

Appendix F. Peer Review Process

F.1 Peer Review

The Sea Grant Cooperative Extension program administered the independent peer review of the draft ARMP. Sea Grant was responsible for acquiring the services of appropriately qualified experts and for providing a written report to the Department. Department staff have reviewed the peer review findings and revised the ARMP accordingly. If the Department disagreed with any aspect of the peer review findings, it explained the basis for disagreement (see below). The Department has submitted the peer review report to the Commission.

F.1.1 Overview of Peer Review Comments

The following review of the Abalone Recovery and Management Plan (ARMP) was submitted in response to Section 7062 (a) of the Fish and Game Code, which requires “external peer review of the scientific basis of marine living resources management documents.” The review was written by a panel of four scientists with diverse backgrounds and expertise in fisheries matters: Louis W. Botsford, University of California at Davis; Alan Campbell, Fisheries and Oceans, Canada; Susan S. Hanna, Oregon State University; and Robert E. Sizemore, Washington Department of Fish and Wildlife.

The peer review panelists acknowledged that developing a recovery and management plan for abalone is a complex and challenging task, and commended the staff of the Department (CDFG) for the work it has done. Nevertheless, the ARMP contained deficiencies that are identified and discussed in the following sections.

F.1.2 Comments From the Peer Review Report, with Department Responses in Italics

F.1.2.1 Report Organization

Comment: The report as presently organized contains a great deal of redundancy and is lacking a logical progression in the presentation of information. Terms should be more specifically defined. The ARMP contains many assertions that should be supported by citations of the scientific literature. Technical editing is needed.

Response: *Redundant statements were removed from sections where they were deemed unnecessary and references were made to the sections where the statements were retained. The overall organization follows the format for fishery management plans developed by the Department’s Marine Region. Definitions for terms indicated by Peer Review Panel (reviewers) and Department staff were added to the Glossary.*

Initially, the document was written with citations in the traditional scientific document format. After this draft was reviewed internally it was decided that in order to make the document more user-friendly to a wider public audience these citations should be removed. Citations have been re-incorporated into the document as suggested.

Comment: A fishery management plan is a framework document that guides decisions. As such, it should contain a systematic assessment of what is known and not known about the fishery, its history, management objectives, and options for actions. The general structure of a fishery management plan is to begin with an assessment of the current situation (legal environment, status of stocks, management, and socio-economics) followed by an evaluative history of the fishery, specification of objectives, identification of management alternatives to meet those objectives, evaluation of management alternatives for achieving those objectives, specification of a plan to monitor and evaluate progress toward meeting objectives, and identification of research and data needs.

Response: *The revised ARMP covers the topics suggested by the reviewers. The structure of the ARMP deviates from reviewers suggestions because it follows the format for fishery management plans developed by the Marine Region.*

Comment: The white abalone status report (Hobday, A.J. and M. J. Tegner. 2000. *Status review of white abalone (Haliotis sorenseni)* NOAA Technical Memorandum NAA-TM-NMFS-SWR-035. May 2000.) is a good example of the technical level of writing that should be in the plan.

Response: *The Department drafted the ARMP to appeal to a wider audience than that for a technical memorandum. This has resulted in a reduction of some of the more technical aspects, while still providing enough technical information for informed decision-making either directly in the plan or in appendices or via cited reference material.*

Comment: Chapter 4 (legal framework) lays out the institutional context for abalone management. This should be brought to the front of the document.

Response: *The structure of the ARMP deviates from reviewers suggestions because it follows the format for fishery management plans developed by the Marine Region.*

Comment: A positive aspect of the plan highlighted by the review team is its inclusion of criteria to guide changes in TACs and to evaluate different stages of resource recovery. The criteria could be made more specific in terms of their operational definitions, but the fact that quantitative criteria to evaluate decisions are included is praiseworthy. It indicates intent to take a systematic, adaptive approach to recovery and management. However, the decision programs specified will work only if they are rigorously enforced (i.e., standards are not lowered when abundance declines).

Response: *Establishing criteria for TAC changes are a key to the ARMP. While the Fish and Game Commission has the final authority for regulating the fishery, formalizing the criteria through the ARMP helps ensure that those standard levels will be maintained in the future.*

F.1.2.2 Costs and Funding

Comment: The management of the abalone fishery was previously conducted with insufficient fishery-independent data or technical expertise, which contributed, in part, to the present need for closures, quota reductions, and restoration.

