

### Which Ecosystem is Most Stable?

Highest scores wins!

	Ecosystem 1	Ecosystem 2	Ecosystem 3
<b>Scenario 1</b>			
<b>Scenario 2</b>			
<b>Scenario 3</b>			
<b>Scenario 4</b>			
<b>Scenario 5</b>			
<b>Total Score:</b>			

Rough rubric – don't sweat it!

1 – **Collapse!** (the ecosystem network completely collapsed!)

2 – **Drastic Change** (likely causes: low biodiversity, low number of organisms within a population, or not enough alternative paths for the energy to flow)

3 – **Not Very Stable** (likely causes: low biodiversity, low number of organisms within a population, or not enough alternative paths for the energy to flow)

4 – **Stable** (some changes occurred, but the network still provides a way for enough energy to flow to all the organisms)

5 – **Very Resilient** (there was a high variety of organisms, a balanced number of them (e.g., enough producers), and there were enough interactions in the network to keep the remaining organisms connected)

### Scenarios

**1** Businesses that harvest kelp to extract an ingredient used in ice cream, toothpaste, and paint, among other things, have harvested the kelp forest aggressively this year. What happens when part of your ecosystems' forest disappears?

**Potential Effects:** Animals that eat the kelp have to rely on other food sources. Animals that need to live in the kelp will have to find other homes (barnacle, abalone, big fish, limpet, crab, snail, shrimp, sea otter)

**2** There's been an oil spill, which kills off most of the sea otters. Because of this, with no predator to eat purple sea urchins, the population of urchins has exploded! They mow down the kelp forest...

**Potential Effects:** The population of urchins has exploded. Same affects as kelp forest over-harvesting.

**3** A disease has infected the local sea lion population. They become sick, and their population declines.

**Potential Effects:** The populations of small and big fish go up! Sharks and orcas have to hunt for smaller food.

**4** El Niño weather brought a huge storm off the coast! Sand ran into the rocky tidepools to bury animals that live there. Good thing the runoff didn't make it all the way out to the deeper kelp forest.

**Potential Effects:** Loss of animals that couldn't move fast enough: sea stars, mussels, rock snails, barnacles, and some urchins.

**5** After a week with lots of rain, the fertilizer that washed into the ocean from the farms on the California Coast caused a bloom in phytoplankton. When these microscopic creatures die after their short life, their decomposition creates an environment in the water with little oxygen, making it toxic to small bivalves, shrimps, and crabs.

**Potential Effects:** Abalones are particularly susceptible and likely to die off. Some of the kelp itself will also die (resulting in similar domino effect as above).

## Teacher Cheat Sheet: California Coast Organisms and What They Eat

Organism	How it obtains energy	What it might eat	What might eat it
abalone	herbivore/consumer	kelp (other algae)	sea otter
baleen whale	carnivore/consumer	zooplankton (krill)	shark
barnacle	omnivore/decomposer/consumer	phytoplankton, zooplankton (detritus)	rock snail, sea star, crab
big fish / salmon	carnivore/consumer	anchovy, shrimp	toothed whale, seal
clam	herbivore/consumer/decomposer	Phytoplankton (detritus)	crab, sea bird, otter, octopus
crab	carnivore/decomposer/consumer	barnacle, shrimp, clams, limpets	octopus, seals
kelp	producer	sunlight and CO <sub>2</sub>	abalone, sea urchin
limpet	herbivore /consumer	kelp (other algae)	crab, sea bird
mussel	herbivore/decomposer/consumer	Phytoplankton (detritus)	
octopus	carnivore/consumer	crab, anchovy, shrimp	toothed whale
phytoplankton	producer	sunlight and CO <sub>2</sub>	zooplankton, limpet, clam
rock snail	carnivore/consumer	mussel, barnacle	
sea bird	carnivore/consumer	anchovy, shrimp, chiton, limpet, clam, mussel	
sea otter	carnivore/consumer	sea urchin, abalone, clam	shark
sea star	carnivore/consumer	mussel, limpet, barnacles (other snails)	
sea urchin	herbivore/consumer	kelp	sea otter
seal	carnivore/consumer	anchovy, salmon (other fish), crabs	shark
shark	carnivore/consumer	seal, whale, sea otter	
shrimp	omnivore/consumer	copepod (algae and fish)	bird, anchovy, octopus, crab
small fish /anchovy	carnivore/consumer	zooplankton, (chiton)	octopus, salmon, bird, squid, toothed whale
squid	carnivore/consumer	shrimp, crab, anchovy	toothed whale
toothed whale	carnivore/consumer	anchovy, salmon, squid, seal	
zooplankton	herbivore/consumer	phytoplankton	anchovy, baleen whale, crab, shrimp

*Note: Food sources listed in parentheses are not included as their own cards in the activity.*

*Sample food chains:*

- -- kelp – sea urchin – sea otter – shark
- -- kelp – abalone – octopus
- -- phytoplankton – krill – baleen whale
- -- phytoplankton – limpet – anchovy – squid
- -- zooplankton – anchovy – salmon – seal
- -- phytoplankton – clam – sea otter