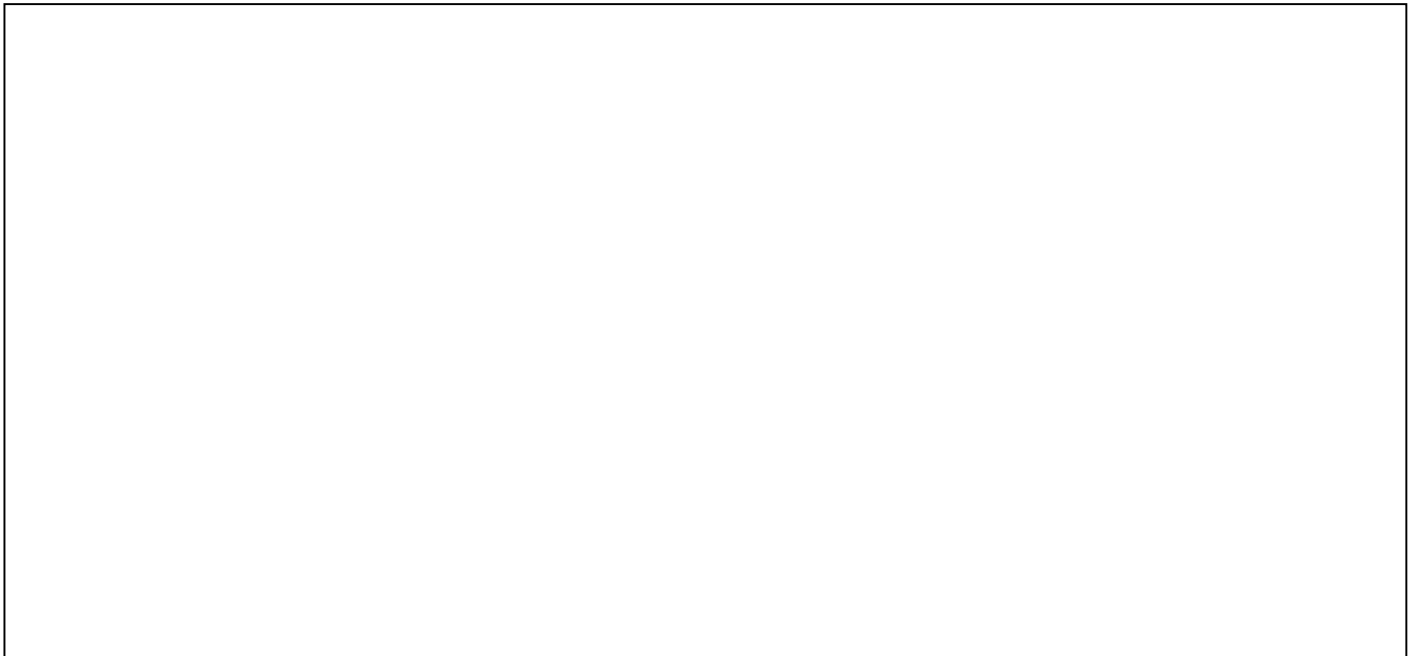




2. Now break those groups down into Primary Producers, Primary Consumers, First-order Carnivores, and Top-order carnivores. (If you are not sure how to do this review the definitions at the top of the page.)

<u>Primary Producers</u>	<u>Primary Consumers</u>	<u>First-order Carnivores</u>	<u>Top-order Carnivores</u>

