# Leopold Week: Predators Keep Ecosystems Healthy

*Based on resources on Keystone Species from HHMI Biointeractive*



Background: Predators kill and eat other animals. How does that effect the species they prey on? Would most species be better off if there were no predators? Let's explore the role of predators in ecology and conservation.

Part 1 - Lakes: There are millions of lakes in the world, most are just an acre or less like this pair of lakes Michigan state. Lakes, like islands, are small ecosystems home to thousands of species. The US & Canada, have about 800 species of freshwater fish species, interacting with thousands of plants and invertebrate species. Lakes get hammered by human pollution, development (roads, buildings, deforestation), overharvesting, and the invasive species we introduction.

1. Note at least 2 differences between the two lakes.

2. The left lake is cloudy and the right is clear. Make 2 guesses about what might cause that difference.

3. In a healthy lake in Michigan, largemouth bass eat minnows, which eat zooplankton, which eat phytoplankton (algae). What possible effects may there be if the bass population is removed from a lake?

4. Which lake do you think is missing bass? Circle: left or right

What would you want to know or measure from the lakes to support your answer?

Part 2: - Kelp Forests

Kelp are a group of plants that grow mostly along ocean coastlines, reaching from the ocean floor up to the surface in a way that reminds us of tree forests on land. Pacific coastal kelp forests are rich ecosystems, providing food, shelter, breeding and nesting grounds for many species. Bring your ideas from freshwater lakes to consider the conditions of two very different looking marine kelp forests off the coast of the state of California.

1. Kelp are the tall plants in each photo. List 2 differences you see between the two kelp forests.

2. Sea urchins are round baseball-sized animals covered with spines. You can see dozens of them in the right-hand photo, very few on the left. Sea urchins eat kelp like crazy. How would a big increase sea urchins affect the kelp forests?

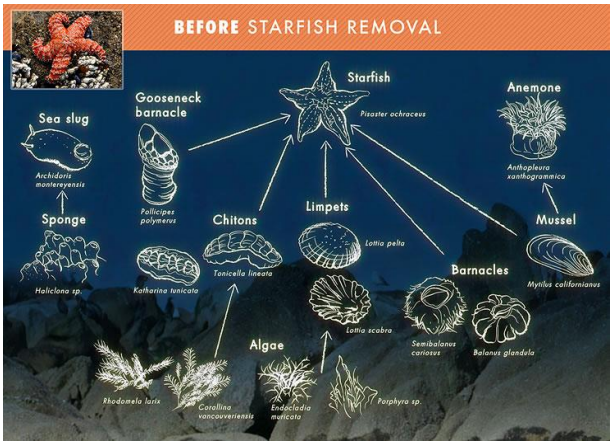
3. Sea otters love to sea urchins. Describe how a decrease in otters might affect kelp forests.

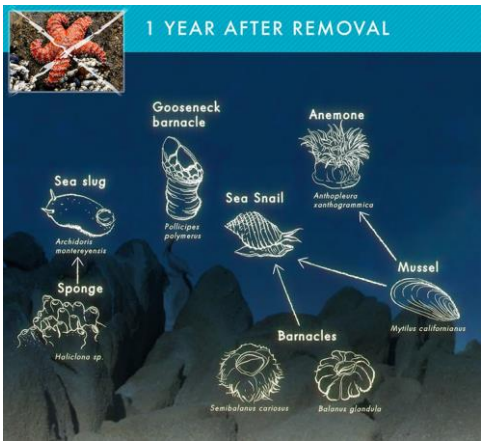
4. Orcas (killer whales) eat sea otters. Describe how an increase in orcas might affect kelp forests

5. Label the pictures as either “increase in otters” or “decrease in otters” based on your understanding of the impact otters have on kelp.

Part 3: - Tide Pools

Rocky areas along coastlines allow the formation of ecosystems called tide pools. Somewhat protected from pounding ocean waves, specialized plants and animals can thrive. The water level in these pools fluctuate in daily and seasonal patterns that these species have adapted to. Building on parts 1 & 2 explore biodiversity balance in Pacific tide pools.





The Purple Sea Star (*Pisaster ochraceus*) is the top predator the tide pools of Makah Bay, Washington. Robert Paine removed Purple Sea Stars from select tidepools to measure the effect on other species.

1. How many organisms are in the tide pool ecosystem before starfish removal? _____
2. How many organisms are in the tide pool ecosystem 1 year after starfish removal? _____
3. How many organisms are in the tide pool ecosystem 5 years after starfish removal? _____
4. Describe what happened to the tide pool ecosystem over the course of 5 years and why.

**Your Conclusions:**

**Explain the impact of top predators on the biodiversity of an ecosystem.**

**Based on the quantitative result of Paine's experiment in tide pools think back to parts 1 & 2 of this activity. Which of the two lakes (left/right) do you think has more species?**

**Which kelp forest (left or right) has more species?**

**Although predators eat members of the species that they prey on, do they generally overall increase or decrease the number of species and overall population numbers in a given place? Does your answer surprise you? Explain your reasoning**