GEAR CHANGES FOR THE PACIFIC COAST GROUNDFISH FISHERY'S TRAWL CATCH SHARE PROGRAM

Environmental Assessment

Magnuson-Stevens Fishery Conservation and Management Act Analysis

Regulatory Impact Review

Initial Regulatory Flexibility Review

Prepared by

National Marine Fisheries Service
7600 Sand Point Way NE, BIN C15700
Seattle, WA 98115-0070
206-526-6150

December 2018

ABSTRACT

This document evaluates the proposed action to revise and remove trawl gear regulations for the Pacific Coast groundfish fishery's trawl catch share program, including trawl gear configuration and gear use. Pre-trawl rationalization regulations applied to the entire fleet may no longer be appropriate for managing individuals operating under the incentives provided in the rationalized portion of the Pacific Coast groundfish fishery. Incentives of the catch share program include resources allocated to individuals (individual fishing quota [IFQ]) or to cooperatives, 100 percent at-sea and shoreside monitoring, and individuals or cooperatives held accountable for the consequences of their decisions.

The Pacific Fishery Management Council (Council) selected the following as its preferred alternatives under this proposed action.

- Eliminate minimum mesh size requirements for groundfish trawls.
- Update the regulatory language for measuring mesh sizes to include knotless webbing.
- Eliminate groundfish trawl codend restrictions (e.g., allow double-wall codends).
- Modify the selective flatfish trawl (SFFT) definition to include two- or four-seam nets (coastwide), and eliminate the SFFT requirement for groundfish bottom trawl shoreward of the trawl rockfish conservation area (RCA) north of 40°10' N. latitude. A NMFS sub-option to this alternative would eliminate the requirement to use SFFT north of 42° N. latitude, but retain the requirement to use SFFT shoreward of the trawl RCA between 42° N. latitude and 40°10' N. latitude shoreward of the trawl RCA.
- Eliminate chafing gear restrictions for groundfish trawl.
- Allow shoreside IFQ trawl vessels to carry and use multiple types of groundfish trawl gear on the same trip.
- Allow shoreside IFQ trawl vessels to fish in multiple IFQ management areas on the same trip and the same haul.
- Allow shoreside IFQ groundfish trawl vessels to bring a haul on board before all catch from the previous haul has been stowed.

The purpose of this action is to provide more flexibility in the configuration and use of gear for participants in the trawl rationalization program, while at the same time ensuring that conservation objectives are met. Such flexibility is expected to foster innovation and allow for more optimal harvest operations. Benefits may include increased efficiency through reduced costs and increased revenues.

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ACRONYMS AND ABBREVIATIONS

ABC	Acceptable biological catch
ACL	Annual catch limit
AM	Accountability measure
AMP	Adaptive management plan
ASHOP	At-sea Hake Observer Program
BAC	Block area closure
BMSY	Biomass of maximum sustainable yield
BOEM	Bureau of Energy Management
BRA	Bycatch reduction area
CEA	Cumulative effects analysis
CCE	California Current Ecosystem
CC/Regs	Chief Counsel for Regulation
CEBA1	Comprehensive Ecosystem-Based Amendment 1
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPUE	Catch per unit of effort
Council	Pacific Fishery Management Council
CP	Catcher processor
CPS	Coastal pelagic species
CV	Coefficient of variation
DBCA	Darkblotched rockfish conservation area
DPS	Distinct population segment
DPH	Dollars per trawling hour
DOVR	Dover sole
DTS	Dover sole, thornyheads, and sablefish
EA	Environmental assessment
EBFM	Ecosystem based fisheries management
EC	Ecosystem component
ECE	Extreme catch event
EDC	Economic Data Collection
EEZ	Exclusive Economic Zone
EFH	Essential fish habitat

EFHCA	Essential fish habitat conservation area
EFP	Exempted fishing permit
EGLS	English sole
EIS	Environmental impact statement
EM	Electronic monitoring
EO	Executive Order
ESA	Endangered Species Act
ESU	Evolutionary significant unit
FEIS	Final environmental impact statement
Five-year Review	West Coast Groundfish Trawl Catch Share Program Five-year Review
FL	Fork length
FM	Fathom
FMP	Fishery Management Plan
FMU	Fishery Management Unit
FPA	Final preferred alternative
FR	Federal Register
FRFA	Final Regulatory Flexibility Analysis
GAP	Groundfish Advisory Subpanel
GMT	Groundfish Management Team
GEMM	Groundfish Expanded Mortality Multiyear database
GSI	Genetic stock identification
HA	Hectares
HAPC	Habitat areas of particular concern
HCR	Harvest control measures
HMS	Highly migratory species
HSP	Habitat suitability probability
IBQ	Individual bycatch quota
IFQ	Individual fishing quota
INPFC	International North Pacific Fisheries Commission
IPHC	International Pacific Halibut Commission
IRFA	Initial regulatory flexibility analysis
ITQ	Individual trawl quota
ITS	Incidental take statement
JV	Joint venture

L_{50}	Length at 50 percent retention
lbs	Pounds
LCOD	Lingcod
LE	Limited Entry
m	Meter
M_{50}	Length at 50 percent maturity
mm	millimeter
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MS	Mothership
MSA	Magnuson-Stevens Fishery Conservation and Management Act, Magnuson-Stevens Act
MSC	Marine Stewardship Council
MSST	Minimum stock size threshold
MSY	Maximum sustained yield
mt	Metric ton
NA	Not applicable
NAICS	North American Industry Classification System
National OCS Program	National Outer Continental Shelf Oil and Gas Leasing Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of intent
NOVA	Notices of Violation and Assessment
NS	Not significant
NWFSC	Northwest Fisheries Science Center
NWTRC	U.S. Navy's Northwest Training Range Complex
OFL	Overfishing limit
OLE	Office for Law Enforcement
OSCZ	Ocean Salmon Conservation Zone
OY	Optimum yield
PacFIN	Pacific Fisheries Information Network
PE	Polyethylene
PCG	Pacific Coast Groundfish

PCGFSS	Pacific Coast Groundfish Social Survey
PIE Rule	Program Improvements and Enhancement Rule
POP	Pacific ocean perch
PPA	Preliminary proposed alternative
PSMFC	Pacific States Marine Fisheries Commission
QP	Quota pounds
QS	Quota share
RecFIN	Recreational Fisheries Information Network
RCA	Rockfish Conservation Area
RIR	Regulatory impact review
RFA	Regulatory Flexibility Act
ROV	Remotely operated vehicle
SAFE	Stock Assessment and Fishery Evaluation
SBA	Small Business Administration
sDPS	Southern distinct population segment
SFFT	Selective flatfish trawl gear
SPR	Spawning potential ratio
T-90	Trawl mesh turned at ninety-degree orientation compared to diamond mesh
TAC	Total allowable catch
TRREC	Trawl Rationalization Regulation Evaluation Committee
U.S.C.	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	Vessel monitoring system
WCGOP	West Coast Groundfish Observer Program
WCR	West Coast Region
WCSPA	West Coast Seafood Processors Association
WDOW	Widow rockfish
YTRK	Yellowtail rockfish

1 INTRODUCTION

This document provides assessments of the environmental impacts of an action and its reasonable alternatives (the Environmental Assessment [EA]), how the action meets the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSA analysis), the economic benefits and costs of the action alternatives, as well as their distribution (the Regulatory Impact Review [RIR]), and the impacts of the action on directly regulated small entities (the Initial Regulatory Flexibility Act analysis [IRFA]). Specifically, this document evaluates the effects of relaxing or eliminating trawl gear regulations in the Pacific coast groundfish fishery's trawl catch share program[1] (Pacific Fishery Management Council [Council] 2016a). The National Marine Fisheries Service (NMFS) prepared this document in cooperation with the Council. Changes in the trawl gear regulations must be consistent with provisions in the MSA and implementing regulations. The MSA is the principal legislation for fishery management within the Exclusive Economic Zone (EEZ), which extends from the outer boundary of the territorial sea to 200 nautical miles from shore.

1.1 The Proposed Action

The proposed action is to revise and remove trawl gear regulations for the Pacific coast groundfish fishery's trawl catch share program, including trawl gear configuration and gear use. The term "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. The groundfish fishery management plan (FMP) (Council 2016a) is implemented through regulations generally recommended by the Council and adopted by NMFS.

The proposed action includes decision points for gear regulations found in the Federal Pacific Coast Groundfish Regulations (50 Code of Federal Regulations [CFR] 660) at https://www.ecfr.gov. The Council selected the following as its preferred alternatives (Section 2).

- Eliminate minimum mesh size requirements for groundfish trawls.
- Update the regulatory language for measuring mesh sizes to include knotless webbing.
- Eliminate groundfish trawl codend restrictions (e.g., allow double-wall codends).
- Modify the selective flatfish trawl (SFFT) definition to include two- or four-seam nets (coastwide), and eliminate the SFFT requirement for groundfish bottom trawl shoreward of the rockfish conservation area (RCA) north of 40º10' N. latitude [Large and small footrope distinctions would remain]. A NMFS sub-option to this alternative would eliminate the

[1] Updated information on catch share programs can be found at the following website: https://www.fisheries.noaa.gov/national/commercial-fishing/catch-share-programs-council-region

requirement to use SFFT north of 42° N. latitude, but retain the requirement to use SFFT shoreward of the trawl RCA when fishing between 42° N. latitude and 40°10' N. latitude.

- Eliminate chafing gear restrictions for groundfish trawl.
- Allow shoreside individual fishing quota (IFQ) trawl vessels to carry and use multiple types of groundfish trawl gear on the same trip.
- Allow shoreside IFQ trawl vessels to fish in multiple IFQ management areas on the same trip and the same haul.
- Allow shoreside IFQ groundfish trawl vessels to bring a haul on board before all catch from the previous haul has been stowed.

1.2 Purpose and Need for the Action

The purpose and need statements were developed during a series of Council meetings and workshops (see Section 1) following implementation of the trawl catch share program on January 11, 2011 (75 FR 78344, Dec. 15, 2010). The Council adopted this final version at its September 2015 meeting and provided confirmation at its March 2016 meeting. NMFS is considering approval of the Council's recommended regulatory revisions.

1.2.1 Purpose

The purpose of this action is to provide more flexibility in the configuration and use of gear for participants in the trawl rationalization program, while at the same time ensuring that conservation objectives are met. Such flexibility is expected to foster innovation and allow for more optimal harvest operations. Benefits may include increased efficiency through reduced costs and increased revenues.

1.2.2 Need

This action is needed to enable better use of current individual accountability for trawl rationalization participants. The action would also spur achievement of anticipated program benefits.

Pre-trawl rationalization regulations applied to the entire fleet may no longer be appropriate for managing individuals operating under the incentives provided in the rationalized portion of the Pacific coast groundfish fishery. With the resource allocated to individuals or cooperatives, 100 percent monitoring, and individuals or cooperatives held accountable for the consequences of their decisions, participants would achieve additional flexibility to determine where to fish and with what gear, based on relaxed restrictions on trawl gear configuration and gear use.

1.2.3 Description of the Management Area

The Pacific coast groundfish fishery management area includes the United States West Coast EEZ, defined as 3 to 200 nautical miles from state baselines along the coast of Washington, Oregon, and California, state waters of the Pacific Ocean, and communities that engage in fishing in waters off these states (Figure 1-1). Although state-managed fisheries are not connected actions, vessels participating in the federally managed fisheries transit through state waters and land fish within states. Thus, some effects of the federally managed groundfish fishery occur within state waters and their associated communities.

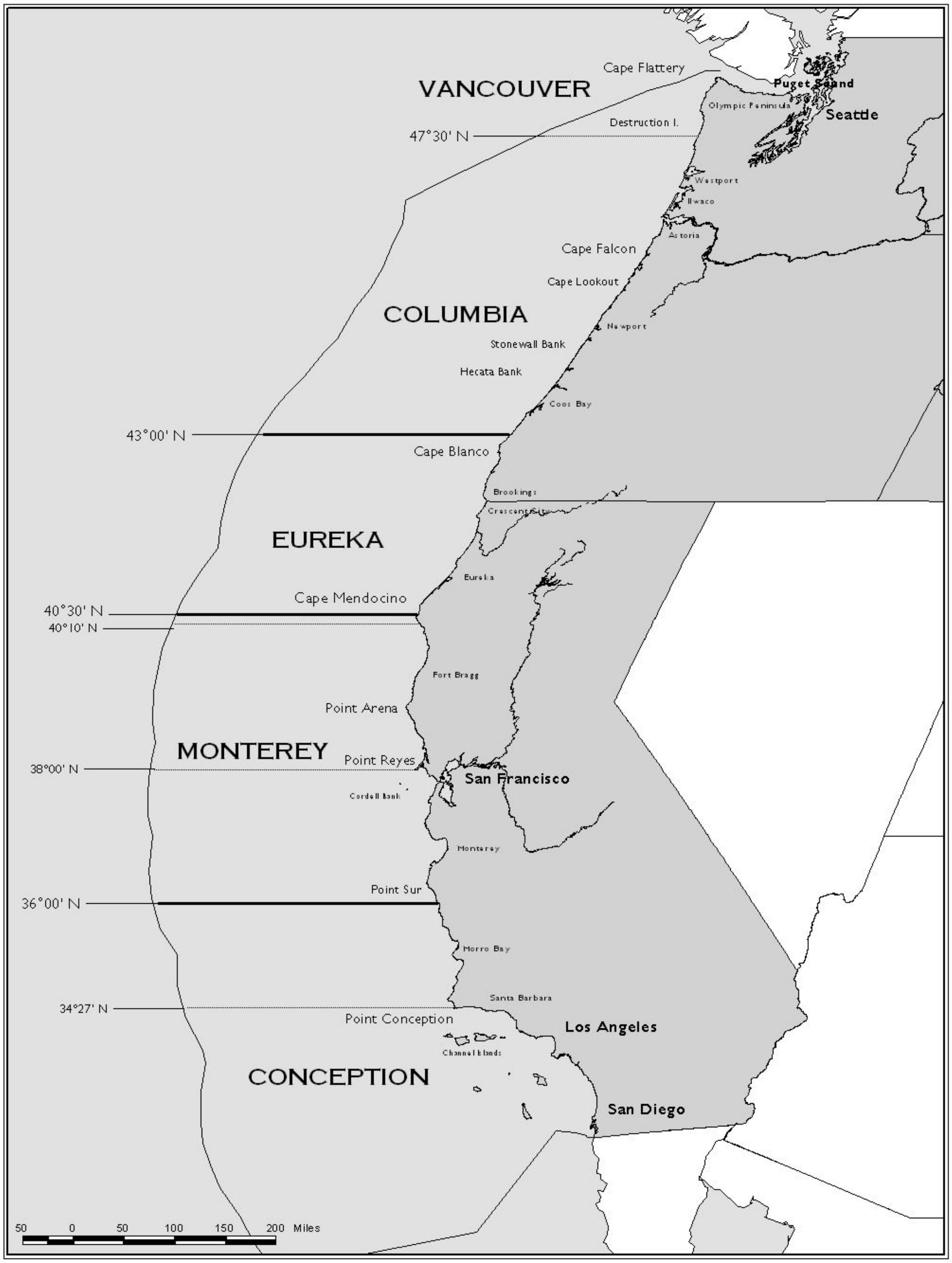

Figure 1-1. The management area within the United States West Coast exclusive economic zone (EEZ) seaward of Washington, Oregon, and California. International North Pacific Fisheries Commission (INPFC) statistical areas, west coast ports, and significant geographical features are shown. Source: Council 2016a

1.3 Background

This section provides background information that led to the development of the proposed action and purpose and need shown in Section 1.2. It also includes an overview of the Pacific coast groundfish fishery and the development of the catch share program.

1.3.1 Overview of the Groundfish Fisheries

The Pacific Coast groundfish fishery consists of tribal, recreational, and commercial sectors (Figure 1-2) (Council 2016a). The proposed action affects the commercial sector, which is divided into open access and limited entry (LE) sectors. The LE sector is further divided into groundfish vessels participating in the trawl sector (affected by the proposed action) and the LE fixed gear sector (not affected by the proposed action). The trawl sector consists of a shoreside component and an at-sea component (Figure 1-2) (Council 2016a). The at-sea component includes a mothership sector and a catcher-processor sector, both of which only target Pacific whiting with midwater trawl gear and are managed as cooperatives. In regulation, the shoreside sector is called the shoreside IFQ program, and it targets many groundfish species, including Pacific whiting (Council 2016a). In the shoreside IFQ program, groundfish can be targeted with several gear types, including bottom trawl (small or large footrope), midwater trawl, and fixed gear (Council 2016a). This proposed action only applies to harvesters within the trawl sector fishing with trawl gear; the proposed action does not apply to harvesters using IFQ fixed gear (Figure 1-2). Descriptions of trawl gear are provided in Section 3.4.1.

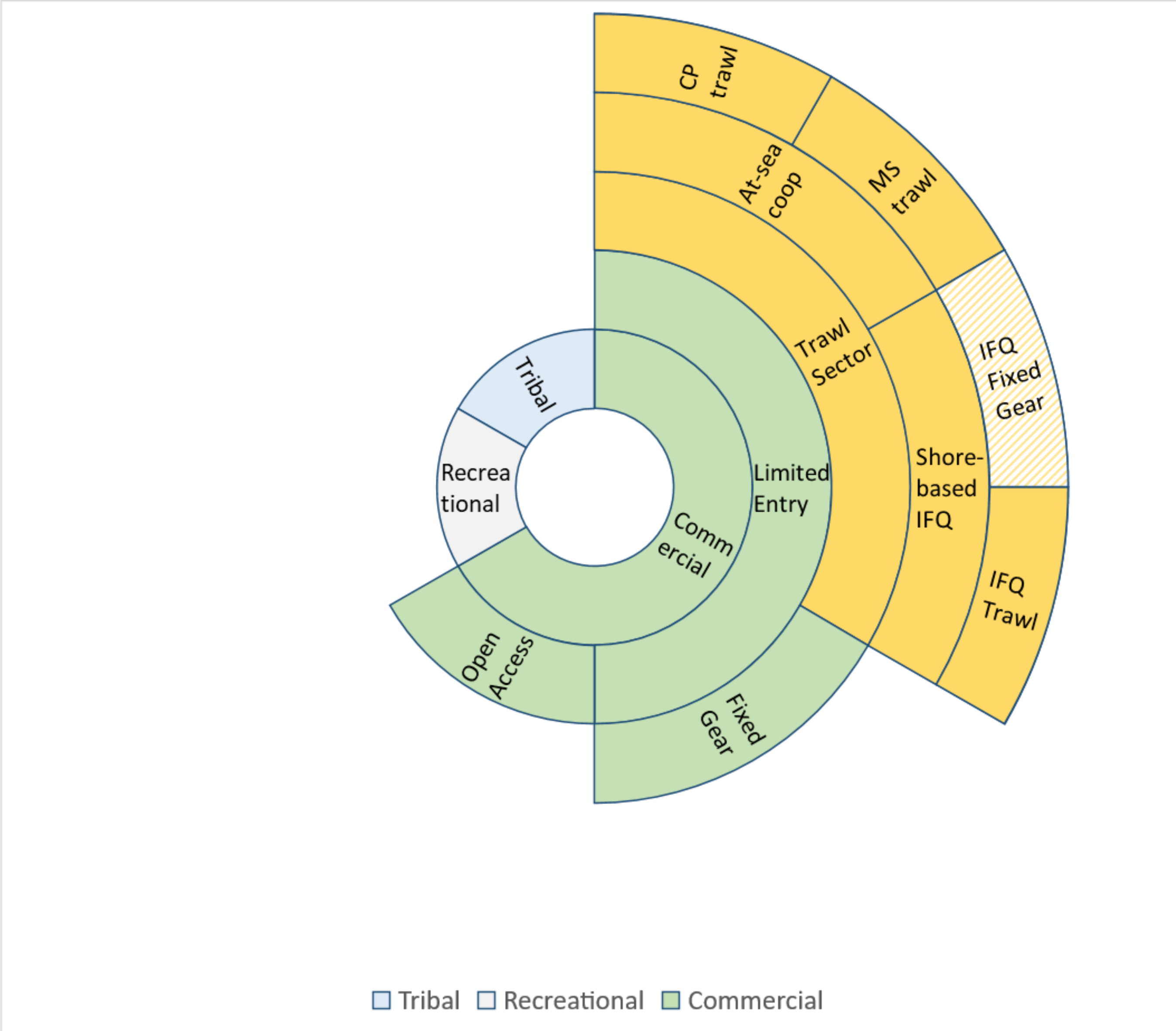

Figure 1-2. Overview of the Pacific Coast groundfish fishery, which consists of recreational, tribal, and commercial sectors. Trawl sectors are affected by the proposed action (gold), with the exception of IFQ fixed gear (hatch). CP = catcher-processor; MS = mothership.

1.3.2 Implementation of the Trawl Rationalization Program – A Historical Perspective of the Groundfish Trawl Fishery and Associated Regulations

NMFS implemented Amendments 20 and 21 to the Pacific Coast Groundfish FMP on December 15, 2010 (75 FR 78344). Amendment 20 established a trawl rationalization program, which is a catch share program for the Pacific Coast groundfish fishery (Council and NMFS 2010a). The catch share program is intended to increase net economic benefits, create individual economic stability, provide full

utilization of the trawl sector allocation, consider environmental impacts, and achieve individual accountability of catch and bycatch (Council and NMFS 2010a). Amendment 21 established fixed allocations for LE trawl participants (Council and NMFS 2010b). These allocations are intended to improve management under this catch share program by streamlining its administration, providing stability to the fishery, and addressing halibut bycatch. The program was designed, in part, to reduce fleet capacity and economically rationalize the groundfish trawl fishery.

Before implementation of the catch share program in 2011 (75 Federal Register [FR] 78344, Dec. 15, 2010; Council and NMFS 2010a; Council 2016a), regulations governing the non-whiting trawl fleet delivering to shoreside processors primarily were built around per-vessel trip and cumulative landing limits (Pikitch et al. 1988; Council 1996; Council 2002) and area closures (Council and NMFS 2009). Regulations governing the shoreside delivery of whiting were based on staggered season openings and closure upon attainment of the shoreside sector allocation (Council and NMFS 2009). During this period, human observer coverage aboard shoreside-trawl vessels was either nonexistent (Pikitch et al. 1988) or limited to less than 25 percent of the trawl landings (Somers et al. 2016a). Single-species trip limits, when combined with little or no observer coverage, resulted in high levels of discards by the trawl fleet (Pikitch et al. 1988). Annual discard rates (discard weight/total catch weight) by the shoreside groundfish trawl fishery exceeded 15 percent from 1985 to 1987 for most species managed under trip limits. For example, the 1987 discard rate was 28 percent for sablefish (Pikitch et al. 1988). In this case, regulatory-induced discarding occurred after reaching single-species trip limits or while high grading to maximize catch value before reaching trip limits (Pikitch et al. 1988; Gillis et al. 1995). Other reasons for discarding target or non-target species included limited or no market (e.g., arrowtooth flounder and spiny dogfish shark), small size (e.g., splitnose and redstripe rockfish), and prohibited species (e.g., Chinook salmon and Pacific halibut).

Various gear restrictions were implemented during the 1990s and early 2000s to reduce discarding of bycatch while at sea and reduce access to overfished species and associated rocky habitats (Council 2016a). Gear restrictions included the following:

- Increasing minimum mesh size
- Eliminating multi-wall codends
- Increasing chafing gear restrictions (57 FR 12212, April 9, 1992; Council 1994; Council 1996; Council 1999; 68 FR 11182, March 7, 2003; Council 2016a)
- Implementing RCAs that prohibit certain gear types (Council 2016a)

- Requiring use of selective flatfish trawl shoreward of the trawl RCA north of 40º10' N. latitude (King et al. 2004; Hannah et al. 2005; Council 2016a)

Nonetheless, at-sea discarding remained prevalent until implementation of the catch share program in 2011. For example, the 2010 sablefish discard rate by non-whiting bottom trawl was 16.2 percent of the total catch north of 40˚10′ N. latitude (Bellman et al. 2011).

At-sea discarding by the non-whiting groundfish trawl fishery decreased dramatically after the catch share program was implemented in 2011 (Matson 2012; NMFS and Council 2017). This decrease in discarding was largely due to the replacement of trip limits with individual fishing quota (IFQ or quota pounds) for many species, as well as to the requirement for full monitoring of all vessels (Council 2016a; NMFS and Council 2017). These components of the program were intended to increase individual accountability and to provide strong disincentives for discarding (Council and NMFS 2010a). Reductions in discarding were realized for many IFQ species (Matson 2012; NMFS and Council 2017). For example, the 2016 discard rate of sablefish by non-whiting bottom trawl was less than 1 percent of the total sablefish catch north of 36° N. latitude (Somers et al. 2017a).

The change from trip-limit management to the catch share program, coupled with the reduction in discarding and low attainment of IFQ species (Matson 2012), created the impetus for the proposed action. The Trawl Rationalization and Regulatory Evaluation Committee[2] (TRREC) stated the following as the underlying reason for the proposed action in its November 2011 report:

> *These regulations were important when vessels were managed based on cumulative trip limits and fleet-wide impacts were modeled. Under trawl rationalization, individuals are accountable for their total fishery impacts and those impacts are observed on every trip and on every vessel. Thus, such specific gear type prohibitions no longer appear to be needed* (Agenda Item E.7.b, Supplemental TRREC Report, November 2011).

[2] The Council authorized the appointment of a new ad hoc committee, the TRREC, at its April 2011 meeting. The Groundfish Advisory Subpanel (GAP) stated the highest priority for the TRREC should be to focus on regulatory artifacts of the old management system with the potential to limit the success of the catch share program.

NMFS provided a similar rationale for relaxing trawl gear regulations in June 2013:

> *Before implementation of the trawl rationalization program in 2011, regulations governing the groundfish trawl fleet were built around monthly, bi-monthly, and per vessel trip limits to address a variety of Council concerns, including: minimizing bycatch, maintaining a year-round fishing season, better accounting for total groundfish catch, and administrative challenges associated with managing licensed and unlicensed fisheries. The trawl rationalization program replaced the need for some, but not all, of the trip limit structure in the regulations. Some of the remaining trip limit framework regulations may be less efficient and effective under an individual quota framework* (Agenda Item F.6.b, Supplemental NMFS Report, June 2013).

1.4 Public Participation and the Scoping Process

A Notice of Intent (NOI), published on March 3, 2016 (81 FR 11189), announced NMFS' and the Council's intent to prepare an environmental impact statement (EIS) in accordance with the National Environmental Policy Act (NEPA) to identify and to analyze potentially significant impacts of the proposed action on the human environment. The purpose of the NOI was to alert the interested public to the scoping process and to provide for public participation in compliance with environmental documentation requirements. The NOI also provided notification that the March 2016 Council meeting would be considered a public scoping meeting for this action. The Council provided a preliminary draft EIS for the March 2016 Council meeting (Agenda Item G.8 Attachment (Full Version), Electronic Only, March 2016). However, new information became available (Section 1.5) that was used to complete the analysis shown in Section 4. On June 8, 2018, following completion of the analysis shown in Section 4, NMFS determined the impacts associated with this action would not reach a level necessitating an EIS and announced its intent to withdraw preparation of the EIS and instead prepare an EA (i.e., included in this document) (83 FR 26640; see the Finding of No Significant Impact in Section 7).

This EA was developed with several opportunities for public participation (Table 1-1). It is based on and prepared from the issues and alternatives identified during scoping and the Council process. The meetings shown in Table 1-1 were open to the public. Formal public comment that became part of the public record was encouraged. Notices of these meetings were published in the Federal Register (FR) and advertised on the Council website.

Table 1-1. Chronology of meetings and actions leading to the gear regulation change proposal and the Council's final preferred alternatives (FPAs). Source: Information derived from documents accessed through the Council website (www.pcouncil.org).

