UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

MAR 30 2011

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act (NEPA), an environmental review has been performed on the following action.

TITLE:	Environmental Assessment on the Effects of NMFS Permitted Scientific Research and Enhancement Activities of Endangered White Abalone (*Haliotis sorenseni*)
LOCATION:	Captive research on live abalone under the direction of UC Davis Bodega Marine Laboratory and experimental small-scale field planting in the Channel Islands at three sites on the south side of Santa Cruz Island (along Yellow Banks outside of the protected area Gull Island Reserve).
SUMMARY:	Research activities will be focused on the establishment of a captive breeding program. Key aspects of research include reproduction, larval behavior, ecology, disease, endocrinology, and optimal field planting techniques. In addition, white abalone will be maintained at participating aquariums for education and reserve holding. No white abalone will be taken from the wild; animals will come from existing captive broodstock and their progeny.
RESPONSIBLE OFFICIAL:	James H. Lecky Director, Office of Protected Resources National Marine Fisheries Service National Oceanic and Atmospheric Administration 1315 East-West Highway, Room 13821 Silver Spring, MD 20910 (301) 713-2332

The environmental review process led us to conclude that this action will not have a significant effect on the human environment. Therefore, an environmental impact statement will not be prepared. A copy of the finding of no significant impact (FONSI) including the supporting environmental assessment (EA) is enclosed for your information.

Although NOAA is not soliciting comments on this completed EA/FONSI we will consider any comments submitted that would assist us in preparing future NEPA documents. Please submit any written comments to the responsible official named above.

Sincerely,

for Paul N. Doremus, Ph.D.
NOAA NEPA Coordinator

ENVIRONMENTAL ASSESSMENT
ON THE EFFECTS OF NMFS PERMITTED SCIENTIFIC RESEARCH AND ENHANCEMENT ACTIVITIES ON ENDANGERED WHITE ABALONE (*Haliotis sorenseni*)

March 2011

Lead Agency: USDC National Oceanic and Atmospheric Administration
National Marine Fisheries Service, Office of Protected Resources

Responsible Official: James H. Lecky, Director, Office of Protected Resources

For Further Information Contact: Office of Protected Resources
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Location: The University of California, Davis, Bodega Marine Laboratory, California and associated research partner facilities in California.

Abstract: The National Marine Fisheries Service (NMFS), Office of Protected Resources, proposes to issue a scientific research and enhancement permit to the University of California, Davis, Bodega Marine Laboratory, Bodega Bay, California for the captive maintenance, breeding and outplanting (referred to as field planting) of white abalone (*Haliotis sorenseni*), pursuant to the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.). The purpose of this research is to overcome key barriers to captive propagation of the endangered white abalone, to identify limitations to reproduction in wild animals, to further understand disease processes and how to mitigate them, and the most successful means of restoration. In addition, white abalone will be maintained at participating aquariums for education and reserve holding. No white abalone will be taken from the wild; animals will come from existing captive broodstock and their progeny. The permit would be valid for five years from the date of issuance.

Scientific research permits are generally categorically excluded from the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 et seq.) requirements to prepare an environmental assessment (EA) or an environmental impact statement (EIS) (NAO 216-6). However, the issuance of permits for scientific research or to enhance the propagation or survival of a listed species pursuant to section 10(a)(1)(A) of the ESA when hatchery activities are involved requires development of an EA (NAO 216-6, section 6.03(e)(2)(c)). Therefore, for this action NMFS prepared an Environmental Assessment (EA) to facilitate a more thorough assessment of potential impacts on endangered white abalone. This EA evaluates the potential impacts to the human environment from issuance of the proposed permit.

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CHAPTER 1 PURPOSE OF AND NEED FOR ACTION

1.1 DESCRIPTION OF ACTION

In response to receipt of a request from the University of California, Davis, Bodega Marine Laboratory, 2099 Westside Road, Bodega Bay, CA 94923 [Gary Cherr, Ph.D., Principal Investigator] (File No. 14344), NMFS proposes to issue a scientific research and enhancement permit that authorizes "takes"[1] of white abalone pursuant to the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq*.) and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226).

1.1.1 Background

This permit application would continue the work being conducted under Permit No. 1346, issued to the Channel Islands Marine Resource Institute (CIMRI) [Thomas B. McCormick, Principal Investigator]. Permit No. 1346 issued on May 17, 2002, authorizes the collection of white abalone adults from the wild, captive propagate of the broodstock, maintenance and rearing of offspring in a captive setting and the conduct of research with individuals bred in captivity, including experimental field planting of animals for the purposes of enhancing the wild population and recovering the species. In May of 2008, all of the white abalone (4 wild broodstock and 30 progeny) held under Permit No. 1346 were transferred to the Bodega Marine Laboratory located in Bodega Bay, California due to growing concerns about potential disruptions in high quality water supply at CIMRI. On August 20, 2009, NMFS received this permit application from UC Davis, Bodega Bay Laboratory.

1.1.2 Purpose and Need

The primary purpose of the permit is to provide an exemption from the take prohibitions under the ESA to allow "takes" for bona fide scientific research and enhancement purposes. The need for issuance of the permit is related to NMFS's mandate under the ESA. Specifically, NMFS has a responsibility to implement the ESA to protect, conserve, and recover threatened and endangered species under its jurisdiction. The ESA prohibits takes of threatened and endangered species, respectively, with only a few very specific exceptions, including for scientific research and enhancement purposes. Permit issuance criteria require that research activities are consistent with the purposes and polices of the ESA and will not have a significant adverse impact on the species or stock. The permit application focuses on the continuation of three research/enhancement objectives:

Captive propagation of white abalone: Under the current ESA permit (Permit No. 1346); CIMRI established a cultivation and research effort in cooperation with federal and state agencies as well as colleges, universities, and aquariums. CIMRI's hatchery program at Ormond Beach Hatchery in Oxnard, California held broodstock collected from the wild prior to ESA listing. CIMRI successfully applied large-scale abalone cultivation techniques to white abalone

1 The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The term "harm" is further defined by regulations (50 CFR §222.102) as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering."

and produced hatchery-raised animals. Although the ultimate goal of the captive propagation program was to produce white abalone for field planting, a very large proportion of the progeny succumbed to the infectious disease known as Withering Syndrome, and most of the remainder died of unknown causes or in association with a poorly understood disease of the shell ("shell disease"). The CIMRI site was abandoned in May of 2008 when the remaining animals at CIMRI were transferred to Bodega Marine Laboratory.

Research: Captive propagation of white abalone at CIMRI yielded information on the effects of abiotic (e.g., temperature, habitat type) and biotic (e.g., predator presence, food type, disease) factors on the growth and survival of white abalone from fertilization through maturation. Their results are summarized below:

- Fecundity – Previous field studies (Tutschulte, 1976) inferred that animals in the wild must attain a shell length of 100 mm to be sexually mature. CIMRI found that hatchery-raised abalone may become sexually mature at an age of only one year at a shell length of 25 mm (McCormick and Brogan 2003).
- Fertilization rates of greater than 95% are possible in the hatchery.
- Optimal growth and survival occurs at 15°C.
- Of several diets that have been tested to date, growth and survival was optimal when animals are fed a diet of Giant Kelp (*Macrocystis pyriferia*) and Pacific Dulse (*Palmaria mollis*).
- White abalone in captive culture grow best at densities (25 g/ liter) about half that used for commercial culture of red abalone (*Haliotis rufescens*).
- In the hatchery, juvenile and early adult white abalone display a rafting behavior, crawling onto moving kelp. This is the first time that this behavior, common for a range of marine invertebrates, has been described for abalone (McCormick et al. 2008). This behavior has the potential to significantly impact gene flow in wild populations.
- Withering Syndrome, a lethal bacterial disease of unknown origin that is now endemic to ocean waters in southern and central California, has been shown to cause high mortalities in multiple species of cultured and wild abalone. CIMRI found that Withering Syndrome can be equally devastating to hatchery populations of white abalone. Working with the Universities of Washington (Friedman et al. 2007) and California, Davis (Moore and McCormick 2008), CIMRI identified an effective antibiotic treatment capable of completely eliminating the pathogen from infected individuals.
- Field planting modules were established in collaboration with the state and UC Davis at field sites in southern California. These 12 modules at three locations can be used for field planting and subsequent monitoring.
- Due to disease concerns, none of the abalone produced at CIMRI were used in field planting studies.

