Agenda Item I.4
Attachment 1 (**Electronic Only**)
November 2024

Analysis for Proposed Amendment to the Pacific Groundfish Fishery Management Plan in Support of the Final Preferred Alternative

Groundfish Stock Definitions including Area Delineations for

Chilipepper Rockfish, English Sole, Redbanded Rockfish, Rougheye/Blackspotted Rockfish, Widow Rockfish, Yellowtail Rockfish, and Yelloweye Rockfish

November 2024

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This is a standard document produced by the Pacific Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) West Coast Region to provide the analytical background for decision-making.

Analysts have consulted with NMFS West Coast Region and preliminarily determined that the proposed action may fall within one of the NOAA Categorical Exclusion categories listed in Appendix F of the Companion Manual for NOAA Administrative Order 216-6A and that none of the alternatives have the potential to have a significant effect individually or cumulatively on the human environment. This determination is subject to further review and public comment. If this determination is confirmed when a proposed rule is prepared, the proposed action will be categorically excluded from the need to prepare an Environmental Assessment.

Abstract:

The Preliminary Preferred Alternative (PPA) for a proposed Amendment to the Pacific Coast Groundfish Fishery Management Plan is analyzed in this document. This Amendment would define stock units, including geographic delineations, for chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish (a cryptic pair), widow rockfish, yellowtail rockfish, and yelloweye rockfish. The FMP at present does not include this specificity for these species. This analysis examined population structure as a primer to understand if the species were to be considered interrelated single stock species with a single coastwide area delineation or if they were to be considered species with distinct population structure delineated by multiple geographic areas. Based on the best scientific information available (BSIA), analysis revealed chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish, widow rockfish, and yelloweye rockfish did not have evidence of discernable population structure and were consistent with Alternative 1, which would define them as single coastwide stocks. For yellowtail rockfish, BSIA indicated this species has evidence of discernable populations along the coast (Hess et al. 2011), separated by Cape Mendocino, California (approximately north and south of 40° 10′ N. lat.), which is consistent with the multiple stock delineations as described under Alternative 3.

Abbreviations and Acronyms

ABC	Acceptable Biological Catch
ACL	Annual Catch Limit
CE	Categorical Exclusion
CEQ	Council On Environmental Quality
CFR	Code Of Federal Regulations
Council	Pacific Fishery Management Council
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Endangered Species Unit
FMP	Fishery Management Plan
FMU	Fishery Management Unit
FONSI	Finding Of No Significant Impact
FR	*Federal Register*
FRFA	Final Regulatory Flexibility Analysis
GMT	Groundfish Management Team
HCR	Harvest Control Rule
IFQ	Individual Fishing Quota
IRFA	Initial Regulatory Flexibility Analysis
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MMPA	Marine Mammal Protection Act
MFMT	Maximum Fishing Mortality Threshold
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NS	National Standards
NWFSC	Northwest Fishery Science Center
OFL	Overfishing limit
OY	Optimum Yield
PPA	Preliminary Preferred Alternative
PRA	Paperwork Reduction Act
RCA	Rockfish Conservation Area
RFA	Regulatory Flexibility Act
RFFA	Reasonably Foreseeable Future Action
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SBA	Small Business Act
SSC	Science And Statistical Committee
Secretary	Secretary Of Commerce
U.S.	United States
WCGOP	West Coast Groundfish Observer Program

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1. Executive Summary

1. ES 1 Introduction

The Pacific Fishery Management Council (Council) is undertaking a proposed Amendment to define additional groundfish stocks in the Pacific Coast Groundfish Fishery Management Plan (PCGFMP or FMP). This document analyzes the Council's Preliminary Preferred Alternative (PPA) stock definitions for priority groundfish species. Priority species are identified from those scheduled to be assessed in 2025 or those for potential assessment in 2027 and are as follows: chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish, widow rockfish, yellowtail rockfish, and yelloweye rockfish (Table ES 1).

Table ES 1. Priority groundfish species (scientific name) for this action under the proposed Amendment and year of the anticipated upcoming stock assessment.

Assessment Year	
Scheduled 2025	**Proposed 2027**
Chilipepper rockfish (*Sebastes goodei*)	English sole (*Parophrys vetulus*)
Rougheye/Blackspotted rockfish (*Sebastes aleutianus/Sebastes melanostictus*)	Redbanded rockfish (*Sebastes babcocki*)
Widow rockfish [a/] (*Sebastes entomelas*)	
Yellowtail rockfish (*Sebastes flavidus*)	
Yelloweye rockfish [a/] (*Sebastes ruberrimus*)	

a/ Update assessments are planned in 2025 for widow and yelloweye rockfish, with the priority for widow rockfish should only one update assessment be possible due to assessment capacity.

2. ES 1.1 Purpose and Need

The Pacific Coast Groundfish Fishery Management Plan (FMP) does not explicitly define the majority of groundfish stocks.[1] The Pacific Fishery Management Council (Council) adopted the following purpose and need statement for this action at their June 2024 meeting.

> "With an Amendment (number TBD) to the Pacific Fishery Management Council's (Council) Groundfish FMP, the Council intends to identify stocks in need of conservation and management in the FMP, which will enhance the ability to attain sustainability objectives, especially those outlined in National Standard 1 of the Magnuson-Stevens Act as guided by National Standard 3 and informed by National Standard 2. Appropriate specification of stocks in need of conservation and management is a foundational aspect of sustainability, and

[1] The term "stock of fish" means a species, subspecies, geographical grouping, or other category of fish capable of management as a unit (16 USC. 1802 MSA § 3(42)).

instrumental in the Council's ability to attain Optimum Yield objectives. With this Amendment, the Council intends to identify a subset of species, those expected to be assessed soon, within the Groundfish FMP to define stock boundaries for status determination based on key biological, ecological, social, and economic information currently available."

Agenda Item F.4 Motion, in writing, June 2024

3. ES 1.2 Proposed Action

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) – the principal legal basis for fishery management within the Exclusive Economic Zone (EEZ) and the National Standard (NS) Guidelines (§ 600.305) – the proposed action is to identify and define stocks for 8 identified priority groundfish species (Table ES 1). The action will require an FMP amendment. This action makes no changes to the species composition of groundfish stock complexes that will be used in the 2027-2028 biennium. This action is not intended to revise the harvest specifications framework in the FMP or have allocative effects.

4. ES 1.3 Range of Alternatives (ROA)

The Council adopted the ROA for this action at its June 2024 meeting (Table ES 2). One alternative will ultimately be adopted for each species, i.e., multiple alternatives cannot be selected for a single species.

The ROA is summarized below and in Table ES 2:

- **No Action** would not define priority species as stocks in the FMP.
- **Alternative 1** would amend the FMP to define each priority species, except yellowtail rockfish, as a single coastwide stock within the Fishery Management Unit (FMU).
- **Alternative 2** would amend the FMP to define yelloweye rockfish as two stocks that align with regional-state boundaries; one stock for Washington and Oregon combined, and the second stock for California. This Alternative was recommended for consideration by the SSC due to uncertainty in movement rates (Agenda Item F.4.a Supplemental SSC Report 1, June 2024).
- **Alternative 3** would amend the FMP to define yellowtail rockfish as two separate stocks north of and south of 40° 10′ N. latitude.

Table ES 2. Action alternatives to be analyzed for priority groundfish species stock definition (as of September 2024). Note Alternative 2 for yelloweye rockfish was removed from further consideration in September 2024. Preliminary Preferred Alternative = PPA; North=N. South=S.

Species considered under a single Alternative		
Priority Species	**Alternative**	**Stock Area(s) Delineation**
Chilipepper rockfish	1 (PPA)	Coastwide
English sole	1 (PPA)	Coastwide
Redbanded rockfish	1 (PPA)	Coastwide
Rougheye/Blackspotted rockfish	1 (PPA)	Coastwide

Species considered under a single Alternative		
Priority Species	**Alternative**	**Stock Area(s) Delineation**
Widow rockfish	1 (PPA)	Coastwide
Yellowtail rockfish	3 (PPA)	N. of 40° 10′ N. lat. stock and S. 40° 10′ N. lat. stock
Species considered under multiple Alternatives		
Priority Species	**Alternative**	**Stock Area(s) Delineation**
Yelloweye rockfish	1 (PPA)	Coastwide
	2	*Washington & Oregon stock and California stock*

5. ES 1.4 Preliminary Preferred Alternative (PPA) and Range of Alternative Modifications

The Council adopted a Preliminary Preferred Alternative (PPA) and removed an Alternative from further consideration at its September 2024 meeting. Table ES 2 lists the PPA for each species in the column labeled Alternative. Alternative 2 for yelloweye rockfish was removed from further consideration by the Council in September due to insufficient scientific support to warrant stock structure finer than coastwide at this time. Lastly, the Council removed redbanded rockfish from the list of species to be assessed in 2025 and moved it to the list of species for preliminary assessment in 2027 (September Agenda Item I.4) and continued to support including redbanded rockfish in this action for stock definition (Table ES 1).

6. ES 1.5 Comparison of Alternatives

Chapter 3 compares and contrasts tradeoffs of the alternatives. For species with only one action Alternative, rationale in support of that single alternative and explanation of why additional alternatives are not warranted is also offered. The bulk of the comparative analysis is species-specific and focuses on the following two metrics: biological risks to the species and management burden for the Council. These metrics are described qualitatively as the actual impacts from applying the harvest control rule framework to the newly defined stocks will occur in the 2027-2028 harvest specifications process and at this time those impacts are unknown.

Biological

Biological risks may be in the form of localized depletion or the fishery not achieving OY. Localized depletion can lead to range contraction or fragmentation.

Specifically, the analysis indicated chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish, widow rockfish, and yelloweye rockfish did not have evidence of discernable population structure. Generally, this means an Alternative 1 stock definition for these species is unlikely to increase a risk of localized depletion or not achieving OY compared to status quo management. Alternative 2 for yelloweye rockfish would potentially characterize a stock structure that is not supported by scientific evidence and inadvertently lead to representing depletion trends and management structure at a finer scale than is actually occurring within the population dynamics for this species.

Yellowtail rockfish does have evidence of distinct population structure (Hess et al. 2011), separated by Cape Mendocino, California (approximately one north and one south of 40° 10′ N. lat.). The Alternative 3 stock definition for this species aligns with that structure and status quo management and is unlikely to increase the risk of localized depletion or hinder the Council's ability to achieve OY.

Management

Management burden may come in the form of allocative management recommendations the Council may need to make or additional stock assessments, etc. The premise is that some stock definitions may require allocative decisions by the Council to maintain status quo management measures or require new assessments to provide harvest specifications by stock. That process could increase the risk of inequitable or unfair state-specific allocations or increase the amount of time and effort (may be both analytical and/or procedural[2]) needed to develop fair and equitable allocations.

Yelloweye rockfish provides an example of the trade-offs of this metric. Alternative 2 is perceived to have a higher management burden than Alternative 1. Alternative 2 for yelloweye rockfish would require a new benchmark assessment at a different geographic delineation than has been used previously, and then separate harvest specifications for a Washington and Oregon combined stock and a California stock, which are at finer geographic scales than coastwide status quo management for yelloweye rockfish. Therefore, Alternative 2 would potentially require additional allocative decisions with the states of Washington and Oregon versus status quo management, compared to Alternative 1 (single coastwide stock), as well as require new benchmark stock assessments to inform the proposed two stock structure. Yelloweye rockfish was only selected for an "update" stock assessment in 2025 to the coastwide assessment from 2017 (i.e. an update uses the same model framework as the last full assessment), and thus the next stock assessment cycle could not address this. In addition, yelloweye rockfish is currently in rebuilding (projected to be rebuilt by 2028), with the rebuilding analysis consistent with the single coastwide assessment. Any rebuilding analysis would also need to be recalculated, based on the results of two separate new assessments.

Chilipepper rockfish are currently assessed in the waters off Oregon-California, with harvest specifications subsequently allocated to management areas north and south of 40° 10′ N. lat., and therefore any clarification of the alignment with a coastwide stock definition should be considered if necessary.

Yellowtail rockfish have evidence of discernable populations along the coast (Hess et al. 2011), separated by Cape Mendocino, California (approximately north and south of 40° 10′ N. lat.), consistent with status quo management.

[2] Analytical may be development of allocations that are "fair and equitable" under the NS4. Procedural may be describing formal or informal allocations in the FMP.

7. ES 1.6 Magnuson-Stevens Act

Considerations regarding National Standards 1 through 10 are offered in Section 4 prior to the Final Preferred Alternative(s) being adopted.

Table ES 3. Table showing information by species for this action. The left side shows the species, the alternatives considered, and the resulting geographic delineation of the alternative. The right side summarizes the best scientific information available (BSIA) population structure geographical delineation(s), National Marine Fisheries Service (NMFS) stock status area, geographic scale at which the annual catch limit (ACL) is currently set in harvest management, and the most recent assessment geographic delineation(s) and year. Note Alternative 2 for yelloweye rockfish was removed from further consideration in September 2024. Preliminary Preferred Alternative = PPA.

Species	Alternative	Delineation	BSIA Population Structure	[NMFS Status Area](#)	ACL Scale	Assessment Stratification & Year[1]
Chilipepper Rockfish	1 (PPA)	Coastwide	Oregon-California	Southern Pacific Coast	Shelf Rockfish complex North of 40° 10' N. Lat.; South of 40° 10' N. Lat.	Oregon-California (2015)
English Sole	1 (PPA)	Coastwide	Coastwide	Pacific Coast	Coastwide	Coastwide (2013)
Redbanded rockfish	1 (PPA)	Coastwide	Coastwide		Slope Rockfish complex North of 40° 10' N. Lat. and South of 40° 10' N. Lat.	Coastwide (2011)[2]
Rougheye/ Blackspotted rockfish	1 (PPA)	Coastwide	Coastwide		Slope Rockfish complex North of 40° 10' N. Lat. and South of 40° 10' N. Lat.	Coastwide (2013)
Widow rockfish	1 (PPA)	Coastwide	Coastwide	Pacific Coast	Coastwide	Coastwide (2019)
Yelloweye rockfish	1 (PPA)	Coastwide	Coastwide	Pacific Coast	Coastwide	Coastwide, two sub-areas waters off CA and OR-WA (2017)
	2	*Washington & Oregon*				
		California				
Yellowtail rockfish	3 (PPA)	North of 40° 10' N. Lat.	North of 40° 10' N. Lat.	Northern Pacific Coast	North of 40° 10' N. Lat.	North of 40° 10' N. Lat. (2017)
		South of 40° 10' N. Lat.	South of 40° 10' N. Lat.		Shelf Rockfish complex South of 40° 10' N. Lat.	South of 40° 10' N. Lat. (2011)[2]

[1] Most recent sub-area for assessments endorsed as BSIA by the SSC and NMFS. Assessment area stratifications may change in future assessments.

[2] Data-poor or data-limited stocks estimates of sustainable yield use catch-only methods which the SSC endorsed for use in setting harvest levels but not for use in determining stock status (Agenda Item E.2.b Supplemental SSC report, June 2011).

1. Introduction

The Council is required to identify stocks in need of conservation and management per the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its National Standards. A non-exhaustive list of factors that can be used to determine/define stocks is well described at §600.305(c)(1). FMPs must describe status determination criteria, or the measurable and objective factors (e.g., OFL, MSST, etc.), for each managed stock to determine if a stock is overfished or whether overfishing is occurring (§600.310(e)(2)(i)(A). The National Marine Fisheries Service (NMFS) makes stock status determination based on the condition of a stock relative to the status determination criteria.

> **Stock status determination** is a NMFS decision whether a stock of fish is in an overfished condition and/or is subject to overfishing. NMFS makes these determinations based on BSIA and the status determination criteria described in the PCGFMP and reports them to Congress quarterly.

