When Kelp Vanishes

Trace evidence of change in a coastal reef.

ENV.1.2 "Evaluate evidence in nonfiction text to explain how biological or physical changes within biomes affect populations and communities and how changing conditions may result in altered ecosystems."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two physical or biological changes, circle evidence of population responses, and number the links in one chain that shows how the reef community changes.

A Reef Without Its Forest

(1) Along northern California's rocky coast, bull kelp grows from the seafloor toward sunlight. Its long blades shelter small fish and provide food for grazing animals. Purple sea urchins eat kelp, but sunflower sea stars eat urchins. In 2013, a wasting disease spread among sea stars along the Pacific coast. Sunflower sea stars suffered steep losses. Surveys later found far more purple urchins at many northern California sites. These observations suggest that fewer predators allowed more urchins to survive, although the surveys alone cannot show that disease caused every increase in urchins.

(2) From 2014 through 2016, an unusual marine heat wave brought warm, nutrient-poor water to the region. Bull kelp needs nutrients to grow rapidly, and its forests shrank sharply at many sites during these years. At the same time, dense groups of urchins consumed young kelp before it could form tall blades. Scientists observed bare rock covered with urchins where kelp had grown before. The timing and feeding observations support two linked explanations: reduced kelp growth and heavier grazing. Temperature records alone would not explain why kelp failed to return after the warmest water passed.

(3) The change reached beyond kelp and urchins. Red abalone, shellfish that graze on kelp and drifting pieces of it, faced less food; many died or became too thin to harvest. Fish that use kelp as shelter also lost habitat. Urchins can remain alive on sparse food, so large groups may keep eating new kelp even after cooler water returns. A rocky reef dominated by kelp can thus shift toward an urchin barren, a community with little kelp and fewer kelp-dependent animals. Repeated counts of kelp, urchins, and abalone would test whether this shift lasts.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which observations support the idea that sea star losses helped urchins increase? Why is that conclusion not certain?

2. How do the warm-water and urchin observations together explain the kelp decline better than temperature records alone?

3. What evidence shows that kelp loss affected more than one population in the reef community? Explain two effects.

4. Why might the reef remain an urchin barren after cooler water returns? What repeated observations could test whether this change lasts?

3 YOUR TURN

Your own words

In a grassland, several dry years are followed by fewer grasses, more shrubs, and fewer seed-eating birds. In 4 to 5 sentences, explain a plausible chain of effects and identify one additional observation that would strengthen or challenge your explanation.

When Kelp Vanishes

PART 1 · READ AND MARK

Underline two physical or biological changes, circle evidence of population responses, and number the links in one chain that shows how the reef community changes. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which observations support the idea that sea star losses helped urchins increase? Why is that conclusion not certain?	**Sunflower sea stars suffered steep losses, and later surveys found far more purple urchins. The surveys show a pattern, but cannot prove that disease caused every increase in urchins.**
2	How do the warm-water and urchin observations together explain the kelp decline better than temperature records alone?	**Warm, nutrient-poor water could slow kelp growth, while observed urchin grazing removed young kelp. Grazing also helps explain why kelp did not return when the warmest water passed.**
3	What evidence shows that kelp loss affected more than one population in the reef community? Explain two effects.	**With less kelp to eat, many red abalone died or became too thin to harvest. Fish that use kelp for shelter lost habitat.**
4	Why might the reef remain an urchin barren after cooler water returns? What repeated observations could test whether this change lasts?	**Urchins can survive on sparse food and continue eating new kelp. Repeated counts of kelp, urchins, and abalone could show whether the barren persists.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Dry years may reduce grasses, leaving open space that shrubs can occupy. With fewer grass seeds available, seed-eating birds might leave or produce fewer young. If shrubs continue to spread, the community could shift toward shrubland with fewer grassland birds. Comparing grass seed supplies and bird numbers at dry and wetter sites would help test whether food loss explains the bird decline.

Accept other evidence-based chains and tests that distinguish a plausible cause from a change that merely occurred at the same time.