Red Abalone FMP Project Team Meeting

High Level Summary of Two-Zone MSE Results

Support material for November 21, 2019 Project Team Meeting

This document provides a high-level overview of the operating model, trade-offs, and preliminary results from a management strategy evaluation (MSE) that divides the North Coast management area for the recreational red abalone fishery into two fishing zones using the boundary line between Sonoma and Mendocino County. Zone 1 includes Mendocino, Del Norte, and Humboldt Counties and Zone 2 includes Marin and Sonoma Counties. It considers three states of a fishery, including closed, *de minimis*[1], and open.

A more detailed technical report will accompany this summary following the November 2019 Project Team meeting. Results are still preliminary and should <u>not</u> be considered final.

<u>Operating Model</u>

A key ecological uncertainty is the current state of the red abalone resource. Data from Reef Check California (RCCA) and the California Department of Fish and Wildlife (CDFW) have shown a downward trend in their density estimates that were assumed to reflect unfavorable environmental conditions, however it is unclear how long into the future such environmental conditions may occur. To account for this uncertainty, two operating models are explored in the MSE. Operating model #1 (OM1) assumes that unfavorable environmental conditions will continue through 2020, during which a mortality rate is imposed to deplete red abalone abundance in accordance with these unfavorable conditions. In operating model #2 (OM2), unfavorable environmental conditions are prolonged through 2022.

Within these operating models, sampling efforts for length-based spawning potential ratio (SPR) and density data from the CDFW and RCCA were simulated. Utilizing data streams from both entities helps to maximize site coverage and better inform decision-making. The potential management strategies are designed to be applied annually and independently at the individual fishing zone level. Decision-making relies on data analysis of the three previous years of data (using the most recent available) for length and density.

<u>Management Strategies and Total Allowable Catch Evaluated</u>

The performance of four management strategies are evaluated within each operating model. Two hundred simulations were run for each operating model and management strategy combination. Each management strategy represents a combination of different reference points

[1] A *de minimis* fishery is defined as having a level of catch that is anticipated to have little to no effect on the health or recovery of a fishery resource

for SPR (0.4 and 0.5) and percentiles of density ($T_{DL} = T_{DI} = T_{DT}$ =100% and $T_{DL} = T_{DI} = T_{DT}$ =75%)[2].

- Management Strategy A: SPR (0.5), density percentile (75%)
- Management Strategy B: SPR (0.5), density percentile (100%)
- Management Strategy C: SPR (0.4), density percentile (75%)
- Management Strategy D: SPR (0.4), density percentile (100%)

Four total allowable catch (TAC) levels were also simulated for a *de minimis* fishery - 5,000, 10,000, 20,000 and 40,000 individuals per fishing zone. Noting that a management strategy is applied separately to each fishing zone, it is not necessary to select the same TAC for each fishing zone.

Rebuilding Trajectories

The length of time that it will take for the red abalone resource to recover to a point where it is possible to support an open fishery (time to recovery) is a function of four primary factors - 1) how depleted the red abalone resource is in the year 2021[3], 2) the productivity level of the stock, 3) the reference points selected, and 4) the environmental conditions that may impact growth and mortality of red abalone in the future.

Recovery times were evaluated in two ways -

- Length of time until a *de minimis* fishery could occur
- Length of time until an open fishery could occur.

Median rebuilding times from a closed status to a *de minimis* fishery varied between 11 and 31 years across the different operating models, fishing zones, and rebuilding strategies.

In the absence of fishing, the median recovery times from closed status to an open fishery status ranged between 28 and 59 years, depending on the operating model, fishing zone, and rebuilding strategy reference points. Understanding the median recovery time in the absence of fishing, it was then possible to determine what level of fishing would be possible during a *de minimis* fishery. In Zone 1, a *de minimis* TAC at levels between 20,000 to 40,000 would affect recovery. In Zone 2, a *de minimis* TAC greater than 10,000 would affect recovery.

Differences in times to a *de minimis* fishery varied by operating model. Prolonged poor environmental conditions simulated in OM2 resulted in a longer time period, with an additional 8-10 years needed until *de minimis* fishery status was achieved.

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[2] Confidence intervals (CI) for the density indicator were set to 50%, as a conservative threshold to ensure sufficient red abalone abundance is present to support future catch, given the variability in the data stream. Percentiles are then used to score density (as red, yellow, green) in the decision tree. Percentiles are based on the frequency with which confidence intervals contain the density limit (DL) reference point (0.2 per m^2), density intermediate (DI) reference point (0.3 per m^2), or density target (DT) reference point (0.4 per m^2).

[3] The red abalone season closure is in place through March 31, 2021.

Preliminary results also suggest there is a clear trade-off among the four rebuilding strategies. Management strategies A & C allow the opportunity to fish at a *de minimis* state sooner, however the abalone resource is much more depleted when fishing begins (depletion level[4] of 0.2). Because thresholds for fishing are generally lower, strategies A & C also reach the open status in the shortest amount of time, which was generally triggered at depletion levels between 0.4 and 0.5. Management strategies B & D delay fishing opportunities, however the red abalone resource would be in a much less depleted state (i.e., depletion levels between 0.3 and 0.4) once *de minimis* harvest was allowed. Recovery of the resource under management strategies B & D takes more time to reach an open status, which was generally triggered at higher depletion levels between 0.6 and 0.8.

In addition, recovery trends coupled with different *de minimis* TAC levels produce different recovery times. Higher TACs result in higher overall levels of harvest, however they extend the length of time necessary to achieve an open fishery status.

<u>Takeaway Messages</u>

There are considerable trade-offs to be considered by the Project Team, the Administrative Team, and ultimately the Fish and Game Commission, as they decide on the selection of a management strategy and *de minimis* TAC for the North Coast recreational red abalone fishery. Rebuilding strategies A & C offer the shortest times to open fishery status, while rebuilding strategies B & D have a longer recovery timeline to achieve an open fishery but result in greater red abalone biomass recovery before fishing activities occur. More conservative (i.e. higher) SPR and density reference points will provide the greatest biological protection but fewer fishing opportunities, and the reverse is true where lower reference points result in increased fishing opportunities but reduce biological protections for the resource. Layered on top of this, the magnitude of the TAC chosen for the *de minimis* will impact how long it takes to rebuild the stock to a level where an open fishery could be triggered. Increasing the *de minimis* TAC results in a longer timeline to achieve an open fishery status.

[4] Depletion level is measured on a scale from 0 to 1 and used to understand proportion of stock available to reproduce. Higher levels indicate a more robust or stable stock status.