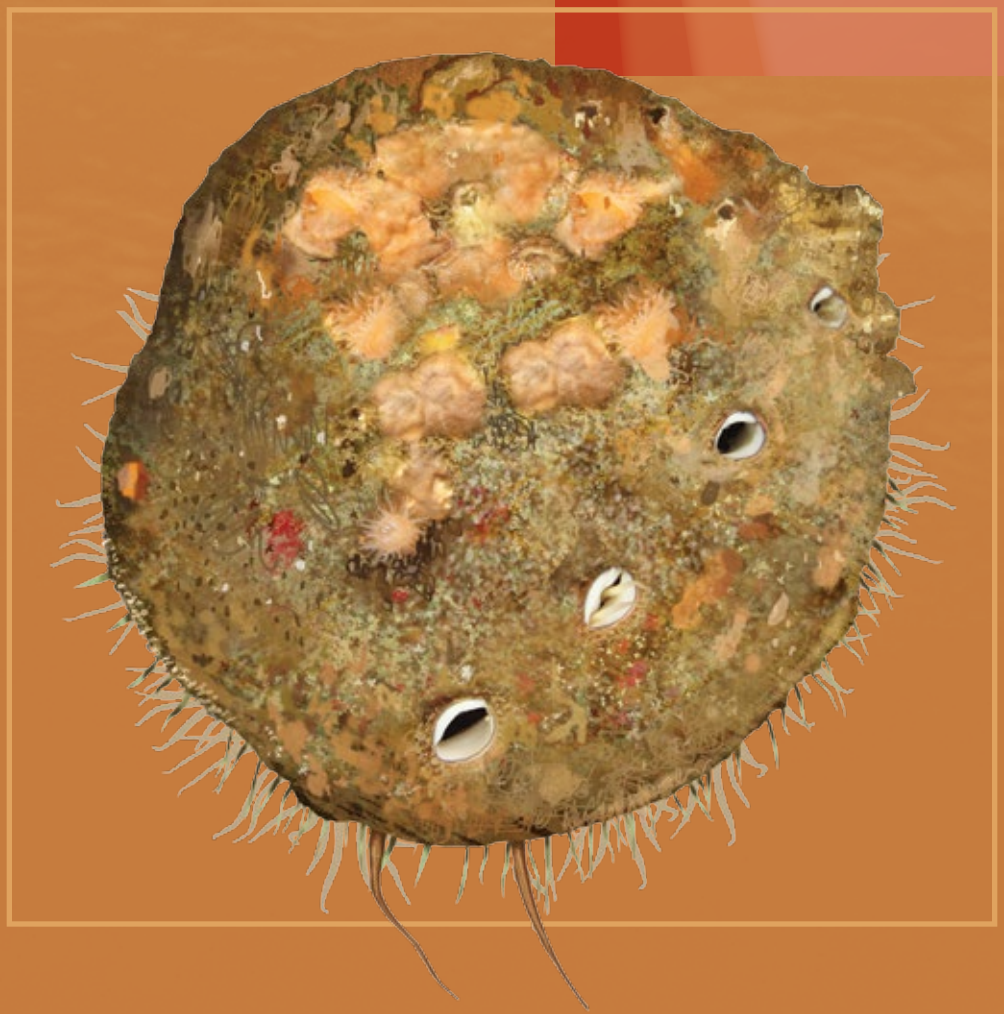
NOAA FISHERIES

SPECIES *in the* SPOTLIGHT

Priority Actions: 2016-2020

White Abalone

Haliotis sorenseni



SPECIES SPOTLIGHT BACKGROUND

The 5-year action plan is part of a strategy to marshal resources on species listed under the Endangered Species Act of 1973 (ESA) for which immediate, targeted efforts are vital for stabilizing their populations and preventing their extinction. Eight species were identified by the National Marine Fisheries Service (NMFS) as among the most at-risk of extinction:

