* These are the peer review instructions provided to the peer review panel. They are meant to be a more detailed version of the Terms of Reference and serve as a road map for the peer review panel to follow. The peer review panel is not required to answer every question exactly as stated, and are welcome to explore other questions outside of these instructions if they feel it is instructive or warrented at any time during their review.

Scientific and Technical Review Instructions

Scientific and technical review of the management strategies prescribed in the following documents: 1) CDFW Fishery Management Plan of red abalone and 2) collaborative stakeholder-submitted Management Strategy led by TNC

About this Document

Developed by Ocean Science Trust in collaboration with the California Department of Fish and Wildlife (CDFW) and The Nature Conservancy (TNC), these instructions take the focal points of the review, as delineated in the formal Terms of Reference, and turn them into a series of focused questions intended to guide your scientific assessment. Working with the review committee co-chairs, we will use your written responses to these questions, as well as input from discussions during remote meetings, to draw comments emerging from across the review committee, and prepare the final summary report. Please refer to the Terms of Reference for more details about the management context and background information.

Review Context

The following project documents are the main documents under review:

- **Draft CDFW Red Abalone Fishery Management Plan Chapter 5 and Appendices (describes management strategy), ~49 pages**
- **TNC- led Collaborative Management Strategy and Appendices, ~117 pages**

CDFW has also provided the following materials:

1. *ARMP*
2. *Status Review Update 2010*
3. *Record of regulations since 2005-List all the management changes*
4. *Angler survey 1*
5. *Angler survey II*
6. *Phase 1 public workshops*
7. *Essential Fishery Info meeting summary*

8. *Density Methods Document DFW*
9. *Depensatory Density Literature*
10. *MPA Abalone literature*
11. *Catch estimation*
12. *Economics of the fishery*
13. *Model assumptions literature*

Existing Review Resources:

*Scientific and Techinical Review of the Survey Design and Methods Used by the California Department of Fish and Wildlife to Estimate Red Abalone (*Haliotis rufescens*) Density:* Red abalone density estimation methods

In addition to these provided materials, you will have the opportunity to request further information from CDFW and TNC that would assist in your assessment of the scientific and technical elements relevant to the review scope. OST will work with the co-chairs and TNC or CDFW to facilitate these requests. While we welcome your comments on all the materials under review, please do pay particular attention to the thematic sections which align with your areas of expertise.

Expectations for Reviewers

To ensure you are comfortable with this review request, this section is intended to clarify what we are asking of you. Throughout the review, please do not hesitate to contact us with any questions or suggestions regarding the information below.

- **Webinar and Call Attendance**. Reviewers will attend four remote meetings (webinars) and additional calls as necessary to complete the review. Ocean Science Trust will provide you with specific agendas and assigned questions in advance of each webinar. Given the size of this particular review panel, we know that full attendance at each webinar is unlikely. We ask that you do your best to attend webinars, engage actively with full panel via email, and watch video of any webinars you missed. We anticipate the opportunity for reviewers to also participate in extra Q&A sessions with the two author teams as needed.
- **Duties**. We ask that each reviewer:
    - Read through and familiarize yourself with the provided project documents and accessory materials.
    - Provide written responses to the assigned guiding evaluation criteria questions relevant to the webinar (Ocean Science Trust will provide deadlines for each section prior to the

webinars). You may also provide specific in-text comments in the project documents using the "comment" and "track-change" feature in MS Word.

- Come to each webinar/call prepared to talk through your assessment and written responses with the entire review committee.

- **Final Report**. Reviewers will work with Ocean Science Trust to prepare a final summary report that translates information from the webinars and your responses to the guiding questions provided below that address the scope. Reviewers will contribute to drafting and editing the final report. Ocean Science Trust will work with the review committee Co-Chairs to: 1) ensure that the views of each reviewer are accurately represented in the final product, and, 2) attempt to resolve any areas of disagreement. If differences of opinion cannot be resolved, the final report will document such instances in a manner that contributes to the overall quality of the report.

Example of past peer review reports:
California Spiny lobster FMP peer review

Background and Context provided by CDFW

The ARMP was adopted by the Fish and Game Commission in 2005 based on the best available information and desired management outputs and precaution. The plan was mandated by the legislature after the collapse of the fishery south of San Francisco. Since 2005, the scientific understanding of abalone has improved, but many important elements of their population dynamics are still not well understood. In addition, the recent environmental instability has introduced a new set of management vulnerabilities that need to be understood and accounted for in the new management plan. The CDFW seeks to improve abalone fishery management by incorporating ARMP "lessons learned," and the gained knowledge on abalone life history, the fishery, and the environment. The red abalone fishery management plan offers the opportunity to incorporate this new information in a revised management strategy that optimizes opportunity while maintaining sustainability in a changing climate.

