

The VENTS Program, established in 1984, conducts research on the impact and consequences of submarine volcanoes and hydrothermal venting on the global ocean.

www.pmel.noaa.gov/vents/home.html

William J. Broad, author of *The Universe Below*, discusses the origins of life on Earth and extraterrestrial life as it relates to new discoveries about hydrothermal vents.

www.pbs.org/newshour/forum/june97/broad_6-16.html

For Kids:

The National Undersea Research Programs lists some fun ocean links.

www.nurp.noaa.gov/kids2.html

A marine science information page sponsored by the Bamfield Marine Station and friends has an "ask a scientist" feature as well as great information on marine science and related links.

www.oceanlink.island.net/

This site has a fun underwater mystery to solve.

www.secretsatsea.org/

Follow the instructions at this site and make your own miniature deep-sea vent.

www.neaq.org/learn/kidspage/vent.html

This excellent interactive learning site, designed by students, takes you on a simulated dive in the Alvin deep submergence vehicle. It also contains many resources about vents and deep-sea environments.

<http://library.thinkquest.org/18828/>

Printed Resources

Deep-Ocean Journeys: Discovering New Life at the Bottom of the Sea, by Cindy Lee Van Dover, Perseus Press, 1997.

The Deep Sea (Monterey Bay Aquarium Natural History Series), by Bruce H. Robison and Judith Connor, Monterey Bay Aquarium Press, 1999.

Life on the Edge: Amazing Creatures Thriving in Extreme Environments, by Michael Gross, Plenum Press, 1998.

Ocean Planet: Writings and Images of the Sea, by Peter Benchley, edited by Judith Gradwohl, Harry N. Abrams, 1998.

"Weird Life on the Ocean Floor," *The Washington Post*, July 9, 1997.

For Kids:

Back to the Sea (The Deep Blue Planet), by Renato Massa, translated by Neil Frazer Davenport, Raintree/Steck Vaughn, 1998.

Creeps from the Deep: Life in the Deep Sea, illustrated by Norbert Wu, Chronicle Books, 1997.

UNIVERSE BENEATH THE SEA

CREATURES OF ALL SHAPES AND SIZES

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UNIVERSE BENEATH THE SEA

CREATURES OF ALL SHAPES AND SIZES

The largest remaining frontier for exploration rests on Earth, miles under water. But visiting the ocean depths is as challenging as navigating the distant reaches of space. Darkness, depth, pressure, and the destructive power of corrosive seawater pose life-threatening hazards that can be addressed only by the most sophisticated technologies. Deep submergence systems developed during the Cold War have offered some solutions to these problems and are now providing unprecedented access to the universe below. In the last ten years, scientists and explorers have learned more than ever before about this world of stranger-than-fiction life-forms and untapped resources. Precious minerals and potential cures for cancer are just a few of the many riches hidden in the Universe Beneath the Sea.



For centuries the deep was thought to be the lair of monsters. But scientists today, like Dr. Bruce Robison of the Monterey Bay Aquarium Research Institute and Dr. Tony Rice of the Southampton Oceanography Centre, are discovering more and more about the wonderful creatures that inhabit the abyss - such amazing living things as bioluminescent Galatootha squids and nematodes, microscopic worms that are among the most abundant life-forms on Earth. Moreover, explorations of underwater volcanoes provide what may be clues to the origins of life itself.

Terms: _____

- abyssal plain** -- The deepest part of the ocean, which contains a complex ecosystem.
- bacterial flock** -- Clouds of primitive life-forms coagulated together that are released during deep-sea volcanic activity.
- benthic storms** -- Deep-sea storms that regularly occur on the abyssal plain.
- bioluminescence** -- The production of light by living organisms.
- hydrothermal vents** -- Deep-sea vents that emit sulfur-rich hot water warmed by activity from the Earth's core. They are virtually the only environment on Earth that is not dependent on light energy but on chemical energy instead.
- photophores** -- Bioluminescent organs in living things where chemical reactions create light.
- phytodetritus** -- Tiny, slow-sinking particles that clump together and function as a food source for creatures in the ocean depths.
- phytoplankton** -- Microscopic plants in the upper layers of the oceans that are at the basis of the ocean food chain.
- ROV** -- Remotely operated vehicle, remote-controlled robot-craft that are often used to retrieve objects from the ocean floor.