Public outreach and education: Education activities were identified in the White Abalone Recovery Plan (NMFS 2008) with the intent of establishing multidirectional sharing of information between the federal, state and local government, constituent groups, academia, and the general public. This public outreach and education program will help to raise awareness of the ecological and economic importance of abalone species with a focus on the need for restoration of the endangered white abalone, as well as raising awareness of the unique life history features of marine invertebrates and the risk of extinction at low population densities.

Although the primary focus at the Bodega Marine Laboratory (BML) will be its role as the primary holding facility and center of research, BML receives more than 12,000 public visitors each year and white abalone would be incorporated into the existing public education program. Initial educational programs were created between CIMRI and the Cabrillo Marine Aquarium (N=20) and the Ty Warner Sea Center (N= 4). This permit seeks to include the Aquarium of the Pacific (N=6) in this education initiative. Captive breeding is requested to occur at Cabrillo Marine Aquarium and the Aquarium of the Pacific under the supervision of the principal investigator. These facilities also function as alternate holding facilities for grow out for field planting efforts, freeing up space at the (BML) to maximize research capacity, and as a reserve in the case of a catastrophic failure of the primary research facility.

1.1.3 Research Objectives

The primary objective of this research is to gain fundamental knowledge on several aspects of white abalone biology that would lead to the development of an effective captive rearing and enhancement program. There is a startling dearth of information on key aspects of white abalone biology, including the fields of reproduction, larval behavior, ecology, disease, endocrinology, and optimal field planting techniques, which are essential topics to design effective captive propagation and restoration strategies.

This research objective is directly linked to the White Abalone Recovery Plan. Recovery Goal #4 outlines necessary actions for the continuation, refinement and expansion of a captive propagation and enhancement program for white abalone in California with the goal of artificially enhancing populations in the wild. In addition, Recovery Goal #5 calls for planning and implementing a public outreach and education plan. This goal is being supported by the work of Cabrillo Marine Aquarium and the Ty Warner Sea Center. The Aquarium of the Pacific is also interested in creating a public education program as well as filling the role as a grow-out facility.

In general, the primary goal will be to generate lab-raised white abalone for a suite of research topics, using the remaining wild-collected broodstock and their progeny, to answer questions associated with establishing an effective captive breeding and field planting program. Unlike Permit No. 1346-01, collection of wild white abalone is not being requested and activities will be conducted with the animals currently in captivity and their progeny.

The objectives of the proposed research, laboratory cultivation, enhancement, and educational activities are as follows:

1. Increase the knowledge of the biology of white abalone.

2. Identify and overcome barriers to critical stages of captive propagation (broodstock conditioning, spawning, larval rearing, settling and metamorphosis, juvenile grow-out, disease susceptibility and treatment).

3. Develop successful field planting strategies (identify optimal field planting sites and habitat, size at planting, cultivation methods prior to planting that reduce predation and disease susceptibility).

4. Educate and inform the public as to the role of abalone in the marine ecosystem, the impact of low density on population recovery and the current status of white abalone as an endangered species.

1.2 OTHER EA/EIS THAT INFLUENCE SCOPE OF THIS EA

The original CIMRI Permit No. 1346 was issued on May 17, 2002, and was limited to the establishment of a captive breeding program utilizing pre-listed white abalone as broodstock and the rearing of the progeny. Because no actions were occurring in the wild (collection or field planting), it was determined that this action was categorically excluded from further NEPA analyses. Under Section 7 of the ESA, it was concluded in an informal consultation that the action was not likely to adversely affect the wild population given that the research was to take place in a captive situation and would not involve any takes in the wild.

On July 2, 2004, a modification was issued to Permit No. 1346, issued to CIMRI, which included the collection and field planting of white abalone for the purposes of scientific research and enhancement. This action included an Environmental Assessment and a Biological Opinion under Section 7 of the ESA. The resulting EA, *Environmental Assessment on the Effects of NMFS Permitted Scientific Research Activities on Endangered White Abalone (Haliotis sorenseni)*, analyzed the effects of the collection of white abalone adults from the wild, the captive propagation and maintenance of offspring in a captive setting and the conduct research with individuals bred in captivity, including experimental field planting of animals for the purposes of enhancing the wild population and recovering the species. A Finding of No Significant Impact (FONSI) was signed by the Assistant Administrator for Fisheries on June 21, 2004, stating that issuance of the proposed permit would not significantly impact the quality of the human environment.

Following issuance of Modification #1 to Permit No. 1346, five minor modifications have been issued. No NEPA analysis was conducted on these amendments as there were no additional impacts to the environment from these actions that were not previously analyzed under the EA prepared for the first modification. Modification #2 authorized the transfer of white abalone progeny to the Cabrillo Marine Aquarium and the Ty Warner Sea Center for public education and grow-out. The following four modifications (#3 - #6) extended the permit while determinations regarding CIMRI's future and responsibility for the subsequent permit were being made. Permit No. 1346-07 will expire on April 1, 2011.

1.3 SCOPING SUMMARY

The purpose of scoping is to identify the issues to be addressed and the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues that are not significant or that have been covered by prior environmental review. An additional purpose of the scoping process is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes. CEQ regulations implementing the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 et seq.) do not require that a draft EA be made available for public comment as part of the scoping process.

1.3.1 Comments on application

A Notice of Receipt of the application was published in the *Federal Register*, announcing the availability of the application for public comment (74 FR 43679, August 27, 2009). No public comments were received on the application.

1.4 APPLICABLE LAWS AND NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

This section summarizes federal, state, and local permits, licenses, approvals, and consultation requirements necessary to implement the proposed action, as well as who is responsible for obtaining them. Even when it is the applicant's responsibility to obtain such permissions, NMFS is obligated under NEPA to ascertain whether the applicant is seeking other federal, state, or local approvals for their action.

1.4.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was enacted in 1969 and is applicable to all "major" federal actions significantly affecting the quality of the human environment. A major federal action is an activity that is fully or partially funded, regulated, conducted, or approved by a federal agency. NMFS issuance of permits for research represents approval and regulation of activities. While NEPA does not dictate substantive requirements for permits, licenses, etc., it requires consideration of environmental issues in federal agency planning and decision making. The procedural provisions outlining federal agency responsibilities under NEPA are provided in the Council on Environmental Quality's implementing regulations (40 CFR Parts 1500-1508).

NOAA has, through NOAA Administrative Order (NAO) 216-6, established agency procedures for complying with NEPA and the implementing regulations issued by the CEQ. NAO 216-6 specifies that issuance of scientific research permits under the MMPA and ESA is among a category of actions that are generally exempted (categorically excluded) from further environmental review, except under extraordinary circumstances. When a proposed action that would otherwise be categorically excluded is the subject of public controversy based on potential environmental consequences, has uncertain environmental impacts or unknown risks, establishes a precedent or decision in principle about future proposals, may result in cumulatively significant impacts, or may have an adverse effect upon endangered or threatened species or their habitats, preparation of an EA or EIS is required.

While issuance of scientific research permits is typically subject to a categorical exclusion, as described in NAO 216-6, NMFS is preparing an EA for these actions to provide a more detailed analysis of effects to ESA-listed species. This EA is prepared in accordance with NEPA, its implementing regulations, and NAO 216-6.

1.4.2 Endangered Species Act

Section 9 of the ESA, as amended, and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption such as by a permit. Permits to take ESA-listed species for scientific purposes, or for the purpose of enhancing the propagation or survival of the species, may be granted pursuant to Section 10(a)(1)(A) of the ESA.

NMFS has promulgated regulations to implement the permit provisions of the ESA (50 CFR Part 222) and has produced OMB-approved application instructions that prescribe the procedures necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the ESA.

Section 10(d) of the ESA stipulates that, for NMFS to issue permits under section 10(a)(1)(A) of the ESA, the Agency must find that the permit: was applied for in good faith; if granted and exercised will not operate to the disadvantage of the species; and will be consistent with the purposes and policy set forth in Section 2 of the ESA.

Section 2 of the ESA sets forth the purposes and policy of the Act. The purposes of the ESA are to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in section 2(a) of the ESA. It is the policy of the ESA that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA. In consideration of the ESA's definition of conserve, which indicates an ultimate goal of bringing a species to the point where listing under the ESA is no longer necessary for its continued existence (i.e., the species is recovered), exemption permits issued pursuant to section 10 of the ESA are for activities that are likely to further the conservation of the affected species.

Section 7 of the ESA requires consultation with the appropriate federal agency (either NMFS or the U.S. Fish and Wildlife Service) for federal actions that "may affect" a listed species or adversely modify critical habitat. NMFS issuance of a permit affecting ESA-listed species or designated critical habitat, directly or indirectly, is a federal action subject to these Section 7 consultation requirements. Section 7 requires federal agencies to use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. NMFS is further required to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of habitat for such species. Regulations specify the procedural requirements for these consultations (50 Part CFR 402).

