

Peer Review Report for ID 415:

Peer Review Comments on the Draft Recovery Plan for Black Abalone

We solicited review of the *Draft Recovery Plan for Black Abalone (Haliotis cracherodii)* from three potential reviewers. Two people agreed to be reviewers and two provided reviews. We asked the reviewers to comment on any aspect of the draft plan, with a specific focus on the biological and ecological information presented in the plan and scientific data relating to the proposed recovery program. We provided six questions to help focus the review. We compiled and present the reviewers' responses to these questions below.

Reviewers (listed alphabetically):

Michael Kenner
Biologist
U.S. Geological Survey, Western Ecological Research Center

Dr. Brian Tissot
Professor and Marine Lab Director
Humboldt State University

General Comments

Reviewer #1:

In general, the draft recovery plan is very thorough and well thought out with lots of good information. It does a good job of presenting the biology of the species as well as the threats, proposed actions, and means of evaluating the populations. Listed below are a few observations.

The plan suffers from a repetitive style. This is probably the result of an imposed structure, but it does make it a bit harder to digest.

Reviewer #2:

Overall, with the exceptions I note below, I found the plan to be accurate and current and based on rigorous scientific studies, with the exception of habitat. As indicated in the plan, there is still much we don't know so expanding research efforts to address information gaps should be a priority. I believe the discussion of potential threats and other stressors accurately considers the risk to this species with the exception of temperature. It is listed as an issue but I believe it to be the major threat (in conjunction with diseases) and that needs more emphasis in the report. I imagine this is because it is a difficult threat to address but regardless it is a major issue.

The habitat-based criteria and the selection of study sites, my comments are below, lack sufficient detail to understand how well these criteria will assist in recovery efforts. Since the recovery action priorities are based on these criteria I feel this is significant weakness in the plan. Finally, the proposed research, monitoring, and management recovery actions are appropriate but should be expanded (through open an open RFP process) to include more researchers and develop leaders for what is clearly a rigorous and long-term recovery efforts.

Responses to Peer Review Questions

1. *Is the information presented in the background sections accurate and current? If you are aware of additional or more current relevant information, please provide the suggested reference(s) and, if possible, a copy of the paper(s).*

Subspecies, p.2: There is a well-documented subspecies of black abalone, *H. cracherodii californiensis*, found only on Guadalupe Island in Baja California that should be mentioned. This subspecies may be genetically distinct.

Current northern geographic limit, p. 2: There are quite a few well documented live animals collections by abalone experts in the Fort Bragg area. According to Buzz Owen, an abalone expert and well published author on abalone, the current northern limit should be listed as Fort Bragg, not Pt. Arena.

Diet, p.2: the diet of black abalone is much broader than giant kelp (Tissot, 1991, chapter 2), see below. Based on hundreds of observations over two years, diet varied with location and they showed preferences to the availability of local seaweeds.

Larval duration, p. 3: The statement “Black abalone have a short planktonic larval stage (about 3-10 days) (McShane 1992).” is incorrect. McShane (1992) did not study black abalone but Australia species. The statement should say “based on other studies, it is believed that black abalone larval stage is...” John Steinbeck at TENERA studied this issue in the early 1980s at Diablo Canyon and it is published in technical reports.

Table 2.2. Macroalgal species collected as drift along intertidal transects at Año Nuevo and Santa Cruz Island. All species were found along exposed study sites at both islands. Species also found at protected sites are indicated by an *.

<i>Año Nuevo Island</i>			<i>Santa Cruz Island</i>		
<u>Species</u>	<u>Percent Number</u>	<u>Total Weight</u>	<u>Species</u>	<u>Percent Number</u>	<u>Total Weight</u>
* <i>Laminaria setchellii</i>	35.2	21.4	* <i>Macrocystis pyrifera</i>	76.2	80.9
* <i>Botryoglossum farlowianum</i>	22.8	8.2	* <i>Egregia menzesii</i>	12.8	16.2
* <i>Pterygophora californica</i>	11.7	18.7	* <i>Gigartina</i> spp.	2.3	0.3
* <i>Dictyoneurum californica</i>	5.6	2.1	* <i>Cystoseira osmundacea</i>	1.8	1.6
* <i>Egregia menzesii</i>	4.7	6.7	* <i>Iridaea</i> spp.	0.6	<0.1
* <i>Iridaea</i> spp.	3.2	0.7	*Unidentified red algae	0.6	0.1
Coralline algae	2.4	0.6	* <i>Laminaria setchellii</i>	0.4	<0.1
*Unidentified red algae	2.3	0.7	<i>Porphyra</i> sp.	0.4	0.1
* <i>Gigartina</i> spp.	1.8	0.4	<i>Gelidium</i> sp.	0.1	<0.1
* <i>Nereocystis luetkeana</i>	1.7	35.5	<i>Pterocladia</i> sp.	0.1	<0.1
* <i>Cystoseira osmundacea</i>	1.2	0.6	<i>Prionitis</i> sp.	0.1	<0.1
* <i>Ulva</i> spp.	1.1	0.1			
* <i>Macrocystis integrifolia</i>	0.8	2.4			
* <i>Alaria marginata</i>	0.7	0.7			
*Unidentified brown algae	0.7	<0.1			
* <i>Neoptilota densa</i>	0.7	0.2			
* <i>Prionitis</i> sp.	0.5	0.1			
* <i>Gymnogongrus</i> sp.	0.3	<0.1			
* <i>Postelsia palmaeformis</i>	0.3	0.8			
<i>Eisenia arboretum</i>	0.1	<0.1			
<i>Laminaria sinclarii</i>	0.1	<0.1			
<i>Microcladia coulteri</i>	0.1	0.1			

2. *Does the discussion of potential threats and other stressors accurately consider and reflect the risk to this species?*

Elevated water temperatures: I believe the discussion of potential threats and other stressors accurately considers the risk to this species with the exception of temperature. It is listed as an issue but I believe it to be the major threat (in conjunction with diseases) and that needs more emphasis in the report. I imagine this is because it a difficult threat to address but regardless it is a major issue.

