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 Using Math · CCC Scale, Proportion, and Quantity

Tap every urchin and every kelp plant in the square. Press **Record this quadrat**. Do two on each island by hand. Then press **Count the rest of this island for me**.

1. Copy your counts.

Quadrat	A urchins	A kelp	B urchins	B kelp
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Total				
Average per m²				

Example: 10 quadrats add up to 50. Average = 50 ÷ 10 = 5 per m². Press **Show averages** to check.

2. How many times as many urchins on Island B?

Example: 40 ÷ 4 = 10 times as many.

_____ ÷ _____ = _____ times as many

3. A 10 m × 10 m patch = 100 m². Multiply the average by 100.

Island A: _____ urchins Island B: _____ urchins

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

4. Why count a **sample** of 10 quadrats, not 1? Tick one.

☐ One square could be unusual. Ten give a fair average.

☐ Divers like to swim far.

☐ Ten squares always have more urchins.

5. Claim: Otters live around ☐ Island A ☐ Island B

Evidence: Island A has _____ urchins per m². Island B has _____ urchins per m².

Reasoning: Otters eat urchins, so an island with otters has ☐ more urchins ☐ fewer urchins

Island A was _____ Island. B was _____ Island.

WORD BANK Amchitka · Shemya · Adak

Part 2. Keystone coast (Tab 2)

SEP 2 Using Models · CCC Cause and Effect

Check only what the row says. Pick your prediction in **Predict first**. Press **Skip to the end**. **Your runs** keeps the numbers at year 50.

6. Circle your prediction first: ↑ up, ↓ down, = same. Then write the numbers.

What is checked	Urchins will	Kelp will	Otters /km²	Urchins /m²	Kelp %
Otters at the start (only)	↑ ↓ =	↑ ↓ =			
Otters + killer whales	↑ ↓ =	↑ ↓ =			
Otters + fur hunters	↑ ↓ =	↑ ↓ =			
No otters + a few swim in	↑ ↓ =	↑ ↓ =			

7. Use the killer-whale run. Fill the chain from the word bank. **WORD BANK** go up · go down · stay the same

Killer whales eat otters → otters _____ → urchins _____ → kelp _____

CLUE: fewer eaters means more of what they eat.

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

8. With otters, kelp ends at _____%. Without otters, kelp ends at _____%. So the otter
☐ is a keystone species ☐ is not a keystone species

9. Fur-hunter run: hunting stops in year 20. By year 50 the otters are at _____ and the kelp is at _____%. Tick one.

☐ The kelp came back as fast as the otters.

☐ The kelp is slow to come back. Once a forest is lost, it takes many years to return.

Part 3. California comeback (Tab 3)

SEP 4 Analyzing Data · CCC Stability and Change

Dots = real counts. Red dashed line = **carrying capacity**, the most otters the coast could hold. Pick settings, press **Skip to the end**, read **Average miss**. Smaller miss = better fit.

10. 1938: about _____ otters. 1985: _____. Highest: _____ in _____. 2019: _____

11. Growth rate 10%. "Range can spread" unchecked. Write the numbers.

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

12. Best fit: ☐ no sharks, no disease ☐ disease only ☐ sharks only ☐ sharks + disease

I know because its average miss is the ☐ smallest ☐ biggest

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

13. The coast could hold 6,500 otters. The best fit levels off near _____. What holds it below? Tick two.

☐ shark bites ☐ disease from runoff ☐ no room left on the coast ☐ too much kelp

These ☐ add deaths ☐ add births, so the population stays below its carrying capacity.

14. Recovery goal: above 3,090. In 2040 the best fit is at _____. It is
☐ above the goal ☐ about at the goal ☐ far below

To grow more, otters would need fewer _____ or fewer _____.

Wrap it up

SEP 1 Asking Questions · CCC Cause and Effect

15. Build a **testable question** in **Your question** . Save it. Copy it here.

Example: How does the amount of kelp affect the number of otters found dead from shark bites?

How does _____

affect _____ ?

16. A classmate says, "California's otters stopped growing because the coast is full." Tick one.

☐ I agree ☐ I disagree

The model levels off near _____, but the coast could hold _____. With no sharks and no disease it reaches _____. So _____

NYSSLS: building toward HS-LS2-1, HS-LS2-2 and HS-LS2-6 (DCI LS2.A; LS2.C). Environmental Science, Chapter 5: Sea Otters Step Up, and Case Study: The Southern Sea Otter. SEP = Science and Engineering Practice, CCC = Crosscutting Concept.