The FMP currently lists the species managed under the FMP (see FMP Chapter 3, Table 3-1) and the groundfish stocks thus far defined under Amendment 31 (see FMP Chapter 3, Table 3-2). Until recently, the Council and NMFS used the FMP, coupled with the groundfish Stock Assessment and Fishery Evaluation (SAFE) report, and the biennial harvest specifications in regulation to manage species in the FMP as stocks. The FMP list of species provides insufficient detail necessary to identify the species as a stock, e.g., geographic boundaries, etc. and the Council has not formally adopted stock definitions for most managed groundfish. The FMP does, however, describe the harvest specification process used to set the overfishing fishing limit (OFL), acceptable biological catch (ABC), and annual catch limits (ACL). The SAFE details the harvest specification factors such as harvest control rules (HCR), OFLs, ABCs, etc. based on the best scientific information available (BSIA) for each groundfish species in the fishery on a biennial basis. Groundfish harvest specifications for species and stock complexes in varying geographic scales are developed through the framework described in the FMP and codified into federal regulations.

Under the harvest specifications framework in the FMP, the OFL should directly correspond to the geographic extent of the stock because it is the annual amount of catch corresponding to the estimate of the maximum fishing mortality threshold (MFMT) applied to the stock's abundance (600.310(e)(2)(i)(D)). The Council's Scientific and Statistical Committee (SSC) recommends specific OFL values based on the BSIA for an assessed unit of fish. The OFL is a biological reference point and if exceeded can negatively affect stock health, and therefore a single OFL is provided for a defined stock. Reference points, as in the ABC and ACL, are adopted by the Council based on its preferred level of risk aversion in combination with the recommendations of the SSC regarding scientific uncertainty (PFMC 2022, PFMC 2024). ABCs and ACLs are generally set for the stock, and can be apportioned to regions (e.g., sablefish regional ACLs), which is generally done consistent with the allocation framework in the FMP.

As noted in MSA §303(a)(1)) "...fishery management plan... shall...contain the conservation and management measures... necessary and appropriate... to prevent overfishing and rebuild overfished stocks...". In order to meet this, NS1 guidelines at §600.310(d) direct "...Councils should identify in their FMPs the stocks that require conservation and management. Such stocks must have ACLs, other reference points, and accountability measures...". As shown in the following infographic (Figure 1), NS1 identifies criteria to assist the Council in determining if a species (called a 'stock' in the figure) is in need of conservation and management. This analysis presumes that the priority species considered in this action are in need of conservation and management.

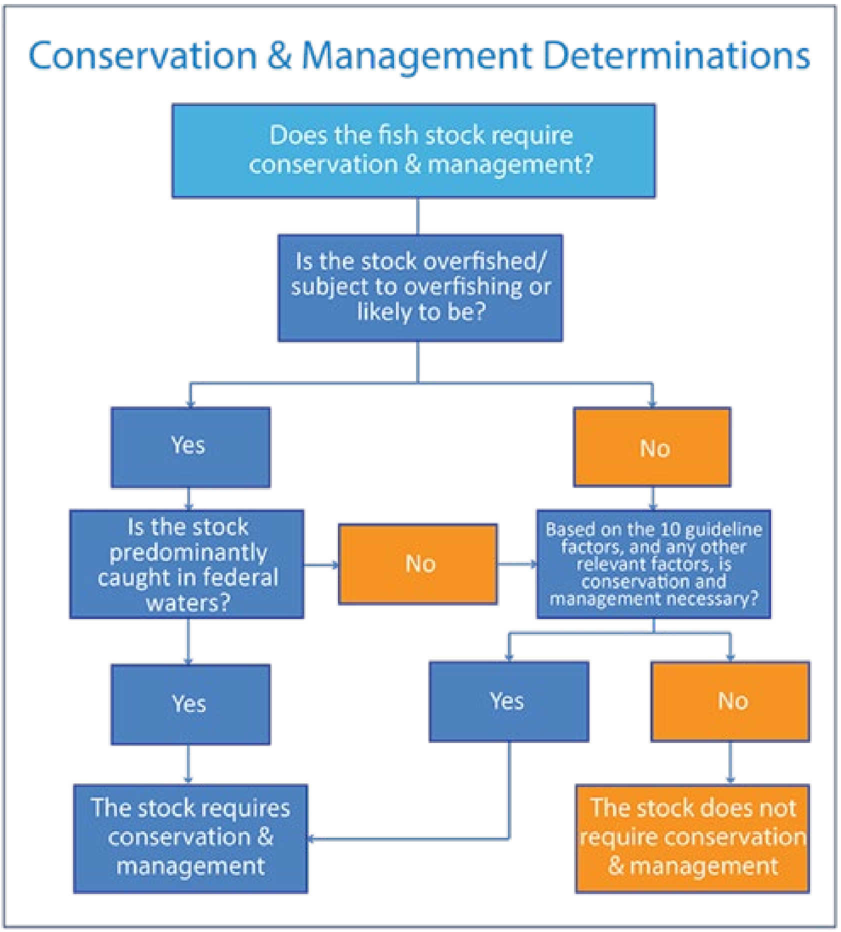

Figure 1. Diagram from National Marine Fisheries Service simplifying the process of determining if a stock is in need of conservation and management. Source NMFS NS1 Guidelines.

The MSA and National Standards, notably National Standards 1 and 2, consider a stock as a single unit, generally within the confines of specific geographical delineation(s). Further, under NS2, conservation and management measures shall be based upon the best scientific information available and therefore the Council is required to use BSIA in their decision-making processes. Current scientific literature and the advice of the Scientific and Statistical Committee (SSC) suggests population structure is a foundation to defining a species as a stock and can help to delineate the stock on a geographic scale (see Agenda Item H.5.a, Supplemental SSC Report 1, November 2022; Agenda Item E.3.a, Supplemental SSC Report 1, November 2021; Agenda Item E.8.a Supplemental SSC Report 1 November 2023). Genetics, larval dispersal, adult movement, and variation in life history characteristics are used to understand population structure. Based on the MSA, the National Standards, BSIA, and how the Council has considered species in the past, this analysis frames the question of how to define a stock by first reviewing the BSIA (Appendix 1) and contrasting/comparing that information against the Alternatives. In defining stocks, the Council must use BSIA, but also take into account the MSA and the National Standards, the goals, objectives and existing frameworks in the FMP, and socioeconomics of the fishery.

Additionally, the implementation team for the prior Amendment 31 for groundfish stock definitions noted the lack of consistency in wording of the FMP (PFMC, 2022a), SAFE (PFMC, 2022b), and other Council documents. For example, the word 'stock' is often used interchangeably with other related terms such as population and/or sub-population. In order to create a common literary 'currency', a Glossary was created and provided to guide terminology (Section 5).

1.1 Proposed Action

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the principal legal basis for fishery management within the Exclusive Economic Zone (EEZ), the proposed action would amend the FMP to identify and define stocks for each of the Council identified priority groundfish species (Table 1). The action must also be consistent with the National Standard Guidelines for fishery management. This action makes no changes to the species composition of stock complexes or harvest specifications as implemented in the 2025-2026 groundfish harvest specifications. This action is not intended to have allocative effects. It is assumed the Council would continue to manage species that are currently in a complex within their current complex. Changes to complexes will be considered in a later phase of stock definition.

Table 1. Priority groundfish species (scientific name) for this action under the proposed Amendment and year of the anticipated upcoming stock assessment.

Assessment Year	
Scheduled 2025	**Proposed 2027**
Chilipepper rockfish (*Sebastes goodei*)	English sole (*Parophrys vetulus*)
Rougheye/Blackspotted rockfish (*Sebastes aleutianus/Sebastes melanostictus*)	Redbanded rockfish (*Sebastes babcocki*)
Widow rockfish [a/] (*Sebastes entomelas*)	
Yellowtail rockfish (*Sebastes flavidus*)	
Yelloweye rockfish [a/] (*Sebastes ruberrimus*)	

a/ Update assessments are planned in 2025 for widow and yelloweye rockfish, with the priority for widow rockfish should only one update assessment be possible due to assessment capacity.

1.2 Description of Management Area

The management area is the U.S. West Coast Exclusive Economic Zone (EEZ) defined as the area from 3 nautical miles to 200 nautical miles (nm) seaward of Washington, Oregon, and California state waters and the communities that engage in fishing in waters off these states. This geographic area within the jurisdiction of the FMP may be referred to as the fishery management unit (FMU) and is depicted in Figure 1 of the FMP (PFMC 2023). Some of these priority species may also occur in state waters (0-3 nm), however, any fishing activity for these species in state waters is not covered by the FMP and is outside the scope of this action.

1.3 Purpose and Need

The Council adopted the following purpose and need statement for this action at their June 2024 meeting.

> "With an Amendment (number TBD) to the Pacific Fishery Management Council's (Council) Groundfish FMP, the Council intends to identify stocks in need of conservation and management in the FMP, which will enhance the ability to attain sustainability objectives, especially those outlined in National Standard 1 of the Magnuson-Stevens Act as guided by National Standard 3 and informed by National Standard 2. Appropriate specification of stocks in need of conservation and management is a foundational aspect of sustainability, and instrumental in the Council's ability to attain Optimum Yield objectives. With this Amendment, the Council intends to identify a subset of species, those expected to be assessed soon, within the Groundfish FMP to define stock boundaries for status determination based on key biological, ecological, social, and economic information currently available."
>
> Agenda Item F.4 Motion, in writing, June 2024

1.4 History of this Action

The history of this action is detailed in the hyperlinked reports. These reports are incorporated by reference, though information is summarized, as appropriate, throughout the following analysis.

In March 2022, the NMFS outlined concerns regarding the FMP in their report to the Council (Agenda item E.3.a NMFS Report 1, March 2022). The report noted that while the FMP identifies groundfish species[3][1] in the fishery, it did not identify stocks and, as a result, NMFS was unable to report status to Congress as required.[4][2] NMFS recommended the Council "…initiate action to ensure that stocks that are managed at a scale other than coastwide for the purposes of status determination, and other stocks, are clearly identified in the FMP".

Subsequently, the Council completed a process resulting in Amendment 31 to the Pacific Coast Groundfish FMP, which defined stocks assessed in 2021 and 2023. This included initial scoping in June 2022 (Agenda Item F.4, Attachment 1, June 2022), in September 2022 identification of priority species to be included and analyses to support the Amendment (Agenda Item G.5, Attachment 1 and Attachment 2, September 2022), a range of alternatives (ROA) in November 2022 (Agenda Item H.5, Attachment 1, November 2022), with preliminary preferred alternatives in March 2023 (Agenda Item F.7, Attachment 1, March 2023), and a final alternative in June 2023.

[3] see Table 3-1 of the FMP

[4] MSA §304(e)(1)

Amendment 31 was incorporated into the Pacific Coast Groundfish FMP, as well as provided updates to Council Operating Procedure (COP) 9.

The term **stock** is defined in the MSA as "a species, subspecies, geographical grouping, or other category of fish capable of management as a unit." – 16 U.S.C. 1802 MSA §3(42)

At its June 2024 meeting, the Council identified the species (Table 1) to be covered under the next proposed Pacific Coast Groundfish FMP Amendment, which are those scheduled for assessment in 2025 and potential assessment in 2027, hereinafter called priority species. The Council also adopted a range of alternatives (ROA) for further analysis and review (Agenda Item F.4 Attachment 1 and Supplemental Attachment 2, June 2024). Some modifications from the original list of priority species and ROA considerations were adopted, based on the 2025 stock assessment schedule decision under Agenda Item F.3 at the same meeting.

At its September 2024 meeting, the Council adopted a preliminary preferred alternative for priority species stock definitions (bolded in Table 1 of Agenda Item I.5.a Supplemental GMT Report 1) and removed Alternative 2 for yelloweye rockfish from further consideration, based on insufficient scientific support cited by the SSC (Agenda Item I.5.a Supplemental SSC Report 1, September 2024). Lastly, the Council removed redbanded rockfish from the list of species to be assessed in 2025 and moved it to the list of species for preliminary assessment in 2027 (September Agenda Item I.4) and continued to support including redbanded rockfish in this action for stock definition (Table 1).

The ultimate goal of this process is to create stock definitions for all groundfish species in need of conservation and management. Given time constraints, this process to develop stock definitions for all managed groundfish species is a longer-term multi-phase process. The process to complete Amendment 31 was referred to as "Phase 1". The Council is pursuing a process for groundfish stock definition under Phase 2 and includes potential revisions to stock complexes and removal or delegation of stocks. The current proposed Amendment slightly overlaps Phase 2 but will allow the Council to initiate the 2027-2028 biennial harvest specifications and management measure process based upon new stock definitions for those species assessed in 2025. Stock definitions for all remaining species will be completed in future actions.

The proposed Amendment is time-sensitive and should be completed by June 2025, or prior to Council adoption of new stock assessments and the initiation of 2027-2028 biennial management decision-making. The Council is scheduled to adopt a final preferred alternative in November 2024.

1.5 Analytical Process

The focus of the proposed Amendment is to define the unit stock, including spatial delineations, for the priority species. A quantitative analysis for this action is not possible, therefore the analysis of the alternatives follows a qualitative approach. The qualitative comparison weighs the tradeoffs between two types of metrics; biological risks to the species and management burden. Biological risks may be in the form of localized depletion or the fishery not achieving optimum yield (OY). Management burden may change in management compared to status quo, as characterized by the 2025-2026 harvest specifications and management measures (PFMC 2024). These metrics are described qualitatively as the actual impacts from applying the harvest control rule framework to the newly defined stocks will occur in the 2027-2028 harvest specifications process and at this time those impacts are unknown.

The SSC had extensive discussions in November 2021 and recommended at least three tiers of biological attributes to consider when deciding a stock definition (Agenda Item E.3.a. Supplemental SSC Report 1 November 2021). The highest tier of these attributes is a genetic difference among meaningful markers. When members of a fish species are segregated into multiple reproductive stocks, allele frequencies at neutral genetic markers diverge under genetic drift such that the variance in gene frequencies reflects the magnitude of reproductive isolation among these stocks. Thus, gene frequency differences among geographic samples can be used to indirectly estimate patterns of gene flow and hence stock structure of the species. The next highest tier of information is exchange or movement of adults, followed by larval dispersal between areas. The SSC also recommended consideration of variation in life history characteristics (e.g. growth, maturity) when identifying stocks for species (Agenda Item E.8.a Supplemental SSC Report 1 November 2023).

A comparison of current geographic area stratifications is presented as a baseline of sorts to compare and contrast the Alternatives. In the Comparison of the Alternatives section (Chapter 3), a series of tables are presented that illustrates geographic area stratification in relation to population structure metrics for each species considered in this action. While on an individual basis, these factors may not definitively identify a population or sub-population, yet when combined they can indicate population structure. Multiple factors of population structure were investigated (e.g., genetics, larval dispersal, etc.) as well as perspectives garnered from SSC recommendations of best scientific information available (BSIA); the geographic scale of assessments, historic NMFS stock status determinations areas; and the geographic scale of annual catch limits (ACL) for the species or stock complex in which the species is managed.

The factors considered in analyzing each species are as follows:

- BSIA Population Structure - the geographic extent informed by an amalgamation of SSC recommendations for stock status areas and BSIA from Appendix 1 for the species.
- NMFS Status Area - the geographic area stratification of stock status determinations that NMFS has made in the past for this species, if applicable.
- ACL Scale - the geographic extent of 2025 ACLs set for the species, or, if applicable, the complex in which it is managed.
- Assessment - the finest scale geographic extent of the species' assessments or sub-area assessments from the most recent assessment.

The first step was to perform an in-depth scientific literature review for each of the priority species and research past BSIA assessment endorsements by the SSC to gauge relative biological impacts of alternatives. Appendix 1 compiles this information for the priority species and is incorporated through reference throughout this analysis. This information was used by analysts to develop conclusory statements found herein. An underlying assumption related to this action regards optimum yield (OY) as an indicator of a stock's delineation definition. Assessments generally indicate the spatial level at which OY can be achieved. Assessors develop the geographic scale of the assessment using multiple factors, including scientific information review and fishery dependent and independent data to provide assessment advice at a scale suitable for management. It is unclear if the stock delineation were to not align with the geographic area for which the assessment was conducted, if that scale would achieve OY relative to the sub-area without additional management and/or allocative actions.