1.4.3 National Marine Sanctuaries Act

NMSA (32 U.S.C. 1431 et seq.) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance. The National Marine Sanctuary Program, operating under the NMSA and administered by NOAA's National Ocean Service (NOS) has the authority to issue special use permits for research activities that would occur within a National Marine Sanctuary. Obtaining special use permits is the responsibility of individual researchers.

1.4.4 Magnuson-Stevens Fishery Conservation and Management Act

Under the MSFCMA Congress defined Essential Fish Habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH provisions of the MSFCMA offer resource managers means to accomplish the goal of giving heightened consideration to fish habitat in resource management. NMFS Office of Protected Resources is required to consult with NMFS Office of Habitat Conservation for any action it authorizes (e.g., research permits), funds, or undertakes, or proposes to authorize, fund, or undertake that may adversely affect EFH. This includes renewals, reviews or substantial revisions of actions.

CHAPTER 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the range of potential actions (alternatives) determined reasonable with respect to achieving the stated objective, as well as alternatives eliminated from detailed study. This chapter also summarizes the expected outputs and any related mitigation of each alternative. One alternative is the "No Action" alternative where the proposed permit would not be issued. The No Action alternative is the baseline for rest of the analyses. The Proposed Action alternative represents the research proposed in the submitted application for a permit, with standard permit terms and conditions specified by NMFS.

2.1 ALTERNATIVE 1 – NO ACTION

Under this alternative, the permit for scientific research of white abalone would not be issued. However, takes presently authorized for white abalone under the permit held by Thomas B. McCormick, (Permit No. 1346) would continue until the permit expires on April 1, 2011. This permit currently authorizes the permit holder to breed pre-listed white abalone and maintain the progeny for scientific research at the Bodega Marine Laboratory. Upon expiration of the permit, the pre-Act animals could be maintained without additional permits; however the progeny are considered listed animals and they would have to be humanely euthanized.

Under this alternative, non-intrusive research techniques could be utilized to assess and monitor the remaining white abalone population as well as conduct assessments of abalone habitat. Current no-fishing laws would continue to be enforced (fishing has been identified as the primary reason for the decline of the white abalone populations) and the natural population of white abalone would be left in situ to recover on its own. Permits would not be required for non-intrusive surveys, as the animals would be left undisturbed in their environment. This alternative would allow for the collection of information regarding the current abalone population and also on life history characteristics, population dynamics, and suitable habitat characteristics. Management strategies and recovery efforts would be developed for white abalone, based on research results.

2.2 ALTERNATIVE 2 – PROPOSED ACTION (ISSUANCE OF PERMIT WITH STANDARD CONDITIONS)

Under the Proposed Action, a permit (File No. 14344) would be issued to the Bodega Marine Laboratory for the continued scientific research and enhancement activities of endangered white abalone. This permit would specifically authorize: 1) the continued maintenance of currently captive white abalone, 2) a captive breeding program, 3) captive research associated with reproduction, development, and disease, and 4) experimental small-scale field planting.

The proposed action would not authorize the collection of any white abalone from the wild. The permit would condition that broodstock be reserved for captive propagation purposes only and not be used for research purposes. A minimum of 5,000 progeny from each year class would be raised to maturity for field planting. In addition, every attempt must be made to field plant progeny within the known geographic range of parents, but isolated from extant populations and all abalone must be screened for disease and parasites prior to release or transport.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Alternatives considered but eliminated include those alternatives that would call for the collection or translocation of animals from the wild. The applicant is not at this time interested in pursuing collections and is focusing on establishing a captive program that will maximize propagation of progeny, capitalize on research efforts and methodically work through the challenges of field planting. Those alternatives that fall under this heading include: 1) translocation of white abalone into aggregations; 2) a phased collection of individuals over time; and 3) a onetime collection of a subset or of all known white abalone individuals. These alternatives are excluded from further analysis.

CHAPTER 3 AFFECTED ENVIRONMENT

This chapter presents baseline information necessary for consideration of the alternatives, and describes the resources that would be affected by the alternatives, as well as environmental components that would affect the alternatives if they were to be implemented. The effects of the alternatives on the environment are discussed in Chapter 4.

3.1 SOCIAL AND ECONOMIC ENVIRONMENT

3.1.1 Hatchery and Research Facilities

The majority of the permitted activities would occur at the Bodega Marine Laboratory or the facilities of affiliated research and education partners. A list of associated facilities is provided in Table 1.

Table 1: Associated Facilities under File No. 14344

Facility	Role	Primary Contact
UC Davis Bodega Marine Laboratory[1]	Research	Gary N. Cherr, Ph.D.
University of California, Santa Barbara[1]	Research	Hunter Lenihan, Ph.D.
Southwest Fisheries Science Center	Research	John Butler, Ph.D.
University of Washington	Terminal Research	Carolyn Friedman, Ph.D.
Northwest Fisheries Science Center	Research (samples)	Linda Park, Ph.D.
Scripps Institution of Oceanography	Research (samples)	Ronald Burton, Ph.D.
Cabrillo Marine Aquarium[1]	Education and Public Outreach	Mike Schaadt
Ty Warner Sea Center	Education and Public Outreach	Amanda Hendrickson
Aquarium of the Pacific[1]	Education and Public Outreach	Sandy Trautwein

[1] captive breeding is authorized at these facilities

The associated facilities are equipped to maintain and conduct the proposed research and enhancement activities. The Bodega Marine Laboratory, the University of California at Santa Barbara and the Southwest Fisheries Science Center are research laboratories with seawater delivery systems that are reliable and monitored regarding temperature control, filtration and UV

irradiation. The University of Washington facility consists of recirculating tanks. The laboratory at the Scripps Institution of Oceanography would receive only tissue samples for genetic analysis and would not work with live individuals. The Cabrillo Marine Aquarium and the Ty Warner Sea Center are public aquaria that are currently displaying live white abalone as integral components of their education/conservation programs and serve as grow-out facilities. The Aquarium of the Pacific recently received six white abalone as part of their education and conservation program and is functioning as a grow-out site. Both Cabrillo Marine Aquarium and the Aquarium of the Pacific will be authorized to participate in breeding activities. All facilities that maintain live abalone require permits from the California Department of Fish and Game certifying that they are sabellid-free and those facilities must be regularly inspected.

3.1.2 Field-planting Sites

The only activities that will occur outside of the captive environment would be experimental field planting of progeny. Experimental small-scale field planting would occur in the Channel Islands utilizing existing Baby Abalone Recruitment Modules (BARTs) that were designed for white abalone restoration and located at three sites on the south side of Santa Cruz Island (along Yellow Banks outside of the protected area Gull Island Reserve). Expansion of field planting efforts would be dependent on bottom topography, temperatures, potential predators and coralline algae type and would include sites that were historically maintained white abalone such as San Clemente Island north and south (Rogers-Bennett et al. 2002b).

The social and economic effects of the Proposed Action mainly involve the effects on the people involved in the research, as well as any industries that support the research, such as charter vessels and suppliers of equipment needed to accomplish the research. The research would not be expected to impact, inhibit, or prevent other human activities from occurring. More likely, researchers would have to adjust or modify their plans around such activities. No economic losses to other human activities would be expected as a result of the research. Permitting the proposed research could result in a low level of economic benefit to local economies in the action area. However, such impacts would be negligible on a national or regional (state) level and therefore are not considered significant. No significant social or economic impacts of the Proposed Action are interrelated with significant natural or physical environmental effects. Thus, the EA does not include any further analysis of social or economic effects of the proposed action.

3.2 PHYSICAL ENVIRONMENT

The area extending approximately 1,000 km from Point Conception southward past San Diego is a region referred to as the Southern California Bight (SCB). The SCB represents all of the U.S. range of white abalone and approximately half of the entire range (U.S. and Mexican) of white abalone. Kelp forests, abundant and relatively predictable food sources for white abalone, cover most of the rocky subtidal habitat in the SCB.

The continental shelf along the SCB is very narrow (<<10 km), and at its widest, extends about 300 km from the mainland. Along the mainland coast, the dominant nearshore habitat is sandy beach; while along the offshore islands (Channel Islands), the shores are predominantly rocky. The benthos consists of soft sediment with patches of rocky outcrops, the preferred habitat of white abalone.