3. Next, **draw** a food web for the ecosystem using all 17 organisms.



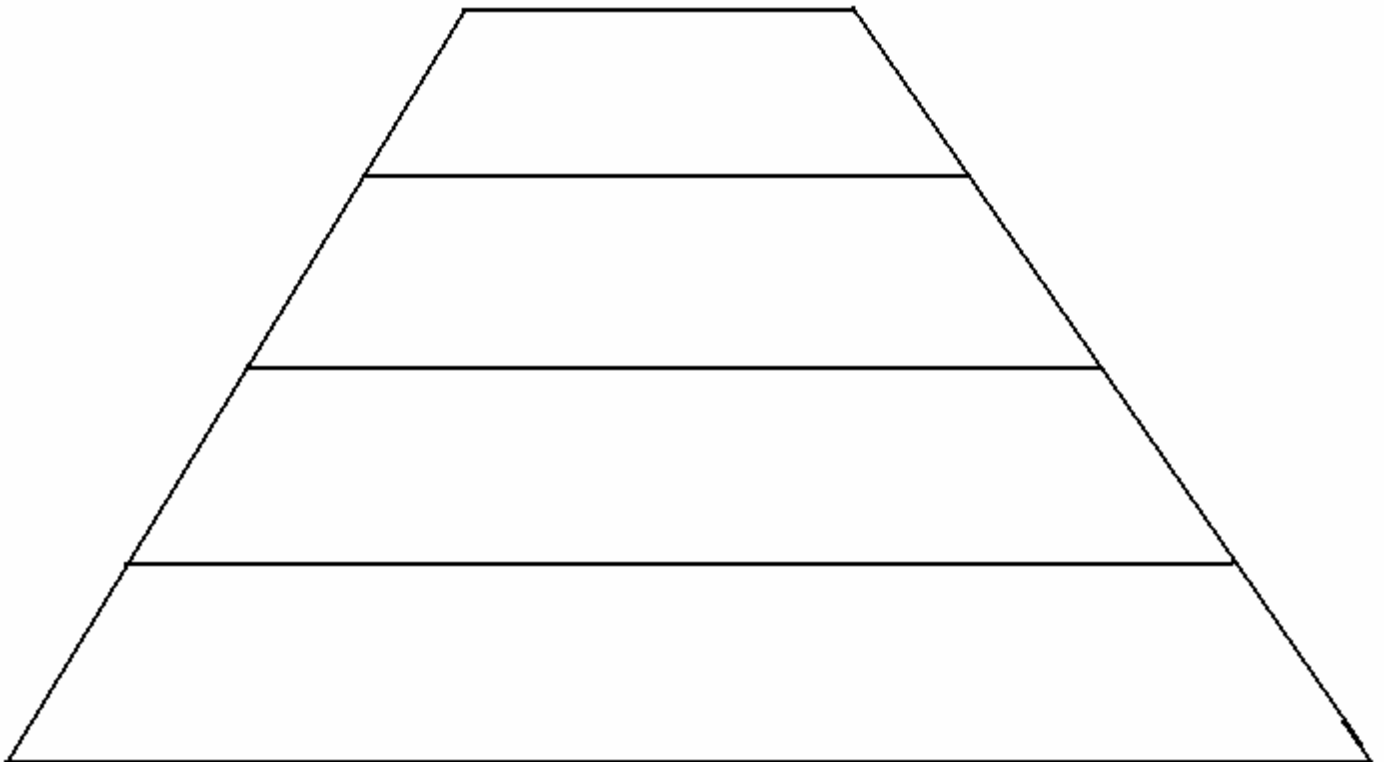
Answer the following questions.

- How does this ecosystem *create* energy (carbohydrates)?
- What happens if one producer is removed from the food web?
- What happens if one consumer is removed from the food web?
- What happens if one decomposer is removed from the food web?
- Why is it important for humans *not* to interfere with even one species in a food web?

4. Now identify 10 different food chains from your food web. Label each organism T1 for trophic level 1, T2 for trophic level 2, and so on.

Ex. Vent bacteria (T1) → Vent shrimp (T2) → Vent Octopus (T3)

5. Finally, create a trophic pyramid that includes all 17 organisms of the hydrothermal vent community.



6. Critical Thinking Question

Marine scientists were stunned to find complex ecosystems based on chemosynthesis flourishing around deep-sea hydrothermal vents. This discovery also caught the attention of space scientists, giving them renewed hope that they might find life elsewhere in the solar system. Explain why chemosynthesis may be more likely to support life on distant worlds than photosynthesis.

(Answer this question on the back of this piece of paper – fill up the entire sheet!!)

**Hide Answer**

Scientists seek to understand and explain how the natural world works. Many of the questions raised in this endeavor have no absolute answers.

Although photosynthesis is widespread on Earth, it has fairly stringent requirements. Levels of carbon dioxide, water, and sunlight must be just right, and the temperature can't be too hot or too cold. Planets closer to the sun than Earth may be too hot, dry, or bright for photosynthesis, while those farther away appear to be too dark and cold. Chemosynthesis is more flexible than photosynthesis. On Earth alone it occurs under a wide temperature range and utilizes a number of different chemicals, and it is unaffected by light intensity. Because chemosynthetic organisms can function in such harsh and hostile habitats on Earth, it seems possible that chemosynthesis may also be occurring under the difficult conditions found on other worlds.



