htm

American Museum of Natural History
http://www.amnh.org/exhibitions/permanent/ocean/02_ecosystems/02c2_algae.php

Background Info Kelp - http://life.bio.sunysb.edu/marinebio/kelpforest.html

Articles on Catalina Kelp by Bill Bushing
http://gis.esri.com/library/userconf/proc95/to250/p247.html
http://www.starthrower.org/research/kelpmisc/kelp_mp.htm

Pictures of Kelp - http://www.oceanlight.com/html/kelp.html

Jewels of the Sea - http://www.abc.net.au/oceans/jewel/kelp/default.htm

Student research page - http://projects.edtech.sandi.net/grant/kelpbeds/

Upwelling:
http://oceanexplorer.noaa.gov/explorations/02quest/background/upwelling/upwelling.html