- Atlantic Salmon Gulf of Maine Distinct Population Segment (DPS)
- Central California Coast Coho Evolutionarily Significant Unit (ESU)
- Cook Inlet Beluga Whale DPS
- Hawaiian Monk Seal
- Pacific Leatherback Sea Turtle
- Sacramento River Winter-run Chinook ESU
- Southern Resident Killer Whale DPS
- White Abalone

These species were identified as most at-risk of extinction based on three criteria (1) endangered listing, (2) declining populations, and (3) are considered a recovery priority #1[1]. We know the threats facing these species and understand the management actions we can take that will have a high probability of success. The 5-year action plan builds upon existing recovery or conservation plans and details the focused efforts needed over the next 5 years to reduce threats and stabilize population declines. We will engage our partners in the public and private sectors in actions they can take to support this important effort. We will report on our progress through the Biennial Report to Congress and post updates on our website: http://www.nmfs.noaa.gov/pr/.

This strategy will guide agency actions where we have the discretion to make critical investments to safeguard these most endangered species. The strategy will not divert resources away from the important and continued efforts to support all ESA-listed species under our authority. Many of our species have long-standing conservation programs supported by multiple partners. We remain committed to those programs. This action plan is designed to highlight the actions that can be taken by us, other federal and state resource agencies, environmental organizations, Native American Tribes and other partners to turn the trend around for this species from a declining trajectory to a trajectory towards recovery.

[1] Priority #1 is defined as a species whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity. NMFS Endangered and Threatened Listing Recovery Guidelines (55 FR 24296, June 15, 1990).

WHITE ABALONE STATUS

White abalone supported a brief but intense commercial fishery in southern California during the 1970s. The fishery was historically managed using size limits and seasons, but such methods failed because they did not account for density-dependent reproduction and assumed regular successful recruitment. Overfishing reduced numbers of this bottom-dwelling species to very low levels, resulting in a fragmented population. Results from remotely operated vehicle (ROV) surveys and population viability analyses suggested that the remaining individuals were too far from potential mates to successfully reproduce in the wild (Tegner and Hobday 2000; Stierhoff et al. 2012). Fishery closure in 1997 has not reversed this status. In 2001, white abalone was the first marine invertebrate to be listed as endangered under the ESA, a protective step that managers hoped would help white abalone to recover.

Monitoring of wild white abalone has confirmed that populations continue to decline in some areas and that the wild population is at high risk of extinction (Butler et al. 2006; Stierhoff et al. 2012). Even if limited natural recruitment of white abalone is occurring, it is happening too slowly to give the species the foothold it needs to weather future threats and be viable over the long-term. The best way to safeguard white abalone against extinction is a captive breeding program aiming to produce young abalone. These captive-raised animals can enhance wild populations to the point that densities are boosted enough to sustain healthy and prolific populations. This enhancement may occur as a variety of approaches aimed at increasing abundance and reproductive success of white abalone in the wild by placement of these captive bred individuals (outplanting) in currently unoccupied areas or groups of wild abalone and captive bred abalone. Continued monitoring of wild white abalone and their habitat must occur at the same time as captive breeding in order to identify habitats best-suited for future enhancement efforts and to track species' status over time.

WHITE ABALONE KEY CONSERVATION EFFORTS/CHALLENGES

NMFS' recovery strategy for white abalone includes a captive breeding program that will serve to enhance wild populations in strategic locations in Southern California and Mexico and a population and habitat monitoring program that is designed to track populations over time and determine whether the species is sustaining itself in the wild. Conservation efforts have focused on two recovery activities. The first is a captive propagation and enhancement program initiated to increase the number of captive-grown white abalone that can be reintroduced back into the wild. NMFS West Coast Region (WCR) oversees the program in close coordination with the University of California at Davis' Bodega Marine Laboratory (BML) and in partnership with five other facilities. The second is monitoring the demographics of the small population of wild white abalone and characterizing habitat use using ROVs and SCUBA in the Southern California Bight and Baja California, Mexico. NMFS oversees this program in close partnership with the California Department of Fish and Wildlife (CDFW) and several other partners.

