Red Abalone FMP Project Team Meeting
High Level Summary of Draft Management Strategy
Support material for August 27, 2019 Project Team Meeting

This document represents a high-level overview of the structure and key components of a draft integrated management strategy for the North Coast recreational red abalone fishery. *It has been developed by the modelers as part of the Red Abalone Fishery Management Plan (FMP) development process, at the direction of the Fish and Game Commission. Its design has been informed by peer review recommendations, discussions from the past two Project Team meetings, and technical considerations highlighted by the modelers regarding constraints with data quality and quantity. The Project Team will discuss and refine this draft strategy during the August 27, 2019 Project Team meeting.* ***As a draft strategy, various reference points and related criteria should be thought of as placeholders; the Management Strategy Evaluation will be used throughout this process to understand the trade-offs associated with selection on a final reference points.***

Overview

In the absence of sufficient data to conduct a more traditional, quantitative stock assessment, the modelers have developed a draft management strategy[1] that relies on simpler indicators to evaluate the status of the North Coast red abalone resource. The management strategy is designed to inform decision-making, with the objective of providing fishing opportunities while safeguarding the recovery of the red abalone resource. This strategy utilizes a decision tree in order to recommend a management status (i.e., open, *de minimis*, or closed fishery). The appropriate interval at which this recommendation should be re-evaluated (i.e., decision interval) via Management Strategy Evaluation (MSE) is proposed to be either every one or three years.

The management strategy would be applied separately to each 'fishing zone' (i.e., geographic areas of coastline comprising several defined abalone report card sites). A total allowable catch (TAC) would be defined for each fishing zone, with TACs examined via MSE. During the *de minimis* fishery, a static TAC would be established. If a zone is accessible for fishing activities (open or *de minimis* fishery), it is possible to harvest at all sites within the zone (minus Marine Protected Areas or closed sites). This strategy assumes a restricted access policy, as well as a number of existing management measures would be in place for a *de minimis* fishery. This strategy also proposes exploration of a randomized design for sampling site selection within a fishing zone, where sites sampled would vary over time.

Harvest Control Rules

Within the draft management strategy is a harvest control rule. It is structured as a decision tree that uses the traffic light method. In a scenario where data availability or quality is limited, this method provides a coarse characterization of the state of the resource or environment. Each indicator is scored for each fishing zone (red, yellow, green – see Figure 1) based on the analysis of a data stream and

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[1] A management strategy consists of three parts: the data streams that comprise the monitoring program, the data analysis used to calculate indicator values, and a harvest control rule that is used to interpret indicator values within a pre-agreed decision framework and produce a recommended management action

comparison to an established reference point (see below for proposed[2] reference points for each indicator).

The harvest control rule is applied in two parts (Part A and B - see Figures 2-5). Certain conditions must be met in Part A (Figure 2) before moving to Part B (Figures 3-5). Part A asks whether there is sufficient data available to inform a management decision (Yes or No) and considers the previous management status (i.e. closed, *de minimis*, open) of the fishery. Provided there is sufficient data, the previous management status will determine which harvest control rule to follow in Part B – Closed (Decision Tree #1), *De Minimis* (Decision Tree #2), Open (Decision Tree #3). Within Part B, a different indicator is evaluated at each tier of the harvest control rule (i.e., decision tree), and ultimately identifies all potential decision-making outcomes. If the status of the resource is improving, it is possible to only move one step (i.e. from closed to *de minimis* or from *de minimis* to open but not closed to open). If the status of the resource is deteriorating, multiple steps can be taken as needed (i.e., from open to closed, open to *de minimis*, or *de minimis* to closed).

Indicators

The draft harvest control rules include the following indicators: density, length-based spawning potential ratio (SPR), body condition index, ocean temperature, canopy-forming kelp abundance, and sea urchin density. SPR and red abalone density are the foundational indicators of the harvest control rules, and therefore MSE will focus on the performance of these two indicators in characterizing the status of the resource. The remaining indicators provide added insights and precaution to the decision-making process, but will not undergo formal performance testing, in part due to challenges in clearly defining the associated mechanistic links.

