

STAFF SUMMARY FOR OCTOBER 11-12, 2017

22. ABALONE**Today's Item****Information** **Action**

Discussion of proposed changes to recreational abalone regulations.

Summary of Previous/Future Actions

- | | |
|-------------------------------------|------------------------------------|
| • Adopted emergency regulations | Dec 7, 2016; San Diego |
| • MRC vetting | Jul 20, 2017; MRC, Petaluma |
| • Notice hearing | Aug 16, 2017; Sacramento |
| • Today's discussion hearing | Oct 11-12, 2017; Atascadero |
| • Adoption hearing | Dec 6-7, 2017; San Diego |

Background

On Aug 16, 2017, FGC readopted the emergency action reducing the annual recreational limit from 18 to 12 abalone (except for Sonoma County, for which the annual limit remains at 9 abalone) and reduced the recreational fishing season from 7 months to 5 by closing Apr and Nov, the first and last months of the regular season. The emergency regulations are set to expire on Dec 5, 2017. In addition, FGC authorized publishing a notice of its intent to amend regulations for the recreational abalone fishery with proposed management measures more restrictive than the 2017 emergency regulations, due to the lack of significant improvement to the environmental conditions and continued declines in abalone densities and abalone health observed by DFW in 2017. The authorization includes the regulatory option presented by DFW (Option 1) and additional options discussed and requested by FGC at the Aug meeting (Option 2), options that are more restrictive than the 2017 emergency regulations.

DFW submitted the ISOR (Exhibit 3) with the two proposed regulatory options for the recreational red abalone fishery in 2018 as follows:

- Option 1– Full Fishery Closure, based on abalone densities below the density trigger for fishery closure specified in the Abalone Recovery and Management Plan (ARMP) (below 0.30 abalone per square meter).
- Option 2 - Limited Fishery Option, with four sub-options for limiting the fishery per the request of FGC. The four sub-options can be selected individually or in any combination. Two of the sub-options have ranges from which specific numbers must be selected at the adoption hearing.
 - Sub-Option A: Re-open Fort Ross for Abalone Fishing
 - Sub-Option B: Reduce Daily Bag/Possession and Annual Limits
 - Sub-Option C: Increase Minimum Size Limit to 8 Inches
 - Sub-Option D: Limit the Number of Report Cards to between 5,000 – 25,000

A draft notice of exemption (NOE) is also attached (Exhibit 4), which gives FGC notice of DFW's recommendation to rely on a California Environmental Quality Act categorical exemption for this regulation change.

STAFF SUMMARY FOR OCTOBER 11-12, 2017

Significant Public Comments

1. Statement from a fisherman's perspective that the emergency regulations adopted at the Aug 2017 meeting have had little impact on the quality of his take and recommends two suggestions for consideration: (1) increase the minimum size to eight inches since three abalone at seven inches can be taken with little effort and increasing the size will force other fishermen to be more selective; and (2) reduce the daily bag limit to two abalone per day (Exhibit 4).
2. Suggestion from a fisherman that FGC consider: (1) keeping the abalone fishery open, (2) allowing two abalone per day, (3) limiting to eight abalone per year, and (4) leaving the size at seven inches (Exhibit 5).
3. Recommendation from a fisherman for no changes to the regulations (Exhibit 6).
4. Recommendation from a group of scientists and two fishermen that FGC include a proposed harvest control rule in the new red abalone fishery management plan (Exhibit 7).
5. Recommendation from a fisherman that the 2018 abalone season remain open pending adoption of a new fishery management plan.

Recommendation

FGC staff: Adopt DFW's recommendation to close the recreational abalone fishery, consistent with the ARMP and DFW's findings.

DFW staff: DFW recommends Option 1, to close the recreational abalone fishery. This recommendation is consistent with the ARMP and reflects evidence that the fishery is unsustainable and in rapid decline.

Exhibits

1. [DFW memo, received Sep 19, 2017](#)
2. [ISOR](#)
3. [Draft NOE](#)
4. [Email from Brandon Earhard, received Sep 15, 2017](#)
5. [Email from Alex Reynaud, received Sep 26, 2017](#)
6. [Email from Whitney Hitaz, received Sep 26, 2017](#)
7. [Email from Jono Wilson, The Nature Conservancy, transmitting a proposed abalone harvest control rule, received Sep 28, 2017](#)
8. [Email from Jack Likins, dated Sep 28, 2017](#)
9. [DFW Presentation](#)

Motion/Direction (N/A)

Memorandum

2017 SEP 19 PM 1:00

Date: September 19, 2017

To: Valerie Termini
Executive Director
Fish and Wildlife Commission

From: Charlton H. Bonham
Director



Subject: **Initial Statement of Reasons to Amended Section 29.15 Re: Red Abalone Regulations**

At its August 16th meeting, the Fish and Game Commission (Commission) authorized publishing notice of its intent to amend regulations for the recreational abalone fishery, including the regulatory option presented by the Department and additional options discussed and requested by the Commission at the meeting. The Initial Statement of Reasons (ISOR) must be filed by September 19th to accommodate the 45-day public comment period and allow the Commission to consider adopting new regulations at its meeting on December 6th.

The Department is submitting the ISOR with two proposed regulatory options for the recreational red abalone fishery in 2018.

- Option 1– Full Fishery Closure due to continued decline of abalone densities below the Abalone Recovery and Management Plan (ARMP) fishery closure density trigger of 0.30 abalone m². Additionally, the Department has not observed any significant improvement to the environmental conditions and health of the red abalone resource in 2017.
- Option 2 - Limited Fishery Option with four sub-options for limiting the fishery. This option was included in the ISOR at the request of the Commission. The four sub-options include:
 - Sub-Option A: Re-open Fort Ross for Abalone Fishing
 - Sub-Option B: Reduce Daily Bag/Possession and Annual Limits
 - Sub-Option C: Increase Minimum Size Limit to 8"
 - Sub-Option D: Limit the Number of Report Cards from 5,000 – 25,000

The four sub-options can be selected individually or in any combination. Some of the sub-options have ranges that must be selected from at the adoption hearing.

The Department recommends Option 1 to close the recreational abalone fishery. This recommendation is consistent with the ARMP and reflects the evidence that this fishery is unsustainable and in rapid decline.

Valerie Termini, Executive Director
Fish and Game Commission
September 19, 2017
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A draft Notice of Exemption (NOE) is also attached. Since the NOE is not anticipated to change, this early submission gives the Commission notice of the Department's recommendation to rely on a California Environmental Quality Act (CEQA) categorical exemption for red abalone.

If you have any questions or need additional information, please contact Dr. Craig Shuman, Marine Region, Regional Manager at (805) 568-0216.

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STATE OF CALIFORNIA
FISH AND GAME COMMISSION
INITIAL STATEMENT OF REASONS FOR REGULATORY ACTION
(Pre-publication of Notice Statement)

Amend Section 29.15,
Title 14, California Code of Regulations
Re: Abalone Regulations

I. Date of Initial Statement of Reasons: September 12, 2017

II. Dates and Locations of Scheduled Hearings:

- (a) Notice Hearing: Date: August 17, 2017
 Location: Sacramento, CA
- (b) Discussion Hearing: Date: October 12, 2017
 Location: Atascadero, CA
- (c) Adoption Hearing: Date: December 7, 2017
 Location: San Diego, CA

III. Description of Regulatory Action:

- (a) Statement of Specific Purpose of Regulation Change and Factual Basis for Determining that Regulation Change is Reasonably Necessary:

The recreational red abalone (*Haliotis rufescens*) fishery is one of California's most successful and popular fisheries, and is economically important, particularly to Sonoma and Mendocino counties where approximately 95 percent of the multi-million dollar fishery takes place. Over 25,000 fishermen participate in the fishery each year. Red abalone may be taken with a sport fishing license subject to regulations prescribed by the Fish and Game Commission (Commission). The Marine Life Management Act (MLMA) requires that fisheries are managed with objectives that include that the fishery is conducted sustainably so that the long-term health of the resource is not sacrificed in favor of short-term benefits (Fish and Game Code Section 7056(a)).

Under existing statute (Fish and Game Code Section 5521) and regulation (Section 29.15, Title 14, CCR), only red abalone may be taken for recreational purposes north of a line drawn due west magnetic from the center of the mouth of San Francisco Bay, except in the closed Fort Ross area. The current regulation also specifies the season, hours, a combined daily and possession limit, annual limit, special gear provisions, measuring

devices, abalone report card requirements, and minimum size. Red abalone may only be collected by skin diving (without SCUBA) or rock picking during low tides, so that a deep-water refuge population is maintained to enhance productivity of the fishery. The recreational red abalone season is scheduled to open April 1, 2018.

In 2005, the Commission adopted the Abalone Recovery and Management Plan (ARMP) pursuant to requirements in statute (Fish and Game Code Section 5522), to provide a cohesive framework for recovering depleted abalone populations in southern California, and for managing the northern California fishery and future fisheries, including red abalone. The ARMP articulates a framework for sustaining red abalone populations based largely on densities, catch, size, and reproductive success which serve as triggers for adjusting total allowable catch (TAC) and engaging other management measures. Using criteria described in the ARMP, the TAC is adjusted when specific triggers are met, through various management actions such as changes to daily bag/possession limits, seasonal limits, and season length.

In 2013, when average densities in northern California fell below established ARMP triggers, the Commission took action to adjust the TAC from 280,000 to 190,000, with the goal to sufficiently reduce take such that densities would stop declining and eventually recover to target densities. The Commission also took management action to meet the adjusted TAC by amending the annual limit for red abalone north of the Mendocino/Sonoma county line from 24 to 18, amending the annual limit south of the Mendocino/Sonoma county line from 24 to 9, and moving the start time for fishing from one half hour before sunrise to 8:00 a.m. The Fort Ross area was closed to red abalone fishing as a result of hitting the site closure trigger. The new regulations went into effect in 2014, resulting in a 35 percent decline in take to approximately 148,000 in 2015.

In 2015, a combination of unprecedented environmental and biological stressors began to take their toll on red abalone populations, including warmer-than-normal waters and decreasing food resources, leading to starvation conditions. In 2016 the California Department of Fish and Wildlife (Department) determined from surveys that deep water red abalone densities were below ARMP minimum sustainable levels, which prompted the Commission to take emergency action to reduce the season by two months and the annual limit from 18 to 9 for the 2017 season. Throughout 2016 and 2017, the Department conducted surveys, visual assessments, and histological sampling of red abalone along the north coast, and documenting citizen reports of unhealthy or moribund red abalone within the fishery. The Department has identified wide-sweeping changes in the density, occurrence, depth distribution, size and health of

red abalone and the kelp upon which it depends for food. Specifically, the Department has found:

- **Warm Water Conditions and Kelp and Algae Declines.** Red abalone are herbivores that live on rocky reefs in kelp forests, eating red and brown algae. In 2014, the kelp forests in the abalone fishery region declined by 93 percent from known maximum potential due to (1) extreme warm water conditions, (2) a dramatic decline in sea stars, important sea urchin predators, due to sea star disease, and (3) an unprecedented 60 percent increase in herbivorous purple sea urchin populations. Unlike red abalone, sea urchin populations are generally resilient to food shortages and can survive longer, such that even if water conditions cool, grazing pressure from surviving sea urchins may still keep kelp from wide-spread recovery. Warm water conditions persisted through 2015, impacting kelp recovery and red abalone health. Recently there has been some improvement in kelp growth with cooler water this year, but current kelp canopies are still very sparse compared to the long-term average.
- **Starvation Conditions.** Red abalone are susceptible to starvation when kelp and algal abundances decline. Kelp and other algal species are being actively cleared from rocky bottom habitat that is dominated by grazing purple sea urchins, which are at least sixty times more abundant now than prior to 2013. Urchin populations increased, in part, to large-scale loss of predatory starfish species in 2013 due to sea star wasting disease. Bull kelp and other algal food sources for red abalone have remained at extremely low levels since 2014; the large number of purple urchins is likely keeping kelp recovery confined to very limited areas.

Red abalone have been observed stacked on top of each other in shallow water, which could be attributed to either red abalone moving from deeper water to shallower water where algae is slightly more abundant, or red abalone trying to graze whatever algae is growing on the shells of other red abalone; shells were observed to be unusually clean of algal growth. Recent evidence indicates the starvation conditions have not yet abated; additional impacts have been observed in 2017 and are expected to continue through the 2018 season.

- **Density Declines.** In spite of the Commission's 2013 actions to reduce take and allow for recovery, densities continued to decline from an average of 0.47 red abalone per square meter (m²) in 2013 to 0.44 per m² in 2016. The Department believes the density decline is largely due to the environmental conditions described herein. The emergency action taken by the Commission last year was made with a level of optimism about environmental conditions that are not being realized. Recent Department

surveys conducted in August of this year (2017) in Sonoma and Mendocino counties show a large decline in densities at seven of the ten index sites, to an average of 0.16 per m² (Table 1).

Table 1. Sonoma County and Mendocino County index site red abalone densities past (2012-2016) and current (2017) with percentage decline.

Index Site (Sonoma-SC or Mendocino-MC)	Past Density (abalone/m²) (year sampled)	2017 Density (abalone/m²)	Decline
Fort Ross (SC)	0.44 (2015)	0.20	-55%
Timber Cove (SC)	0.38 (2015)	0.15	-60%
Ocean Cove (SC)	0.44 (2016)	0.17	-61%
Salt Point (SC)	0.38 (2016)	0.06	-84%
Sea Ranch (SC)	0.37(2012)	0.27	-27%
Sonoma Average	0.39	0.17	-46%
Point Arena (MC)	0.66 (2014-15)	Not sampled	NA
Van Damme (MC)	0.33 (2016)	0.14	-58%
Russian Gulch (MC)	0.60 (2014)	Not sampled	NA
Caspar Cove (MC)	0.35 (2013)	Not sampled	NA
Todd's Point (MC)	0.47 (2013)	0.16	-60%
Mendocino Average	0.49	0.15	-69%
Overall Average	0.44	0.16*	-58%

* The ARMP fishery closure is 0.3 abalone/m². The overall average, when including past densities as a proxy for sites not sampled in 2017, is 0.28.

