

DATA *Nugget*

Do urchins flip out in hot water?

Featured scientists: Erin de Leon Sanchez (she/her) from University of California - Santa Barbara, Emily Chittick (she/her), and Traci Kennedy (she/her) from Milwaukee Public Schools.

Research Background:

Imagine you are a sea urchin. You live in the ocean. You attach to hard surfaces and move slowly. You eat a type of seaweed called giant kelp. You are covered in spikes to protect you from predators. But one day the ocean around you starts to feel too hot.

When the ocean is hotter than normal, it is called a **marine heatwave**. During marine heatwaves, water is 2 to 3 degrees warmer than normal. That might not sound like much, but it is a lot for urchins. Urchins are **cold-blooded**. This means they can't control their body temperature. Their bodies are the same temperature as the water around them.



Erin getting ready to scuba dive to look for urchins.

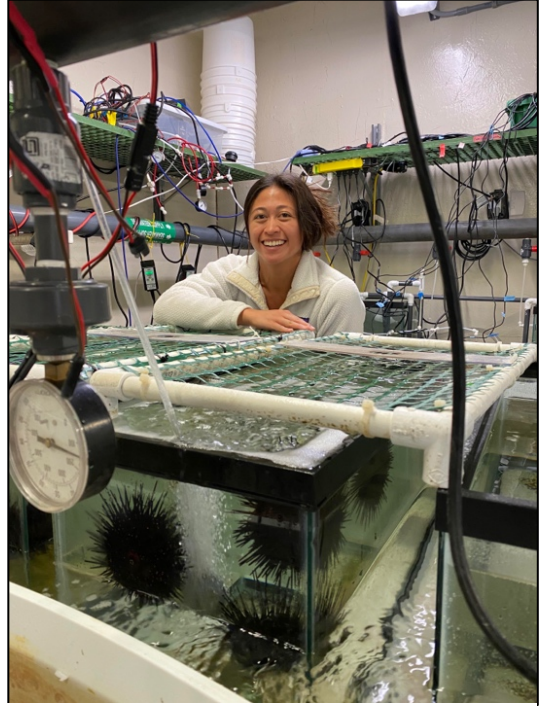
Erin is a scientist who studies urchins. She wondered how urchins would react to marine heatwaves. Erin thought urchins could have two responses to hot water. Urchins might be ok and not affected. Or they might get stressed from the heat. This stress would make them clumsy and confused.

Erin decided to test whether hot water stressed urchins. She knew that healthy urchins can right themselves. This is the same as when turtles get flipped and must get themselves in the right direction again. When

healthy urchins are turned upside down, they can flip back over by using their small sticky feet. Erin thought that urchins living in hot water would be more stressed and predicted they would take longer to turn back over.

To test her ideas, she took 10 urchins into her lab and kept them in water that matched the ocean. These tanks were set at **15°C**. The urchins lived in this temperature water for two weeks. Then, she started her experiment. She flipped each urchin over. She recorded how long it took for the urchin to get itself right side up again.

Later, she put the same urchins in water that matched a marine heatwave at **18°C**. They lived in that warmer temperature for two weeks. She did the same test. She flipped each urchin and timed their response. Finally, she put the urchins in water that was **21°C** and did the same test one last time. This temperature would be very hot for urchins.



Erin in the urchin lab at her university.

Scientific Question: How are urchins affected by marine heatwaves?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Scientific Data:

Use the data below to answer the scientific question:

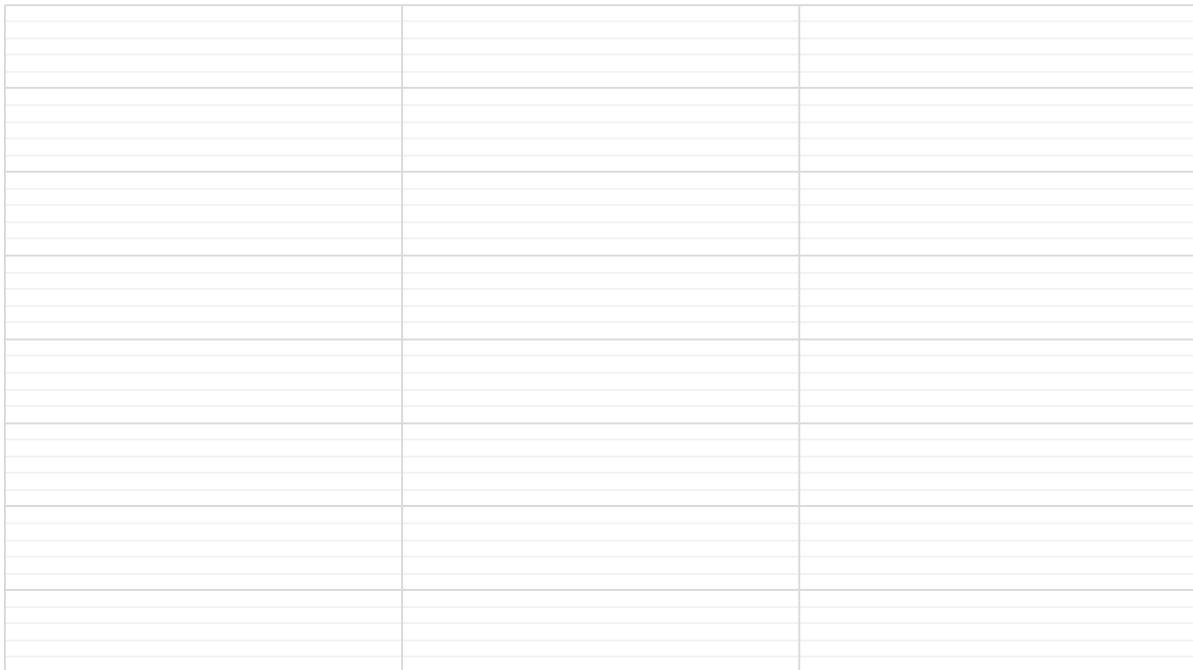
Water Temperature			
	15°C	18°C	21°C
	<i>Typical Ocean</i>	<i>Marine Heatwave</i>	<i>Extreme Marine Heatwave</i>
Average time to flip over (seconds)	99	95	152

What data will you graph to answer the question?

Independent variable: _____

Dependent variable: _____

Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.



Name _____

Interpret the data:

Make a claim that answers the scientific question, how are urchins affected by marine heatwaves?

What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how urchins respond to the temperature of their environment.

Name _____

Did the data support Erin's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Apply this research: Sea urchins have spikes for defense so that predators don't want to eat them. There are fewer spines on their undersides. These spines are also shorter. Some predators will flip urchins over to eat them.

Based on the data from Erin's experiment, what do you predict will happen if there are more heatwaves? Would hot water cause urchins to be more or less vulnerable to predation? Explain your answer.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Erin's research? How do your questions build on the research that has already been done?