Response: *Although insufficient data and expertise were factors in the closure of California abalone fisheries, another significant factor was the sentiment that biologists needed to demonstrate harm to fished populations before further restricting the fishery.*

A more precautionary outlook is prevalent in fisheries management today that will facilitate protecting abalone populations.

Comment: The average annual allocations for recovery assessments total \$66,000 and management assessments total \$68,000. This represents only 9% of the costs identified to implement the management plan and is inadequate to meet the stated need for improved stock assessment. The reviewers recommend that funding for stock assessment should be increased.

Response: *The allocations mentioned come from Table 9-3 and do not include Department staff salaries which consist of an additional estimated \$413.5 thousand for recovery and management.*

Comment: The funding from sport fishers reporting cards creates a dependent relationship between continuation of the fishery and implementation of this plan, which compromises the precautionary approach and the objective to re-build stocks.

Response: *Because abalone is a high priority species, the majority of funding expended is from sources other than abalone permit report card funds (Table 9-3). If abalone permit report card funds are reduced or eliminated due to closures, it is likely that alternative funding will be identified to cover management, research, and enforcement needs. If funding sources become less available, the Department will adopt a more cautious management approach for abalone.*

Comment: The reviewers recommend that funding for community involvement and public education should be increased.

Response: *The Department agrees that community involvement and public education are important components to management plans and many public education efforts such as contact by wardens and answering questions during creel sampling, boat shows, and ocean-themed festivals are not accounted for in the ARMP cost tables.*

Comment: Lacking funding from other sources, increases in cost recovery from user groups could be explored for funding of research, fishery catch monitoring and other critical rebuilding elements.

Response: *The only current user group is the northern California recreational abalone fishermen. Increasing fees would require legislation and the unpredictability of the legislative process makes it an unreliable method of increasing available funding. Increases in fees could also cause an overall decline in revenues if a large number of people decline to participate in the fishery due to higher fees.*

F.1.2.3 Expected Elements

Comment: The ARMP is not in the form of a typical fishery management plan or recovery plan. It needs to be a technical, scientifically supported framework that policy makers can use to make management decisions.

Response: *Chapter 5 is a summary of information presented in greater detail in Chapters 6 and 7, which was added to address some of these concerns. The structure of the ARMP deviates from reviewers' suggestions because it follows the format for fishery management plans developed by the Marine Region.*

Comment: The summary of existing scientific knowledge of California abalone should be complete (i.e., include all relevant scientific information) and well-documented (i.e., supported by references).

Response: *Text and references were added to make the summary of knowledge more complete.*

Comment: Both technical terms (e.g., "keystone species") and critical commonly used terms (e.g., "sustainable") should be defined.

Response: *Technical terms and critical commonly used terms were added to the Glossary.*

Comment: In addition to definitions, the report needs an operational basis for computing the value of defined terms to enable judging whether a definition or goal is met (i.e. The northern California fishery is referred to as "sustainable"; does that simply mean that it has not collapsed yet?)

Response: *The ARMP supplies densities for critical population levels such as minimum viable population and sustainable fishing level in Chapter 5. The sustainable fishery level was determined from Department surveys conducted in 1999 and 2000 at 3 sites (see Section 7.1.2.1). The density acts as a target to be achieved by a recovering fishery.*

Comment: Both recovery and fishery management require a clear assessment of alternative ways of meeting well-defined, measurable objectives.

Response: Section 6.8: Alternative Approaches to Recovery *and* Section 7.3: Management Alternatives, *were added to address these issues.*

Comment: Fisheries management should follow a precautionary approach, including a Control Law (a statement of actions to be taken for all possible states of the fishery) based on both Target Reference Points and Limit Reference Points. Table 7-2 is a step in the right direction. See:

Shelton, P.A. and J.R. Rice. 2002. Limits to overfishing: reference points in the context of the Canadian perspective on the precautionary approach. Canadian Science Advisory Secretariat Research Document 2002/084. It can be read here: <http://www.ncr.dfo.ca/csas/>

Response: *The ARMP follows the precautionary approach and has incorporated it to the extent possible for California abalone resources. We have attempted to integrate the concept of target and limit reference points into our approach as outlined in Chapter 5 (see Figure 5-1). The MVP is essentially our best estimate proxy for a biomass limit reference point for these fisheries.*

Comment: Recovery planning should be based on a measure of risk such as Probability of Extinction, and should include Delisting Criteria (i.e., measurable means of determining that a population is secure).