The second step was to examine the ROA through the lens of MSA and the NS by comparing the relative risk of increasing the management burden or having a stock definition that would differ so much from status quo harvest specifications and management measures that it could considerably increase complexity of (1) the proposed Amendment beyond its current scope or (2) the anticipated 2027-28 harvest specifications and management measures.

1.6 Appendix 1 Biological Information Overview

Appendix 1: Biological Information, which is incorporated through reference, is a detailed literature review which investigates overarching considerations regarding population dynamics as well as biological information for each species considered in this action. The following summarizes key points of Appendix 1.

The SSC had extensive discussions in November 2021 and recommended at least three tiers of biological attributes to consider when deciding a stock definition (Agenda Item E.3.a. Supplemental SSC Report 1 November 2021). The highest tier of these attributes is a genetic difference among meaningful markers. When members of a fish species are segregated into multiple reproductive stocks, allele frequencies at neutral genetic markers diverge under genetic drift such that the variance in gene frequencies reflects the magnitude of reproductive isolation among these stocks. Thus, gene frequency differences among geographic samples can be used to indirectly estimate patterns of gene flow and hence stock structure of the species. The next highest tier of information is exchange or movement of adults, followed by larval dispersal between areas. The SSC also recommended consideration of variation in life history characteristics (e.g. growth, maturity) when identifying stocks for species (Agenda Item E.8.a Supplemental SSC Report 1 November 2023).

The one oft-used attribute is genetic differentiation. When members of a fish species are segregated into multiple reproductive stocks, allele frequencies at neutral genetic markers diverge under genetic drift such that the variance in gene frequencies reflects the magnitude of reproductive isolation among these stocks. Thus, gene frequency differences among geographic samples can be used to indirectly estimate patterns of gene flow and hence population structure of the species. Genetic differences often provide signals on long-time scales (e.g., geologic), and thus can miss more recent and relevant time scales unless extremely sensitive markers are used. Population connectivity by measuring dispersal and movement (which can also be done using natural markers, such as in otolith microchemistry studies) in at least one stage of the life cycle is a more direct way to measure contemporaneous connections among subpopulations along a species range (Gunderson and Vetter, 2006).

Homogeneous population structure assumes there is connectivity in the population, meaning reproductive units within the population are not isolated from one another. It only takes exchange in a few individuals to cause this homogeneity using genetic markers, though this type of population structure may also suggest high mixing patterns in terms of larvae, juveniles, and/or adults along the species range. In brief, evidence suggests that individuals in homogeneous populations are not isolated from one another on the geographic scale i.e., the population is connected. Heterogeneous population structure assumes the converse, with low connectivity caused by life history, geographic, and/or oceanographic constraints. Within a heterogeneous population, there would be identifiable subpopulations that are likely reproductively isolated from other subpopulations. Reproductively isolated subpopulations are known to show genetic differences, suggesting limited connectivity along the species range.

Population connectivity is not the only criterion to use for defining a stock. Ideally, a stock should consist of a collection of individuals that interact enough to create a coherent population trend (i.e., have the same population dynamics). This defines subpopulations as from the same stock if they demonstrate comparable recruitment patterns, life history values and exploitation histories, thus exhibiting similar population trends (Cope and Punt, 2009; 2011). In fact, exploitation history alone can cause localized depletion events despite total population connectivity via larval dispersal or adult movements. Ignoring this can lead to mismanagement of stocks (Cope and Punt, 2011), thus providing spatially-resolved population assessments when considering each of the factors can provide the most appropriate resolution to set catch limits.

Assessments attempt to model population dynamics at a geographic scale that is informed by BSIA for population structure. Meaning, a coastwide assessment assumes the population is homogeneous throughout its west coast range and assessments at the less than coastwide scale assumes the population is heterogeneous. In heterogeneous populations, assessors often use state boundaries to delineate sub-areas (e.g., quillback rockfish), though sub-areas can be based on more discrete biogeographical data (e.g., vermilion/sunset rockfish north and south of Point Conception [34°27′ N. lat.]). These sub-areas are informed by BSIA. Population delineations can also be informed by data availability, history of fishery exploitation, etc. Population breaks can often correspond to biogeographic boundaries that occur within state lines (Keller et al., 2018; Brooks, 2021). Spatially explicit assessment methods that reflect population structure, as well as incorporate fishery exploitation data at the same scale, likely increase the understanding of the species as well as improve managers ability to maintain a sustainable resource (Brooks, 2021).

In general, the level of or lack of structure indicates population connectivity. High connectivity implies a single connected unit of fish across the species' range (i.e., a single stock); whereas low connectivity implies isolated, unconnected units of fish across species' range homogeneous population (i.e., multiple stocks). Population structure can be determined on a geographic basis, giving a base method to determine geographical boundaries for the population.

2. Description of Alternatives

This section describes the ROA adopted by the Council at their June 2024 meeting and includes the Alternatives selected as the PPA at their September 2024 meeting.

The Council adopted the ROA for this action at their June 2024 meeting.

> "…And adopt the species and alternatives in the table below as the range of alternatives for stock definition for stocks being assessed in 2025 and preliminarily identified for assessment in 2027.

Species	Alt. 1 Coastwide	Alt. 2 State/ Region	Alt. 3 North and South of 40° 10' N lat.
Chilipepper rockfish	*		
English sole	*		
Redbanded rockfish	*		
Rougheye/Blackspotted rockfish	*		
Widow rockfish	*		
Yellowtail rockfish			*
Yelloweye rockfish	*	*	

> "

Agenda Item F.4 Motion, in writing, June 2024

2.1 Summary of Alternatives

The ROA includes the No Action alternative and Action alternatives 1, 2, and 3 (Table 2). A single alternative will be adopted for each species, i.e., multiple alternatives cannot be selected for a single species. Alternative 1 would define the species as a single stock and status would be determined at the coastwide scale. Alternative 1 signifies the population has no discernible structure. Under Alternatives 2 and 3, a stock would be delineated at a finer scale than coastwide, with status made at the corresponding delineation specified by the alternative. Alternatives 2 and 3 assume the species population has distinct population structure.

The ROA is summarized below:

- **No Action** would not define priority species as stocks in the FMP.
- **Alternative 1** would amend the FMP to define each priority species, with the exception of yellowtail rockfish, as a single coastwide stock within the Fishery Management Unit (FMU). **(PPA)**
- **Alternative 2** would amend the FMP to define yelloweye rockfish as two stocks that align with regional-state boundaries; one stock for Washington and Oregon combined, and the second stock for California. This Alternative was recommended for consideration by the SSC due to uncertainty in movement rates (Agenda Item F.4.a Supplemental SSC Report 1, June 2024).
- **Alternative 3** would amend the FMP to define yellowtail rockfish as two separate stocks north of and south of 40° 10′ N. latitude. **(PPA)**

For all the Action alternatives, the following applies:

- Overfishing status determination is calculated comparing mortality to the OFL that is set. The OFL would be calculated (if managed in a complex) or set (if managed species-specific) at the same scale as the stock's geographic delineation;
- For stocks managed in a complex, the OFL calculation is apportioned into the stock complex OFL contributions using status quo methods;
- Overfished status determination (i.e., "overfished"/"not overfished") is depletion relative to biomass reference points (e.g., minimum stock size threshold) and would be made by NMFS at the same scale as the geographic scale identified in the alternative;
- All of the alternatives would allow varying sigma values for sub-area assessments to capture assessment uncertainty.
- No alternative would make changes to stock complexes.

The alternatives are detailed below and analyzed in comparative fashion in Chapter 3. Table 2 provides a summary of the Alternative(s), the species considered, and the resulting stock area delineation.

Table 2. Action alternatives analyzed for priority groundfish species under this proposed FMP Amendment. Note Alternative 2 for yelloweye rockfish was removed from further consideration in September 2024. Preliminary Preferred Alternative = PPA.

Priority Species	**Alternative**	**Stock Area(s) Delineation**
Species considered under a single Alternative		
Chilipepper rockfish	1 (PPA)	Coastwide
English sole	1 (PPA)	Coastwide
Redbanded rockfish	1 (PPA)	Coastwide
Rougheye/Blackspotted rockfish	1 (PPA)	Coastwide
Widow rockfish	1 (PPA)	Coastwide
Yellowtail rockfish	3 (PPA)	N. of 40° 10′ N. lat. stock and S. 40° 10′ N. lat. stock
Species considered under a multiple Alternatives		
Priority Species	**Alternative**	**Stock Area(s) Delineation**
Yelloweye rockfish	1 (PPA)	Coastwide
	2	*Washington & Oregon stock and* *California stock*

2.2 No Action

Under the No Action alternative, the Council would not adopt stock definitions for the priority species. The FMP would not be amended. Status for the priority species could not be determined. Additionally, under the No Action alternative the Council would not achieve the Purpose and Need for this action.

2.3 Alternative 1: Single Stock

Under Alternative 1, the Council would amend the FMP to define chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish, widow rockfish and yelloweye rockfish as single stocks. Chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish, and widow rockfish are only considered under Alternative 1. The OFL would be provided at a scale equivalent to the population's geographic extent on the U.S. West Coast. NMFS would determine status for these species as a single stock at the same geographic scale as described in the stock definition.

Chilipepper rockfish is scheduled for a coastwide stock assessment in 2025 and was last assessed with a benchmark assessment for the waters off Oregon and California combined (Field et al. 2015). All other species considered for Alternative 1 are currently assessed consistent with the proposed coastwide stock definition.

2.4 Alternative 2: Two Stocks based on State/Region

Alternative 2 would amend the FMP to define yelloweye rockfish as two stocks, delineating it as a California stock and a combined Washington and Oregon stock. The SSC recommended this delineation due to uncertainty in movement rates (Agenda Item F.4.a Supplemental SSC Report 1, June 2024). The OFL values would be stock specific, i.e., a California stock OFL and a combined Washington and Oregon stock OFL. NMFS would determine status for these stocks at the geographic scale of each stock.

Yelloweye rockfish was last assessed in a single coastwide stock assessment, with a shared stock-recruitment relationship, but between two assessment sub-areas. Oregon and Washington were combined in a single sub-area due to difficulties separating the catch and compositional data of fish caught in one state but landed in the other, with California as a second sub-area (Gertseva and Cope 2017). If Alternative 2 were adopted, two separate stock assessments would need to be conducted for yelloweye rockfish to utilize in determining stock status. In addition, yelloweye rockfish is currently in rebuilding, with the rebuilding analysis consistent with the single coastwide assessment. Any rebuilding analysis would also need to be recalculated, based on the results of those two separate assessments under Alternative 2.

Yelloweye rockfish is also considered under Alternative 1. See Section 3.3.1 for species-specific considerations under both Alternatives.

2.5 Alternative 3: Two stocks North and South of 40° 10' N. Latitude

Under Alternative 3, the Council would amend the FMP to define yellowtail rockfish as multiple stocks, delineated by a boundary at 40° 10' N. latitude. The OFL would be stock specific, i.e., a north of 40° 10’ N. lat. stock and a south of 40° 10’ N. lat. stock would each have separate harvest specifications. NMFS would determine status for these stocks at the geographic scale of each stock.

This geographic delineation correlates to the stock assessment areas and management structure. Yellowtail rockfish was last assessed with a benchmark assessment north of 40° 10′ N. lat. (Stephens and Taylor 2017) and a data-limited catch-only method south of 40° 10′ N. lat. (Dick and MacCall 2010; Dick 2011). Current harvest management utilizes a species-specific OFL/ABC/ACL in the area north of 40° 10′ N. lat. and yellowtail rockfish is managed south of 40° 10′ N. lat. in the shelf rockfish complex, of which it is a component species that contributes to an overall complex level OFL/ABC/ACL.

3. Comparison of the Alternatives

This chapter discusses the tradeoffs between **two types of metrics**, biological risks to the species and management burden:

1. Biological risks may be in the form of localized depletion or the fishery not achieving OY.
2. Management burden may change management compared to status quo or may increase the need for an allocative decision. The status quo is characterized by the 2025-26 harvest specifications and management measures (PFMC 2024).

These metrics are described qualitatively as the actual impacts from applying the harvest control rule framework to the newly defined stocks will occur in the 2027-2028 harvest specifications process and at this time those impacts are unknown.

In Table 3, each species' geographic area stratification of four different indicators are presented:

- Action Alternative stock structure and delineation
- BSIA population structure
- NMFS' current stock status determination area, if applicable
- ACL scale of harvest management
- Assessment stratification.

Table 3. Table showing the combined information by species for this action. The left side shows the species, the alternatives considered, and the resulting geographic delineation of the alternative. The right side summarizes the best scientific information available (BSIA) population structure geographical delineation(s), National Marine Fisheries Service (NMFS) stock status area, geographic scale at which the annual catch limit (ACL) is currently set in harvest management, and the most recent assessment geographic delineation(s) and year. Note Alternative 2 for yelloweye rockfish was removed from further consideration in September 2024. Preliminary Preferred Alternative = PPA.

Species	Alternative	Delineation	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification & Year[1]
Chilipepper Rockfish	1 (PPA)	Coastwide	Oregon-California	Southern Pacific Coast	Shelf Rockfish complex North of 40° 10' N. Lat; South of 40° 10' N. Lat.	Oregon-California (2015)
English Sole	1 (PPA)	Coastwide	Coastwide	Pacific Coast	Coastwide	Coastwide (2013)
Redbanded rockfish	1 (PPA)	Coastwide	Coastwide		Slope Rockfish complex North of 40° 10' N. Lat. and South of 40° 10' N. Lat.	Coastwide (2011)[2]
Rougheye/ Blackspotted rockfish	1 (PPA)	Coastwide	Coastwide		Slope Rockfish complex North of 40° 10' N. Lat. and South of 40° 10' N. Lat.	Coastwide (2013)
Widow rockfish	1 (PPA)	Coastwide	Coastwide	Pacific Coast	Coastwide	Coastwide (2019)
Yelloweye rockfish	1 (PPA)	Coastwide	Coastwide	Pacific Coast	Coastwide	Coastwide, two sub-areas waters off CA and OR-WA (2017)
	2	*Washington & Oregon*				
		California				
Yellowtail rockfish	3 (PPA)	North of 40° 10' N. Lat.	North of 40° 10' N. Lat.	Northern Pacific Coast	North of 40° 10' N. Lat.	North of 40° 10' N. Lat. (2017)
		South of 40° 10' N. Lat.	South of 40° 10' N. Lat.		Shelf Rockfish complex South of 40° 10' N. Lat.	South of 40° 10' N. Lat. (2011)[2]

[1] Most recent sub-area for assessments endorsed as BSIA by the SSC and NMFS. Assessment area stratifications may change in future assessments.
[2] Data-poor or data-limited stocks estimates of sustainable yield use catch-only methods which the SSC endorsed for use in setting harvest levels but not for use in determining stock status (Agenda Item E.2.b Supplemental SSC report, June 2011).

3.1 No Action

In the following comparative analysis, the action alternatives are compared amongst themselves and not to the No Action alternative, which is a departure from the norm. In most Council actions, the Action alternatives are compared to the No Action alternative; however, in this case, the No Action alternative would mean the FMP would not be in compliance with the MSA and is an untenable option for the Council to consider. In brief, the No Action alternative is untenable because the Council is required to define groundfish species as stocks in the FMP and, therefore, if the Council were to adopt No Action, the FMP would continue to not align with the MSA and National Standards (NS). All action alternatives, regardless of species, represent a change from No Action as it would draw the FMP into alignment with the MSA and the National Standards. Further, because stocks are not defined under No Action, the stock definitions under the action alternatives have nothing to compare to.

NMFS has advised the Council, both in writing (Agenda Item E.3.a, NMFS Report 1, March 2022) and verbally at the March (Agenda Item E.3), June (Agenda Item F.4), September (Agenda Item G.5) and November (Agenda Item H.5) 2022 Council meetings, that steps must be taken to draw the FMP into compliance with the MSA and the National Standards by defining the groundfish species in need of conservation and management as stocks. If stocks are not defined and delineated on a geographic scale, status cannot not be determined. Status determination is a key tenant to NS1 and NMFS must provide this information to Congress. As such, No Action is an untenable option for the Council to adopt as it is out of compliance with the MSA and it does not meet the purpose and need for the proposed Amendment.