Fun Facts: _____

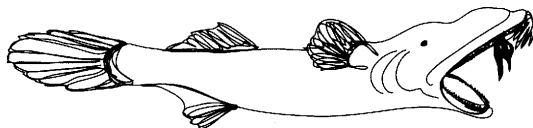
- Earth's longest mountain range is the Mid-Ocean Ridge, which is four times longer than the Andes, Rockies, and Himalayas combined.
- Mt. Everest, the world's highest mountain, stands 29,028 feet high. But Mauna Kea, an inactive volcano on the island of Hawaii, is actually taller. Only 13,796 feet of Mauna Kea stand above sea level, yet it is 33,465 feet tall if measured from the ocean floor to its summit.
- The oceans contain 99% of the living space on the planet.
- One study of a deep-sea community revealed 898 species from more than 100 families and a dozen phyla in an area about half the size of a tennis court. More than half of these were new to science.
- Life began in the seas 3.1 billion to 3.4 billion years ago.

•Land dwellers appeared 400 million years ago--a relatively recent point in the geologic time line.

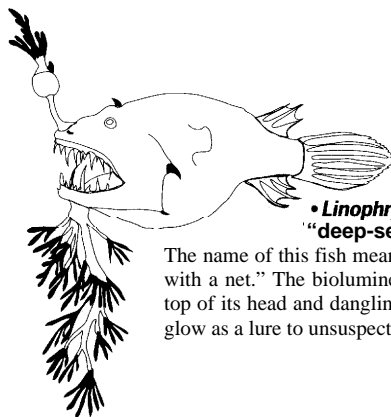
Things To Think About: _____

• Recent scientific inquiry has focused on the apparent presence of mysterious light sufficient for photosynthesis in deep-sea hydrothermal vents. Furthermore, molecular studies of RNA sequences in living organisms suggest that microbes that thrive at excessive temperatures are ancestral to all organisms alive today. Based on this information, some scientists are developing new theories about the origins of life. Perhaps life itself began in these warm sea waters. Maybe it arrived on a meteor from outer space and flourished in the deep ocean. In addition, the space probe Galileo sent back images of Europa, one of Jupiter's moons, that suggested that it has a deep inner sea kept liquid by the volcanic heat of its core. Do you think it's possible that extraterrestrial life might have evolved in sea vents similar to those in our own oceans?

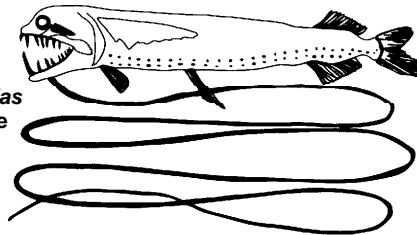
Look at the following pictures and descriptions of some odd deep-sea inhabitants: _____



•*Thaumaticthys axei*, "Prince Axel's wonderfish."
This animal displays a luminescent organ dangling from its toothy jaws. During the Galathea expedition of 1950-52, the first specimen was trawled from a depth of 11,778 feet in the Atlantic.

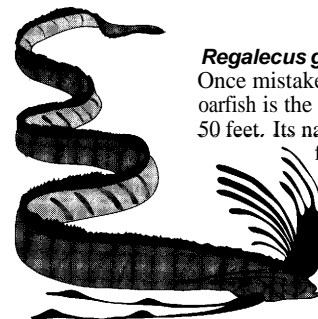


•*Linophryne arborifera*
"deep-sea anglerfish."
The name of this fish means "toad that fishes with a net." The bioluminescent filaments on top of its head and dangling from its chin glow as a lure to unsuspecting prey.



Gramma tos tomias flagellibarba. The name of this fish means "lined stomiid with a whip-barbel."

The fish itself is only 6 inches long, but its chin barbel can be 6 feet in length. It also has a double row of luminous blue-violet organs running down its flanks.



Regalecus glesne "Oarfish."
Once mistaken for a sea serpent, the oarfish is the longest bony fish, over 50 feet. Its name refers to the red fins that pivot as it swims, like oars on a boat.

After looking at these pictures, what familiar myths about sea monsters do you recall? Think about mythological creatures like the kraken and leviathan. Perhaps write a few notes or draw pictures of some of these fantastical creatures. Then create your own myth based on a real creature from the sea. Visit the following website for more information. seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/squid_opening.html

Internet Resources: _____

- The Seaweb website is a good resource for current information on ocean life. It also provides numerous links to related sites.
- www.seaweb.org/
- The Monterey Bay Aquarium in California maintains an interesting site on-ocean life.
- www.mbayaq.org/sg/
- Information on bioluminescence can be found at this site.
- www.lifesci.ucsb.edu/~biolum/
- London's Natural History Museum is home to one of the world's oldest and largest collections of marine specimens.
- www.nhm.ac.uk/