Response: *Presently, the white abalone is the only 'listed' species of abalone, an action of the federal government. The Department assists on the federal white abalone recovery team. Criteria for evaluating resource recovery are explained in Chapter 6: Recovery.*

Comment: Both fisheries management and recovery require a plan for monitoring, evaluation and adaptive management.

Response: *The ARMP adequately outlines just such a plan.*

Comment: The ARMP should also include an analytical summary of the driving economic and ecological forces in the fishery, identifying essential, specific knowledge, critical uncertainties and needed research.

Response: *The ARMP attempts to meet this concern with a revised Section 3.2: Socio-economic Characteristics of the Fishery. Needed research was described in Section 7.2.3: Future Research. Delving into greater depth would have required more resources and may have deviated from the focus of the ARMP.*

F.1.2.4 History of Abalone Fishery Management

Comment: The report contains historical information scattered throughout different sections. What is missing is an integrated assessment of the evolution of the present abalone management problem.

Response: *The Department concurs, and has added Section 3.1.1.1 to Chapter 3: History and Socio-economics of the Fishery to more thoroughly address the problem from a serial depletion perspective.*

Comment: An ecological-economic-management history of abalone stocks, their management, the fishery and fishing communities, would integrate these pieces of information in a way that would demonstrate how the different pieces of this complicated picture have fit together. To set the stage for recovery and sustainable management, the report should provide a clear understanding of how the different components of the fishery have interacted to produce the present situation.

Response: *Chapter 2: Description of the Stocks was expanded, in part, to address this concern.*

Comment: A summary of the history of management actions could be produced from information contained in Appendix A and included here.

Response: *We have chosen to leave that level of detail in the Appendix.*

Comment: The integrated history should go beyond a description of what happened to evaluate why things happened. For example, the history should not only include past management decisions, but why those decisions were made, why stocks were overfished, why management has been ineffective, and why the commercial and recreational fisheries developed as they did.

Response: *The Department agrees, and has added a sub-section to Section 3.1.1.1 in Chapter 3: History and Socio-economics of the Fishery describing serial depletion, causes of the decline, and factors in management failure. See Karpov et al. (2000) and Dugan and Davis (1993)(in the Literature Cited section) for a more detailed explanation.*

Comment: The point of the fishery history section is to evaluate the biological, ecological, economic and management history of the fishery in a way that allows lessons to be learned from what has been done in the past and sets the stage for assessing management alternatives for recovery.

Response: *Chapter 3. History and Socio-economics of the Fishery was extensively revised to address this concern.*

F.1.2.5 Quantitative Analysis

Comment: The ARMP does not contain the quantitative analysis necessary for stock assessment and population viability analysis. This aspect seems to be inadequately funded. Additional expertise in this discipline is needed.

Response: *We agree that more and better quantitative analysis needs to be developed, and that given additional resources, these areas could be developed under both long-term management, and recovery. Section 7.2.3, Future Research, states the need for improving knowledge of key population parameters such as growth, mortality and recruitment rates, and defining the stock-recruitment relationship for each abalone species, essential information for abalone population modeling.*

Comment: No size distribution or growth data are presented. These data exist and can be used to estimate population parameters necessary to assess the effects of size limits, fishing effort, etc. on catch, sustainability and population persistence.

Response: *Figure 2-1 was added showing density-weighted abalone size distributions from Van Damme State Park subtidal surveys for 6 years from 1986-99. Previous investigators demonstrated that the present size limits are optimal, using Yield Per Recruit analysis (see Table 2-3).*

Comment: A more complete discussion of the effectiveness, efficiency, and statistical adequacy of timed and transect surveys is needed, including discussion of habitat destruction in invasive surveys, and time lags of information on recruitment.

Response: *A more complete discussion of timed surveys and a comparison with transects are not needed since data from this type of survey is not used for management decisions other than to determine whether abalone densities are high enough for transect surveys.*

Comment: The level of poaching and its effects on populations needs to be estimated (e.g., included in mortality rates).

Response: *Poaching is difficult to estimate but has the same effect as natural and legal fishing mortalities in lowering abalone density. Since our decision table (Table 7-2) is based on abalone density, poaching is accounted for in this way. Problems would arise if poaching approached the magnitude of the legal catch but there is no indication that is the case.*

Comment: There is inadequate scientific basis for the TAC estimation, and other population goals given. A program for refining the estimate should be identified. The uncertainty in the TAC should be quantified and the consequences should be assessed.

