

Name: _____ Date: _____ Group: _____

Kelp Forests and Ecosystem Balance

Lexile 1100L

1 Along the coastlines of the northern Pacific Ocean, there exists a unique and interesting ecosystem, the giant kelp forests. The kelp in these ocean forests can rise up to 80 meters from the ocean floor. They provide a multi-layered habitat for a variety of sea organisms. Two organisms play a fundamental role in the health of this ecosystem — the sea otter and the sea urchin. The sea otters are vital to the balance within this ecosystem. Their presence largely determines whether the coastline will support a kelp forest or become overgrazed by sea urchins.



2 How is this dynamic equilibrium maintained? The sea otters eat a variety of shellfish, but sea urchins are a large portion of their diet. In turn, the sea urchins are herbivores that feed on ocean plants, especially the giant kelp. The sea otters' feeding habits limit the population of sea urchins. This allows the kelp to grow and reproduce. The combination of sea otters, sea urchins, and kelp form an interaction called a **trophic cascade** within this dynamic ecosystem. The presence of the sea otters maintains the balance of the kelp forest ecosystem.

3 So, what could occur if external factors interfered with this system? Apex consumers are organisms at the top of the food chain. Apex consumers such as the sea otter play a critical role in the health of an ecosystem. Sometimes an external factor alters the apex consumer population. This can affect not only the individual organisms of that species, but also entire populations and communities in the ecosystem. When the size of apex consumer populations decreases, the health of the entire ecosystem can become compromised.

4 In the 1990s, scientists noticed that the sea otter populations were suddenly declining in the northern Pacific coastal ecosystems. They proposed that there might be some type of external factor affecting the sea otter population. At the time, they did not have a reason for why this was occurring. As a result of the otter die-off, the kelp forests were starting to disappear. As the otter populations were removed from the system, the sea urchin populations grew without the controls provided by the otters' feeding habits. As a result, the sea urchin population exploded. They began to eat the holdfasts that attached the kelp to the ocean floor.

- 5 In many places, the kelp forests became so overgrazed by sea urchins that they turned into areas called **urchin barrens**. This caused problems, since kelp forests have a positive affect on the coastline. The giant kelp beds reduced both wave height and intensity near the shore. This created safe and diverse habitats for many different ocean creatures. The disappearance of the kelp forests affected the populations of many other organisms. In fact, the entire kelp forest community was altered as a result of the decline in sea otters.
- 6 So, why were the otters disappearing? After several studies, scientists found that orcas (killer whales) had shifted their diets. They were now eating sea otters at a level that had not been seen before the 1990s. Orcas traditionally feed on sea lions and harbor seals, and sometimes on larger whales. However, in the years after 1990, expanding commercial fishing practices shifted the food sources of the sea lions and harbor seals.
- 7 Other scientists offered a different explanation for the change in the orca's feeding habits. It may have been due to shifts in the temperatures of the oceans as a result of climate change. Shifting ocean currents may have changed the patterns of fish and other prey for the sea lions and harbor seals. Sea lions and harbor seals may have had to move to new hunting grounds, making it difficult for the orcas to find them. Or, perhaps the numbers of the orcas' traditional prey declined enough to force the orcas to look for another food source. Whatever the reason, factors that were external to the kelp forest ecosystem at first affected the individual otters within that ecosystem. The consequences, however, had a severe effect on all of the populations of organisms within the entire kelp forest community.



Reading Science

- 1** Based on Paragraph 6, what might have caused orcas to eat fewer sea lions and harbor seals?
- A** The orcas were eating too many fish, so the sea lions and harbor seals left.
 - B** The fish that the sea lions and harbor seals eat were being commercially over-fished.
 - C** Sea otters were eating the sea lions' and harbor seals' food.
 - D** The sea lions and harbor seals began eating the kelp forests.
-
- 2** What would be an example of a food chain in the giant kelp forest ecosystem?
- A** The sea urchins are eaten by the sea otters, which also eat the kelp.
 - B** The orcas eat the sea otters, which eat sea lions and harbor seals.
 - C** The sea otters are eaten by the orcas, which also eat sea lions and sea urchins.
 - D** The giant kelp is eaten by the sea urchins, which are eaten by the sea otters.
-
- 3** What is the immediate cause of the decline in the sea otter population?
- A** The feeding habits of the orca
 - B** The feeding habits of the sea urchins
 - C** The feeding habits of the other organisms within the kelp forest
 - D** The feeding habits of harbor seals and sea lions



- 4** What would be a negative consequence of the kelp forest ecosystem falling out of balance?
- A** Increased wave height and intensity
 - B** A loss of diversity within the ecosystem
 - C** An increase in the sea urchin population
 - D** All of the above
-
- 5** The combination of sea otters, sea urchins, and kelp form:
- A** a northern Pacific coastline.
 - B** a trophic cascade.
 - C** an apex consumer.
 - D** good fishing grounds for commercial fishermen.
-
- 6** What is an urchin barren?
- A** A giant kelp forest that has been overgrazed by sea urchins
 - B** A situation where the sea otters have eaten all of the urchins
 - C** An external factor that has affected the sea urchins
 - D** None of the above