

SSC Pacific Farm Helps Restore Southern California Abalone Populations

U.S. Navy Supporting Conservation Efforts

SOUTHERN CALIFORNIA ABALONE populations have declined dramatically. The Endangered Species Act (ESA) designated the black abalone, *Haliotis cracherodii*, and the white abalone, *Haliotis sorenseni*, as endangered species. The National Marine Fisheries Services (NMFS) has also expressed concern that the green abalone, *Haliotis fulgens*, a species of concern (SOC), and various other species of southern California abalone are well on their way to be added to the list. But the U.S. Navy supports an ongoing southern California abalone conservation project in order to mitigate the southern California abalone population decline.

Background

In the 1990's, the Withering Foot Syndrome—a bacteria that causes abalone to atrophy and ultimately die—is one of the main reasons for the population decrease of the black abalone. Another factor leading to the increased mortality of southern California abalone is human impact—through poaching and coastal habitat destruction. This leads to stress on present coastal ecosystems which

southern California abalone inhabit. In light of the ESA, the Department of Defense (DoD) must act to alleviate the further decline of southern California abalone on U.S. Navy property. The Space and Naval Warfare Systems Center (SSC) Pacific Abalone Farm, located in Point Loma, San Diego, CA grows abalone solely for conservation and educational purposes.

David Lapota's passion and concern for the dwindling populations of southern California abalone drives the continued presence of the SSC Pacific Abalone Farm. Green and red abalone are cultured at SSC Pacific. Green abalone are the main focus of this effort, which acts to improve strategies to prevent green abalone from becoming listed as another endangered species. This includes spawning, settling, culturing, outplanting, and educational awareness strategies to aid in the restora-

tion of wild southern California abalone populations. The SSC Pacific Abalone Farm team believes by improving techniques for the green abalone, methods could be used for various restoration projects of other southern California abalone, such as black abalone, white abalone, and red abalone.

Taking Action

Spawning and culturing techniques of southern California abalone is crucial to reviving wild populations. Spawning is the act of female abalone releasing their eggs and male abalone releasing



Green abalone during spawning.



Red abalone cultured at the SSC Pacific Abalone Farm.

their sperm into the water, in hopes that the eggs will be fertilized. Culturing abalone must include increasing the settling and survival rate of newly hatched larvae within the laboratory. Increased numbers translate to more abalone for outplanting. During summer 2010, the SSC Pacific Abalone Farm experimented and modified spawning and culturing techniques in order to increase settlement of juvenile abalone with some success. They modified spawning techniques and culturing techniques by experimenting with an ultraviolet filtration system, antibiotics, and batch culturing. These techniques are crucial to restore southern California abalone populations—by increasing the population of cultured abalone, more abalone are available to outplant into wild populations.

In 2004, the SSC Pacific Abalone Farm and U.S. Navy divers outplanted 700 to 800 reproductive green

abalone off the coast of Point Loma, San Diego, CA. This area is in a Marine Protected Area, under the Marine Protection Act. Outplanting included placing reproductive, tagged green abalone into a suitable habitat to increase the reproductive success of wild populations. Outplanting is crucial to restoring populations of this SOC, for it increases the number of eggs to be fertilized and promotes genetic diversity of wild populations. Although the outplanting was successfully completed, a complete survey has yet to be conducted to determine the impacts of the successful outplanting.

The SSC Pacific Abalone Farm takes an added

interest in educational outreach regarding southern California abalone. Lapota has worked with various high schools around the United States. These high schools include Thomas Jefferson High School for Science and Technology, Alexandria, VA, High Tech High School, San Diego, CA, and Cesar Chavez High School, San Diego, CA. He provided students with the knowledge and materials to care for southern California abalone species, by helping



Tagged green abalone outplanted by U.S. Navy divers off Point Loma in 2004.



Red abalone.
David Lapota

students house red abalone in a classroom aquarium. He also helped perform research in the classroom with students. One research effort pertained to how diet affects the growth and coloration patterns of red abalone. The SSC Pacific Abalone team believes it is crucial to educate the community, especially the young generation, about southern California abalone conservation. In the future, students and the community would aim to minimize their human impact on the environment, and/or help support conservation efforts.

Future Plans

Future efforts for outplanting would include a thorough survey of the 2004 outplant, where U.S. Navy divers would visit each previous enclosure, and record the number of green abalone present. This number would be compared to the number of green abalone outplanted in 2004. The survey would also help improve conservation efforts of outplanting green abalone, and these improved outplanting methods would be used for outplanting other species (black abalone, white abalone, and red abalone). The SSC Pacific Abalone Farm will continue to perform future outplants to increase wild abalone stock.



A High Tech High School student feeding green abalone brood stock at the SSC Pacific Abalone Farm.

Black abalone is listed as endangered under the ESA, and SSC Pacific hopes to continue conservation efforts with this species. Because of this listing, it is necessary to include black abalone in the Navy's natural resources conservation program and ensure that DoD training, operations, and facility activities do not jeopardize the continued existence of the species. Factors affecting species growth and/or sustainability have been identified as key issues under the San Clemente Integrated Natural Resource Management Plan and the ESA. Both the black and white abalone are endangered species and found within the U.S. Navy's test ranges off southern California. Recent work on San Nicolas Island has tentatively identified black abalone populations which appear to be resistant to the Withering Foot Syndrome.

The future project would increase these populations out on the Channel Islands and coastal San Diego by providing methods to develop reproductive techniques for outplanting sufficient quantities of black abalone. Through appropriate conditioning of black abalone (diet, temperature regime), black abalone will be capable of successful spawning and rearing of larvae, for future outplanting activities. ⚓

Note: Melissa Blando, an SSC Pacific intern, made significant contributions to this article.

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