Three large-scale currents (>500 km alongshore) occur in this region, the California Current, the California Undercurrent, and the Davidson Current. The California Current flows towards the equator along the shelf break of the Pacific coast and then turns west along Baja, CA to flow offshore. The California Current, which transports colder, fresher subarctic water, is the dominant current in the SCB and is strongest at the sea surface and during the summer (seasonal mean speed of 10 cm/s). The California Undercurrent flows poleward along the continental slope and transports warmer, saltier Southern water. This subsurface current is at a maximum in summer (peak speeds 30-50 cm/s) and strongest flow occurs 100-300 m below the sea surface. During fall and winter, a poleward-flowing countercurrent surfaces to form a warmer-water current called the Davidson Current. The Davidson Current is broader and sometimes stronger than the California Undercurrent and can extend seaward of the continental slope. Smaller-scale features that occur in the SCB and exhibit temporal and spatial variability include the Southern California Countercurrent and the Southern California Eddy.

Wind-driven, coastal upwelling, which brings colder, nutrient-rich water to the surface, helps fuel primary production within the SCB. During summer, upwelling in the SCB is minimal or absent as a result of locally reduced wind stress. Upwelling is also reduced every few years due to El Nino.

3.2.1 Sanctuaries, Parks, Historic Sites, etc.

The eight islands within the SCB, or the U.S. Channel Islands, lie 19-97 km off the mainland coast. The Channel Islands are in an area of upwelling, which supports the rich marine flora and fauna of the islands. Algae and invertebrates dominate the rocky intertidal communities of the islands, and giant kelp forests, which provide habitat for a diverse assemblage of fish, invertebrates and other algae, structure the nearshore community. In 1980, a 1,252-square-nautical-mile portion of the Santa Barbara Channel within the SCB was designated a National Marine Sanctuary. The Channel Islands National Marine Sanctuary encompasses the waters that surround Anacapa, Santa Cruz, Santa Rosa, San Miguel and Santa Barbara Islands, and extend from mean high tide to six nautical miles offshore around each of the five islands.

Channel Islands National Park consists of five of the eight Channel Islands that span 160 miles off the coast of southern California. Congress established San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, and the submerged lands and waters within one nautical mile of each island as Channel Islands National Park on March 5, 1980; although Anacapa and Santa Barbara Islands had been a national monument since 1938.

The three field planting sites are located within the boundaries of the Channel Islands National Marine Sanctuary and Channel Islands National Park. Four BARTs were placed at the sites at depths of 18 – 26 m (60 – 85 feet). Each BART consists of a cage filled with pieces of concrete blocks and has a foot print of 72 X 91 cm (28.5 X 36 inches). BARTs are placed on rock / sand bottoms and do not permanently modify the substrate. The BARTs were deployed in 2004 and have been in place for four years. Monitoring of the BARTs has occurred at least once a year since their deployment. The Department of Fish and Game obtained a research permit from the Channel Islands National Marine Sanctuary to deploy the BARTs and to conduct research on them (permit number: CINMS-2004-003).

3.2.2 Essential Fish Habitat

EFH has been designated for many of the fish species within the action area identified for field planting (i.e. three sites near the Channel Islands). The Pacific Fishery Management Council manages fisheries for about 119 species of salmon, groundfish, coastal pelagic species (sardines, anchovies, and mackerel), and highly migratory species (tunas, sharks, and swordfish). Details of the designations and descriptions of the habitats are available in the Fishery Management Plans of the Pacific Fishery Management Council (http://www.pcouncil.org/). Activities that have been shown to affect EFH include disturbance or destruction of habitat from stationary fishing gear, dredging and filling, agricultural and urban runoff, direct discharge, and the introduction of exotic species. None of the activities in the Proposed Action are directed at or likely to have any impact on any designated EFH.

3.2.3 Designated Critical Habitat

As part of the final rule listing white abalone as endangered (66 FR 29046; May 29, 2001), NMFS determined that it was not prudent to designate critical habitat, because identification of such habitat would be expected to increase the threat of poaching for this species. This determination is consistent with § 424.12(a)(1)(i) of NMFS' and the U.S. Fish and Wildlife Service's joint implementing regulations for listing endangered and threatened species and designating critical habitat (50 CFR part 424) which states that a designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and the identification of critical habitat can be expected to increase the degree of such threat to the species, or (2) such designation of critical habitat would not be beneficial to the species.

Over-harvesting of white abalone for human consumption has been identified as the primary factor responsible for the decline in white abalone abundance, and it has led to a situation where the density of surviving adults is so low that successful reproduction and recruitment are unlikely to occur. After considering the increased risks to white abalone from poaching that would be more likely to occur as a result of a critical habitat designation, and noting the benefits that may accrue to the species from such a designation, NMFS did not believe that a designation would provide significant benefits that outweigh the increased risks (see 50 CFR 424.12(a)(1)(i)).

3.3 BIOLOGICAL ENVIRONMENT

White abalone (*Haliotis sorenseni*) are marine mollusks belonging to the family Haliotidae within class Gastropoda. Abalone are slow growing, long-lived gastropods characterized by a flattened, spiral shell. White abalone are the deepest-living of the eight species of *Haliotis* occurring on the west coast of North America and occur on rocky benthic habitat. At the time of the status review, population estimates for white abalone range from 1,600-2,500 individuals (Hobday and Tegner 2000) representing a > 99% decline in abundance from historical estimates of 725,518 – 4.24 million individuals throughout their former range (Hobday and Tegner 2000). This dramatic decline in abundance has been attributed to overfishing of the spawning stock, which led to the eventual closing of the white abalone fishery.

Remotely operated vehicle (ROV) and multi-beam sonar surveys conducted in 2002- 2004 off of the southern California coast (Tanner Bank, Cortes Bank and San Clemente Island) indicated that the white abalone population on the banks may be larger than previously estimated (Butler et al.

2006). Butler et al. (2006) identified a total of 258 individual white abalone. Using estimated available habitat and surveyed densities of white abalone, an estimated population size of between 15,187 and 22,123 was calculated (Butler et al. 2006). Of note, 89% of the abalone were observed as singletons and estimates for Tanner Bank fall dramatically from 2002 (12,818.6 $\pm$ 3,582.2) and 2004 (5883.2 $\pm$ 3323.9) by a difference of 46% (Butler et al. 2006). So while the estimated population may currently be higher, observed surveys suggest that the population is declining temporally and the remaining individuals are spatially separated as to prevent successful spawning.

3.3.1 Reproduction

White abalone are dioecious, with separate sexes occurring in approximately a 1:1 ratio, and exhibit broadcast spawning (i.e. directly releasing gametes into the water column for external fertilization). For those species that have been examined, fecundity has been shown to increase linearly with increasing body size (Tuschulte 1976; Clavier 1992). Adult abalone of intermediate sizes are capable of spawning over two million viable eggs, indicating their high reproductive potential (Leighton 2000). Previous field studies (Tutschulte 1976) inferred that animals in the wild must attain a shell length of 100 mm to be sexually mature. CIMRI found that hatchery-raised abalone may become sexually mature at an age of only one year at a shell length of 25 mm (McCormick and Brogan 2003) and have been able to achieve a 95% fertilization rate in the hatchery.

Gonads of white abalone mature on an annual cycle, and the spawning season of white abalone is of limited duration (Leighton 2000). Synchronization of gonadal maturation and spawning are critical to successful fertilization. In white abalone, gonads ripen and spawning occurs in winter months, although sometimes spawning extends into the spring. Most of the other abalone species in California spawn during the spring and summer months. White abalone exhibit a high degree of spawning synchronicity relative to other California species; however, the environmental cues and the mechanism for synchronization are not yet known (Hobday and Tegner 2000; Leighton 2000). Temperature changes, lunar cycles and sea conditions have been associated with spawning episodes of other California abalone, but have not been unequivocally demonstrated as spawning cues (Ino 1952; Owen and Meyer 1972; Leighton 1977). The duration of an individual spawning event in white abalone is unknown (Hobday and Tegner 2000).