- Deep-Water Refuge.** Deep-water refuge is believed to be a critical component in maintaining a highly productive recreational fishery. Deep-water red abalone are generally safe from take and can be a source of both adults to replace red abalone removed from shallower waters and larvae to enhance red abalone reproduction rates. Surveys in summer of 2016 showed large reductions in red abalone densities in deep water refuges (greater than 28 foot depths). The average density of deep-water red abalone populations over the past four years has declined below the ARMP management trigger and increases the risk that the fishery is not sustainable. It should be noted that red abalone movement from deep water into shallow water or from cryptic locations to exposed shallow areas can give the impression that red abalone populations are stable or have increased if the absence of red abalone in deeper waters is not considered.

- Abalone Health, Reproduction, and Mortality.** The abundance of warm water, coupled with a lack of algae, has severely impacted the health and reproductive development of red abalone. Fishermen and the public have reported weak, shrunken, and dying red abalone, as well as unusually high numbers of empty shells of all size classes throughout 2016, which has continued into the 2017 season. Department surveys in 2016 revealed that more than 25 percent of catch at 10 survey sites had body mass that was shrunken (foot observably smaller than the size of the shell), a sign of starvation conditions. The first survey of the 2017 season at nine survey sites show similar results with approximately 25 percent of the catch continuing to show starvation conditions. Reductions in body mass lead to reduced reproductive fitness; just a 20 percent reduction in body mass can reduce reproduction by 60-90 percent. Red abalone require approximately 12 years to grow to minimum legal size, so that multi-year gaps in reproduction will be observed in the fishery for years to come. Furthermore, recent laboratory feeding studies of starved wild red abalone indicate that reproductive capability may take more than one year to recover to normal levels after algal conditions improve.
- The weakened condition of red abalone may also reduce their ability to withstand normal storm waves during the winter months, and increase mortality. 2017 appears to be the third consecutive year of poor reproduction compared with previous average or good years, which is likely to put future sustainability of the fishery at risk. Four plus years of no or little reproduction (three consecutive years plus one year to recover to normal if conditions improve) will have very significant effects on the red abalone fishery in the future. Lack of kelp and other algae greatly reduces cover for red abalone, making them easier to locate by fishermen. In addition, fishermen are able to select the healthiest of the remaining red abalone from declining populations.

On December 7, 2016, the Commission took emergency action to reduce the annual limit for the take of red abalone from 18 to 12 (except for Sonoma County, which remains at 9) and reduce the months open to fishing from 7 to 5 by closing April and November. The emergency actions, along with the reductions in the fishery from action taken in 2014, have not had the desired effect of stopping the decline in red abalone densities during this unprecedented environmental disaster for red abalone in northern California's nearshore rocky reef habitats.

The ARMP adopted by the Commission in 2005 outlines management triggers (also known as control rules) to help guide fishery management.

- Fishery Reduction Density: The ARMP prescribes a 25% reduction in the catch when the density drops by 25%. **The fishery reduction trigger of 0.5 red abalone/m² has been met.** The next trigger for a 25% reduction in the catch is when the overall density of the fishery drops below 0.375 red abalone/m², which current densities are well below, **thereby triggering further reduction under the ARMP.**
- Fishery Closure Density: The ARMP prescribes a fishery closure if the average density of the index sites falls below 0.3 red abalone/m². Average density in this case is calculated using the most recent data from all ten index sites. **The fishery closure density of 0.3 red abalone/m² has been met (Table 1).**

Proposed Regulatory Options to Reduce Catch

The proposed regulations respond to continued dramatic decline of the red abalone population following severe, wide-spread, starvation conditions throughout the fishery. The proposals are grouped into two options:

- **Option 1– Full Fishery Closure**, until it recovers, due to continued decline of red abalone densities below the ARMP fishery closure density trigger of 0.30 red abalone/m².
 - The Department has not observed any significant improvement to the environmental conditions and health of the red abalone resource in 2017. This option is consistent with the ARMP.
- **Option 2 - Limited Fishery Option**, with four sub-options for limiting the fishery, which are not consistent with the ARMP. This option was included at the request of the Commission at the August 2017 meeting for further discussion. The four sub-options include:
 - Sub-Option A: Re-open Fort Ross for Abalone Fishing
 - Sub-Option B: Reduce Daily Bag/Possession and Annual Limits
 - Sub-Option C: Increase Minimum Size Limit to 8 inches
 - Sub-Option D: Limit the Number of Report Cards to within a Range of 5,000 to 25,000.

Estimates of the reduction in catch for some management sub-options are presented below, and are based on past fishing behavior and catch from report card data; however, these estimates are highly uncertain due to changes in the fishery and environment. Because past experience does not necessarily predict future behavior, especially when combining multiple sub-options, there are varying degrees of uncertainty associated with these estimates.

Option 1 - Full Fishery Closure: Amend Section 29.15 to close the fishery until it recovers.

Pros

- Consistent with the ARMP
- Consistent with general policies of the MLMA to ensure conservation, sustainable use, and restoration of state marine living resources for the benefit of all citizens of the state
- Easy to understand and enforce
- Maintains red abalone populations in shallow water since there are functionally none in deep water, which previously acted as a refuge population
- Population and fishery recovery rate maximized
 - Long-term economic impacts may be minimized
 - Maximizes future sustainable fishing opportunities
- Provides language for red abalone legally taken prior to the April 1, 2018 closure and still in possession at a residence.

Cons

- Eliminates all fishing opportunity in the near-term until recovery
- Will adversely affect local businesses in the-near term until recovery
- May increase illegal fishing
- Ceases Department funding from abalone report card sales to support biological research and enforcement

Option 2 – Limited Fishery Option: Amend Section 29.15 to establish a limited fishery to reduce take.

The limited fishery option uses as baseline the regulations that existed prior to the 2016 emergency action that modified the 2017 season. For example, the proposal assumes the season length is 7 months, April – June plus August through November. The limited fishery option has four sub-options that can be selected individually or in any combination. Some of the sub-options have ranges that must be selected at the adoption hearing.

Pros

- Allows limited red abalone fishing opportunity in the short-term
- Provides some economic benefits as compared to a complete closure

Cons

- Not consistent with the ARMP

- Not consistent with the MLMA objectives of conducting sustainable fisheries
- Allows continued targeting of healthiest remaining red abalone from declining populations
- Increases risk of collapse of California's last red abalone fishery

Sub-Option A: Re-open Fort Ross for Abalone Fishing

Fort Ross was closed through regulatory action in 2014 due to a severe decline in density following a toxic harmful algal bloom (HAB) in 2011. The most recent surveys from 2017 show an additional 18% density reduction from 2012 values, despite nearly four years of no fishing allowed in the area. Density at Fort Ross remains low (Table 1), below the site closure threshold, although it is higher than most of the other sites in Sonoma County. The sub-option to re-open Fort Ross acknowledges that all of the Sonoma County sites are now at similarly very low densities, and seeks to reduce fishing impacts at any given location by further distributing effort. In the past, a newly-opened site (e.g. Sea Lion Cove at Stornetta Ranch) experienced higher fishing pressure than surrounding sites and local densities were severely reduced (>65%) in just three years. The response of fishers to re-opening a very low-density site is not predictable.

Pros

- See Option 2 pros above
- May help spread fishing pressure so that most sites may experience somewhat reduced fishing pressure
- Re-introduce red abalone fishing access to the historically most-popular fishing site

Cons

- See Option 2 cons above
- Allows fishing of a population that is not self-sustaining. The density at Fort Ross has declined even in the absence of fishing. Opening this site to fishing pressure while starvation conditions persist will drive densities to decline more rapidly.
- Continued density declines at Fort Ross will severely hinder future population recovery through reduced reproduction.

Sub-Option B: Reduce Daily Bag/Possession and Annual Limits

The proposed regulation to reduce the daily bag/possession and annual limits is to allow limited fishing effort under the current conditions; a reduction in these limits is relatively simple to enforce and the regulation is easy to understand. A range of 1 to 3 red abalone per day (daily bag/ possession limit) and 2 to 9 red abalone per year (annual limit) is proposed. Some combinations of reduced

bag/possession and annual limits are listed in Table 2 with corresponding estimates of possible catch reductions. The estimates are based on data from abalone report cards returned in 2016 and are provided to frame take that could occur as a result of this sub-option. However, behavior of the fishers under these regulations are unknown. Estimates assume people will not increase or decrease the number of trips they made in 2016. Actual reductions in catch could be significantly different because of changes in availability of red abalone, the reluctance of fishers to buy abalone report cards under more restrictive limits, or a change in the numbers of trips per individual to take red abalone.

Table 2. Examples of estimated catches for reduced bag/possession and annual limits (Sub-Option B) using 2016 abalone report card data.

Daily Bag/ Possession Limit	Annual Limit	Estimated Catch
3	9	120,000
3	6	94,000
2	6	82,000
1	5	52,000
2	4	63,000
3	3	54,000
1	3	42,000
2	2	37,000
1	2	32,000

Pros

- See Option 2 pros above

Cons

- See Option 2 cons above
- Allows fishing on a resource that is not self-sustaining
- May increase illegal fishing. The demand for black market red abalone is already high and any further restrictions that limit take will increase the value of black market red abalone creating a greater incentive for poaching. In particular, poaching under the guise of recreational fishing (i.e., altering report card information) may increase.
- Lower annual limits may increase violations of card alteration, failure to complete card, or false application for lost card
- Fishers accustomed to taking larger annual limits might decide greatly reduced annual limits are not worth the cost of a report card
- Fishers from outside the region who are accustomed to taking larger bag/possession limits might decide that the necessary travel and costs are not worth the effort, impacting fishing-related businesses

Sub-Option C: Increase Minimum Size Limit to 8 Inches

Increasing the minimum size limit is often used to allow more time for animals to reproduce before fishing. However, during this starvation event most red abalone are starving and are not reproductive. It is unclear if increasing the size limit to 8-inch red abalone under these conditions will result in the expected benefits. In addition, there is evidence that increasing the size limit will likely increase incidental fishing mortality as fishers remove red abalone searching for larger animals that are less common. Red abalone have no blood clotting mechanisms and so injury with an abalone iron can lead to mortality even when sublegal red abalone are returned to the ocean. Another potential negative effect of an increased size limit is that fishing effort will focus on larger animals, which produce exponentially more gametes, and would therefore hinder the recovery of populations once ocean conditions improve.

This option is often proposed as a way to lower the number of red abalone taken without reducing daily or annual limits. While the total number of red abalone taken would be lower, the number of larger red abalone taken will increase along with the mortality of sublegal red abalone; the overall effect would be reduced reproductive capacity of the population. A reduction in daily/possession and annual limits should also be included with an increase in size limit to reduce the negative effects.

Pros

- See Option 2 pros above

Cons

- See Option 2 cons above
- Allows fishing on a resource that is not self-sustaining
- Increases fishing-related injuries and incidental mortality to red abalone
- Targets most valuable (large) red abalone needed for recovery when conditions improve
- Requires every fisher to buy or make new fixed gauges, increasing compliance costs

Sub-Option D: Limit the Number of Report Cards to within a range of 5,000 to 25,000.

The number of fishery participants since the 2014 regulation change has averaged around 25,500 annually. The estimated total catch for 2016 was

154,000 red abalone (25,129 participants). Limiting the number of report cards sold is one alternative to potentially reducing the fishery catch and still allow a limited fishery under current conditions. Current regulations limit the number of cards an individual can purchase per season to one. There is also a provision for limited replacement due to lost cards.

Table 3 shows estimated catch for various limits on abalone report cards sold. The estimated catch is based on a season with an annual limit of 18, but the actual estimate of catch may be lower with a lower annual and/or bag/possession limit. Similar to Sub-option B, the estimates are based on data from abalone report cards returned in 2016 and provide a framework of the potential take that could occur. As with Sub-option B, behavior of the fishers under these regulations are unknown and assume that people will not increase or decrease the number of trips they made in 2016. Actual reductions in catch could be significantly different because of changes in availability of red abalone or the demographic group of fishers that are likely to purchase a limited number of cards on a first-come-first-serve basis (i.e., fishery highliners versus casual participants).

Table 3. Examples of estimated catches from limiting report cards (Sub-Option D) using straight percentage reductions (2016 catch is the basis for catch estimate)

Number of Report Cards	Estimated Catch
5,000 (20%)	30,800
10,000 (40%)	61,600
15,000 (60%)	92,400
20,000 (80%)	123,200
25,000 (2016)	154,000

Pros

- See Option 2 pros above

Cons

- See Option 2 cons above
- Allows fishing on a resource that is not self-sustaining
- The fishery is no longer an open access fishery and access will be first-come-first-serve until the report card sales quota is reached
- May increase illegal fishing. The demand for black market red abalone is already high and any further restrictions that limit take will increase the value of black market red abalone creating a greater incentive for poaching. In particular, poaching under the guise of recreational fishing (i.e., altering report card information) may increase.

Necessity of Regulation Changes

This regulatory proposal is necessary to facilitate the red abalone population's recovery from the multi-year poor environmental conditions and massive losses of red abalone in both shallow and deep-water habitats. The Department finds the following detrimental red abalone resource conditions:

- (1) A dramatic decline in sea stars, important sea urchin predators, due to sea star disease.
- (2) A dramatic decline (93 percent) of the kelp canopy in Sonoma and Mendocino counties in 2014 which continues to persist.
- (3) A dramatic increase (60 times) in the density of purple sea urchins in 2015, increasing competition with red abalone for food.
- (4) An increased efficiency of fishing efforts in shallow habitats due to the lack of kelp and movement of red abalone into shallow fishing areas.
- (5) A decline in deep-water red abalone densities.
- (6) Continued decline in overall average red abalone densities in spite of significant take reductions implemented in 2014 and in 2017.
- (7) Visual body health scores for red abalone taken in the fishery during the spring of 2016 show that more than 25 percent of red abalone were shrunken in body mass at sites in northern California. Similar body health scores have been seen in the fishery in the spring of the 2017.
- (8) Body condition index was very low in both Sonoma and Mendocino county sites in 2016 and 2017 (60 red abalone per county per year).
- (9) Department staff and red abalone fishermen have observed weak red abalone washed up on shore and easy to remove from the rocks.
- (10) Department staff and red abalone fishermen have observed many new shells of all size classes, indicating significant increases in natural mortality.
- (11) Gonad index was very low in both Sonoma and Mendocino county sites in 2016 and 2017 (60 red abalone per county per year).
- (12) Low numbers of larval red abalone observed in plankton surveys in Sonoma and Mendocino counties in 2015.
- (13) Low numbers of newly settled red abalone observed in coralline-covered rock samples from Sonoma and Mendocino counties in 2015 and 2016.
- (14) No juvenile (< 21 millimeter) red abalone observed in artificial reefs in Van Damme State Park in 2016 and 2017.