Four key challenges must be addressed and overcome in order to recover white abalone. The first is to develop methods for reliable and increased production of healthy captive-raised white abalone that will be used to increase the abundance and reproductive success of the wild population. The second is to determine the factors that lead to high survival rates of captive-reared animals in the wild. The third is to develop methods and tools that will effectively monitor the demographics of enhanced white abalone populations over time and gauge the overall success of the program. The fourth is to strengthen existing partnerships and forge new ones through the development of an outreach plan that communicates the key messages of the recovery program and highlights the important roles partners will play in recovering white abalone throughout its range.


D. Witting, NOAA Restoration Center

KEY ACTIONS NEEDED 2016-2020

The key actions that follow represent a small subset of the recovery actions identified in the 2008 recovery plan, and represent actions NMFS and partners can take in the next five years to promote recovery of the species. The partners identified below have indicated their interest in helping achieve the action, but are not committed to a specific activity or commitment of resources. This list is not comprehensive of all potential partners, and we welcome partnering with others not identified within this plan.

Expand a Captive Propagation Program

Description and Background: Low species density leading to repeated recruitment failure and continued declines in abundance is the primary threat to white abalone. Captive propagation is the species' best hope for quickly boosting numbers in the wild through outplanting (also known as reseeding, restocking, reintroduction, or enhancement; a method whereby captive-bred abalone are introduced into their native kelp forest habitat where they will grow and become a part of a healthy wild population over time; see next action). The capability of producing large numbers of healthy abalone in a captive setting has been proven for other closely related species and should be possible with white abalone, especially if production is expanded to include other key partners within the aquaculture industry.

Expected Benefits to the Species: Expanded captive production efforts by existing and future aquaculture partners are expected to produce hundreds of thousands of animals that are ready for experimental and large-scale outplanting over the next five to fifteen years. Captive-reared abalone will be held at multiple facilities, including commercial abalone culture facilities, under conditions that mimic natural conditions to maximize the fitness potential of the animals so that when they are transitioned to the wild, survival will be maximized.

Source: Captive propagation is discussed in the Recovery Strategy, Recovery Goals Objectives and Criteria and Recovery Program section of the NMFS (2008) recovery plan for white abalone.

- Recovery Action 1.4.2: Determine the best captive propagation design that serves to maintain the current genetic structure of the wild population (Priority # 1)
- Recovery Action 4.4: Comply with and periodically update NMFS global management plan for a captive propagation program (Priority # 1)
- Recovery Action 4.5: Encourage partnerships with potential permit applicants who may be interested in participating in furthering the goals of the captive propagation program (Priority # 2)

Location: Coastal California

NMFS Point of Contact: Melissa Neuman, WCR, Melissa.Neuman@noaa.gov, 562-980-4115; Susan Wang, WCR, Susan.Wang@noaa.gov, John Hyde, NMFS Southwest Fisheries Science Center (SWFSC), John.Hyde@noaa.gov, 858-546-7086.
Lead Partners: BML, WCR, CDFW
Partners: Aquarium of the Pacific, Cabrillo Marine Aquarium, Santa Barbara Natural History Museum Sea Center, University of California Santa Barbara, NMFS SWFSC, CDFW, The Cultured Abalone, The Abalone Farm, Southern California Marine Institute
Proposed Start Date: 2000
Expected Completion Date: 2030
Current Status: Between 2012 and 2015 the number of animals raised to the juvenile stage at partner facilities has increased by three orders of magnitude resulting in thousands of settled animals in captivity. The program is working to distribute hundreds of healthy juvenile white abalone to partner facilities throughout the state. Partners are working to get the Southern California abalone farms more involved in white abalone rearing, monitoring the growth and survival of juveniles, requesting to collect additional broodstock to increase the chances for successful future spawning and enhance the genetic diversity of the captive population, and exploring methods for improving health, reproductive maturation, fertilization rates and settlement success. NMFS is leading efforts with partners to develop innovative methods for minimizing disease risks and loss of genetic diversity among captive-reared abalone (Gruenthal et al. 2014), as well as non-invasive genetic methods for sex identification, and genomic tools for increasing the fitness potential of captive-raised abalone.
Updates: Update annually end of each fiscal year
Resources:

Funding:

$600K per year is needed. The program is currently funded at approximately $160K per year, of which some partners actually receive <50% after accounting for overhead.