In addition to the duration and the degree of synchronization of spawning, the concentrations of gametes and the density of spawning individuals will affect the fertilization success rate and recruitment. Studies indicate that fertilization success in several abalone species is optimal when concentrations of sperm are $10^5 – 10^6$ /ml (Leighton and Lewis 1982; Clavier 1992). Experiments conducted with sea urchins indicate, however, that even with high concentrations of eggs and sperm, fertilization rates will be very low (< 10%) when individuals are separated by as little as 1 m (Pennington 1985; Levitan 1991). Experiments conducted in the field with the Australian abalone, *H. laegivata,* indicated that fertilization rates ranged from 87.6% ±5.5% at the point of sperm release to 48%± 1.7%, 2 m downstream, and to 2.8%±0.7%, 16 m downstream (Babcock and Keesing 1999). Based on these experiments and observations in the field, the effective nearest-neighbor distance for successful fertilization in *H. laevigata* is estimated to be 1- 2 m (Shepherd and Brown 1993; Babcock and Keesing 1999). Although

adults are considered relatively sedentary, aggregating behavior has been reported for a few abalone species (Newman 1968; Breen and Adkins 1980), and several abalone species (e.g. *H. sorenseni* and *H. fulgens*) have been observed in a laboratory setting to become very active immediately prior to spawning (Leighton 2000). Aggregating and spawning events, however, have rarely been observed in the field, and environmental cues for aggregating behavior have not been identified.

3.3.2 Larval Stage, Settlement, and Metamorphosis

Duration of the larval stage is temperature dependent (Leighton 1974), but generally lasts for about 1-2 weeks. Temperature effects on the survival of larvae have been implicated in setting the upper and lower limits of the depth distributions of adult abalone (Leighton 1974; Tutschulte 1976). Survival of white abalone larvae and growth of post-larvae was greatest at 18°C, and settlement rate was greatest at 15-16°C (Leighton 1972). Dispersal distances of abalone larvae may vary depending on the species, habitat characteristics and hydrodynamic conditions. Studies have shown that under either high or low current and wave-energy regimes, settlement occurred nearby to (< 50 m away) parent abalone (Prince et al. 1987, 1988; McShane et al. 1988). In contrast, Shepherd et al. (1992b) found no relationship between recruitment of *H. laevigata* and adult densities, and larval transport occurred over hundreds of meters. No data on dispersal distances of white abalone larvae currently exist. Given that larval lifetime of white abalone larvae is relatively long (Hobday and Tegner 2000) and that larvae drift passively in water currents, the potential for some transport does exist.

Abalone larvae are lecithotrophic and do not actively feed while in the plankton (Leighton 2000). Chemical cues associated with suitable substrate have been found to induce settlement, and a combination of chemical, biological and physical factors are thought to be involved in triggering metamorphosis (Morse and Morse 1988; Leighton 2000). Recognition and acceptance of a suitable substrate are events critical for recruitment and survival of subsequent life stages.

3.3.3 Juvenile Stage

Abalone are cryptic until they are about 3-5 years old or when they reach a size of 75-100 mm long (Cox 1962). Juveniles of this size and smaller occur in rock crevices, under rocks and under the cover of adult sea urchin spines (Tegner 1989). Small juveniles feed on benthic diatoms, bacterial films and other benthic microflora. Densities of cryptic white abalone have not been measured directly (Hobday and Tegner 2000). Tutschulte (1976) reported that juvenile white abalone <130 mm long were rare in undisturbed areas in 1971, and more recent surveys by Davis et al. (1996) failed to detect any live juveniles. Abalone larger than about 100 mm are classified as “emergent” abalone as they leave sheltered habitats and move to more open habitat to forage on attached or drifting macroalgae. Juveniles are more active than adults and may move tens of meters per day, and are also more active at night.

Information on growth rates of juveniles is limited; however, in the laboratory, growth rates were 29.2 ±15.0 mm / year for juveniles (n=5) fed on *Macrocystis* (Tutschulte 1976). CIMRI recorded optimal growth and survival with animals fed a diet of Giant Kelp (*Macrocystis pyriferia*) and Pacific Dulse (*Palmaria mollis*) and at densities (25 g/ liter) about half that used for commercial culture of red abalone (*Haliotis rufescens*). Growth rate is also influenced by temperature, and different species achieve maximum growth rates at different temperatures;

however, research at CIMRI has shown that optimal growth and survival occurs at 15°C. CIMRI also observed juvenile and early adult white abalone displaying a rafting behavior (i.e. crawling onto moving kelp). This is the first time that this behavior, common for a range of marine invertebrates, has been described for abalone (McCormick et al. 2008) which may potentially impact gene flow in wild populations. No field estimates of juvenile mortality rates have been reported for white abalone (Hobday and Tegner 2000). The juvenile stage lasts, in general, for about 1-2 years, and ends upon reaching sexual maturity.

3.3.4 Adult Stage

White abalone become sexually mature when they are approximately 88-134 mm long or 4 -6 years old (Tutschulte and Connell 1981); however, CIMRI has been able to spawn animals at an age of only one year at a shell length of 25 mm (McCormick and Brogan 2003). Adult white abalone reach a maximum size of 20-25.4 cm (Cox 1960), and are estimated to live for about 35-40 years (Tutschulte 1976). Adult white abalone found in the field are usually 13-20 cm long, and individuals smaller than 10 cm are rarely seen. Growth rates for adults (n=3) fed on *Macrocystis* have been measured at 16.4 ± 7.8 mm/ year in the laboratory (Tutschulte 1976). Adult abalone feed primarily on drift algae but will also feed on attached macroalgae, using their radula and mouth parts to graze algae of rocky substrates. Drift algae is captured with the anterior portion of the foot and brought to the mouth. Cephalic and epipodial tentacles are equipped with sensory capabilities for detecting the arrival of drifting alga fragments.

Field estimates of mortality rates for adult white abalone have not been reported (Hobday and Tegner 2000). Natural sources of mortality include factors such as predation, disease, old age, and starvation. Abalones face a variety of predators, whose importance varies with location and the size-class of abalone. For example, filter-feeders will consume abalone at the egg and larval stages. Predation mortality, however, is greatest during the post-larval stages (Leighton 2000). Typical predators include sea otters, starfishes, octopuses, spiny lobsters, crabs, sheephead, moray eels, bat rays, and humans. Field data is lacking on the predation pressure of these non-human predators on white abalone. Abalone are important prey to sea otters, but sea otters typically forage at depths no greater than 25 m; thus, they are unlikely to forage within the current depth range of white abalone (>25 m – 60 m).

Diseases associated with mortality of abalone in nature include Withering Syndrome (WS), which resulted in mortality of >90% of the black abalone population in many areas (Leighton 2000). This bacterial disease affects the digestive glands of abalone and results in lethargy and loss of pedal mass. WS occurs in other California abalone, including white abalone, but has been successfully treated with antibiotics. WS is not considered a major factor in the decline of white abalone, but could be a limiting factor to the recovery of the population in the wild. The spread and virulence of WS is enhanced by higher than average sea water temperatures. Warmer water conditions associated with climate change and El Niño events may thus result in increased occurrence of WS and are also associated with decreased kelp growth (Tegner et al. 2001). CIMRI has found that WS can be devastating to hatchery populations of white abalone, as evidenced by the mortality experienced at the hatchery. Working with the Universities of Washington (Friedman et al. 2007) and California, Davis (Moore and McCormick, 2008), CIMRI identified an effective antibiotic treatment capable of completely eliminating the pathogen from infected individuals.

Nutrient availability (e.g. nitrogen) is inversely related to sea water temperature; consequently, increased water temperature results in decreased growth of kelp, the major food source for adult white abalone (Tegner et al. 2001). Severe storms may also result in loss of standing stocks of kelp. Declines in growth or abundance of white abalone as a result of low food availability, however, have not been reported. Many of the remaining white abalone are thought to be >25 years old (Davis et al. 1996) and approaching the end of their expected life span. Thus, many white abalone are expected to die within the next decade.

Abundance and distribution of white abalone may have been affected by competition with sea urchins and sympatric abalone species. Past competition with pink abalone has been implicated in restricting the upper depth distribution of white abalone (Tutschulte 1976). Sea urchins (*Strongylocentrotus* spp.) and abalone are both herbivorous, thus increased abundance of sea urchins can result in increased competition for available macroalgae. Sea urchins and white abalone may also compete for available crevice space, since both are known to take refuge in rocky crevices. Current densities of these potential competitors within white abalone habitat are low, and thus they are no longer thought to affect white abalone abundance.

3.3.5 Other Non-Target Species

The proposed action and alternatives will have limited affects on other species. The populations of other California abalone species are so depressed that the likelihood of competitive interactions or hybridization of white abalone with other species of abalone is very low (Owen et al. 1971). Captive bred white abalone would be field planted in areas clear of other abalone species. Urchins (*Strongylocentrotus purpuratus* and *S. franciscanus*) and the gastropod *Lithopoma (Astrea) undosa* are potential abalone competitors, but unfortunately there are no field studies on competition for food or space between these species and white abalone (Hobday and Tegner 2000). How these species may interact with field planted white abalone remains unknown, but removal (or absence) of potential competitors is proposed during the initial field planting experiments. Hobday and Tegner (2000) state that under current conditions, with low density of not only white abalone but also potential competitors, competitive interactions are unlikely to alter the population dynamics of these species.