Department Recommendation

The red abalone fishery is in an unprecedented state and its future is at risk. The possibility of a complete fishery collapse is unknown; however, this period of extreme natural mortality (>50%) is ongoing and has not yet begun to subside.

The risk of fishery collapse increases when abalone densities fall below levels identified in the ARMP at the fishery closure density trigger. For example, Southern California's abalone fisheries collapsed after densities fell below 0.3 abalone per m². MLMA requires that fisheries are managed to meet specific objectives, including that the fishery is conducted sustainably so that the long-term health of the resource is not sacrificed in favor of short-term benefits (Fish and Game Code Section 7056(a)).

Based on the sustainability mandates in the MLMA and the fishery management measures outlined in the ARMP, the Department's recommendation is to close the fishery (Option 1) which is consistent with the management triggers of the ARMP.

Option 2 consists of four sub-options for a limited fishery that are not consistent with the management triggers in the ARMP; as such, the Department does not recommend Option 2.

Updates to Authority and Reference Citations Based on Recent Legislation

Senate Bill 1473 (Stats. 2016, Ch. 546) made organizational changes to the Fish and Game Code that became effective January 1, 2017. The changes included moving the Commission's exemptions from specified Administrative Procedure Act time frames from Section 202 to Section 265 of the Fish and Game Code, moving the Commission's notice requirements from Section 210 to Section 260 of the Fish and Game Code, and moving the Commission's authority to adopt emergency regulations from Section 240 to Section 399 of the Fish and Game Code. These were organizational changes only. In accordance with these changes to the Fish and Game Code, sections 202, 210 and 240 are removed from, and sections 260, 265 and 399 are added to, the authority and reference citations for Section 29.15. Senate Bill 1473 also repealed subdivision (b) of Section 220 of the Fish and Game Code; therefore, Section 220 is removed from the list of authority and reference citations in Section 29.15.

- (b) Authority and Reference Sections from Fish and Game Code for Regulation:

Authority: Sections 200, 205, 260, 265, 399, 5520, 5521, and 7149.8, Fish and Game Code.

Reference: Sections 200, 205, 265, 5520, 5521, 7145 and 7149.8, Fish and Game Code.

- (c) Specific Technology or Equipment Required by Regulatory Change:

None.

- (d) Identification of Reports or Documents Supporting Regulation Change:

Abalone Recovery and Management Plan
<https://www.wildlife.ca.gov/Conservation/Marine/ARMP>

- (e) Public Discussions of Proposed Regulations Prior to Notice Publication:

November 5, 2016, Cotati, California
December 3, 2016, Fort Bragg, California
December 7, 2016, San Diego, California
February 8, 2017, Rohnert Park, California
March 18, 2017, Sacramento, California.
March 23, 2017, San Clemente, California
June 22, 2017, Crescent City, California
July 20, 2017, Petaluma, California
August 16, 2017, Sacramento, California

IV. Description of Reasonable Alternatives to Regulatory Action:

- (a) Alternatives to Regulation Change:

Site closures were considered but rejected because it would concentrate fishers to a smaller number of locations, be complicated and confusing to enforce, and would most likely put excessive pressure on the open sites.

- (b) No Change Alternative:

Without the proposed regulatory change, red abalone fishery regulations will revert back to those that existed before the 2016 emergency rulemaking. Evidence exists that levels of take prior to the emergency rulemaking will be unsustainable under current environmental and stock health conditions. The no change alternative is not consistent with established ARMP triggers and management measures.

- (c) Consideration of Alternatives:

In view of information currently possessed, no reasonable alternative considered would be more effective in carrying out the purpose for which

the regulation is proposed, would be as effective and less burdensome to affected private persons than the proposed regulation, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

V. Mitigation Measures Required by Regulatory Action:

The proposed regulatory action will have no negative impact on the environment; therefore, no mitigation measures are needed.

VI. Impact of Regulatory Action:

The potential for significant statewide adverse economic impacts that might result from the proposed regulatory action has been assessed, and the following initial determinations relative to the required statutory categories have been made:

(a) Significant Statewide Adverse Economic Impact Directly Affecting Businesses, Including the Ability of California Businesses to Compete with Businesses in Other States:

The proposed action will not have a significant statewide adverse economic impact directly affecting business, including the ability of California businesses to compete with businesses in other states because the regulatory action is not likely to significantly increase compliance costs, may or may not significantly impact fishery activity, and only applies to a fishery that is unique to the state of California.

(b) Impact on the Creation or Elimination of Jobs Within the State, the Creation of New Businesses or the Elimination of Existing Businesses, or the Expansion of Businesses in California; Benefits of the Regulation to the Health and Welfare of California Residents, Worker Safety, and the State's Environment:

The Commission anticipates limited impacts on the creation or elimination of jobs within the state; no impact on the creation of new businesses or the elimination of existing businesses; generalized benefits to the health and welfare of California residents; no effects on worker safety; and benefits to the State's environment. The proposed action is designed to ensure the sustainability and quality of the fishery, promoting participation, fishing activity, and economic activity. However, a complete closure of the red abalone fishery could result in up to 250 direct job losses.

(c) Cost Impacts on a Representative Private Person or Business:

Except for Option 2, Sub-Option C: Increase Minimum Size Limit, wherein

fishers may have to spend from \$5 -\$15 to purchase a new abalone measuring gauge, the agency is not aware of any cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

- (d) Costs or Savings to State Agencies or Costs/Savings in Federal Funding to the State:

No costs or savings; however, the Department has the potential to lose revenue from abalone report card sales, from \$103,750 to \$520,825. Federal funding to the state would not be impacted by this proposed change in recreational abalone fishing regulations.

- (e) Nondiscretionary Costs/Savings to Local Agencies:

No costs or savings, however local governments have the potential to receive less sales tax and transient occupancy tax revenue.

- (f) Programs Mandated on Local Agencies or School Districts:

None.

- (g) Costs Imposed on Any Local Agency or School District that is Required to be Reimbursed Under Part 7 (commencing with Section 17500) of Division 4, Government Code:

None.

- (h) Effect on Housing Costs:

None.

VII. Economic Impact Assessment:

The proposed regulations are designed to serve the objectives of resource management and the interests of the recreational fishing community, while minimizing the potential for adverse economic impacts to fishery area businesses and throughout the state. Restrictive actions are only proposed to preserve the sustainability of the resource and thus the long-term viability of the fishery that should continue to draw economic benefits to the relatively isolated coastal communities in the fishery area.

The proposed Full Fishery Closure (Option 1) is anticipated to eliminate all recreational abalone fishers' visits, along with their spending traveling to and spending in the fishery areas on food and accommodations, equipment, and

other retail. In the absence of the unique draw of recreational abalone fishing, a 100% drop in direct expenditures of \$18.6 million is estimated; this drop is estimated to reduce the total (direct, indirect, and induced) economic impact by \$26.7 million. A maximum of 250 direct jobs could be eliminated.

The Limited Fishery (Option 2) with an array of sub-options that may be applied singularly or combined is anticipated to reduce direct expenditures by varying degrees. The degree by which each sub-option impacts fishing trips, days and spending is difficult to predict. Conjecture about the extent to which abalone fishers reduce fishing trips, days, overnight stays, and/or opt out of abalone fishing for the entire season would be speculative. Additionally, the combination of sub-options that may be chosen is not known. Given that, we present estimates for how a 25%, 50%, 75% and 100% decline in fishery activity could impact the local and statewide economies.

Table 4. Economic Impact of Incremental Reductions in Abalone Fishing

Percent Change in Direct Expenditure	Total Seasonal Direct Expenditure	Total Economic Output	Change in Total Output	Job Direct Impacts
2014*	\$18.6	\$26.7	\$0.0	250
-25%	\$14.0	\$20.0	-\$6.7	-63
-50%	\$9.3	\$13.4	-\$13.4	-125
-75%	\$4.7	\$6.7	-\$20.0	-188
-100%	\$0.0	\$0.0	-\$26.7	-250

* 2014 season had a reduced bag/possession limit, later start time, and the closure of Fort Ross (Reid, et al., 2016). Dollar figures are in millions of 2016\$.

While reaction of abalone fishers to Option 2 sub-options is difficult to predict, previous emergencies and restrictive actions taken in 2014 and 2016 have shown drops in abalone report cards sales only as large as 15.6%. If sub-option C, a limit on the number of cards, is implemented alone, then the anticipated economic impact could be more predictable. However, the reduction in daily and/or annual bag/possession limits, the opening of Fort Ross, and/or the increase in size limits may have various influences on the extent that fishery participants may be inclined to reduce fishing trips. Other factors may also influence participation in the fishery, such as the quality of the red abalone, the weather, gas prices, and other unknowns. That said, the impacts may range from a \$6.7 to \$20 million reduction in red abalone-associated spending and 63 to 188 potential job losses.

Fiscal Impact Assessment

Local Government Tax Impact

Abalone regulatory options were evaluated as if visits and spending to the fishery

areas were to drop by 25%, 50%, 75%, or 100%. Abalone fishers introduce expenditures in the retail, food and accommodations, automotive service and fuel, sporting equipment sales/rent/lease, and recreational services sectors; these direct expenditures generate local sales taxes and transient occupancy taxes for the fishery area local governments. The California State Board of Equalization reports local sales tax rates for the areas under evaluation. Local sales tax rates in Sonoma, Marin, Mendocino, Humboldt, and Del Norte counties range from 1.5% to 2.5%. Reduced spending due to reduced numbers of visits and reductions in the length of stay could result in sales tax revenue losses that range from \$66,750 to \$267,000 over the season.

Transient occupancy tax (TOT) fishers' survey responses reveal that those who travel a greater distance to the fishery area are more likely to choose to stay overnight in the area. Those who live in the closest proximity to harvest sites and those who harvest in the earliest hours of the day show a lower likelihood of staying overnight. Overnight stays are often at private campgrounds, motels, and hotels, all of which collect TOTs. County treasurer tax collectors report the county transient occupancy taxes. TOT rates in Sonoma, Marin, Mendocino, Humboldt, and Del Norte counties range from 9% to 10%. The projected losses in overnight stays range from 1,000 to 10,000 nights, which could result in losses in local TOT revenues to local governments from \$7,600 to \$76,000 over a season.

State Government Fiscal Impact

Fiscal impacts to the state via Department revenue could occur through reduced abalone report card sales, with limits on card sales (Option 2, Sub-option D), declines due to changes in bag/possession and size limits (sub-options B, C), and/or the full closure of the fishery (Option 1).

Abalone report card sales from 2012 to the partial year 2017 show that the 2016 emergency action did not precipitate a substantial drop in abalone report card sales revenue to the Department. Notably, the 2014 regulation change that targeted a 25% reduction in red abalone take elicited the largest drop of 15.6% in card sales.

Table 5. Abalone Report Card Sales 2012 – 2017

Abalone Report	2012	2013	2014	2015	2016	2017
Cards Sold	29,202	30,579	25,798	25,542	25,129	21,062*
% Change	-6.35%	4.72%	-15.63%	-0.99%	-1.62%	N/A

*Partial 2017 data – as of 6/30/2017.

Reductions in abalone report card sales are estimated to range from about 5,000 to 25,000 cards, which could result in card sales revenue losses from \$103,750 to \$520,825 at the 2017 card price of \$20.75. Assuming similar decreases in report card sales both years, potential losses in revenues for fiscal years 2018 and 2019 are projected below.

Table 6. Projected Revenue Loss

Fiscal Year	Projected Report Card Revenue Loss
2018	\$103,750 to \$520,825
2019	\$131,775 to \$527,100

Federal funding to the state would not be impacted by this proposed change in recreational abalone fishing regulations.

(a) Effects of the Regulation on the Creation or Elimination of Jobs Within the State:

The Commission anticipates limited negative impacts on the creation or elimination of jobs within the state. The proposed action is designed to ensure the sustainability and quality of the fishery, promoting participation, fishing activity, and economic activity. However, a complete closure of the red abalone fishery could result in up to 250 direct job losses.

(b) Effects of the Regulation on the Creation of New Businesses or the Elimination of Existing Businesses Within the State:

The Commission does not anticipate the impact of take limitations or potential seasonal closure of the red abalone fishery to be a principle impetus for the creation of new businesses or the elimination of existing businesses within the state. Restrictive seasonal actions are only proposed to preserve the sustainability of the resource and thus the long-term viability of the fishery that may then continue to support fishery-related businesses.

(c) Effects of the Regulation on the Expansion of Businesses Currently Doing Business Within the State:

The Commission does not anticipate the impact of take limitations or potential seasonal closure of the red abalone fishery to have a significant impact on the expansion of businesses currently doing business within the state. Restrictive seasonal actions are only proposed to preserve the sustainability of the resource and thus the long-term viability of the fishery that may then continue to support fishery-related businesses.

(d) Benefits of the Regulation to the Health and Welfare of California Residents:

The Commission anticipates generalized benefits to the health and welfare of California residents through the sustainable management of the red abalone fishery.

(e) Benefits of the Regulation to Worker Safety: None

(f) Benefits of the Regulation to the State's Environment:

The Commission anticipates benefits to the State's environment. It is the policy of this State to ensure "the conservation, sustainable use, and, where feasible, restoration of California's marine living resources for the benefit of all the citizens of the State" (Fish and Game Code sections 1700, 7050(b)).

(g) Other Benefits of the Regulation: None

Informative Digest (Plain English Overview)

The recreational red abalone (*Haliotis rufescens*) fishery is one of California's most successful and popular fisheries, and is economically important, particularly to Sonoma and Mendocino counties where approximately 95 percent of the multi-million dollar fishery takes place. Over 25,000 fishermen participate in the fishery each year. Red abalone may be taken with a sport fishing license subject to regulations prescribed by the Fish and Game Commission (Commission).

Under existing statute (Fish and Game Code Section 5521) and regulation (Section 29.15, Title 14, CCR), red abalone may only be taken for recreational purposes north of a line drawn due west magnetic from the center of the mouth of San Francisco Bay, except in the closed Fort Ross area. The current regulation also specifies the season, hours, a combined daily and possession limit, daily limit, special gear provisions, measuring devices, abalone report card requirements, and minimum size. Red abalone may only be collected by skin diving (without SCUBA) or rock picking during low tides. The recreational red abalone season is scheduled to open April 1, 2018.

