

# Hydrothermal Vent Biology

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## Key Concepts

1. Scientists can make only limited observations of hydrothermal vent organisms because the vent habitats are so deep, dark, cold and under such high pressures.
2. Scientists have only these observations and their knowledge of organisms from other habitats to infer the adaptations of vent creatures.



## Background

When geologist Robert Ballard and a team of technicians and other scientists first set out to study deep sea hydrothermal vents in the 1970s, they believed they were venturing into an area with many fascinating geological phenomena, but few if any life forms worth the attention of biologists. Submersible divers knew that vast areas of the sea floor were very nearly barren of life because there was not enough sunlight penetrating these depths to support the plant cells needed to start food webs.

Ballard was stunned to find a profusion of life around the first hydrothermal vent field he visited. There were abundant tube worms, clams, and mussels, all more profuse and larger than any biologist would ever have dreamed. Crabs, octopus, fish and strange creatures the geologists nicknamed “dandelions” were common. And everywhere, there was a substance the scientists called white spaghetti.

What fueled this food web? How did all these organisms survive in this unusual place? Scientists have made some progress in answering these questions, identifying, for example, chemosynthetic bacteria as the producers in these vent food webs. However, a multitude of mysteries remain.

Many expeditions since have visited, filmed and sampled life from vents. It is a painstaking process, limited by the expense of sending manned or unmanned submersibles to such depths and by the difficulties of collecting and bringing to the surface intact specimens. The scientists can insulate organisms from temperature changes, but do not have ways to protect the creatures from the enormous changes in pressure.

In this activity, students observe photographs of deep sea vent organisms and infer how and what the organisms might eat and where on or around a vent chimney they might live. They are going through a model of the process scientists go through as they try to figure out the biology of these unusual organisms.

## Materials

Set of 12 photographs of hydrothermal vent organisms

One copy per student of the Vent Biology Observation and Inference Sheet (to reduce photocopying expenses, have students make their own copy of this sheet on notebook paper)

## Teaching Hints/Lesson Plan

Create 12 stations around your classroom or pass out the photographs and have students circulate them.

Ask the students to note in words and/or drawings observations about the organisms. The most helpful observations would be about body structures, body plan (does the body plan resemble a familiar shallow water animal or phylum?), and any behaviors that might be discernible in the pictures. Students should note any clues in the pictures about where around a chimney the animal might have been photographed.

Explain that since it is so difficult for scientists to stay at the vents for very long or to visit often and since they have difficulty bringing up live specimens, they must go through this process of making observations and then guessing how each organism might make a living.

Tell the students to try their hand at making inferences about the creatures, hypothesizing how and what they eat and where they might live around a chimney. The point is not to come up with correct answers (few “correct” answers are known to any scientists yet). The point is rather to generate observations, questions and analysis. Later in this series of lessons, you may choose to have the students build a hydrothermal vent food web. There is information contained in that lesson about what scientists know so far about these organisms. Consider doing an internet search as well to find the latest hydrothermal vent research.

### Hydrothermal Vent Biology Observation And Inference Sheet

<b>ORGANISM</b>	<b>DRAW AND DESCRIBE</b>	<b>HOW AND WHAT IT EATS</b>	<b>HOW COULD YOU TELL?</b>	<b>WHERE ON OR AROUND A VENT CHIMNEY IT LIVES</b>	<b>HOW COULD YOU TELL?</b>
Tube worms					
Limpets					

Unit 3 – Hydrothermal Vent Organisms – Hydrothermal Vent Biology

<b>ORGANISM</b>	<b>DRAW AND DESCRIBE</b>	<b>HOW AND WHAT IT EATS</b>	<b>HOW COULD YOU TELL?</b>	<b>WHERE ON OR AROUND A VENT CHIMNEY IT LIVES</b>	<b>HOW COULD YOU TELL?</b>
Spider crabs					
Plume bacteria					

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Snails					
Clams					

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Mat bacteria					
Mussels					

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<b>ORGANISM</b>	<b>DRAW AND DESCRIBE</b>	<b>HOW AND WHAT IT EATS</b>	<b>HOW COULD YOU TELL?</b>	<b>WHERE ON OR AROUND A VENT CHIMNEY IT LIVES</b>	<b>HOW COULD YOU TELL?</b>
Fish					
Sulfide worms					

Unit 3 – Hydrothermal Vent Organisms – Hydrothermal Vent Biology

ORGANISM	DRAW AND DESCRIBE	HOW AND WHAT IT EATS	HOW COULD YOU TELL?	WHERE ON OR AROUND A VENT CHIMNEY IT LIVES	HOW COULD YOU TELL?
Plume worms					
Sea spiders					