Opportunities for Partners:

- We encourage sustained partnerships with BML, CDFW, Aquarium of the Pacific, Cabrillo Marine Aquarium, Santa Barbara Natural History Museum Sea Center, University of California Santa Barbara and encourage expanded partnerships with The Cultured Abalone, The Abalone Farm, Southern California Marine Institute, U.S. Navy, Port of San Diego, Hubbs-Sea World Research Institute, or another appropriate facility to expand the program's capacity for rearing large numbers of juvenile abalone prior to outplanting.

Implement a Successful Outplanting Program

Description and Background: Low species density leading to repeated recruitment failure and continued declines in abundance is the primary threat to white abalone. Enhancement of the wild population with captive-reared animals is the species' best hope for quickly boosting numbers so that the species can endure future threats such as El Niño, climate change, disease, or predation. Reintroduction of abalone, a species that plays a unique and crucial role in kelp forest ecosystem function, will help increase the resilience of these important habitats in the face of future threats, and thus will secure white abalone habitat into the future. Successful outplanting programs have been documented in other parts of the world, largely for supplementing fisheries, but there is evidence that it can also occur for bringing about recovery of white abalone.

Expected Benefits to the Species: Over the short term, experimental outplanting efforts will be conducted to refine methodologies and increase the chances of successful large-scale outplanting efforts. If successful over the long-term, this action will increase wild white abalone abundance to self-sustaining levels.

Source: Outplanting is discussed in the Recovery Strategy, Recovery Goals Objectives and Criteria and Recovery Program section of the NMFS (2008) recovery plan for white abalone.

- Recovery Action 3.3: Protect white abalone populations and habitat as they are discovered or established through outplanting (Priority #1)
- Recovery Action 4.6: Enhance wild populations by outplanting captive-bred white abalone in selected sites throughout the range of the species (Priority #1)

Location: Point Conception, California to Central Baja California, Mexico

NMFS Point of Contact: Melissa Neuman, WCR, Melissa.Neuman@noaa.gov, 562-980-4115; Kevin Stierhoff, SWFSC, Kevin.Stierhoff@noaa.gov, 858-546-7180; David Witting, NMFS Restoration Center (RC), David.Witting@noaa.gov, 562-980-3235.

Lead Partners: WCR, NMFS RC, SWFSC, CDFW

Partners: BML, The Bay Foundation, Get Inspired, Puget Sound Restoration Foundation, the University of Washington; Citizen Science Group of San Diego, Occidental College, Channel Islands National Marine Sanctuary, Channel Islands National Park

Proposed Start Date: 2000

Expected Completion Date: 2040

Current Status: NMFS is leading efforts with partners to develop innovative methods for outplanting, and outplanting other species of abalone in restored and natural kelp forests is underway to help us determine the best size and density of animals to outplant and the optimal locations for white abalone restoration efforts.

Updates: Update annually end of each fiscal year

Resources:

Funding:

$500K per year is needed. Current and past funding levels are approximately $100K per year.

Opportunities for Partners:

- We encourage sustained partnerships with CDFW, BML, The Bay Foundation, Get Inspired, Puget Sound Restoration Foundation, the University of Washington; Citizen Science Group of San Diego, Occidental College, Channel Islands National Marine Sanctuary, Channel Islands National Park.

