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# White Abalone Restoration

The white abalone is a marine snail, a deep-water species found between 80 and 200 feet on rocky reefs from Point Conception in California to Punta Abreojos in Baja California, Mexico. During the early 1970s, the Channel Islands were home to 1,000–5,000 white abalone per acre.

Highly prized for their tender white meat, white abalone were harvested in an intense commercial and recreational fishery that developed during the 1970s, then quickly peaked and crashed as the abalone became increasingly scarce. The fishery for white abalone closed in 1996.

In the 1990s, less than one white abalone per acre could be found in surveys conducted by federal and state biologists. The rarity of this species within its historical center of abundance prompted the National Marine Fisheries Service (NMFS) to list it as a candidate species under the Endangered Species Act in 1997. In May 2001, the white abalone became the first marine invertebrate to receive federal protection as an endangered species.

White abalone may live dozens of years and attain a length of about 10 inches. Unlike more mobile animals, abalone are slow-moving creatures confined to a small area for their entire life. They reproduce by broadcasting their eggs and sperm into the seawater. For fertilization to occur, the spawners need to be within three feet of a member of the opposite sex. No neighbors means that the remaining animals are effectively sterile.

One of 15 white abalone studied to develop husbandry techniques for captive breeding. Photo: K. Lafferty, USGS.

**Research is still needed on:**

- Large-scale culturing techniques
- Survival of outplanted abalone in the wild
- Effects of disease on abalone
- Abalone population genetics

## Search by Submarine

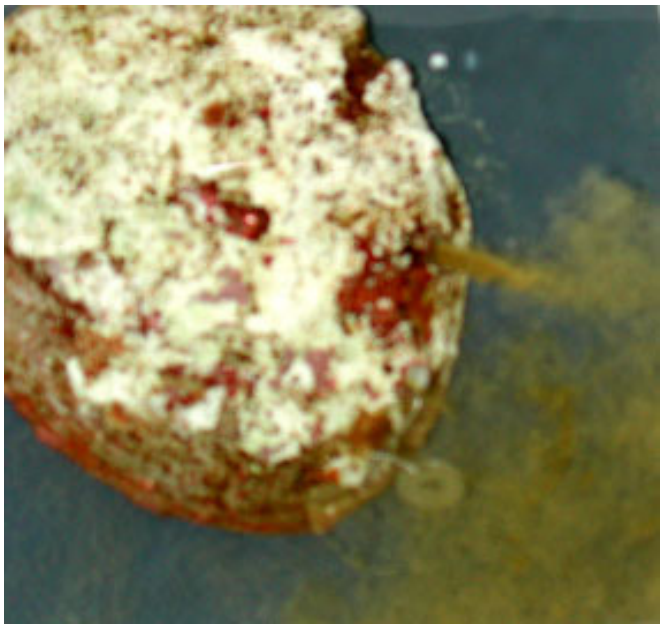
The Abalone Restoration Consortium, a team of biologists from the University of California, Santa Barbara (UCSB), U.S. Geological Survey (USGS), Channel Islands Marine Resource Institute (CIMRI), National Park Service (NPS), California Department of Fish and Game (CDFG), and NMFS, is striving to bring the rare abalone back to a self-sustaining population. In fall 1999, the biologists launched a two-person submarine from their research vessel in a series of surveys to locate white abalone. They hoped to bring a small number into captivity to develop husbandry techniques that might allow the establishment of a captive breeding program. Stocking of hatchery-reared white abalone is one of the possible strategies that may be used to rebuild the white abalone population. By noting characteristics of the habitats and depths where white abalone were found, the researchers located additional populations. Unfortunately, their survey found only 157 live white abalone, an average density of 2.7 abalone per hectare of habitat.

By fall 2000, the biologists had accumulated 15 white abalone captured from the wild, which they were nurturing at UCSB and at CIMRI in Port Hueneme, Calif. Husbandry techniques that had been developed for culture of other abalone were adapted to suit the white abalone's particular food and environmental needs, and the key to their fertility cycle was sought.

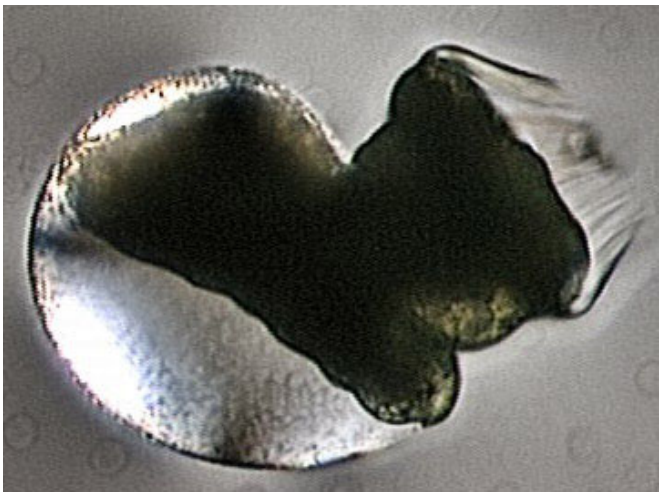
## Spawning 6 Million

On April 23, 2001, the biologists placed 3 females and 2 males that were reproductively ready into separate containers in a UCSB lab, dimmed the lights, and added hydrogen peroxide, an abalone aphrodisiac, to the abalone tanks. A couple of hours later, 2 females had spawned about 3 million eggs, followed by release of sperm from one of the males. The biologists added the sperm to the two batches of eggs and watched as more than 95 percent of the eggs were fertilized and developed normally, the next day, into free-swimming larvae. About a week later the larvae settled onto plates thinly filmed with red algae.

The consortium had successfully spawned white abalone, a crucial step in developing a white abalone hatchery. At the CIMRI hatchery, the young abalone will dine on algae and grow in tanks, protected from predators, for several years. By the time they reach a size of three to four inches long, they will be adults, with each female capable of producing 1 million eggs a year. Biologists from CDFG will then be able to place these young adults in groups in the ocean with the intent that the abalone will quickly start to reproduce.



Female white abalone releasing 3,000,000 eggs in spawn of the rare mollusk, a joint effort by biologists of the Abalone Restoration Consortium. Photo: Courtesy B. Bosma, UCSB.



Two-day-old white abalone in free-swimming larval stage, with developing first shell (white) and fringed swimming organ (right), in culture at UCSB. Photo: Courtesy B. Matsumoto, UCSB.

The consortium estimates that to find and collect 200 white abalone to launch a large-scale captive breeding program could cost $1.2 million or more.

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