Date	Meeting	Action
March 4-7, 2011	Council meeting, Vancouver, WA	The GAP proposed modifying groundfish trawl regulations, such as mesh size and use of four-seam trawl shoreward of the trawl RCA, because of the new rationalized management system. The Council discussed convening an ad hoc committee along the lines recommended by the GAP to advise the Council on fixes needed in the trawl rationalization regulations that would allow fishermen to take advantage of the catch share program as the Council intended.
April 7-13, 2011	Council meeting, San Mateo, CA	The Council authorized the appointment of a new ad hoc committee, the TRREC. The GAP stated that the highest priority for the TRREC should be to focus on regulatory artifacts of the old management system with the potential to limit the success of the catch share program.
September 14-19, 2011	Council meeting, San Mateo, CA	The Council prioritized future trailing actions; the TRREC was tasked with providing comments on issues identified for implementation in 2013, including gear issues that were made obsolete or unnecessary because of implementation of the catch share program.
October 27, 2011	TRREC meeting, Portland, OR	The TRREC report provided recommendations pertaining to the use and possession of multiple gear types on the same trip (including different types of trawl and fixed gear) and the relaxation or elimination of restrictions on the configuration of trawl gear to improve efficiency and flexibility.
November 2-7, 2011	Council meeting, Costa Mesa, CA	The TRREC report was presented; the Council forwarded items related to use and possession of multiple gear types and trawl gear modifications intended to improve efficiency and flexibility to a gear workshop.
August 29-30, 2012	Gear workshop, Portland OR	The gear workshop report provided recommendations on carrying and use of multiple gears on the same trip, year-round use of midwater gear within the RCAs north of 40°10' N. latitude, reduction of minimum mesh sizes, elimination of the selective flatfish trawl requirement, and allowing IFQ program vessels to move fixed gear across management lines.
September 13-18, 2012	Council meeting, Boise, ID	The Council rescheduled action on gear issues (other than midwater chafing gear) for September 2013 (Agenda Item G.6.a, Supplemental Attachment 3).
November 2-7, 2012	Council meeting, Costa Mesa, CA	The gear workshop report was presented to the Council. The Council confirmed rescheduling action on gear issues for September 2013 (Agenda Item I.5.a, Attachment 1 – Trailing Actions).

Table 1-1, continued.

Date	Meeting	Action
September 11-17, 2013	Council meeting, Boise, ID	The Council conducted its third round of scoping on trawl trailing actions. It decided to move forward with trailing action priorities recommended by the GAP for a trawl flexibility rule. The next action was delayed until June 2014 (Council Decisions, September 2013).
September 9-16, 2015	Council meeting, Sacramento, CA	A report (Agenda Item H.2, Attachment 1) containing a draft purpose and need statement and alternatives was provided for Council decision processes covering the issues listed in the June informational report. The Council added to the list of issues and alternatives identified in the GAP report (Agenda Item H.2.a, Supplemental GAP Report). While adopting the GAP recommendations, the Council indicated that only those issues should move forward that would not delay the package.
November 13-19, 2015	Council meeting, Garden Grove, CA	A staff report (Agenda Item F.6, Attachment 5) was presented. It identified which of the gear issues could be moved forward without delaying 2017 implementation.
March 3, 2016	Notice of Intent	An NOI to prepare an EIS was published in the FR on March 3, 2016 (81 FR 11189). The public comment period was open through April 4, 2016.
March 9-14 2016	Council meeting, Sacramento, CA	The Council selected FPAs recommended in the GAP report (Agenda Item G.8.a, Supplemental GAP Report), except with respect to the use of multiple gears on a trip (Issue F) and fishing in multiple individual fishing quota management areas (Issue G). For Issue F, the Council adopted the GAP recommendation to allow vessels to carry and use multiple types of trawl gear on the same trip, but it recommended that the vessels be required to separate catch by gear type and that landings be recorded on separate electronic fish tickets by gear type (Sorting Sub-option A). For Issue G, the Council did not select an FPA, but scheduled the issue for final consideration at the June 2016 meeting.
June 21-28, 2016	Council meeting, Tacoma, WA	The Council approved Issue G3 and sorting option 2 for recommendation to NMFS as its FPA. These options would allow trawl vessels to fish in multiple management areas on the same trip (and same haul) and assign catch to management areas pro-rata based on effort in the area on the trip, as described in the Agenda Item G.9.a, NMFS Report.

1.4.1 Council and Agency Scoping Results

The Council carefully considered comments received during scoping when developing the management alternatives under consideration. The scoping process revealed that potential impacts of concern were related primarily to the socioeconomic environment. Most public-identified impacts of this action had to do with economic efficiency, flexibility, and stability of harvesting and processing operations, as

well as the communities and consumers benefiting from those operations. No public comments were raised concerning negative impacts of this action on the biological or physical environments during the scoping process.

1.4.1.1 Response to the NOI and Public Input at Council Meetings

The Council received ten responses to the NOI. The NOI provided notice for the March 2016 Council meeting (81 FR 11189), where a preliminary draft EIS was presented (Agenda Item G.8 Attachment (Full Version), Electronic Only, March 2016). The response letters are provided in their entirety in Appendix A. Detailed excerpts from the GAP reports and public comments presented at the March and June 2016 Council meetings are shown in Appendix B. A historical summary of key points made by the GAP and the public prior to the March 2016 Council meeting are shown in Appendix C.

1.4.1.2 Public Comments on the Draft EA and the Proposed Rule

The public comment period for the draft EA was open from September 7 through October 9, 2018. The comment period overlapped with the public comment period for the proposed rule. NMFS received six comment letters from private citizens during the comment period for the proposed rule. Most of the comments raised similar issues regarding the potential for these gear changes to negatively impacts previously overfished rockfish stocks and their habitat, and the potential for the changes to increase salmon bycatch. One comment each was raised on the impact on the quality of stock assessments, the purpose and need, and the need for an Environmental Impact Statement. NMFS has summarized and addressed these comments in the final rule, which can be viewed at www.regulations.gov (Regulatory Identification Number 0648-BH74) along with all public comment letters and the proposed rule.

1.5 New Information and Additional Analyses Relevant to the Development of this EA

New information and additional analyses became available since the Council released the preliminary draft EIS in March 2016 (Agenda Item G.8 Attachment (Full Version), Electronic Only, March 2016). The new data include the following:

- Updated or new information used in this EA:
    - West Coast Groundfish Observer Program (WCGOP) observer data
    - WCGOP catch monitor data
    - WCGOP groundfish expanded mortality multiyear (GEMM) data
    - Pacific States Marine Fisheries Commission (PSMFC) electronic monitoring (EM) data

  - Pacific Fisheries Information Network (PacFIN) logbook data
  - PacFIN fish ticket data
  - West Coast groundfish trawl survey data
  - Additional analyses using trawl discard data described by Pikitch et al. 1988 and Wallace (unpublished)
  - Additional analyses using mesh size selectivity data described by Pikitch et al. (1990), Perez-Comas et al. (1998), Lomeli et al. (2017), and Wallace (unpublished)
- Documents released since March 2016:
  - Council documents (https://www.pcouncil.org/council-operations/briefing-books/)
  - West Coast Groundfish Trawl Catch Share Program Five-year Review (Five-year Review) (NMFS and Council 2017)
  - Endangered Species Act (ESA) Section 7 Biological Opinion (NMFS 2017a), hereafter referred to as the 2017 salmon biological opinion
  - Reconsultation for eulachon and new biological opinion and incidental take statement (ITS) [NMFS 2018a], hereafter referred to as the 2018 eulachon biological opinion.
  - Draft EIS on proposed modifications to Pacific coast groundfish essential fish habitat conservation areas (EFHCAs) and trawl RCAs (NMFS and Council 2018)
  - 2017 and 2018 trawl-gear exempted fishing permits (EFPs) and Environmental Assessments (NMFS 2017b; NMFS 2017c)

Other new documents and analyses supporting NMFS's determination can be found in Section 4.

2 ALTERNATIVES

Section 2 describes the alternatives analyzed in this EA. Modifications are proposed for eight components of the current trawl-gear regulations. These eight "issues" are included for analysis. They are labeled from A to H for consistency between this EA and the preliminary draft EIS (Agenda Item G.8 Attachment, (Full Version) Electronic Only, March 2016), public comments, situation summaries, GMT reports, and GAP reports. For each issue, we analyze a no-action alternative and one or two action alternatives. Some alternatives include options that the Council considered at the March 2016 Council meeting (see Agenda Item G.8, Supplemental Attachment 4, March 2016). One alternative includes a sub-option added by NMFS following publication of the 2017 salmon biological opinion (NMFS 2017a). The Council's FPA is shown for each issue.

2.1 Minimum Mesh Size (Issue A)

The current groundfish trawl mesh size regulations were implemented in the 1990s. Mesh size restrictions were used to increase mean retention length and to reduce fishing mortality for smaller fish, thus increasing survival to maturity. Increasing size selectivity of trawl gear was also expected to reduce bycatch of non-target groundfish species.

The current groundfish regulations at 50 CFR 660.130(b)(2) would remain unchanged under the No-action Alternative (A1). These regulations define minimum mesh size requirements that apply throughout the groundfish trawl net (Figure 2-1), including chafing gear. Minimum mesh size means the smallest distance allowed from the inside of one knot to the inside of the opposing knot, regardless of twine size. The minimum mesh size for bottom trawl is 4.5 inches throughout the trawl; for midwater trawl, the minimum mesh size is 3.0 inches throughout the trawl. Midwater trawl has additional mesh size restrictions at 50 CFR 660.130(b)(4). These added restrictions affect the first 20 feet immediately behind the footrope or headrope where bare ropes or mesh of 16-inch minimum mesh size must completely encircle the net (see Figure 3-8 in NMFS 2005a). These additional restrictions for midwater trawl were implemented in the mid-1990s to better ensure that midwater trawl would not come in contact with the seafloor by making the gear impractical or ineffective for fishing on the bottom.

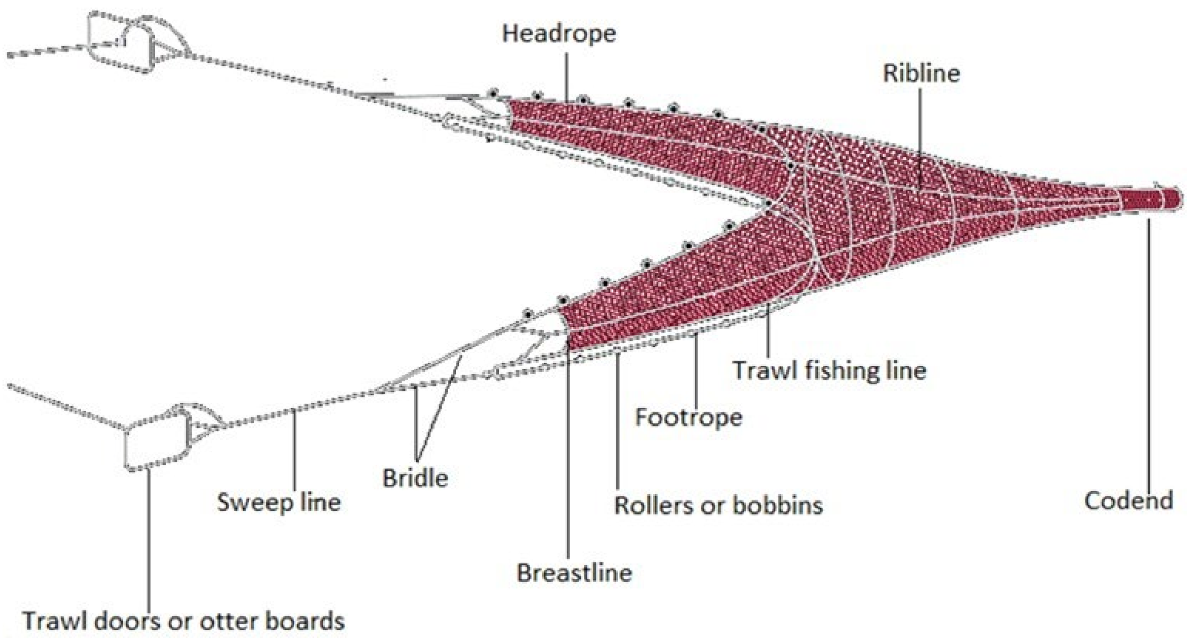

Figure 2-1. Diagram showing components of groundfish bottom trawl gear. Although this illustration represents a bottom trawl, most of the primary components shown are relevant to midwater trawls (except for rollers or bobbins). Source: Groundfish trawl gear small entity compliance guide (CFR 660 Subpart C and D), NMFS, WCR. Available at the following website: http://www.westcoast.fisheries.noaa.gov/publications/fishery_management/groundfish/public_notices/compliance_guide_chafing_gear_2014.pdf

Two alternatives to the No-action Alternative (A1) are considered (Table 2-1). Alternative A2 considers setting a 4-inch minimum mesh size for bottom trawl while retaining the 3-inch minimum mesh size for midwater trawl. This alternative would affect groundfish bottom trawl participants along the entire West Coast. The intent of Alternative A2 is to accommodate the inconsistency of available netting in meeting the minimum mesh size requirement of 4.5 inches in all net sections (Agenda Item I.5.a, Attachment 4, November 2012). This would likely reduce incidental violations that may occur when net shrinkage reduces mesh size below the legal minimum.

Alternative A3 (the Council's FPA) considers removing all mesh size restrictions except the restriction that affects the 20 feet immediately behind the footrope or headrope on midwater trawl nets (Table 2-1). This alternative would affect groundfish trawl participants (midwater and bottom trawl) along the entire Pacific Coast. The intent of eliminating the minimum mesh size requirements is to provide fishermen with more flexibility to configure their trawl gear to improve efficiency for catching target species, while reducing catch of unwanted species.

Strategic use of smaller mesh sizes may facilitate the use or construction of excluder devices (e.g., flexible grates). For instance, small meshes may be needed to herd or guide fish, as well as to reinforce the net where the excluder or guiding panels are attached to reduce wear on the net meshes. Examples of selectivity devices that may require mesh sizes smaller than 4.5 inches to improve effectiveness include (a) ramps or tubes constructed of small mesh that may guide unwanted fish out of trawls (Graham et al. 2010; O'Neill and Mutch 2017), (b) separator panels that may sort fish and invertebrates to optimize retention of marketable species and sizes (Graham et al. 2010; O'Neill and Mutch 2017), (c) creation of slack water or eddies within discrete areas of the intermediate or codend that may promote escapement of certain species (e.g., salmonids) through top- or side- escape panels (O'Neill and Mutch 2017), and (d) reducing gilling (Pikitch et al. 1988).

Table 2-1. Summary of minimum mesh size alternatives (Issue A): description, affected participants, and area affected. See text for more detail.

Minimum Mesh Size (Issue A)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Minimum Mesh Size	A1	No action: Minimum mesh size is 4.5 in. for bottom trawl and 3.0 in. for midwater trawl	Groundfish trawl vessels	Entire region	No Change
	A2	Change minimum mesh size for bottom trawl gear to 4.0 in.	Groundfish bottom trawl vessels	Entire region	Groundfish trawl vessels can use smaller mesh
	A3 (Preferred)	Remove all mesh size restrictions except that affecting the 20 ft immediately behind the footrope or headrope on midwater trawl nets	Groundfish trawl vessels	Entire region	All groundfish trawlers no longer need to have nets comply to a minimum mesh size

2.2 Measuring Mesh Size (Issue B)

The definition of mesh size at 50 CFR 660.11 describes, in part, how minimum mesh size is measured. Under the current regulations, mesh size means the opening between opposing knots (Figure 2-2). Minimum mesh size means the smallest distance allowed from the inside of one knot to the inside of the opposing knot, regardless of twine size (No-action Alternative, Alternative B1). Regulations at 50 CFR 660.130(b) further state that minimum trawl mesh size requirements are met if a 20-gauge stainless steel wedge, less one thickness of the metal wedge, can be passed with only thumb pressure through at least 16 of 20 sets of two meshes each of wet mesh. The current regulations pertain only to

knotted webbing and are out of date because knotless webbing (Figure 2-2) is currently also used in the construction of many trawl nets and codends.

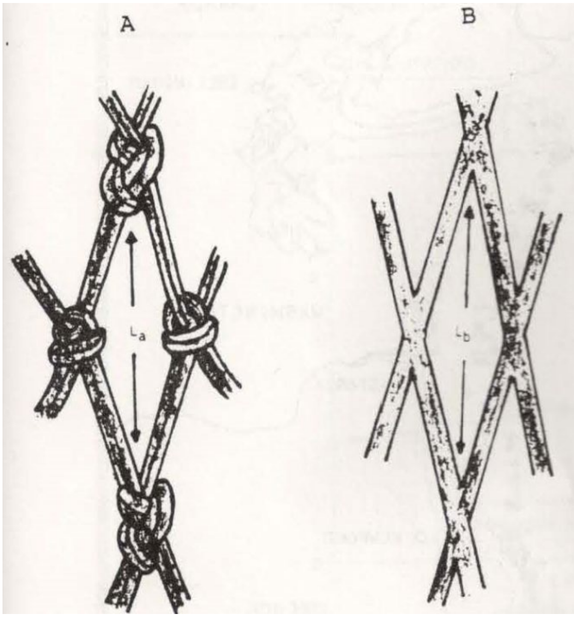

Figure 2-2. Diagram knotted webbing (A) and knotless webbing (B). Under Alternative B2, mesh size would mean the opening between opposing knots (L_a) for knotted webbing or the opening between opposing corners (L_b) for knotless webbing. Source: Pikitch et al. 1990.

Alternative B2 (the Council's FPA) would revise the regulations to include measurements of knotless webbing (Table 2-2). Alternative B2 would apply to groundfish trawl participants (midwater and bottom trawl) along the entire Pacific coast. This revision is intended to improve clarity and enforceability of the regulations relative to either knotted or knotless trawl webbing.

Table 2-2. Measuring mesh size alternatives (Issue B): description, affected participants, and area affected.

Measuring Mesh Size (Issue B)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Measuring Mesh Size (definition)	B1	No action: regulation specifies distance between knots	Groundfish trawl vessels	Entire region	No Change
	B2 (Preferred)	Revise language of 50 CFR 660.11 to include language regarding knotless webbing	Groundfish trawl vessels	Entire region	No change to fishing practices; this measure is largely administrative, meant to improve enforceability

2.3 Codend Regulations (Issue C)

Only single-wall codends may be used under the current regulations (No-action Alternative, Alternative C1), and double-wall codends are prohibited as they can be used to reduce the effective mesh size. In addition, chafing gear may not be used to create a double-wall codend. Double-wall codends are constructed of two walls (layers) of webbing, while single-wall codends are constructed of a single wall of webbing. The current codend regulation was implemented in the 1990s, along with mesh size and chafing gear restrictions (60 FR 13377, March 13, 1995, codified at 50 CFR 660.322), and updated in 2014 (79 FR 71340, December 2, 2014) to prevent fishermen from reducing the effective mesh size of the net.

Under Alternative C2 (the Council's FPA), gear regulations that allow only single-wall codends, and that would prohibit the use of double-wall codends and the use of chafing gear to create the effect of a double-wall codend, would be removed from the regulations (Table 2-3). This alternative would affect groundfish trawl participants (midwater and bottom trawl) along the entire Pacific coast. Reducing codend restrictions is intended to allow fishermen to choose the most efficient and effective gear for their operations.

Table 2-3. Codend regulation alternatives (Issue C): description, affected participants, and area affected.

Codend Regulations (Issue C)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Codend Regulations	C1	No action: Codends must be single-wall; Chafing gear cannot be used to create a double-wall codend	Groundfish trawl vessels	Entire region	No Change
	C2 (Preferred)	Allow double-wall codends; allow the use of chafing gear to create a double-walled codend	Groundfish trawl vessels	Entire region	Trawl vessels would no longer be prohibited from using or creating double-wall codends

2.4 Selective Flatfish Trawl (Issue D)

SFFT is a type of small footrope trawl developed over several years through research trials and fishery-scale testing (see Section 3.4.1.4). The gear was developed to maintain a nearshore flatfish trawl fishery while reducing the catch of canary rockfish and other overfished species (Council 2004). The

SFFT (Figure 2-3) reduces the catch of rockfish by allowing them to escape upward and over the wings and the low-rise, cut-back headrope of the approaching trawl (Hannah et al. 2005). Flatfish tend to dive down or remain near the bottom of the trawl during the capture process (Rose 1996; Ryer 2008), which accounts for the differential selectivity of the SFFT between rockfish and flatfish.

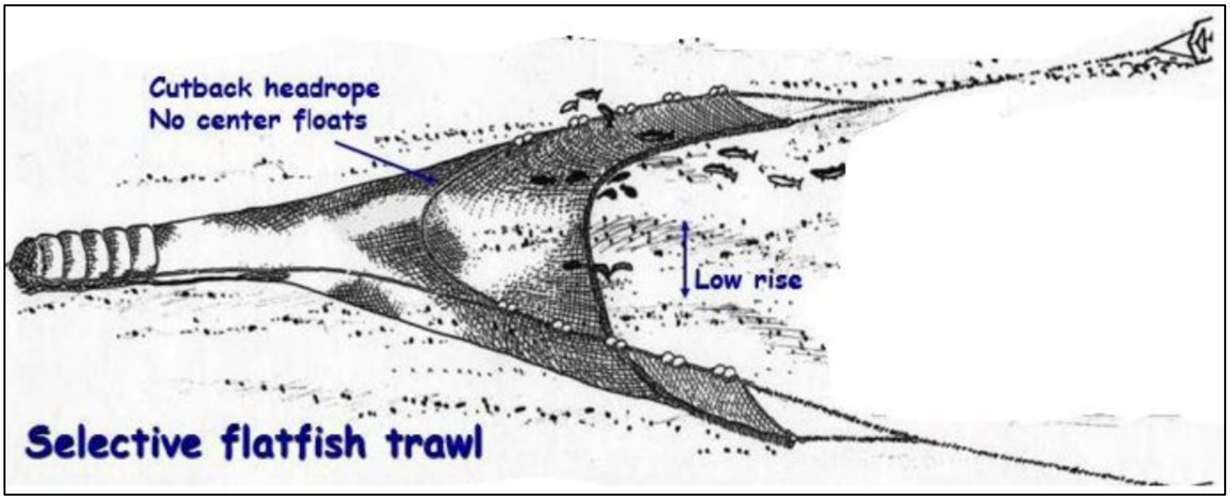

Figure 2-3. Diagram of SFFT showing cutback, low-rise headrope with limited floats. Source: Oregon Department of Fish and Wildlife, Marine Resources Program, Newport, OR

Under the No-action Alternative (D1), current regulations require that SFFT must be a two-seamed net with no more than two riblines (Figure 2-3), excluding the codend. The breastline (Figure 2-1) may not be longer than 3 feet (0.92 m). There may be no floats along the center third of the headrope or attached to the top panel except on the riblines (Figure 2-3). The footrope must be less than 105 feet (32.26 m). The headrope must be not less than 30 percent longer than the footrope. The headrope must be measured along the length of the headrope from the outside edge to the opposite outside edge.

Since 2005, the groundfish regulations at 50 CFR 660.130(c)(2) have required vessels fishing with groundfish bottom trawl gear to use of SFFT shoreward of the trawl RCA north of 40°10′ N. latitude (No-action Alternative) (Figure 2-4). Current regulations further prohibit vessels fishing north of 40°10′ N. latitude from having small footrope trawl gear other than SFFT on board while fishing shoreward of the trawl RCA. South of 40°10′ N. latitude, vessels fishing with groundfish bottom trawl gear are allowed, but not required, to use SFFT shoreward of the trawl RCA. The use of SFFT gear is allowed seaward of the trawl RCA coastwide, but it is not required in these deeper waters.

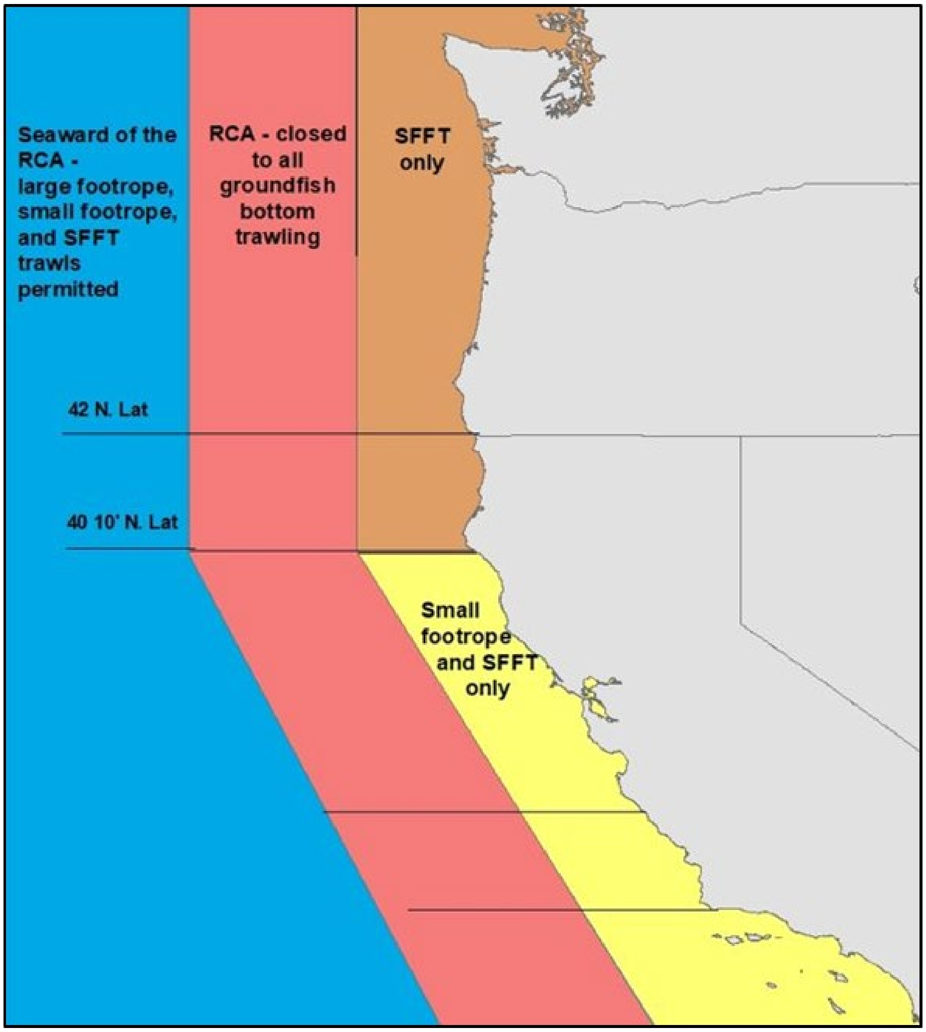

Figure 2-4. Areas where SFFT and other types of groundfish bottom trawls are required or allowed off the United States West Coast. Under the No-action Alternative (D1), SFFT is required shoreward of the trawl RCA north of 40°10' N. latitude.

Two action alternatives (D2 and D3) and one sub-option to Alternative D3 are considered. Under Alternative D2, the SFFT definition would be modified to allow either a two-seam or a four-seam net, while retaining the remaining gear and area restrictions stated in the No-action Alternative (e.g., cutback headrope and area restrictions) (Table 2-4). This alternative would affect bottom groundfish trawlers using SFFT coastwide. The intent of this alternative is to allow more flexibility for the installation of flexible sorting grates or grids (e.g., halibut excluder devices [Lomeli and Wakefield 2015]) (Agenda Item I.5.a, Attachment 4 – Gear Workshop Report, November 2012). It was expected that a four-seam trawl would improve flow and, therefore, would improve the function of halibut excluder devices, which might allow trawlers to increase catch of target species, while remaining below their halibut individual bycatch quotas (IBQ) (Agenda Item I.7.c, Supplemental Public Comment, Power Point, April 2011).

Under Alternative D3 (the Council's FPA), the SFFT definition would be modified to allow a two- or a four-seam net, while retaining the other gear restrictions (Table 2-4). However, the area restrictions north of 40°10′ N. latitude would be eliminated; the SFFT would no longer be required shoreward of the trawl RCA north of 40°10′ N. latitude (Figure 2-4), except for groundfish bottom trawls fished within the Klamath and Columbia River Conservation Zones to reduce trawl impacts on ESA-listed salmon (NMFS 2017a). This area restriction would be replaced with a small footrope requirement (like the requirement south of 40°10′ N. latitude). Requirements shoreward of the trawl RCA south of 40°10′ N. latitude and seaward of the trawl RCA coastwide would remain as stated in the No-action Alternative (D1). The new definition of SFFT under Alternative D3 would affect bottom groundfish trawl participants along the entire Pacific coast, whereas the area restrictions under current regulations would be lifted for groundfish bottom trawl participants north of 40º10' N. latitude (Table 2-4). Alternative D3 would likely provide fishermen with more flexibility to configure their trawl gear to improve efficiency for catching target species, while reducing catch of unwanted species (Section 3.4.1.4).