These findings result in an inability to provide a basis for meaningful comparison of No Action with the action alternatives. Therefore, it cannot be compared to the other alternatives the Council is considering under this action. For species where there are multiple alternatives under consideration, the alternatives are compared among themselves. As such, the No Action alternative is not analyzed further.

3.2 Alternative 1 Comparison

Five of the priority species are considered under a single Alternative 1: chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish (considered a single cryptic pair), and widow rockfish (Table 4). The only comparative alternative to these species is the No Action Alternative, which, as discussed above, is untenable and not a meaningful comparison. Therefore, this analysis describes the impact of the alternative for each of those species but does not compare to other alternatives.

Alternative 1 would define these priority species as single stocks with a geographic range set as the U.S. West Coast (referred to as coastwide). A single stock definition is appropriate when sufficient mixing occurs and harvest in one area could affect the trajectory of the stock in all areas. Status for these stocks would be at the coastwide scale.

Table 4. Five priority species with only Alternative 1 stock area delineation considered. Preliminary Preferred Alternative = PPA.

Priority Species	Alternative	Stock Area(s) Delineation
Chilipepper rockfish	1 (PPA)	Coastwide
English sole	1 (PPA)	Coastwide
Redbanded rockfish	1 (PPA)	Coastwide
Rougheye/Blackspotted rockfish	1 (PPA)	Coastwide
Widow rockfish	1 (PPA)	Coastwide

3.2.1 Chilipepper rockfish

Chilipepper rockfish is considered only under Alternative 1 (PPA) as a single, coastwide stock.

Table 5. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for chilipepper rockfish.

Species	Geographic Factors of Population			
	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification, Year
Chilipepper rockfish	Oregon-California		Shelf Rockfish complex North of 40° 10' N. lat.	Oregon-California (2015)
		S. Pacific Coast	South of 40° 10' N. lat.	

Prior to 2007, chilipepper rockfish were only assessed in the area south of 40°10' N. lat. (Ralston et al. 1998). A full assessment for chilipepper rockfish in waters off California and Oregon was conducted in 2007 (Field 2008). An update of the 2007 assessment of chilipepper rockfish was conducted in 2015 (Field et al. 2015). Chilipepper rockfish is scheduled to be reassessed in 2025 as a full benchmark assessment. The SSC and NMFS endorsed the last 2015 assessment model as BSIA (Agenda Item D.8.a Supplemental SSC Report 1, June 2015). Catch-only updates from the 2015 assessment were conducted in 2017 and in 2023 to provide projections used in recent harvest management.

Biological - Current BSIA, literature, and assessments at present do not support a discernible population structure for chilipepper rockfish (*Sebastes goodei*) and is likely a single stock (Appendix 1: Biological Information). Defining this species under Alternative 1 as a single stock would be consistent with BSIA and literature. Although the distribution of this species extends into British Columbia, abundance peaks near Cape Mendocino, California and declines north of Cape Blanco in Oregon (Beyer et al. 2015).

Management – Chilipepper rockfish are managed north of 40° 10′ N. lat. in the Shelf Rockfish complex, and species-specifically in the area south of 40° 10′ N. lat. The OFL/ABC/ACL from the coastwide stock assessment is apportioned to each area north and south of 40° 10′ N. lat. based on average historical landings (Agenda Item E.2 Attachment 2, November 2023). The ACL scale is less than coastwide, however the ACL control rule that calculates their ACLs is applied coastwide (i.e., two different ACL control rules are not applied to sub-areas independently). From the assessment, by application of the harvest specifications framework in the FMP, a coastwide ACL is calculated using a coastwide ACL control rule and then the ACL is subsequently apportioned north and south, so that any formal allocation structures can be applied consistent with the FMP.

The 2007 assessment was first used in 2008 to decide 2009 and 2010 chilipepper harvest specifications. The Council consideration for 2011 and 2012 was whether or not to remove chilipepper rockfish from the Shelf Rockfish North complex and manage it coastwide. Chilipepper rockfish are predominantly found south of 40°10' N. lat. Prior to 2007 they were only assessed in the area south of 40°10' N. lat. (Ralston et al. 1998). When the stock assessment area was extended for the 2007 chilipepper stock assessment, it was extended through waters off Oregon (e.g. chilipepper rockfish are not believed to occur in waters off Washington). However, it was decided to continue to manage chilipepper rockfish south of 40°10' N. lat. with stock-specific harvest specifications and as part of the Shelf Rockfish complex north of 40°10' N. lat. This management structure is assumed to continue under Alternative 1. Under Alternative 1, the coastwide stock definition would encompass the geographic areas both north and south of 40°10' N. lat. and would therefore not pose a management burden.

Other Considerations – Given that chilipepper rockfish are uncommon north of Oregon, the Council may want to consider a revised Alternative 1 or an Alternative 2 (regional-state), defining chilipepper rockfish as a single stock in the waters off Oregon and California, consistent with the current geographic assessment stratification. On the other hand, there would be greater uncertainty in particular if its range were to expand northward of its current area of abundance under climate change scenarios, as there is unlikely to be enough information to assess chilipepper rockfish in waters off of Washington state. The current coastwide stock definition under Alternative 1 accounts for a broader population range and encompasses the entire management area north of north of 40° 10′ N. lat. (see section below). It is acknowledged that the coastwide stock definition under Alternative 1 would be informed by Oregon-California stock assessment estimates only, at this point in time. Alternative 1 recognizes this species does not have population structure and the assessment is representative of regional dynamics that align with potential single population structure for this species. For these reasons, a coastwide Alternative 1 is less likely than a potential regional-state Alternative 2 to have biological implications within the context of the harvest specifications framework in the FMP.

Summary - Chilipepper rockfish do not have evidence of discernable population structure and Alternative 1 is consistent with a single stock. It is noted that the current assessment stratification encompasses only waters off Oregon-California, with harvest specifications subsequently allocated to management areas north and south of 40° 10′ N. lat., and therefore any clarification of the alignment with a coastwide stock definition should be considered if necessary (see Management and Other Considerations above).

3.2.2 English sole

English sole is considered only under Alternative 1 (PPA) as a single, coastwide stock.

Table 6. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for English sole.

Species	Geographic Factors of Population			
	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification and Year
English sole	Coastwide	Pacific Coast	Coastwide	Coastwide (2013, published 2015)

English sole is a species on the preliminary list for consideration to conduct a full benchmark assessment in 2027. A coastwide data-moderate stock assessment for English sole was completed in 2013 (Cope et al. 2015). Previous assessments include a full benchmark assessment in 2005 (Stewart 2005) and an update in 2007 (Stewart 2007); both conducted on a coastwide scale. The SSC and NMFS endorsed the last 2013 assessment model as BSIA (Agenda Item F.5.b Supplemental SSC Report 1, June 2013). A catch-only update from the 2013 data-moderate assessment was conducted in 2019 to provide projections used in recent harvest management.

Biological - Current BSIA, literature, and assessments at present do not support English sole (*Parophrys vetulus*) stock delineation on a finer geographic scale than a coastwide basis, nor support a discernible population structure (Appendix 1: Biological Information). English sole can be found in shallow waters (less than 200 m) from Unimak Island in Alaska to Baja California, Mexico (Fargo and Kronlund 2000).

Defining English sole as a stock at a finer scale than coastwide would require new information. No new information was found in the literature review presented in Appendix 1. Defining this species under Alternative 1 as a single coastwide stock would be consistent with BSIA and literature.

Management – English sole is managed coastwide, and not within a management complex. This species has been assessed at the coastwide scale and historically had single coastwide OFL/ABC/ACLs. Alternative 1 is unlikely to require the Council to consider changes to management, such as formal or informal allocations, and therefore management implications are not anticipated.

Summary – English sole does not have evidence of discernable population structure. Alternative 1 is consistent with a single coastwide stock and aligns with geographic factors under consideration as well as current management structure. Given the lack of evidence to support considering other alternatives for this species, no additional alternatives are considered, and no comparisons to other alternatives can be made.

3.2.3 Redbanded rockfish

Redbanded rockfish is considered only under Alternative 1 (PPA) as a single, coastwide stock.

Table 7. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for Redbanded rockfish.

Species	Geographic Factors of Population			
	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification and Year
Redbanded rockfish	Coastwide		Slope Rockfish complex North of 40° 10' N. Lat. and South of 40° 10' N. Lat.	Coastwide (2011)[1]

[1] Data-poor or data-limited stocks estimates of sustainable yield use catch-only methods which the SSC endorsed for use in setting harvest levels but not for use in determining stock status (Agenda Item E.2.b Supplemental SSC report, June 2011).

To date, redbanded rockfish has not been fully assessed. Redbanded rockfish is well observed by the NWFSC West Coast Groundfish Bottom Trawl (WCGBT) survey and has large numbers of lengths and age structures collected from commercial fisheries that could support a future assessment. Redbanded rockfish has been considered a data-poor or data-limited stock in past management. Redbanded rockfish was included in estimates of sustainable yield for data-poor stocks in the FMP (Dick and MacCall 2010), using the Depletion-Based Stock Reduction Analysis (DB-SRA) method. Subsequent revisions were made to OFL contributions (Dick 2011) to correct several errors and have provided the current values used in harvest specifications and management. The SSC noted that this catch-only method (DB-SRA) is not a formal stock assessment and that results should not be used for stock status but did endorse them for use in setting harvest levels (Agenda Item E.2.b Supplemental SSC report, June 2011). The OFL values are apportioned to management areas north and south of 40°10' N. lat. based on cumulative catch data (Dick and MacCall 2010).

Biological - Current BSIA, literature, and estimation methods for harvest specifications at present do not support redbanded rockfish (*Sebastes babcocki*) stock delineation on a finer geographic scale than a coastwide basis, nor support a discernible population structure (Appendix 1: Biological Information). Redbanded rockfish range from the Gulf of Alaska to southern California (Sullivan et al. 2022). There is no information available for genetics, larval dispersal, or adult movement rates, with little biological research available for this species.

Defining redbanded rockfish as a stock at a finer scale than coastwide would require new information. No new information was found in the literature review presented in Appendix 1. Defining this species under Alternative 1 as a single coastwide stock would be consistent with BSIA and literature.

Management – Redbanded rockfish are managed north and south of 40° 10′ N. lat. in the Slope Rockfish Complex. Harvest specifications from the coastwide DB-SRA estimate are apportioned to each area north and south of 40° 10′ N. lat. based on cumulative historical catch. The ACL contribution scale is less than coastwide, however the ACL control rule that calculates the ACL contribution is applied coastwide (i.e., two different ACL control rules are not applied to sub-areas independently). From the assessment, by application of the harvest specifications framework in the FMP, a coastwide ACL is calculated using a coastwide ACL control rule and then the ACL is subsequently apportioned to each complex north and south, so that any formal allocation structures can be applied consistent with the FMP.

In recent years, catches of redbanded rockfish have been at a high proportion relative to their species-specific ACL contribution to the slope rockfish north complex and thus it is under consideration for assessment in 2027.

Alternative 1 is unlikely to require the Council to consider changes to management, such as formal or informal allocations, and therefore management implications are not anticipated.

Summary – Redbanded rockfish do not have evidence of discernable population structure. Alternative 1 is consistent with a single coastwide stock and aligns with geographic factors under consideration as well as current management structure. Given the lack of evidence to support considering other alternatives for this species, no additional alternatives are considered, and no comparisons to other alternatives can be made.

3.2.4 Rougheye/Blackspotted rockfish

Rougheye and Blackspotted rockfish are considered only under Alternative 1 (PPA) as a single, coastwide stock.

Table 8. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for Rougheye/Blackspotted rockfish.

Species	Geographic Factors of Population			
	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification and Year
Rougheye/ Blackspotted rockfish	Coastwide		Slope Rockfish complex North of 40° 10' N. Lat. and South of 40° 10' N. Lat.	Coastwide (2013)

Rougheye rockfish (*Sebastes aleutianus*) and blackspotted rockfish (*Sebastes melanostictus*) are a set of cryptic slope rockfish species that share broad overlap in their depth and geographic distributions. It is very difficult to visually distinguish between the two species and they have been persistently confused in surveys and catches. Off the U.S. West Coast the two species have been reported as rougheye rockfish or in an even more generic rockfish category. It has only been from recent genetic studies in the early 2000s that the two separate species have been identified and described (Orr and Hawkins 2008). Genetic information is not available to provide positive species identification in historical survey and landings information used in stock assessments.

Hicks et al. (2013) conducted the first assessment of rougheye and blackspotted rockfish off the U.S. West Coast as a complex of two species. The SSC and NMFS endorsed the last 2013 assessment model as BSIA (Agenda Item G.3.b Supplemental SSC Report 1, September 2013). A catch-only update from the 2013 assessment was conducted in 2019 to provide projections used in recent harvest management. These species are again scheduled for a full benchmark assessment in 2025.

Biological - Current BSIA, literature, and assessments at present do not support a rougheye/blackspotted rockfish stock delineation on a finer geographic scale than a coastwide basis, nor support a discernible population structure (Appendix 1: Biological Information). Rougheye and blackspotted rockfish range along the Eastern Aleutian Islands along the North American continental margin to southern Oregon (Gharrett et al. 2005, Hawkins et al 2005, Orr and Hawkins 2008). It is noted that combining these species within stock assessments could potentially mask areas of localized depletion.

Defining a stock for rougheye and blackspotted rockfish at a finer scale than coastwide would require new information. No new information was found in the literature review presented in Appendix 1. Defining this species under Alternative 1 as a single coastwide stock would be consistent with BSIA and literature.

Management – Rougheye and blackspotted rockfish are managed north and south of 40° 10′ N. lat. in the Slope Rockfish Complex. Harvest specifications from the coastwide 2013 stock assessment are apportioned to each area north and south of 40° 10′ N. lat. based on average historical catch. The ACL contribution scale is less than coastwide, however the ACL control rule that calculates the ACL contribution is applied coastwide (i.e., two different ACL control rules are not applied to sub-areas independently). From the assessment, by application of the harvest specifications framework in the FMP, a coastwide ACL is calculated using a coastwide ACL control rule and then the ACL is subsequently apportioned to each complex north and south, so that any formal allocation structures can be applied consistent with the FMP.

Alternative 1 is unlikely to require the Council to consider changes to management, such as formal or informal allocations, and therefore management implications are not anticipated.

Summary – Rougheye and blackspotted rockfish do not have evidence of discernable population structure. Alternative 1 is consistent with a single coastwide stock and aligns with geographic factors under consideration as well as current management structure. Given the lack of evidence to support considering other alternatives for this species, no additional alternatives are considered, and no comparisons to other alternatives can be made.

3.2.5 Widow rockfish

Widow rockfish are considered only under Alternative 1 (PPA) as a single, coastwide stock.

Table 9. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for Widow rockfish.

Species	**Geographic Factors of Population**			
	BSIA Population Structure	**NMFS Status Area**	**ACL Scale**	**Assessment Stratification and Year**
Widow rockfish	Coastwide	Pacific Coast	Coastwide	Coastwide (2019)

Widow rockfish have had multiple stock assessments, starting in 1984 and the most recent as an update assessment conducted in 2019 (Adams et al. 2019) of the 2015 full benchmark stock assessment (Hicks and Wetzel 2015). Widow rockfish is scheduled to be reassessed in 2025 again as an update assessment. The SSC and NMFS endorsed the last 2015 benchmark assessment model as BSIA (Agenda Item H.5.a Supplemental SSC Report 1, September 2019). A catch-only update from the 2015 assessment was conducted in 2023 to provide projections used in recent harvest management (Wallace 2023).