### Vent Zooplankton

Drifting animals in the water column find plenty of food in the form of the chemosynthetic bacteria which thrive in the hot sulfide water.



### Zoarcid fish - An eelpout, *Pachycara gymninium*

These two-foot long white fish are top predators around vents. They eat everything from tubeworms to shrimp. Despite their huge appetites, these fish are slow and lethargic. They spend a lot of time floating around clumps of tube worms and mussels.



### Vent Tubeworm, *Riftia pachyptila*

Tubeworms have no mouth, eyes, or stomach ("gut"). Their survival depends on a symbiotic relationship with the billions of bacteria that live inside of them.



### Vent Tube-Dwelling Anemones, *Cerianthus* sp.

Tube anemones of the genus *Cerianthus* attach themselves to the sea floor and capture animals with their stinging tentacles. Most are found in shallow waters, the vent species thrives 1.5 miles below the surface.

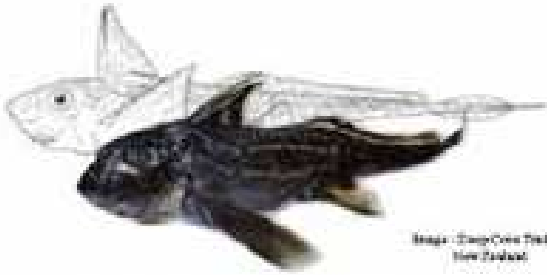


Image: Deep-Sea Fishes from Zoology

**Vent Ratfish, *Hydrolagus affinis***  
(Pisces: Chimaeridae)

The vent ratfish is a carnivore and feeds on a variety of animals smaller than itself. It eats crabs, shrimps, smaller fish and the vent mussel.



**Vent Octopus, *Graneledone pacifica***

Octopus are very active, carnivorous mollusks. They capture other animals such as crabs, shrimp and mussels.



NOAA

**Vent Mussel, *Bathymodiolus childressi***  
(Mollusca: Mytilidae)

Bacteria in these mussels convert methane to food, so they have an abundant food supply all year round.



**Vent Clam**  
*Calyptogena magnifica*

Vent clams form beds in the cracks that form in the lava. They thrive on the bacteria which live inside their tissues. Luis Hurtado of the Monterey Bay Aquarium Research Institute has found evidence that the bacteria may have lost their ability to reinfect *C. magnifica* from the environment and are passed on by the mother to her eggs.

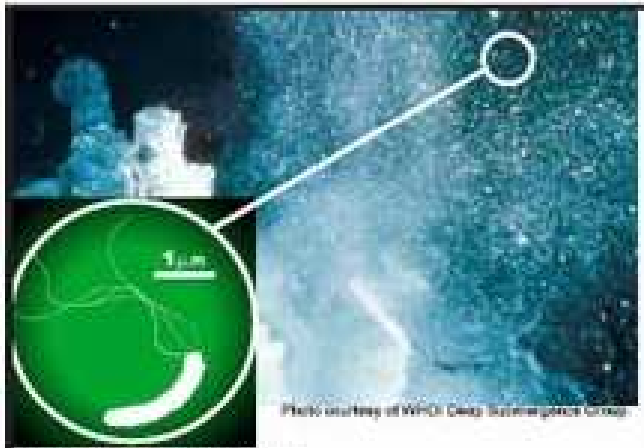


Image: Barbara Moran - Deep Seawaterport Group, Woods Hole Oceanographic Institution

### Vent Bacteria, *Arcobacter sulfidicus*

The four long tails on the vent microbe are flagella that help propel it through the water. It uses the process of chemosynthesis to produce carbohydrates from the hydrogen sulfide that pours out of the vents. These bacteria—like plants in most other ecosystems—form the base of the food web in vents.