The following proposals are outlined as a means to score each indicator using the traffic light method (green, yellow, red) within the harvest control rule:

- Length-based SPR
    - Percentiles used to score this indicator relative to target reference point (e.g. 0.75)
        - If ≥ 75% of sites fall below target reference point, RED
        - If ≤ 25% of sites fall below target reference point, GREEN
        - Otherwise, YELLOW
- Red abalone density
    - Three separate indicators are calculated based on density values relative to limit, intermediate, and target reference points
    - Percentiles used to score this indicator are based on whether confidence intervals (CIs) contain the limit (e.g.,$0.2/m^2$), intermediate (e.g., $0.3/m^2$), or target (e.g. $0.4/m^2$) reference points
        - Limit Reference Point Indicator
            - 100% of density CIs are greater than limit reference point, RED
            - Otherwise, GREEN
        - Intermediate Reference Point Indicator
            - 100% of density CIs are greater than intermediate reference point, YELLOW
            - Otherwise, GREEN

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[2] Please note that reference points are not final and will be discussed with the Project Team during the meeting

- Target Reference Point Indicator
    - 100% of density CIs are greater than target reference point, YELLOW
    - Otherwise, GREEN
- Body condition
    - More than 95% of all abalone[3] within at least 4 sites within a fishing zone have a foot muscle shrinkage score of 0, GREEN
- Ocean temperature
    - Nearshore ocean temperatures at 30-feet (10-m) in Mendocino County <15°C for all but three days in the previous calendar year[4], GREEN
- Canopy-forming kelp abundance
    - The total area of surface kelp in either of the counties is > 30% of historic maximum extent[5], GREEN
- Sea urchin density
    - The combined densities of red and purple sea urchins < 5 urchins / m^2-, GREEN

Project Team Meeting & Next Steps

During the August 27, 2019 Project Team meeting, the modelers will introduce this draft integrated management strategy for discussion with the Project Team. Additional details of the strategy will be shared to provide further context and understanding, including, assumptions, proposed sampling design, and rationale for the calculation of indicators and sampling design. The Project Team will be invited to discuss, evaluate, and refine this draft strategy and help to inform the inputs. Following the meeting, a more detailed technical report on the management strategy will be shared with the Project Team, and will reflect suggestions and input provided during the meeting.

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[3] $n \geq 300$ abalone sampled is the proposed minimum target sample size

[4] Proposed data stream is CDFW or Reef Check (use subtidal temperature loggers)

[5] Proposed data stream is CDFW kelp aerial surveys or other comparable remote sensing tools tracking kelp surface area

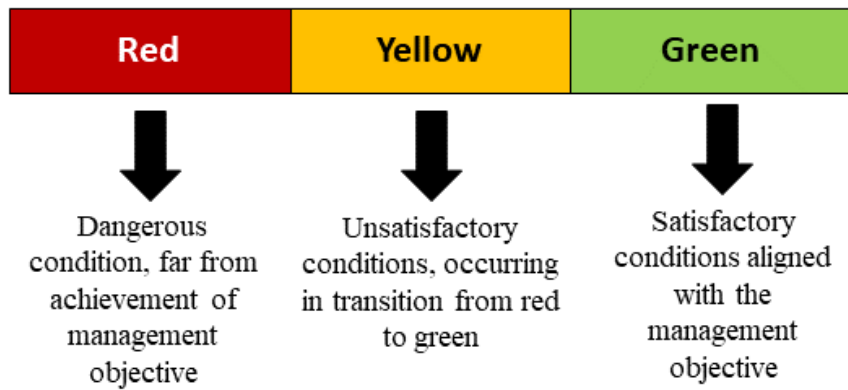Management objective: enable open fishery status

