



### ScienceWatch – A Whale of a Feast

Scavengers, the creatures that consume rotting carcasses, may appear to have a disgusting lifestyle but they perform a very important ecological function. Just think what the world would look (and smell) like if all those dead remains hung around unconsumed. Even at the ocean bottom thousands of feet below the surface where it is 2°C (36°F), scavengers perform their necessary clean up, and a 35-ton whale corpse, known as a whale fall, is like finding a refrigerator full of meat.

Studies by biological oceanographers have shown that whale falls go through three successive stages of colonization by scavengers. First the soft tissue is stripped by roaming scavengers like benthic sharks, hagfish and huge numbers of amphipods, and specialized crabs only found at whale falls. This stage may last up to two years for a large carcass. The next stage is distinguished by the arrival of small, bottom-dwelling crustaceans (cumaceans), also called lollipop shrimp, and polychaetes, segmented marine worms that resemble centipedes. Finally, the bones are decomposed by bacteria whose presence supports a large community of clams, shrimps and tubeworms.

Hagfish feeding on gray whale skeleton



Now comes a report describing two somewhat bizarre species of tubeworms growing on the whalebones. The bone worms, which resemble plants at first glance, lack mouths and digestive tracts, but have rootlike structures, filled with rod-shaped bacteria that penetrate the bone. Robert C. Vrijenhoek, an evolutionary geneticist from the Monterey Bay Aquarium Research Institute, Moss Landing, CA, led the team that discovered the remains of a gray whale nearly two miles deep at the bottom of Monterey Canyon. Their report is published in the July 30, 2004 issue of *Science*.

Scientists once thought the ocean floor was a vast wasteland, but they now know otherwise. In recent decades huge colonies of tubeworms, shrimps and creatures have been discovered living near the hydrothermal vents that form at the edges of the deep ocean plates. These vents discharge normally toxic hydrogen sulfide (H<sub>2</sub>S) which forms the energy basis heretofore unknown community. Bacteria living in the tubeworms derive energy from the H<sub>2</sub>S, producing the organic matter that feeds the worms. Similarly, the bone worms have formed a symbiotic relationship with the bacteria they harbor in their “roots”. The bacteria produce enzymes that can digest the fat-rich marrow, supplying nutrients to the worms. This unique way of feeding prompted the Vrijenhoek team to place the bone worms in their own genus – *Osedax* – Latin for “bone devouring”.

Lollipop shrimp



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Craig Smith, a biological oceanographer at the University of Hawaii, has been studying the communities that crop up at whale falls. He believes they spread throughout the vast ocean floor over the past 30 million years or so by hop scotching from one whale fall to another. DNA analysis by Vrijenhoek and his team support this idea by showing that the two species of bone worms diverged about 42 million years ago and that they are close cousins to the vent tubeworms. All the bone worms visible to the naked eye turned out to be females. In a deflating stab to the male ego, the bone worm males are little more than microscopic sperm sacs, living in the tubes of females. Each female was seen to harbor many males, the record being 111.

Given these facts Vrijenhoek's team concluded that the free-swimming larvae of both bone worm species are attracted to the stripped carcass, land on the bones over a period of time and develop into mature females. As the bones become covered, later-arriving larvae land in the female tubes where they remain relatively undeveloped and become males.

Beyond these bizarre creatures, what may prove most significant for us are the bacteria that can digest fats in very cold water. Imagine the energy savings if those bacterial enzymes could be isolated and put to work in the washing machine. A detergent company is investigating.

Saul Scheinbach