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France's Canopus nuclear test, conducted in 1968 on the Fangataufa atoll in the South Pacific.

Nuclear blasts shed light on how animals recover from annihilation

By David Shultz (/author/david-shultz) | 10 June 2015 11:15 am | 10 Comments (/biology/2015/06/nuclear-blasts-shed-light-how-animals-recover-annihilation#disqus_thread)

In the late 1960s and early 1970s, France detonated four nuclear bombs on the Fangataufa atoll—a ring-shaped island of coral in the middle of the Pacific Ocean. The detonations—the largest, a hundred times more powerful than the bomb dropped on Nagasaki—destroyed just about all life in the region, setting up an "unthinkable" ecological experiment: If life had to start fresh, would it develop the same way again? A new study of the aftermath of the blasts suggests it would not.

That conclusion comes thanks to more than 25 years of observations of

Fangataufa. The nuclear blasts annihilated much of the vegetation on the island and many aquatic species as well, but the scientists focused on mollusks because of their longevity and stationary nature. “They stay where they are,” says Pierre Legendre, a community ecologist at the Université de Montréal in Canada, and the study’s lead author. “They are long-lived so we can expect that over a year the same mollusk that sits on the reef today will still be there 3, 4, 5, 10 years from today.”

Over the course of the study, the researchers used a rope ladder to divide three separate reefs around the atoll into 6-square-meter segments. They then counted all mollusks (except for tubeworms and snails) in the segments five times between 1972 and 1997. The team compared these recovering communities with observations made in 1968 before the largest nuclear tests.

Overall, the communities that have developed since the final nuclear test are considerably different from the original populations (http://rspb.royalsocietypublishing.org/lookup/doi/10.1098/rspb.2015.0750) , the team reports online in the *Proceedings of the Royal Society B*. On all the reefs, species richness either stayed the same or increased, meaning there were more types of mollusks in a given area following the blasts. Additionally, the overall composition of species changed significantly; carnivorous mollusks appeared to fare particularly well, increasing in prevalence at all sites, while their herbivorous relatives often decreased in abundance.

There was one area of the reef that regrew a population very similar to the one killed off by the bombs. The supralittoral zone, which is submerged at high tide but exposed at low tide, closely resembled the prenuclear assemblages. However, this may be because only two or three mollusk species are able to brave the harsh conditions there, and all of them happened to find their way back to the open habitat.

Legendre and his colleague conclude that the new communities appear to have emerged largely as a result of chance. Many mollusk species reproduce by ejecting larvae, which can float hundreds of miles in the ocean’s currents before coming to rest. When the Fangataufa atoll populations were decimated by the nuclear bombs, it opened up a new habitat to colonize for the free floating larvae, but which species happened to land on the reef is mostly a matter of luck.

The idea that an organism's success in an environment might be a matter of chance has been heavily debated by scientists recently, says community ecologist Stephen Hubbell of the University of California, Los Angeles, who was not involved in the study. "On the face of it, certainly [the results] are consistent it, but it doesn't in my opinion prove it. It isn't a slam dunk."

Hubbell points out that while shifting winds and swirling tides do introduce an element or randomness, mollusk larva dispersal does follow seasonal patterns, which have been shown to influence community makeup in previous studies. "It's not entirely random. It's not as if every species has an equal chance of colonizing," adds Terry Hughes, a coral reef ecologist at James Cook University, Townsville, in Australia.

Whether the population might one day revert back to its original structure is also up for debate. It's been more than 40 years since the last explosion on the island, but the mollusk communities appear to still be in flux. Legendre's results show that many of the populations changed dramatically between 1987 and 1997, but he doesn't think there's much chance that they will ever revert back to their pre-explosion states: "If you evolve a community that it is different, then it has its own inertia." He thinks the only way to recapture the original structure is to completely wipe out the new mollusks and reroll the dice again. Hughes is less sure though and says it's still too early to tell. "It hasn't stabilized," he says.

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