Alternative D3, NMFS Sub-option 1 was added since the draft of this EA was released in September, 2018 (Draft Gear EA, September 2017). This sub-option was added by NMFS after considering the 2017 salmon biological opinion, which describes uncertainty in impacts to ESU-listed salmon by the groundfish trawl fishery south of 42º N. latitude (page 2-123 in NMFS 2017a). NMFS determined that the Council's recommended changes to the SFFT gear requirement shoreward of the trawl RCA between 42º N. latitude and 40º10' N. latitude are out of compliance with the terms and conditions of the 2017 salmon biological opinion Incidental Take Statement. Term and Condition 4b requires that "prior to allowing additional non-whiting trawling south of 42º N. latitude, NMFS will implement one or more EFPs designed to collect information about Chinook and coho bycatch levels and stock composition from fishing in those areas or at those times for a minimum of three years (page 2-189 in NMFS 2017a)." Trawl gear EFPs were issued in 2017 and 2018 that exempted the requirement to use SFFT shoreward of the trawl RCA north of 42º N. latitude, but did not exempt SFFT requirements for EFP participants south of 42º N. latitude (Appendix D). Not including the area shoreward of the trawl RCA between 42º N. latitude and 40º10' N. latitude in the exemption to the SFFT requirement in the 2017 and 2018 trawl gear EFPs, as was recommended by the Council, precludes NMFS from making restrictions in this area that could result in additional non-whiting trawling effort.

The description of Alternative D3, NMFS Sub-option 1 is identical to that shown for the Council preferred Alternative D3 (above), except for the area restrictions. Under Alternative D3, NMFS Sub-option 1, the SFFT would no longer be required for groundfish bottom trawl shoreward of the trawl RCA north of 42º N. latitude, but would still be required shoreward of the trawl RCA between 42º N.

latitude and 40°10′ N. latitude (Figure 2-4). The small footrope requirement would continue to be in effect shoreward of the trawl RCA and north of 42° N. latitude (like the requirement south of 40°10′ N. latitude). Requirements shoreward of the trawl RCA south of 42° N. latitude and seaward of the trawl RCA coastwide would remain as stated in the No-action Alternative (D1). The new definition of SFFT under Alternative D3, NMFS Sub-option 1 would affect bottom groundfish trawl participants along the entire Pacific coast, whereas the area restrictions under current regulations would be lifted for groundfish bottom trawl participants north of 42° N. latitude (Table 2-4).

Table 2-4. Selective flatfish trawl alternatives (Issue D): description, affected participants, and area affected.

Selective Flatfish Trawl (Issue D)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Selective Flatfish Trawl Definition and Required Use	D1	No action: SFFT gear must be a two-seamed net; required shoreward of the trawl RCA north of 40°10' N. lat.	Trawl Vessels using SFFT	Entire region	No Change
	D2	Modify SFFT definition to allow either a two-seamed or four-seamed net	Trawl Vessels using SFFT	Entire region	Trawl vessels using the SFFT would be allowed to choose between two- and four-seamed nets
	D3 (Preferred)	Modify SFFT definition to allow a two- or four-seamed net; No longer require SFFT shoreward of the trawl RCA boundary N. of 40°10′ N. lat.; Groundfish bottom trawls shoreward of the RCA would continue to be bound by a small footrope requirement	Bottom groundfish trawl vessels	Entire region, AND changed restrictions N. of 40°10′ N. lat.	Groundfish bottom trawl vessels choose between two- and four-seamed nets, and trawlers would no longer be required to use SFFT shoreward of the RCA boundary N. of 40°10′ N. lat., provided they have a small footrope
	D3, NMFS Sub-option 1	Modify SFFT definition to allow a two- or four-seamed net; No longer require SFFT shoreward of the trawl RCA boundary N. of 42° N. lat.; Groundfish bottom trawls shoreward of the RCA would continue to be bound by a small footrope requirement	Bottom groundfish trawl vessels	Entire region, AND changed restrictions N. of 42° N. lat.	Groundfish bottom trawl vessels choose between two- and four-seamed nets, and trawlers would no longer be required to use SFFT shoreward of the RCA boundary N. of 42° N. lat., provided they have a small footrope

2.5 Chafing Gear (Issue E)

Current regulations define chafing gear as webbing or other material attached to the codend (Figure 2-1); the intent of chafing gear is to protect the net from wear and abrasion. In the early 1990s,

regulations required that chafing gear be of large-mesh material and be fastened such that it allowed for escapement of small fish through the mesh openings (57 FR 12212, April 9, 1992). Over the past 30 years, the Council has recommended and NMFS has implemented changes to regulations for chafing gear; a historical summary of chafing gear and pertinent codend regulation changes in the Council area is provided in Council and NMFS 2014. Many of the historical revisions were intended to provide protection for the underside of the net without unduly or intentionally restricting escapement of fish through the webbing. The most recent change in 2015 revised midwater trawl chafing gear regulations (Figure 2-5) to allow for greater protection of the codend and net and to be more compatible with the chafing gear regulations for the Gulf of Alaska and the Bering Sea and Aleutian Islands groundfish fisheries (79 FR 71340, December 2, 2014).

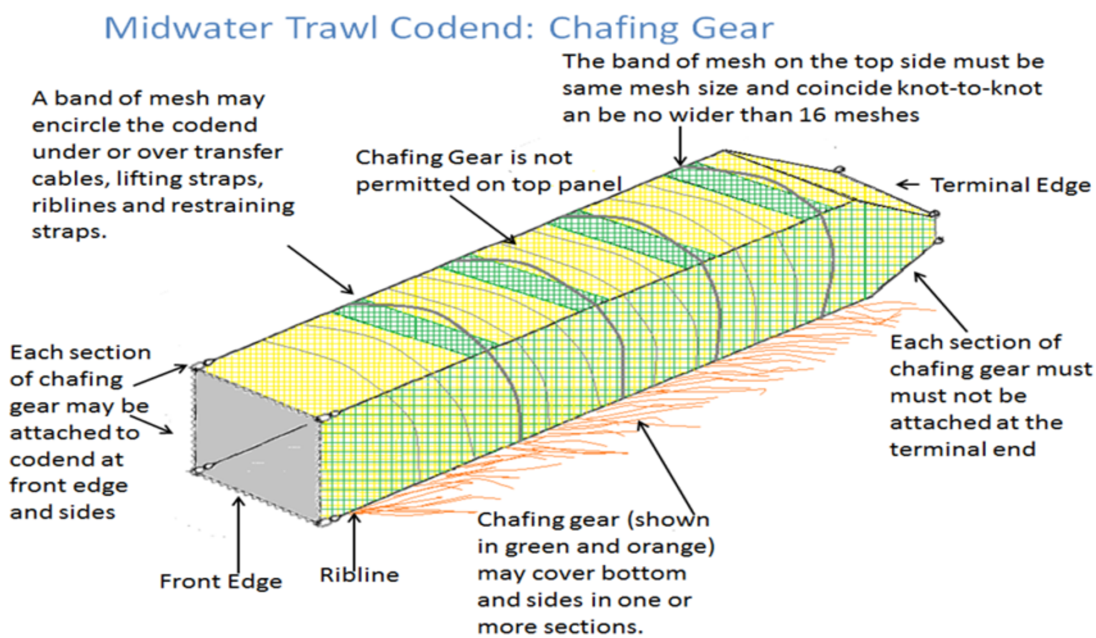

Figure 2-5. Diagram of a midwater trawl codend, including chafing gear and other components. Source: Groundfish trawl gear small entity compliance guide (CFR 660 Subpart C and D), NMFS, WCR. Available at the following website: http://www.westcoast.fisheries.noaa.gov/publications/fishery_management/groundfish/public_notices/compliance_guide_chafing_gear_2014.pdf

Under the No-action Alternative, Alternative E1, chafing gear restrictions would continue to be defined separately for midwater and bottom trawl (Table 2-5). For midwater trawl, chafing gear could cover the bottom and sides of the codend in either one or more sections (Figure 2-5). Only the front edge (the edge closest to the open end of the codend) and sides of each section of chafing gear may be attached to the codend; except at the corners, the terminal edge (edge closest to the closed end of the codend) of each section of chafing gear must not be attached to the net. Chafing gear is not permitted on the top codend panel, except that a band of mesh (a skirt) may encircle the net under or over the transfer

cables, lifting or splitting straps (chokers), riblines, and restraining straps, but it must be the same mesh size, and it must coincide knot-to-knot with the net to which it is attached and be no wider than 16 meshes (Figure 2-5). Under the No-action Alternative for bottom trawl gear, chafing gear could encircle no more than 50 percent of the net's circumference and may be in one or more sections. Chafing gear may be used only on the last 50 meshes of the codend, measured from the terminal (closed) end of the codend. Only the front edge (the edge closest to the open end of the codend) and sides of each section of chafing gear may be attached to the codend; except at the corners, the terminal edge (the edge closest to the closed end of the codend) of each section of chafing gear must not be attached to the net. Chafing gear must be attached outside any riblines and restraining straps.

Two action alternatives (E2 and E3) are considered (Table 2-5). Under Alternative E2, the groundfish bottom trawl chafing gear regulations would be revised to align with the midwater trawl chafing gear restrictions shown under the No-action Alternative (E1). This alternative would affect bottom groundfish trawl participants along the entire West Coast. The intent of Alternative E2 is to allow groundfish bottom trawl fishermen with the strategic flexibility to protect additional areas of their codend from wear, similar to protections allowed for midwater trawls. Under Alternative E2, chafing gear could cover the bottom and sides of the codend in either one or more sections (Figure 2-5), but would not be permitted on the top codend panel, except that a band of mesh may encircle the net under or over lifting or splitting straps, riblines, and restraining straps (Figure 2-5). Other provisions for groundfish bottom trawl under Alternative E2 would be identical to those shown for midwater trawl under Alternative E1.

Under Alternative E3, chafing gear restrictions would be eliminated for groundfish bottom trawl and midwater trawl gear coastwide (Table 2-5). Chafing gear could be used without restrictions. Reducing or removing the chafing gear restrictions would allow for greater flexibility in how vessels use chafing gear to protect nets and codends and how they would fish relative to the seafloor. Reducing the chafing gear restrictions would likely allow fishermen to choose the most efficient gear for their operations.

Table 2-5. Chafing gear alternatives (Issue E): description, affected participants, and area affected.

Chafing Gear (Issue E)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Chafing Gear	E1	No Action: For bottom trawl, chafing gear could encircle no more than 50 percent of the net's circumference and may be used only on the last 50 meshes. For midwater trawl, chafing gear could cover the bottom and sides of the codend; chafing gear is not permitted on the top codend panel, except for the band of mesh that may encircle the net under restraining straps and other trawl components, but must be no wider than 16 in.	Groundfish trawl vessels	Entire region	No Change
	E2	Bottom trawl chafing gear regulations would be revised to align with midwater trawl chafing gear restrictions	Groundfish bottom trawl vessels	Entire region	Flexibility to strategically protect additional areas of the codend from abrasion by the stern ramp, sea bed, and restraining straps or other trawl components
	E3 (Preferred)	Chafing gear restrictions would be eliminated for groundfish bottom trawl and midwater trawl gear	Groundfish trawl vessels	Entire region	Trawl vessels may use chafing gear as it best suits their operations, with no restrictions on covering or connecting to the codend

2.6 Multiple Trawl Gears on Board (Issue F)

Current trawl regulations define the following trawl gear types: large footrope trawl, small footrope trawl, SFFT, and midwater trawl (Section 3.4.1). SFFT is a specific type of small footrope trawl (Section 2.4; Section 3.4.1.4). Restrictions on the use and simultaneous possession of each gear type vary, depending on whether a vessel is fishing north or south of 40˚10´ N. latitude, or shoreward of, seaward of, or within the trawl RCA (50 CFR 660.130).

Limited entry trawl vessels could fish with multiple trawl gears during the same trip prior to the development of RCAs (i.e., midwater and bottom trawls). For example, the 2002 groundfish trawl regulations stated the following: “If a vessel has both small footrope trawl and midwater trawl gear on

board, the landing is attributed to the most restrictive gear-specific limit, regardless of which gear type was used" (67 FR 1555, January 11, 2002). On September 13, 2002, NMFS took emergency action to define new depth-based management measures that created a darkblotched RCA (DBCA) (67 FR 57937, September 13, 2002). The Council subsequently sought a new management strategy, beginning in 2003, to establish large-scale, depth-related closures (RCAs) to prohibit both commercial and recreational fishing across much of the continental shelf. To ensure that bottom trawl gear was not used within trawl RCAs, a new regulation was published in 2003 to allow no more than one type of trawl gear on board during a single fishing trip (68 FR 907, January 7, 2003). Regulations requiring vessel monitoring systems (VMS) (Exhibit G.3.b, Supplemental NMFS Report, November 2002), paired with vessel declarations, became effective on January 1, 2004, to ensure adequate monitoring and to enforce these new gear-specific area restrictions (68 FR 62375, November 4, 2003).

Under the No-action Alternative (F1), north of 40°10' N. latitude (Table 2-6), a vessel may not have both groundfish trawl gear and non-groundfish trawl gear on board simultaneously, nor may a vessel have both groundfish bottom trawl gear and midwater trawl gear on board simultaneously (50 CFR 660.130(c)(4). A vessel may, however, have more than one type of groundfish bottom-trawl gear on board, either simultaneously or successively, during a cumulative limit period, with one exception: SFFT is the only type of small footrope trawl allowed onboard when fishing shoreward of the trawl RCA north of 40°10' N. latitude (50 CFR 660.130(c)(2). Large footrope gear is allowed on board when fishing shoreward of the trawl RCA but cannot be fished in that area (50 CFR 660.130(c)(1). Vessels are allowed to fish any legal bottom groundfish trawl seaward of the trawl RCA north of 40°10' N. latitude (i.e., large footrope, small footrope, and SFFT) (50 CFR 660.130(c) (Agenda Item E.9.b, GMT Report 2, November 2011, page 10). Finally, a vessel may have more than one type of midwater trawl gear on board, either simultaneously or successively, during a cumulative period (50 CFR 660.130(c)(4)(i)(A).

Under Alternative F1, south of 40°10′ N. latitude (Table 2-6), a vessel may not have both groundfish trawl gear and non-groundfish trawl gear on board simultaneously, may not have both bottom trawl gear and midwater trawl gear on board simultaneously, and may not have small footrope trawl gear and any other type of bottom trawl gear on board simultaneously (50 CFR 660.130(c)(4)(ii)(A).

Some species are still managed with cumulative trip limits in the catch share program both north and south of 40°10 'N. latitude. As such, trip limits shown in 50 CFR 660, Table 1 (North) and Table 1 (South), apply to certain species, trawl gear types, and management areas. Gear-specific trip limits would continue to apply under the No-action Alternative.

Two action alternatives (F2 and F3) are considered (Agenda Item G.8, Supplemental Attachment 4, March 2016). Alternative F2 would allow any type of groundfish bottom trawl (small/large footrope) and midwater trawl on board simultaneously for shoreside IFQ trawl vessels throughout the West Coast (Table 2-6) (GMT Report E.9.b, GMT Report 2, November 2011). Under Alternative F2, only one type of groundfish trawl gear (e.g., midwater or bottom trawl) may be fished on a trip. For species managed with trip limits, the No-action Alternative crossover provisions, gear-specific trip limits, and declaration reports would remain in effect. The intent of Alternative F2 is to improve efficiency by saving catch share participants time and labor expenses in swapping out nets on consecutive trips.

Alternative F3 (the Council's FPA) would allow any type of groundfish bottom trawl (small/large footrope) and midwater trawl on board simultaneously and would allow any of these trawl gears to be fished during a single fishing trip for shoreside IFQ trawl vessels throughout the West Coast (Table 2-6) (GMT Report E.9.b, GMT Report 2, November 2011). For species managed with trip limits, the No-action Alternative crossover provisions, gear-specific trip limits, and declaration reports would remain in effect. Alternative F3 is intended to provide flexibility to the trawl fleet, reducing operating costs such as fuel and observer costs and creating more efficient fishing operations (Agenda Item G.8.a, Supplemental GAP Report, March 2016). In addition, Alternative F3 is intended to improve safety, because it may reduce the number of bar crossings by reducing unnecessary trips back to port to change trawl gear (Agenda Item E.9.b, GMT Report 2, November 2011, page 10).

Alternative F3 included gear-type and sorting options that were considered at the March 2016 Council meeting (Agenda Item G.8, Supplemental Attachment 4, March 2016). Sorting options that were rejected by the Council are discussed in Section 2.10.2. This alternative has one sorting option recommended by the Council (see Decision Summary Document, Council, March 2016). This sorting option (Council's FPA) would require shoreside IFQ trawl vessels to separate catch by gear type in the fish hold (bottom trawl versus midwater trawl) and report catch by gear type on separate electronic fish tickets or on the same fish ticket but separate lines.[3]

[3] Since the March 2016 Council meeting, PacFIN redesigned the electronic fish ticket system to allow entering catch for multiple gears separately on a single fish ticket.

Table 2-6. Multiple trawl gear alternatives (Issue F): description, affected participants, and area affected.

Multiple Trawl Gears (Issue F)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Same-trip use of Bottom Trawl and Midwater Trawl Gear	F1-North	No action: Vessels may not have both groundfish trawl gear and non-groundfish trawl gear, nor both bottom trawl gear and midwater trawl gear; Vessels may have more than one type of limited entry bottom-trawl gear	Groundfish trawl vessels	N. of 40°10' N. lat.	No Change
	F1-South	No action: Vessels may not have both groundfish trawl gear and non-groundfish trawl gear, nor both bottom trawl gear and midwater trawl gear, nor both small footrope trawl gear and any other type of bottom trawl gear	Groundfish trawl vessels	S. of 40°10' N. lat.	No Change
	F2	Allow any type of groundfish bottom trawl and midwater trawl on board simultaneously, but only one type may be fished on a trip	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may carry any type of bottom trawl and midwater trawl gear, but on a single fishing trip, they would only be allowed to fish with ONE type of gear
	F3 (Preferred)	Allow any type of groundfish bottom trawl and midwater trawl gear on board simultaneously, and any of these gears to be fished on a single trip; Separate catch by gear type (bottom trawl versus midwater trawl) and report catch by gear type separately on electronic fish tickets	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may carry any type of bottom and midwater trawl gear on board simultaneously, and fish with any of them

2.7 Fishing in Multiple IFQ Management Areas (Issue G)

The catch share program includes IFQ management areas, specified in regulation at 50 CFR 660.140(c)(2) and listed below, that are based on the stock information for select species, harvest allocations, and the corresponding quota shares for species. The IFQ management areas currently found in regulation are as follows (see Figure 1-1):

- Between the United States/Canada border and 40°10′ N. latitude (southern boundary is near Cape Mendocino)
- Between 40°10′ N. latitude and 36° N. latitude (southern boundary is near Point Sur)
- Between 36° N. latitude and 34°27′ N. latitude (southern boundary is near Point Conception)
- Between 34°27′ N. latitude and the United States/Mexico border

The IFQ management areas were established in 2011 with implementation of the catch share program. They are intended to allow for different management measures for species or species groups in different IFQ management areas (75 FR 53380, August 31, 2010; 75 FR 78344, December 15, 2010). Several IFQ species are tracked either as a single species with different quota share by area, or as a single species in one area and as a component of an assemblage in another area (e.g., minor shelf or slope complex north or south of 40°10′ N. latitude) (see Table 2-1 in NMFS 2018b).

To address differences in management measures for species or species complexes among IFQ management areas, shoreside IFQ trawl vessels have been prohibited from fishing in different IFQ management areas during the same fishing trip. In the shoreside catch share program, retained and discarded catches of all species are tracked by at-sea observers or at-sea electronic monitoring and shoreside catch monitors (Section 3.3.6). First receivers report landings of IFQ species, including target species, on electronic fish tickets. The electronic fish ticket also records the gear type used and the IFQ management area fished for the trip. In addition, the catch monitor tracks and records landed catch during the offload and reports landed catch in the online IFQ vessel account system. The higher of the two catch values (catch monitor recorded weight or fish ticket weight) is then deducted from the vessel's quota pounds for IFQ species.

Because shoreside IFQ landings are a mix of all hauls taken during a single trip, vessels have been required to fish entirely in one IFQ management area during a trip to simplify sorting requirements, at-sea observation, and enforcement of IFQ limits. While this provision has reduced flexibility for a vessel that wishes to fish in more than one area during a trip, the catch accounting and enforcement concerns were addressed without increasing costs of implementing the program by overburdening the observer and enforcement programs.

Under No-action Alternative (Alternative G1), regulations at 50 CFR 660.140(c)(2) would continue to prohibit shoreside IFQ trawl vessels from fishing in multiple IFQ management areas on the same trip

throughout the West Coast (Table 2-7). Each electronic fish ticket (or separate lines on a single electronic fish ticket)[4] would represent a separate IFQ management area.

Two action alternatives are being considered relative to area management (Agenda Item G.9.a, NMFS Report, June 2016). Under Alternative G2, shoreside IFQ trawl vessels would be allowed to fish in multiple IFQ management areas on the same trip (Table 2-7). If catch were retained from multiple IFQ management areas on a single trip, catch would be kept separate by IFQ management area on deck and in the hold. Catch would also be recorded by IFQ management area on separate electronic fish tickets or on separate lines of the same electronic fish ticket. Shoreside IFQ trawl fishermen would be still be required to fish a single tow on either side of an IFQ management line, and they could not tow across an IFQ management line.

Under Alternative G3 (Council's FPA), shoreside IFQ trawl vessels would be allowed to fish in multiple IFQ management areas on the same trip and on the same tow throughout the West Coast (Table 2-7). If retaining catch from multiple IFQ management areas on a single trip or tow, catch would not have to be sorted by area (i.e., catch from different IFQ management areas could be mixed in the fish hold), and this catch from different areas could be recorded on the same line of a single electronic fish ticket. Shoreside IFQ trawl vessels would also be allowed to tow across management lines under Alternative G3.

Under Alternative G3, three accounting options were considered for reporting catch when fishing in different IFQ management areas (Agenda Item G.9.a, NMFS Report, June 2016). An accounting procedure would be needed if Alternative G3 were selected. Those options are as follows:

- Under Option 1 (the Conservative Option), all IFQ management areas fished would be reported on the same electronic fish ticket, and quota pounds would be deducted from the management area with more restrictive or conservative harvest limits (take could be based on acceptable biological catch [ABC], annual catch limit [ACL], trawl allocation, etc.).
- Under Option 2 (Pro-rata Option; the Council's FPA), a pro-rata approach would be taken to account for catch from different IFQ management areas. To deduct quota pounds from vessel accounts, each IFQ species would have to be evaluated by area. For species where quota share would be issued separately on either side of the management line, the quota pounds would be deducted from the IFQ management area pro rata based on the number of hauls. For example, if six hauls came from north of 40°10' N. latitude, and two came from south of 40°10' to 36° N.

[4] Since the March 2016 Council meeting, PacFIN redesigned the electronic fish ticket system to allow entering catch for multiple areas separately on a single fish ticket.

latitude, the total weight of each species would be split on two tickets (or two separate lines on the same ticket) at a 6:2 ratio. If a vessel towed across a management line during a trip, policies would be established to determine how to count the haul (against which IFQ management area; e.g., start of tow, end of tow, area with the longest time on the tow).

- Under accounting Option 3 (Port of Landing Option), if a vessel fished on both sides of a management line, all IFQ management areas would be reported on the same electronic fish ticket, but quota pounds would be deducted from the area where the fish were landed.

Table 2-7. Fishing in multiple areas alternatives (Issue G): description, affected participants, and area affected.

Fishing in Multiple IFQ Management Areas on a Single Trip (Issue G)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Fishing in Multiple IFQ Management Areas on a Single Trip	G1	No action: Vessels cannot fish in multiple IFQ management areas on a single fishing trip	Shoreside IFQ vessels	Entire region	No change
	G2	Vessels may fish in multiple IFQ management areas on a single trip; Catch must be sorted by area on deck and in the hold; Catch from different IFQ management areas would be reported separately fish tickets; Tows could not cross management lines.	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may fish in multiple IFQ management areas during a trip, provided landings are separated and reported on separate fish tickets for each area, and tows do not cross IFQ management lines
	G3 Option 1	Vessels may fish in multiple IFQ areas on a single trip. Catch would not have to be sorted by IFQ management area, and catch from multiple areas could be recorded on a single fish ticket. Tows would be allowed to cross IFQ management lines. Quota pounds would be deducted from the management area with most restrictive harvest limits.	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may fish in multiple IFQ management areas on a single trip, and would not have to keep the catch separated by area or report them separately by area on fish tickets. Tows would be allowed to cross IFQ management lines.
	G3 Option 2 (Preferred)	Vessels may fish in multiple IFQ areas on a single trip; Catch would not have to be sorted by management area, and catch from multiple areas could be recorded on a single fish ticket; Tows would be allowed to cross IFQ management lines; Quota pounds would be deducted on a pro rata basis; Quota pound deduction of multi-area tows still needs to be established	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may fish in multiple IFQ management areas on a single trip, and would not have to keep catch separated by area or report catch separately by area on fish tickets; Tows would be allowed to cross IFQ management lines.

2.8 Bringing a New Haul on Board before Previous Catch is Stowed (Issue H)

Under current regulations, shoreside IFQ trawl vessels are prohibited from bringing a new haul on board the deck until all catch from the previous haul has been stowed. This requirement was added when the catch share program was implemented to aid observers in carrying out their duties (75 FR 78344, December 15, 2010). Under the No-action Alternative (H1), a shoreside IFQ trawl vessel would continue to be prohibited from bringing a new haul on board before all catch from the previous haul has been stowed (Table 2-8).

Under Alternative H2, the prohibition of bringing a new haul on board before the previous catch is stowed would be removed for shoreside IFQ trawl vessels throughout the West Coast (Table 2-8). However, catch from separate hauls would not be mixed on deck until after the observer completed the haul-specific collection of catch for sampling. With electronic monitoring, catch from different hauls would be kept separate on deck until fully documented according to electronic monitoring protocols established for the vessel. Alternative H2 is intended to allow for improved efficiency and fishing operations for shoreside IFQ trawl vessels.

Table 2-8. Bringing a haul on board before stowing the catch from the previous haul (Issue H): description, affected participants, and area affected.

Bringing a Haul On Board before Previous Catch is Stowed (Issue H)					
Issue	**Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Landing Successive Hauls	H1	No Action: Entire haul must be stowed before next haul can be landed on the deck	Shoreside IFQ trawl vessels	Entire region	No Change
	H2 (Preferred)	Another haul may be landed before the prior haul is stowed, but may not be mixed until observer sampling has been completed	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels would be allowed to land a second haul on deck before the first haul is stowed, though the two hauls may not be mixed until all observer sampling has been completed for both hauls

2.9 Summary of Council's Preferred Alternatives and NMFS Sub-option 1

Table 2-9. Summary of the Council's Preferred Alternatives and Alternative D3, NMFS Sub-option 1. Only key components are shown for each alternative; see text in Section 2 for more detail.

Final Preferred Alternatives					
Issue	**Preferred Alternative**	**Description**	**Participants Affected**	**Area Affected**	**Impact on Participants**
Minimum Mesh Size	A3	Remove all mesh size restrictions except that affecting the 20 ft immediately behind the footrope or headrope on midwater trawl nets	Groundfish trawl vessels	Entire region	All groundfish trawlers no longer need to have nets comply to a minimum mesh size
Measuring Mesh Size (definition)	B2	Revise language of 50 CFR 660.11 to include language regarding knotless webbing	Groundfish trawl vessels	Entire region	No change to fishing practices
Codend Regulations	C2	Allow double-wall codends; allow use of chafing gear to create a double-wall codend	Groundfish trawl vessels	Entire region	Trawl vessels would no longer be prohibited from using or creating double-wall codends
Selective Flatfish Trawl Definition and Required Use	D3	Modify SFFT definition to allow a two- or four-seamed net; No longer require SFFT shoreward of the RCA boundary **N. of 40°10′ N. lat**.; Groundfish bottom trawls shoreward of the RCA would continue to be bound by a small footrope requirement	Groundfish bottom trawl vessels	Entire region, AND changed restrictions **N. of 40°10′ N. lat**.	Groundfish bottom trawl vessels would choose between two- and four-seamed nets, and would no longer be required to use SFFT shoreward of the RCA boundary **N. of 40°10′ N. lat.**, provided they use a small footrope
	D3, NMFS Sub-option 1	Same as D3, except no longer require SFFT shoreward of the RCA boundary **N. of 42° N. lat.**	Same as D3	Entire region, AND changed restrictions **N. of 42° N. lat.**	Same as D3, except groundfish bottom trawl vessels would no longer be required to use SFFT shoreward of the RCA boundary **N. of 42° N. lat.**
Chafing Gear	E3	Chafing gear restrictions would be eliminated for groundfish bottom trawl and midwater trawl gear	Groundfish trawl vessels	Entire region	Trawl vessels may use chafing gear as it best suits their operations, with no restrictions on covering or connecting to the codend
Same-trip Use of Bottom Trawl and Midwater Trawl Gear	F3	Allow any type of groundfish bottom trawl and midwater trawl gear on board simultaneously, and any of these gears to be fished on a single trip; Separate and report catch by gear type (bottom vs midwater trawl)	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may carry any type of bottom trawl gear and midwater trawl gear on board simultaneously, and fish with any of them; Would sort and report catch by gear type
Fishing in Multiple IFQ Management Areas on a Single Trip	G3 Option 2	Vessels may fish in multiple IFQ areas on a single trip; Catch would not have to be sorted by area, and catch from multiple areas could be recorded on a single fish ticket; Tows would be allowed to cross IFQ management lines; Quota pounds would be deducted on a pro rata basis	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels may fish in multiple IFQ management areas in a single trip, and would not have to keep catch separated by area or report catch separately by area on fish tickets; Tows would be allowed to cross IFQ management lines
Landing Successive Hauls	H2	Another haul may be landed before the prior haul is stowed, but may not be mixed until observation sampling has been completed	Shoreside IFQ trawl vessels	Entire region	Shoreside IFQ trawl vessels could land a second haul before the first haul is stowed, though the two hauls may not be mixed until all observation sampling has been completed

2.10 Alternatives Considered but Rejected

During development of this action, the measures in this section were considered but rejected for further analysis by the Council. They are described below.