Biological - Current BSIA, literature, and assessments at present do not support a discernible population structure for widow rockfish (*Sebastes entomelas*) (Appendix 1: Biological Information). Defining this species under Alternative 1 as a single stock would be consistent with BSIA and literature. Widow rockfish range from southeast Alaska to Baja California, Mexico and are most abundant from British Columbia to northern California (Ressler et al. 2009, Hicks et al. 2015, Adams et al. 2019). There is no genetic evidence of distinct genetic populations along the U.S. West Coast (Sivasundar and Palumbi 2010).

Defining a stock for widow rockfish at a finer scale than coastwide would require new information. No new information was found in the literature review presented in Appendix 1. Defining this species under Alternative 1 as a single coastwide stock would be consistent with BSIA and literature.

Management – Widow rockfish is managed coastwide, and not within a management complex. This species has been assessed at the coastwide scale and historically had single coastwide OFL/ABC/ACLs. Alternative 1 is unlikely to require the Council to consider changes to management, such as formal or informal allocations, and therefore management implications are not anticipated.

Summary – Widow rockfish does not have evidence of discernable population structure. Alternative 1 is consistent with a single coastwide stock and aligns with geographic factors under consideration as well as current management structure. Given the lack of evidence to support considering other alternatives for this species, no additional alternatives are considered, and no comparisons to other alternatives can be made.

3.3 Alternative 2 Comparison

Only yelloweye rockfish is considered under Alternative 2, which can be compared to its consideration under Alternative 1 (PPA).

Alternative 1 was selected as PPA by the Council in September 2024. In addition, Alternative 2 for yelloweye rockfish was removed from further consideration by the Council, due to insufficient scientific support to warrant stock structure finer than coastwide at the time. The SSC also indicated that relatively long larval durations and preliminary evidence for broad-scale movements of adults promote population connectivity (Agenda Item I.5.a Supplemental SSC Report 1, September 2024).

Table 10. Priority species considered under Alternative 2 for stock area delineation. Preliminary Preferred Alternative = PPA.

Priority Species	Alternative	Stock Area(s) Delineation
Yelloweye rockfish	1 (PPA)	Coastwide
	2	*Washington & Oregon*
		California

Alternative 2 would define yelloweye rockfish as two separate stocks; one stock for waters off Washington and Oregon combined and one stock for waters off California. The SSC recommended this delineation due to uncertainty in movement rates (Agenda Item F.4.a Supplemental SSC Report 1, June 2024). The OFL values would be stock specific, i.e., a California stock OFL and a combined Washington and Oregon stock OFL. NMFS would determine status for these stocks at the geographic scale of each stock.

Alternative 1 (PPA) would define yelloweye rockfish as a single stock with a geographic range set as the U.S. West Coast and stock status would be at the coastwide scale. A single stock definition is appropriate when sufficient mixing occurs and harvest in one area could affect the trajectory of the stock in all areas.

3.3.1 Yelloweye rockfish

Yelloweye rockfish is considered under Alternative 1 (PPA) as a single coastwide stock and under Alternative 2 as two separate stocks; one stock for waters off Washington and Oregon combined and one stock for waters off California.

Table 11. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for Yelloweye rockfish.

Species	Geographic Factors of Population			
	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification and Year

Yelloweye rockfish	Coastwide	Pacific Coast	Coastwide	Coastwide (2017)

Yelloweye rockfish have had multiple stock assessments, starting in 2001 and the most recent as a full benchmark assessment conducted in 2017 (Gertseva and Cope 2017a). Based on the outcome of the 2017 assessment, a subsequent rebuilding analysis was conducted (Gertseva and Cope 2017b). The SSC and NMFS endorsed the 2017 benchmark assessment model and rebuilding analysis as BSIA (Agenda Item E.8.a Supplemental SSC Report 1, September 2017; Agenda Item F.4.a Supplemental SSC Report 1, November 2017). A catch-only update from the 2017 rebuilding analysis was conducted in 2023 to provide projections used in recent harvest management (Wallace 2023). The 2017 benchmark assessment used a single coastwide model, with a shared stock-recruitment relationship between two sub-areas. Yelloweye rockfish is scheduled to be reassessed in 2025, as an update assessment to that conducted in 2017.

Biological - Current BSIA, literature, and assessments at present do not support a discernible population structure for yelloweye rockfish (*Sebastes ruberrimus*) (Appendix 1: Biological Information). Defining this species under Alternative 1 as a single stock would be consistent with BSIA and literature. Yelloweye rockfish are distributed from the western Gulf of Alaska to northern Baja California (Hart 1973; Eschmeyer and Herald 1983). There may be genetic separation between yelloweye rockfish in the Strait of Georgia (British Columbia) and the outer coasts of Washington and Oregon (Yamanaka et al. 2001; Siegle et al. 2013), but outer coastal populations are not genetically distinct from each other.

Defining a stock for yelloweye rockfish at a finer scale than coastwide would require new information. No new information was found in the literature review presented in Appendix 1. Defining this species under Alternative 1 as a single coastwide stock would be consistent with BSIA and literature. There is insufficient information on genetics, larval dispersal, spatial variation in life history traits with which to assess stock structure for yelloweye rockfish. There is, however, recent evidence to suggest greater adult movement rates than previously documented. This, combined with otolith microchemistry, suggests that yelloweye rockfish may exhibit a high degree of population connectivity along the US West Coast, and aligns with the stock definition defined under Alternative 1.

In June 2024 under considerations for the Range of Alternatives, the SSC noted uncertainty in movement rates for this species (Agenda Item F.4.a Supplemental SSC Report 1, June 2024). Although adult movement rates may be uncertain, Alternative 2 for yelloweye rockfish would potentially characterize a stock structure that is not directly supported by scientific evidence and inadvertently lead to representing depletion trends and management structure at a finer scale than is actually occurring within the population dynamics for this species.

If Alternative 2 were considered for yelloweye rockfish stock definition, it would require new benchmark assessments to inform the proposed two stock structure. Yelloweye rockfish was only selected for an “update” stock assessment in 2025 to the coastwide assessment from 2017 (i.e. an update uses the same model framework as the last full assessment), and thus the next stock assessment cycle could not address this.

Management – Yelloweye rockfish is managed coastwide, currently as a rebuilding species (projected to be rebuilt in 2028), and not within a management complex. This species has been assessed at the coastwide scale and historically had single coastwide OFL/ABC/ACLs since 2002. Alternative 1 is unlikely to require the Council to consider changes to management, such as formal or informal allocations, and therefore management implications are not anticipated.

Alternative 2 may have a higher management burden than Alternative 1. Alternative 2 would require the Council to conduct new stock assessments for yelloweye rockfish to obtain stock-specific OFL values (for the Washington and Oregon stock and the California stock), as well as require changes to the current management structure with potential formal or informal allocations between the states of Washington and Oregon for the combined states' stock. Currently, a methodology or process has not yet been developed or adopted to separate out a single coastwide assessment into multiple stocks. In addition, yelloweye rockfish is currently in rebuilding, with the rebuilding analysis consistent with the single coastwide assessment. Any rebuilding analysis would also need to be recalculated, based on the results of two separate new assessments.

Summary – Yelloweye rockfish does not have evidence of discernable population structure and movement rates are uncertain. Alternative 1 is consistent with a single coastwide stock and aligns with geographic factors under consideration as well as current management structure. Alternative 2 would require new stock assessments and require the implementation of changes to the current management structure. Therefore, Alternative 2 is perceived to have a higher management burden than Alternative 1.

3.4 Alternative 3 Comparison

Only yellowtail rockfish is considered under Alternative 3 (PPA) as a single alternative.

Table 12. Priority species considered under Alternative 3 stock area delineation. Preliminary Preferred Alternative = PPA.

Priority Species	Alternative	Stock Area(s) Delineation
Yellowtail rockfish	3 (PPA)	N. of 40° 10′ N. lat. stock and S. 40° 10′ N. lat. stock

Alternative 3 would define yellowtail rockfish as multiple stocks, delineated by a boundary at 40° 10' N. latitude. The OFL values would be stock specific, i.e., a north of 40° 10' N. lat. stock OFL and a south of 40° 10' N. lat. stock OFL. NMFS would determine status for these stocks at the geographic scale of each stock.

The only comparative alternative for this species is the No Action Alternative, which, as discussed above, is untenable and not a meaningful comparison. Therefore, this analysis describes the impact of the alternative for this species but does not compare to other alternatives.

3.4.1 Yellowtail rockfish

Yellowtail rockfish are considered only under Alternative 3 defined as two stocks; one stock north of 40° 10′ N. lat. and one stock south of 40° 10′ N. lat.

Table 13. Comparison of best scientific information available (BSIA) population structure, National Marine Fisheries Service (NMFS) stock status area, annual catch limit (ACL) scale of species in current harvest management, and the most recent assessment stratification and year conducted for Yellowtail rockfish.

Species	Geographic Factors of Population			
	BSIA Population Structure	NMFS Status Area	ACL Scale	Assessment Stratification and Year
Yellowtail rockfish	North of 40° 10′ N. lat.	Northern Pacific Coast	North of 40° 10′ N. lat.	North of 40° 10′ N. lat. (2017)
	South of 40° 10′ N. lat.		Shelf Rockfish Complex South of 40° 10′ N. lat.	South of 40° 10′ N. lat. (2011)[1]

[1] Data-poor or data-limited stocks estimates of sustainable yield use catch-only methods which the SSC endorsed for use in setting harvest levels but not for use in determining stock status (Agenda Item E.2.b Supplemental SSC report, June 2011).

Yellowtail rockfish has two distinct subpopulations along the coast (Hess et al. 2011), separated by Cape Mendocino, California (approximately one north and one south of 40° 10′ N. lat.). This biogeographic split was used as the basis for the most recent assessment work in 2017 (Stephens and Taylor 2017). Available literature and assessment findings for yellowtail rockfish support this biogeographic stock definition. The SSC recommended the north of 40° 10′ N. lat. assessments as BSIA as well as the geographic scale for status determination (Agenda Item E.8.a, Supplemental SSC Report 1, Sept. 2017). A catch-only update from the 2017 assessment was conducted in 2023 to provide projections used in recent harvest management (Wetzel 2023).

Though attempts were made to assess the southern population using data-moderate methods, a southern model sufficiently robust for use in management could not be developed. Additional age and length data were needed prior to attempting another full stock assessment. A depletion-based stock reduction analysis was used to assess yellowtail rockfish south of Cape Mendocino in 2011 (Dick and MacCall 2010). Subsequent revisions were made to OFL contributions (Dick 2011) to correct several errors and have provided the current values used in harvest specifications and management. The SSC noted that this catch-only method (DB-SRA) is not a formal stock assessment and that results should not be used for stocks status but did endorse them for use in setting harvest levels (Agenda Item E.2.b Supplemental SSC report, June 2011).

Biological - Current BSIA, literature, and assessments support the finding that yellowtail rockfish (*Sebastes flavidus*) have a discernible population structure (Appendix 1: Biological Information). Defining this species under Alternative 3 would define the species as two stocks which align with BSIA and literature. Yellowtail rockfish are distributed from Aleutian Islands to Baja California, abundant from British Columbia to Oregon, and rare south of Point Conception (Tagart et al. 2000; Wallace and Lai 2005).

Management – Yellowtail rockfish are managed south of 40° 10′ N. lat. in the Shelf Rockfish Complex, and species-specifically in the area north of 40° 10′ N. lat. This management structure is assumed to continue under Alternative 3. Harvest specification values are used from the full stock assessment work for the population in the north of 40° 10′ N. lat. management area. Yellowtail rockfish OFL estimates from the DB-SRA method contribute to harvest specifications for the Shelf Rockfish Complex in the area south of 40° 10′ N. lat. but are not used for stock status determination.

Alternative 3 is unlikely to require the Council to consider changes to management, such as formal or informal allocations, and therefore management implications are not anticipated.

Summary – Yellowtail rockfish have evidence of discernable populations along the coast (Hess et al. 2011), separated by Cape Mendocino, California (approximately one north and one south of 40° 10′ N. lat.). Alternative 3 is consistent with geographic factors under consideration as well as the current management structure.

Given the lack of evidence to support considering other alternatives for this species, no additional alternatives are considered, and no comparisons to other alternatives can be made.

3.5 Alternatives Considered but not Analyzed Further

For yelloweye rockfish, Alternative 1 was selected as PPA by the Council in September 2024, and Alternative 2 was removed from further consideration due to insufficient scientific support to warrant stock structure finer than coastwide at the time. The SSC also indicated that relatively long larval durations and preliminary evidence for broad-scale movements of adults promote population connectivity (Agenda Item I.5.a Supplemental SSC Report 1, September 2024).

This section will be updated as appropriate after final action scheduled for the November 2024 Council meeting.

4. National Standard Discussion

Below are the 10 National Standards (NS) as contained in the Magnuson-Stevens Act, and a brief discussion of how each alternative is consistent with the National Standards, where applicable. In recommending a preferred alternative, the Council must consider how to balance the national standards.

4.1 National Standard 1 - Optimum Yield

National Standard 1**:** Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

All action alternatives would improve the FMP's alignment with NS1 compared to the No Action alternative because there would be sufficient information for NMFS to make status determinations for each of the priority species. The alternatives should allow for the Council to adopt harvest specifications and management measures that achieve optimum yield (OY) from a stock, and in turn, the fishery.

The Council is taking this action to rectify the misalignment of the FMP with the requirements of the FMP and the National Standards. The FMP must define stocks and delineate their boundaries in such a manner that NMFS is able to make status determinations for each stock in the FMP. The Status determination criteria (SDC) is used by NMFS to determine the overfished and overfishing status for groundfish species in the fishery, consistent with requirements at 50 CFR 600.310(e)(2)(i)(A). Status determination is needed to understand if conservation and management measures achieve OY. For priority species, this action will define stocks, which would allow for NMFS to make status determinations for this sub-set of managed groundfish. Subsequent actions will build on this process until all managed groundfish species are defined as stocks.

The FMP (§4.5) describes the use of minimum stock size threshold (MSST) and the maximum fishing mortality threshold (MFMT) in status determination. Assessments calculate MSST, MFMT, and MSY for the assessed species and areas, which may be used to inform overfished status determinations. The Council has adopted OFLs and related harvest specifications, including accountability measures, for all managed species and has sector specific management measures designed to achieve, but not exceed harvest specification reference points (PFMC 2022, PFMC 2024). These indicators are used to determine the status of the species.

If status determinations, which are a key trigger to hold Councils accountable for meeting the requirements under NS1, are made at a scale that is mis-aligned with population structure of a species within the FMU, then the stock definition is more likely to fail to achieve OY. It is acknowledged that management measures taken at a finer scale may substantially mitigate risks of failing to achieve OY; however, according to the NS1 guidelines, it is not an adequate substitute for stock definitions that yield status determinations designed to achieve OY.

4.2 National Standard 2 - Best Scientific Information Available

National Standard 2**:** Conservation and management measures shall be based upon the best scientific information available.

Stock definitions are a Council decision, and Councils have discretion to make a policy decision on how to define stocks. That said, conservation and management measures (including stock definitions and SDC) must be based on the best scientific information available (BSIA). If BSIA indicates population structure at a finer scale than would be expected in a single stock, the Council should strongly consider this information, in light of other fishery management objectives.

BSIA is informed by, but not limited to, stock assessments, research, published scientific literature, and technical reports. Appendix 1 is an attempt to consolidate and synthesize this information for the priority species. Stock assessments incorporate established information as well as consider new and emerging concepts. The SSC and the Council are informed at multiple stages by NMFS Science Center leadership regarding stock assessment planning and how the assessment(s) will be structured.[5] The pre-assessment workshops aide in verifying and validating all sources of data that can be used in the assessment. Ultimate determination of BSIA for federal fisheries management lies with the Secretary of Commerce, as informed by advice from NMFS as described in the West Coast BSIA Regional Framework documentation.

Assessment reviews are open to the public and are peer reviewed through the Council's Stock Assessment Review (STAR) process or by the SSC Groundfish Subcommittee. The SSC is tasked by the Council to review the findings of the assessment and STAR Panel. The SSC independently assesses that process and provides recommendations to the Council regarding whether the stock assessment is sufficient to provide management advice. The SSC will also recommend if the assessment is BSIA, if it can be used to determine status, and at what scale.