Monitor and Enhance White Abalone Populations in the Wild

Description and Background: Monitoring wild white abalone has employed a number of tools (ROVs, SCUBA, in situ time lapse cameras, abalone recruitment modules) that have been useful for estimating population size (Stierhoff et. al. 2012), recording size distributions, estimating nearest neighbor distances, recording short-term movements and behavior, and estimating recruitment rates in the Southern California Bight. It is essential that these efforts continue and expand to include more tools (e.g., acoustic sensing of tagged abalone to track movements, genetic analysis to confirm identification and determine origin) and provide greater spatial coverage so that we will know whether our restoration efforts are effective and make changes as necessary.

Expected Benefits to the Species: Post-outplanting monitoring methods will be further developed and improved upon so that when the time for white abalone reintroduction comes, NMFS, CDFW and partners will have good confidence in the tools and methods used for measuring growth, survival and abundance of white abalone and gauging the overall success of the captive propagation and outplanting program. Continuing and expanding our monitoring and research program for white abalone in the wild will benefit the species by: 1) providing long-term trend data essential for gauging population status and health over time; 2) developing genetic tools that can help us identify abalone in the wild that are a product of our outplanting efforts; 3) understanding which factors play the most important role in white abalone survival, growth and reproduction; and 4) refining and adapting methodologies to make sure our efforts are resulting in data that is high in quality, fills information gaps, and addresses the question of whether outplanting is an effective recovery tool.

Source: Monitoring and research with extant wild populations of white abalone is discussed in the Recovery Strategy, Recovery Goals Objectives and Criteria and Recovery Program section of the NMFS (2008) recovery plan for white abalone.

- Recovery Action 1.1: Develop an assessment and monitoring program to identify current status of and track changes in wild subpopulations (Priority # 1)
- Recovery Action 1.2: Tag extant individuals belonging to multiple subpopulations (Priority # 2)
- Recovery Action 1.4: Conduct genetic analyses of wild population structure (Priority # 1)
    - Recovery Action 1.4.2: Determine the best field planting and translocation design that serves to maintain the current genetic structure of the wild population (Priority # 1)
- Recovery Action 2.4: Collaborate with Mexican researchers in assessing and monitoring white abalone habitat in Mexico (Priority # 2)

Location: Point Conception, California to Central Baja California, Mexico

NMFS Point of Contact: Melissa Neuman, WCR, Melissa.Neuman@noaa.gov, 562-980-4115; Kevin Stierhoff, SWFSC, Kevin.Stierhoff@noaa.gov, 858-546-7180; David Witting, NMFS RC, David.Witting@noaa.gov, 562-980-3235; John Hyde, SWFSC, John.Hyde@noaa.gov, 858-546-7086..

Lead Partners: SWFSC, WCR, NMFS RC, CDFW, NAVY

Partners: Citizen Science Group of San Diego, The Bay Foundation, Occidental College, Channel Islands National Marine Sanctuary, Channel Islands National Park

Proposed Start Date: 2000

Expected Completion Date: 2050

Current Status: ROV and SCUBA surveys in the Southern California Bight and Baja California, Mexico have been useful for identifying wild white abalone, characterizing the habitats they depend on, and examining trends in the size structure and abundance of the wild population over time (Stierhoff et al. 2012; Witting, Hagey, Neuman, Stierhoff, Williams, Taniguchi, Bosch, Kushner, unpublished data). Population declines of about 14% per year continue in at least one area, but in other locations presence has been recorded for the first time in over two decades and shell lengths suggest that very limited recruitment may have occurred since 2001. Overall, abundance remains extremely low, distribution is patchy, and movements over the short-term (weeks to months) are limited, supporting the view that successful reproduction in the wild is occurring infrequently or not at all in most areas of the range. CDFW has monitored artificial modules that sit on the ocean floor and are designed to examine the occurrence of baby abalone (recruitment). Thus far this monitoring has revealed that in Southern California, recruitment of all abalone species to the modules is extremely rare.

Updates: Update annually end of each fiscal year

Resources:

Funding:

$350K per year is needed. This level of funding would support a partnership agreement with CDFW to partner with abalone biologists and divers, and provide funding for field work on the R/V Garibaldi. Current funding is about $150 per year.