2.10.1 Removal of the SFFT Description from Regulations

In 2012, members of the fishing industry recommended the complete removal of regulations defining SFFT, as well as the required use of the gear (Agenda Item I.5.a, Attachment 4 – Gear Workshop Report, November 2012). Members of the fishing industry requested having only a general definition for small footrope trawl to allow for experimentation with four-seam nets that are better suited for the use of flexible sorting grates and for experimentation with new net designs or net configurations. Although this alternative was considered, it was not carried forward because removing the requirement to use SFFT would have the same effect as Alternative D3, which would remove the requirement for groundfish bottom trawl vessels to use SFFT shoreward of the trawl RCA north of 40°10' N. latitude. In addition, the salmon biological opinion (NMFS 2017a) requires SFFT for groundfish bottom trawling within the Klamath and Columbia River Conservation Zones to reduce trawl impacts on ESA-listed salmon.

2.10.2 Sub-options Associated with Alternative F3 (Multiple Gears Onboard)

Alternative F3, which would allow multiple types of trawl gear to be onboard and fished during the same trip (see Section 2.6), included gear-type and sorting sub-options that were considered at the March 2016 Council meeting (Agenda Item G.8, Supplemental Attachment 4, March 2016). The Council's preferred sub-options are shown in Section 2.6. Sub-options rejected by the Council are described below (see Decision Summary Document, Council, March 2016).

- Gear-type Sub-option B, which would allow the use of any legal IFQ groundfish gear on the same trip, was removed from consideration during the Council motion at the March 2016 Council meeting, based on reasoning shown in the GAP Report (Agenda Item G.8.a, Supplemental GAP Report, March 2016). The GAP supported Alternative F3, but it suggested eliminating sub-option B because it is unlikely fishermen would use both trawl and fixed gear on the same trip.
- Sorting Sub-option B, which was considered but rejected under an amendment to the original Council motion at the March 2016 meeting, would allow catch to be mixed in the hold regardless of gear type used (i.e., bottom and midwater trawl). Catch would be recorded on a single electronic fish ticket. This Sub-option was rejected because of concern for reduced accuracy of data used for stock assessments and protected species.

2.10.3 Allow Year-round Use of Midwater Gear

Midwater non-whiting trawl gear is prohibited north of 40°10′ N. latitude before the start of the Pacific whiting fishery. South of 40°10′ N. latitude, midwater trawl gear is allowed year-round seaward of the trawl RCA, and it is prohibited inside and shoreward of the trawl RCA. During the development of this action, members of the fishing industry requested that the seasonal restrictions be removed from regulation and that a year-round midwater trawl fishery for any species be allowed throughout the entire EEZ (Agenda Item I.5.a, Attachment 4 – Gear Workshop Report, November 2012). Because of potential impacts on ESA-listed salmon, allowing year-round use of non-whiting midwater trawl gear throughout the EEZ would require separate Council consideration. The Council and NMFS discussed the need for additional data before considering the expansion of the midwater trawling season to a year-round fishery north of 40°10' N. latitude; they decided that data might be most appropriately collected through an exempted fishing permit (Agenda Item D.1.a, NMFS Report 3, June 2015). An EFP designed to collect this information was initiated in 2018 (Section 4.3.1.1) (see Appendix D).

2.10.4 Use of Midwater Trawl Gear Inside the Trawl RCA South of 40°10' N. Latitude

At the Council's September 2015 meeting, the GAP recommended including an allowance for the use of midwater trawl gear within the trawl RCA south of 40°10′ N. latitude (Agenda Item H.2.a, Supplemental GAP Report, September 2015). Current regulations allow midwater non-whiting trawl gear seaward of the trawl RCA. Members of the fishing industry indicated that allowing the use of midwater gear within the trawl RCA, both north and south of 40°10′ N. latitude, would clarify regulations and eliminate a management line while allowing fishermen access to healthy stocks. This issue was not moved forward at the time of Council action because it would entail analyses that would be particularly challenging, given data limitations (Agenda Item F.6, Attachment 5, November 2015). An EFP was initiated in 2018 that was designed to collect this information (Section 4.3.1.1) (see Appendix D).

2.10.5 Allow the Targeting of Pacific Whiting with any Type of Trawl Gear

At the Council's September 2015 meeting, the GAP recommended allowing Pacific whiting fishing with any trawl gear (Agenda Item H.2.a, Supplemental GAP Report, September 2015). In that statement, the GAP recommended deleting the current regulation at 50 CFR 660.112(b)(1)(viii), which prohibits fishing "on a Pacific whiting IFQ trip with a gear other than midwater groundfish trawl gear." This issue was dropped from consideration, however, because it would entail analysis that would be particularly challenging, given data limitations (Agenda Item F.6, Attachment 5, November 2015).

2.10.6 Allowance to Move Fixed Gears Across Management Lines

Vessels that participate in the shoreside IFQ program may fish in only one IFQ management area during a trip. For vessels using fixed gear under the gear switching provision, vessel operators must offload their catches before resetting their gear in a different IFQ management area. Under current regulations, fixed gear catch from one IFQ management area must be landed before the gear can be reset in a new IFQ management area. During the development of this action, consideration was given to allowing gear-switching vessels in the catch share program to move fixed gear across management lines if they would provide a new fishery declaration made with the intent to check and move gear (Agenda Item I.5.a, Attachment 4 – Gear Workshop Report, November 2012). This alternative was removed from further consideration at the GAP's request, because the goal of Multiple Area Alternative G3 (Section 2.7) was to allow groundfish trawl fishermen to tow across IFQ management lines, which was allowed prior to the implementation of the catch shares (Agenda Item G.9.a, Supplemental GAP Report, June 2016).

2.10.7 Fixed Gear Restrictions South of 36° N. Latitude

Previously when NMFS was preparing an EIS for this action, NMFS published an NOI (81 FR 11189) (Section 1.4). In response to that NOI, NMFS received nine comment letters and emails from California fishermen who participate in the traditional fixed gear fleet off southern California (south of 36° N. latitude) (Appendix A). The comment letters identified biological and economic impacts on their industry and communities because of the catch share program's gear-switching provision, and they asked that this action consider measures to constrain gear-switching activity south of 36° N. latitude. The gear-specific constraints for these fixed gear vessels would include restrictions on the quantity of trap gear that could be used, the duration that unattended gear that could be left on the grounds, and the underwater storage of gear.

These concerns were not addressed in this action because they did not fit the purpose and need (Section 1.2). The purpose of this action is to provide more flexibility in the configuration and use of gear for participants in the trawl rationalization program. The concerns shown in these response letters were new issues developed after the implementation of Amendment 20 that affected fixed gear fishermen outside of the trawl rationalization program. These concerns are considered and discussed under the five-year review of the catch share program (NMFS and Council 2017).

3 AFFECTED ENVIRONMENT

This chapter describes the environment that would be affected by the proposed action, along with the potential impacts of that action. The descriptions of the affected environment below reflect conditions as they currently exist, before the proposed action would be implemented, and they provide a baseline for considering the potential impacts. Because this section focuses specifically on those elements of the environment that are potentially affected by the proposed action, it does not include additional information on other parts of the environment that are unaffected (e.g., California Current Ecosystem and cultural resources). For more detailed information on the Pacific Coast Groundfish Fishery or topics not covered in this EA, see Chapters 3 of the 2015-16 Harvest Specifications FEIS (Council and NMFS 2015), 2017-18 Harvest Specifications EA (NMFS 2016a), and the EA for the Chafing Gear Trawl Rationalization Trailing Action (Council and NMFS 2014).

3.1 Physical Environment

Section 3.1 focuses on those aspects of the physical environment that are most likely to be affected by changes in groundfish management strategies relative to trawl gear, changes in IFQ area management, and changes relative to essential fish habitat (EFH) interactions.

3.1.1 Essential Fish Habitat (EFH)

Section 7 in the Groundfish FMP (Council 2016a) describes groundfish EFH.[5] The current EFH descriptions were incorporated into the FMP in 2006 through Amendment 19. Amendment 19 established measures to mitigate the adverse impacts of fishing on groundfish EFH; these measures are fully described in FMP Section 6 (Management Measures). The mitigation measures include gear restrictions (FMP Section 6.6), time/area closures (FMP Section 6.8), and measures to control fishing capacity (FMP Section 6.9). As acknowledged in Section 7.4 of the FMP, "Some of the management measures … have been implemented specifically to mitigate adverse impacts to EFH while others may have another primary purpose … but may have a corollary mitigating effect on adverse impacts to EFH."

Trawl Gear and EFH **-** The most common and direct effect of fishing on groundfish habitat results from fishing gear coming into contact with bottom habitats. Fishing gears can cause physical harm to corals, sponges, rocky reefs, sandy ocean floor, eelgrass beds, and other components of seafloor habitats. Indirect effects on habitats include physical contact of the vessel with habitat while underway, gear that sinks or is

[5] Since 2000, the Council has undertaken a review of the EFH designations that is likely to result in changes in 2019. See the following: http://www.pcouncil.org/groundfish/groundfish-essential-fish-habitat/.

abandoned, chemical effects derived from paints or oils used on the vessel, and subsequent bilge waste release. The action alternatives under consideration in this EA have the potential to impact important groundfish habitats.

The Council implemented small footrope requirements January 4, 2000 (65 FR 221). These rules limit most groundfish trawl fishing on the continental shelf to those trawl nets with small footropes (equal to or less than 8 inches in diameter, including any rollers or rock-hopper gear or midwater gear). Small footrope requirements also apply shoreward of the rockfish conservation areas. This small footrope requirement was implemented to prevent access to overfished groundfish species. From initial studies, small footropes have been effective at discouraging fishermen from accessing most rocky habitat (see Section 3.4.1 and Section 3.4.2.2). Small footrope trawl gear is defined in 50 CFR 660.302 and 660.322(b).

Habitat Disturbance - Changes in habitat structure due to bottom contact of fishing gear depends on habitat (i.e., soft bottom, hard bottom, or reef), previous fishing intensity, gear type (e.g., bottom trawl or midwater trawl), and gear component (e.g., footrope type and size) (NRC 2002). In general, trawl impacts are held to be most severe when used on hard bottom habitat and with gear that has a high degree of contact with the bottom surface (NRC 2002). Most of the bottom habitat off the Washington, Oregon, and California coasts to the 700-fm EFH boundary consists of soft substrate (91 percent) (Table 3-1). Hard and mixed substrates appear to be relatively rare in this groundfish management area (5.9 percent and 1.5 percent, respectively) when compared coastwide to soft substrate.

Table 3-1. Percent habitat type (substrate) within the area bound by the coastlines of Washington, Oregon, and California and the 700-fm EFH boundary. Source: Data summarized from Table 2.1 in NMFS (2013)

Substrate	Area (ha)	Percent
Hard	940,220	5.9%
Mixed	241,987	1.5%
Soft	14,530,534	91.0%
Undefined	262,853	1.6%

The degree of impact that affects a habitat depends on several conditions; these include the inherent dynamics (dynamic versus static), history of disturbances (disturbed versus non-disturbed), and recovery of fished habitats and the relationships of adjoining habitats (Council 2012). Although virtually all fishing gear can affect the structure and biota of a given bottom habitat, the significance of the impact can be difficult to predict and quantify fully. There are natural background levels of disturbance to all types of benthic communities because of large-scale activities such as storms, wave action, tidal currents, and

geological events, as well as smaller-scale actions such as bioturbation of predator feeding activities (Hall 1994; Kaiser et al. 2002).

Historic and, to a lesser degree, contemporary fishing activities have been concentrated at specific areas on the continental shelf and slope. This repetitive fishing activity disturbs the seafloor to various degrees depending on gear types used. Most of the current trawling activities occur on soft, unconsolidated sand and mud seafloor and adjacent to hard bedrock outcrops (Council 2012). Where fishing disturbance exceeds background levels and frequency of the natural disturbance, the impacts of fishing will also vary because of the magnitude and spatial extent of the disturbance, the complexity of the habitat substrate, the configuration and towing speed of the gear, and other factors (Collie 2000; NRC 2002). For example, depending upon the habitat type, intensive but spatially localized disturbances may have relatively lower ecological impacts than more infrequent, but widespread, fishing disturbance (Kaiser et al. 2002).

3.1.2 Essential Fish Habitat Conservation Area (EFHCA)

An EFHCA is a type of closed area where specified types of fishing gears are prohibited; EFHCAs are defined by latitude and longitude coordinates at 50 CFR 660.75 through 660.79, subpart C. EFHCAs apply to vessels using bottom trawl gear or to vessels using “bottom contact gear” (which would include bottom trawl and other fishing gear types). Midwater trawling is allowed in EFHCAs when midwater trawl fishing is allowed in adjacent waters by the groundfish regulations (50 CFR 660 Parts C-G). Currently, there are 4,515 square miles of EFHCAs closed to bottom trawling off the United States West Coast: 816 miles^2 of hard bottom, 55 miles^2 of mixed bottom, 3,604 miles^2 of soft bottom, and 40 miles^2 of unknown bottom type (Table 4-2 in NMFS and Council 2018).

Amendment 19 established EFH boundaries and conservation areas in 2006 (Agenda Item D.6.b, Supplemental NMFS Report, April 2013). NMFS and the Council are considering changes to EFHCA under Amendment 28, which is expected to increase EFHCA-specific protections (NMFS and Council 2018) (See Section 5).

3.1.3 Rockfish Conservation Area (RCA)

RCAs (PFMC 2016c) are large-scale closed areas that extend along the entire length of the United States West Coast. Vessels that are subject to the trawl RCA restrictions may not fish in the trawl RCA, or operate in the trawl RCA for any purpose other than transiting. RCA boundaries are defined by a series of latitude/longitude coordinates intended to approximate particular depth contours. RCA boundaries for particular gear types differ between the northern and southern areas of the coast. RCA boundaries change at different times of the year. The locations of the RCA boundaries were established to minimize the incidental catch of overfished rockfish. The closed areas eliminated fishing opportunity in areas where,

and times when, those overfished species are most likely to co-occur with more healthy stocks[6] of groundfish. NMFS and the Council are considering changes to trawl RCAs under Amendment 28 (See Section 5).

Although EFHCAs and trawl RCAs have different purposes, both actions prohibit bottom trawl activities in specific areas, thereby providing habitat protections in those areas. RCAs protect various benthic habitat types, hard-bottom or rocky habitats in particular, where overfished rockfish are most abundant. Several current EFHCAs overlap with the current trawl RCA. Areas within and/or adjacent to the current trawl RCAs contain ecologically important and/or sensitive habitats important to overfished species and targeted groundfish species.

Although groundfish bottom trawling does not occur in the trawl RCA, some state-managed fisheries (e.g., pink shrimp trawl fishery) do operate in parts of the trawl RCA. These fisheries can fish in the trawl RCA, but they are restricted from EFHCAs.

3.2 Biological Environment

The following sections describe the affected environment for selected groundfish species (target and non-target), non-groundfish species, prohibited species, and protected species. Information is presented as it relates to the alternatives.

Fish stocks classified as fishery management units (FMUs) are in the fishery, whether as target or non-target species. Federal regulations at 50 CFR 600.310(d)(3) and (4) provide the following definitions for "target stocks" and "non-target species," both of which are considered FMU species: Target stocks are stocks that fishermen seek to catch for sale or personal use, including "economic discards" as defined under MSA 3(9). Non-target species and non-target stocks are fish caught incidentally during the pursuit of target stocks in a fishery, including "regulatory discards" as defined under MSA section 3(38). They may or may not be retained for sale or personal use. Non-target species may be included in a fishery and, if so, they should be identified at the stock level. Some non-target species may be in an FMP as ecosystem component species (EC species) (Council 2016a).

The information in the following subsections is summarized from Appendix B, Part 2 of the groundfish FMP (Council 2005a), Stock Assessment and Fishery Evaluation (SAFE)[7] documents, the 2015-16

[6] The term "healthy" is described in the Groundfish FMP as stock biomass greater than the maximum sustained yield (MSY) biomass target level.

[7] http://www.pcouncil.org/groundfish/safe-documents/

Harvest Specifications FEIS (Council and NMFS 2015), and the 2017-18 Harvest Specifications EA (NMFS 2016a).

3.2.1 Groundfish

More than 90 fish species are actively managed under the Groundfish FMP (Council 2016a). These species include more than 60 rockfish species, 12 flatfish species, 6 roundfish species, and 4 species of elasmobranchs. In addition, shared ecosystem component (EC) species, which include other skates, grenadiers, herrings, smelts, squids, etc., are monitored under the Groundfish FMP (Council 2016a).

The life-history traits of groundfish species have important implications for stock assessments and how the stocks are managed. This is because fishing changes population abundance of the target species, as well as affecting life-history traits and population dynamics. Fishing may also affect yield.

Groundfish harvest levels are established every two years through the harvest specifications and management process and are based on the best available scientific information. Harvest specifications include overfishing limits (OFLs), ABCs, and ACLs for each management unit (Council 2016a). The OFL is the MSY harvest level associated with the current stock abundance. It is the estimated or proxy MSY harvest level, which is the harvest threshold above which overfishing occurs. The harvest specifications are consistent with the policies and procedures established in the Groundfish FMP and in compliance with other applicable laws established to manage the groundfish stocks at sustainable levels and to rebuild overfished stocks. For overfished species, the ACLs are based on the rebuilding plans intended to rebuild the stock in as short a period as possible, while considering the status and biology of the stock, the needs of fishing communities, and the interaction of the overfished stock with the marine ecosystem. Accountability measures are proposed to prevent catch from exceeding the annual limits set for management units. The accountability measures include ACL reductions (set-asides), sector allocations, and adjustments to management measures. Allocations establish overall limits for different groundfish fishery sectors (segments of the overall fishery distinguished by gear type, permit programs, target species, and other factors) as a basis for controlling catch. Detailed information on harvest specifications are found in the Harvest Specifications and Management Measures for 2015-2016 and Biennial Period Thereafter (Council and NMFS 2015) and the Harvest Specifications and Management Measures for 2017-2018 (NMFS 2016a).

3.2.1.1 Target Groundfish Species

Catcher processors and mothership catcher vessels target Pacific whiting. Vessels in the shoreside IFQ sector focus much of their effort on Pacific whiting, Dover sole, thornyheads, and sablefish (DTS species) along the continental slope, and flatfish species along the continental shelf. Historically, much of the

shoreside trawl fleet effort focused on rockfish species. However, since the early 2000s, regulatory restrictions to rebuild overfished stocks have reduced rockfish opportunities. To reduce rockfish catch in the shelf flatfish fisheries, only SFFT has been allowed shoreward of the trawl RCAs north of 40º10' N. latitude since 2005. The rebuilding of previously overfished stocks such as lingcod (2006), widow rockfish (2012), and canary rockfish (2016), as well as stocks identified as rebuilt in 2017 (i.e., bocaccio south of 40°10' N. latitude, darkblotched rockfish, and Pacific ocean perch [POP]), are expected to increase target fishing opportunity for both the rebuilt stocks and co-occurring stocks.

Generally, trawl target species are grouped as follows:

Pacific whiting target fishery – This category targets Pacific whiting with midwater trawl; it consists of both a shoreside and an at-sea component.

The DTS target fishery targets Dover sole, thornyheads (shortspine and longspine), and sablefish with bottom trawl gear. Vessels also use fixed gears to fish in the trawl catch share program (i.e., gear switching) (Figure 1-2), and they predominately target sablefish.

Non-whiting target fisheries – This category includes three broad target strategies: bottom trawl rockfish fishery, midwater rockfish fishery, and flatfish fishery.

For the purposes of this document, target groundfish stocks are considered to include only non-overfished species where the 2011 to 2017 average trawl mortality exceeded 25 percent of the trawl allocation (see Section 3.3.2) and where targeting occurs over a large geographical area by a large portion of the trawl fleet.

Overfishing (i.e., when total mortality across sectors exceeds the OFL) has not occurred for any trawl-targeted groundfish stock since the inception of the catch share program (Table 3-2). With the exception of Pacific whiting, sablefish, and petrale sole, the annual total groundfish mortality for target stocks across all sectors was less than 50 percent of the OFL (Table 3-2). The groundfish fishery reached greater than 50 percent of the OFL only for Pacific whiting (maximum = 87 percent), sablefish (maximum = 83 percent), and petrale sole (maximum = 93 percent) from 2011 to 2017.

Table 3-2 provides ACLs for trawl-target stocks for 2016 and 2017, and for selected stocks from 2011 to 2015. Although OFLs and ACLs may be relatively constant over time for some stocks, large interannual fluctuations may occur due to changes in stock status and harvest policy. For example, the ACL for widow rockfish increased from 2,000 mt in 2016 to 13,508 mt in 2017, and the petrale sole ACL doubled between 2011 and 2012.

Table 3-2. OFLs and ACLs for groundfish trawl target species (metric ton [mt]). Total mortality across all sectors (mt) and mortality as a percent of the annual OFL are provided from 2011 to 2017. ACLs are provided for 2016 and 2017 for all stocks and in earlier years for selected stocks. Source: Bellman et al. 2012; Bellman et al. 2013; Somers et al. 2014; Somers et al. 2015; Somers et al. 2016b; Somers et al. 2017a; Somers et al. 2018. TH = thornyhead; ATF = arrowtooth flounder; RF = rockfish.

Stock	2011			2012			2013			2014			2015			2016			2017		
	OFL (ACL)	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL (ACL)	Total Fishing Mortality	% OFL
Pacific whiting																					
Pacific whiting a/	719,370	231,996	32%	186,037	160,706	86%	269,745	234,499	87%	316,206	265,120	84%	383,365	155,559	41%	367,553	261,172	71%	441,433	356,839	81%
Dover Sole, Thornyheads (TH) and Sablefish																					
Dover sole	44,400	7,927	18%	44,826	7,175	16%	92,955	8,081	9%	77,774	6,566	8%	66,871	6,354	10%	59,221 (50,000)	7,290	12%	89,702 (50,000)	7,547	8%
Longspine TH (coastwide) b/	3,577	985	28%	3,483	930	27%	3,391	1,095	32%	3,304	921	28%	5,007	786	16%	4,763 (NA)	684	14%	4,571 (NA)	847	19%
Shortspine TH (coastwide) b/	2,384	1,011	42%	2,358	930	39%	2,333	1,069	46%	2,310	897	39%	3,203	907	28%	3,169 (NA)	949	30%	3,144 (NA)	1,029	33%
Mixed thornyhead	NA	6	NA	NA	2		NA	6	NA	NA	4	NA	NA	4	NA	NA	3	NA	NA	2	NA
Sablefish c/	8,808	6,582	75%	8,623	5,406	63%	6,621	4,192	63%	7,158	5,909	83%	7,857	5,290	67%	8,526 (NA)	5,405	63%	8,050 (NA)	5,809	72%
Non-whiting trawl target species																					
ATF	18,211	2,666	15%	14,460	2,508	17%	7,391	2,510	34%	6,912	1,843	27%	6,599	1,780	27%	6,396 (5,328)	1,474	23%	16,571 (13,804)	1,446	9%
Petrale sole	1,021 (976)	953	93%	1,279 (1,260)	1,111	87%	2,711 (2,592)	2,265	84%	2,774 (2,652)	2,439	88%	2,946 (2,816)	2,668	91%	3,044 (2,910)	2,652	87%	3,280 (3,136)	2,942	90%
Widow RF	5,097 (600)	216	4%	5,097 (600)	278	6%	4841 (1,500)	499	10%	4,435 (1,500)	748	17%	4,137 (2,000)	886	21%	3,990 (2,000)	1,014	25%	14,130 (13,508)	6,366	45%
Yellowtail RF	4,566	1,352	30%	4,573	1,570	34%	4,579	1,424	31%	4,584	1,461	32%	7,218	1,931	27%	6,949 (6,344)	1,418	20%	6,786 (6,196)	3,060	45%

a/ 2011 US OFL; 2012-2017 US TAC under US-Canada Treaty

b/ Longspine and shortspine thornyhead ACL is split north and south of 34° 27' N. latitude but is not shown here.

c/ Sablefish ACL is split north and south of 36° N. latitude but is not shown here. The ACL north of 36° N. latitude (5,252 mt) was exceeded by 2 percent in 2017 (Somers et al. 2018)

The following summaries of trawl fishery target species show the general distribution of the stock, habitat preference, most recent estimates of stock health and abundance relative to overfished thresholds, and recent fishing mortality relative to overfishing. The data provided in each summary are from the most recent stock assessments for each species and the Groundfish FMP Appendix I (Council 2016a). Trawl mortality relative to trawl allocations is provided in Section 3.3.2.

Pacific whiting - Pacific whiting is a semi-pelagic species distributed along the West Coast of North America, generally ranging from 25° to 55° N. latitude. Shoreside and at-sea midwater trawl fisheries target the coastal stock of Pacific whiting, which is a schooling species and is the most abundant groundfish in the California Current Ecosystem (CCE) (Berger et al. 2017). In 2016, observers monitored nearly all hauls in the at-sea trawl sector (motherships at 99.6 percent and catcher-processors at (100 percent) providing confidence in the estimates of fishing mortality.[8] Similarly, the shoreside Pacific whiting sector was fully monitored at sea with electronic monitoring and onshore by catch monitors. From 2012 to 2017, total mortality of Pacific whiting in the United States ranged from 32 to 87 percent of the United States total allowable catch (TAC) (Table 3-2).

Dover sole, thornyheads (shortspine and longspine), and sablefish

Dover sole- Dover sole range from Baja California to the Bering Sea and eastern Aleutian Islands (Kramer et al. 1995). Results from tagging studies conducted from 1948 to 1979 suggest that Dover sole migrate seasonally, moving onto the shelf in the summer and off the shelf in the winter with little evidence of considerable north-south movement (Westrheim et al. 1992). Dover sole spawn in relatively deep water from November to April, with the peak spawning period occurring from December to February (Hagerman 1952).

Dover sole tend to be found on mud or mud-sand bottom deeper than 37 m (20 fathoms [fm]) and out to deeper than 1,500 m (820 fm) (Jacobson and Hunter 1993). Tissot et al. (2007) found that Dover sole were most abundant in mud-dominated seafloors that included boulders, cobbles, and pebbles, as well as cobble-mud. Living to more than 50 years, female Dover sole attain a maximum length of 55 to 60 cm, about 5 to 10 cm longer than the males. Dover sole appear to shift into deeper waters gradually as they age (Jacobson et al. 2001).

[8] https://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/sector_products.cfm#ob

Groundfish trawl fisheries land most of the Dover sole. Dover sole is considered a healthy stock with the level of depletion well above the MSY target of 25 percent of unfished spawning biomass. Total mortality across all sectors ranged from 8 to 18 percent of the OFL from 2011 to 2017 (Table 3-2).

***Shortspine Thornyhead* -** Shortspine thornyhead range from northern Baja California to the Bering Sea and have been found in waters as deep as 1,524 m (833 fm) (Taylor and Stephens 2014). Distribution of the smallest shortspine thornyheads suggests that they settle to the bottom in depths from 100 to 400 m (55 to 219 fm). As they age, they are believed to migrate into deeper waters, although large individuals are found across the depth range (Taylor and Stephens 2014). The distribution of shortspine thornyhead varies along the West Coast, with higher densities (kg/ha) in shallower areas (under 500 m or 273 fm) off Oregon and Washington and higher densities in deeper areas off of California (Taylor and Stephens 2014). Jacobson and Vetter (1996) reported the greatest abundance of adults between 200 and 400 m (109 and 219 fm). Adult shortspine thornyheads are commonly found on muddy substrates and substrates with mixtures of mud and cobble and mud and boulders at depths between 160 m (87 fm) and 230 m (126 fm) (Eschmeyer et al. 1983; Pearcy et al. 1989; Stein et al. 1992; Love 1996).