Each of the priority species is scheduled for assessment in 2025 or potential assessment in 2027. Each of these species have been assessed previously and the SSC has endorsed the assessments, as well as recommended the scale for status determination of each species. The above analysis states the BSIA findings from each assessment. Regarding the priority species, the population structure of certain species may not support a coastwide stock definition.

The following bullet point summarizes the SSC BSIA recommendations regarding priority species stock status area delineations.

- *Single stock, single populations:* Chilipepper rockfish, English sole, redbanded rockfish, rougheye/blackspotted rockfish, widow rockfish, yelloweye rockfish.
- *Multiple stocks, multiple area populations:* Yellowtail rockfish.

[5] refer to Council Operating Procedure 9 and the Terms of Reference for the Groundfish Stock Assessment Review process of 2025-2026.

4.3 National Standard 3: Management Units

National Standard 3**:** To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

This action would define priority stocks, which is a necessary step to determine whether stocks of fish are managed appropriately as a unit or in close coordination. This action would not change management measures, so would not impact the current structure of managing stocks as a unit throughout their range, as also bound by the authority provided to the PFMC and NMFS. The PFMC manages groundfish species specified in the FMP in Federal waters off of California, Oregon, and Washington. If a species range is greater than the Council's jurisdictional geographic scale, those areas are not considered within the scope of this action or the Council's management authority.

4.4 National Standard 4: Allocations

National Standard 4**:** Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be; (A) fair and equitable to all such fishermen, (B) reasonably calculated to promote conservation, and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

There is no allocation of fishing privileges through the proposed action and therefore there are no impacts outside of No Action.

4.5 National Standard 5: Efficiency

National Standard 5**:** Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.

This action and the PPAs selected by the Council align with current management and would be expected to maintain the state of the fishery at present, preserving existing efficiencies. There is no economic allocation through the proposed action and therefore there are no impacts outside of No Action.

4.6 National Standard 6: Variations and Contingencies

National Standard 6**:** Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

This action is necessary to provide enough information on stock boundaries in the FMP to inform NMFS' status determinations. This action is expected to reflect the current scientific knowledge while allowing for variations and contingencies in our scientific understanding of the resources as they relate to the reference points in the FMP. Specificity in geographic or latitudinal boundaries (e.g., north and south of 40° 10' N. lat.) can and should be used to set harvest specifications and describe management measures in regulations that have on-the-water effects, affecting things like fishing activity, fishery monitoring, and enforcement of fishing prohibitions.

4.7 National Standard 7: Costs and Benefits

National Standard 7**:** Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

This action is administrative in nature and will not modify any management measures that would change costs, duplicity in regulations, or change the burden placed on user groups. Costs and benefits will be evaluated when the 2027-2028 harvest specifications and management measures are developed based on the new stock definitions.

4.8 National Standard 8: Communities

National Standard 8**:** Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of National Standard 2, in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

This action does not make changes to any conservation and management measures that impact communities. Defining stocks is largely an administrative action and does not directly or indirectly cause socioeconomic impacts to port communities. This action defines stocks for which status determinations may be made by NMFS. If a stock is determined to be overfished, the Council will be obligated to design a rebuilding plan that rebuilds the stock as quickly as possible, taking into account the needs of fishing communities (among other factors). In that situation, the impacts of harvest specifications and management measures on fishing communities would be explicitly discussed in a future action. Regardless of overfished status, when these stock definitions are applied in a future action, i.e., through the harvest specifications, the impacts to communities will be analyzed relative to status quo.

4.9 National Standard 9: Bycatch

National Standard 9**:** Conservation and management measures shall, to the extent practicable, (A) minimize bycatch, and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

This action does not make changes to any conservation and management measures that influence or minimize bycatch.

4.10 National Standard 10: Safety of Life at Sea

National Standard 10**:** Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

This action is not expected to change any aspect of conservation and management measures that could compromise the safety of human life at sea.

5. Glossary

Acceptable Biological Catch (ABC): A harvest specification that accounts for the scientific uncertainty in the estimate of OFL, and any other scientific uncertainty.

Annual Catch Limit (ACL): A harvest specification set equal to or below the ABC in consideration of conservation objectives, socioeconomic concerns, management uncertainty, ecological concerns, and other factors. The ACL is a harvest limit that includes all sources of fishing-related mortality including landings, discard mortality, research catches, and catches in exempted fishing permit activities. Sector-specific ACLs can be specified, especially in cases where a sector has a formal, long-term allocation of the harvestable surplus of a stock or stock complex.

Assessment Unit: The area at which the assessment is conducted/modeled. Assessors often refer to this as **the "stock"**, which is not equivalent to the "stock" under MSA. The stock may be assessed across areas that only comprise segments of the coast or coastwide depending upon the species biology, data availability, exploitation history, etc.

Fishery Management Unit (FMU): For the purposes of this document, this term is a geopolitical unit that is equivalent to the cumulative geographic area that is within the jurisdiction of the Fishery Management Plan. For the Pacific Coast Groundfish Fishery Management Plan, FMU refers to the EEZ off the coasts of Washington, Oregon, and California. This may or may not include the entire range or distribution of a single species.

Localized depletion: Localized depletion is a way of characterizing when a portion of a stock, or within a part of a species' range, has estimated abundance that lower than for other portions of the stock or areas of the species' range. Localized depletion may be caused by a number of factors, including but not limited to, fishing pressure, local habitat loss or degradation, ecological changes, environmental conditions, etc. Localized depletion may be mitigated in a number of ways, including but not limited to, spillover of fish from areas of higher abundance, local reductions in fishing pressure, etc.

Metapopulation: A system of interacting biological populations that exhibit a degree of independence in local population dynamics as well as connectivity between populations (Cadrin et al. 2014; Levins, 1969).

Overfishing limit (OFL): The MSY harvest level or the annual abundance of exploitable biomass of a stock or stock complex multiplied by the maximum fishing mortality threshold or proxy thereof and is an estimate of the catch level above which overfishing is occurring (FMP).

Population: A group of interbreeding individuals that exist together in time and space that are isolated from other groups (Waples and Gaggiotti, 2006; Taylor and Taylor, 1977; Mayr, 1942).

Sub-population: A delineated subset of individuals within a population (Wells and Richmond 1995).

Species: A group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding (Milius, 2017; Mayr, 2000). Refers to the genus and species; the unit as it is included in the FMP off the U.S. West Coast.

Status: Status is a determination of the health of a stock of fish and is reported to Congress quarterly by NMFS. A stock may be determined by NMFS to have any of the following overfished statuses: “unknown”, “overfished”, “not overfished”, or “approaching an overfished” condition. A stock may be determined by NMFS to have any of the following overfishing statuses: “unknown”, “subject to overfishing”, or “not subject to overfishing”.

Status Determination Criteria (SDC): SCD mean the measurable and objective factors, maximum fishing mortality threshold (MFMT), OFL, and minimum stock size threshold (MSST), or their proxies, that are used to determine if overfishing has occurred, or if the stock or stock complex is overfished. SDC are required to be identified in every FMP. See full description at 50 CFR 600.310(e)(2).

Sub-area assessment: A term to describe an assessment unit when multiple assessment areas are used to assess a single species or a stock (e.g., a single stock may have sub-area assessments for different areas or portions of the stock based on data availability). Sub-area assessment results may be combined to estimate abundance and OFL, for overfished and overfishing status determinations, respectively.

Sub-species: Aggregate of phenotypically similar populations of a species inhabiting a geographic subdivision of the range of that species and differing taxonomically from other populations of that species (Mayr, 2000; Mayr and Ashlock, 1991)

Status determination: The Secretary of Commerce makes formal determinations and the Status of Stocks are reported to Congress quarterly. Status determinations include, but are not limited to, “overfished” (relates to biomass of a stock or stock complex), and “overfishing” (pertains to a rate or level of removal of fish from a stock or stock complex).

Stock: The term "stock of fish" means a species, subspecies, geographical grouping, or other category of fish capable of management as a unit. (16 U.S.C. 1802 MSA §3(42)). It is a delineation of a species (or group of species) that is made at the discretion of the Council (e.g., a policy decision), based on BSIA and other relevant management needs; stocks are required to be defined in the FMP (i.e., subject to deliberative public process and Secretarial approval), per NS1 guidelines. This is the unit at which status determinations are made and OFLs should be set.

6. Literature Cited

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8. Appendix 1: Biological Information

8.1 Synthesis of Spatial Population Structure Literature

There is extensive literature describing the progression of knowledge around understanding the spatial structure of fishery populations, how to incorporate that knowledge into assessments, and how that knowledge can inform management. Cadrin and Secor (2009) describe this progression for assessments from early assumptions of homogeneity to more complex concepts of spatial and temporal variability. Hammer and Zimmerman (2005) discuss that management units have traditionally grown and are not adjusted to either the changes in distribution of stocks or to the change of scientific perception of the particular stock boundaries. In recent years, there has been an increase in the application of simulation models to evaluate alternative approaches to address misalignment of biological and management units (e.g., Kell et al., 2009; Cope and Punt, 2011; Ying et al., 2011; Kerr et al., 2014b, Berger et al. 2021).

Understanding the spatiotemporal scale of population structure for a species in relation to management units is important for effective long-term sustainable management (Goethel et al., 2011). Most species demonstrate variability in life history characteristics, uneven distributions across a species range, and connectivity across population components that can lead to different responses to harvest (Kerr et al., 2017; Zipkin and Saunders, 2018; Punt, 2019). Not accounting for differences in these characteristics when they exist can result in inaccurate estimates of stock productivity and sustainable yield and misinterpretation of trends in abundance (e.g., Kerr et al., 2014a; Secor, 2015). Kerr et al. (2014) found that the Atlantic cod populations located off the northeastern United States appeared more robust to fishing pressure when management boundaries were used rather than the correct biological stock delineations, which could lead to overfishing. Spawning biomass and fishing mortality rate were also biased for Atlantic herring when management boundaries were used to assess population status rather than biological boundaries (Guan et al., 2013). Berger et al. (2021) found increased bias in estimates of terminal spawning biomass as management areas misaligned with biological areas. This bias increased when fishing mortality was disproportionate to vulnerable biomass, demographic parameters were not homogenous, and connectivity existed between the management areas and was not accounted for (Berger et al., 2021). Altogether, the situations described in the above papers create barriers to successful management such as increased risk for local depletion, inappropriate allocations of catch across regions, loss of sustainable yield, and overall biased estimates informing decisions.

A particular concern with assuming no population structure when in fact population structure exists is with localized dynamics. Although system-wide biomass was found to be unbiased when assumptions about spatial structure did not align with the underlying dynamics, looking only at system-wide biomass or assuming a single homogeneous areas masked localized depletion (Goethel and Berger, 2017; Bosley et al., 2019; Berger et al., 2021). Consequently, if a coastwide population is assumed, but the underlying population is structured at a finer scale, there are risks that localized depletion can occur.

The above examples emphasize the importance of aligning management boundaries with the underlying biological dynamics. Kerr et al. (2017) noted that management units usually cannot exactly match biological boundaries, because the latter are not precisely known and do not have abrupt edges, and the spatial resolution of fishery management (e.g., reporting of fishing effort, monitoring of catch, and enforcement of regulations) is limited. However, key elements can be incorporated and the literature consulted to ensure setting of management boundaries follows the best scientific information available.

Kerr et al. (2017) outline a process for updating management and assessment considerations in relation to population structure. The first step of that process involves a "holistic review of available stock identity information by a group of experts". Cadrin et al. (2014) describes the elements of such a holistic review as including the following steps:

i. Clearly define the current spatial management units and their scientific or practical justification.
ii. Identify all a priori hypotheses about population structure, including the paradigm used to justify current management units.
iii. Conduct a comprehensive review of information related to the specific fishery resource being evaluated, ideally considering information from throughout the species' geographic range.
iv. Synthesize the information available within each discipline with respect to population structure and the stated hypotheses and evaluate the perception of population structure across the disciplines.
v. Consider each a priori hypothesis, the information that rigorously tested the hypotheses, and whether the information could be used to either reject or support hypotheses. Draw final conclusions on biological stocks based on the most robust and parsimonious view of population structure that is consistent with the best scientific information available.

The International Council for the Exploration of the Sea (ICES) Stock Identification Methods Working Group is an example of such a group, with representatives from diverse fields, and updates best practices related to identifying stocks in the Atlantic Ocean (Cadrin, 2020).

Cadrin (2020) provides additional considerations when identifying stocks. These include three broad categories of data including spatial distribution, dispersal, and geographic variation, each of which contain multiple sub-categories. A few sub-categories include adult and larval distribution for dispersal, and patterns in life history traits, abundance, size composition, and genetics for geographic variation. Both Kerr et al. (2017) and Cadrin (2020) stress the importance of interdisciplinary identification of stocks to both increase the chance of correctly identifying population structure and also to account for information across ecological and evolutionary time scales that the different disciplines capture.

Identifying population structure requires fine scale data that does not always exist. Assuming population structure based on imperfect information does have risks. Through simulation Punt et al. (2016) showed some of the consequences of assuming spatial structure but still missing critical differences. Models capturing all spatial differences between two areas performed best among simulations, but assuming spatial structure, yet incorrectly assuming constant growth between the areas, performed no better than assuming a single homogeneous area. This contrasts with Bosely et al. (2022) who found allowing for spatial population structure is likely to be less detrimental than ignoring it completely. Bosley et al. (2022) found that allowing assessments flexibility in movement estimation could mitigate against the risk of not knowing the correct underlying spatial structure.

Large and fine scale habitat and oceanographic features are often considered to be key drivers of population or stock structure for marine species, where such structure exists. Within the California Current ecosystem, the nearshore, shelf, slope and offshore regions generally have their greatest changes in physical and biological characteristics at major promontories, with Point Conception (34°27′ N. lat.), Cape Mendocino (40°30′ N. lat.), and Cape Blanco (42°50′ N. lat.) generally considered to be among the most important biogeographic features along the U.S. West coast (Hickey, 1979; Checkley and Barth, 2009; Gottscho, 2016). These features typically reflect strong shifts in biological community structure and other ecological features (Horn et al., 2006; Tolimieri and Levin, 2006; Tolimieri, 2007) as well as often being regions in which greater genetic diversity within species is observed (Sivasundar and Plumbi, 2010; Hess et al., 2011; others). However, within species or populations, differences in depth and habitat distributions, seasonality of reproduction, larval durations and both juvenile and adult movement patterns also factor into the degree of population structure or connectivity over larger spatial scales, and a wide range of potential population structure "types" is possible depending on a suite of life history factors.

Gunderson and Vetter (2006) built on previous analyses to develop a useful conceptual model for a suite of plausible population structure types for rocky reef fishes throughout the Northeast Pacific (i.e., U.S. West coast north through the Gulf of Alaska). They suggest four primary types of population structures that are useful to consider in this analysis. In the first, there is broad dispersal of larvae throughout most or all of the Northeast Pacific, and consequently little to no population structure. They suggest that this is likely to be a reasonable conceptual model for many deep-water species for which spawning occurs in deep or offshore waters, and larval duration can be extensive (a year or more), such as the thornyheads or Dover sole. In a second, major biogeographic features (such as Cape Mendocino, Point Conception, and the northern tip of Vancouver Island) help to define population structure by limiting (but not eliminating) dispersal across these oceanographic domains. Their review suggests that this is likely to be the most appropriate model for many shelf and some nearshore rockfishes, and indeed this is consistent with many genetic population structure studies (e.g., Rochas-Olivares and Vetter, 1999; Hess et al., 2011; others). Their third model reflects "diffusive dispersal" in which nearshore species, particularly those associated with kelp forests and with shorter larval durations, are subject to more constraining advective processes, such as "sticky water" zones in which larvae tend to be entrained in nearshore water masses that are rarely advected offshore or great distances (Largier, 2003). The fourth model is described as "non-dispersing," and relates primarily to a very limited number of species with high parental investment and no larval or juvenile dispersal stages, such as some elasmobranchs and live bearing surfperches.