Any attempted field planting would follow measures outlined in the NOAA Fisheries Disease and Parasite Management Plan (Appendix 1) and be restricted by specific permit conditions to ensure that this activity would not cause the spread of disease (Withering Syndrome) and parasites (sabellid worms) to natural populations of other gastropods.

Interactions with one of abalone's primary predator, the threatened southern sea otter (*Enhydra lutris nereis*), would be kept at a minimum by choosing field planting areas that are beyond the current range of the sea otter and field planting would be coordinated with the southern sea otter recovery team as recommended by the USFSW. Otter abundance and foraging habits would become an important consideration as abalone abundance increases and sea otters expand their range. Other observed predators include asteroids (*Pyncnopodia*, and *Astrometis*), fish (*Scopaenichthys*, *Myliobatis*, and *Semicossyphus*), crustaceans (*Panulirus*, *Cancer*, and *Loxorhynchus*), and octopuses (*Octopus* spp.) (Hobday and Tegner 2000). How the abundance and density of these potential predators may change once the field planting program begins

remains unknown, but removal (or absence) of potential predators is proposed during the initial field planting experiments.

White abalone consume benthic diatoms, bacterial films, and single-celled algae as newly settled juveniles and eventually an ontogenetic diet shift to primarily attached or drifting brown algae occurs (*Laminaria farlowii* and *Agarum fimbriatum*). Of the major factors under consideration for the decline of the abalone, lack of food is not one of them (Hobday and Tegner 2000). There is no evidence to suggest that these food supplies are limited and thus, the return of white abalone to former densities through field planting is unlikely to have a negative impact on primary producers.

CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

This chapter represents the scientific and analytic basis for comparison of the direct, indirect, and cumulative effects of the alternatives. Regulations for implementing the provisions of NEPA require consideration of both the context and intensity of a proposed action (40 CFR Parts 1500-1508). This chapter will reiterate each alternative and provide a discussion of the potential for significant adverse impacts on the endangered white abalone and other natural resources by the proposed action or the alternatives. One of the criteria for determining significance of impacts is whether the proposed action threatens to violate federal, state, or local law, or other legal requirements for the protection of the environment, which holds federal agencies to a broader standard than minimum compliance. The ESA requires that the proposed action is not likely to jeopardize the continued existence of an endangered species or result in the destruction or adverse modification of its critical habitat, and will not disadvantage the affected species or stock. Thus, consistent with the purposes and policies of the ESA and their implementing regulations, NMFS must assess: (1) the risks to individual abalone from the proposed techniques, such as collection and handling; (2) the potential for significant cumulative adverse effects on individual abalone; and (3) the potential for a significant adverse effect on the endangered white abalone population due to the large geographic extent of the proposed research (throughout the species' range) and the percentage of the total population that would be disturbed and/or handled. Therefore, this document examines the relevant effects of a variety of scientific research activities on white abalone and the environment.

The protocols for abalone research and enhancement as revised by the White Abalone Recovery Team and as published in the 2008 White Abalone Recovery Plan are included in Appendix A.

4.1 EFFECTS OF ALTERNATIVE 1: No Action

4.1.1 Information Gained by Alternative 1

Under Alternative 1, the permit would not be issued to continue the research and enhancement activities currently authorized under Permit No. 1346. There would be no collection of white abalone from the wild and no subsequent field planting. Captive breeding and research associated under current permit would continue until the permit expires on April 1, 2011. Information gains would be limited to that information gained in the laboratory regarding propagation and basic biology of the species.

Under this alternative, non-intrusive research techniques could be utilized to assess and monitor the remaining white abalone population as well as conduct assessments of abalone habitat.

Information would be gathered regarding abundance, distribution, life history characteristics, population dynamics, and suitable habitat characteristics would be gathered.

4.1.2 Anticipated Takes under Alternative 1

Under this alternative, no takes in the wild would be authorized. However, takes authorized by Permit No. 1346 would remain in effect for captive propagation and research until April 1, 2011.

4.1.3 Potential Effects of Alternative 1

The recovery of white abalone rests on the ability of the species to rebound on their own under this alternative. This seems doubtful due to mortalities from natural sources (predation and senescence) or illegal collection. It is likely that abundance and densities of the white abalone would continue to decline. This, in turn, would increase the likelihood of repetitive reproductive and recruitment failure. Given this cycle of recruitment failure, Hobday and Tegner (2000) predicted eventual extinction of the species.

Even if spawning aggregations exist in the wild, current white abalone have been observed only at the deepest portions (>30m) of their former distribution (Butler et al. 2006). Temperatures at deep depths are considered unsuitable for larval survival. Laboratory studies indicate that larval development is arrested at temperatures below 12 ^{o}C (Leighton 1972), a temperature common at depths beyond 30m. In the laboratory, no larval settlement was observed at 10 ^{o}C while only 57-66% settled at 12 ^{o}C after 15 days and those larvae did not survive beyond the 30th day (Leighton 1972). Permits would not be required for non-intrusive surveys, as the animals would be left undisturbed in their environment. Current no-fishing laws will continue to be enforced (fishing has been identified as the primary reason for the decline of the white abalone populations) and the natural population of white abalone would be left in situ to recover on its own.

4.2 EFFECTS OF ALTERNATIVE 2: Issue permit with standard conditions

4.2.1 Information Gained by Alternative 2

In addition to the captive breeding program, the issued permit would include field planting of subsequent progeny. As in Alternative 1, research data regarding the propagation and maintenance of white abalone would be gathered. Research activities previously authorized under Permit No. 1346 would continue including: 1) the continued maintenance of currently captive white abalone, 2) a captive breeding program, and 3) captive research associated with reproduction, development, and disease treatment and prevention.

In addition to research performed in the laboratory, experimental small-scale field planting of progeny would occur. This field planting would evaluate habitat preferences and life history characteristics of white abalone to aid in the development of an enhancement program. Additional information including abundance, distribution and population dynamics would continue to be gathered regarding white abalone in the wild.

4.2.2 Anticipated Takes under Alternative 2

As in Alternative 1, no collection from the wild would be authorized. Takes would be authorized for the continued maintenance of currently captive white abalone and the breeding of this species. In addition, research activities would be authorized associated with reproduction, development and disease treatment and prevention. Some of these takes associated with research

would result in lethal takes of individuals. This permit would also include field planting of subsequent progeny generated by the breeding programs. Current estimates of survival would predict a survival rate of between 1-70% (McCormick et al. 1994, Saito 1984).

4.2.3 Summary of Potential Effects of Alternative 2

Field planting of progeny would achieve a number of short-term goals. White abalone progeny currently in captivity could be field planted as soon as feasible and abundance in the wild could increase quickly. CIMRI found that hatchery-raised abalone may become sexually mature at an age of only one year at a shell length of 25 mm (McCormick and Brogan 2003); therefore outplanted individuals may be capable of reproducing immediately after field planting. Preliminary measures of enhancement success (e.g., survival, growth, reproductive output, recruitment success, etc.) would occur immediately as opposed to waiting for another group of progeny to reach appropriate field planting sizes.

The long-term benefits of this alternative may include the continued growth and range expansion of the wild population. If these field planted animals successfully reproduce in nature, the reproductive and recruitment potential of the wild population could continue to increase over time. Monitoring of field planted individuals would be conducted which in turn would provide data to be used to improve field planting protocols which would improve the likelihood of field planting success over time.

There are a number of risks associated with the field planting of progeny raised in captivity including:

- Behavioral modification of captively bred white abalone that may increase predation vulnerability and/or decrease ability to successfully forage for food;
- Vulnerability to invasive parasites (sabellid worms) and/or disease (Withering Syndrome) which may compromise success of field planting;
- Risks associated with the introduction of parasites or disease into the wild through the field planting of infected animals (Friedman and Finley 2003);
- The risk of exposing wild animals to disease/parasites that went undetected in the laboratory prior to field planting will increase (Friedman and Finley 2003);
- The risk of hybridization of field planted, captive reared white abalone with other species of abalone may increase; and
- While numbers are expected to increase as a result of this activity, risk of poaching and exploitation by natural predators will also increase.