| Red | Yellow | Green |

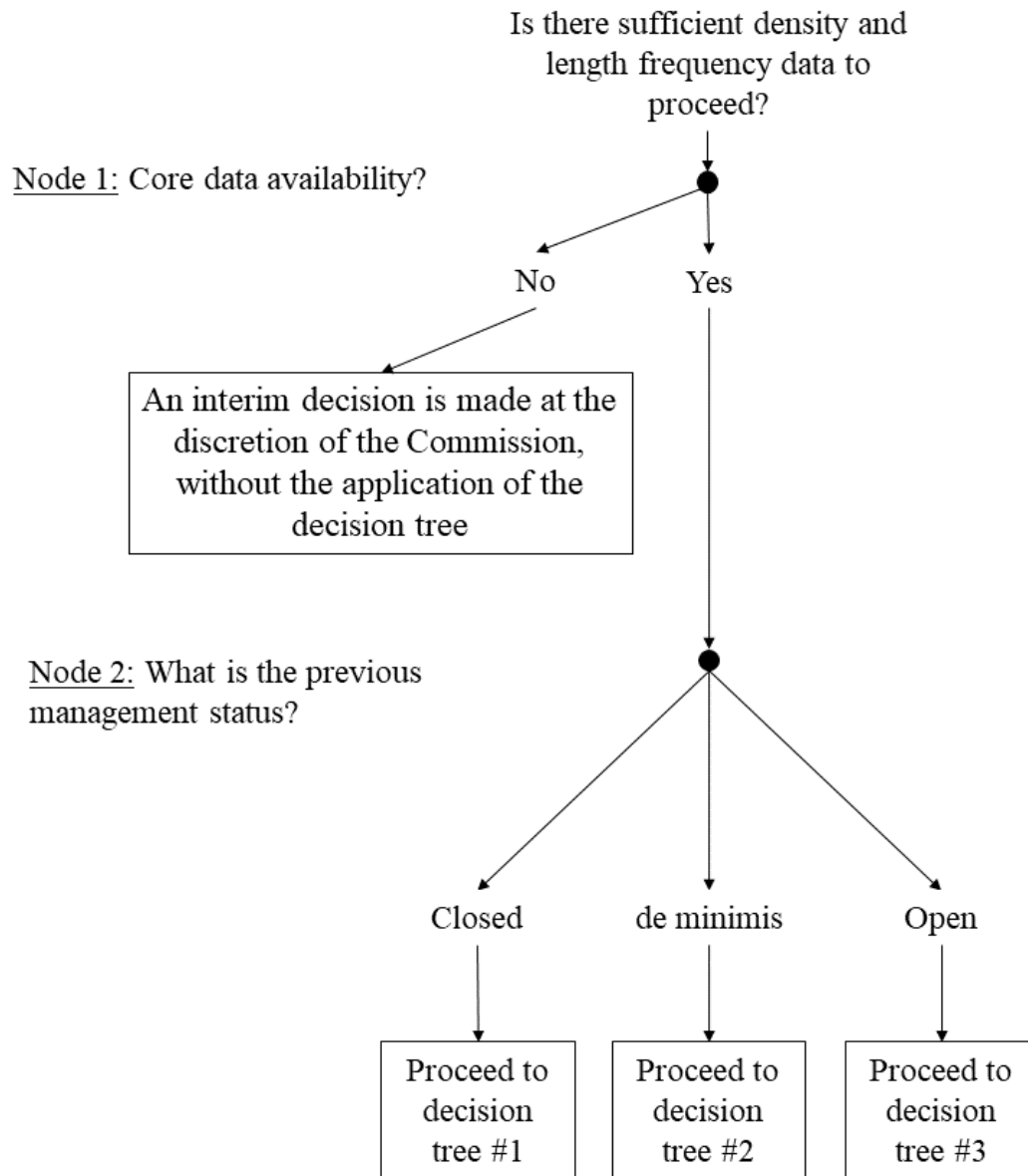Dangerous condition, far from achievement of management objective

Unsatisfactory conditions, occurring in transition from red to green

Satisfactory conditions aligned with the management objective

Figure 1. Traffic light method.

Is there sufficient density and
length frequency data to
proceed?

Node 1: Core data availability?

No   Yes

An interim decision is made at the
discretion of the Commission,
without the application of the
decision tree

Node 2: What is the previous
management status?

Closed   de minimis   Open

| Proceed to decision tree #1 | Proceed to decision tree #2 | Proceed to decision tree #3 |

Figure 2. Part A of the management strategy.