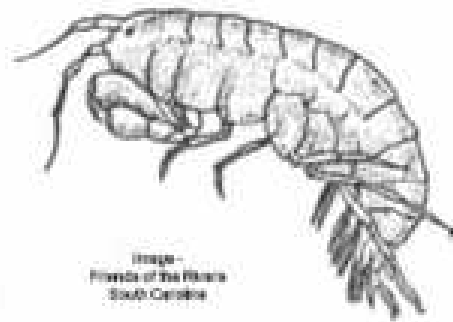
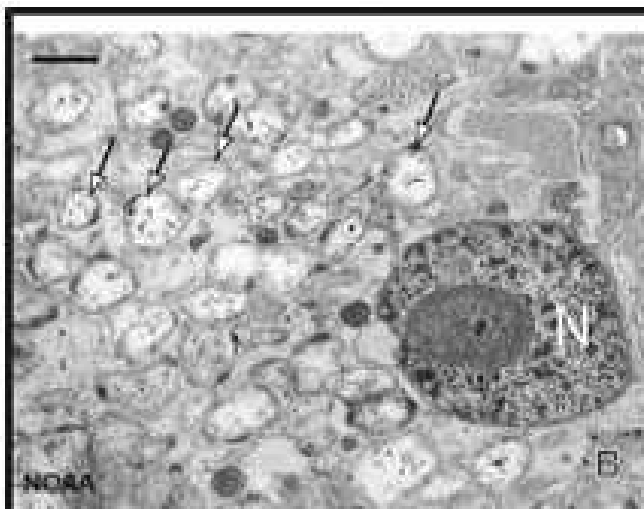


Image - Friends of the Planet, South Carolina

### Vent Amphipod, *Ventiella sulfuris*

A small crustacean, related to crabs and lobsters, found embedded in bacterial mats around the vents. Probably feeds directly on the bacterial mats.



### Symbiotic Chemosynthetic Bacteria

Endosymbionts of vent bivalves. A. Methanotrophic (large arrows) and sulfide-oxidizing (small arrows) bacteria in mussel gills. B. Sulfide-oxidizing bacteria (arrows) in clam gill cells. N = nucleus; scale bars = 1mm.



Photo - University of Delaware

### Pompeii worm, *Alvinella pompejana*

The most heat-tolerant animal on Earth, able to withstand a bath as hot as 176°F. The gray "fleece" on its back is actually bacteria which the worm feeds upon.



Galatheid crab, *Munidopsis alvisca*  
also known as a "squat lobster"

Squat lobsters are small crustaceans that roam about the vent ecosystem feeding on small animals and debris.



Photo by Al Gettings © National Geographic Society  
"Dandelion" Siphonophores

The animals in these colonies are related to the Portuguese-Man-O-War and other jellyfish. They use long whisker-like tentacles to anchor themselves on rocks and to move around. They sting and eat shrimp and other animals and it may also be that the dandelions are scavengers.





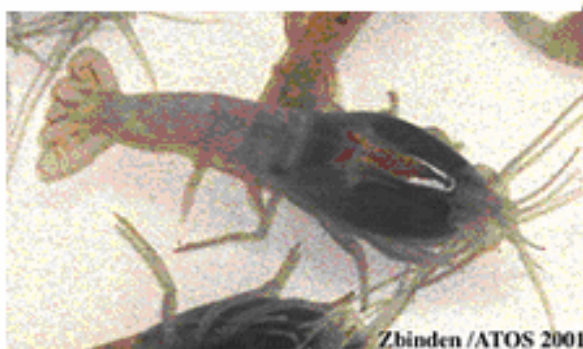
**Blind Vent Shrimp, *Rimicaris***

This is the species of white shrimp that swarm the black smoker chimneys, feeding on the bacteria that live there.



**Blind Brachyuran Crab, *Bythograea thermydron***

These crabs live around vent sites in the Pacific Ocean. These round white crabs are fierce predators. They eat bacteria, shrimp, mussels, clams, tubeworms, and even each other.



**Blind Vent Shrimp, *Rimicaris***

This is the species of white shrimp that swarm the black smoker chimneys, feeding on the bacteria that live there.



Simple Chemicals	Primary Producers	Primary Consumers	First Order Carnivores	Top Order Carnivores
H <sub>2</sub> S	Symbiotic Bacteria	Vent Zooplankton	Zoarcid fish	Blind Crabs
		Vent Shrimp		
CO <sub>2</sub>		Vent Amphipod	Galtheid Crabs	Vent Ratfish
		Riftia Worm	Tube-dwelling Anemones	
O <sub>2</sub>	Vent Bacteria	Pompeii Worm	Dandelion Siphonophores	Vent Octopus
CH <sub>4</sub>		Vent Clam		
		Vent Mussel		