Opportunities for Partners:

- We encourage sustained partnerships with CDFW, Navy, Citizen Science Group of San Diego, The Bay Foundation, Occidental College, Channel Islands National Marine Sanctuary, Channel Islands National Park, and seek additional partners to support the white abalone monitoring program.

Identify, Characterize, and Prioritize Existing and Potential White Abalone Kelp Forest Habitat

Description and Background: All subtidal kelp forests are not equal in providing suitable habitat for supporting viable white abalone populations. Fine-scale characterization of habitats (on the order of meters) that currently or historically supported white abalone can be accomplished through the use of ROVs, SCUBA, acoustic mapping, time-lapse video tools, and local oceanographic data.

Expected Benefits to the Species: Identifying optimal habitats can improve agency efficiency by highlighting areas that should be prioritized for conservation (e.g., marine conservation/protected areas, restoration activities, sanctuary designation) and/or regulatory efforts (e.g., ESA Section 7 consultations, mitigation banking).
Source: Habitat characterization of kelp forests is discussed in the Recovery Strategy, Recovery Goals Objectives and Criteria and Recovery Program section of the NMFS (2008) recovery plan for white abalone.

- Recovery Action 2.1: Identify existing and potential habitat using multibeam sonar generated bathymetry data and quantify and revise estimates of habitat availability in California (Priority # 1)
- Recovery Action 2.2: Generate ROV transect data to assess biological and physical attributes of habitat (Priority # 1)
- Recovery Action 2.3: Determine the level of risk associated with habitat degradation/destruction that existing and potential viable populations (will) face (Priority # 2)

Location: Point Conception, California to Central Baja California, Mexico
NMFS Point of Contact: Melissa Neuman, WCR, Melissa.Neuman@noaa.gov, 562-980-4115; Kevin Stierhoff, SWFSC, Kevin.Stierhoff@noaa.gov, 858-546-7180; David Witting, NMFS RC, David.Witting@noaa.gov, 562-980-3235.
Lead Partners: WCR, NMFS RC, SWFSC, CDFW, NAVY
Partners: Citizen Science Group of San Diego, Occidental College, Channel Islands National Marine Sanctuary, Channel Islands National Park
Proposed Start Date: 2000

Expected Completion Date: 2040

Current Status: ROV surveys and acoustic maps have provided information regarding broad-scale habitat features (e.g., depth, relief, algal composition) that may help predict the presence of white abalone in Southern California kelp forests (Butler et. al. 2006). Finer-scale information is necessary for narrowing down the broad array of habitat characteristics that may be suitable for white abalone so that enhancement and protective efforts are focused on areas that are most likely to promote the survival of white abalone.

Updates: Update annually end of each fiscal year

Resources:

Funding:

No funds have been allocated to date. Approximately $100K per year is needed.

Opportunities for Partners:

- We encourage sustained partnerships with CDFW, Navy, Citizen Science Group of San Diego, Occidental College, Channel Islands National Marine Sanctuary, Channel Islands National Park and seek additional partners to identify suitable kelp habitat.

Develop a Comprehensive, Multi-Institution Outreach Plan

Description and Background: Despite the different approaches that current partners may take when educating interested parties about the white abalone recovery program, it is necessary for them to communicate consistent themes and unified messages in lesson plans, signage, research proposals, presentations, web posts, media interviews, etc. Highlighting the important role that additional partners (e.g., Mexican researchers, cooperative Mexican fisheries ("cooperativos"), enforcement agencies, and citizen scientists) could be playing in reaching their particular audiences and/or geographic areas and informing them about white abalone recovery is critical to the success of the white abalone recovery program.

Expected Benefits to the Species: Communicating a clear and consistent message regarding the goals of the white abalone recovery program will broaden overall support for the program. Greater geographic coverage of public and private partners is needed to address threats and challenges that are specific to different areas throughout the species' range. Increased support will come in a variety of forms including financial, logistical, regulatory, enforcement, international, and scientific. All of this support is necessary to move the recovery program for white abalone forward.

