

Coastline Data Detectives

Use averages, trends, and comparisons to revise ecosystem explanations.

HS-LS2-2 "Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline every number or numerical comparison in the passage. Circle words that show a comparison or a limit on what the data can prove, so you can use evidence carefully in an explanation.

Heat, Kelp, and Sea Stars

- ① At Cedar Point, biologists studied rocky tide pools after a summer heat wave. They counted ochre sea stars in four equal-sized pools during low tide. In 2022, the pools held 12, 15, 13, and 16 sea stars. In 2023, after several unusually hot, low-tide days, they held 7, 9, 8, and 10. The team also recorded water temperature. Mean afternoon temperature rose from 18°C in 2022 to 23°C in 2023. Because the pools were the same size and were surveyed the same way, the counts can be compared. The data show a population change at a local scale.
- ② To examine a broader pattern, researchers surveyed six kelp-forest sites along 60 kilometers of coast. At each site, they recorded the number of fish species and the percent of the seafloor covered by living kelp. In the cooler year, sites averaged 18 fish species and 72 percent kelp cover. In the warmer year, they averaged 11 fish species and 41 percent kelp cover. A graph with year on the horizontal axis and separate lines for fish species and kelp cover would let readers compare the direction of both changes. These averages describe a regional pattern, but they do not prove that temperature alone caused it.
- ③ Scientists then added evidence from 40 tide pools across the coast. Pools with water temperatures above 22°C had an average of 6 sea stars, while pools below 22°C had an average of 14. However, 30 of the warm pools also had signs of sea star wasting disease, compared with 5 of the cooler pools. The data make a heat-only explanation less complete. Heat may stress sea stars, but disease could also affect their population. To revise an explanation responsibly, scientists should state what the averages and comparisons support, identify another possible factor, and avoid claiming a cause that the provided data cannot isolate.

2 ANSWER WITH EVIDENCE Use the passage

1 Calculate the average number of sea stars per Cedar Point pool in 2022 and in 2023.

2 At the regional scale, how much did the average number of fish species change, and how much did average kelp cover change from the cooler year to the warmer year?

3 If you made the regional graph described in paragraph 2, what would go on the horizontal axis, and what two data sets would be shown?

4 Write a revised explanation for the lower sea star counts using the regional evidence and the 40-pool comparison. Include one limit on the conclusion.

3 YOUR TURN Your own words

A class sampled four equal-area prairie plots in 2024 and 2025. Butterfly counts were 18, 22, 20, and 16 in 2024, then 9, 11, 10, and 8 in 2025. Native plant-species counts were 14, 13, 15, and 14 in 2024, then 10, 9, 11, and 10 in 2025. Rainfall fell from 62 cm to 35 cm. Make a two-line graph of the yearly averages, then write exactly two sentences that use the trends to explain a possible factor affecting both populations and biodiversity, including one limit on your claim.

PART 1 • READ AND MARK

Underline every number or numerical comparison in the passage. Circle words that show a comparison or a limit on what the data can prove, so you can use evidence carefully in an explanation. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Calculate the average number of sea stars per Cedar Point pool in 2022 and in 2023.	2022: 14 sea stars per pool. 2023: 8 sea stars per pool.
2	At the regional scale, how much did the average number of fish species change, and how much did average kelp cover change from the cooler year to the warmer year?	Fish species decreased by 7 species, from 18 to 11. Kelp cover decreased by 31 percentage points, from 72 percent to 41 percent.
3	If you made the regional graph described in paragraph 2, what would go on the horizontal axis, and what two data sets would be shown?	The horizontal axis would show year. The graph would show average fish species and average kelp cover as separate data sets.
4	Write a revised explanation for the lower sea star counts using the regional evidence and the 40-pool comparison. Include one limit on the conclusion.	Warmer conditions are associated with lower sea star populations, lower fish-species averages, and lower kelp cover. Sea star wasting disease may also contribute because it was more common in warm pools, and the data cannot show that heat alone caused the decline.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Graph points: butterfly average, 2024 = 19 and 2025 = 9.5; native plant-species average, 2024 = 14 and 2025 = 10. Both averages declined as rainfall fell from 62 cm to 35 cm, so lower rainfall is associated with lower butterfly population and plant biodiversity in these plots. The data support drought as a possible factor, but they do not show that rainfall alone caused the declines.

Accept correctly calculated averages, accurate descriptions of decreasing trends, and explanations that distinguish an association from a proven cause. For the open task, accept any clear graph with the correct average values and exactly two evidence-based sentences that include a causal limit.