Deep coral reveals ocean's fickle history

A deep-sea coral.

Climate scientists have long viewed the deep ocean as resembling an elephant on Quaaludes: a sluggish beast that takes ages to get going. A new study of ancient coral teaches that the deep ocean is actually far nimbler, reorganizing currents rapidly in the face of a shifting climate.

"This work tells us the deep ocean can respond quickly," says Jess F. Adkins of Columbia University's Lamont-Doherty Earth Observatory in Palisades, N.Y. "This is the best evidence to date that the deep ocean can change nearly as quickly as the surface ocean and the atmosphere."

Adkins and his colleagues gleaned this finding from deep-sea coral specimens inadvertently pulled up by marine geologists as they dredged for rock samples. Corals are communities of filter-feeding animals that build hard, calcium carbonate skeletons. Unlike the corals that live in shallow tropical water, deep-sea forms lack photosynthetic algae and consume detritus floating in the water far below the sunlit surface.

The researchers used two types of radioactive decay to date coral samples taken from the Kelvin Seamount in the North Atlantic Ocean, 1,800 meters under the surface. By measuring the decay of uranium-238 to thorium-230, they determined that four of the coral samples died about 15,400 years ago, just as the last ice age was ending.

Measuring a second form of radioactive decay—carbon-14 to carbon-12—they determined how long some carbon had been in the ocean. Carbon-14 is created in the atmosphere, dissolves in surface waters, and hitches a ride inside deep currents. The calculation represents the age of the coral plus the time needed for carbon to reach the coral.

By combining the two techniques, Adkins and his coworkers calculated how long it took surface water to sink to the site where the coral grew. In its 30 to 160 years of growth, a single coral showed a marked increase in the transport time of water reaching it, the researchers report in the May 1 SCIENCE.

The Kelvin Seamount represents a meeting ground for deep currents from the Arctic and Antarctic. To learn which waters bathed the coral, the researchers analyzed the shells' ratios of cadmium to calcium, chemical fingerprints of different sources of water. These data showed the coral starting life in a mixture of the two currents but ending in purely southern waters—evidence of a major oceanic shift over several decades.

The coral study not only indicates how climate behaved in the past, it also holds implications for how the oceans will respond in the future. Some researchers have predicted that greenhouse warming could trigger wild climate swings of the type seen in the last ice age.

"The results of this paper are extremely important," says Michael J. Risk of McMaster University in Hamilton, Ontario. "It emphasizes again to us how rapid climate change can be." That change is not going to take place a generation from now, he adds, "it's going to be a lot faster than that."

He and his colleague Jodie E. Smith pioneered the successful extraction of climate information from deep-sea coral. "These are the Rosetta stone of deep-sea environmental conditions over many thousands of years," says Risk. —*R. Monastersky*

No raccoon boom after vaccination program


Vaccinating raccoons has been proposed to control diseases such as rabies.

Garbage can owners in Scarborough, Ontario, can sleep as peacefully as ever.

Vaccinating the city's raccoons against canine distemper in the early 1990s successfully reduced the prevalence of the disease in these urban scavengers. Even better news to some residents, the shots do not seem to have triggered the population boom that some feared would create bigger, healthier hordes of raccoons to rattle garbage cans all night, report researchers at the University of Guelph in Ontario.

The raccoon shots raise the deceptively simple question of how to determine the effects of a disease on a population, observes Guelph wildlife ecologist Thomas D. Nudds. He and his colleagues used the raccoon test to provide data for a rare large-scale analysis of a wildlife disease. Their results appear in the May ECOLOGICAL APPLICATIONS.

Nudds bemoans the tendency to assume that a disease which kills many animals necessarily holds the population in check. "They might have died anyway," he says. Canine parvovirus, for example, decreases the survival of wolf pups, yet a detailed analysis has shown that it does not regulate the wolf population.

Without a strict analysis, says Nudds, limited wildlife management dollars may be wasted trying to prevent a disease that doesn't menace a population. "You can spend a lot of time running down the wrong path," he warns.

The question of population-level effects also comes up in discussions of vaccinating wild animals against rabies or other diseases to keep the creatures from posing a public health hazard. Would this strategy trigger booms in nuisance animals in cities? As Nudds puts it, "Nobody wants rabies, but nobody wants skunks either. So what are you going to do?"

To study such problems, he and his colleagues monitored an Ontario Ministry of Natural Resources' project that trapped, vaccinated, and released skunks and raccoons in certain areas of the city. Because no rabies outbreak has since struck Scarborough, the researchers can't draw conclusions about rabies' role in controlling animal numbers.

In 1991, the project added canine distemper shots to the regimen. Canine distemper provides a good model for studying whether a disease regulates a population, Nudds notes.

After comparing animals in the vaccination zone to those in another part of the city, the researchers concluded that the vaccine was indeed keeping disease prevalence down—about 1.4 percent of raccoons were infected rather than 8.3 percent. Yet the program did not change overall growth trends in the raccoon population.

Nudds cautions against applying these results directly to rabies or to skunks, but he does note similarities between the way rabies and canine distemper spread and the way skunks and raccoons adapt to city living.

Wildlife veterinarian Elizabeth S. Williams of the University of Wyoming in Laramie says she hopes that publication of the raccoon study will inspire more researchers to tease out the population-level effects of diseases. "These studies are hard to do," she comments. —*S. Milius*