Source: Outreach, education, coordination with enforcement and Mexico is discussed in the Recovery Strategy, Recovery Goals Objectives and Criteria and Recovery Program section of the NMFS (2008) recovery plan for white abalone.

- Recovery Action 1.6: Maintain and enhance communications with the Mexico (Priority # 2)
- Recovery Action 1.6.3: Collaborate with Mexico to help improve our understanding of the status of extant subpopulations throughout the range and to help conserve and protect them (Priority # 2)
- Recovery Action 2.4: Collaborate with Mexican researchers in assessing and monitoring white abalone habitat in Mexico (Priority # 2)
- Recovery Action 3.3.3: Establish an interagency enforcement task force that can monitor areas containing viable populations of white abalone on a semi-regular basis (Priority # 1)
- Recovery Action 4.5: Encourage partnerships with potential permit applicants who may be interested in participating in furthering the goals of the captive propagation program (Priority # 2)
- Recovery Priority 6.2: Form cooperative funding agreements among state, federal and private entities (Priority # 1)

Location: California to Central Baja California, Mexico

NMFS Point of Contact: Melissa Neuman, WCR, Melissa.Neuman@noaa.gov, 562-980-4115; Susan Wang, WCR, Susan.Wang@noaa.gov, 562-980-4119; Gabrielle Dorr, NMFS RC, Gabrielle.Dorr@noaa.gov, 562-980-3236; Peggy Foreman, Peggy.Foreman@noaa.gov, 206-526-4447; Michelle Zetwo, NOAA Office of Law Enforcement, Michelle.Zetwo@noaa.gov, 619-557-5494

Lead Partners: WCR

Partners: NMFS RC, BML, CDFW, Aquarium of the Pacific, Cabrillo Marine Aquarium, Santa Barbara Natural History Museum Center, University of California Santa Barbara, Get Inspired, LA Conservation Corps SeaLab, California Science Center, NOAA Office of Law Enforcement, Center for Scientific Research and Higher Education at Ensenada, Instituto Nacional de la Pesca, Stanford University

Proposed Start Date: 2013

Expected Completion Date: 2020

Current Status: NMFS has worked to develop a communication plan for white abalone that involves posting web stories about the progress of recovery partners and sharing those stories via a list serve. NMFS is currently formalizing K-12 lesson plans that will be posted on the web. NMFS is convening a workshop for existing partners to prioritize methods and messaging for the captive propagation and enhancement program. University of California Santa Barbara is leading the development of a plan for educators and aquaria that will emphasize key messages that should be incorporated into their lessons and outreach tools.

Updates: Update annually end of each fiscal year

Resources:

Funding:

No funds have been allocated to date. Approximately $100K per year is needed. Staff within and outside NMFS have been contributing to this effort, but a dedicated contractor or full-time employee is needed to bring a multi-faceted outreach plan together to enhance current limited outreach capabilities.

Opportunities for Partners:

- We encourage sustained partnerships with BML, CDFW, Aquarium of the Pacific, Cabrillo Marine Aquarium, Santa Barbara Natural History Museum Center, University of California Santa Barbara, Get Inspired, LA Conservation Corps SeaLab, California Science Center, Center for Scientific Research and Higher Education at Ensenada, Instituto Nacional de la Pesca, Stanford University, and seek additional partners such as researchers and citizen scientists in both the United States and Mexico, fisheries cooperatives, and enforcement agencies to support outreach efforts.
- We encourage U.S. citizens to report abalone poaching or suspicious activity on CALTIP (Californians Turn In Poachers) run by the CDFW. Number to call is 1-888-334-2258. http://www.dfg.ca.gov/enforcement/caltip.aspx. Taking of any species of abalone in California is against the law, except for the recreational take of red abalone north of San Francisco during designated time periods.

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