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8.2 Priority Species Literature Review

A key first step in defining stocks is understanding the species biology. This information originates from current scientific literature, the 2022 Groundfish Stock Assessment and Fishery Evaluation (SAFE) document, and from the species-specific assessments. The majority of the species detailed below have ranges that exceed the U.S./Mexico and/or the U.S./Canada borders; however, assessments focus only on the populations off of the U.S. West coast, though posit on potential connectivity to other populations. Some of these species could be considered sub-populations of a larger population (or metapopulation) that extends beyond the U.S. given their geographic extent. While the following centers on the scientific rationale for stock definitions, the Council could consider other issues as relayed in National Standards guidance. Implications regarding defining these populations are discussed under the Alternative analyses.

We note past assessments of the following priority species, which were previously endorsed as BSIA by the SSC and NMFS. While U.S. West Coast populations of these species do not have officially defined stock units in the FMP, the assessments treat the populations as de facto stocks and have developed harvest specifications based on these assumed units. To date, the Council has managed to apply these harvest specifications to inform management decisions under the same assumption.

The following literature review was conducted by Madison Bargas (Oregon State University) and represents the results of a scientific literature review for the Council's June 2024 candidate species for potential assessment in 2025 and 2027.

Table 14. Overview of types of scientific information that may inform stock structure; full results of scientific literature review in subsequent species-specific sections.

Priority Species	Genetic differentiation	Adult movement	Larval dispersal	Demographic differences	Assessment stratification
Chilipepper rockfish (*Sebastes goodei*)	There is no evidence of population structure for chilipepper rockfish (Wishard et al. 1980; Berntson and Moran 2009). Wishard et al. (1980) found chilipepper rockfish to be genetically similar to canary rockfish (*Sebastes pinniger*).	No information on adult movement rates. Likely move inshore during winter spawning months (Petersen et al. 2010)	No information on larval dispersal distances. Pelagic juvenile stage (avg 3.5 months, up to 6 months; Solinger 2019; Ralston and Stewart 2013).	Winter upwelling negatively impacted recruitment success in northern CA, and positively impacted recruitment success in Morro Bay (Solinger 2019).	Single model, Oregon-California (Field et al. 2016).
English sole (*Parophrys vetulus*)	A study from the Salish Sea found little genetic diversity among sampled individuals (Winans et al. 2022). No information about spatial variation in English sole genetics.	Adults move into shallow waters (10 to 40 fathoms) in the spring and into deeper waters (20 to 50 fathoms) during winter (Barss 1976). English sole tend to migrate south in the fall and north in spring (Barss 1976).	Pelagic phase lasts between 6 and 10 weeks (Laroche et al. 1982) before settle into estuaries and other coastal zones (Gunderson et al. 1990). Nursery areas along OR and WA are thought to support the entire coastwide population (Rooper et al. 2002; Rooper et al. 2004).		Single model, coastwide, data-moderate (Cope et al. 2015)

Priority Species	**Genetic differentiation**	**Adult movement**	**Larval dispersal**	**Demographic differences**	**Assessment stratification**
Redbanded rockfish (*Sebastes babcocki*)	Redbanded rockfish are closely related to treefish (*S. serriceps*), tiger rockfish (*S. nigrocinctus*), and flag rockfish (*S. rubrivinctus*) (Love et al. 2002). No information about spatial variation in redbanded rockfish genetics.	No information on adult movement rates.	Pelagic phase lasts approximately 109 days (Ottman et al. 2019). No information on larval dispersal distances.		
Rougheye rockfish (*Sebastes aleutianus*)/ **Blackspotted rockfish** (*Sebastes melanostictus*)	Rougheye rockfish are genetically distinct from blackspotted rockfish (Orr and Hawkins 2008).	Rougheye and blackspotted rockfish share broad overlap in depth and geographic distributions.	No information on larval dispersal distances.	There is no information on spatial variation in rougheye and blackspotted rockfish life history (Clausen et al. 2003).	Single model, coastwide (Hicks 2013).

Priority Species	**Genetic differentiation**	**Adult movement**	**Larval dispersal**	**Demographic differences**	**Assessment stratification**
Widow rockfish (*Sebastes entomelas*)	A study found no genetic variation among widow rockfish along the California coast (Sivasundar and Palumbi 2010).	Mark-recapture data suggest small home ranges and/or high site fidelity (Hartmann 1987). NWFSC bottom trawl survey data suggest they recruit to central or southern CA and move northward as they age (Adams et al. 2019).	No information on larval dispersal distances. Evidence of spatial synchrony in year-class strength, with potential differences north and south of Cape Mendocino, CA (Field and Ralson 2005).	CA fish tend to mature at a smaller length than those off Oregon (Barss and Echeverria 1987); but do not show clear latitudinal patterns in growth (Gertseva et al. 2017).	Single model, coastwide (Adams et al. 2019).
Yelloweye rockfish (*Sebastes ruberrimus*)	Some evidence of genetic difference between the Strait of Georgia (Canada) and coastal populations ranging down to Oregon, though coastal populations lacked any genetic structure (Siegle et al. 2013).	Although yelloweye rockfish are generally considered sedentary (Coombs 1979; DeMott 1983; Hannah and Rankin 2011), recent studies suggest movements up to 233 km (Rasmuson et al., in prep).	An otolith microchemistry study suggested complete mixing of offspring between OR and WA (Gao et al. 2010).	Spawning output is greatest off Oregon, followed by California and Washington (Stewart et al. 2009).	Single coastwide model, with two sub-areas: waters off CA and waters off OR/WA, but linked by common stock-recruit relationship (Gertseva and Cope 2017).

Priority Species	**Genetic differentiation**	**Adult movement**	**Larval dispersal**	**Demographic differences**	**Assessment stratification**
Yellowtail rockfish (*Sebastes flavidus*)	Genetic study indicates that there are two stocks, with a genetic cline at Cape Mendocino, California, roughly 40° 10′ N. Lat. (Hess et al. 2011). A study using mtDNA and microsatellites found genetic differences between Oregon and California (Sivasundar and Palumbi 2010).	Mean home ranges from 0 to 67 km2 (Carlson and Haight 1972; DeMott 1983; Matthews and Barker 1983; Hartmann 1987; Stanley et al. 1994; Freiwald 2012). A mark-recapture study (n = 36) estimated that 75% in Canadian waters moved ≤ 25 km from release location; with 3 fish >100 km. Of the fish tagged off Alaska, all five recaptures moved southward, between 425 and 1400 km (Stanley et al. 1994).	Pelagic larval duration 3 to 4 months (Hess et al. 2011). No information on larval dispersal distances.	Evidence of spatial synchrony in year-class strength, with potential differences north and south of Cape Mendocino, CA (Field and Ralson 2005).	North of 40º N. Lat..(Stephens and Taylor 2017); South of 40º N. Lat..(Dick 2010/Dick 2011)

8.2.1 Chilipepper Rockfish (*Sebastes goodei*)

Chilipepper rockfish *(Sebastes goodei)* is a semi-pelagic species of high commercial and recreational value along the West Coast, from the US-Mexico border to the Columbia River in Washington (Field et al. 2016). Although the distribution of this species extends into British Columbia, abundance peaks near Cape Mendocino and declines north of Cape Blanco in Oregon (Beyer et al. 2015). Survey-based indices of abundance suggest considerably greater biomass densities of chilipepper rockfish south of 40° 10` N (Wetzel and Hastie 2022). Adult chilipepper rockfish form large schools, tend to live in midwater environments (75 to 325 m), and move into deeper waters as they grow (Beyer et al. 2015). Adults are common in waters deeper than 100 (Love et al. 1990, 2009).

Assessment History

Prior to 2007, chilipepper rockfish were only assessed in the area south of 40°10' N. lat. (Ralston et al. 1998). A full assessment for chilipepper rockfish in waters off California and Oregon was conducted in 2007 (Field 2008). An update of the 2007 assessment of chilipepper rockfish was conducted in 2015 (Field et al. 2015). A selectivity offset for recreational fishing effort was used to account for chilipepper moving into deeper water with age and size. Stock assessment authors recommend that future assessments consider northern and southern models whenever data permit (Field et al. 2015). Chilipepper rockfish has a target assessment frequency of 4 yr (PFMC 2024).

Genetics

There is no evidence of population structure for chilipepper rockfish (Wishard et al. 1980; Berntson and Moran 2009). Chilipepper rockfish are genetically similar to canary rockfish (*Sebastes pinniger*) and display a very close relationship for nonsibling species (Wishard et al. 1980).

Larval Dispersal

Chilipepper rockfish remain in the pelagic juvenile stage for 3.5 to 6 months (Solinger 2019; Ralston and Stewart 2013). Young-of-the-year are most abundant off of central California, though they are encountered at many sites from the southern Channel Islands to north of the Columbia River (Field et al. 2021). There is evidence of spatial synchrony in year-class strength for chilipepper rockfish throughout the California Current, with potential differences north and south of Cape Mendocino, CA (Field and Ralson 2005). There is no information about dispersal distances for chilipepper rockfish larvae.

Adult Movement

There is no information about movement rates of adult chilipepper rockfish.

Other Life History Traits

Chilipepper rockfish live to 27 yr (Love et al. 1998) and reach a maximum length of 59 cm (Love et al. 2002). Length-at-50%-maturity for female chilipepper rockfish is 30 cm off southern California and 34 cm off central and northern California (Wyllie Echeverria 1987; Beyer et al. 2015). Chilipepper rockfish tend to move inshore to spawn from December to March, with peak activity between January and February (Petersen et al. 2010; Harvey et al. 2011). Larvae are released from August to April off southern California, with peak abundance in December and January, whereas larvae are released from November to June off northern California, with peak activity in January and February (Wyllie Echeverria 1987). There is evidence of geographic, seasonal, and annual differences in the occurrence of secondary broods (Beyer et al. 2015). Multiple broods are more common among rockfishes with more southern distributions, perhaps due to more optimal reproductive conditions (Mapes et al. 2023). There is also evidence of spatial variation in the size at which females produce multiple broods (Lefebvre et al. 2018). For example, multiple brooding females tend to be smaller off southern California (Holder and Field 2019). Winter upwelling decreases recruitment success off northern California and increases recruitment success in Morro Bay, CA (Solinger 2019). Life history data are limited south of Point Conception (Field et al. 2016).

Data Quality/Quantity of Information

Limited: There is insufficient information on genetics and adult movement rates with which to assess stock structure for chilipepper rockfish. The combination of long larval durations and synchronous recruitment dynamics suggests a high degree of population connectivity among chilipepper rockfish, though there is evidence of regional differences in growth, maturation, and spawning activity.

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8.2.2 English sole (*Parophrys vetulus*)

English sole (*Parophrys vetulus*) range from Unimak Island, AK to Baja California, Mexico (Fargo and Kronlund 2000). Survey-based indices of abundance suggest similar biomass densities of English sole from California to Washington (Wetzel and Hastie 2022). English sole have distinct and spatially-explicit hotspots with narrow depth distributions (100 to 200 m) and exhibit relatively high densities near Point Conception, CA (Tolimieri et al. 2020). Juveniles are more common in estuaries and bays than along the open coast (Krygier and Pearcy 1986).

Assessment History

A coastwide data-moderate stock assessment for English sole was completed in 2013 (Cope et al. 2015). Previous assessments include a full benchmark assessment in 2005 (Stewart 2005) and an update in 2007 (Stewart 2007). All stock assessment models were conducted at the coastwide scale. English sole has a target assessment frequency of 4 yr (PFMC 2024).

Genetics

A study from the Salish Sea found little genetic diversity among sampled individuals (Winans et al. 2022). There is no information about spatial variation in English sole genetics.

Larval Dispersal

The pelagic larval duration for English sole is 6 to 10 weeks (Laroche et al. 1982). English sole settle into estuaries and other coastal zones (Gunderson et al. 1990). Nursery areas along Oregon and Washington are thought to support the entire coastwide population (Rooper 2002; Rooper et al. 2004). There is no information on dispersal distances for English sole larvae.

Adult Movement

English sole tend to emigrate from estuaries as juveniles (~ 2 yr) (Gunderson et al. 1990). Adults move into shallow waters (18 to 73 m) during spring and deeper waters (36 to 91 m) during winter (Barss 1976). English sole tend to move southward in the fall and northward in spring (Barss 1976).

Other Life History Traits

English sole live to 22 yr (Munk 2001) and reach a maximum length of 61 cm with sexually dimorphic growth (Mecklenburg et al. 2002). Female growth rates surpass that of males at 3 yr (Fargo and Kronlund 2000). Both sexes exhibit interannual variation in growth and maturity (Fargo and Tyler 1994; Fargo and Kronlund 2000). English sole mature between 3 and 4 yr off Oregon (Barss 1976). Length-at-50%-maturity is estimated at 23 cm for females along the US West Coast (Stewart 2005). English sole spawn between September and April (Barss 1976; Kruse and Tyler 1983), with smaller fish spawn later in the season (Fargo and Kronlund 2000). There is no information about spatial variation in life history traits of English sole.

Data Quality/Quantity of Information

<u>Insufficient</u>: There is insufficient information on genetics, larval dispersal, adult movement rates, and/or spatial variation in life history traits with which to assess stock structure for English sole.

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8.2.3 Redbanded rockfish (*Sebastes aleutianus*)

Redbanded rockfish (*Sebastes babcocki*) range from the Gulf of Alaska to southern California (Sullivan et al. 2022) but are most abundant in Southeast Alaska (Rooper 2007). They can be found over hard substrate and sometimes mud at 150 to 400 m depth (Mecklenberg et al. 2002) (Edwards et al. 2017). Redbanded rockfish are considered a data-limited species and do not have a directed fishery (Haigh and Starr 2006; Sullivan et al. 2022). Due to similarities in coloration, redbanded rockfish are often confused with flag rockfish *(Sebastes rubrivinctus)*. Flag rockfish previously reported north of Heceta Bank, OR were likely misidentified and should be classified as redbanded rockfish (Love 1996; Edwards et al. 2017; McCain et al. 2019). Redbanded rockfish can often be found intermixed with Pacific Ocean perch *(Sebastes alutus)* and darkblotched rockfish *(Sebastes crameri)*.

Assessment History

A data-limited assessment for redbanded rockfish was conducted in 2010 (Dick and MacCall 2010; Wetzel and Hastie 2022). Redbanded rockfish management is currently based on data-limited methods with a target assessment frequency of 10 years (PFMC 2024).

Genetics

Redbanded rockfish are closely related to treefish (*S. serriceps*), tiger rockfish (*S. nigrocinctus*), and flag rockfish (*S. rubrivinctus)* (Love et al. 2002). There is no information about spatial variation in redbanded rockfish genetics.

Larval Dispersal

The pelagic larval duration for redbanded rockfish is approximately 109 days (Ottman et al. 2019). There is no information on dispersal distances for redbanded rockfish larvae.

Adult Movement

There is no information about movement rates of adult redbanded rockfish.

Other Life History Traits

Redbanded rockfish live to 106 yr and reach a maximum length of 64 cm (Cailliet et al. 2001; Alaska Department of Fish and Game, unpubl. data). Redbanded rockfish reach maturity at 19 yr in the Gulf of Alaska (Mangel et al. 2006). It is unknown if this is first, 50%, or 100%. Length estimates are not provided for Alaska. In British Columbia, they reach 50% maturity at 18 yr for females and 16 yr for males. Females grow to larger sizes than males (Edwards et al. 2014). Off of Oregon, females reach first maturity at 36 cm and 9 yr, 50% maturity at 40 cm and 14 yr, and 100% maturity at 49 cm and 22 yr (Hannah and Kautzi 2015). Male ages and lengths at maturity are not reported. There is no further information on redbanded rockfish life history traits in the California Current.

Data Quality/Quantity of Information

Insufficient: There is insufficient information on genetics, larval dispersal, spatial variation in life history traits, and adult movement rates with which to assess stock structure for redbanded rockfish.