Figure 3. Part B of the management strategy. Decision tree #1. Applied when previous management status is closed.
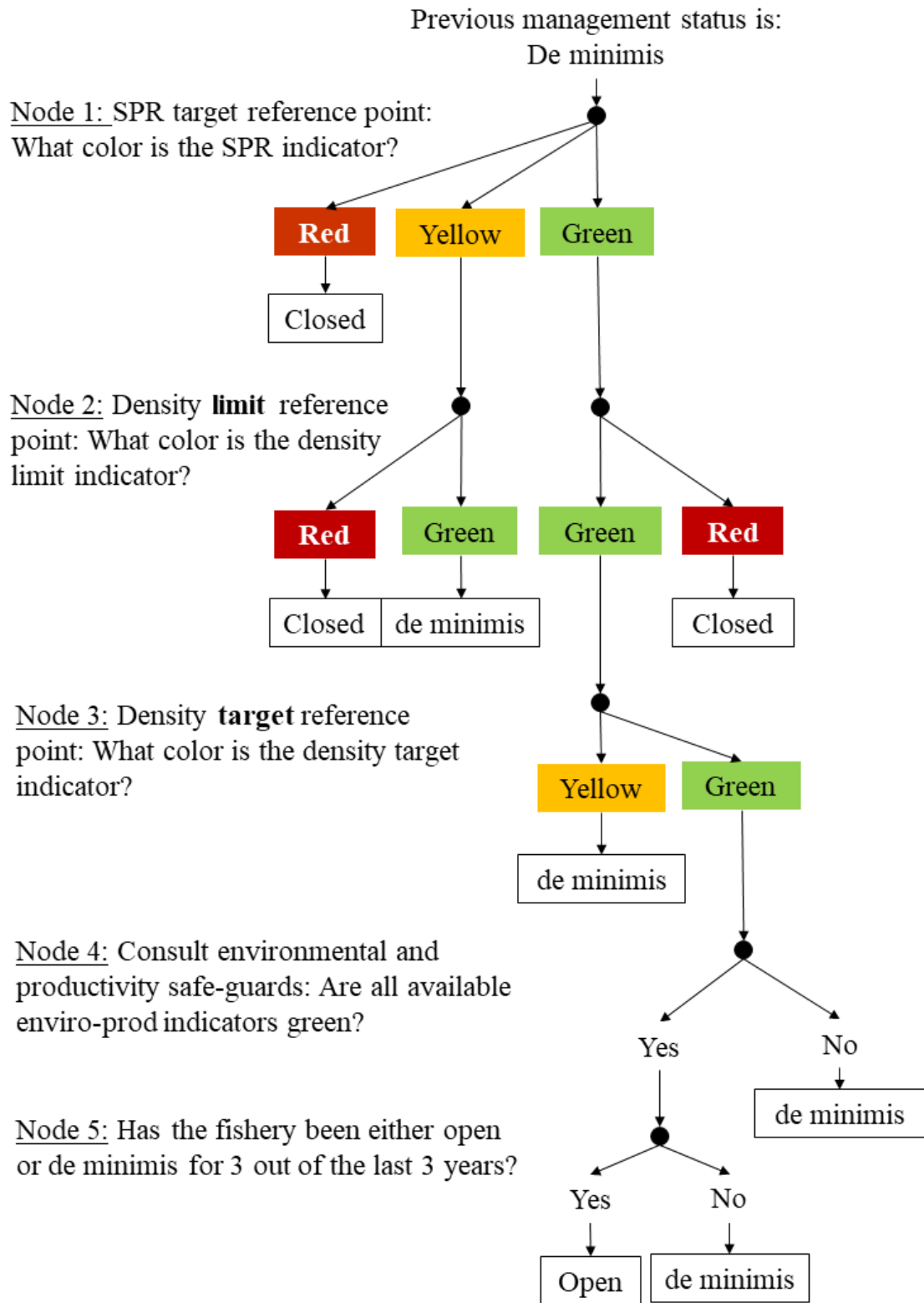
Figure 4. Part B of the management strategy. Decision tree #2. Applied when previous management status is de minimis.
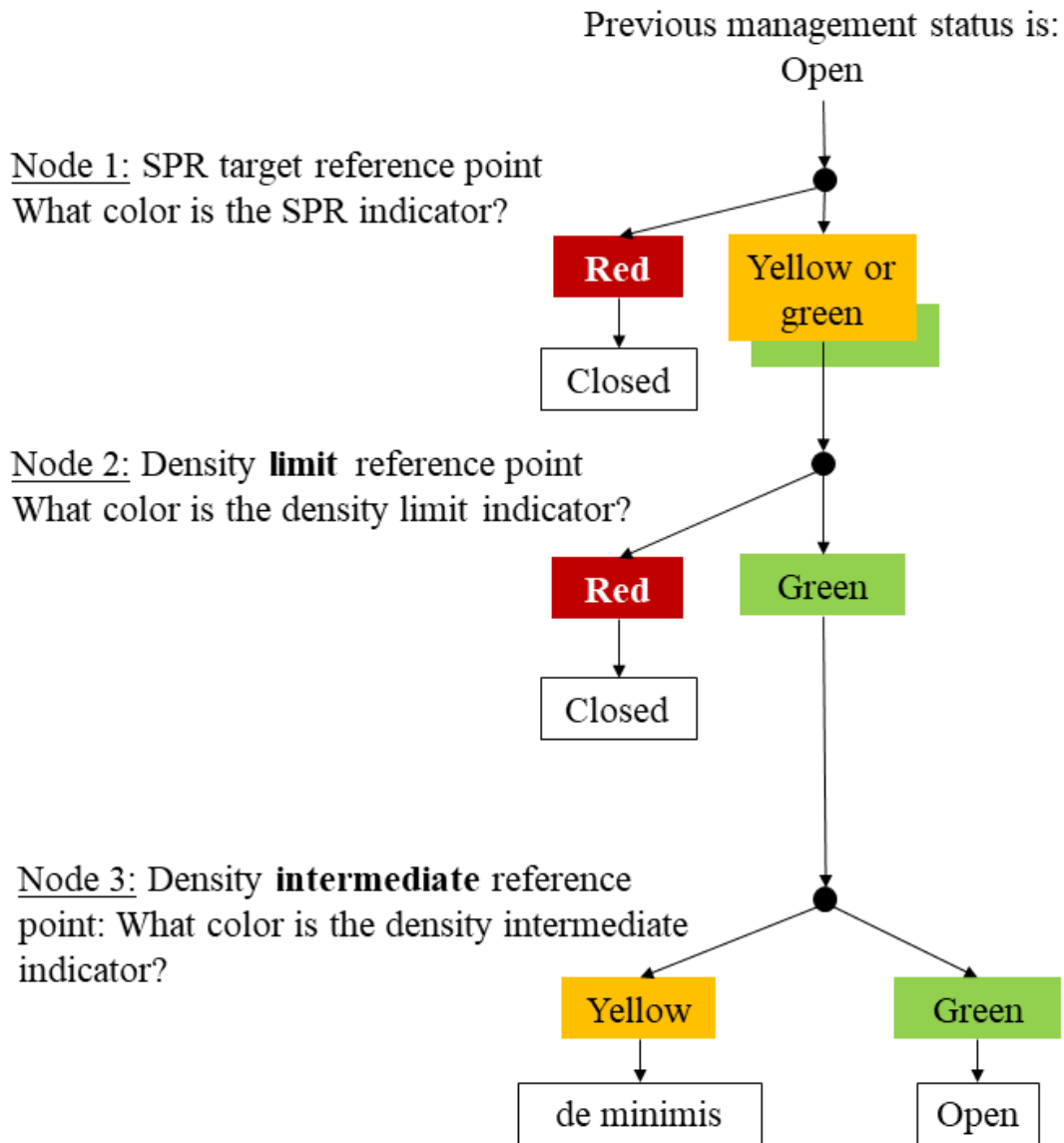
Figure 5. Part B of the management strategy. Decision tree #3. Applied when previous management status is open.