Region 2 threats, p. 21: Primary threats should include temperature. I don't believe listing disease is sufficient.

Ocean Acidification, p. 9: There are quite a few studies that have evaluated the effects of OA on abalone that are not cited or discussed but to my knowledge they are not on black abalone. An expansion of this discussion would help focus future research efforts.

3. *Do you have any comments or concerns regarding the proposed recovery criteria?*

Demographic Recovery Criteria, p. 20: Given the slow, long-term recovery of abalone, I don't believe requiring annual surveys is necessary at all sites to establish recovery. Some could be surveyed at less frequent, 2-3 year intervals and still provide valuable information on recovery that could be used for delisting.

Demographic recovery criterion 2: Habitat-based density. Despite the repetitive structure, it was hard to find that demographic criterion 2 was not yet developed. It was referred to many times throughout the document, but I don't think it was ever clearly stated that target density levels either had or had not been developed. I finally figured out that they have not and doing so is part of recovery action 3.1(b). I think it would be helpful to mention up front that this still needs to be developed. The fact that the SubRegion from Pacific Grove to the Monterey/San Luis Obispo County line met this criterion is apparently more a matter of definition than anything else and is a bit misleading without the admission that it is not yet developed. If there actually is a target density per habitat quality, that should be clearly stated. This all should be more clearly laid out in the Demographic Recovery Criteria section on page 25.

Habitat-based density criteria, p. 32: boulders fields can be good habitat for juveniles (Tissot, 1988, 1995) and are not mentioned as important habitat. I found the criterion for habitat quality not to be clearly articulated. First, the document cited for the method (George et al., 2009) is a poster not a paper and lacked sufficient detail for evaluation. Second, habitat quality, as defined, is study site specific. Since no mention was made of how study sites were selected (I assume not randomly) it is unclear how representative of the coastline they are. Therefore, there may be significant locations and habitats not defined by the method that are not being surveyed for recovery, which could then be over- or under-estimated. Third, since habitat-quality was not measured randomly along the coastline and may vary significantly with geology and geomorphology, there may a major bias in what is surveyed and used as recovery criterion. Although the plan recognizes that the relationship between habitat quality and density does not hold true for all sites, they do not describe how that would be overcome except to reference the same set of pre-existing study sites.

Population trend, p. 26 & 30: The Southern California mainland region should include three of four subregions to establish delisting. With only two, recovery areas could be limited only to northern or southern regions. Historical data at PV is likely due to a more direct connection to larvae from the Channel Islands (Chambers et al., 2003) and Miller's previous work in a long-term protected area.

Demographic recovery criterion 6: Genetic diversity. This criterion forces recovery into a 20+ year time frame although there is an admission here that achieving other criteria will indirectly preserve genetic diversity. It seems then, that while important in directing activities such as translocation, captive breeding and outplants, perhaps it should not itself be considered as a critical criterion for down or delisting.

4. *Do recovery action priorities presented in the plan's Implementation Schedule reflect a biologically sound conservation approach for black abalone recovery?*

Recovery Actions (general): As recovery is a long-term process all elements of the actions listed should include opportunities for new researchers (the future leaders of these programs) to become involved in monitoring, restoration, and captive breeding research. Example: captive breeding should be extended to more than one lab. The potential partners listed in the implementation schedule could be much larger.

Recovery Action One, p. 47: Yes, subtidal populations of black abalone were abundant in the mid-1980s and should be monitored as recovery continues. In some cases I observed 10-20% of the populations below MLLW.

5. *Are the proposed research, monitoring, and management recovery actions appropriate and sufficient?*

Recovery Strategy - Assumptions, p. 15: Withering syndrome (WS) is not the primary threat to species recovery it is WS and rising seawater temperatures. As noted, WS is likely present in "robust and healthy" populations north of the Monterey/SLO County line. But as has been shown in other populations, as temperatures rise, those populations will likely become infected in the absence of WS resistance. Although this process is discussed, it needs more emphasis as the primary threat to recovery, not just one of many.

Restoration, p. 16: Due to highly localized genetic variability, transplantation, aggregation, and outbreeding should involve individuals from geographically adjacent areas. The paper by Ruediger (2009), cited for the transplant work, is not available online and hence I was unable to evaluate previous methods. Other studies are not cited.

Coordinate research, p. 16: The Research Coordination Plan should be available to potential researchers to develop collaborations for future work.

6. *Are there other recovery actions that should be considered for inclusion in the plan?*
The reviewers did not comment on additional recovery actions to include in the plan.

Editorial Comments

On page 5 *Candidatus Xenohaliotis californiensis* was called a “bacteria-like pathogen” whereas on page 7 it is stated that “Withering syndrome is caused by a bacterium...”

Typo in 3rd paragraph on page 14:

“In addition to withering syndrome, other factors have the potential to affect black abalone and their habitat, including illegal take, contaminant spills and associated response activities, ocean warming, ocean acidification, and the potential introduction of other abalone ~~diseases~~ pathogens known to affect abalone.“