Mitigation measures may effectively address concerns associated with the field planting of captively raised white abalone. Specific research projects have been designed to address the first concern. Behavioral and morphological modification may be achieved by exposing a portion of captive-reared white abalone destined for field planting to predators and competitors on a regular basis. A study conducted by Delgado et al. (2002) with Florida queen conch (*Strombus gigas*) suggests that hatchery reared animals exposed to predators exhibit behaviors and morphologies that may render them better able to survive in the wild than their naïve counterparts. Briefly, survival rates of hatchery-reared white abalone would be compared to others once field planting occurs and if survival rates of these animals were significantly higher than naïve animals, all animals destined for field planting would be exposed to predators and competitors on a regular

basis. If survival rates were the same or significantly lower, predator/competitor exposure protocols would cease. In addition, a portion of captive-reared white abalone destined for field planting could be encouraged to forage for prey. Most hatchery-reared animals are fed *ad libitum.* While the feeding habits and requirements of white abalone are not well understood, an experimental program could be designed to determine whether the survival rates of animals that have been forced to search for food are higher than those that have been fed *ad libitum* once field planting occurs.

Techniques described in the National Marine Fisheries Service White Abalone Disease and Parasite Management Plan (Appendices A-E) would reduce the risk of captive-bred animals becoming infected with disease or parasites, increase the reproduction potential of field planted animals, and reduce the risks of introducing disease and parasites into the wild.

Hybridization of these progeny with other abalone species may occur upon field planting. However, the current depth range of wild white abalone overlaps very little with other species of abalone. Given white abalone distribution and the fact that the abundances of other California abalone species remain extremely low, the current risk of hybridization of wild white abalone is low. The historic range of white abalone did overlap with other abalone species and although hybridization did occur naturally in the past, reported natural hybridization rates among all species are low (approx. 2%; Leighton 2000). Hybridization of field planted white abalone with other species would be avoided by placing animals in areas that do not contain other abalone species. If other species should be encountered during subsequent monitoring, they would be removed from the field planting area.

4.3 SUMMARY OF COMPLIANCE WITH APPLICABLE LAWS, NECESSARY FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

As summarized below, NMFS has determined that the proposed research is consistent with the purposes, policies, and applicable requirements of the MMPA, ESA, and NMFS regulations. NMFS issuance of the permit would be consistent with the MMPA and ESA.

4.3.1 Endangered Species Act

This section summarizes conclusions resulting from consultation as required under section 7 of the ESA. The consultation process was concluded after close of the comment period on the application and draft EA to ensure that no relevant issues or information were overlooked during the initial scoping process summarized in Chapter 1. For the purpose of the consultation, the draft EA represented NMFS' assessment of the potential biological impacts.

During issuance of Modification #1 to Permit No. 1346, NMFS determined that southern sea otters would be present in the action area and may be affected but were not likely to be adversely affected by the proposed study. On October 31, 2003, the USFWS concurred with NMFS' determination that issuance of the requested permit is not likely to adversely affect the southern sea otter and recommended that the applicant coordinate field planting of abalone with the southern sea otter recovery effort to minimize potential predation of field planted abalone by sea otters. This permit condition would be transferred to the new permit. Given the nature of the project and the limited takes of white abalone occurring in the wild, NMFS determined that no other endangered species were likely to be affected by issuance of the proposed permits.

After reviewing the current status of the endangered white abalone, the environmental baseline for the action area, the effects of the proposed research and the knowledge to be gained from the proposed research it is NMFS' biological opinion that the issuance of Permit No. 14344 and the scientific research activities it authorizes, as amended by the Permits, Conservation and Education Division, is not likely to jeopardize the continued existence of white abalone in the wild. Critical habitat for this species has not been designated so critical habitat will not be destroyed or adversely affected by the proposed action.

4.3.2 National Marine Sanctuaries and National Parks

National Marine Sanctuaries Act (NMSA) (32 U.S.C. 1431 et seq.) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance. The National Marine Sanctuary Program, operating under the NMSA and administered by NOAA's National Ocean Service (NOS) has the authority to issue special use permits for research activities that would occur within a National Marine Sanctuary. Because the field planting sites occur within the boundaries of the Channel Islands National Marine Sanctuary and Channel Islands National Park, permits may be required to conduct the proposed research activities. Obtaining special use permits is the responsibility of individual researchers.

4.4 COMPARISON OF ALTERNATIVES

While the No Action alternative would have no environmental effects, the opportunity would be lost to collect information that would contribute to better understanding white abalone and that would provide information to NMFS that is needed to implement NMFS management activities. This is important information that would help conserve and manage white abalone as required by the ESA and NMFS's implementing regulations. The Proposed Action would affect the environment, primarily individual white abalone. However, the effects would be minimal and the preferred alternative would allow the collection of valuable information that could help NMFS' efforts to recover white abalone. Neither the No Action nor the Proposed Action is anticipated to have adverse population or stock-level effects on white abalone or other non-target species. Given the Proposed Action's minimal impact to the environment and the potential positive benefits of the research, it is the most desirable action to pursue.

4.5 MITIGATION MEASURES

Permit No. 14344, if approved, would require the permit holder to follow certain procedures in order to minimize and mitigate any effects of the proposed action. These permit conditions are described below.

- In the event of an unusual mortality event in the hatchery (mortality due to unique circumstances; *e.g.* disease outbreak) or mortality in excess of that authorized in the Permit, research must be immediately suspended and the protocol must be reviewed, and, if necessary, revised to the satisfaction of NMFS.

- Shell waxing must only be done to animals when more than 50% of the surface of the shell shows evidence of boring organisms. The animal must not be out of the water longer than 45 minutes. The foot and tissue on the bottom of the abalone must be kept moist by placing the abalone on a screen that is immersed in a shallow film of water.

- Prior to any release of white abalone to the wild (including field planting), all protocols including disease screening, prevention of disease transmission at the facility, genetics management, field planting and monitoring must be updated and revised based on the best available science and submitted to the Chief, F/PR1 for approval.

- Prior to transfer to a new facility which has not previously held white abalone, husbandry and research protocols including disease screening and prevention of disease transmission at the facility must be submitted to the Chief, F/PR1 for approval.

- All abalone must be screened for disease and parasites prior to release or transport to another facility.

- A minimum of 5,000 individuals, from each year class, must be raised to maturity for field planting purposes.

- Progeny are to be field planted within the known geographic range of parents, but isolated from extant populations.

- Researchers should wash all field gear and equipment with fresh water between survey sites to avoid the potential introduction and spread of disease and non-indigenous species between sites.

- This permit does not authorize takes of any protected species not identified in Part A, including those species under the jurisdiction of the USFWS. Should other protected species be encountered during the research activities authorized under this permit, researchers should exercise caution and remain a safe distance from the animal(s) to avoid take, including harassment.

- Field planting of white abalone must be coordinated with the Fish and Wildlife's southern sea otter recovery team.

4.6 UNAVOIDABLE ADVERSE EFFECTS

The research activities would cause disturbance , stress, and injury to individual white abalone. Some research projects, including disease studies and captive management, would require intentional lethal take of abalone. Unintentional lethal take is also possible, for example, during field planting activities. However, the research is not expected to have any effect on the populations of white abalone in the wild.

4.7 CUMULATIVE EFFECTS

The purpose of this section of Chapter 4 is to summarize the cumulative effects of the proposed action on white abalone. "Cumulative impact" is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

The California Department of Fish and Game (CDFG) - Abalone Recovery and Management Plan (ARMP) was adopted by the Fish and Game Commission on December 9, 2005 (http://www.dfg.ca.gov/marine/armp/index.asp). The purpose of the ARMP is to provide a framework to direct recovery efforts of all abalone species, and to manage existing and future fisheries. Given that the CDFG is a partner in the recovery of white abalone and that white abalone recovery falls under federal jurisdiction, the CDFG is deferring to NMFS as the lead in all aspects of recovery planning that involve collection, captive rearing, field planting, and genetic stock structure determination. CDFG employees have participated in research activities authorized under Permit No. 1346 and CDFG is identified as a partner under the pending application (File No. 14344).

The United States Fish and Wildlife Service (USFWS) released a Draft Supplemental Environmental Impact Statement on the threatened southern sea otter (*Enhydra lutris nereis*) translocation program in August of 2005. The purposed action involves the termination of the southern sea otter translocation program; however those sea otters residing within the translocation or management zones at the time the decision to terminate is made will not be removed. The possibility remains that over time the natural range for this species could expand and could compromise the effectiveness of the proposed action and ultimately the entire white abalone recovery program. Thus, the permit is conditioned to require coordination between the Fish and Wildlife's southern sea otter recovery team with respect to field planting activities.

