**Grade Level:** 6-8

**Subject Area:** Ecosystems

**Classroom Size:** 10 students

**Time Required:** 4 hours

**Common Core and Next Generation State Standards**

**MS-LS2-1** Students will analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

**MS-LS2-2** Students will construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

**MS-LS2-5** Students will evaluate competing design solutions for maintaining biodiversity and ecosystem services.

**Background:**

        Kelp forests are a complex ecosystem that supports many interconnected food webs. They are inhabited by thousands of different varieties of marine life.

        The giant kelp is the largest and the most common algae found along the California coasts. Known as *Macrocystis pyrifera,* giant kelp is able to grow as long as 150 feet and stretch into mile wide kelp forests. It has 3 main structures: the holdfast, stipe, and the blade. The holdfast helps to anchor the kelp onto hard surfaces, the stipe provides support to the blades, and the blades absorb the nutrients that the kelp requires for photosynthesis.

Kelp is a protist, not a plant because it is a type of brown algae. Kelp forests typically live in cold water, which is why they are commonly found in California waters. Kelp forests are analogous to terrestrial forests; they both play vital roles as ecosystems. Kelp forests offer a variety of habitats for all trophic levels.

        A large amount of biodiversity can be found in kelp forests because they offer food, shelter, and diverse habitats for various marine life populations, including semi-aquatic mammals. For instance, many small invertebrates like crabs and snails that are found on the kelp serve as prey for active predators like sea otters, California Sheephead, and lingcod. Sea urchins are one of the biggest threats to kelp forests throughout the Pacific coast because they feed off any nutrients that they can find; consequently, they eat kelp when there is scarce food available to them. Sea urchin populations are controlled by predators, including the California Sheephead, spiny lobster, and the sea otter. Unfortunately, because the populations of these predators are threatened, sea urchins can overpopulate and eat kelp uncontrollably. Thus, a lack of food for sea urchins urges them to eat the holdfasts of the kelp and this causes the kelp to drift off.

        Fortunately, there are kelp restoration programs that function to help restore kelp populations in urchin barrens and dying areas. Volunteers of these programs plant lab-grown kelp and remove sea urchins to repopulate kelp forests. These restored areas are continually monitored for progress. However, they are unable to control the damage caused by commercial kelp harvesting because it has grown into a billion dollar industry.

**Field Trip Description**

        Students will go on a field trip to the California Science Center to view the exhibits on Ecosystems.

        The California Science Center Ecosystems exhibit is composed of 7 zones; each of them describing the type of environment that zone is (e.g. habitats, weather conditions, significance to community). Students will specifically visit the Extreme Zone and Forest Zone.

        The Extreme Zone provides background information on some of the harshest environments in the world like deserts and the very deep depths of the ocean. This exhibit offers a Touch Zone where students will be able to touch real invertebrates found on rocky shores such as sea urchins, limpets, and sea stars.

        The Forest Zone contains two exhibits: the rain forest and kelp forest. Students will only view the kelp forest section. The California Science Center has its own kelp restoration project and it has successfully collaborated with the Santa Monica Baykeepers in removing 120,000 sea urchins from the Palos Verdes Peninsula. The California Science Center grows its own kelp too. It has a 188,000 gallon tank filled with kelp, fish, and invertebrates. The Kelp Forest exhibit will be followed by a trip to the Diversity on Display where they show different species of marine life in tanks to be seen by the public. They will be able to see lobsters, anemone, sea stars, and more. The California Science Center also has a dive show that the students will see upon arrival.

**Objectives/Goals:**

Students will be able to do the following:

* Students will be able to identify the parts of kelp and explain their function
* Students will understand kelp forests as an ecosystem
* Students will be able to identify common species of fish and invertebrates that inhabit kelp forests
* Students will be able to explain the importance of kelp for marine life
* Students will analyze and interpret data to provide evidence for the reasons what urchins feed on when their primary food sources are not available
* Students will explain how populations of urchins interact with organisms in different ecosystems
* Students will design solutions for maintaining kelp populations in ecosystems affected by sea urchins

**General Outline of the Program**

* Students will play a Kelp crossword game where they must match the descriptions of organisms living in kelp forests.
* Students will form groups and they will devise experiments evaluating how sea urchins will react in a kelp forest. Students will test their experiment and they will compare their results to the results of their peers.
* Students will create a food web depicting how various organisms in a kelp forest depend on each other for food.
* Students will take a dry fish survey by spotting any fish/invertebrates that live in kelp forests they recognize from prior knowledge.

**Project Outline**

**Grade Level:** 6-8

**Subject Area:** Ecosystems

**Classroom Size:** 10 students

**Time Required:** 4 hours

This four-hour long program will educate students about what kelp forests are and about their vital role in the marine environment. Students will be enriched with an understanding of how kelp forests supports other organisms in the marine environment and of how they are threatened by various invertebrates.

**Common Core and Next Generation State Standards**

Grades 6-8:

**MS-LS2-1, MS-LS2-2, MS-LS2-5**

**General Outline of the Program**

* Students will play a Kelp crossword game where they must match the descriptions of organisms living in kelp forests.
* Students will form groups and they will devise experiments evaluating how sea urchins will react in a kelp forest. Students will test their experiment and they will compare their results to the results of their peers.
* Students will create a food web depicting how various organisms in a kelp forest depend on each other for food.
* Students will take a dry fish survey by spotting any fish/invertebrates that live in kelp forests they recognize from prior knowledge.