Response: *The TAC was set based on a combination of current and historical fishery conditions and an added precautionary element. The level was set following regulation change by the Fish and Game Commission that reduced take by an estimated 41%. The information was the best available at the time and any additional data will be incorporated when possible. The ARMP provides for further reductions (or increases) in the TAC, based on abundance changes at index sites as a component of adaptive management. The long term management plan calls for a zonal based refinement of TAC.*

Comment: An operational quantitative expression for relative population jeopardy or risk is needed for each species. It should include population abundance, size structure and spatial structure.

Response: *While an operational expression of this type would be useful it is beyond the scope of the ARMP at this time.*

Comment: Criterion 1 is not related to population dynamics, and depends as much on sample size as on existing population size structure.

Response: *More detail was added explaining the importance of a broad size range early in recovery for severely depleted populations. Section 6.2.1 was revised and an additional sub-section (6.2.1.1) was added. The Fish and Game Code requires recovery at multiple locations so the broad size distribution requirements must be met at multiple index sites.*

Comment: Constituent involvement in surveys is a good idea, but plans for training and data verification should be included.

Response: *Plans for constituent involvement in surveys are still in initial stages and are not available for the ARMP.*

Comment: Consider closer monitoring of removals (catch).

Response: *The abalone permit report card system in combination with our telephone survey is unique among marine recreational fisheries in its ability to provide reliable catch estimates. Chapter 8, Abalone Enforcement Activities was added to address this and related issues.*

F.1.2.6 Human Dimensions

Comment: The human component of the abalone fishery needs much greater emphasis in the document. The present *Chapter 3: History and Socio-economics of the Fishery* is inadequate. The ARMP neglects to present a thorough review of the literature, omits important economic aspects of abalone, and contains technical errors in the presentation of economics.

Response: *The ARMP now includes historic information on market values and trends over time. Additional information on commercial harvest ex-vessel revenues, adjusted to a base year price index, is also presented. References to resource value and economic value have been clarified or defined where necessary, to distinguish between revenues (e.g. ex-vessel revenues) and value (e.g. estimates of value based on travel cost method analyses).*

Comment: An economist or other social scientist, with expertise in fishing systems, should write Chapter 3.

Response: *We had a staff person with an economics background review and make additions to this chapter.*

Comment: The unique economic and ecological characteristics of abalone make the human component a large part of the recovery and management problem. The chapter should contain information on human demographics (e.g. population changes in California coastal communities over time), abalone markets (domestic and international), ports of landing, and user groups.

Response: *The increase in fishing effort for abalone in northern California is detailed in Section 3.1.3.2: Historical Catch and Effort - Recreational. This trend is more pertinent to the fishery than demographic changes in the coastal communities over time. Since there is no longer a commercial fishery, abalone markets and ports of landing are not relevant.*

Comment: An evaluation of the interaction of management and markets over time and their influence on compliance should be included.

Response: *Since there is no longer a commercial fishery, management and market interactions are not relevant.*

F.1.2.7 Management

Comment: Chapter 7 describes present management measures and provides some management alternatives for the future. What is missing from the discussion is analysis of the effectiveness of alternative management tools for abalone populations.

This section should contain a literature review of other abalone management programs with an emphasis on the effectiveness of various management instruments in abalone populations elsewhere.

Most abalone management programs center around commercial fisheries and do not apply to a recreational-only fishery. The ARMP needs a clearer assessment of how various management alternatives meet the goals. The section should outline a wider array of management alternatives and assess their relative merits for the California abalone recovery and management regions. Management alternatives to assess would

include closing the northern fishery, access limitation, size limits, spatial management (e.g. TURFs), temporal management (e.g. open/closed areas that change over time), community based property rights (e.g. co-management by area) or individual property rights (e.g. tradable quota share). These management alternatives should be assessed for their potential to contribute to recovery, enforcement, social and economic net benefits.

Response: Section 7.3: Management Alternatives was added to address these concerns. Some of the suggested alternatives such as property rights are more relevant to a commercial fishery than our recreational-only fishery and were not included.