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8.2.4 Rougheye rockfish (*Sebastes aleutianus*) and Blackspotted rockfish (*Sebastes melanostictus*)

Rougheye rockfish (*Sebastes aleutianus*) range from Japan to the Bering Sea and south to Point Conception, CA (Clausen et al. 2003; Shotwell et al. 2009; Sullivan et al. 2021). The center of rougheye rockfish abundance is in the eastern Gulf of Alaska (Clausen et al. 2003). Blackspotted rockfish (*Sebastes melanostictus*) are more common to the north and in the western Gulf of Alaska (Orr and Hawkins 2008). Survey-based indices of abundance suggest similar biomass densities of rougheye rockfish off Oregon and Washington and little to no biomass off California (Wetzel and Hastie 2022). Adults of both species are abundant between 200 to 350 m (Clausen et al. 2003). Juveniles are typically found in nearshore rocky habitats (Shotwell et al. 2009).

Assessment History

Rougheye rockfish are physically similar to shortraker rockfish (*Sebastes borealis*); thus the two species are difficult to differentiate in the field and often grouped (Cluasen et al. 2003). Much of the data available for assessments also combines rougheye and shortraker rockfishes with blackspotted rockfish (Hicks et al. 2014). Rougheye and blackspotted rockfishes along the US West Coast were assessed as a single stock in 2013 (Hicks et al. 2014). The rougheye/blackspotted rockfish complex has a target assessment frequency of 10 yr (PFMC 2024).

Genetics

Blackspotted rockfish were originally considered a distinct “type” of rougheye rockfish (Gharrett et al. 2005; Hawkins et al. 2005). More recent advancements in technology demonstrated that blackspotted rockfish are genetically distinct from rougheye rockfish (Orr and Hawkins 2008). There is some evidence of genetic differentiation among rougheye rockfish in the Gulf of Alaska (Seeb 1986; Hawkins et al. 1997; Matala et al. 2004; Gharrett et al. 2006), though the extent to which is unknown (Clausen et al. 2003).

Larval Dispersal

There is little information about the larval, post-larval, and early juvenile stages of rougheye and blackspotted rockfishes. This is partially because genetic information is necessary to positively identify their larvae to species (Gharrett et al. 2001). Post-larval rougheye rockfish have been collected from epipelagic waters in the Gulf of Alaska (Matarese et al. 1989). There is no information about settlement size or age (Clausen et al. 2003).

Adult Movement

Adult rougheye rockfish are demersal and typically inhabit steep, rocky areas of the continental slope, concentrating along the 300 to 500 m depth contours (Ito 1999). Rougheye rockfish may comprise a greater proportion of the rougheye and blackspotted rockfish complex off Washington and Oregon compared to the Gulf of Alaska (Gharrett et al. 2005; Hawkins et al. 2005; Orr and Hawkins 2008).

Other Life History Traits

Rougheye rockfish live to 205 yr and reach a maximum length of 97 cm (Kastelle et al. 2000; Munk 2001). There are no longevity or maximum size estimates for blackspotted rockfish. Lengths-at-50%-maturity are 45 cm (20 yr) for rougheye rockfish and 45 cm (27 yr) for blackspotted rockfish in the Gulf of Alaska (Conrath 2017). Rougheye rockfish have protracted reproductive periods with parturition taking place between December and April in Alaska (McDermott 1994). There is no information about spatial variation in the life history traits of rougheye or blackspotted rockfishes (Clausen et al. 2003).

Data Quality/Quantity of Information

<u>Insufficient</u>: There is insufficient information on genetics, larval dispersal, spatial variation in life history traits, and adult movement rates with which to assess stock structure for rougheye and blackspotted rockfishes.

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Wetzel CR and J Hastie. 2022. Detailed summary of available data to support West Coast groundfish stock assessments in 2023. Attachment 4, Agenda Item F.3. June 2022 PFMC Meeting. 408 pp.

8.2.5 Widow Rockfish (*Sebastes entomelas*)

Widow rockfish (*Sebastes entomelas*) is a midwater species that ranges from Southeast Alaska to Baja California, Mexico (Love et al. 1990: He et al. 2007a; Hicks 2015; Adams et al. 2019). They are most abundant from British Columbia to northern California and tend to occupy a broader range of depths with increasing latitude (Ressler et al. 2009; Adams et al. 2019). Survey-based indices of abundance suggest similar biomass densities of widow rockfish from Washington to California (Wetzel and Hastie 2022). Adults are most common at depths > 150 m (Love et al. 1990). Juveniles tend to occupy waters 50 to 225 m (Love et al. 2009).

Assessment History

Widow rockfish were fully assessed on a coastwide basis in 1984, 1989, 1990, 1993, 1997, 2000, 2003, 2005, 2009, 2011, and 2015 (Lenarz 1984, Hightower and Lenarz 1989, 1990; Rogers and Lenarz 1993; Ralston and Pearson 1997; Williams et al. 2000; He et al. 2003a; He et al. 2006; He et al. 2011a; Hicks and Wetzel 2015). Update assessments were conducted in 2007 and 2019 (He et al. 2007a; Adams et al. 2019). The population was declared overfished in 2001, thus rebuilding analyses were conducted in 2003, 2005, 2007, and 2009 (He et al. 2003b; He et al. 2005; He et al. 2007b; He et al. 2009b). A catch-only projection was conducted in 2023 (Wallace 2023). Widow rockfish has a target assessment frequency of 4 yr (PFMC 2024).

In 1989, the widow rockfish assessment consisted of a two-area model (delineated at 43°N) with separate fisheries and selectivities (Hightower and Lenarz 1989). In 2011, a coastwide assessment produced results comparable to a two-area model that was based on differences in growth and maturity (He et al. 2011; Hicks and Wetzel 2015). Widow rockfish are assessed as part of the “other rockfish” complex in Alaska (Stanley 1999) and the “shelf rockfish” complex in Canada (Stanley 1999).

Genetics

A study using mtDNA and microsatellites found no genetic variation among widow rockfish along the California coast (N_{cenCA} = 36 and N_{soCA} = 36; Sivasundar and Palumbi 2010).

Larval Dispersal

The larval duration for widow rockfish is approximately 3 to 4 months (Sivasundar and Palumbi 2010). There is evidence of spatial synchrony in year-class strength for widow rockfish, with potential differences north and south of Cape Mendocino, CA (Field and Ralson 2005). There is no information on dispersal distances for widow rockfish larvae.

Adult Movement

Adult widow rockfish tend to be active in the water column at night and disperse during the day (Wilkins 1986). Mark-recapture data suggest small home ranges and/or high site fidelity (Hartmann 1987). NWFSC bottom trawl survey data suggest that widow rockfish may recruit to central or southern California and move north as they age (Adams et al. 2019).

Other Life History Traits

Widow rockfish live to 60 yr (Cailliet et al. 20010) and reach a maximum length of 59 cm (Love et al. 2002). Widow rockfish do not show clear latitudinal patterns in growth (Gertseva et al. 2017). Widow rockfish off California mature at smaller lengths than those off of Oregon (Barss and Echeverria 1984; Echeverria 1987). Lengths-at-maturity for widow rockfish off southern California are 26 cm (first), 32 cm (50%), and 37 cm (100%) for males and 34 cm (first), 35 cm (50%), and 36 cm (100%) for females (Love et al. 1990). Age-at-50%-maturity has been estimated at 5.5 yr (Adams et al. 2019). Widow rockfish spawn from December to May, with peak activity in February (Love et al. 1990). Parturition occurs from December to March off California and in April off British Columbia (Barss and Echeverria 1987; Adams et al. 2019).

Data Quality/Quantity of Information

<u>Limited</u>: There is insufficient information on genetics and larval dispersal with which to assess stock structure for widow rockfish. There is evidence, however, of spatial variation in life history traits throughout the California Current.

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8.2.6 Yelloweye Rockfish (*Sebastes ruberrimus*)

Yelloweye rockfish (*Sebastes ruberrimus*) are distributed from the western Gulf of Alaska to northern Baja California, Mexico (Hart 1973; Eschmeyer et al. 1983). They are most abundant from Southeast Alaska to central California. Yelloweye rockfish in Puget Sound represent a distinct population segment (DPS) (Drake et al. 2010). Adults are typically found along the continental shelf to 400 m. Juveniles are often found in shallower waters (Gertseva and Cope 2017). Survey-based indices of abundance suggest similar biomass densities of yelloweye rockfish off California and Oregon and lesser biomass densities off Washington (Wetzel and Hastie 2022).

Assessment History

Before 2000, yelloweye rockfish were managed as part of the Sebastes complex. From 2000 to 2002, yelloweye rockfish were considered part of the minor shelf complex (Wallace et al. 2006). Benchmark assessments for yelloweye rockfish were conducted in 2005, 2006, 2009, and 2017 (Wallace et al. 2005; Wallace et al. 2006; Stewart et al. 2009; Gertseva and Cope 2017). The 2009 assessment modeled three areas: California, Oregon, and Washington (Stewart et al. 2009). The 2017 assessment used region-specific catch histories to model two areas: California and Oregon-Washington (Gertseva and Cope 2017). Update assessments were conducted in 2007 and 2011 (Wallace 2008; Taylor and Wetzel 2011). Rebuilding analyses were conducted in 2005-2007, 2009, 2011, 2017, and 2023 (Tsou and Wallace 2005, 2006; Wallace 2007; Stewart 2009; Taylor 2011; Gertseva and Cope 2018; Wallace 2023). Yelloweye rockfish has a target assessment frequency of 10 yr (PFMC 2024).

Genetics

There may be genetic separation between yelloweye rockfish in the Strait of Georgia (British Columbia) and outer coasts of Washington and Oregon (Yamanaka et al. 2001; Siegle et al. 2013). The coastal populations, however, are not genetically distinct from each other.

Larval Dispersal

Little is known about the pelagic juvenile stage for yelloweye rockfish (Taylor and Wetzel 2011). The pelagic larval phase may last up to one year in Alaska (Olson et al. 2018). This extended period promotes some mixing of reproductive output, which is dependent upon environmental factors such as upwelling (Gertseva and Cope 2017). Yelloweye rockfish do not settle within a well-defined depth range (Stewart et al. 2009). An otolith microchemistry study suggested complete mixing of offspring between Oregon and Washington (Gao et al. 2010).

Adult Movement

There is little information about the movement rates of adult yelloweye rockfish. Although yelloweye rockfish are generally considered sedentary (Coombs 1979; DeMott 1983; Hannah and Rankin 2011), recent studies suggest movements up to 233 km (Rasmuson et al., in prep).

Other Life History Traits

Yelloweye rockfish live to 118 yr and reach a maximum length of 104 cm (Kastelle et al. 2000; Tian et al. 2017). Length-at-50%-maturity is 46 cm for females and 54 cm for males in British Columbia (Olson et al. 2018). The age-at-50%-maturity for female yelloweye rockfish is between 20 and 25 yr (O'Connell and Fujioka 1991). Spawning output is greatest off Oregon, followed by California and Washignon (Stewart et al. 2009). Parturition occurs from February to September in Alaska, with shorter spawning periods south of British Columbia (O'Connell 1987; Hannah et al. 2009; Olson et al. 2018).

Data Quality/Quantity of Information

Insufficient: There is insufficient information on genetics, larval dispersal, spatial variation in life history traits with which to assess stock structure for yelloweye rockfish. There is, however, recent evidence to suggest greater adult movement rates than previously documented. This, combined with otolith microchemistry, suggests that yelloweye rockfish may exhibit a high degree of population connectivity along the US West Coast.

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8.2.7 Yellowtail Rockfish (*Sebastes flavidus*)

Yellowtail rockfish (*Sebastes flavidus*) are a midwater species found from the Aleutian Islands to Baja California, Mexico, are abundant from British Columbia, Canada to Oregon, and rare south of Point Conception, CA (Love et al. 1990; Tagart et al. 2000; Wallace and Lai 2005). Adults occur in the water column near rocky reefs (49 to 98 fm) and are commonly found aggregated near deep (60 to 110 fm) pinnacles (Carlson and Haight 1972; Tagart and Kimura 1982; Wallace and Lai 2005; Hess et al. 2011). Survey-based indices of abundance suggest much greater biomass densities of yellowtail rockfish north of 40° 10` N (Wetzel and Hastie 2022).

Assessment History

The first benchmark assessment for yellowtail rockfish was conducted in 1999 (Tagart et al. 2000). This stock assessment pertained only to the northern stock, which was divided into three sub-area models: Southern Vancouver (from Cape Elizabeth, 47°20'N, to ~49°N), Northern Columbia (from Cape Falcon, 45°46'N, to Cape Elizabeth), and Eureka-South Columbia (from Cape Mendocino to Cape Falcon). An update assessment was conducted in 2004 (Wallace and Lai 2005). A data-moderate assessment was conducted in 2013, given that abundance indices but no length or age data were available for inclusion in the model (Cope et al. 2015). A depletion-based stock reduction analysis was used to assess yellowtail rockfish south of Cape Mendocino in 2011 (Dick and MacCall 2011).

Yellowtail rockfish were most recently assessed in 2017 as two stocks separated by Cape Mendocino, CA (40°10′N; Stephens and Taylor 2017). The northern stock extends from Cape Mendocino to the US-Canada border. The southern stock is managed as part of the "minor shelf rockfish" complex from Cape Mendocino to the US-Mexico border (Stephens and Taylor 2017). The reduction from three to two sub-area models was due to a lack of available fine-scale data. Yellowtail rockfish has a target assessment frequency of 4 yr (PFMC 2024).

Genetics

Yellowtail rockfish are closely related to black rockfish (*Sebastes melanops*) (Baetscher 2019). Wishard et al. (1980) and McGauley and Mulligan (1995) found no evidence of genetic differences among yellowtail rockfish along the US West Coast. Hess et al. (2011), however, found a genetic break at Cape Mendocino with greater genetic diversity to the south. A study using mtDNA and microsatellites found genetic differences between yellowtail rockfish off Oregon and California (N_{OR} = 18 and N_{CA} = 49; Sivasundar and Palumbi 2010).

Larval Dispersal

Yellowtail rockfish have a pelagic larval duration of 3 to 4 mo (Hess et al. 2010). There is evidence of spatial synchrony in year-class strength for yellowtail rockfish, with potential differences north and south of Cape Mendocino, CA (Field and Ralson 2005). There is no information about dispersal distances for yellowtail rockfish larvae.

Adult Movement

Yellowtail rockfish have been identified as having mean home ranges from 0 to 67 km^2 (Carlson and Haight 1972; DeMott 1983; Matthews and Barker 1983; Hartmann 1987; Stanley et al. 1994; Freiwald 2012). A mark-recapture study (n = 36) estimated that 75% of yellowtail rockfish caught in Canadian waters moved ≤ 25 km from their release location (Stanley et al. 1994). Notably, three individuals traveled over 100 km. Of the fish tagged off Alaska, all five recaptures moved between 425 and 1400 km to the south (Stanley et al. 1994).

Other Life History Traits

Yellowtail rockfish live to 64 yr (Cailliet et al. 2001) and reach a maximum length of 55 cm (Tagart et al. 2000). Asymptotic sizes are slightly larger off northern California compared to southern California (Tagart et al. 2000). Length-at-50% maturity for females from northern California were estimated at 42.5 cm but sample sizes were limited (Stephens and Taylor 2017). Lengths-at-maturity for yellowtail rockfish off southern California are 31 cm (first), 32 cm (50%), and 37 cm

(100%) for males and 33 cm (first), 36 cm (50%), and 38 cm (100%) for females (Love et al. 1990).

Females at Cordell Bank, CA have been observed with developing ovaries or embryos between October and January (Eldridge et al. 1990). Spawning takes place from January to July, with peak activity in February (Love et al. 1990). Parturition typically occurs in March and April (Eldridge et al. 1990). Yellowtail rockfish reproduction varies spatially along the California coast (Beyer et al. 2015). Larger, older yellowtail rockfish tend to spawn earlier in the season (Eldridge et al. 1990; Bobko and Berkely 2004).

Data Quality/Quantity of Information

Limited: There is some information about spatial variation in yellowtail rockfish genetics along the US West Coast. However, larval dispersal and adult movement rates may promote considerable population connectivity.

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