The California Department of Fish and Wildlife (Department) has identified major changes in the density, occurrence, size and health of red abalone and the kelp upon which it depends for food. Specifically, the Department has found no meaningful changes in three red abalone resource conditions: fishing grounds, health and reproduction.

Critical negative impacts to red abalone fishing grounds:

- (1) A dramatic decline in sea stars, important sea urchin predators, due to sea star disease.
- (2) A dramatic increase (60 times) in the density of purple sea urchins in 2015, increasing competition with red abalone for food.
- (3) A lack of kelp, a vital food for red abalone and which has resulted in increasing the efficiency of fishing efforts in shallow habitats.
- (4) A decline in deep-water red abalone densities.
- (5) Continued decline in overall average red abalone densities in spite of significant take reductions implemented in 2014. 2017 Department surveys in Sonoma and Mendocino counties show a dramatic decline in densities at seven of the 10 index sites, to an average of 0.16 per m². This average is below the ARMP fishery closure trigger of 0.3 per m²

Critical negative impacts to red abalone health:

- (1) Visual red abalone body health scores for red abalone taken in the fishery during the spring of 2016 show that more than 25 percent of red abalone were shrunken in body mass at sites in northern California.

- (2) Body condition index declined at Van Damme State Park by 20 percent, but no significant difference was observed at Fort Ross in summer of 2016 (60 red abalone per site).
- (3) Department staff and abalone fishermen have observed weak red abalone washed up on shore and easy to remove from the rocks as well as many new shells of all size classes, indicating increased natural mortality.

Critical negative impacts to red abalone reproduction:

- (1) Gonad index declined significantly at Van Damme State Park and at Fort Ross in the summer of 2016 (60 red abalone per site).
- (2) Small numbers of larval red abalone observed in plankton surveys in Sonoma and Mendocino counties in 2015.
- (3) Small numbers of newly settled red abalone observed in coralline-covered rock samples from Sonoma and Mendocino counties in 2015.
- (4) No juvenile (< 21 millimeter) red abalone observed in artificial reefs in Van Damme State Park in 2016 and 2017.

Proposed Regulatory Action

At the August 16, 2017 Commission meeting, the Department presented its recommendation that the fishery be closed due to hitting the trigger as set forth in the ARMP (Option 1). The Commission added additional regulatory options to protect the tradition of abalone fishing. These additional options are presented as Option 2 with sub-options that can be selected individually or in any combination. Some of the sub-options have ranges that must be selected from at the adoption hearing. Option 2 is not consistent with the ARMP.

Option 1 is consistent with the ARMP and protects the fishery during poor environmental conditions without the addition of fishing mortality. The Department recommends this regulatory proposal as a necessary step to facilitate the red abalone population's recovery from the multi-year poor environmental conditions and massive losses of red abalone fishery stock.

Option 2 is a set of regulatory options to maintain some fishing opportunity to maintain the tradition of abalone fishing. This option is divided into sub-options that allow limited take as follows:

Sub-Option A: Open Fort Ross to abalone fishing

Sub-Option B: Reduce the daily bag/possession limits within the range of [1 to 3] and the annual limit within the range of [2 to 9]

Sub-Option C: Increase the size limit to 8 inches

Sub-Option D: Limit the number of report cards sold annually within the range of [5,000 to 25,000]

The Commission may adopt one or more sub-options from Option 2 and must specify a specific number for sub-options B and D.

Updates to Authority and Reference Citations Based on Recent Legislation

Senate Bill 1473 (Stats. 2016, Ch. 546) made organizational changes to the Fish and Game Code that became effective January 1, 2017. The changes included moving the Commission's exemptions from specified Administrative Procedure Act time frames from Section 202 to Section 265 of the Fish and Game Code, moving the Commission's notice requirements from Section 210 to Section 260 of the Fish and Game Code, and moving the Commission's authority to adopt emergency regulations from Section 240 to Section 399 of the Fish and Game Code. These were organizational changes only. In accordance with these changes to the Fish and Game Code, sections 202, 210 and 240 are removed from, and sections 260, 265 and 399 are added to, the authority and reference citations for Section 29.15. Senate Bill 1473 also repealed subdivision (b) of Section 220 of the Fish and Game Code; therefore, Section 220 is removed from the list of authority and reference citations in Section 29.15.

Benefits of the Regulation

The proposed reduction within the red abalone fishery will benefit the valuable red abalone resource by protecting it from excessive fishing mortality during the current poor environmental conditions. Further conserving the red abalone resource now will allow it the opportunity to rebuild and be sustainable for the future.

Consistency and Compatibility with Existing State Regulations

The Legislature has delegated authority to the Commission to promulgate recreational fishing regulations (Fish and Game Code, sections 200, 205, and 265); no other state agency has the authority to promulgate such regulations. The Commission has conducted a search of Title 14, CCR and determined that the proposed regulation is neither inconsistent nor incompatible with existing State regulations and that the proposed regulations are consistent with other recreational fishing regulations and marine protected area regulations in Title 14, CCR.

Regulatory Language

OPTION ONE

Section 29.15, Title 14, CCR is amended to read:

§ 29.15. Abalone.

~~(a) Open Area: Except in the area described in subsection (a)(1) below, abalone may only be taken north of a line drawn due west magnetic from the center of the mouth of San Francisco Bay. No abalone may be taken, landed, or possessed if landed south of this line.~~

~~(1) No Abalone may be taken in the Fort Ross area bounded by the mean high tide line and a line drawn due south true from 38°30.63' N, 123°14.98' W (the northern point of Fort Ross Cove) and a line drawn due west true from 38° 29.45' N, 123°11.72' W (Jewel Gulch, south boundary Fort Ross State Park).~~

(a) Effective April 1, 2018, all ocean waters are closed to the take of abalone. Abalone may not be taken or possessed. The following exceptions are for abalone in possession prior to April 1, 2018:

(1) Minimum Abalone Size: All red abalone must be seven inches or greater measured along the longest shell diameter.

(2) Abalone Possession and Transportation: It shall be unlawful to possess any untagged abalone or any abalone that have been removed from their shell, except when they are being prepared for immediate consumption.

~~(b) Open Season and Hours:~~

~~(1) Open Season: Abalone may be taken only during the months of May, June, August, September and October.~~

~~(2) Open Hours: Abalone may be taken only from 8:00 AM to one-half hour after sunset.~~

~~(c) Bag Limit and Yearly Trip Limit: Three red abalone, *Haliotis rufescens*, may be taken per day. No more than three abalone may be possessed at any time. No other species of abalone may be taken or possessed. Each person taking abalone shall stop detaching abalone when the limit of three is reached. No person shall take more than 12 abalone during a calendar year. In the Open Area as defined in subsections 29.15(a) and 29.15(a)(1) above, not more than 9 abalone of the yearly trip limit may be taken south of the boundary between Sonoma and Mendocino Counties.~~

~~(d) Minimum Abalone Size: All legal size abalone detached must be retained. No undersized abalone may be brought ashore or aboard any boat, placed in any type of receiver, kept on the person, or retained in any person's possession or under his control. Undersize abalone must be replaced immediately to the same surface of the rock from which detached. Abalones brought ashore shall be in such a condition that the size can be determined.~~

~~(e) Special Gear Provisions: The use of SCUBA gear or surface supplied air to take abalone is prohibited. Abalone may not be taken or possessed aboard any boat, vessel, or floating device in the water containing SCUBA or surface supplied air. Abalone may~~

~~be taken only by hand or by devices commonly known as abalone irons. Abalone irons must be less than 36 inches long, straight or with a curve having a radius of not less than 18 inches, and must not be less than 3/4 inch wide nor less than 1/16 inch thick. All edges must be rounded and free of sharp edges. Knives, screwdrivers and sharp instruments are prohibited.~~

~~(f) Measuring Device. Every person while taking abalone shall carry a fixed caliper measuring gauge capable of accurately measuring seven inches. The measuring device shall have fixed opposing arms of sufficient length to measure the abalone by placing the gauge over the shell.~~

~~(g) Abalone Possession and Transportation:~~

~~Abalones shall not be removed from their shell, except when being prepared for immediate consumption.~~

~~(1) Individuals taking abalone shall maintain separate possession of their abalone. Abalone may not be commingled in a float tube, dive board, dive bag, or any other container or device, until properly tagged. Only after abalones are properly tagged, as described in Section 29.16(b), Title 14, CCR, may they be commingled with other abalone taken by another person.~~

~~(h) Report Card Required: Any person fishing for or taking abalone shall have in their possession a nontransferable Abalone Report Card issued by the department and shall adhere to all reporting and tagging requirements for abalone defined in Sections 1.74 and 29.16, Title 14, CCR.~~

OPTION TWO

There are 4 Sub-Options for subsections (a), (c), (d) and (h)

Section 29.15, Title 14, CCR is amended to read:

§ 29.15. Abalone.

[Sub-Option A – Opens Fort Ross for no site closures in Northern California]

~~(a) Open Area: Except in the area described in subsection (a)(1) below,~~
Abalone may only be taken north of a line drawn due west magnetic from the center of the mouth of San Francisco Bay. No abalone may be taken, landed, or possessed if landed south of this line.

~~(1) No Abalone may be taken in the Fort Ross area bounded by the mean high tide line and a line drawn due south true from 38°30.63' N, 123°14.98' W (the northern point of Fort Ross Cove) and a line drawn due west true from 38° 29.45' N, 123°11.72' W (Jewel Gulch, south boundary Fort Ross State Park).~~

(b) Open Season and Hours:

- (1) Open Season: Abalone may be taken only during the months of April, May, June, August, September, October, and November.
- (2) Open Hours: Abalone may be taken only from 8:00 AM to one-half hour after sunset.

[Sub-Option B – Reduces daily bag/possession and/or annual limits]

(c) Bag Limit and Yearly Trip Limit: ~~Three~~^[1-3] red abalone, *Haliotis rufescens*, may be taken per day. ~~No more than three abalone may be or~~ possessed at any time. No other species of abalone may be taken or possessed. Each person taking abalone shall stop detaching abalone when the limit of ~~three~~^[1-3] is reached. No person shall take more than ~~48~~^[2-9] abalone during a calendar year. ~~In the Open Area as defined in subsections 29.15(a) and 29.15(a)(1) above, not more than 9 abalone of the yearly trip limit may be taken south of the boundary between Sonoma and Mendocino Counties.~~

[Sub-Option C – Increases minimum size limit for take]

(d) Minimum Abalone Size: All red abalone must be ~~seven~~^{eight} inches or greater measured along the longest shell diameter. All legal size abalone detached must be retained. No undersized abalone may be brought ashore or aboard any boat, placed in any type of receiver, kept on the person, or retained in any person's possession or under his or her direct control. Undersize abalone must be replaced immediately to the same surface of the rock from which detached. Abalones brought ashore shall be in such a condition that the size can be determined.

[...No changes to subsections (e) through (g)]

[Sub-Option D – Provides limit on report card sales]

(h) Report Card Required: Any person fishing for or taking abalone shall have in their possession a nontransferable Abalone Report Card issued by the department and shall adhere to all reporting and tagging requirements for abalone defined in Sections 1.74 and 29.16, Title 14, CCR.

(1) Starting January 1, 2018, a total of not more than [5,000-25,000] Abalone Report Cards may be issued by the department per season.

(2) Abalone report cards will be available on a first-come, first served basis no earlier than 45 days prior to the first day of the abalone season.

Note: Authority cited: Sections 200, ~~202~~, 205, ~~240~~, 220, ~~240~~260, 265, 399, 5520, 5521 and 7149.8, Fish and Game Code. Reference: Sections 200, ~~202~~, 205, ~~220~~265, 5520, 5521, 7145 and 7149.8, Fish and Game Code.

Notice of Exemption

Appendix E

To: Office of Planning and Research
P.O. Box 3044, Room 113
Sacramento, CA 95812-3044

County Clerk
County of: N/A

From: (Public Agency): CA Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814

(Address)

Project Title: Amend § 29.15, Title14, CCR, Abalone take reduction due bad environmental conditions

Project Applicant: N/A

Project Location - Specific:
Statewide

Project Location - City: N/A Project Location - County: N/A

Description of Nature, Purpose and Beneficiaries of Project:

A combination of environmental and biological stressors has greatly reduce abalone populations due to starvation conditions. In 2016, the Commission took emergency action to reduce the annual take limit and close the season in April and November. This project will continue the emergency regulations protection.

Name of Public Agency Approving Project: California Fish and Game Commission

Name of Person or Agency Carrying Out Project: California Department of Fish and Wildlife

Exempt Status: (check one):

- Ministerial (Sec. 21080(b)(1); 15268);
- Declared Emergency (Sec. 21080(b)(3); 15269(a));
- Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
- Categorical Exemption. State type and section number: Cal. Code Regs., tit. 14, §§ 15307, 15308
- Statutory Exemptions. State code number: _____

Reasons why project is exempt:

See attached.

Lead Agency
Contact Person: Valerie Termini Area Code/Telephone/Extension: (916) 653-4899

If filed by applicant:

1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? Yes No

Signature: _____ Date: 12/7/2017 Title: Executive Director

Signed by Lead Agency Signed by Applicant

Authority cited: Sections 21083 and 21110, Public Resources Code.
Reference: Sections 21108, 21152, and 21152.1, Public Resources Code.

Date Received for filing at OPR: _____

December 7, 2017

**ATTACHMENT TO NOTICE OF EXEMPTION
Adoption of Red Abalone Take Reduction
Due to Harmful Environmental Conditions**

The California Fish and Game Commission (Commission) has taken final action under the Fish and Game Code and the Administrative Procedure Act (APA) with respect to the proposed project on December 7, 2017. In taking its final action for the purposes of the California Environmental Quality Act (CEQA, Pub. Resources Code, § 21000 *et seq.*), the Commission adopted the regulations relying on the categorical exemption for “Actions by Regulatory Agencies for Protection of Natural Resources” contained in CEQA Guidelines section 15307, and the categorical exemption for “Actions by Regulatory Agencies for Protection of the Environment” contained in CEQA Guidelines section 15308. (Cal. Code Regs., tit. 14, §§ 15307, 15308.)