Comment: The management section should also identify critical uncertainties (gaps in data and knowledge) and discuss alternative means to reduce them. These uncertainties should be accommodated not only in management decisions (through precautionary adjustments) but also in a monitoring and evaluation plan designed to generate information. There needs to be a clear plan for monitoring and evaluating the fishery and the abalone populations as part of adaptive management.

Response: The interim and long-term management plans outlined in Chapter 7 adequately address this issue.

Comment: Collapse of the southern California fisheries lead naturally to the question of whether the northern California red abalone fishery is on the same path to collapse. The ARMP does not demonstrate that the northern California fishery is sustainable, but it does outline a management plan in Table 7-2.

Response: A more precautionary management alternative was added to Section 7.3 to address this concern.

Comment: The Department should demonstrate that the northern California red abalone fishery is sustainable. Additional data, such as size distributions should be presented and analyzed. Further analysis of the apparent lack of recent recruitment and the evidence for local serial depletion should be presented. Analysis of the expected effects of recent reductions in take limits should be presented.

Response: Section 2.2.1.1 was added to address these concerns, while the recommended TAC is expected to coincide with the recent reductions in take limits.

Comment: If the fishery is not closed now, and it is not sustainable, the management plan embodied in Table 7-2 may close it in the near future. However, it can be depended on to do so only if rigorously enforced, and the population will be at an even lower level and take longer to recover. If the fishery is not closed now, that enforcement should be ensured. The Department should compare the costs of closing the fishery now with the cost of closing the fishery later, when it has declined even further.

Response: *Our observations in the field indicate the fishery is not close to a condition in which closures and the consequences of the timing of closures need to be considered.*

F.1.2.8 Inter-jurisdictional Issues

Comment: The relationship between state management of invertebrate resources (including recreational abalone and commercial urchin fisheries), federal management of ESA-listed species, and management of marine invertebrate resources in other nations should be discussed in greater detail.

The white abalone is listed as an endangered species under ESA and black abalone may be a candidate species. The ranges of six abalone species found in California (including white abalone) extend into Mexico. It is not clear what cooperative structures exist with Mexico to address ESA protections and the relationship between Mexico abalone fisheries and illegal harvest of abalone in California.

Response: *International issues are beyond the scope of the required ARMP elements.*

Comment: Inter-state and international enforcement issues should be discussed.

Response: *See previous response.*

Comment: The impact of sea otter re-introduction under the MMPA and ESA on abalone stocks needs additional development and discussion.

Response: *Section 6.5.2: Sea Otters, was added to address this issue.*

Comment: International scientific exchange is not evident in the plan and should be encouraged to improve management.

Response: *Department biologists frequently interact with abalone biologists from other jurisdictions at international conferences, etc.*

Comment: Use of university resources should also be employed to improve management and supplement limited management resources.

Response: *The ARMP was developed with input from experts in academia both formally during advisory workshops and informally, and cooperative research will continue in the future.*

F.1.2.9 Enforcement and Poaching

Comment: The ARMP acknowledges that illegal harvest (poaching) has a major impact on abalone stocks, both in closed areas and areas open for (recreational) harvest. Consistent and successful enforcement effort is crucial to abalone recovery. Measurable criteria for enforcement success need to be developed, and included in the plan, with a schedule for evaluation.

Response: *Enforcement success is difficult to quantify, since it is directly related to the level of enforcement effort, however trends in parameters such as the rate of violations per interdiction can be determined and may prove useful for estimating success.*

Comment: It is important to understand who is involved in poaching (sport or commercial divers) and what markets (personal, local or international) consume poached product, in order to find ways to curtail poaching.

Response: *Our enforcement branch has a good understanding of these problems.*

Comment: Use of forensics and other scientific procedures should be implemented to enhance enforcement and prosecution of poachers. For example, genetic analysis could be used to definitively identify species that are not open for harvest.

Response: *Procedures such as these have been used by our enforcement staff.*

Comment: Enforcement alone will not resolve the problem, however, and further development of a multi-disciplinary approach to compliance is needed.

Response: *Chapter 8: Abalone Enforcement Activities was added to detail enforcement efforts.*

Comment: If fishery managers are not presently including estimates of illegal harvest as part of the total fishery-related mortalities, then this should be done by subtracting it from the TAC (Total Allowable Catch).