The goals of the FMP as outlined by CDFW are:

- Balance resource sustainability, socio-econonomics, and cultural heritage
- Optimize stock productivity and fishing opportunity
- Consistent and simple regulations
- Adaptive area-based management
- Transparent management strategy and implementation
- Climate ready
- A plan that learns

Guiding Evaluation Criteria Questions

CDFW, Fish and Game Commission, and TNC are seeking an independent assessment of the scientific underpinnings of both proposed management strategies. Both management strategies propose different analysis, indicators and models in support of meeting management goals. The State is asking for an assessment of the scientific rigor of each of these strategies and their ability to help the State detect and respond to changes in the population, important for maintaining sustainability and yield (opportunity). The State is also interested in any insight the reviewers may provide on how those components from both management strategies that are deemed scientifically sound during the peer review may or may not be integrated.

The questions below are intended to help guide your review. Specific deadlines for individual topics will be provided in advance of each webinar. We will discuss these topics, as well as any others identified by the review committee, during the remote webinars. Provide written responses to each of the following and come prepared to the webinars for discussion. Please support your comments, positive or negative, with specific evidence.

In addition to the focused questions in this section, we would like you to consider the following overarching discussion questions throughout your assessment:

- Are the underlying data and analyses, and application of those in each of the proposed management strategies scientifically sound, reasonable and appropriate while also meeting the management goals for the recreational red abalone fishery in northern California as defined by MLMA (as outlined in Chapter 1, Section 7050 & Chapter 2, Section 7055-c)?
- Do the scientific and technical components within and supporting the proposed management strategies form a rigorous framework that can support sound fishery management decisions?
- Discuss the technical merits of the application of analytical methods and components of the management framework (i.e. indicators) and provide suggestions or new analyses to improve assessment, if needed.
- Are there any additional comments you would like to provide on ways the scientific and technical elements within either of the proposed management strategies and supporting materials might be improved that were not captured in the questions here?

1. Management Strategy Thresholds (Indicators, Target Catch, Total Allowable Catch)

Overview

Your review should focus on evaluating the robustness, reliability, interpretation and application of the indicators underpinning the harvest control rule decision making process outlined in the management strategy and the rationale behind the interpretation and inclusion of these indicators in setting or changing the catch limit or target catch. The State is particularly interested in understanding whether the associated indicators used to estimate catch limits or target catch have adequate spatial resolution to detect rapid changes in stock staus, especially those driven by changing environmental conditions.

Scope from Terms of Reference

- Evaluation of the data collection methods that inform management indicators, triggers, and decisions including informing responses to changes in the environment, fishing, or other stressors.
- What is the scientific rationale for the indicators used and their link to responses in the abalone population?

Relevant Sections for Conducting Review:

CDFW:

Section 5.2: Adaptive, Area-Based Management

Appendix A: Baseline Density Calculations

Appendix B: Density Reference Points

Red Abalone Density Estimation Methods (supporting materials)

Catch Estimation (supporting materials)

TNC-led: (not a fully exhaustive list)

Choice of Indicators for Inclusion in Decision-Tree (pg. 5, 7-9, 33-35, Appendix E)

Catch MSY approach (pgs. 8, 19-20, Appendix D, Tables 6 & 7)

Length-based SPR approach (pgs. 20-22, Appendix D, Tables 6 & 7)

Catch Limits (pgs. 18-19, 22-23, Figure 2, Tables 3, 6, 7, Appendices C & E)

Reliability of Indicators to inform of ecosystem conditions and impacts to stock status (pgs. 1, 15-17, 33,

Figures 3-5, Tables 5-8, Appendices D & E)

Data collection and monitoring (pgs. 4, 7, 18-22, Tables 1 & 2, Appendix C)

Evaluation Questions

- Are the indicators* and management triggers used in the management strategy and the way they are calculated based on sound science, reference points, data, and analysis with appropriate assumptions?

  **including:*

  CDFW:

  - *Environmental indicators (kelp cover, sea urchin density, and ocean temperature)*
  - *Productivity indicators (average density, gonad index, body condition, deep-water density)*

  TNC-led:

  - *Length-based spawning potential ratio*
  - *Harvest and exploitation rate (as informed by catch-MSY approach)*
- Do the indicators provide adequate information to detect rapid changes in stock status? Are the indicators used and their link to responses in the red abalone population scientifically sound and rigorous?
  - *For example, are the indicators sensitive to the changes we have seen in the past (e.g. 2014)?*
- Are the catch targets limits and ranges* set forth in the management strategy and the way they are calculated based on sound science, reference points, data, and analysis with the appropriate assumptions? Is the scientific rationale for how indicator thresholds inform management triggers and setting catch limits scientifically sound and justified?

  *defined as total allowable catch (TAC) for TNC-led and Target Catch (TC) and Target Catch Range (TCR) in the CDFW documents.

- Is the geographic scale over which data is collected and indicators are estimated appropriate to inform assessment of stock status and associated calculations of target catch or TAC?
- Are the data collection methods and analysis proposed that inform the management thresholds appropriate and scientifically rigorous, and are the limitations of each indicator for use in management thoroughly evaluated?