Shortspine thornyhead is considered a healthy stock, with the level of depletion well above the MSY target of 40 percent of the unfished spawning biomass (Taylor and Stephens 2014). Most of the shortspine thornyhead catch in the north has been taken by bottom trawl, while most of the catch in the south has been taken by non-IFQ fixed gear. For the fishery as a whole, the total catch mortality has been well below the OFL from 2011 to 2017 (Table 3-2).

***Longspine Thornyhead* -** Longspine thornyhead ranges from Cabo San Lucas, Baja California, to the Aleutian Islands (Jacobson and Vetter 1996; Orr et al. 2000). Longspine thornyheads are estimated to occur to a maximum depth of 1,700 m (930 fm) (Stephens and Taylor 2014), and they prefer muddy or soft-sand bottoms (Alton 1986). Peak abundance and spawning biomass occur at depths around 1,000 m (547 fm) (Wakefield 1990; Jacobson and Vetter 1996).

Longspine thornyhead is considered a healthy stock (Stephens and Taylor 2014). Most of the longspine thornyhead catch in the north has been taken in deep-water, bottom trawl fisheries on the continental slope, while the majority of catch in the south has been taken by non-IFQ fixed gears. For the groundfish fishery as a whole, the total catch mortality has been well below the OFL from 2011 to 2017 (Table 3-2).

***Sablefish* -** Sablefish are widely distributed in the CCE, with smaller younger individuals generally found in shallower water, but they show a characteristic ontogenetic shift to a fully mixed (adult and juvenile) demographic in deeper water near the shelf-slope break (Johnson et al. 2016). Adults dominate the biomass beyond the shelf-slope break, and younger fish become increasingly rare (Methot et al. 1994).

Sablefish stocks are not considered healthy; instead, they are in the precautionary zone because the relative spawning biomass is below the MSY target of 40 percent of unfished spawning biomass, but it is above the overfished level of 25 percent (Johnson et al. 2016). Sablefish are caught by IFQ trawl, IFQ fixed gear, and non-IFQ fixed gear. Coastwide for the whole groundfish fishery, the total catch mortality has been below the OFL annually from 2011 to 2017 (Table 3-2). However, sablefish mortality for the northern sablefish stock exceeded the ACL by 2 percent in 2017 (Somers et al. 2018).

Other non-whiting target species

Arrowtooth flounder - Arrowtooth flounder range from northern California north to the eastern Bering Sea. They are typically found at depths ranging from 50 to 800 m (27 to 437 fm) (Sampson et al. 2017). Arrowtooth flounder migrate inshore during the summer (Zimmerman and Goddard 1996). Juveniles and adults are most commonly found on sand or sandy gravel substrata, but they occasionally occur over low-relief rock-sponge bottoms (NOAA 1990).

Arrowtooth flounder is considered a healthy stock (Sampson et al. 2017). It is primarily caught by trawl gear (Kaplan and Helser 2007). Much of the arrowtooth flounder catch is discarded as bycatch due to low flesh quality and a lack of market (Kaplan and Helser 2007; Sampson et al. 2017). Fishing mortality across sectors has been less than 35 percent of the OFL from 2011 to 2017 (Table 3-2).

Petrale sole - Petrale sole are found from Baja California to the Gulf of Alaska (Hart 1988). Petrale sole move from shallow summer feeding grounds to deep-water spawning grounds in the winter. PacFIN fishery trawl logbook data show that adults off the West Coast are caught in depths from 18 to 1,280 m (10 to 700 fm), with most being taken between 70 to 220 m (38 to 120 fm) from March through October, and between 290 to 440 m (159 to 241 fm) from November through February (Stawitz et al. 2016).

Recent petrale sole catches exhibit marked seasonal variation, with most of the annual harvest taken from the spawning grounds during December and January (Stawitz et al. 2016). Petrale sole are harvested almost exclusively by groundfish bottom trawls. Total catch mortality across sectors has remained below the OFL annually from 2011 to 2017 (Table 3-2).

Widow rockfish - Widow rockfish are most abundant from British Columbia to northern California (Hicks and Wetzel 2015). Widow rockfish are most common in depths from 100 to 350 m (55 to 191 fm), but they can be found in depths from 24 to 549 m (13 to 300 fm) (Eschmeyer et al. 1983; NOAA 1990; Orr et al. 2000; Love et al. 2002). They are known to form dense midwater aggregations at night, but can also be solitary (Love et al. 2002). Widow rockfish occur over hard bottoms along the continental shelf (NOAA 1990).

Widow rockfish, which was targeted by non-whiting midwater trawl in the 1980s through the 1990s (Council 2016d), was declared overfished in 2001 (Williams et al. 2000), but became rebuilt in 2011 (He et al. 2011) and increased in biomass in 2015 (Hicks and Wetzel 2015). The rebuilt status has resulted in an increase in fishing effort by non-whiting midwater fisheries that target widow rockfish; widow rockfish catches have been increasing annually since 2011 (Table 3-2). The total annual mortality between 2011 and 2017 was well below the respective OFLs (Table 3-2).

Yellowtail rockfish - Yellowtail rockfish are found throughout the northeast Pacific Ocean ranging from San Diego, California, to Kodiak and Admiralty Island, Alaska (Hart 1988). Yellowtail rockfish is a shelf rockfish species reported to occur at depths of 0 to 549 m (0 to 300 fm) (Hart 1988) with commercial harvest occurring at depths of 110 to 201 m (60 to 110 fm) (Fraidenburg 1980; Tagart and Kimura 1982).

Yellowtail rockfish adults are considered semi-pelagic (Laroche and Richardson 1981; Stanley et al. 1994) and are most common near the bottom, but not on the bottom (Murie et al. 1994; Stanley et al. 1994; Love 1996). Adult yellowtail rockfish can be found above mud with cobble, boulder, and rock ridges, and sand habitats; they are not, however, found on mud or flat rock (Laroche and Richardson 1981; Love 1996).

Yellowtail rockfish is considered a healthy stock, with the spawning biomass estimated to be well above the MSY target of 40 percent of unfished spawning biomass (Cope et al. 2015). Yellowtail rockfish commonly occur with canary and widow rockfishes (Cope and Haltuch 2012). Despite its popularity in commercial and recreational fisheries, its association with those highly regulated species has greatly decreased removals over the last decade.

A limited opportunity to target yellowtail rockfish in the trawl fishery has been available since 2011 under the trawl rationalization program, yet low quotas for widow rockfish, canary rockfish, and for other constraining stocks limited mid-water targeting of yellowtail rockfish. With the improved status of widow and canary rockfish, the industry is developing a strategy to better target the species and attain more of their trawl allocations (Council 2016d). Total fishing mortality of yellowtail rockfish across sectors nearly doubled in 2017 relative to the previous six years, largely due to the improved status of widow rockfish and canary rockfish (Table 3-2). However, the total fishing mortality of yellowtail rockfish across all sectors remained at less than 50 percent of the OFL each year from 2011 to 2017 (Table 3-2).

3.2.1.2 Non-target Groundfish Species

The following section addresses non-target groundfish species taken by vessels using trawl gear. For the purposes of this document, non-target groundfish species are considered to include overfished species and non-overfished species where the 2011 to 2017 average total catch mortality did not exceed 25 percent of the trawl allocations for the same period (see Section 3.3.2), or where targeting may be limited to a small area of the coast or by a limited number of vessels (e.g., longnose skate and lingcod). Target species are expected to change in the future as the fishery evolves and as status of stocks change. As overfished stocks become rebuilt, fishing restrictions may be reduced, fishing practices may become more efficient, and new market opportunities may arise. Historical target species may reappear, while others may be targeted by only a small portion of the fleet and not broadly considered to be target species.

Total fishing mortality relative to the OFL for non-target groundfish are shown in Table 3-3. Although total mortality for most non-target groundfish stocks represented less than 50 percent of the OFL, more than 50 percent of the OFL was reached for a few stocks, all of which are caught primarily by the non-trawl sector (i.e., black rockfish, cabezon, California scorpionfish, minor nearshore rockfish, and “other fish”); (Somers et al. 2017a). Fishing mortality of these stocks by the trawl sector was less than 0.3 percent of the total mortality (Somers et al. 2017a).

Overfished groundfish species - The status of overfished stocks, how a stock is determined to be overfished, and the effect of rebuilding measures are defined within the NEPA documents supporting the biennial harvest specifications and management measures for 2015-2016 and 2017-2018 (Council and NMFS 2015; NMFS 2016a) and are not repeated here. This section describes total fishing mortality of overfished species by trawl gear relative to the harvest specifications established by rebuilding plans (Council and NMFS 2015; NMFS 2016a). These harvest specifications are intended to rebuild the stocks within the prescribed time frame.

For each overfished groundfish stock with an approved rebuilding plan, there is a specified target year for rebuilding the stock to its MSY level, and a harvest control rule that is used to derive an ACL to rebuild the stock. As of January 1, 2017, there were five stocks managed under rebuilding plans (NMFS 2016a). These species include bocaccio, cowcod, darkblotched rockfish, POP, and yelloweye rockfish. New 2017 stock assessments for bocaccio, darkblotched rockfish, and POP estimate these stocks to be rebuilt (He and Field 2017; Wallace and Gertseva 2017; Wetzel et al. 2017). Harvest specifications for bocaccio, darkblotched rockfish, and POP will no longer be specified by rebuilding plan harvest control rules in 2019 (see Table 2-1 in NMFS 2018b).

Yelloweye rockfish and cowcod are most frequently caught by non-trawl gear (commercial and recreational), whereas POP and darkblotched rockfish are a primarily caught in the trawl fisheries. Bocaccio rockfish are most commonly caught by trawl gear and non-trawl gear (commercial and recreational), especially south of 40º10' N. latitude. From 2011 to 2017, total mortality for each of the overfished species was well below the OFL across all sectors (Table 3-3).

Other non-target groundfish species - Non-target groundfish species are caught with trawl gear and include stocks with species-specific trawl allocations, stocks in complexes with trawl allocations, and species without specific trawl allocations (Table 3-4). Groundfish species without trawl allocations include trip limit species and EC species. The non-target groundfish species include flatfish, rockfish, roundfish, sharks, and skates as shown in Table 3-3 and Table 3-4.

Flatfish species are primarily taken with trawl gear (Table 3-4). The “other flatfish” complex consists of flatfish species that are not managed with stock-specific OFLs/ABCs/ACLs; it includes butter sole, curlfin sole, flathead sole, Pacific sanddab, rock sole, sand sole, and rex sole. From 2011 to 2017, the total mortality of “other flatfish” for the groundfish fishery has been well below the complex OFL (Table 3-3).

Adult canary rockfish are typically found along the continental shelf shallower than 300 m (Council 2016d). Adults primarily inhabit areas in and around rocky habitat. They form very dense schools, leading to an extremely patchy population distribution that is reflected in both fishery and survey encounters. Canary rockfish are often caught with lingcod, yellowtail rockfish, and other rockfishes. Canary rockfish have long been an important component of rockfish fisheries, but have constrained rockfish fisheries since being declared overfished in 2000. A 2015 stock assessment (Thorson and Wetzel 2016) found canary rockfish rebuilt at the beginning of 2015 (Thorson and Wetzel 2016). As of January 1, 2017, canary rockfish are no longer managed under a rebuilding plan; canary rockfish ACLs increased from 125 mt in 2016 to 1,714 mt in 2017 (Table 3-3). This increase in ACL resulted in more than a four-fold increase in canary rockfish harvest (mortality) across all sectors; however, total mortality remained well below the OFL in 2017.

Non-target, trawl-dominant rockfish species (Table 3-4) include aurora, bank, blackgill, chilipepper, darkblotched, greenstriped, pink rockfish, redstripe rockfish, rougheye, sharpchin, silvergray, shortraker, shortbelly, splitnose, stripetail, and yellowmouth rockfish. Except for blackgill rockfish south of 40°30' N. latitude, which is a precautionary zone stock, all of these assessed stocks are considered healthy (Table 3-4).

Table 3-3. OFLs and ACLs for groundfish stocks that are not primary trawl targets (mt). Total mortality (mt) across all sectors and mortality as a percent of the annual OFL are provided for 2011 to 2017. ACLs are provided for 2016 and 2017 for all stocks. Source: Bellman et al. 2012; Bellman et al. 2013; Somers et al. 2014; Somers et al. 2015; Somers et al. 2016b; Somers et al. 2017a; Somers et al. 2018. S=south; N = north; RF = rockfish.

Stock	2011			2012			2013			2014			2015			2016			2017		
	OFL (ACL)	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL (ACL)	Total Fishing Mortality	% OFL	OFL (ACL)	Total Fishing Mortality	% OFL
Ovefished Species on 1/1/2017																					
Bocaccio a/	737	112	15%	732	140	19%	884	149	17%	881	119	14%	1,444	142	10%	1,351 (362)	122	9%	2,139 (790)	225	11%
Cowcod	13	1	8%	13	1	8%	11	2	18%	12	1	8%	67	1	1%	68 (10)	1	2%	70 (10)	2	2%
Darkblotched Rockfish a/	508	133	26%	497	105	21%	541	133	25%	553	140	25%	574	148	26%	580 (346)	146	25%	671 (641)	238	35%
POP a/	1,026	62	6%	1,007	56	6%	844	58	7%	838	56	7%	842	60	7%	850 (164)	68	8%	964 (281)	124	13%
Yelloweye Rockfish	41	9	22%	48	12	25%	51	11	22%	51	9	18%	52	12	23%	52 (19)	9	18%	57 (20)	18	32%
Groundfish species that are not primary trawl target species																					
Big skate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	385	NA	541 (494)	260	48%
Black RF (S)	1,217	523	43%	1,169	563	48%	1,159	845	73%	1,166	865	74%	1,176	908	77%	1,183 (1,000)	761	64%	349 (334)	NA	NA
Black RF (N)	445	208	47%	435	249	57%	430	252	59%	428	261	61%	421	306	73%	423 (404)	361	85%	577 (527)	NA	NA
Cabezon (CA)	187	50	27%	176	74	42%	170	68	40%	165	82	50%	161	90	56%	158 (151)	78	49%	157 (150)	55	35%
Cabezon (OR)	52	48	92%	50	47	94%	49	34	69%	49	27	55%	49	27	55%	49 (47)	28	57%	49 (47)	51	104%
California scorpionfish	141	104	74%	132	120	91%	126	115	91%	122	125	**102%**	119	84	71%	117 (111)	81	69%	289 (150)	86	30%
Canary RF	614	52	8%	622	45	7%	752	43	6%	741	46	6%	733 (122)	112	15%	729 (125)	73	10%	1,793 (1,714)	322	18%
Chilipepper RF	2,073	329	16%	1,872	302	16%	1,768	404	23%	1,722	334	19%	1,703	204	12%	1,694 (1,619)	92	5%	2,727 (2,607)	128	5%

a/ Stock rebuilt during the 2017 to 2018 harvest specifications cycle; ACLs will no longer be based on rebuilding plans beginning January 1, 2019

Table 3-3 Continued.

Stock	2011			2012			2013			2014			2015			2016			2017		
	OFL (ACL)	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL	Total Fishing Mortality	% OFL	OFL *(ACL)*	Total Fishing Mortality	% OFL	OFL *(ACL)*	Total Fishing Mortality	% OFL
English sole	20,675	205	1%	10,620	224	2%	7,129	357	5%	5,906	306	5%	10,792	389	4%	7,890 (7,204)	451	6%	10,914 *(9,964)*	349	3%
Lingcod (N)	2,438	588	24%	2,251	731	32%	3,334	861	26%	3,162	724	23%	3,010	765	25%	2,891 *(2,719)*	809	28%	3,549 *(3,333)*	1,167	33%
Lingcod (S)	2,523	264	10%	2,597	337	13%	1,334	433	32%	1,276	575	45%	1,205	723	60%	1,136 (946)	671	59%	1,502 *(1,251)*	539	36%
Longnose skate	3,128	1,133	36%	3,006	991	33%	2,902	989	34%	2,816	911	32%	2,449	850	35%	2,405 *(2,000)*	924	38%	2,556 *(2,000)*	900	35%
Minor Nearshore Rockfish (N)	116	99	85%	116	96	83%	110	75	68%	110	59	54%	88	64	73%	88 *(69)*	56	64%	118 *(105)*	90	76%
Minor Shelf Rockfish (N)	2,188	85	4%	2,197	90	4%	2,183	70	3%	2,195	94	4%	2,209	70	3%	2,218 *(1,952)*	78	4%	2,303 *(2,049)*	320	14%
Minor Slope Rockfish (N)	1,462	341	23%	1,507	453	30%	1,518	355	23%	1,553	295	19%	1,831	371	20%	1,844 *(1,706)*	345	19%	1,897 (1,755)	430	23%
Minor Nearshore Rockfish (S)	1,156	436	38%	1145	445	39%	1,164	495	43%	1,160	1143	99%	1,313	676	51%	1,288 *(1,006)*	642	50%	1,329 *(1,163)*	713	54%
Minor Shelf Rockfish (S)	2,238	336	15%	2,243	402	18%	1,910	426	22%	1,913	402	21%	1,918	553	29%	1,919 *(1,625)*	441	23%	1,917 *(1,623)*	571	22%
Minor Slope Rockfish (S)	907	191	21%	903	257	28%	681	148	22%	685	145	21%	813	107	13%	814 *(695)*	82	10%	827 *(707)*	115	14%
"Other Fish"	11,150	2,521	23%	11,150	1,655	15%	6,832	1,574	23%	6,802	1,588	23%	291	83	29%	291 *(243)*	100	34%	537 *(474)*	109	20%
"Other Flatfish"	10,146	921	9%	10,146	897	9%	10,060	1,080	11%	10,060	1,106	11%	11,453	1,110	10%	9,645 *(7,243)*	1,055	11%	11,165 *(8,510)*	1,003	9%
Pacific cod	3,200	607	19%	3,200	634	20%	3,200	391	12%	3,200	440	14%	3,200	776	24%	3,200 *(1,600)*	540	17%	3,200 *(1,600)*	159	5%
Shortbelly RF	6,950	12	0%	6,950	7	0%	6,950	25	0%	6,950	18	0%	6,950	9	0%	6,950 *(500)*	30	0%	6,950 *(500)*	320	5%
Spiny dogfish	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	2,523	705	28%	2,503 *(2,085)*	775	31%	2,514 *(2,094)*	497	20%
Splitnose RF	1,529	42	3%	1,610	62	4%	1,684	49	3%	1,747	69	4%	1,794	32	2%	1,826 *(1,746)*	18	1%	1,841 *(1,760)*	27	1%
Starry flounder	1,802	24	1%	1,813	17	1%	1,825	9	0%	1,825	28	2%	1,841	29	2%	1,847 *(1,539)*	19	1%	1,847 *(1,282)*	19	1%

Table 3-4. Non-target groundfish species management criteria, including management group, area, stock status, if overfishing has occurred, and trawl dominance. Stock status is based on terminology in the Groundfish FMP (Council 2016a): Healthy = stock biomass greater than MSY; precautionary = stock biomass less than MSY but greater than the overfished/rebuilding threshold; overfished = stock biomass below the overfished/rebuilding threshold.

Common Name	Management group	OFL Management area	Stock status	OFL exceeded from 2011 to 2015 (Y/N)	Trawl dominant in 2015 (Y/N) a/
Flatfish Species					
Butter sole	"Other flatfish"	Coastwide	Unassessed	N	Y
Curlfin sole	"Other flatfish"	Coastwide	Unassessed	N	Y
English sole	English sole	Coastwide	Healthy	N	Y
Flathead sole	"Other flatfish"	Coastwide	Unassessed	N	Y
Pacific sanddab	"Other flatfish"	Coastwide	Healthy	N	Y
Rex sole	"Other flatfish"	Coastwide	Healthy g/	N	Y
Rock sole	"Other flatfish"	Coastwide	Unassessed	N	N
Sand sole	"Other flatfish"	Coastwide	Unassessed	N	Y
Starry flounder	Starry flounder	Coastwide	Healthy	N	N
Rockfish Species					
Aurora rockfish	Slope rockfish N. & S.	N. & S. of 40°10' N. lat.	Healthy	N	Y
Bank rockfish	Slope rockfish N. & S.	N. & S. of 40°10' N. lat.	Unassessed h/	N	Y
Black rockfish	Black rockfish	S. of 46°16' N. lat. N. of 46°16' N. lat.	Healthy	N	N
Black & yellow rockfish d/	Nearshore rockfish N. & S.	N. & S. of 40°10' N. lat.	Unassessed	N	N
Blackgill rockfish	Slope rockfish N. & S.	N. & S. of 40°10' N. lat.	Healthy	N	Y
Blue rockfish e/ f/	Nearshore rockfish N. & S.	N. & S. of 40°10' N. lat.	Precautionary off California Heathy off Oregon	N	N
BOCACCIO c/	Bocaccio S./Shelf rockfish N.	S. of 40°10' N. lat. Shelf complex N. 40°10' N. lat.	Healthy (Stock S. of 40°10' N. lat. rebuilt 2017)	N	S. of 40°10 N/ lat – N N. of 40°10 N/ lat - Y
Bronzespotted rockfish	Shelf rockfish N. & S.	N. & S. of 40°10' N. lat.	Unassessed	N	N
Brown rockfish e/	Nearshore rockfish N. & S.	N. & S. of 40°10' N. lat.	Healthy g/	N	N
Calico rockfish e/	Nearshore rockfish N. & S.	N. & S. of 40°10' N. lat.	Unassessed	N	N
California scorpionfish	California scorpionfish	S. of 34°27' N. lat.	Healthy	Y -2014	N
Canary rockfish	Canary rockfish	Coastwide		N	N

Common Name	Management group	OFL Management area	Stock status	OFL exceeded from 2011 to 2015 (Y/N)	Trawl dominant in 2015 (Y/N) a/
Chameleon rockfish	Shelf rockfish N. & S.	N. & S. of 40°10’ N. lat.	Unassessed	N	--
Chilipepper	Chilipepper S. Shelf rockfish N.	S. of 40°10’ N. lat. Shelf rockfish N. of 40°10’ N. lat.	Healthy	N	Y
China rockfish d/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Precautionary	N	N
Copper rockfish e/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Healthy g/	N	N
COWCOD	Cowcod S. & Shelf rockfish N.	S. of 40°10’ N. lat./ Shelf N. lat.	Overfished	N	N
DARKBLOTCHED ROCKFISH	Darkblotched rockfish	Coastwide	Healthy (rebuilt in 2017)	N	Y
Dusky rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	--
Dwarf-Red rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	--
Flag rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Freckled rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	--
Gopher rockfish d/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Healthy	N	N
Grass rockfish d/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Greenblotched rockfish	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Greenspotted rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Precautionary	N	N
Greenstriped rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Healthy	N	Y
Halfbanded rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Harlequin rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	--
Honeycomb rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Kelp rockfish c/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Mexican rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Olive rockfish e/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
POP	POP N. Slope rockfish S.	N. of 40°10 N. lat. Slope complex S. of 40°10’ N. lat.	Healthy (rebuilt 2017)	N	Y
Pink rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	Y
Pinkrose rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Pygmy rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Quillback rockfish e/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Redbanded rockfish	Slope rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Redstripe rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	Y
Rosethorn rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N

Common Name	Management group	OFL Management area	Stock status	OFL exceeded from 2011 to 2015 (Y/N)	Trawl dominant in 2015 (Y/N) a/
Rosy rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Rougheye rockfish b/	Slope rockfish N. & S.	N. & S. of 40°10 N. lat.	Healthy	N	Y
Sharpchin rockfish	Slope rockfish N. & S.	N. & S. of 40°10 N. lat.	Healthy g/	N	Y
Shortbelly rockfish	Shortbelly rockfish	Coastwide	Healthy	N	Y
Shortraker rockfish	Slope rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	Y
Silvergray rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	Y
Speckled rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Splitnose rockfish	Splitnose S. Slope rockfish N.	S. of 40°10’ N. lat. Shelf complex N. of 40°10’ N. lat.	Healthy	N	Y
Squarespot rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Starry rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Stripetail rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Healthy g/	N	Y
Swordspine rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Tiger rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Treefish e/	Nearshore rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
Vermilion rockfish	Shelf rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	N
YELLOWEYE ROCKFISH	Yelloweye rockfish	Coastwide	Overfished	N	N
Yellowmouth rockfish	Slope rockfish N. & S.	N. & S. of 40°10 N. lat.	Unassessed	N	Y
Roundfish Species					
Cabezon	Cabezon & “Other fish”	Cabezon S. of 46°16 N. lat. “Other fish” N. of 46°16 N. lat.	Healthy	N	N
Kelp greenling	“Other fish”	Coastwide	Healthy	N	N
Lingcod	Lingcod	N. & S. of 40°10 N. lat.	Healthy north of 40°10 N. lat Precautionary south of 40°10 N. lat.	N	N
Shark and Skate Species					
Big skate	Big skate	Coastwide	Unassessed	N	Y
Leopard shark	“Other fish”	Coastwide	Unassessed	N	N
Longnose skate	Longnose skate	Coastwide	Healthy	N	Y
Spiny dogfish	Spiny dogfish	Coastwide	Healthy	N	Y

a/ The column represents only commercial non-tribal trawl
b/ Specification includes blackspotted rockfish
c/ Specification includes deacon rockfish
d/ South of 40º10' N. latitude considered a shallow nearshore species
e/ South of 40º10' N latitude considered a deeper nearshore species
f/ Blue rockfish are managed south of 34°27' N. lat., 40°10' to 34°27' N. lat., and north of 40°10' N. lat.
g/ Based on data poor/data moderate assessment (https://www.pcouncil.org/groundfish/stock-assessments/by-year/gf2013/)

Species managed within the north and south minor rockfish complexes (nearshore, shelf, and slope) are not managed with stock-specific OFLs, ABCs, and ACLs. There are no minor nearshore rockfish species that are considered trawl-dominant; these species are rarely caught by trawl. Trawl-dominant species are included in minor shelf and minor slope rockfish complexes (Table 3-4). Total mortality across all sectors has remained well below the OFL for the minor shelf and minor slope rockfish complexes (Table 3-3). The stock composition of these minor rockfish complexes are described in Council and NMFS (2015).

Big skate and longnose skate are trawl dominant species (Table 3-4). Big skate and longnose skate occupy the inner and outer shelf areas (Allen and Smith 1988; Lauth 1999; Ebert 2003). Adults are associated with soft bottom sediments and with combinations of mud and cobble near high-relief structures (CDFG 2003; Ebert 2003). Only longnose skate has been assessed, and it is considered a healthy stock. Big skate has been managed with stock-specific harvest specifications since 2017 to reduce the risk of overfishing.

Spiny dogfish is a trawl dominate species that was assessed in 2011 (Table 3-4). Spiny dogfish is a healthy stock, with the level of depletion well above the target MSY. Spiny dogfish has been managed with a stock-specific harvest specification since 2015 to reduce the risk of overfishing.

Ecosystem component species – Ecosystem Component species (Council 2016a; Council 2016b) are monitored, but they do not require specification of an ACL or status determination criteria (MSA National Standard 1). EC species are caught incidentally with trawl gear in relatively small amounts.

3.2.1.3 Discard Mortality of Target and Non-target Groundfish

For all but widow rockfish, bottom trawl gear accounted for 90 percent or more of the discards by groundfish trawl fisheries before the catch share program (NMFS and Council 2017). One of the primary intentions of Amendment 20 was to reduce discard mortality for all species (Council and NMFS 2010a). This intention has largely been met, as discards associated with bottom trawl declined 75 percent from an average of 8,004 mt per year before implementation (2002 to 2010) to 2,219 mt per year after implementation (2011 to 2015) (NMFS and Council 2017). This reduction in discards could have multiple causes, including decreases in overall effort, landing species rather than discarding them, changes in gear, and changes in fishing behavior.

Table 3-5 and Table 3-6 provide a direct comparison in discard rates by groundfish bottom trawl for 2010 (immediately before the catch share program) and 2011 (immediately after implementation of the catch share program). These years were selected to provide an example of the impact of the catch share

program on discarding; other factors that might confound the comparison, such as changes in stock status and other regulations, occurred during later years.