Response: *A reliable estimate of the amount of poaching is not available, though crude estimates have been made from warden intercept data. However, the impact of poaching, like all forms of mortality, would be evident in declining population densities during dive surveys, which would then become part of the decision-making process outlined in the plan.*

Comment: Opening other fisheries, such as the commercial urchin fishery, should take into account areas where remnant populations of abalone exist, either to exclude those areas and reduce the potential for poaching, or closely monitor the fishery and assess the abalone populations pre- and post-fishing.

Response: *Because these issues are better addressed through the Marine Protected Area (MPA) process, they are not included in the ARMP.*

Comment: To raise public awareness, and encourage compliance, outreach strategies should be more fully developed. As examples the public could be engaged through a “coast watch” to monitor local fishing activities, education curricula could be developed, and internet games and activities could be utilized. Mechanisms should also be identified which encourage communication and linkage between enforcement, managers, and the public. Educating the public to the impacts of poaching could exert “peer” pressure to reduce poaching and encourage reporting of poaching activities.

Response: *Section 8.5: Community Outreach was added to address this issue.*

F.1.2.10 Ecological Interactions

Comment: Understanding the ecology of abalone is essential to the purpose of the plan.

Response: *The Department concurs and has added sections to address this issue.*

Comment: The relationship between abalone and sea urchins is described in the plan, due to similarities in the ecological niche and coordinated management of fisheries. Review and research into this important relationship needs to be more fully developed. For example, the beneficial role of sea urchins to the protection of juvenile abalone may be more important on smooth substrate versus highly rugose substrates.

Response: *Section 2.1.10: Competition, and Section 2.1.11:Community Associates of Abalone, discuss this relationship.*

Comment: The complex interaction between sea otter re-introduction and removal of competitive/beneficial sea urchins through the commercial sea urchin fishery highlights the pressing need for additional research into suitable/preferred habitat, grazing preferences, and other predator/prey relationships such as sea stars.

Response: *Section 7.2.3: Future Research acknowledges these research needs.*

Comment: Information about critical/preferred habitat should be mapped and used in management decisions for identifying MPAs, enhancement sites, and fishery openings/closures.

Response: *Benthic habitat mapping is underway and has been completed for some index areas in northern California, but completion of extensive mapping of nearshore rocky habitat is a long way off into the future.*

F.1.2.11 Genetics and Disease

Comment: The panel recommends that the ARMP review hazards of introducing sabellid polychaetes, withering syndrome and other diseases and novel genes into new areas with abalone translocations.

Response: Sections 6.4.3.2 and 6.5.1 were added to address this comment regarding *Withering Syndrome and other diseases*. Section 6.4.3.1 was added to identify the needs for genetic research prior to beginning enhancement activities.

Comment: Discuss the existing CDFG shellfish health program as it relates to abalone.

Response: *The Department shellfish health issues are discussed in newly added Sections 6.4.3.2 and 6.5.1.*

Comment: Discuss the effectiveness of this program (e.g., for freedom of diseases) in screening and certification of transplanted broodstock and or progeny to and from hatcheries and into the wild.

Response: *The initial comment was directed to sabellid infestation. The Department has a very active shellfish health program that addresses the concerns of the comment, however, we did not feel the issue needed more detail than was provided in Section 2.1.9.2: Diseases and Parasites. In addition, a sentence was added to this section explaining that the only known infestation in the wild is believed to be eradicated.*

F.1.2.12 Broodstock Management

Comment: The panel recommends that the ARMP develop protocol to assess and minimize impact of wild broodstock removal on the extant wild population (i.e., numbers and sizes), for culture programs.

Response: *Specific protocols for broodstock collection are not written in the ARMP. However, wording was added to Section 6.6.1.2 -Task 4, to recognize the need for such protocols in the future if culture/out-planting techniques progress to a larger scale for enhancing recovery.*

Comment: Develop less damaging methods for broodstock collection (e.g., use of sea stars) to reduce mortality during handling and transport.

Response: *Protocols for minimizing broodstock collection mortality have been developed and are used currently for white abalone. However they were not included as part of the ARMP.*

Comment: Consider genetic issues for broodstock maintenance, control of inbreeding (maximize genetic diversity, reduce potential for genetic bottlenecks), and impacts of out planting offspring.

Response: Section 6.4.3.1: Genetics Research *outlines these concerns.*

Comment: Attempt to develop and use withering syndrome disease-resistant strains in different abalone species.

Response: *Refer to* Section 6.6.1.3: Evaluation of Resistance to WS - Task 10

Comment: Develop hatchery methods for optimum survival and production of high quality gametes.

