Sea Otters and Kelp Lab

Name _____

Date _____

Period _____

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Sea otters eat sea urchins. Sea urchins eat kelp. Otters never eat kelp.

☐ I can explain why the sea otter is a keystone species in a kelp forest.

☐ I can use the southern sea otter case study to ask a testable question about what controls a population.

Part 1. Survey the seafloor (Tab 1)

SEP 5, 7 · CCC Scale, Proportion, and Quantity

Each quadrat is a 1 m × 1 m square. Tap every urchin and every kelp plant (count kelp by its holdfast), then press **Record this quadrat**. Do at least two quadrats on each island by hand. Then press **Count the rest of this island for me**.

1. Copy your counts.

Quadrat	Island A urchins	Island A kelp	Island B urchins	Island B kelp
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Total				
Average per m² (total ÷ 10)				

Work out the averages, then press **Show averages** to check.

2. Island B has about how many times as many urchins per m² as Island A? Show the division.

3. Scale it up. A patch of reef is 10 m × 10 m = 100 m². About how many urchins live on a patch that size?

Island A: _____ Island B: _____

READ FIRST. In the lab, find the **Learn It** box and read it. Then answer 4 and 5.

4. Use your table and the word **sample** . Why does a dive team count 10 quadrats along a transect instead of just one?

5. Claim: Sea otters live around Island _____. **Evidence:** two numbers from your table. **Reasoning:** why those numbers point to otters.

Press your answer in **Your claim** . Island A was _____ Island. Island B was _____ Island.

Part 2. Keystone coast (Tab 2)

SEP 2 · CCC Cause and Effect, Stability and Change

Set the coast. Make your prediction in **Predict first**, then press **Run** (or **Skip to the end**). Uncheck everything you are not using. The **Your runs** box keeps the numbers at year 50.

6. Predict with an arrow (↑ up, ↓ down, = same) before each run. Then write the numbers at year 50.

What is checked	Predict urchins	Predict kelp	Otters per km²	Urchins per m²	Kelp %
Otters at the start (nothing else)					
Otters at the start + killer whales					
Otters at the start + fur hunters					
No otters at the start + a few swim in					

7. Otters never eat kelp. Use the killer-whale run to fill the chain.

Killer whales eat otters → otters [ ] → urchins [ ] → kelp [ ]

READ FIRST. In the lab, find the **Learn It** box and read it. Then answer 8 and 9.

8. Use two numbers from your table to show that the sea otter is a **keystone species** .

9. In the fur-hunter run the hunting stops in year 20, and by year 50 the otters are almost back. Is the kelp back? Use your numbers to explain how fast a lost kelp forest recovers.

Part 3. California comeback (Tab 3)

SEP 4, 5 · CCC Stability and Change

The dots are the real spring counts. The red dashed line is the carrying capacity in the model: the most otters the coast they live on now could hold. Pick settings, press **Skip to the end**, and read **Average miss**: how far the model is from the real dots. Smaller is a better fit.

10. Read the dots. In 1938 there were about _____ otters. By 1985 there were _____. The highest count was _____ in _____. In 2019 it was _____.

11. Keep the growth rate at 10%. Leave "Range can spread" unchecked. Fill in the table.

Settings (growth rate 10%)	Model in 2019	Model in 2040	Average miss
No sharks, no disease			
Disease only			
Shark bites only			
Shark bites + disease			
Your own try: _____			

12. Which settings fit the real counts best? How do you know?

READ FIRST. In the lab, find the **Learn It** box and read it. Then answer 13 to 16.

13. In the best fit, the coast could hold 6,500 otters, but the model levels off near _____. Use **births** and **deaths** to explain the cause and effect that hold it below its **carrying capacity** .

14. The recovery goal is a 3-year average above 3,090. Using your best fit, does the population reach it and stay there by 2040? What would have to change for it to?

Wrap it up

SEP 1, 7 · CCC Cause and Effect

15. Build a question in **Your question** and save it. Write your final question here. Make it a **testable question** .

To test it I would change or compare _____ and measure _____.

16. A classmate says, "California's otters stopped growing because the coast is full. There is no room for more." Use your Part 3 numbers to argue for or against this claim.

NYSSLS: building toward HS-LS2-1, HS-LS2-2 and HS-LS2-6 (DCI LS2.A Interdependent Relationships in Ecosystems; LS2.C Ecosystem Dynamics, Functioning, and Resilience). Environmental Science, Chapter 5: Explorers at Work, Sea Otters Step Up, and Case Study, The Southern Sea Otter: A Species in Recovery. Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept. Tab 1 counts are practice numbers; Tab 3 dots are real U.S. Geological Survey counts.