Discard mortality of groundfish, as a percentage of total mortality (landings plus discard), varies by groundfish species and whether species are targeted or non-targeted. Table 3-5 shows that bottom trawl discard mortality for selected target species was reduced by 2.9 percent for Dover sole (absolute difference) to 83.5 percent for widow rockfish during the first year of the catch share program. Sablefish discard mortality dropped 8.7 percent immediately after implementation of the program (Table 3-5; Section 1). Reductions in discards by groundfish bottom trawl during the first year of the catch share program were also observed for most non-target species (Table 3-6). NMFS and Council (2017) provided numerous examples of this immediate reduction in discarding after implementation of the catch share program. For example, they showed that six of seven stocks considered overfished in 2011 experienced at least a 90 percent reduction in discard mortality (relative percentage) immediately after the implementation of the catch share program (NMFS and Council 2017).

Table 3-5. Percent discard[a/] of selected target-groundfish species by LE bottom trawl during 2010 (pre-catch share) and 2011 (first year of the catch share program), along with the absolute difference between years. Discard percent represents percent discard mortality for all species except sablefish (see footnote). Source: WCGOP Groundfish Expanded Mortality Multiyear (GEMM) database.

	Discard Percent (Bottom Trawl)		
Target groundfish	**2011**	**2010**	**Difference**
Arrowtooth flounder	9.9%	19.1%	-9.1%
Dover sole	2.0%	4.9%	-2.9%
Longspine thornyhead	4.5%	22.4%	-17.9%
Petrale sole	2.0%	14.5%	-12.4%
Sablefish	0.6%	16.1%	-15.5%
Shortspine thornyhead	0.5%	6.8%	-6.2%
Widow rockfish	0.6%	84.1%	-83.5%
Yellowtail rockfish	0.0%	54.8%	-54.8%

[a/]Discard mortality for sablefish was 8.7 percent in 2010 and 0.3 percent in 2011.

Table 3-6. Percent discard[a/] of selected non-target groundfish species by LE bottom trawl during 2010 (pre-catch share) and 2011 (first year of the catch share program), along with the absolute difference between years. Discard percent represents percent discard mortality for all species except lingcod (see footnote). Source: WCGOP Groundfish Expanded Mortality Multiyear (GEMM) database.

	Discard Percent (Bottom Trawl)		
Non-target groundfish	**2011**	**2010**	**Difference**
Bank rockfish	0.2%	1.0%	-0.8%
Canary rockfish	6.1%	16.3%	-10.1%
Chilipepper rockfish	7.9%	11.4%	-3.5%
Darkblotched rockfish	1.9%	45.7%	-43.8%
English sole	21.4%	34.4%	-12.9%
Lingcod	14.4%	20.2%	-5.9%
POP	0.8%	46.4%	-45.5%
Redstripe rockfish	17.8%	32.1%	-14.4%
Rex sole	5.8%	15.0%	-9.2%
Splitnose rockfish	70.3%	74.1%	-3.8%

[a/]Discard mortality for lingcod was 11.3 percent in 2010 and 7.7 percent in 2011.

Even though overall discard levels by IFQ bottom trawl during the catch share program are lower than discard levels observed during years prior to the catch share program (Table 3-5; Table 3-6) (NMFS and Council 2017), targeted and non-targeted groundfish continue to be discarded regardless of gear specifications (e.g., minimum mesh size) and incentives that were developed in the catch share program to reduce discarding; there is some level of discard that may be unavoidable (e.g., large year class of fish too small to market). For most species, however, recent discard mortality rates for IFQ bottom trawl (Table 3-7; Table 3-8) remains as low or lower than observed during the first year of the catch share program, and much lower than observed prior to the catch program (Table 3-5; Table 3-6).

During recent years (2016 and 2017), bottom trawl participants in the catch share program typically discarded less than 2 percent of targeted groundfish catch (Table 3-7). The most prevalent reason for this discard is "market" (WCGOP, unpublished data), which may include fish that are too small to fillet or fish that are difficult to market for other reasons. Minimum market sizes were shown by Lomeli et al. (2017) for Dover sole (33 cm or 13 inches), rex sole (32 cm or 12.6 inches), and shortspine thornyhead (22 cm or 8.7 inches). Perez-Comas et al. (1998) showed that the 75th percentile of discarded lengths during the 1980s oscillated around 30 cm (11.8 inches) for most flatfish and rockfish, and authors attributed most of that discard to unmarketable sizes. Size distributions of discarded catch during 2011 to 2015 (WCGOP, unpublished data) suggest that most of the targeted groundfish discard by IFQ bottom trawl continues to be due to size (i.e., too small to market). However, some target groundfish species that are larger than minimum market size may also be discarded for market-related reasons other than size

(e.g., due to processor plant limits). For example, observers measured some discarded Dover sole that were much larger than the minimum market size of 33 cm (WCGOP, unpublished data).

Discard of arrowtooth flounder by the bottom trawl fishery is generally much greater than discard of other targeted groundfish (Table 3-7). Arrowtooth flounder markets are limited, and poor flesh quality precludes retention, especially during the initial days of fishing trips. These market problems result in relatively high discard of arrowtooth flounder independent of fish size (see Section 3.2.1.1).

Table 3-7. Percent discard mortality of selected target-groundfish species by IFQ bottom trawl during 2016 and 2017. Columns represent discard mortality (mt), landed catch (mt), and percent discard mortality (relative to landed catch). Source: Somers et al. (2017a) for 2016 data; GEMM database for 2017 data.

	Bottom Trawl					
	2016			2017		
Target groundfish	Discard mortality (mt)	Landed catch (mt)	Discard mortality (%)	Discard mortality (mt)	Landed catch (mt)	Discard mortality (%)
Arrowtooth flounder	323.3	1,077.4	23.1%	348.5	1,006.9	25.7%
Dover sole	29.7	7,153.5	0.4%	55.9	7,282.6	0.8%
Longspine thornyhead (N)	12.1	631.7	1.9%	4.9	798.6	0.6%
Petrale sole	18.1	2,446.6	0.7%	13.5	2,718.2	0.5%
Sablefish (N)	12.2	1,430.4	0.8%	21.4	1,517.3	1.4%
Shortspine thornyhead (N)	8.4	717.9	1.2%	4.3	732.0	0.6%
Widow rockfish a/	0.02	6.3	0.3%	0.3	33.6	0.8%
Yellowtail rockfish a/	0.0	108.3	0.0%	0.5	199.3	0.3%

a/ Widow and yellowtail rockfish landings do not include landings made by 2017 gear EFP trips. Most of these bottom trawl EFP trips fished gear off bottom, similar to midwater trawl (see Section 4.3.2.1).

The 2016 and 2017 discard mortality rates of non-target groundfish for bottom trawl vessels in the catch share program were highly variable among species (Table 3-8). Bottom trawl discard for some species, such as bank rockfish and canary rockfish, was less than 2 percent of the total mortality, but discard rates exceeded 39 percent for other species (e.g., splitnose rockfish in 2016). The primary reason for discarding non-target groundfish shown in Table 3-8 (except lingcod) was market (WCGOP, unpublished data). Much of this market-related discarding was likely because fish were smaller than the minimum market size (WCGOP, unpublished data), which is generally 30.5 to 33 cm (12 to 13 inches) for most rockfish and flatfish (see above). Some non-target groundfish (see Somers et al. 2017) were discarded for reasons other than unmarketable sizes. For example, spiny dogfish shark is an example of a non-target species that is often discarded because of market reasons, independent of size. Finally, some non-target species are discarded due to regulatory reasons; 85 percent of the discarded lingcod during 2016 (Table 3-8) was attributed to “regulation” (e.g., below the minimum regulatory size limit) (WCGOP, unpublished data).

Nearly all groundfish EC species listed in the FMP (e.g. grenadiers, skates, and spotted ratfish) are caught in relatively small amounts and mostly discarded (Somers et al. 2017a) because of market reasons (WCGOP data).

Table 3-8. Percent discard mortality of selected non-target groundfish species by IFQ bottom trawl during 2016 and 2017. Columns represent discard mortality (mt), landed catch (mt), and percent discard mortality (relative to landed catch) during 2016. Source: Somers et al. (2017a) for 2016 data; GEMM database for 2017 data.

	Bottom Trawl					
	2016			2017		
Non-target groundfish	**Discard mortality (mt)**	**Landed catch (mt)**	**Discard mortality (%)**	**Discard mortality (mt)**	**Landed catch (mt)**	**Discard mortality (%)**
Bank rockfish	0.1	36.0	0.2%	0.1	35.9	0.1%
Canary rockfish a/	0.1	6.5	1.2%	0.1	133.1	0.1%
Chilipepper rockfish (S)	2.3	72.8	3.0%	7.9	122.5	6.1%
Darkblotched rockfish	4.4	100.8	4.2%	2.8	147.6	1.9%
English sole	83.9	289.9	22.4%	42.0	204.3	17.1%
Lingcod (N)	7.0	236.0	2.9%	12.7	580.5	2.1%
POP (N)	0.8	25.9	2.9%	0.6	46.1	1.2%
Redstripe rockfish	0.03	0.5	6.1%	0.0	3.9	0.6%
Rex sole	63.6	510.2	11.1%	85.1	464.7	15.5%
Splitnose rockfish	8.7	13.1	39.8%	8.8	25.9	25.4%

a/ Canary rockfish landings do not include landings made by 2017 gear EFP trips. Most of these bottom trawl EFP trips fished gear off bottom, similar to midwater trawl (see Section 4.3.2.1).

3.2.2 Prohibited Species

Prohibited species are those species or species groups which must be returned to the sea as soon as practicable with minimum injury when caught and brought aboard except when their retention is authorized by applicable law (Council 2016a). Salmon, Pacific halibut, and Dungeness crab are listed as prohibited species for harvesters in the catch share program and are discussed below.

3.2.2.1 Salmon

Salmon is an anadromous fish native to the rivers and oceans of the northern hemisphere. Seven salmon species are native to the Pacific Ocean, and five of those species spawn in the rivers off the West Coast: Chinook salmon, chum salmon, coho salmon, pink salmon, and sockeye salmon. Steelhead is an anadromous form of rainbow trout that occupies similar habitats and a similar ecological niche to the Pacific salmon species. This section broadly discusses the trawl fishery interaction with all salmon species and overall salmon bycatch. Some United States West Coast populations of Chinook salmon and

coho salmon are listed under the ESA and are further discussed below in Section 3.2.3.1. The temporal and spatial distribution of Chinook salmon bycatch is also shown in Section 3.2.3.1.

Chinook salmon - Most salmon caught in the trawl fishery are Chinook salmon. Table 3-9 shows catch by trawl sector (excluding tribal trawl) for 2002 to 2016. During the 2002 to 2016 period, Chinook salmon bycatch averaged 7,416 fish per year in all trawl sectors, with an average of 4,801 fish per year in the Pacific whiting fisheries and 2,615 fish per year in the non-whiting midwater and bottom trawl fisheries. The highest annual catch of Chinook salmon occurred in 2003, when the trawl fisheries combined took 19,475 fish. A large drop in coastwide Chinook salmon bycatch occurred in the non-whiting LE bottom trawl fishery after 2003. The post-2003 reduction may have been due to changes in management measures affecting the nearshore trawl fishery. Before implementation of trawl RCAs, flatfish species were caught by vessels using large and small footrope bottom trawl gear in 50-fm to 150-fm depths. Beginning in 2003, many of the areas where these flatfish species had been harvested fell within the trawl RCAs (Section 3.1.3) where bottom trawl is prohibited. In September 2003, differential trip limits were used to encourage bottom trawl fishing seaward of RCAs, and SFFT became required shoreward of the RCAs in 2005 (Section 2.4).

Coho salmon - Coho salmon make up a small portion of the overall salmon catch by trawl gear (Table 3-9). During 2002 to 2016, coho salmon bycatch averaged 103 fish per year in the trawl fisheries with an average of 82 fish per year in the Pacific whiting fisheries and 21 fish per year in the non-whiting midwater and bottom trawl fisheries. The highest annual catch of coho salmon occurred in 2007, when all trawl fisheries combined took 380 fish.

Chum salmon - Like coho salmon, chum salmon make up a small portion of the overall salmon catch by trawl gear (Table 3-9). During 2002 to 2016, chum bycatch averaged 63 fish per year in the trawl fisheries with an average of 59 fish per year in the Pacific whiting fisheries and 4 fish per year in the non-whiting midwater and bottom trawl fisheries. The highest annual catch of chum salmon occurred in 2007, when the trawl fisheries combined took 282 fish.

Pink salmon - The United States West Coast EEZ is at the southern end of the range of pink salmon within the eastern North Pacific. In the trawl fishery, pink salmon catch tends to occur on odd numbered years (Table 3-9). During the 2002 to 2016 period, pink salmon bycatch averaged 426 fish per year in the groundfish trawl fisheries with an average of 426 fish per year in the Pacific whiting fisheries, and less than 1 fish per year in the non-whiting midwater and bottom trawl fisheries. Most pink salmon were taken in a single year in the shoreside whiting fishery. The highest annual catch of pink salmon occurred in 2011, when the trawl fisheries combined took 6,125 fish.

Sockeye salmon - Very few sockeye have been documented as catch in trawl gear (NMFS 2016b). During 2002 to 2016, sockeye bycatch averaged 1 fish per year in the trawl fisheries, with an average of 1 fish per year in the Pacific whiting fisheries and 0 fish per year in the non-whiting midwater and bottom trawl fisheries (Table 3-9). The highest annual catch of sockeye occurred in 2016, when the groundfish trawl fisheries combined took 6 fish.

Steelhead and sea run cutthroat trout- Very few steelhead have been documented as catch in trawl gear. In the 14-year period between 2002 and 2015, only two steelhead were documented (NMFS 2016b). Both were taken in the Pacific whiting shoreside fishery in 2014. No cutthroat trout take have been documented by trawl gear.

Table 3-9. Salmon mortality (number of fish) by species and commercial trawl gear sector in Pacific Coast Groundfish Fisheries, from 2002 to 2016. Source: WCGOP, NWFSC (2017) for 2002 to 2015 data; NWFSC (2018) for 2016 data.

Fishery	Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
At-sea whiting	Chinook	1,663	2,617	803	3,958	1,192	1,317	718	318	714	3,989	4,209	3,739	6,695	1,806	3,051
	Coho	146	3	1	86	28	226	21	12	0	5	17	6	104	4	2
	Chum	24	11	55	20	87	169	60	41	10	46	53	26	4	5	41
	Pink	0	17	0	48	0	34	0	2	0	12	22	37	0	23	0
	Sockeye	0	0	0	0	0	0	2	0	2	0	0	0	0	0	6
Shoreside whiting	Chinook	1,062	425	4,206	4,018	839	2,462	1,962	279	2,997	3,722	2,359	1,263	6,898	2,002	738
	Coho	0	0	0	0	0	141	10	37	16	136	16	33	167	9	5
	Chum	0	0	0	0	0	113	8	2	8	42	3	7	4	7	32
	Pink	0	0	0	0	0	47	7	26	0	6,113	0	2	0	0	0
	Sockeye	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0
Groundfish bottom trawl	Chinook	14,501	16,433	1,758	808	67	194	449	304	282	175	304	323	984	996	374
	Coho	24	32	66	5	0	13	0	0	31	19	27	49	18	3	9
	Chum	14	38	4	0	0	0	0	0	0	0	0	0	0	0	0
	Pink	0	0	0	0	0	0	0	2	0	0	2	0	2	0	0
	Sockeye	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Midwater non-whiting	Chinook	--	--	--	--	--	--	--	--	--	--	12	71	661	482	47
	Coho	--	--	--	--	--	--	--	--	--	--	0	0	12	7	0
	Chum	--	--	--	--	--	--	--	--	--	--	0	1	0	5	0
	Pink	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0
	Sockeye	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0

3.2.2.2 Pacific Halibut

Pacific halibut are managed by the bilateral (United States/Canada) International Pacific Halibut Commission (IPHC). Regulations are implemented by Canada and the United States in their own waters. The Pacific Halibut Catch Sharing Plan for waters off Washington, Oregon, and California (Area 2A) specifies IPHC management measures for Pacific halibut on the West Coast. Pacific halibut mortality in the groundfish trawl fishery north of 40°10' N. latitude is managed with individual bycatch quotas (IBQ), except for the at-sea Pacific whiting fishery, which is provided with a set-aside amount. The shoreside groundfish fishery south of 40°10' N. latitude is also provided with a set-aside amount of Pacific halibut to accommodate bycatch. The bycatch allocation percent and set-asides can be adjusted through biennial specifications and management measures process.

From 2011 to 2017, the mortality of Pacific halibut by all non-tribal midwater trawl fisheries combined was less than 1.73 mt annually. Pacific halibut mortality was less than 1.06 mt per year in the at-sea whiting fishery and less than 1.36 mt annually in the shoreside whiting fishery (Table 3-10). Pacific halibut mortality was observed only during 2017 in the non-whiting midwater trawl fishery (0.04 mt). Most Pacific halibut was taken by groundfish bottom trawl; between 2011 and 2017, the annual Pacific halibut mortality ranged between 26.28 mt and 36.13 mt in this fishery (Table 3-10), which is more than 50 percent lower than the IBQ during those years (see Figure 1 in Jannot et al. 2016a).

Table 3-10. Mortality of Pacific halibut (mt) by trawl sector, from 2011 to 2017. Source: GEMM database

Fishery	2011	2012	2013	2014	2015	2016	2017
At-sea whiting	0.57	0.64	1.06	0.37	0.06	0.15	0.55
Shoreside whiting	0.35	0.62	1.34	1.36	1.25	1.33	0.97
Bottom trawl	31.30	36.13	32.41	26.28	33.36	33.29	35.15
Non-whiting midwater	a/	0.00	0.00	0.00	0.00	0.00	0.04

a/ Confidential

3.2.2.3 Dungeness Crab

Off the United States West Coast, Dungeness crab is most abundant in nearshore areas from central California to the Washington/Canada border. Dungeness crab is found to a depth of about 170 m (38 fm).[9] Although Dungeness crab occurs on mud and gravel, it is most abundant on sand bottoms, and it

[9] http://wdfw.wa.gov/fishing/commercial/crab/coastal/

frequently occurs in eelgrass. Routine stock assessments are not conducted on Dungeness crab stocks in the action area, and catch per unit effort is unknown. The states of Washington, Oregon, and California examine annual landings to evaluate the condition of the stock.

Dungeness crab are unintentionally taken as bycatch by trawl. Table 3-11 shows recent catch by sector for 2011 to 2017. All sectors of the Pacific whiting fishery rarely encountered Dungeness crab. The groundfish bottom trawl fishery encounters the most Dungeness crab, ranging from 95.58 mt to 171.96 mt annually.

Table 3-11. Catch of Dungeness crab (mt) by trawl sector, from 2011 to 2017. Source: Bellman et al. 2012, Bellman et al. 2013, Somers et al. 2014, Somers et al. 2015, Somers et al. 2016b, GEMM database (for 2016 and 2017 data).

Fishery	2011	2012	2013	2014	2015	2016	2017
At-sea whiting	0.00	0.00	0.04	0.00	0.00	0.00	0.00
Shoreside whiting	0.03	0.00	0.01	0.03	0.01	0.00	0.00
Bottom trawl	151.67	196.51	150.47	115.23	95.58	138.00	171.96
Non-whiting midwater	-	-	-	-	0.00	0.00	0.10

3.2.3 Protected Species

Protected species are species listed under the ESA, the Marine Mammal Protection Act (MMPA), the Migratory Bird Treaty Act (MBTA), and Executive Order (EO) 13186. Of the protected species evaluated in this document, only Chinook salmon, green sturgeon, and eulachon may be affected by the proposed action (see Section 4). For example, marine mammals, sea birds, and sea turtles would not be affected by Alternative A (eliminate mesh size requirements), Alternative C (eliminate codend requirements), and Alternative E (eliminate chafing gear requirements) because of their large size relative to current minimum mesh size regulations; escapement of these species from within trawls would be independent of mesh size, codend regulations, and chafing gear coverage. ESA-listed coho salmon would not be affected by the action alternatives because they are caught in low numbers, and most trawl-caught coho salmon are unlisted natural-origin or hatchery fish (NMFS 2017a). This section will, therefore, focus only on Chinook salmon, green sturgeon, and eulachon. Information regarding other ESA species, as well as marine mammals, seabirds, and sea turtles not listed under the ESA, can be found in NMFS (2016a) and the 2012 biological opinion (NMFS 2012).

3.2.3.1 ESA-listed Salmon

In December 2017, NMFS completed a new salmon biological opinion (NMFS 2017a) that considered impacts of the Groundfish FMP on seven listed Chinook salmon evolutionarily significant units (ESUs)

and four listed coho salmon ESUs (Table 3-12). Other listed salmon and steelhead occurring in the action area and affected by the proposed action have been evaluated in separate formal or informal ESA biological opinions (NMFS 2012; NMFS 2017a). Of the ESA-listed species, Chinook salmon are most likely to be encountered in the trawl fisheries (Table 3-9). NMFS (2017a) determined that the groundfish fisheries were not likely to jeopardize any listed salmon ESUs or destroy or adversely modify their critical habitat.

Table 3-12. ESA status of West Coast salmon ESUs impacted by the groundfish fishery management plan. Source: NMFS 2017a.

Species	**ESU**	**Status**
Chinook salmon	Puget Sound	Threatened
	Lower Columbia River	Threatened
	Upper Willamette River	Threatened
	Upper Columbia River Spring	Endangered
	Snake River Spring/Summer	Threatened
	Snake River Fall	Threatened
	California Coastal	Threatened
Coho salmon	Lower Columbia River	Threatened
	Oregon Coast	Threatened
	Southern Oregon/Northern California	Threatened
	Central California Coast	Endangered

The 2017 salmon biological opinion and ITS (NMFS 2017a) replaced the previous biological opinion (NMFS 2006). The proposed action for that opinion includes limits on Chinook bycatch in the groundfish fisheries (NMFS 2017a). Those limits are 11,000 Chinook salmon per year for whiting fisheries and 5,500 Chinook salmon per year for all non-whiting groundfish fisheries. In addition, the proposed action anticipates creation of a reserve of 3,500 Chinook salmon per year to act as a safety net to minimize disruption to the fishery where actions already being taken in the fishery to reduce bycatch are insufficient. The analysis in the 2017 salmon biological opinion concluded that coho salmon bycatch would not likely exceed 474 fish in the whiting fishery and 565 fish in the non-whiting fisheries (NMFS 2017a). The whiting fishery would have exceeded the Chinook salmon base guideline (excluding the reserve) once since 2002 (i.e., in 2014), and the non-whiting fishery would have exceeded the base guideline twice since 2002 (i.e., in 2002 and 2003) (Table 3-9).

The ITS Term and Condition 3c in the 2017 salmon biological opinion (NMFS 2017a) requires the Council and NMFS to develop regulations, through the 2019-2020 biennial harvest specifications and the management measures process to create an automatic authority that could be used to close a sector (whiting or non-whiting) when that sector exceeds its Chinook salmon guideline bycatch amount plus the reserve, or when one sector has been closed under the prior scenario, and the other sector reaches its guideline.

Chinook salmon bycatch by area, depth, season, and size - Temporal and spatial distribution of Chinook salmon bycatch rates (number of Chinook/mt whiting) by Pacific whiting sectors were described by NMFS (2016a) and Matson and Erickson (2017). Although the proposed action may affect Pacific whiting sectors (e.g., provide flexibility for improved salmon excluders; Lomeli and Wakefield 2012), the alternatives shown in Section 2 may have the largest effects on IFQ bottom trawl fisheries. As such, Chinook salmon interactions by Pacific whiting sectors are not discussed here; it is unlikely that midwater whiting vessels would construct complete codends or nets with meshes smaller than they are currently using (see Section 4.2.2.1).

Unlike the Pacific whiting fisheries, which begin on May 15 and mostly occur north of 42^{o} N. latitude (NMFS 2016b), the IFQ bottom trawl fishery operates year-round and is a coastwide fishery. Matson and Erickson (2017) showed that although extreme catch events (ECEs) of Chinook salmon can occur with bottom trawl, there is low probability that Chinook salmon bycatch by bottom trawl and non-whiting midwater trawl (combined) would exceed 5,500 fish (threshold for non-whiting trawl fisheries) (also see NMFS 2017a).

Figure 3-1 shows Chinook salmon bycatch (number) per haul during WCGOP observed trips by LE bottom trawl from 2002 to 2015. In most cases, when Chinook salmon are caught by bottom trawl, they are caught in low numbers per haul (i.e., one to three salmon). However, there are occasions where Chinook salmon bycatch by bottom trawl exceeded 100 fish per haul (Figure 3-1), which was also shown by Erickson and Pikitch (1994). Chinook salmon bycatch per haul exceeded 100 fish in three observed hauls from 2011 to 2015. Note that selective flatfish trawl became mandatory shoreward of the RCA north of 40^{o}10' N latitude beginning 2005 (Section 3.4.1.4).

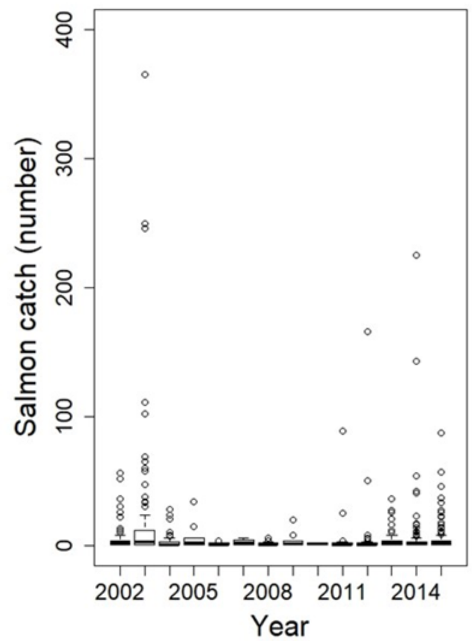

Figure 3-1. Chinook salmon bycatch per haul for LE bottom trawl from 2002 to 2015. Only WCGOP observed trips are included (EM trips are excluded). Observer coverage on LE bottom trawl vessels was less than 25 percent prior to 2011, and it increased to nearly 100 percent since 2011 (Somers et al. 2016a). Source: WCGOP observer database.

Salmon bycatch by IFQ bottom trawl varies with season and depth. Figure 3-2 shows most encounters during 2011 to 2015 occurred between 150 fm and 250 fm during winter months (November through March). April (defined here and by WCGOP as part of the winter season) is a transitional month, when the median catch depth by bottom trawl is approximately at 100 fm (i.e., shallower than the other winter months). Chinook salmon bycatches by IFQ bottom trawl during summer months typically occur at depths shallower than 100 fm. Results shown for LE trawl during 2003 to 2010 (Figure 3-2) and during 1986 and 1987 (Erickson and Pikitch 1994) also demonstrate that Chinook salmon bycatch is most prevalent in deeper water during winter months and in shallower water during summer months.

The width of bars in Figure 3-2 are in proportion to the number of hauls that encountered Chinook salmon. During recent years (2011 to 2015), most encounters occurred during January through April. Fewest encounters occurred during summer months, even though bottom trawling effort shoreward of the RCA increases during the summer season to target shallow-water flatfish (see Section 3.2.1.1) (Figure 3-3). Erickson and Pikitch (1994) showed similar seasonal depth distributions of Chinook salmon bycatch for LE bottom trawl off Oregon and Washington during the 1980s.

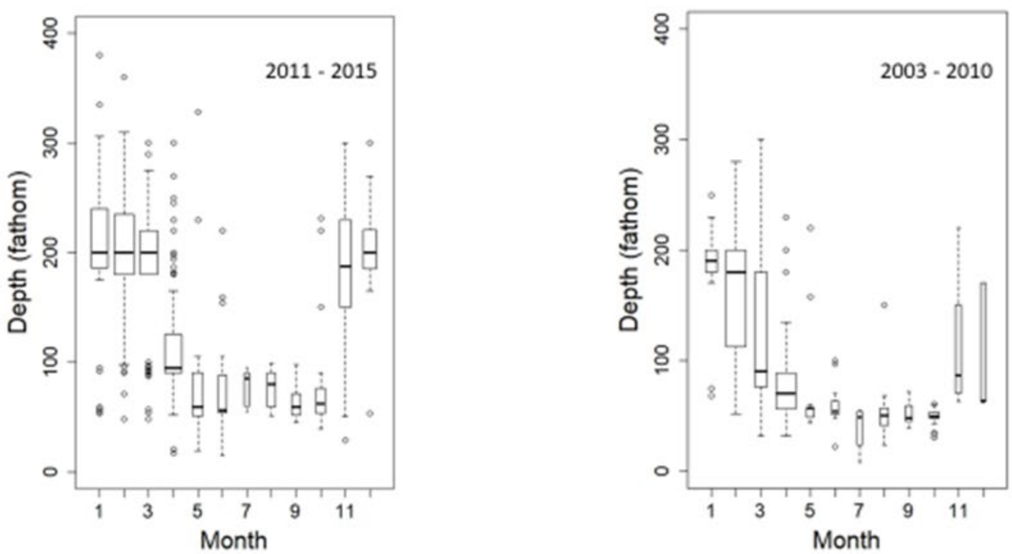

Figure 3-2. Depth of Chinook salmon positive hauls (set depth, fm) for bottom trawl during the catch share program (2011 to 2015) and during pre-catch share (2003 to 2010). Width of box plots is proportional to number of hauls with salmon (i.e., wider box = more hauls with salmon). Source: WCGOP observed trips.