Categorical Exemptions to Protect Natural Resources and the Environment

In adopting the sport fishing regulations for red abalone take reduction due to harmful environmental conditions, the Commission relied for purposes of CEQA on the Class 7 and 8 categorical exemptions. In general, both exemptions apply to agency actions to protect natural resources and the environment. The regulations define annual fishing seasons and daily and yearly bag limits. A combination of unprecedented environmental and biological stressors began to take their toll on abalone populations, including warmer-than-normal waters and decreasing food resources, leading to starvation conditions. The Department of Fish and Wildlife (Department) has identified wide-sweeping changes in the density, occurrence, size and health of red abalone and the kelp upon which it depends for food. Because these regulations are intended to protect the sustainability of the fishery as a natural resource, Commission adoption of these regulations is an activity that is the proper subject of CEQA’s Class 7 and 8 categorical exemptions.

Tiemann, Sheri@FGC

From:
Sent: Friday, September 15, 2017 11:58 AM
To: FGC
Subject: Future Red Abalone Regulations

To Whom It May Concern,

If at all possible I'd like to submit some feedback regarding current Red Abalone Regulations and also contribute some input toward future management.

This past season from what I have observed there has been some positive effect upon the pressure to the fishery but I have also seen a negative impact upon those communities whose economy depends heavily on tourism and in particular the draw of the Abalone fishery. For their sake I would like to see the open season remain status quo or go back to previous length.

Personally the new regulations have had very little impact upon the quality of my experience and fulfillment of my take. It is more conservative but a very reasonable compromise if it at all ensures the continued health/recovery of our fishery.

If there are any additional adjustments to be made I would like to make two suggestions for consideration:

1. Increase the minimum size to at least 8 inches. If all I wanted to do is pull 3 Abalone, at 7 inches I can find 3 legal size Abalone with little effort in almost no time at all. By increasing the size I think we can influence the take and force divers to be more selective.
2. Reduce the daily bag limit to two per day. Personally I find it very difficult to consume more than two Abalone per day even with company. Taking more than that is beyond my needs.

That's my two cents.

Brandon Earhart

Tiemann, Sheri@FGC

From:
Sent: Tuesday, September 26, 2017 1:08 PM
To: FGC
Subject: Red Abalone Fishery

Good afternoon,

In regards to the evaluation of the Red Abalone Fishery and Potential Closure.

I would like to recommend that a solution other than a full closure be pursued. With respects to what that might look like, I offer the following suggestion:

2 abalone per day
8 per year
Leave the size at 7 inches
Do not limit the sale (plenty of people will not purchase tags at 2 abs per day)

Thank you,

Alex Reynaud
Sea Sniper Team

Tiemann, Sheri@FGC

From: Whitney Hitaz
Sent: Tuesday, September 26, 2017 5:43 PM
To: FGC
Subject: Abalone

I dive every year, every year i am only able to get a small portion of my limit due to weather, surf, rain ect, but everytime I do go I have my choice of dozens of leagl abalone. The current regs are good. Please do not change them there are plenty of abalone!

Aloha!

September 28, 2017

Mr. Eric Sklar, President
California Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814

RE: Agenda Item 22, Discuss proposed changes to recreational abalone regulations

Dear President Eric Sklar and Commission Members,

Although the California Department of Fish and Wildlife (CDFW) has been working diligently on emergency regulations to improve the trajectory of red abalone along our coasts, we the undersigned (representatives from the non-profit, academic, and recreational sectors) wish to highlight the need to simultaneously continue exploring long-term solutions to improve outcomes for harvesters and ensure conservation of this high value resource. As CDFW explores a permanent framework for management of red abalone in the Northern California recreational red abalone fishery management plan (FMP), they should consider the use of more nimble and adaptive management strategies to ensure this resource is available to support thriving coastal fishing communities under changing ocean conditions. **In the attached document, we provide a science-driven management strategy to address the need for a long-term solution to address conservation and sustainable management of this iconic fishery.**

Limitations of the Existing Management Approach

The current management framework utilized by CDFW to manage the recreational red abalone fishery, which relies exclusively on limited data generated from state-led density and recruitment surveys, is cost ineffective and does not represent the best available science or the latest thinking on managing benthic invert fisheries. Since 2005 when status quo management approaches were formalized in the Abalone Recovery and Management Plan, stakeholders have raised continuous concerns regarding the lack of transparency, consistency, and effectiveness in regulatory measures used to manage red abalone. Based on the 2014 recommendation from the Ocean Science Trust to fundamentally improve the approaches used to assess and manage abalone, and an invitation from CDFW to help them develop a next generation FMP, we present the following adaptive management framework.

Our Proposed Harvest Control Rule

We the undersigned believe that the management solution for this fishery must be cost-effective, based on the best available scientific methods and data, and provide transparency in decision-making, to gain substantial stakeholder support. **As such, we are submitting a multi-indicator, decision-tree based harvest control rule (HCR) for inclusion as a science-driven alternative in the FMP currently in development.** It is structured hierarchically, uses multiple indicators provided from all 56 landing sites, assesses stock status, and then recommends a corresponding adjustment to the previous year's catch limit. We have utilized two indices in the proposed HCR – landings and length data. Landings have been incorporated from each of the 56 sites, and length data has been incorporated from 17 sites and counting. As described in the attached document, there is precedent from both domestic and internationally recognized scientific and management bodies to use length and landings data to estimate sustainable yield and reproductive potential of a population. **This**

harvest control rule can be specified to be more or less precautionary than status quo, and provides a pathway to make clear and transparent management decisions.

There are a number of significant benefits associated with our proposed HCR including –

- Integration of multiple streams of information to mitigate against unmet assumptions of each of the individual methods
- Increased transparency in decision-making by explicitly stating by how much annual catch limits will be modified based on the stock status determination
- The ability to accommodate levels of risk that managers are comfortable with by choosing more or less conservative percentages by which the TAC would be modified
- Significant cost savings by transitioning away from the use of costly density surveys (on the order of hundreds of thousands of dollars) that are almost not usable to inform resource management
- Increased stakeholder support facilitated by collaborative engagement with recreational divers and citizen scientists to collect high quality, timely data that informs management

We have developed a management strategy evaluation (MSE) to evaluate the performance of our proposed HCR under normal and extreme environmental conditions. Initial results suggest that the **proposed HCR performs best when only landings and length data are included and that use of multiple streams of data in the proposed harvest control rule help to reduce the risk of stock collapse while maximizing yields and maintaining stability under a range of normal and extreme environmental conditions.**

Our Recommendation to the Commission

Adoption of such a harvest control rule by the state of California will represent a significant step forward in advancing climate-driven fisheries and present a valuable model for how we can improve the management of other fisheries in California. The decision-tree based HCR outlined in the attached document represents an adaptive management framework that incorporates robust, multi-indicator parameters, provides transparency in decision-making, and has been conceived via a multi-stakeholder collaborative process. Thus, **we ask that the Fish and Game Commission recommend including this harvest control rule for inclusion in the red abalone FMP, and we look forward to continuing to work with the State’s managers, harvesters, and scientists to ensure the long-term sustainability of this fishery.**

Sincerely,

Bill Harford, Ph.D.
Research Scientist
University of Miami

Jeremy Prince, Ph.D.
Adjunct Associate Professor
Murdoch University

Jack Shaw
Recreational Diver

Jono Wilson, Ph.D.
Lead Fisheries Scientist
The Nature Conservancy

Natalie Dowling, Ph.D.
Senior Research Scientist
CSIRO Oceans and
Atmosphere

Alexis Jackson, Ph.D.
Fisheries Project Director
The Nature Conservancy

Jack Likins
Recreational Diver

Red Abalone Harvest Control Rule

For consideration as an alternative in the California Red Abalone Fishery Management Plan.

September 28th, 2017



Prepared by:

Bill Harford, PhD, Research Scientist, University of Miami
Jono Wilson, PhD, Lead Fisheries Scientist, The Nature Conservancy
Natalie Dowling PhD, Senior Research Scientist, CSIRO, Australia
Jack Likins, North Coast Recreational Fisherman
Jack Shaw, North Coast Recreational Fisherman
Alexis Jackson, PhD, Project Director, The Nature Conservancy
Lyll Bellquist PhD, Fisheries Scientist, The Nature Conservancy
Jeremy Prince, PhD, Biospherics, PTY, Australia

Executive Summary

California's Marine Life Management Act (MLMA) allows for the development and proposal of fishery management plan (FMP) amendments. Specifically, Section 7075(d) of the MLMLA states that "Fishery participants and their representatives, fishery scientists, or other interested parties may propose plan provisions or plan amendments to the department or commission. The commission shall review any proposal submitted to the commission and may recommend to the department that the department develop a fishery management plan or plan amendment to incorporate the proposal." This document is a proposal made pursuant to 7075(d) from a diverse group of fishermen, scientists, and NGOs that seeks to integrate a Harvest Control Rule (HCR) into the developing FMP for recreational red abalone (*Haliotis refuscens*).

A Harvest Control Rule (HCR) is a set of well-defined management actions to be taken in response to changes in stock status. Motivated by a need to improve adaptive management of the California Recreational Red Abalone Fishery using best-available science, the proposed HCR was developed in association with recreational abalone fishermen, the California Department of Fish and Wildlife (CDFW) and international fisheries scientists, for consideration in the management of the fishery. The HCR is structured as a decision tree that integrates catch histories and length frequency data into a transparent decision-making framework. Together, these two indicators are used to determine stock status and guide decision-making.

To understand how the HCR functions, the catch data is first analyzed using an estimation routine called Catch-MSY, which determines whether the harvest rate from a particular area is above or below that which would result in meeting the limit reference point of Maximum Sustainable Yield (MSY). The length frequency data are combined with biological information and analyzed using an estimation routine called Length-Based Spawning Potential Ratio (SPR) which determines whether the SPR – a proxy for the fishing mortality rate (F) – is above or below a pre-determined, conservative SPR reference point of 0.6.

The HCR does not use density data due to the extreme variability of the data and the high cost of these sampling efforts. This is a departure from status quo, yet will yield significant cost savings to the CDFW and improve management outcomes. Removal of the density surveys from the decision-making process is supported by the scientific evidence within our analysis and from evaluations conducted within multiple independent reviews of the survey data, including the Ocean Science Trust Review (OST 2014).

In order to design and test the utility of the HCR, we utilized Management Strategy Evaluation (MSE), a simulation approach that is a prerequisite for many fisheries agencies when developing HCRs. MSE represents the state of the art in evaluating the tradeoffs of particular approaches to fisheries management. We conducted a MSE that shows the HCR is a viable means to set precautionary total allowable catches (TAC) at any spatial scale deemed appropriate for enforcement. Under normal conditions, the HCR ensured the stock biomass fluctuated around the Biomass that achieves MSY (B_{MSY}) and catches around MSY. Following severe environmental events including high natural mortality and El Nino conditions, the HCR responds conservatively

and lowers TACs. The following table demonstrates how TAC adjustments are made for each possible combination of the two indicators (SPR and Catch-MSY).

Table 1. Combinations of indicators in the Red Abalone Decision Tree and the recommended management decision (TAC adjustment) for each possibility. Different combinations of the two indicators (SPR and Catch-MSY) indicate exploitation status, which can be used to inform adjustments to the total allowable catch (TAC).

SPR indicator	Catch-MSY indicator	Exploitation status	TAC adjustment	Explanation
Stable	High	Over exploited	-10%	SPR stable around reference, but increasing fishing pressure.
Stable	Stable	Fully exploited	0%	SPR stable around reference.
Stable	Low	Under exploited	+10%	SPR stable, possibly restrictive management.
Low	High	Depleted	-20%	Recruitment overfishing likely.
Low	Stable	Over exploited	-10%	Recruitment overfishing likely.
Low	Low	Fully exploited	0%	Recruitment overfishing likely.
High	High	Over exploited	-10%	Although SPR high, catches also high. Watch and wait.
High	Stable	Under exploited	+10%	SPR high under stable catches.
High	Low	Under exploited	+10%	SPR high under possibly restrictive management.

Recommendations

Overall, the proposed harvest control rule for the Recreational Red Abalone Fishery represents an opportunity to greatly improve the management of the fishery, provides a science-based method for incorporating multiple streams of information, and ensures that best-available science is efficiently incorporated into decision-making.

We recommend the following:

- The Fish and Game Commission consider this proposed Harvest Control Rule in the Fishery Management Plan for Red Abalone.
- The proposed Harvest Control Rule be compared to alternatives using Management Strategy Evaluation by an independent peer-review panel.

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Background

In 2014, the CDFW began developing a Fishery Management Plan (FMP) to guide the management of the red abalone fishery. A central component in any FMP is the decision-making framework - commonly called a Harvest Control Rule (HCR). A HCR is a set of well-defined management actions to be taken in response to changes in stock status. A HCR is objective and transparent, allowing all stakeholders to clearly see how and why decisions are being made. Consequently, a HCR increases efficiencies in management and reduces subjectivity and politics in the decision-making process. As such, HCRs can stabilize business operations and enhance trust in management bodies.

Given the cultural and economic importance of the red abalone fishery in Northern California, it is critical that the development of a HCR be supported by stakeholders in the fishery and reflect the best available science. The HCR should therefore be thoroughly vetted and tested so that all stakeholders can evaluate the costs and benefits of the approach and evaluate the scientific rationale for the decision-making process.

The vulnerability of red abalone to changing ocean conditions requires that data feeding into the HCR be able to detect variability across space and time. It also requires that managers be able to cost-effectively collect the information needed to quickly respond to changes in stock status. Only two such data sources are currently collected across a broad range of the stock on annual time scales: length frequency and catch data.

Incorporating multiple, scientifically defensible indicators (data streams) into a decision-making process has been shown to provide substantial benefits to management (Hilborn et al. 2002; Caddy et al. 2004). This is especially true when utilizing data-limited methods as these methods include several known assumptions. Integrating multiple indicators and methods into a decision tree structure is advantageous, since what one indicator or method may assume, or fail to overcome, may be countered by the inclusion of additional, independent indicators or methods.

This document provides an overview of a multi-indicator HCR developed in collaboration with stakeholders in the red abalone fishery. The HCR utilizes length frequency and catch data to recommend scientifically defensible TAC adjustments in the red abalone fishery.