2. Evaluation of proposed Management Strategy, TAC, and Harvest Control Rules

Overview

Your review should focus on how each management strategy was scientifically evaluated and the application of its results. This includes any underlying operating model assumptions, data, analyses, results, or sensitivity analyses, as appropriate. Your review should also include

whether or not the approach appropriately took into account past, current and future environmental conditions especially given changing ocean conditions.

Scope from Terms of Reference

- Evaluation of modelling approach used including model assumptions, analyses, interpretation, and application of the model results to evaluate performance of the harvest control rules against management objectives.

Relevant Sections for Conducting Review:

CDFW:

Section 5.5: Target Catch Evaluation

Appendix C: Management Evaluation

Model Assumption Literature (supporting materials)

TNC-led: (not a fully exhaustive list)

MSE Operating model (pgs. 10-18, Appendices A, B)

Decision-Tree (pgs. 19-22, Figure 2, Tables 3, 4)

Uncertainty in Current and Future Environmental Conditions (pgs. 1, 23-25, 32, Figures 3-5, Tables 5-8)

MSE Performance (pgs. 25, 27-35, Figures 3-8, Tables 5-8, Appendix E)

Evaluation Questions

- Is the evaluation of the proposed management strategy based on sound science, data and analysis?
- Is the evaluation of the proposed management strategy based on scientifically robust assumptions of stock and fishery dynamics with appropriate considerations of recent environmental impacts?
- Where models are used, are the underlying parameters, uncertainty scenarios, and assumptions scientifically sound given what is known about the Northern California red abalone stock? Does the evaluation address performance of the management strategy relative to uncertainties in the stock status, data streams, and analytical methods?
- Are the results of the evaluation appropriately interpreted and applied to the management strategy (e.g. considers uncertainty, variance in data, stock productivity, and past, current, and future environmental conditions)?

3. Management Strategy

Overview

For this section your review should focus on the overall management strategy and how and if the underlying scientific and technical components are sound and rigorous and their ability to function together to meet the management objectives (to support an economically and culturally valuable recreational open-access abalone fishery). The State is particularly interested in assessing how well the management strategy will address the overall management goals and the flexibility of the HCR to adapt management to changing ocean conditions. As part of your review you should take into account the spatial scale at which the management strategy is applied and data is collected, opportunities for citizen-science, public and State data sources, and realistic assumptions of time needed to detect and then respond to changes (e.g. data collection scheme, analysis, decision processes).

Scope from Terms of Reference

- Is the proposed quantitative analysis and application of the data scientifically rigorous and is the scientific rationale for the proposed management actions it triggers accurate?
- From a scientific perspective, provide a general assessment of the proposed methodologies including application, assumptions, and management implications of uncertainties in the stock status, data streams, and analytical method within the confines of CDFW capacity and regulatory authority.

Relevant Sections for Conducting Review:

CDFW:

Section 5.1: Fixed Management

Section 5.2: Adaptive, Area-Based Management

Section 5.3: Emergency Management Scenarios

Section 5.4: Fishery Reopening Following Recovery

Angler Surveys 1 and 2; Phase 1 Public Workshops (supporting material)

TNC-led: (not a fully exhaustive list)

Cohesive and complementary functioning of constituent parts of management strategy (pg. 8-9, 21, 30-35, Appendix A)

Consideration of bag limits for open access fishery (pg. 26-27, 30)

Flexibility to implement regional regulations at variety of spatial scales, and implementation error (pg. 22-23)

Demonstration of stock rebuilding under climate variability (pg. 26, 29, Figure 6)

Decision-Tree (pgs. 19-22, Figure 2, Tables 3 & 4)

Uncertainty in Current and Future Environmental Conditions (pgs. 1, 23-25, 32, Figures 3-5, Tables 5-8)

MSE Performance (pgs. 25, 27-35, Figures 3-8, Tables 5-8, Appendix E)

Evaluation Questions

- Is the overall structure and flow of the management strategy scientifically sound and appropriate for achieving sustainability and other management objectives under MLMA (as outlined in Chapter 1, Section 7050 & Chapter 2, Section 7055-c)? If not, are there any suggestions for improving its performance?
- Is the spatial scale (i.e., data collection scheme, analysis, and area of management action) of the proposed management strategy appropriate given the underlying scientific and technical components?
- Are there any components of the management strategy that are may be detrimental to achieving management objectives?
- Are there any additional indicators, research studies, or analyses (given the data streams outlined in both management strategies) that would be beneficial to consider?
- Does the management strategy appropriately take into account environmental conditions such as harmful algal blooms, spread of disease, low oxygen events, etc. and uncertainty in future conditions? Is the way in which the environmental conditions are treated and utilized in the management strategy based on sound science, reference points, data, and analysis?
- How flexible and adaptable is the management strategy in proactively responding to changes in fishery productivity?
    - How well does the management strategy address the trade-off between stakeholder desires to maintain the opportunity for more limited, sustainable harvesting opportunities (i.e., de minimis fishery) and the need to rebuild the abalone resource?