Figure 3-3 demonstrates seasonal-depth-area patterns of Chinook salmon bycatch (number of fish per haul). The scale differs between seasons. The magnitude of Chinook salmon bycatch is highest during the winter months (November to April) and lowest during the summer months (May to October) (Figure 3-3), similar to results shown in Figure 3-2. NMFS (2016b) also demonstrated that 77 percent of the Chinook salmon bycatch by IFQ bottom trawl was taken during the winter months from 2011 to 2014.

The largest ECEs during winter months (up to 228 Chinook salmon per haul) typically occurred at depths between 150 fm and 250 fm and north of 40°10' N. latitude (Figure 3-2; Figure 3-3). Groundfish trawling effort is low shoreward of the RCA during the winter months relative to summer months, and it is low south of 40°10' N. latitude during the winter months between 150 fm and 250 fm and (Figure 3-3); lower trawling effort may partially explain the lower and less frequent ECEs in these areas.

During the summer, the highest ECEs were observed north of 46° N. latitude (up to 54 Chinook salmon in a single haul) and between 38° and 41.5° N. latitude (up to 14 Chinook salmon in a single haul) (Figure 3-3). These ECEs are substantially lower than those observed at deeper depths during winter.

Relatively few Chinook salmon were taken in the 100 fm to 150 fm depth bin due to RCA depth closures on the shelf (Figure 3-3); NMFS (2016b) showed that from 2011 through 2014, only one percent of the retained groundfish and trawl hours occurred in the 100 fm to 150 fm depth bin.

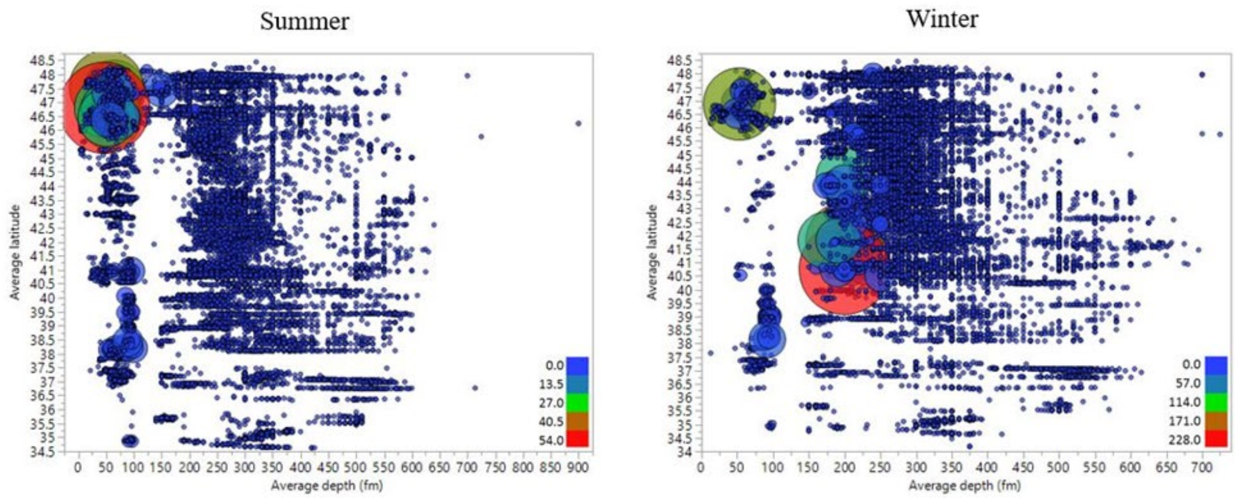

Figure 3-3. Bubble plots of Chinook salmon counts per haul by season and depth for IFQ bottom trawl from 2011 to 2016. Only observed hauls are included; electronic monitoring data are not shown. The legend represents number of Chinook salmon caught per haul. Note the scale difference between seasons. Source: WCGOP.

Chinook salmon caught by bottom trawl range from approximately 25 cm to 85 cm fork length (mostly 35 cm to 75 cm) (Figure 3-4). Larger Chinook salmon are caught and retained by high-rise or hooded trawls than those caught by SFFT (Figure 3-4). Hannah et al. (2005) also demonstrated that larger roundfish and rockfish typically were caught by the high-rise hooded trawls than by the SFFT, and the authors reasoned that larger fish have a better chance of escaping a low-rise cut-back trawl because of superior swimming abilities (Wardle 1975; He 1993).

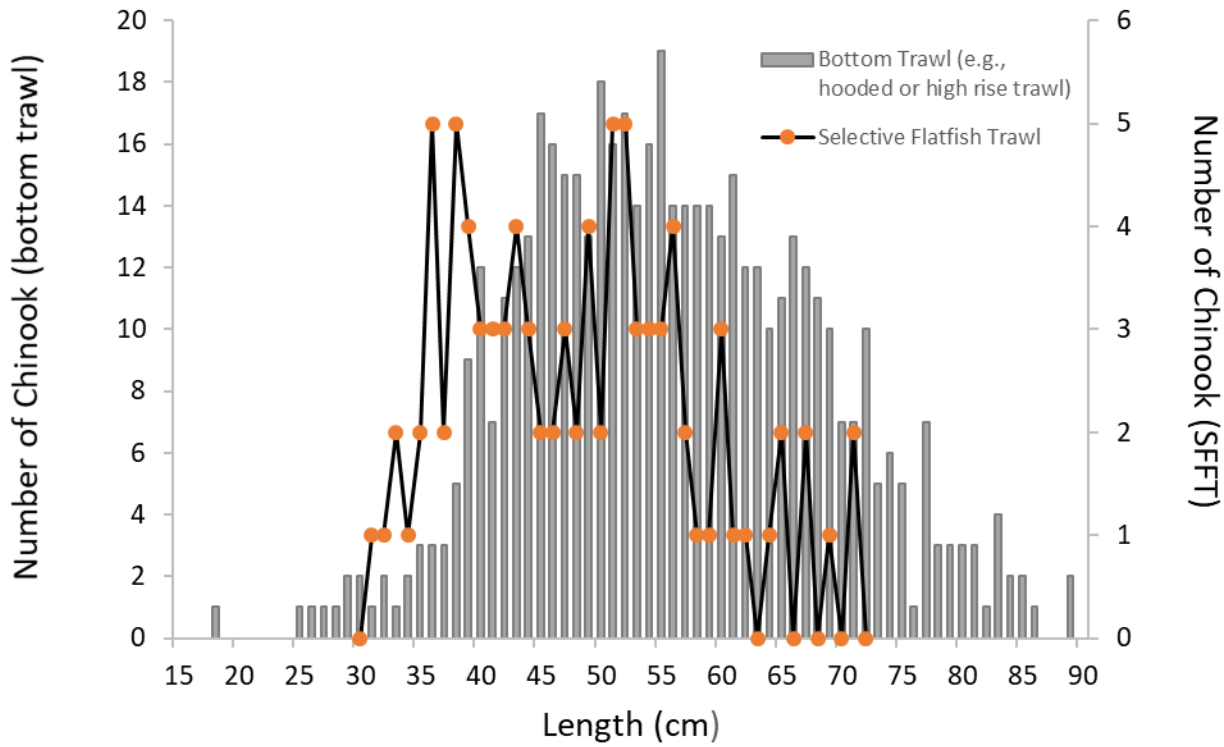

Figure 3-4. Length frequency distribution of Chinook salmon caught by selective flatfish trawl (line) and hooded low-rise or high-rise bottom trawl (bar) during 2002 to 2015. Source: WCGOP observer data. .

3.2.3.2 ESA-listed Green Sturgeon

The southern distinct population segment (DPS) of North American green sturgeon was listed as threatened under the ESA in 2006 (71 FR 17757). The southern DPS is defined as green sturgeon that spawn in rivers south of the Eel River in California (e.g., the Sacramento River and its tributaries) (Moser et al. 2016). Green sturgeon occur along the United States West Coast, mostly at depths shallower than 60 fm (Erickson and Hightower 2007; Payne et al. 2015) (74 FR 2300). Green sturgeon are a long-lived, slow-growing, anadromous fish species that spend one to four years in fresh and estuarine waters before making their first migration into ocean waters as sub-adults (Nakamoto et al. 1995; Moser et al. 2016). Green sturgeon spend most of their adult life in marine and estuarine environments, and they migrate into rivers for spawning (Erickson and Hightower 2007; Lindley et al. 2008; Lindley et al. 2011; Payne et al. 2015; Moser et al. 2016).

Expanded bycatch estimates of southern DPS green sturgeon by the groundfish trawl fishery have ranged from 0 fish to 21 fish from 2002 to 2015 (Table 3-13). Observer coverage rates for trawl vessels ranged from 15 percent to 23 percent from 2002 to 2010, but increased to nearly 100 percent beginning in 2011

with the inception of the catch share program (Somers et al., 2016a; Lee et al. 2017). NMFS (2017c) showed that green sturgeon bycatch during the initial five years of the catch share program mostly occurred in shallow coastal waters off Astoria, Oregon (around the Columbia River outflow). However, this limited distribution of bycatch is likely due to the distribution of fishing effort shoreward of the RCA during 2011 to 2015, rather than the latitudinal distribution of green sturgeon in the ocean. For example, green sturgeon were caught in numerous areas by bottom trawl along the Oregon and Washington coasts during the 1990s when shallow-water trawling (i.e., beach dragging) was more prevalent (Erickson and Hightower 2007) and when some trawlers targeted green sturgeon in nearshore coastal waters (D. Erickson, personal knowledge). In addition, Lee et al. (2017) and Payne et al. (2015) demonstrated high concentrations of green sturgeon off the south-central Oregon coast. Green sturgeon may be found year-around in shallow waters off Winchester Bay in southern Oregon (Payne et al. 2015).

Table 3-13. Green sturgeon southern DPS (sDPS) expanded bycatch estimates by fishery, 2002 to 2015. Source: Lee et al. 2017.

Year	Bycatch estimate by fishery (number of fish)		
	Bottom trawl	At-sea whiting (mothership and catcher-processor)	Shoreside whiting a/
2002	13	0	NA
2003	0	0	NA
2004	5	0	NA
2005	2	0	NA
2006	0	2	NA
2007	3	0	NA
2008	0	0	NA
2009	21	0	NA
2010	4	0	NA
2011	20	0	0
2012	11	0	0
2013	5	0	0
2014	15	0	0
2015	3	0	0

a/ NA indicates that data are not available

Results of genetic stock identification (GSI) analyses (Lee et al. 2017) indicate that 48 percent of green sturgeon caught by trawl off the Oregon and Washington coasts are most likely sDPS fish, whereas 95 percent of individuals caught off the California coast (south of 42° N. latitude) are most likely sDPS fish. Expanded bycatch estimates of southern DPS green sturgeon by the groundfish trawl fishery has ranged from 0 fish to 21 fish from 2002 to 2015 (Table 3-13). The biological opinion (NMFS 2012, p. 122) states that take of sDPS green sturgeon in the combined Limited Entry (LE) groundfish bottom trawl, IFQ groundfish bottom trawl, and at-sea hake fisheries should not exceed more than 28 fish per year. When sDPS bycatch estimates are combined across the federally managed fishery sectors, there was no single year that exceeded the annual limit (28 fish per year) for the years of observations (2002 to 2015) (Table 3-13).

3.2.3.3 ESA-listed Eulachon

The sDPS of eulachon, the stock from Mad River in northern California north to the Skeena River in British Columbia, was listed as threatened under the ESA in 2010 (75 FR 13012). Eulachon is an anadromous smelt. Adults migrate from the ocean to freshwater creeks and rivers where they spawn from late winter through early summer. It has been estimated that eulachon spend about 95 percent of their life in the ocean (Hay and McCarter 2000), although little is known about their distribution and behavior in the marine environment. Eulachon have been taken in research trawl surveys over the continental shelf off the United States West Coast, most often at depths between 27 fm and 109 fm (50 and 200 m) (NWFSC 2012).

Take of sDPS eulachon occurs as incidental catch in the groundfish bottom trawl and Pacific whiting midwater trawl fisheries (NMFS 2018a). Table 3-14 shows estimates of the number of eulachon caught by groundfish trawl fisheries during 2002 to 2015. The annual take estimation of eulachon for West Coast groundfish fisheries (1,004 eulachon), proposed in the 2012 biological opinion (NMFS 2012, page 121), was exceeded three years out of six years since 2011 (Table 3-14). As a result, in May 2016, NMFS reinitiated the consultation process for eulachon and completed a biological opinion (NMFS 2018a). The ITS in the 2018 eulachon biological opinion includes new annual take estimates that compare the five-year geometric means of Columbia River eulachon spawning run estimates and estimated eulachon bycatch levels; the Columbia River minimum eulachon spawning run size is used as a the proxy for the sDPS eulachon spawning abundance. Two thresholds were calculated: a precautionary threshold (0.01 percent of a five-year geometric mean) and a reinitiation threshold (0.02 percent of a five-year geometric mean). The 2016 thresholds calculated using methods shown in the 2018 eulachon biological opinion (NMFS 2018a) would have been higher than the 1,004 eulachon threshold shown in the 2012 biological opinion (NMFS 2012), largely because several indices of eulachon abundance show large increases from 2011 to 2014 (Agenda Item F.5.a, GESW Report, April 2017). The eulachon minimum abundance estimates for the Columbia River increased fivefold from 17.86 million to 84.24 million from 2011 to 2014, but decreased to 8.15 million by 2017 (NMFS 2018a).

The magnitude of eulachon bycatch by the United States West Coast groundfish fisheries (less than 5,113 eulachon annually between 2001 and 2015) is small relative to the 2013 to 2017 average eulachon spawner estimate for the Columbia River and its tributaries (i.e., 32.9 million eulachon spawning adults) (NMFS 2018a) and relative to coastwide bycatch of eulachon in pink shrimp fisheries (nearly 69 million eulachon in 2014) (Agenda Item F.5.a, GESW Report, April 2017; Appendix A in Gustafson et al. 2017). Based on the relatively low bycatch of eulachon in United States West Coast groundfish fisheries, either there is limited interaction with eulachon in these fisheries, or most eulachon encounters result in fish

escaping or avoiding trawl gear. When considering eulachon catch (and escape) mortality by the West Coast groundfish trawl fishery, the 2018 eulachon biological opinion (NMFS 2018a) expects the detrimental effects on eulachon by the groundfish fishery to be minimal and those impacts would only be seen in terms of slight reductions in abundance and productivity.

Table 3-14. Expanded eulachon bycatch estimates (number) by fishery, 2002 to 2015. Source: Gustafson et al. 2017.

Year	Bycatch estimate by fishery (number of fish) a/b/		
	Bottom trawl	At-sea whiting (mothership and catcher-processor)	Shoreside whiting c/
2002	783	0	NA
2003	52	0	NA
2004	0	0	NA
2005	0	0	NA
2006	0	147	NA
2007	72	10	NA
2008	0	43	NA
2009	67	36	NA
2010	0	0	NA
2011	139	1,322	0
2012	168	23	0
2013	658	316	4,139
2014	2,808	267	0
2015	643	56	0

a/ Point estimates of bycatch might fluctuate due to several factors, including annual variation in observer coverage rates, trawl duration, trawl depth, trawl location, seasonality, and haul volume coupled with trawl-net mesh size.
b/ In years before 2011, observers were not required to identify eulachon to species, and many may have been reported as smelt unidentified or herring/smelt unidentified.
c/ Data are not available for shoreside whiting fishery before 2011.

Most bycatch of eulachon by IFQ bottom trawl occurs shoreward of the trawl RCA and north of 42° N. latitude (Table 3-15). Ninety percent of the eulachon encounters by bottom trawl in the catch share program north of 40°10' N. latitude occurs at bottom depths less than 100 fm. Almost no eulachon encounters are reported in the WCGOP database for bottom trawl sets made between 42° and 40°10' N. latitude (Table 3-15). Similar results were shown by the West Coast groundfish bottom trawl survey (combination shelf/slope survey). Almost all eulachon encounters by the bottom trawl survey during summer and fall months are shoreward of the trawl RCA when north of 40°10' N. latitude (Figure 3-5). Ninety-six percent of the eulachon encounters by the bottom trawl survey were north of 42° N. latitude.

Table 3-15. Eulachon bycatch (number and pounds) by IFQ bottom trawl on observed trips during 2011 to 2015. Total bottom trawl hauls and eulachon-positive hauls are also shown. Source: WCGOP observer database.

Area	Depth bin (fm)	Total hauls	Hauls with Eulachon recorded	Eulachon (number)	Eulachon (pounds)
North of 42 N. latitude	< 50	3,000	17	220	12.3
	50 to 100	8,104	285	3,649	381.1
	100+	1,725	32	457	50.9
40°10' N. latitude to 42° N. latitude	< 50	229	0	0	0
	50 to 100	356	1	2	0.15
	100+	4,280	0	0	0

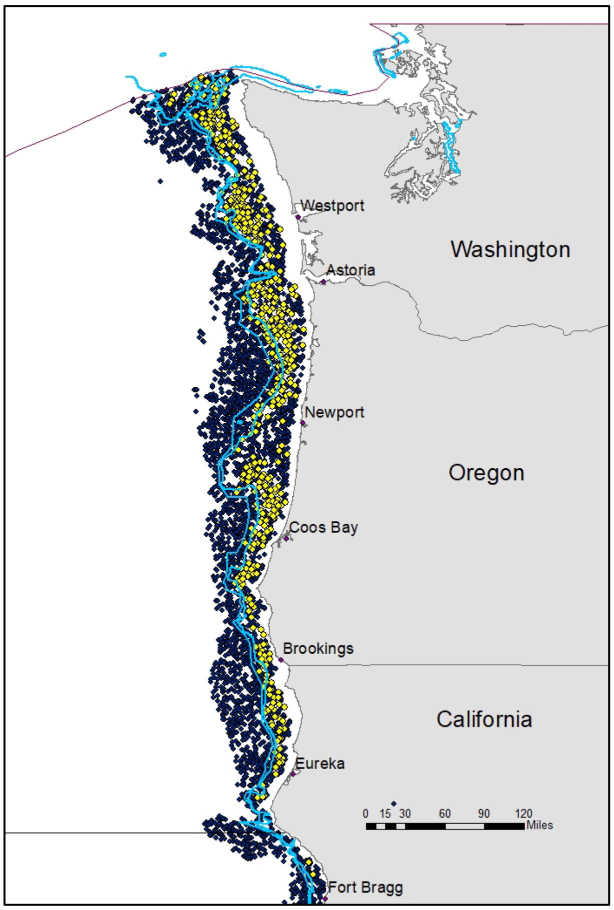

Figure 3-5. Hauls with eulachon bycatch (yellow) and all other hauls (blue) by the combination shelf-slope groundfish survey. Light blue line = 100-fm and 200-fm trawl RCA contours. Source: West Coast Groundfish Bottom Trawl Survey (combination shelf/slope survey), NOAA Fisheries, NWFSC/FRAM, Seattle, Washington (https://www.nwfsc.noaa.gov/data/map).

Several indices of eulachon abundance showed dramatic increases from 2011 to 2015 (Agenda Item F.5.a, GESW Report, April 2017; Section 3.2.3.3). These increases in abundance indices were accompanied by increased eulachon catch by the groundfish trawl fisheries (midwater and bottom trawl; Table 3-14). For example, the annual West Coast slope and shelf combination survey (hereafter referred to as the slope/shelf survey) shows large increases in catch of eulachon beginning 2012 (Figure 3-6). Catch of eulachon by the bottom trawl fishery shows a similar pattern; maximum catch of eulachon by the IFQ bottom trawl fishery and the slope/shelf survey occurred in 2014 (Figure 3-6). However, the magnitude of eulachon catch by the slope/shelf survey is higher than that shown for bottom trawl fishery, even though coastwide fishing effort by the slope/shelf survey (averaging slightly more than 700 hauls per year,[10] with each survey haul lasting approximately 30 minutes, the survey effort could be at least 80 times less than fishing effort by the groundfish bottom trawl fishery (more than 7,000 hauls per year, each lasting an average of 3 to 4 hours per haul) (Somers et al. 2017b). Reasons for the consistently higher eulachon catch by the slope survey could be differences in gear design (e.g., small-mesh liners are used in codends for trawl surveys that prevent escapement of small animals), or differences in areas of concentrated effort between the research hauls and commercial hauls.

[10] West Coast Groundfish Bottom Trawl Survey, NOAA Fisheries, NWFSC/FRAM, 2725 Montlake Blvd. East, Seattle, WA 98112. Accessed at https://www.nwfsc.noaa.gov/data/map.

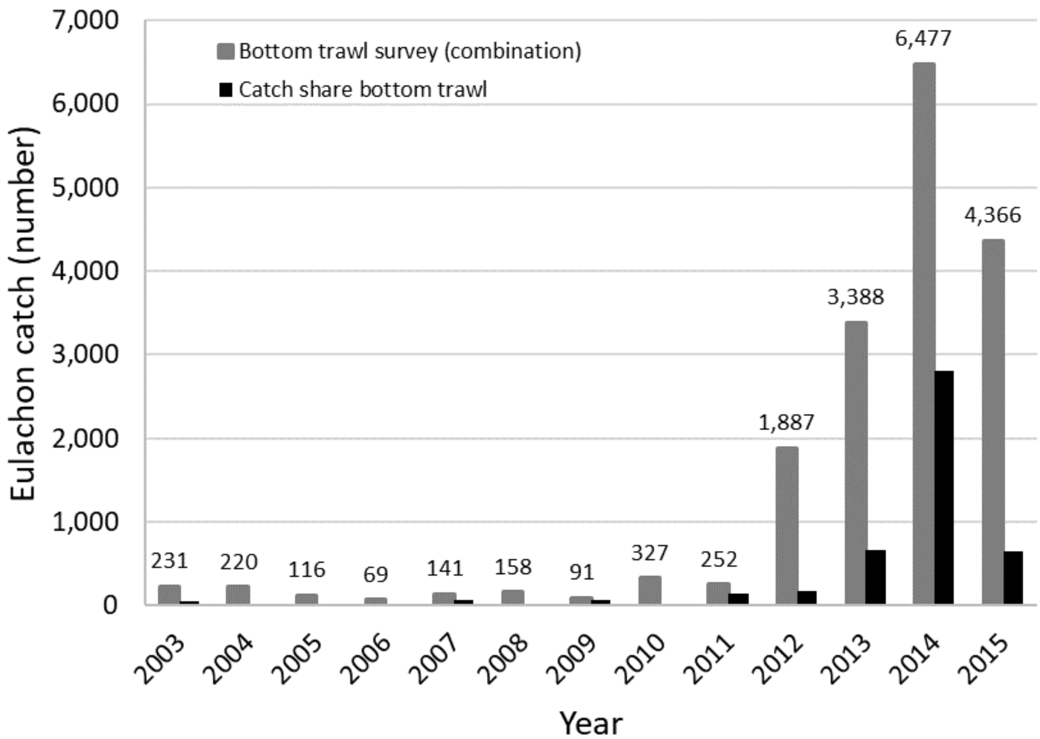

Figure 3-6. Eulachon catch (numbers) by the annual West Coast slope and shelf combination survey (gray bar) and by LE and catch share bottom trawl fisheries (black bar). Source: Gustafson et al. (2017); Groundfish Bottom Trawl Survey, NOAA Fisheries, NWFSC/FRAM, https://www.nwfsc.noaa.gov/data/map.

3.2.4 Other Non-target Non-groundfish Species

In addition to prohibited species and protected species (Section 3.2.2; Section 3.2.3), other non-target non-groundfish species share the same marine environment as groundfish (both temporally and spatially) and may be encountered by trawl. These other non-groundfish species (pink shrimp, forage fish, coastal pelagic species, and highly migratory species) are discussed in this section.

3.2.4.1 Pink Shrimp

Pacific West Coast pink shrimp stocks are found at depths between 45 m and 366 m (25 fm and 200 fm).[11] Pink shrimp undergo diel vertical migration in which they are found in deeper waters near the bottom during the day and rise in the water column during the night to feed.

[11] opc.ca.gov/webmaster/ftp/project_pages/Rapid%20Assessments/Pink%20(Ocean)%20Shrimp.pdf.

Data are not available on the bycatch of pink shrimp, specifically. The GEMM database shows trace amounts of catch of all shrimp species combined (including unidentified shrimp) by shoreside whiting, at-sea whiting, non-whiting midwater trawl, and IFQ bottom trawl since the inception of the catch share program. For example, the highest annual catch of all shrimp from 2011 to 2017 across catch-share sectors occurred in 2013 by IFQ bottom trawl (0.61 mt; GEMM database).

3.2.4.2 Forage Fish

A large portion of what are known as the “forage fish” of the CCE consist of small pelagic fish. In 2014, the Council reviewed trophic connections between unfished forage fish species on the West Coast and predator species managed under the MSA, the MMPA, and the ESA. Because of that review, a final rule was published during 2016 (81 FR 19054, April 4, 2016) that identified forage fish as shared-ecosystem component (EC) species, provided added measures regarding the future development of fisheries for shared EC species, and identified species of forage fish to be included as shared EC species (e.g., herrings, smelts, silversides, mesopelagic fishes, and pelagic squids, except Humboldt squid). Prior to 2016, most shared EC species were reported in aggregate groups or were not reported at all because there was no requirement to report these species on state landing receipts. Improved reporting of forage fish catch by groundfish fisheries was initiated in 2016, when total mortality of shared EC species was shown as 8.69 mt for the at-sea Pacific whiting sector (mostly non-squid species), 8.11 mt for groundfish bottom trawl (mostly unidentified squid), and 0.00 mt for shoreside midwater trawl targeting Pacific whiting and midwater rockfish (Somers et al. 2017a).

3.2.4.3 Coastal Pelagic Species (CPS)

The CPS FMP includes five species and one species group within its FMU: Pacific sardine, Pacific or “chub” mackerel, northern anchovy, market squid, jack mackerel, and krill or euphausiids. Ecosystem component species unique to the CPS FMP include Pacific herring and jacksmelt. Pacific sardine and Pacific mackerel are actively managed and formally assessed annually or biennially. The northern anchovy, jack mackerel, and market squid stocks are monitored to ensure that their stocks are stable. Incidental catch of CPS species in non-CPS fisheries is taken into consideration when setting the harvest specifications. General descriptions of the life histories of CPS FMP species are provided in Appendix A of Amendment 8 to the CPS FMP (Council 1998).

Only trace amounts of each CPS species have been reported as bycatch for IFQ bottom trawl fisheries from 2011 to 2017 (i.e., average less than 0.75 mt per species per year) (GEMM database). Midwater trawl (whiting and non-whiting) also catch only trace amounts of Pacific sardine, northern anchovy, and market squid. Average annual catch (2011 to 2017) for other CPS species by midwater trawl fisheries is

16.95 mt, 42.20 mt, and 327.87 mt for Pacific herring, Pacific mackerel, and jack mackerel (GEMM database). Largest annual midwater bycatch of Pacific mackerel (159 mt) and jack mackerel (881 mt) were observed during 2017, mostly by shoreside and at-sea whiting sectors.

3.2.4.4 Highly Migratory Species (HMS)

The FMUs for the HMS FMP include North Pacific albacore, yellowfin tuna, bigeye tuna, skipjack tuna, Pacific bluefin tuna, common thresher shark, shortfin mako or bonito shark, blue shark, striped marlin, swordfish, and dorado or dolphinfish. General descriptions of the life histories of HMS FMP species can be found in Appendix F to the HMS FMP (Council 2003). Species of the HMS FMP tend to occupy waters farther offshore than most groundfish species, and they are not commonly caught in the trawl catch share program (GEMM database). For those cases when HMS are caught by trawl, they are typically caught by midwater trawl.

3.3 Socioeconomic Environment

The socioeconomic environment of the trawl catch share program includes harvesters, mothership processors, first receivers, fishing communities, and management entities. The intent of the action is to further the goals of Amendment 20, including prevent overfishing, while achieving optimum yield (OY) consistent with the National Standard 1of the MSA.