Response: *While this suggestion would be a valuable component for a fully developed hatchery program, hatchery work will remain on a small scale for the foreseeable future.*

F.1.2.13 Recovery Experiments

Comment: The ARMP should develop a program for disease control and genetics management prior to translocation.

Response: Section 6.6.1.2: Feasibility Studies for Aggregation/Translocation - Task 6, *was revised to recognize the need for such programs for disease control and genetics management prior to the start of translocation activities.*

Comment: Review literature with pros and cons of each rebuilding method already tried in California and elsewhere.

Response: *There is a body of literature relating to rebuilding techniques, particularly attempts at rebuilding and enhancing local stocks, and some on larval (competent) outplanting. Unfortunately, most of it has been unsuccessful for various reasons. A current problem is the prohibition of out planting cultured abalones from most facilities since they have not yet been certified as disease-free. And for the most part, only red abalone are available at this time for a major seeding effort, especially in southern California. White and green abalone are of limited availability and these species are not widely cultured now.*

Comment: Provide rationale for specific methods to be tested with estimated cost benefits.

Response: *Specific methods are discussed in Chapter 6. Recovery and management costs are generally outlined in Section 9.3.1.1*

Comment: Describe possible experimental design (treatment replicates & controls), trying different spatial scales may be important.

Response: *This might be a little premature for two reasons:*

- 1. We don't have source stocks for most species from which to collect individuals for translocation and out-planting.*
- 2. Since assessments have not been completed there is no reliable information as to source locations for individuals, or where the best locations would be for establishing study sites for each species. Only red abalone populations might be sufficient to serve as a source in southern California. With the establishment of MPAs, we will have a better idea of where to start work.*

F.1.2.14 Marine Protected Area (MPA) Issues

Comment: The ARMP should discuss how development of restoration methods and use of pilot studies in no-take MPAs (i.e., Channel Islands), where no interference from poaching can be assured, is a supported and a recommended approach.

Response: *Section 6.4.2.4: Establishing Marine Protected Areas was modified to address these comments.*

Comment: Define the goals and objectives of MPAs for abalone in terms of suitable habitat, area size and location frequency requirements, and how this approach is appropriate as a rebuilding tool (e.g., broodstock protection and potential larval transport to other areas).

Response: *Although some of the points raised in this comment were not addressed, the ARMP adequately covers MPA planning in the revised Section 6.4.2.4: Establishing Marine Protected Areas. The MPA planning process will take an ecosystem approach and single species issues will be considered in relation to a comprehensive plan.*

Comment: Discuss the pros and cons of establishing MPAs throughout California coast, in terms of ecological and biological benefits to abalone populations, and how poaching in these no take areas can be avoided.

Response: *The authority and responsibility of designating MPAs for all species does not fall to the ARMP (See Ch. 4). The ARMP addresses criteria for MPAs which would be beneficial for abalone.*

Comment: Discuss implications of oceanic currents to larval dispersal & transport to local and distant areas (sources and sinks) in relation to MPAs.

Response: *Little information exists about the dispersal of larval and juvenile abalone. Genetic studies suggest that black abalone residing primarily in the intertidal may*

disperse less widely than red abalone. The question of the impacts of MPAs outside their borders has not been answered for a large number of fished species.

Comment: Acknowledge that size structure information from long-term protected areas is essential for stock assessment.

Response: *The value of size structure information from long-term protected areas will need to be assessed for California abalone since growth rates are slow and the effects of habitat quality upon growth are unknown.*

Comment: Provide scientific evidence and references for the assertion that the breath-hold snorkeling fishery provides a “de facto” MPA and therefore formal MPAs are not needed in these areas.

Response: *The breath-hold fishery de facto depth refuge is discussed and referenced in Section 7.1.1.2: Gear Restrictions. There is no provision in the ARMP to limit the creation of northern California MPAs because of the existence of the abalone de facto depth refuge.*

Comment: Manage the abalone fishery and MPAs consistently with each other.

Response: *The Department is very cognizant of the need to coordinate the management of abalone and MPAs.*

Comment: Implement a monitoring plan to accompany implementation of MPAs.

Response: *A monitoring plan for abalone within MPAs would need to be integrated into general monitoring efforts for the MPAs. Planning for abalone monitoring in MPAs will be incorporated with MPA monitoring plans.*