Characteristics of The Red Abalone Decision Tree (Harvest Control Rule)

The proposed Recreational Red Abalone Fishery Harvest Control Rule takes the form of a decision tree that evaluates multiple sources of information to ultimately make transparent recommendations to adjust the total permitted amount of abalone to be taken annually, or the Total Allowable Catch (TAC). A decision tree is a type of HCR that navigates users through a simplified and efficient decision-making process. Each branch of the tree represents a unique combination of indicator values that reflect stock status, and the selected branch determines the decision to be made.

Decision trees require relationships to be explicitly stated between performance indicator values and the underlying status of the stock because these relationships form the basis for directionality and magnitude of TAC adjustments. The decision tree proposed here was developed with three practical considerations in mind. First, development was constrained to the use of existing data streams, along with their inherent data limitations, rather than proposing new data streams or evaluating alternate sampling schemes. Second, a functional decision tree was needed that could accommodate site-specific signals about resource changes, while also successfully guiding adjustment of TACs along the entire coast. This consideration reflected the problem that less than 30% of sites along the coastline where fishing occurs are formally monitored, aside from recording of catches. Third, the decision tree needed to be flexible to accommodate future monitoring at additional sites, as citizen science groups and State agencies potentially expand or modify monitoring programs. The use of the term ‘sites’ throughout this document refers to the 56 abalone report card locations established across four counties.

The decision tree presented here incorporates relevant, existing data streams collected by CDFW, Reef Check California, and recreational fishermen. Specifically, the red abalone decision tree incorporates two indicators of stock status gleaned from 1) length frequency distributions from animals observed underwater and 2) catches by site recorded in report cards. Based on analysis of stock status using each respective data source, the resulting indicators determine which branch should be used to adjust (or maintain) the Total Allowable Catch (TAC; **Box 1**; Table 1).

Assessment Methods Used in the Decision Tree

The decision tree utilizes catch histories and length composition data in calculating indicators that inform TAC adjustments (**Box 1**). Indicator values are calculated using established data-limited fisheries assessment methods. Length composition data are used to estimate the Spawning Potential Ratio (SPR) based on a model developed by Hordyk et al. (2015). Site-specific catch histories are used to estimate current harvest rates based on the Catch-MSY method developed by Martell and Froese (2012).

Spawning Potential Ratio (SPR)

SPR is synonymous with Eggs Per Recruit (EPR), and is the proportion of eggs produced by a fished cohort over a lifetime, relative to the eggs produced by an unfished cohort over a lifetime. Simply put, SPR reflects the influence of mortality from all sources on the stock’s ability to successfully reproduce on a continual basis. Thus, a highly-depleted stock will have a low SPR and low reproductive output and a nearly unperturbed stock will have a high SPR and high reproductive output. SPR is used in U.S. Federal Fisheries Management, the CA spiny lobster FMP (CA) and is an internationally accepted metric for assessing fishery stock health.

The method for calculating SPR in the proposed decision tree is termed Length-Based SPR and requires little information beyond basic biology and length information (Hordyk et al. 2015). CDFW biologists have collected basic biological information such as the size at reproductive maturity, published in the peer reviewed literature that is useful to this analysis.

Catch-MSY

The Catch-MSY assessment (Froese et al. 2017) estimates quantities such as MSY from a time series of catch data, resilience of the species being assessed, and expert judgment regarding stock size during the first and terminal year of the time series. Upon completion of the method, estimates are provided for MSY, F_{MSY} , B_{MSY} , relative stock size (B/B_{MSY}), and relative harvest rate (F/F_{MSY}). The method partially relies on a Schaefer production model and priors on depletion and resilience, and can be used in accordance with precautionary management practices. Catch histories beginning in 2002 at each of 56 sites are used in applying the Catch-MSY method within the decision tree, thus allowing managers a mechanism to integrate the entire fishery into the decision-making process rather than relying on a limited sampling of index sites.

Data Collection Programs

Length Data

Over the past three years, stakeholders in the recreational red abalone fishery have collaborated with Reef Check CA to develop an underwater dive survey protocol to cost effectively collect abalone length composition data in a manner that moves towards spatially expansive monitoring along the northern California coastline (Freiwald et al., 2016). This new data stream can be combined with CDFW length sampling to boost the sample size and inform management decision-making. In addition to these two data sets, the CDFW possesses an additional length frequency data set collected from creel surveys, that is thought to be even more spatially expansive. Consideration should be given to incorporating this data set into the analysis. In the current sampling protocol which combines Reef Check and CDFW dive surveys, 17 sites have length composition data. For sites where length composition monitoring does not occur ($n = 39$), the average current SPR at monitored sites is used as a proxy SPR value. Such an approach dramatically improves the spatial coverage of data collection and management relative to the status quo.

Catch/Landings Data

The CDFW currently records total landings data from report cards submitted by permit holders. The coast is divided into 56 landing sites for which report card holders must log individual abalone. At the end of the season, report card holders submit their landings data to CDFW. These data are summed at the end of the year and inform estimates of total landings. Our decision tree utilizes these data at each site to estimate CatchMSY as described above.

Is Density Information Useful?

Based on the scientific review convened by OST as well as our own simulation testing, we opted to recommend a decision tree that does not include the use of density surveys that are based on the current sampling design conducted by CDFW. Two important assertions made in the OST scientific review led to this recommendation. First, “[t]his sampling method was not designed to

represent or estimate the density of the entire abalone population” (OST, 2014). Second, the OST scientific review points to the possibility that density surveys are unreliable due to the variability of the observations, especially as it pertains to observation of site-level density changes. Taken together, these two considerations suggest that density surveys lack utility for use in informing coast-wide, county, or site level abalone stock status.

Density surveys were also excluded because simulation testing revealed that density indicators derived from the observed variance structure of actual CDFW surveys had a propensity for poor management outcomes, as imprecise surveys often caused the decision tree to adjust TACs in response to noise, rather than signals about red abalone abundance (Harford et al., 2017). Finally, density surveys were excluded due to a lack of consistency in the detectability of animals due to environmental conditions. On several occasions, CDFW biologists and managers have publicly stated that density counts increase during periods of low kelp (poor conditions), and decrease during periods of abundant kelp (good conditions). Furthermore, sampling at each of the density survey sites (n = 10) only occurs once every 3-5 years, severely limiting the ability to detect changes across the fishery.

The simulation testing also evaluated the use of environmental signals as indicators of abalone stock status (i.e., El Nino Southern Oscillation anomalies), but did not recommend their further use, as establishing the strengths of mechanistic linkages between red abalone biology and environmental conditions was tenuous, and the efficacy of such indicators was weak.

Using the Decision Tree

The decision tree is applied at each of 56 sites on a repeated basis (e.g. annually). Branches of the tree correspond with a specific TAC adjustment (relative to the previous year) for each site, ranging between a decrease of 20% to an increase of 20%. While calculation of site-specific TACs are an important technical step, they are impractical as management tools. Site-specific TACs are used to calculate regional aggregate TACS (e.g., county level TACs), which support specification of regulatory tactics (e.g., daily and annual bag limits, etc.) and accommodate fishery enforcement. A full technical description of the decision tree is found in Harford et al. (2017). Also, see Box 1 for more information.

Simulation Testing Via Management Strategy Evaluation

Considerable complexity is involved in developing a decision tree for red abalone, and accordingly, development of such fisheries management frameworks should not be based on expert judgement alone (Butterworth et al., 2010). The decision tree recommended here was subject to simulation testing using management strategy evaluation (MSE). MSE simulates the combined performance of data collection, data analysis, and decision-making (**Box 2**) and produces outputs in currencies that are meaningful to managers – that is, quantities that directly reveal whether fishery objectives are achievable. By comparison, the isolated treatment of any management component is an abstraction from determining whether integration of components will lead to successful fishery management. MSE is the most widely established approach for informing selection of management strategies and quantifying fishery management tradeoffs (Punt et al., 2016).

Our MSE is structured in two stages. In the first stage, a completed MSE (Harford et al., 2017) was aimed at evaluating the decision trees that used various indicators, including density, catches, and length composition within a multi-indicator framework. Our simulations suggested that catch histories and length frequency distributions were the most informative indicators of abalone exploitation status. The use of density surveys reduced the ability for the HCR to guide decisions towards the achievement of management targets and avoid management limits (e.g. biomass levels below 50% of B_{MSY})

This MSE also importantly evaluated red abalone vulnerability to environmental conditions (i.e., climate variability, harmful algal blooms) in conjunction with fishery exploitation and poaching (**Box 2**). The MSE results suggest that under normal environmental conditions and fishing operations, the HCR was able to maintain biomass levels approaching that which achieves maximum sustainable yield (B_{MSY}) and catches that approach MSY (**Box 2**). Under scenarios involving harsh environmental circumstances, the HCR maintained biomass levels commensurate with 2015 levels or led to slight biomass increases, depending on SPR reference points (0.4 or 0.6) and minimum harvest lengths (178 or 203 mm).

By simulating the effectiveness of the decision tree under environmental conditions that were severely detrimental to the simulated abalone stock, we demonstrated the ability for the HCR to operate in a precautionary manner by selecting conservative biological reference points (e.g. SPR of 0.6 rather than 0.4) that are used in these indicators. Importantly, we were able to show that estimates of SPR respond to both natural and fishing mortality suggesting that SPR can be a useful indicator in the face of extreme environmental perturbations unrelated to fishing pressure.

Feedback on this MSE has been offered by stakeholders, academic scientists involved in the original OST report, and CDFW scientists. This feedback is being incorporated into the second stage of MSE development. The second stage MSE will provide an updated technical description of the decision tree and will be provided to the Commission no later than November 23rd, 2017.

Conclusion

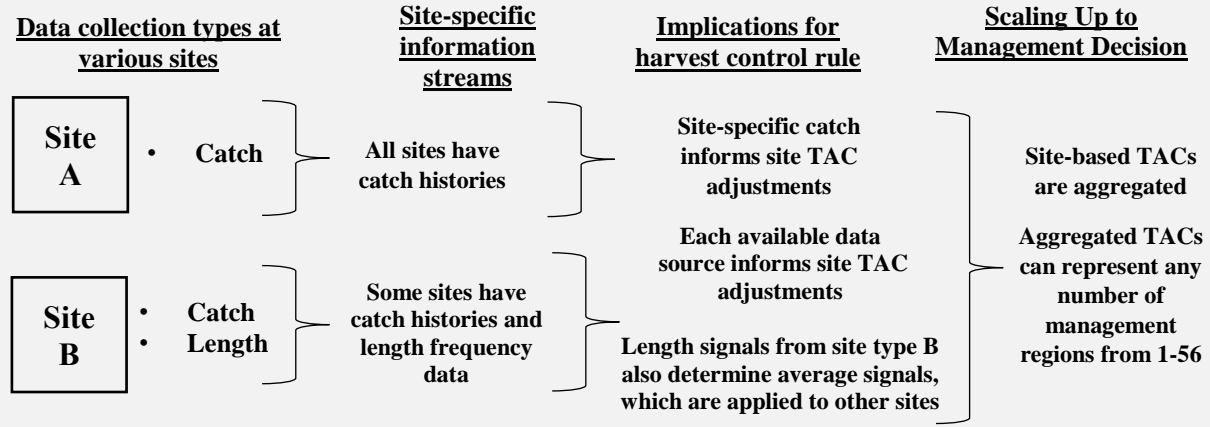
The Harvest Control Rule provided here represents an adaptive management framework that incorporates robust, multi-indicator parameters, provides transparency in decision-making, and has been conceived via a multi-stakeholder collaborative process. Adoption of such a harvest control rule by the state of California could represent a significant step forward in advancing climate-driven fisheries and present a valuable model for how we can improve the management of other fisheries in California.

References

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Box 1. Design of a Multi-indicator Decision Tree For California Red Abalone

Part A: Practical considerations for decision tree design are depicted conceptually using a representation of information types available at fishing sites. Where possible, site-specific indicators inform decision-making, while also guiding catch adjustments along the entire coastline. Existing data streams are considered, along with their inherent data limitations.

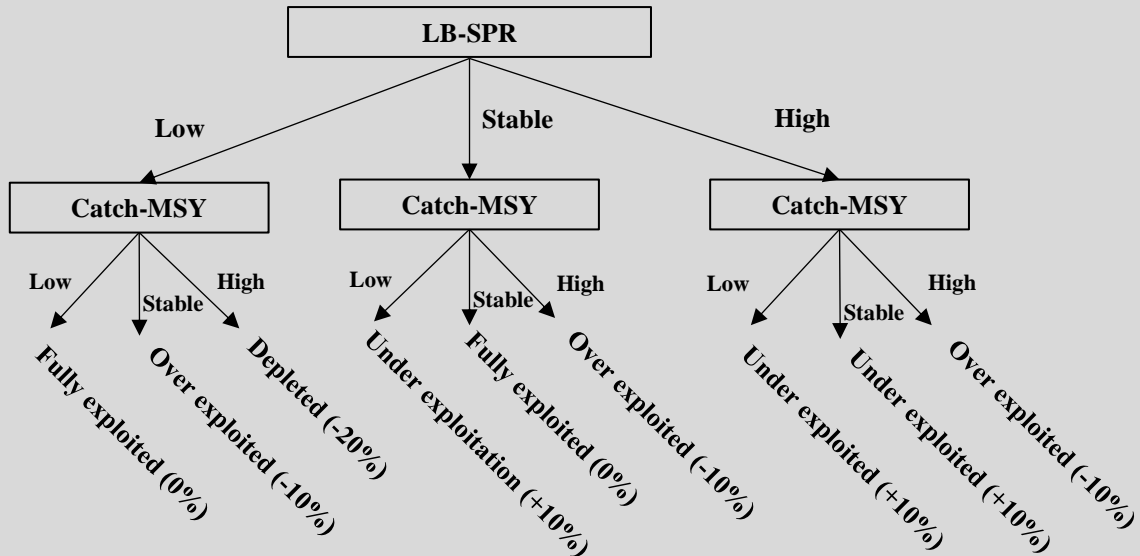


Part B: Multi-indicator decision tree. Data-limited assessment tools are used to produce indicator values.

