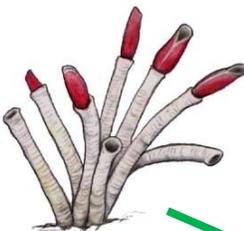
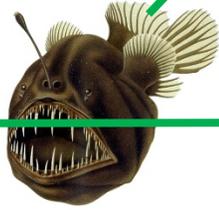
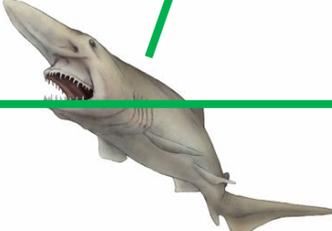


Extreme Adaptations of the Deep: Answer Key

1. **Matching Game:** Life in the deep-sea environment is anything but easy. The creatures of the deep have adapted to the extremes of our planet including high and low temperatures, extreme pressure, and complete darkness at depths of below 600 feet. Animals that survive in these extreme environments are known as **extremophiles**. Match the extremophile to their environment below. As you match, think about what adaptations might be necessary to live in these ecosystems? Why? (Helpful hint: use [Monterey Bay Aquarium Research Institute MBARI's Deep-Sea Guide](#) to explore these species and ecosystems)

Giant Tube Worm	Hagfish	Deep sea trench
		
Yeti Crab	Anglerfish	Hydrothermal vents
		
Dumbo Octopus	Goblin shark	Whale fall
		

Green arrows indicate the following matches:

- Giant Tube Worm → Hydrothermal vents
- Hagfish → Deep sea trench
- Yeti Crab → Hydrothermal vents
- Anglerfish → Deep sea trench
- Dumbo Octopus → Deep sea trench
- Goblin shark → Whale fall

Extreme Adaptations of the Deep: Answer Key

2. Marine Mammals of the Deep: While marine mammals could not live indefinitely in the deep ocean, there are some marine mammals that have adapted to diving down to this harsh environment in search of prey. In fact, our 2nd most common patient, the elephant seal is among the top 5 deepest diving marine mammals. Explore the various diving adaptations below and describe how they may benefit a marine mammal diving over 600 feet deep.

a. Large eyes

Large eyes help to hunt prey under water and especially at depths where light levels are very low. Seals and sea lions have a well developed tapetum lucidum, a layer of reflecting plates behind the retina, that act as mirrors to reflect light through the retina and increase the absorption of light.

b. Vibrissae (whiskers)

In dark environments, vibrissae play an important role in allowing seals and sea lions to orient themselves. Whiskers can be used to sense water movement created by prey.

c. Collapsing lungs

Lungs that collapse protect seals and sea lions from decompression sickness or the “bends”. At depth, the high pressure pushes gas into their lungs. The gases will turn into bubbles when the animal surfaces and can be fatal. Collapsing lungs prevents air flow from the lungs to the blood and preserves oxygen.

d. Reduced heart rate

Seals and sea lions and dolphins can reduce their heart rate to as low as 4 beats per minute! A reduced heart rate also reduces the use of oxygen.

e. Other?

Elephant seals have been recorded as taking naps while diving. They sometimes roll over and spiraling down towards the bottom of the sea in a slow descent known as a drift dive! Drift dives resemble the fluttering of a leaf falling to the ground and slows down the rate of descent.