The potential exists for white abalone to be discovered during oil and gas activities. Previously, the Exxon Mobil Corporation applied for permits from the California Coastal Commission, the The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), formerly the Minerals Management Service, and the Army Corps of Engineers to replace a power cable running from shore (State waters) to an offshore oil and gas platform (Federal waters), remove part of a failed cable, and install power cable between two platforms in federal waters in Santa Barbara Channel. During pre-installation operations in 1999-2000, a single white abalone was discovered on one of the cables. This animal was not re-sighted during subsequent surveys. However, the possibility remains that stray individuals may be encountered during oil and gas activities. Given this, NMFS continues to be consulted BOEMRE and is requiring biological surveys during projects. In the event that a white abalone is found within the project area, all activities will cease until NMFS decides upon a course of action. In addition, NMFS would ensure that field planting of captive bred white abalone would not occur within the project area, if activities are concurrent.

Poaching of white abalone will continue to pose a threat to the success of the proposed action (primarily field planting activities) and ultimately the entire recovery plan. Marine Protected Areas (MPAs) at the Channel Islands National Marine Sanctuary, established by California's Fish and Game Commission, may offer protection to individual animals from poachers both because the use of these areas by commercial and recreational fisherman is prohibited and because the enforcement presence within MPAs will continue to grow. The Channel Islands National Park Service's 20-year data base suggests that as a species, white abalone will not necessarily benefit from MPAs because very few animals have been identified within their boundaries and little or no recruitment has been observed. However, MPAs may be ideal areas to stage future field planting efforts.

4.7.1 Other research permits and authorizations

This permit will replace Permit No. 1346-01 issued to CIMRI, Thomas McCormick. There are currently no other permits for research on white abalone issued or in process.

CHAPTER 5 LIST OF PREPARERS AND AGENCIES CONSULTED

This EA was prepared by the National Marine Fisheries Service, Office of Protected Resources in Silver Spring, Maryland.

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UNITED STATES DEPARTMENT OF COMMERCE
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Finding of No Significant Impact
Issuance of Scientific Research and Enhancement Permit No. 14344

Background

In August 2009, the National Marine Fisheries Service (NMFS) received an application for a permit (File No. 14344) from The University of California, Davis, Bodega Marine Laboratory, Bodega Bay, California to conduct scientific research and enhancement on white abalone (*Haliotis sorenseni*), a species listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.). In accordance with the National Environmental Policy Act, NMFS has prepared an Environmental Assessment (EA) analyzing the impacts on the human environment associated with permit issuance (Environmental Assessment on the Effects of NMFS Permitted Scientific Research and Enhancement Activities on Endangered White Abalone (*Haliotis sorenseni*)). In addition, a Biological Opinion was issued under the Endangered Species Act summarizing the results of an intra-agency consultation. The analyses in the EA, as informed by the Biological Opinion, support the below findings and determination.

Analysis

National Oceanic and Atmospheric Administration Administrative Order 216-6 (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant to making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in Fishery Management Plans?

> EFH has been designated for many of the fish species within the action area identified for field planting (i.e. three sites near the Channel Islands). Details of the designations and descriptions of the habitats are available in the Fishery Management Plans of the Pacific Fishery Management Council. Baby Abalone Recruitment Modules (BARTs) were deployed in 2004 and were placed on rock / sand bottoms and do not permanently modify the substrate. Monitoring of the BARTs has occurred at least once a year since their deployment. Activities that have been shown to affect EFH include disturbance or destruction of habitat from stationary fishing gear, dredging and filling, agricultural and urban runoff, direct discharge, and the introduction of exotic species. None of the activities in the Proposed Action are directed at or likely to have any impact on any designated EFH, therefore consultation was not initiated.

2) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

The proposed action is not expected to have a substantial impact on biodiversity and/or ecosystem function. The only research to be conducted in the wild would be the field planting and monitoring of white abalone. The BARTs were previously deployed in 2004 under the authority of NMFS Permit No. 1346 and Channel Islands National Marine Sanctuary permit number - CINMS-2004-003. The BARTs are located at three sites on the south side of Santa Cruz Island (along Yellow Banks outside of the protected area Gull Island Reserve).

3) Can the proposed action reasonably be expected to have a substantial adverse impact on public health or safety?

The proposed action requires the researchers to store and transport biological samples. Researchers will handle and transport samples following safety protocols to ensure there is no impact to public health or safety.

4) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?

The research activities would cause disturbance and stress and injury to individual white abalone. Some research projects, including disease studies and captive management, would require intentional lethal take of abalone. Unintentional lethal take is also possible, for example, during field planting activities. Research in the wild would involve field planting and monitoring of white abalone. Prior to release, captive-bred abalone would be screened for disease. The permit would restrict field planting activities to those areas that are within the historic habitat of white abalone, but currently without abalone present. In addition, field planting must be coordinated with the US Fish and Wildlife southern sea otter team to minimized predator/prey interactions. The permit further prohibits the incidental take of other protected species that may be in the study area. Therefore, the proposed research is not expected to have any effect on the populations of white abalone in the wild, critical habitat, or other non-target species.

5) Are significant social or economic impacts interrelated with natural or physical environmental effects?

The social and economic effects of the proposed action mainly involve the effects on the people involved in the research, as well as any industries that support the research, such as charter vessels and suppliers of equipment needed to accomplish the research. There are no significant social or economic impacts of the proposed action related to significant natural or physical environmental effects.

6) Are the effects on the quality of the human environment likely to be highly controversial?

The action is not likely to be controversial. The application was made available for public comment and no comments were received. This application is the continuation of research previously authorized and NMFS is not aware of any controversy surrounding this permit application.

7) Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, essential fish habitat, or ecologically critical areas?

Research activities may occur within EFH as noted in the response to Question #1 but EFH would not be substantially impacted. The three field planting sites are located within the boundaries of the Channel Islands National Marine Sanctuary and Channel Islands National Park. Given the precautionary approach researchers will take, and the conditions that will be included in the permit, NMFS does not expect the research will adversely impact protected areas. No research activities will affect any other unique areas.

8) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

The effects of the proposed action on the human environment are not likely to be highly uncertain or involve unique or unknown risks. Because the proposed research is a continuation of previously authorized research, the analysis of effects was informed by permit reports, published documents, and expert professional judgment showing that the research activities have not resulted in adverse effects to the white abalone population. The proposed action would allow research activities to continue, to inform our understanding of the biology, ecology, and status of white abalone populations.

9) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Other factors that may affect white abalone, its habitat, and other aspects of the physical and biological environment include implementation of California's Abalone Recovery and Management Plan (ARMP) and Marine Life Protection Act (MLPA), the continued spread of withering syndrome, and abalone poaching. The proposed action would be expected to result in a low level of disturbance to the physical and biological environment that would not result in cumulatively significant impacts when combined with other actions. The proposed action would be expected to contribute to efforts to manage and recover white abalone and its habitat.

10) Is the proposed action likely to adversely affect districts, sites, highways, structures,

or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

The proposed action would not occur in or be likely to affect entities listed in, or eligible for listing in, the National Register of Historic Places. Thus, the proposed action would not cause the loss or destruction of scientific, cultural, or historic resources.

11) Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

The proposed action would not be expected to result in the introduction or spread of a non-indigenous species. Researchers would clean all field gear thoroughly with fresh water between survey sites, to avoid introducing or spreading any non-indigenous species between sites. Also, the permit would require that all abalone be screened for disease and parasites prior to release or transport.

12) Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

The proposed action would be consistent with previous actions authorized by NMFS and would not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration. The proposed action would not involve any irreversible or irretrievable commitments of resources.

13) Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

The proposed action would not be expected to threaten a violation of Federal, State, or local laws or requirements imposed for the protection of the environment. The proposed action and its effects on ESA-listed species and areas designated or proposed for designation as critical habitat has been analyzed under section 7 of the ESA. Researchers have obtained or will obtain all necessary permits and authorizations as required to ensure that the proposed research is consistent with the MMPA, the National Marine Sanctuary Act, and other Federal and state laws and regulations.

14) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

The action is not expected to result in cumulative adverse effects to any species. The proposed action is expected to have minimal effects on affected target species' populations. No substantial adverse effects on non-target species are expected. No cumulative adverse effects that could have a substantial effect on any species will be expected.

DETERMINATION

In view of the information presented in this document, and the analyses contained in the EA and Biological Opinion prepared for issuance of Permit No. 14344, it is hereby determined that permit issuance will not significantly impact the quality of the human environment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an Environmental Impact Statement for this action is not necessary.

MAR 30 2011

James H. Lecky
Director, Office of Protected Resources

Date