LB-SPR Tool: Length composition used to estimate current spawning potential ratio (SPR)

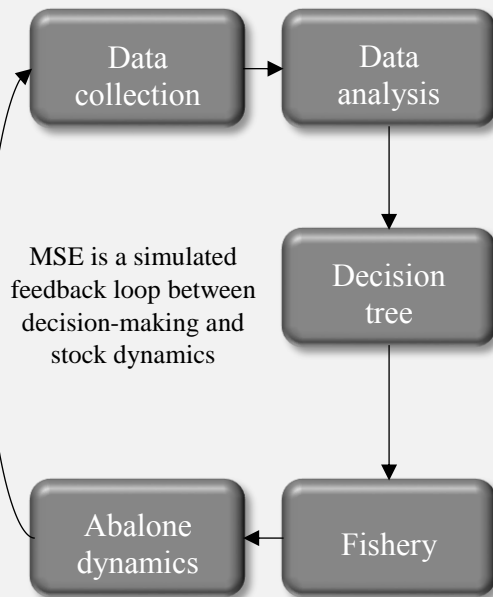
Catch-MSY Tool: Catch histories used to estimate current fishery exploitation rate

Current values of these two indicators are compared to corresponding reference points. Tolerances around reference points determine Low, Stable, or High criteria. These criteria (Low, Stable, High) then trigger which branch of the tree is selected and guide percent change in TAC, relative to previous year's TAC.

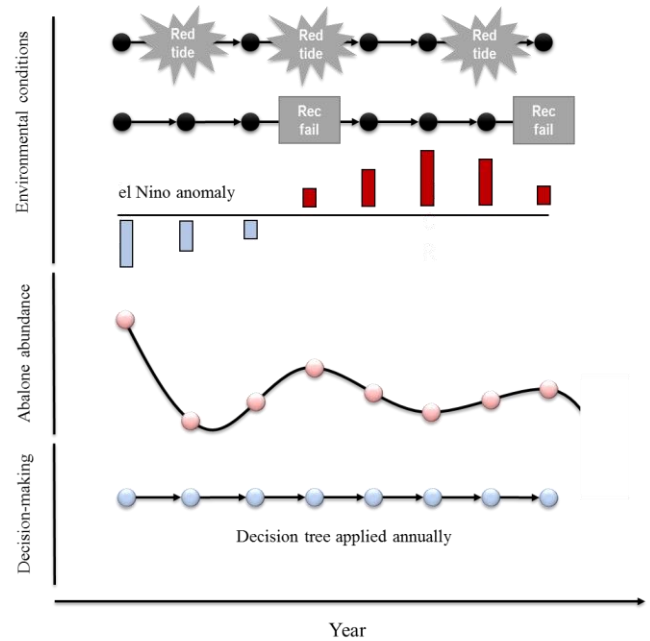


Box 2. Overview of management strategy evaluation (MSE) and its application to California red abalone

Part A: MSE simulates the linkages between a fish stock, its fishery, monitoring, and fishery management decision-making.



Part B: MSE can be used to simultaneously simulate the effects of fishing regulations and environment on sustainability of the stock.



Part C: Example of MSE outcomes.

Performance is reported as biomass relative to unfished biomass (horizontal axis) and catch relative to maximum sustainable yield (MSY; vertical axis).

Median outcomes (points) and 50% centered observations (lines) represent uncertainty in outcomes.

Upper right: Outcomes under typical El Nino climate variability that affects red abalone. Labels *SPR ref 0.4* and *SPR ref 0.6* illustrate effect of fishery reference point selection on performance.

Lower left: Outcomes under severely detrimental environmental conditions, demonstrating how MSE can be used to evaluate combined effects of environment and fishery on abalone biomass and catches.

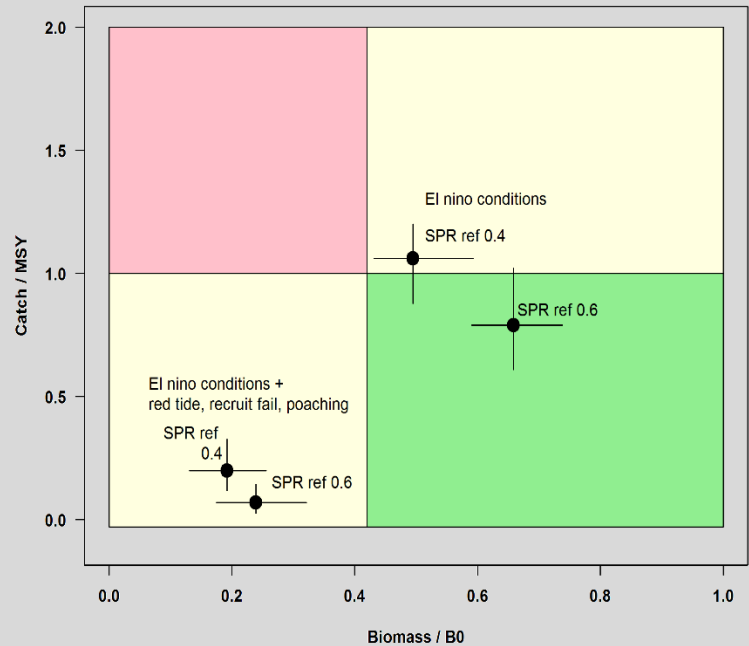


Table 1. Combinations of indicators in the Red Abalone Decision Tree and the recommended management decision (TAC adjustment) for each possibility. Different combinations of the two indicators (SPR and Catch-MSY) indicate exploitation status, which can be used to inform adjustments to the total allowable catch (TAC).

SPR indicator	Catch-MSY indicator	Exploitation status	TAC adjustment	Explanation
Stable	High	Over exploited	-10%	SPR stable around reference, but increasing fishing pressure.
Stable	Stable	Fully exploited	0%	SPR stable around reference.
Stable	Low	Under exploited	+10%	SPR stable, possibly restrictive management.
Low	High	Depleted	-20%	Recruitment overfishing likely.
Low	Stable	Over exploited	-10%	Recruitment overfishing likely.
Low	Low	Fully exploited	0%	Recruitment overfishing likely.
High	High	Over exploited	-10%	Although SPR high, catches also high. Watch and wait.
High	Stable	Under exploited	+10%	SPR high under stable catches.
High	Low	Under exploited	+10%	SPR high under possibly restrictive management.

Appendix I. Definitions.

Biomass (B): Total weight of organisms at a given point in time in a defined fish stock or area.

Biomass at Maximum Sustainable Yield (B_{MSY}): Biomass that corresponds to Maximum Sustainable Yield from a production model or from an age-based analysis using a stock recruitment model. Often used as a biological reference point in fisheries management, it is the calculated long-term average biomass value expected if fishing at F_{MSY} .

Catch-Maximum Sustainable Yield (Catch-MSY): An estimation method which determines whether the harvest rate from a particular area is above or below that which would result in meeting the limit reference point of Maximum Sustainable Yield (MSY).

Harvest Control Rule (HCR): A rule that describes how harvest is intended to be controlled by management in relation to the state of some indicator of stock status. Predetermined adjustments are agreed upon in an actionable plan, which are then activated in response to changes relative to reference points.

Length-Based Spawning Potential Ratio (SPR): The LB-SPR assessment method estimates spawning potential ratio (SPR, the ratio of reproductive potential of a fished vs. unfished population) using only length-frequency data from a fishery and some basic life history information on the species. In total, the method requires length composition, an estimate for the ratio M/k , maximum size (L_{∞}), the coefficient of variation (CV) of L_{∞} , and knowledge of maturity at size. The relative fishing rate F/M is then estimated and SPR is calculated.

Management Strategy Evaluation (MSE): Management Strategy Evaluation simulates the linkages between a fish stock, its fishery, monitoring, and fishery decision-making. It is a simulated feedback loop between decision-making and stock dynamics.

Maximum Sustainable Yield (MSY): The highest theoretical equilibrium yield or catch that can be continuously taken (on average) from a stock assuming existing (constant) environmental conditions. MSY is usually represented as an annual catch that can be removed indefinitely, but may be adjusted given changing environmental conditions.

Reference points: A benchmark against which the abundance of the stock or the fishing mortality rate can be measured in order to determine its status. These reference points can be used as limits or targets, depending on their intended usage.

Spawning Potential Ratio (SPR): Spawning Potential Ratio (SPR), also known as Eggs Per Recruit (EPR), is the proportion of eggs produced by a fished cohort over a lifetime, relative to the eggs produced by an unfished cohort over a lifetime. SPR is commonly utilized to understand the impact that fishing has on the reproduction ability of a population.

Total Allowable Catch (TAC): The total specified catch of a species for each fishing season or time period.

September 28, 2017

California Fish and Game Commission
1416 Ninth Street, room 1320
Sacramento, CA 95814

RE: TITLE 14. Fish and Game Commission Notice of Proposed Changes in Abalone Regulations for 2018.

Dear Commissioners:

I would like to encourage you to allow the 2018 abalone season to remain open pending adoption of the new abalone Fisheries Management Plan (FMP) due for implementation in 2019. In the above referenced notice, the Department is abdicating its responsibility for abalone management to the Commission by blindly following the flawed Abalone Recovery and Management Plan (ARMP) and recommending full closure of the fishery. In the last Commission Meeting Director Bonham said that he was going to direct his DFW invertebrate staff to have a new FMP available within the next 6 months, to be adopted for the 2019 season. With the Department's history of never having reopened a closed abalone fishery, it doesn't make sense to close the 2018 season when the new plan, which might indicate a different response than the ARMP, will be ready for the 2019 season.

As you well know there are several scientific, social, economic and political reasons why a 2018 closure is not a prudent action. The most compelling reason not to close the fishery is the fact that the proposed closure is based on the ARMP which both Director Bonham and Doctor Shuman agree is "flawed". They said, in the August Commission meeting, that they recognized the flaws in the ARMP and that it was their intent to correct the flaws during the development of a new FMP.

The most flagrant flaw in the ARMP is that it relies almost completely on inconsistent density surveys for making decisions about the fishery. In the DFW's "notice" they cited "critical negative impacts" to abalone's health,

reproduction and habitat which have little foundation in science and should only be considered as anecdotal indications, if used at all. While some of these indicators might be developed in the future to be useful, they are currently not well enough proven or accepted by the scientific community to be used as objective indicators. At the very least, before any decision is made to close the fishery, the closure decision recommended by the state biologists and its basis should be reviewed by outside, independent scientists.

Again, the main indicators specified in the ARMP are density surveys which are generally seen by scientists, statisticians, fishermen and even the DFW to be weak indicators of abalone health or even relative abundance. There are two important assertions made by the OST (Ocean Science Trust) scientific review of the DFW's density transect surveys. First, the DFW's *"sampling method was not designed to represent or estimate the density of the entire abalone population"*. Second, the OST scientific review points to the fact that density surveys are unreliable due to the large variances in observations, especially as it pertains to observations of site-level density changes. Taken together, these two considerations suggest that density surveys lack usefulness for informing coast-wide, county, or site level abalone stock status. More recently there has been simulation testing done by Dr. Bill Harford at the University of Miami in collaboration with The Nature Conservancy (TNC) which *"revealed that abalone density indicators derived from the observed variance structure of actual CDFW surveys had a propensity for poor management outcomes."*

Most divers and scientist agree that there are areas and groups of abalones which are currently suffering from environmental conditions that are not conducive to maintaining abalone densities at levels the DFW biologists call a "Cadillac fishery" at current index sites, but it is not at all clear that the overall abalone fishery or stock is in jeopardy or that the ARMP reference points are appropriate for a sustainable fishery. Furthermore, I think most scientists and divers also agree that environmental conditions (water temperature, starfish, kelp and urchins) are improving this year. While it's obvious that the high density "Cadillac fishery" will decline in the heavily fished index sites, most fishermen would much rather have a limited fishery than no fishery.

There were several good alternatives to full closure suggested by the public and the Commissioners at the last Commission meeting which warrant further consideration. These alternatives, if implemented wisely, would not overly stress the resource, would leave the 2018 season open and would give the Department the year to design a better FMP.

On the topic of the new FMP, I encourage the Department to take advantage of the outside scientific help offered by TNC and fishermen in the formulation of the new FMP. There have been some very good, well researched tools and fishery status indicators suggested by TNC to be used in the new FMP. These tools and indicators are proven, science-based and are currently ready to be used with existing data to help make the decision for 2018. The better science we use, the better decisions we can make.

Sincerely,

Jack Likins
Abalone Fisherman



Red Abalone Fishery Regulations



Sonke Mastrup
Program Manager, Marine Region
Fish and Game Commission Meeting
October 12, 2017



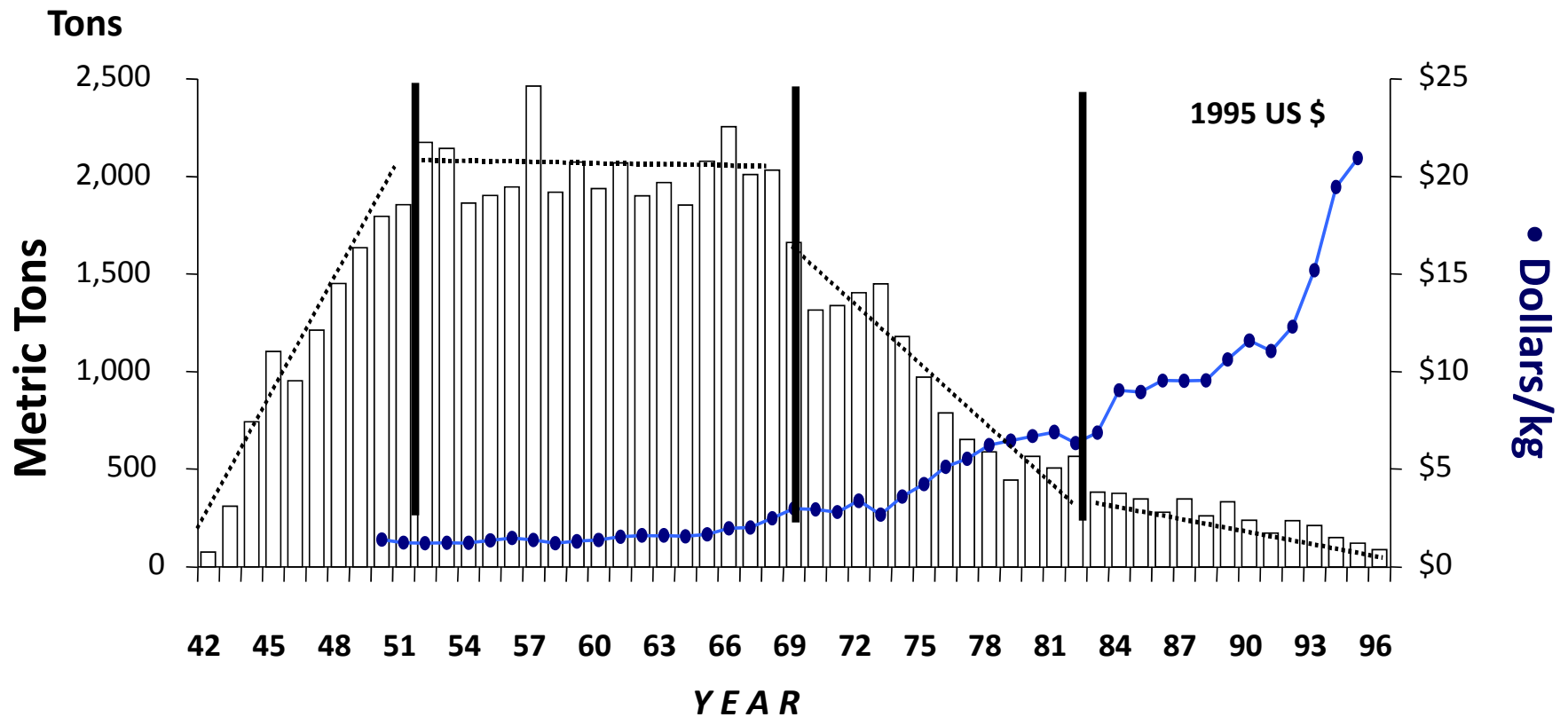
Overview

- Past Fishery History
- Current Status of Abalone Species
- ARMP History
- ARMP Fishery Triggers
- Current Impacts to Red Abalone and Causes
- Current Fishery Densities
- Regulatory Options
- Department Recommendation
- Fishery Conditions and Implications



Commercial Abalone Landings (1942-1997)

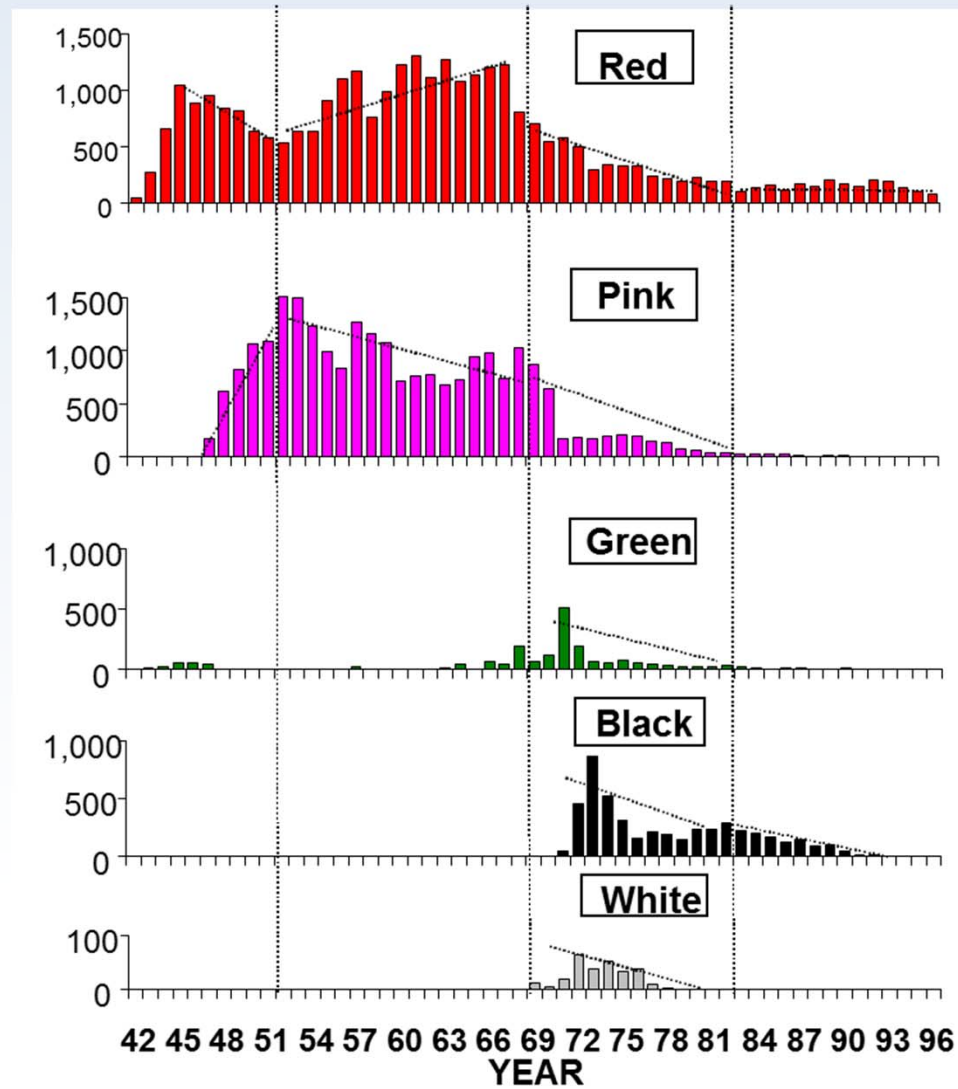
Five Species Combined



Karpov et al 2000



Southern Ca. Abalone Fishery

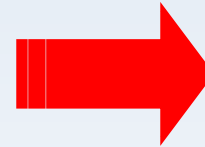




Current Status of Abalone in California

White Abalone (*Haliotis sorenseni*)

Black Abalone (*H. cracherodii*)

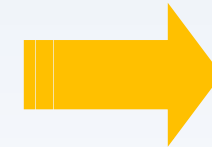


**Endangered Species
(Federal ESA)**

Pink Abalone (*H. corrugata*)

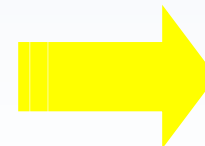
Green Abalone (*H. fulgens*)

Pinto Abalone (*H. kamtschatkana*)



**NOAA Species of
Concern List
(*in need of conservation*)**

Red Abalone (*H. rufescens*)



**Sport fishery north of
San Francisco, Closed
South**

Flat Abalone (*H. walallensis*)

Status Unknown



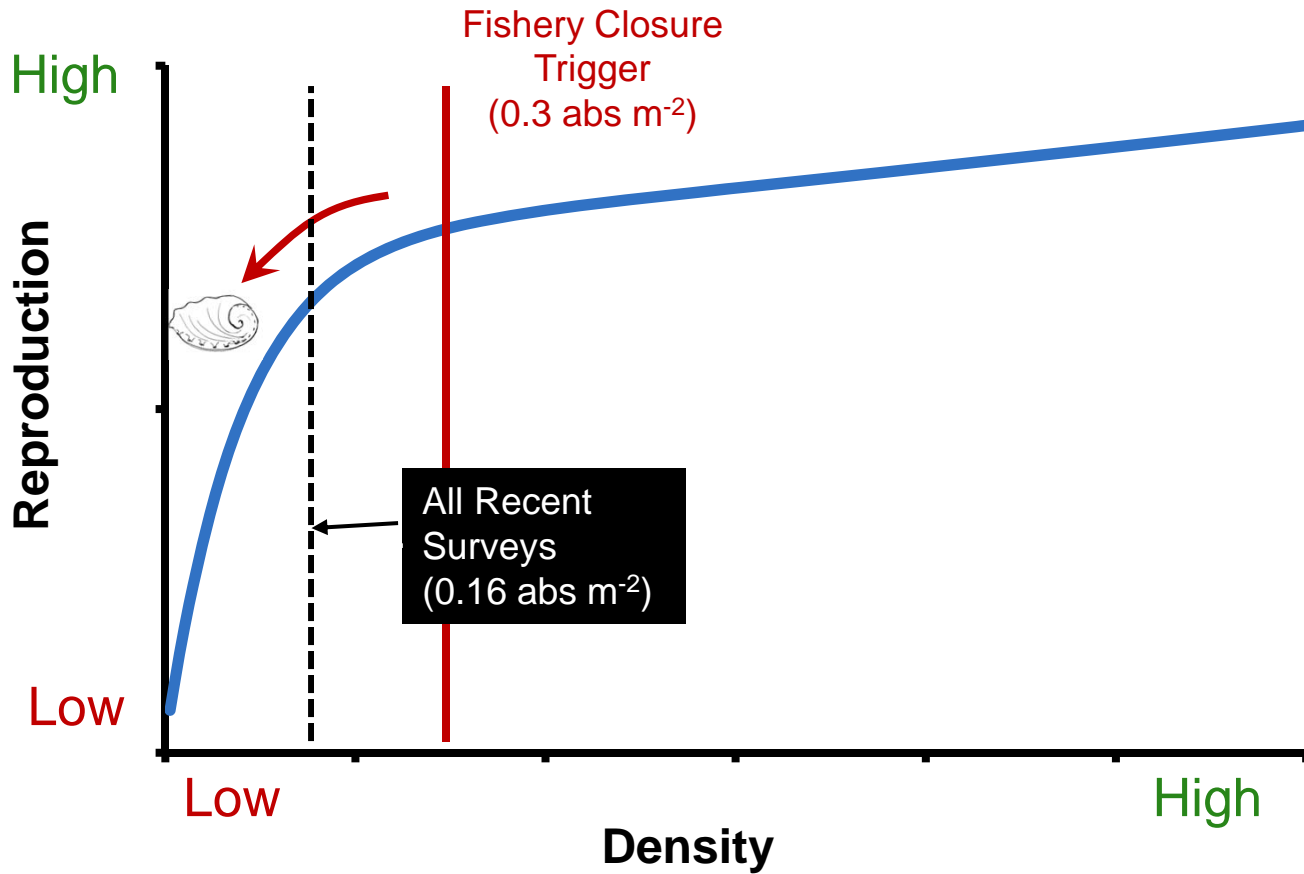
Abalone Recovery and Management Plan

- ARMP (FG Code §5522): five year development process
- Comprehensive and cohesive plan
 - Recovery actions in the south
 - Management of the fishery in the north
- Adaptive management based

<https://www.wildlife.ca.gov/Conservation/Marine/ARMP>



Why Density Matters





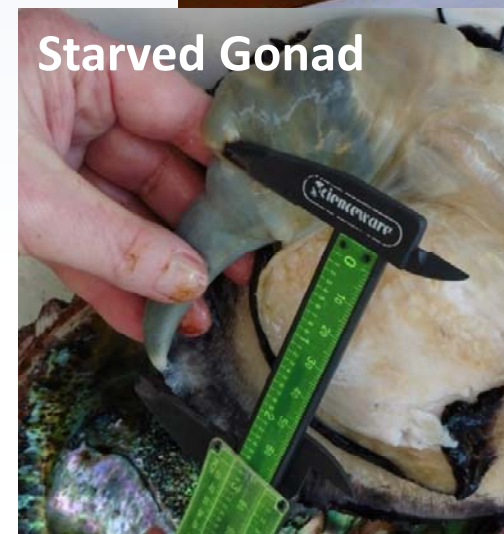
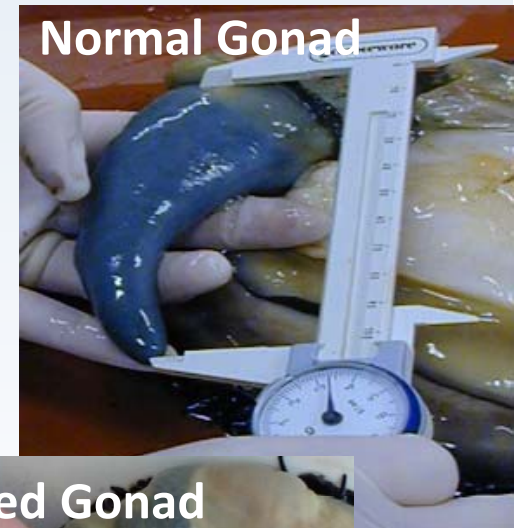
ARMP Fishery Triggers

- Fishery Wide Trigger 1
 - Fishery Density <0.375 abalone/m²
-- 25% reduction in TAC
- Fishery Wide Trigger 2
 - Fishery Density <0.3 abalone/m²
-- Fishery wide Closure
- Site Trigger.
 - Site Closure Trigger = 0.25



Causes and Impacts to Red Abalone

- Persistent Urchin Population Explosion
- Little to No Recovery of kelp
- Abalone Starvation for 4 years
- Reproduction Failure
- Significant Abalone Death
- Weakened Surviving Abalone





Current Density Data

Index Site (Sonoma-SC or Mendocino-MC)	Past Density (abalone/m ²) (year sampled)	2017 Density (abalone/m ²)	% Decline In Density
Fort Ross (SC)	0.44 (2015)	0.20	54%
Timber Cove (SC)	0.38 (2015)	0.15	60%
Ocean Cove (SC)	0.44 (2016)	0.17	61%
Salt Point (SC)	0.38 (2016)	0.06	79%
Sea Ranch (SC)	0.37 (2012)	0.27	27%
Sonoma Average	0.39	0.17	56%
Point Arena (MC)	0.66 (2014-15)	0.25	62%
Van Damme (MC)	0.33 (2016)	0.14	58%
Russian Gulch (MC)	0.60 (2014)	0.07	88%
Caspar Cove (MC)	0.35 (2013)	0.05	86%
Todd's Point (MC)	0.47 (2013)	0.16	66%
Mendocino Average	0.49	0.15	69%
OVERALL AVERAGE	0.44	0.15*	65%

- The ARMP fishery closure trigger is 0.30 abalone/m². The overall average is 0.15.



Abalone Regulatory Options

- Option 1: Close the Fishery per ARMP guidance
- Option 2: Limited Fishery Option
 - Sub-option A: Reopen Fort Ross
 - Sub-option B: Reduce Daily Bag/Possession and Annual limits
 - Sub-option C: Increase Size Limit to 8 inches
 - Sub-option D: Limit the number of Report Cards



CDFW Recommendation

- 2017 survey densities are below the ARMP fishery Closure trigger of 0.3 abalone/m²
- Recommend closing the fishery per ARMP guidance



Fishery Condition and Implications

- Indicators are still negative
 - High abalone mortality continues
- Previous reductions appear ineffectual
- Extreme precaution warranted
- Fishery collapse due to perfect storm
 - Fishing the survivors is adding to the problem
- Consequence of failure could be generations as current experience in Southern California



Thank You



CDFW Invertebrate Program

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