Information on the socioeconomic environment of the West Coast groundfish fisheries is available in the 2015-2016 FEIS (Council and NMFS 2015), the 2017-2018 Harvest Specifications EA (NMFS 2016a), the Whiting Fishery Chafing Gear EA (Council and NMFS 2014), and the Five-year Review (NMFS and Council 2017). These documents describe commercial fisheries targeting groundfish and characterize West Coast fishing communities with respect to groundfish fisheries. Additional information on the shoreside IFQ program can be found in the 2016 Groundfish SAFE document (Council 2016d) that contains a series of tables summarizing landings and ex-vessel revenue in groundfish fisheries, landings and revenue by port, and indicators of fishery participation.

3.3.1 Harvesters

The proposed action pertains to gear regulations that directly affect trawl harvesters. These harvesters include catcher vessels in the mothership sector of the at-sea Pacific whiting fishery, catcher vessels in the shoreside Pacific whiting fishery, Pacific whiting fishery catcher-processors, and non-whiting catcher vessels in the shoreside IFQ sector. Where data are available, the catcher vessels in the shoreside IFQ sector are further divided into DTS bottom trawl, non-whiting non-DTS bottom trawl, and midwater trawl.

A comprehensive report on catcher vessel and catcher-processor participation and performance in the catch share program is available in the Economic Data Collection Program Catcher Vessel Report (2009 to 2015), and the Economic Data Collection Program Catcher-Processor Report (2009 to 2015).[12] Information from these reports are incorporated by reference (Steiner et al. 2017a; Warlick et al. 2017). Harvester data shown below were obtained from the FISHEyE[13] database (August 4, 2017 and December 15, 2017) in which the Economic Data Collection (EDC) data are stored.

3.3.1.1 Catcher Vessels in the Mothership Sector of the Pacific Whiting Fishery

Fourteen vessels participated in the mothership sector of the Pacific whiting fishery in 2015. These vessels delivered to three motherships. The three motherships were all members of a single mothership cooperative. The number of catcher vessels (15 vessels) in 2015 was slightly lower than the average annual number of catcher vessels that participated from 2011 to 2014 (Steiner 2017a). The average length of catcher vessels in the 2015 fishery was 104 feet.

The at-sea Pacific whiting season starts on May 15 and goes until December 31, unless the sector allocations are taken or when the mothership cooperative or the designated manager of the cooperative notifies NMFS that fishing has been completed for the calendar year. Because processing vessels must stay north of 42° N. latitude (Oregon/California border), their catcher vessels infrequently fish slightly south of 42° N. latitude. The start date of May 15 and the prohibition on processing south of 42° N. latitude took effect in 1996 as a conservation measure intended to minimize the bycatch of Chinook salmon (NMFS 1999). The average number of days spent at sea by catcher vessels in the mothership cooperative during 2015 was 42.4 days.

3.3.1.2 Catcher Vessels in the Shoreside Pacific Whiting Fishery

From 2011 to 2015, annual participation in the shoreside Pacific whiting sector ranged from 22 to 26 catcher vessels; participation was highest in 2011 and lowest in 2015. The average length of these catcher vessels ranged from 89 feet to 92 feet during 2011 to 2015.

The shoreside whiting fishery opens on April 15 for operations south of 40°30' N. latitude, where up to 5 percent of the Pacific whiting allocation may be taken prior to the opening of the fishery north of 40°30' N. latitude on May 15. Allowing early fishing south of 40°30' N. latitude allows access to Pacific whiting while the fish are aggregated off California. Like the at-sea sectors, the main portion of the fishery starts

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[12] https://www.nwfsc.noaa.gov/research/divisions/fram/economic/overview.cfm

[13] https://dataexplorer.northwestscience.fisheries.noaa.gov/fisheye/

on May 15 for the area north of 40°30' N. latitude. A May 15 start is intended to minimize the bycatch of Chinook salmon (NMFS 2016b). The fishery remains open until December 31. The average number of days catcher vessels in the shoreside Pacific whiting fishery spent at sea in 2015 was 54.4 days and ranged from 51.9 days to 63.7 days per year during the period from 2011 to 2015.

3.3.1.3 Pacific Whiting Catcher-processors

Nine catcher-processors participated in the catcher-processor cooperative in 2015. The number of vessels that fished on the West Coast and in Alaska has remained constant since the implementation of the catch share program in 2011. The average length of catcher-processors in the 2015 fishery was 304 feet.

The at-sea Pacific whiting fishery north of 42° N. latitude starts May 15 and continues until December 31 unless the sector allocations are taken, or the designated manager of the cooperative notifies NMFS that fishing has been completed for the calendar year. The average number of days at sea for catcher-processors in 2015 was 65 days.

3.3.1.4 Non-whiting Catcher Vessels in the Shoreside IFQ Program

In 2015, 51 catcher vessels used bottom trawl gear to target DTS species, while 46 vessels used bottom trawl gear to fish for groundfish species other than Pacific whiting or DTS. In addition, the growing midwater trawl fishery, primarily for widow and yellowtail rockfish, had 13 vessels participate in 2015. The midwater non-whiting trawl fishery began slowly in 2011 and it has experienced increased participation each year as allocations for midwater trawl species and co-occurring groundfish species have increased (Section 3.3.2). Between 2013 and 2014, 14 vessels exited the DTS bottom trawl fishery, leaving less than half the number of vessels than had participated in the pre-catch share fishery (Steiner et al. 2017a). Non-whiting harvesters tend to have smaller vessels. In 2015, the average length of DTS bottom trawl vessels was 70 feet, the average length of non-whiting, non-DTS bottom trawl vessels was 68 feet, and the average length of non-whiting midwater trawl vessels was 78 feet.

The bottom trawl fishery is a coast-wide, year-round fishery. Midwater trawl south of 40°10' N. latitude is allowed year-round seaward of the trawl RCAs. Midwater trawl north of 40°10' N. latitude is allowed after May 15 within and outside of the trawl RCAs.

In 2015, the average annual number of days at sea was 35.2 days for DTS bottom trawl, 25.3 days for non-DTS, non-whiting bottom trawl, and 12.5 days for non-whiting midwater trawl. In 2015, the DTS bottom trawl fishery primarily targeted Dover sole, longspine and shortspine thornyheads, and sablefish. The fishery also caught other IFQ species, which were primarily rockfish and small amounts on other non-IFQ groundfish species. The non-DTS, non-whiting bottom trawl vessels mostly targeted petrale

sole, other IFQ species, and Dover sole. The most common other IFQ species were Pacific cod, arrowtooth flounder, and rex sole. Non-IFQ groundfish are also caught.

The midwater non-whiting trawl fishery primarily targeted yellowtail rockfish (58 percent of catch) and widow rockfish (24 percent of catch) in 2015 (Steiner et al. 2017a). However, the catch of widow rockfish far exceeded the catch of yellowtail rockfish beginning in 2017, after canary rockfish were no longer declared overfished (see Section 3.4.2.5) and after the widow rockfish ACL increased by more than six times (Table 3-2). Historically, midwater trawling for widow rockfish occurred at night when they formed dense off-bottom schools (Tagart 1987). Although chilipepper rockfish were a commercially important midwater trawl species in waters off California, catches have declined significantly since the late 1980s and 1990s, because of management measures implemented to rebuild overfished species.

3.3.2 Attainment of the Trawl Allocation

Fishery harvest guideline means the harvest guideline or quota after subtracting from the TAC or ACL, when specified, any allocation or projected catch for the West Coast treaty Indian Tribes, projected research catch, deductions for fishing mortality in non-groundfish fisheries, and deductions for EFPs (Section 3.2.1). Separate allocations for trawl and non-trawl fisheries are established biennially or annually, using the standards and procedures described in Chapter 6 of the Groundfish FMP (Council 2016a).

Depending on the stock, annual trawl allocations may be relatively stable across years, or they may show large interannual fluctuations (Table 3-16) due to changes in harvest policy and OFLs/ACLs (Table 3-2 and Table 3-3). For example, the trawl allocation for canary rockfish increased from 59 mt in 2016 (while under the rebuilding plan) to 1,060 mt in 2017 after termination of the rebuilding plan because the stock was no longer considered overfished (Table 3-16). The trawl allocation for widow rockfish increased by more than 7 times in 2017 compared to 2016, based on the stock status described in the 2015 stock assessment (Hicks and Wetzel 2015).

Table 3-16. Trawl allocations for selected groundfish stocks from 2011 to 2017. Gray cells represent years showing greater than 100 percent increase or decrease. TH = thornyhead; RF = rockfish; N = north; S = south. Source: Federal Pacific Coast Groundfish Regulations (50 CFR Part 660)

Stock	Trawl Allocation (mt)						
	2011	2012	2013	2014	2015	2016	2017
Arrowtooth flounder	12441	12,441	3,866	3,487	3,239	3,079	11,121
Dover sole	22,240	22,240	22,240	22,240	45,986	45,986	45,986
Longspine TH (N)	1,971	1,919	1,865	1,816	2,967	2,820	2,705
Petrale sole	876	1,060	2,323	2,383	2,544	2,638	2,750
Sablefish (N)	2,597	2,517	1,878	2,038	2,249	2,461	2,466
Shortspine TH (N)	1,452	1,435	1,407	1,393	1,601	1,583	1,571
Widow RF	491	491	1,284	1,284	1,711	1,711	12,094
Yellowtail RF (N)	3,394	3,407	3,235	3,239	4,893	4,677	4,546
Canary RF	34.1	34	53	54	57	59	1,060
Chilipepper RF (S)	1,475	1,331	1,100	1,067	1,203	1,196	1,921
English sole	18,678	18,678	6,376	5,266	9,158	6,642	9,264
Lingcod (N)	927	846	1,241	1,170	1,148	1,098	1,375
Lingcod (S)	943	971	496	474	448	422	559
Longnose skate	1,159	1,159	1,735	1,735	1,734	1,734	1,668
Pacific cod	1,140	1,140	1,131	1,131	1,036	1,036	1,036
Splitnose RF (S)	1,381	1,454	1,518	1,575	1,619	1,649	1,662
Starry flounder	673	673	757	761	762	764	636
Minor Shelf RF (N)	557	557	543	543	1,127	1,132	1,183
Minor Slope RF (N)	885	885	889	889	1,319	1,330	1,369
Minor Slope RF (S)	377	377	376	379	424	425	433
“Other Flatfish”	4,686	4,217	4,214	4,214	7,691	6,335	7,475

Fishing mortality as a percent of the trawl sector allocation for those species with formal trawl allocations are shown in Table 3-17. Sablefish (south) and shortspine thornyhead (south) were omitted because they are caught mostly by IFQ fixed gear instead of trawl gear, and this action affects only trawl gear. Since

2011, trawl allocations have been exceeded only for sablefish during 2017 (Table 3-17); however, sablefish mortality across all groundfish sectors remained below the OFL (Table 3-2). Trawl mortality for the remaining groundfish stocks was less than the trawl allocation during the 2011 to 2017 period (Table 3-17). Except for petrale sole and sablefish, the seven-year average attainment of the trawl allocation is less than 51 percent for all target stocks. For non-target groundfish stocks, average attainment of the trawl allocation is less than 56 percent for longnose skate and less than 25 percent for the remaining non-target stocks.

Table 3-17. Fishing mortality as a percent of the trawl sector allocation, from 2011 to 2017. Gray = exceed trawl allocation. N = north; S = south. Source of trawl mortality: GEMM database.

Trawl mortality as a percent of the trawl allocation (2011 to 2017)			
Stock	**Lowest annual rate**	**Highest annual rate**	**7-year Average annual rate**
Target groundfish			
Arrowtooth flounder	12.5%	63.3%	38.1%
Dover sole	13.8%	35.9%	25.5%
Longspine thornyhead (N)	23.0%	57.1%	39.9%
Petrale sole	91.5%	99.5%	96.1%
Sablefish (north)[a/]	88.0%	107.1%	95.3%
Shortspine thornyhead (N)	46.0%	61.3%	50.9%
Widow rockfish	34.5%	57.6%	47.5%
Yellowtail rockfish (N)	24.4%	60.2%	34.2%
Non-target groundfish[b/]			
Chilipepper rockfish (S)	5.5%	36.0%	19.5%
English sole	0.7%	5.7%	3.1%
Lingcod (N)	15.5%	44.2%	28.5%
Lingcod (S)	0.7%	6.5%	3.4%
Longnose skate	45.0%	79.2%	55.7%
Pacific cod	4.2%	37.2%	23.3%
Splitnose rockfish (S)	0.8%	4.1%	2.5%
Starry flounder	0.5%	1.9%	1.3%
Minor shelf rockfish (N)	3.0%	21.7%	7.2%
Minor slope rockfish (N)	17.5%	33.6%	24.2%
Minor slope rockfish (S)	11.7%	32.6%	20.8%
Other "flatfish"	9.9%	20.0%	15.0%

a/ Sablefish (north) trawl allocation (2,466 mt) was exceeded during 2017.
b/ In 2017 (after rebuilding), trawl mortality of canary rockfish was 23 percent of the trawl allocation.

3.3.3 Fuel and Gear Costs

In general, vessel operators seek to reduce operational costs through greater efficiency, which typically includes gear innovation. The catch share program was intended in part to create incentives for the development of fishing gear that effectively catches target species and reduces fuel use, thereby increasing the economic return to the vessels. Catch share fishery participants provide data to the EDC on fuel use and the costs related to fuel and fishing gear. The following discussion presents basic vessel costs for fuel and gear used while fishing in the catch share fishery as reported for the EDC data collection reports. The EDC reports are available from NMFS' Northwest Fishery Science Center.[14]

Descriptions of trawl gear are provided in Section 3.4.1. Fishermen work to configure their gear to require the minimum horsepower or minimum towing speed, while maintaining the best configuration of the net. Inefficiently rigged gear increases drag and uses more fuel. For bottom trawl, a properly tuned set of door, sweeps, and net have very light contact with the bottom, have low drag, and, therefore, require less horsepower and less fuel to fish (Muir 2015). The use of excluders to reduce bycatch of unwanted species has been explored with some success, however, fishermen have reported that excluders tend to increase bottom contact and, thereby, increase drag, silt, and fuel use (West Coast Trawlers' Network 2016).

Fuel costs represent a substantial share of each operation. Annual fuel costs typically ranged from 10 percent to 30 percent of revenue from 2011 to 2015, depending on sector and vessel type (FISHEyE, August 14, 2017). Fishing gear also represents a substantial cost to harvesting vessels. Fishing gear includes nets, cables, doors, and machinery that are at least partially used in the catch share fishery. The proposed action includes measures that would allow for greater protection of fishing nets and would remove some restrictions that prevent gear from other fisheries being used in the catch share fishery. Extending the life of fishing gear reduces the overall costs to vessels. Allowing gear to be used in multiple fisheries or during the same trip may reduce the cost of participation. Because most vessels also fish in other fisheries (i.e., Alaska groundfish), some gear costs would be shared with those fisheries.

3.3.4 Processors

Some information regarding first receivers and processors is provided in this section. References for additional information are provided in Section 3.3

[14] https://www.nwfsc.noaa.gov/research/divisions/fram/economic/overview.cfm

3.3.4.1 Mothership Processors

Mothership processors are part of the at-sea whiting sector and are managed under the mothership cooperative. The mothership cooperative may consist of one or more cooperatives and a non-cooperative fishery. Harvesting vessels are directly affected by the proposed action and are described in Section 3.3.1.1. The following section pertains to mothership processors. Data provided within this section were obtained from Steiner et al. (2017b) and FISHEyE (August 31, 2017).

Since the catch share fishery began in 2011, three to five mothership vessels have processed Pacific whiting annually on the West Coast (Steiner et al. 2017b). The Pacific whiting fishery begins on May 15. At-sea processing is prohibited south of 42° N. latitude. Since 2011, the average annual number of days in the Pacific whiting fishery that each mothership has spent processing, offloading, and steaming on the West Coast has ranged between 51 days and 75 days (Steiner et al. 2017b).

The cost to purchase Pacific whiting from catcher vessels is substantial for mothership processors, ranging from 26 percent to 32 percent of the annual fleetwide revenue from 2011 to 2015. During the same period, the cost per metric ton to purchase Pacific whiting ranged between $191/mt and $255/mt. In 2015, the mothership fleet generated $20.3 million in revenue and supported 461 jobs from purchases of Pacific whiting caught in the catch share program (Steiner et al. 2017b). Revenue in 2015 was the lowest since catch shares began in 2011.

3.3.4.2 First Receivers/processors

A first receiver is a person who receives, purchases, or takes custody, control, or possession of catch onshore directly from a vessel. IFQ first receivers who purchase and/or process catch share fish are divided into three categories: Pacific whiting shoreside processors, non-whiting processors, and non-processors. Pacific whiting processors are those who receive and process at least one delivery of Pacific whiting from a vessel targeting Pacific whiting in the catch share fishery. Pacific whiting processors may also process non-whiting species. In addition, some companies have first receiver site licenses, but do not process any fish; they are categorized as “non-processors.”

In 2015, 18 first receivers purchased and processed catch share fish at 21 processing facilities and at 11 buying stations. Nearly all the first receivers processed Pacific whiting (17 out of 18), but only 8 of 18 first receivers processed non-whiting (FISHEyE, September 1, 2017). Although there have been modest changes between years, the overall number of both Pacific whiting and non-whiting first receivers has remained similar since the catch share program began.

Catch share first receivers receive fish in all three West Coast states. In 2015, catch share first receivers accepted approximately 46 percent by volume of all commercially caught fish on the West Coast (Guldin et al. 2017). First receivers range from independent catcher vessel owners who unload and truck their own fish, to large, multi-facility processing companies with a wide range of product offerings, to large businesses that own multiple facilities and process a wide range of species, including groundfish (Guldin et al. 2017). In addition to groundfish delivered by harvesters in the catch share program, first receivers also process non-groundfish, including crab, pink shrimp, halibut, salmon, CPS species, and others.

Like mothership processors, first receivers purchase catch share fish from catcher vessels (Guldin et al. 2017). The cost to purchase fish from catcher vessels is a substantial cost to first receivers, ranging from 47 to 52 percent of the annual coastwide revenue during 2011 to 2015 (FISHEyE, September 1, 2017).

3.3.5 Fishing Communities

Communities with the most active groundfish bottom trawl activity include Astoria, Newport, Coos Bay, Brookings, Eureka, and Fort Bragg (NMFS and Council 2017, page 3-216). Communities most involved with Pacific whiting sectors are Astoria, Newport, coastal Washington (shoreside or at-sea catcher vessels), and Seattle (home port for catcher-processors and motherships) (NMFS 2016, page 2-235). A detailed description of fishing communities and their dependence on and engagement in the catch share program can be found in the Five-year Review (NMFS and Council 2017). The analysis demonstrates the importance of the catch share program to a given community. In addition, descriptive community summaries based on data from the Pacific Coast Groundfish Social Survey (PCGFSS) provide descriptive information to better understand the catch share program relative to the communities and individuals in the communities (Russell et al. 2017).

3.3.6 Management Structure and Monitoring

For the shoreside trawl fleet, the catch share program was a major shift in management as individual fishing quota allocations were established for 30 species or species groups based on historical participation. Provisions of the program included the requirement for 100 percent observer coverage, allowance for gear-switching, and an adaptive management program to set quota aside in support of activities such as cooperative research. However, some management measures remained in place, such as trip limits for non-IFQ species, size limits, and area restrictions (NMFS and Council 2017). Limited entry trawl permit holders received 90 percent of the non-whiting quota shares (QS). Ten percent was held for an adaptive management program (AMP). For whiting, 80 percent of QS was allocated to LE permit holders and 20 percent to qualified processors (NMFS and Council 2017).

In 2011 when the catch program was established, IFQ management areas were defined in regulation (see Section 2.7). The management areas (Section 2.7) were based on the stock information for select species, harvest allocations, and the corresponding quota shares for species, and they were intended to allow for different management measures for different species (75 FR 53380, August 31, 2010; 75 FR 78344, December 15, 2010).

Changes in the at-sea sectors were not as dramatic as they were for the shoreside fishery. In the mothership sector, Pacific whiting catch history assignments were made to qualified catcher vessel permits. Each year, harvester cooperatives are allocated whiting and bycatch species in proportion to the catch history allocations of their members. Those allocations are then committed to a particular mothership for an entire year. Although the regulations allow for the formation of one or more cooperatives or participation in a non-cooperative fishery, to date, all catcher vessels have chosen to participate in a single cooperative, similar to pre-catch shares. However, with harvester allocations, the fleet has had greater flexibility as to when to fish its allocation. The catcher-processor sector had voluntarily formed a harvester cooperative in 1997, known as the Pacific Whiting Conservation Cooperative. Under Amendment 20, the catcher-processors can form one or more harvester cooperatives. Catcher-processors have continued to operate as a single harvester cooperative.

3.3.6.1 Fishery Monitoring

Individual accountability was built into the catch share program through full monitoring of discards and landings. If a vessel was not monitored on each trip, the lack of individual accountability could generate an incentive to alter fishing behavior. Some skippers might elect to target stocks or areas with higher levels of associated constraining species. Without complete shoreside and at-sea monitoring, individual vessel operators or buyers could potentially discard overfished species (or other species) when they reached their quotas, which would likely exacerbate bycatch and overfishing issues. With these concerns in mind, the Council selected 100 percent monitoring for both fishing and offloads as a core element of the program. The Council designed this monitoring system to allow for management of the fishery on an individual vessel basis (NFMS and Council 2017).

Under the catch share program, vessels in the shoreside IFQ program were required to increase observer coverage from approximately an average rate of 19 percent for 2002 to 2010 to 100 percent beginning in 2011. Observers collect valuable fisheries data, including fishing effort and location, estimates of retained and discarded catch, species composition, biological data, and protected species interactions. The data inform fisheries managers and stock assessment scientists, as well as other fisheries researchers. Observer catch data inform the vessel accounting system used for quota management. In addition to observers, the

offloading of catch share fish at first receivers must also be watched by a catch monitor. Catch monitors are individuals who collect data to verify that the catch is correctly sorted, weighed, and reported. Landings data and at-sea discards are later combined for total catch estimation.

Processing vessels are required to have observer coverage based on the vessel's size. Vessels over 125 feet long overall must carry two observers, while processing vessels under 125 feet long overall only have to carry one observer. To date, all mothership processors and catcher-processors have been over 125 feet.

NMFS has proposed revising the monitoring requirements for catcher vessels in the Pacific whiting fishery and fixed gear vessels in the shoreside IFQ fishery. NMFS published a proposed rule on September 6, 2016 (81 FR 61161). A final rule is expected to be effective during 2018 (Agenda Item E.1.a, Supplemental NMFS Report 2, June 2018). Under the proposed action, vessels in the Pacific whiting and fixed gear fisheries would have the option to use EM in place of human observers to meet the requirements of 100 percent at-sea observer coverage. Whiting catcher vessels would have to practice maximized retention and would no longer be allowed to sort catch at sea, with limited exceptions, while using EM. Because the type of catch handling that would be required to identify discards to species would not be practical at the large volumes on whiting trips, maximized retention would be required to ensure that catch could be documented by the shoreside catch monitors or mothership observers before being disposed of or processed. Fixed gear vessels would have to sort and discard catch in a manner that would enable the EM system to record it. Because some species can be difficult to differentiate on camera, Pacific whiting vessels would have to retain all catch until landing with a few exceptions for prohibited and protected species and discards for safety reasons, and fixed gear vessels would be able to discard those species that could be differentiated on camera. The list of species that could be discarded may be modified through a routine action as defined in the FMP. More details about the EM program can be found in the proposed rule (81 FR 61161) and at http://www.psmfc.org/program/electronic-monitoring-program.

The Council is currently considering expansion of the EM option to vessels using non-whiting midwater trawl and bottom trawl. The action is expected to be proposed in 2018 and effective by January 1, 2019 (Agenda Item E.1.a, Supplemental NMFS Report 2, June 2018).

3.3.6.2 Vessel Monitoring System

VMSs that automatically transmit hourly position reports to NMFS are the primary management tool used to monitor commercial vessel compliance with time and area restrictions. All catch share vessels must have an operational VMS to fish in the groundfish fishery. In addition, each vessel operator must submit

declaration reports to the Office for Law Enforcement (OLE) that allow the vessel's position data to be linked to the type(s) of fishing gear and, in some cases, a target strategy.

3.3.6.3 Fishery Enforcement

Consistent with Section 6.10 of the Groundfish FMP, when considering new management measures, the Council is expected to consider the fishery and its characteristics, assess whether the measures are sufficiently enforceable to accomplish the objective of those management measures, and describe measures to be taken to reduce risks to the measures' enforceability. If new management measures are under development, the Council determines whether requirements are needed to facilitate the enforcement of new management measures.

Specific to the development of catch share programs in the groundfish fishery, Section 6.5.3.2 of the FMP states that the development of such programs must be accompanied by an appropriate monitoring mechanism where such programs are sufficiently enforceable and are not expected to increase vessel detection-avoidance activities.

Under the federally funded NOAA Cooperative Enforcement Program, OLE has ongoing formal Cooperative Enforcement Agreements and Joint Enforcement Agreements with all three West Coast states: California Department of Fish and Wildlife, Law Enforcement Division; Oregon State Police, Fish and Wildlife Division, and Washington Department of Fish and Wildlife, Police. These agreements extend federal authority for state agencies to enforce specific federal laws and regulations as defined in specific, agreed-upon federal priorities within each agreement, including the enforcement of the Northern Pacific Halibut Act.

Table 3-18 presents gear-related enforcement actions taken by NOAA and its cooperating enforcement agencies between 2011 and 2016. Few violations resulted in monetary penalties, and most resulted in verbal or written warnings. The violations related to fishing in multiple IFQ management areas and mesh size restrictions in 2011 were those most likely to be fined. In relation to average annual vessel costs, the penalty amounts appeared to be relatively minor.

Table 3-18. Enforcement actions related to gear regulations affected by the proposed action, 2011 to 2016. a/

	2011	2012	2013	2014	2015	2016
Minimum mesh size						
Investigation/results	Did not meet minimum mesh size. Joint inspection with state. State issued a citation for not meeting minimum mesh size requirements.		Near the codend, the net failed to meet 4.5-inch minimum mesh size. Verbal warning.			Only one in six mesh allowed net gauge to pass through. Gauge passed through 16 of 20 meshes on wet codend. Contacted owner who agreed to fix issue.
			Only able to get 4-inch steel gauge through 15 of the 20 mesh bars. Captain notified.			
Chafing gear						
Investigation/results	Codend had excessive chafing gear. Joint inspection with state. State issued a citation for not meeting minimum mesh size requirements.					Codend appeared to have excessive chafing gear, greater than 50 meshes in length. Written warning.
						Excessive length of chafing gear. Written warning.
						Excessive length of chafing gear. Written warning.

	2011	2012	2013	2014	2015	2016
Fishing in multiple IFQ management areas on the same trip						
Investigation/results				Vessel fishing in two IFQ management areas $9,000 Notice of Violation and Assessment (NOVA).	VMS shows vessel fishing in two IFQ management areas. $5,400 NOVA.	VMS shows vessel fishing in two IFQ management areas. Written warning. VMS shows vessel fishing in two IFQ management areas. Under investigation.
Mixing of hauls before observer completes sampling						
Investigation/results		Mixing of hauls. Closed.		Haul brought on board before previous haul stowed. Closed.		Mixing of hauls prior to observer sampling. Verbal warning.
		Mixing of hauls. Closed.				Mixing of hauls prior to observer sampling. Verbal warning.

a/ No violations related to the use of selective flatfish trawl gear or multiple types of trawl gears on board were identified from 2011 to 2016

3.4 Fishing Gear and Fishing Effort

3.4.1 Trawl Gear

This section describes the basic characteristics of trawl gear used by fishermen in the catch share fishery. The fishing gear descriptions below are organized under the broad categories of midwater trawl and bottom trawl. The gear descriptions in this section are followed by Section 3.4.2, which describes trawling effort, CPUE, and bottom contact by gear type. Section 3.3.3 describes the costs of gear and fuel. The description of gears is found in Section 3 of the 2005 Final Groundfish EFH EIS (NMFS 2005a). Legal descriptions of groundfish gear can be found in the Federal Pacific Coast Groundfish Regulations, Title 50 Section VI, Part 660 (http://www.ecfr.gov).

Trawling involves towing a funnel shaped net behind a fishing vessel. The trawl gear varies, depending on the species sought and the size and horsepower of the boats used. Trawl gear may be fished on the bottom, near the bottom, or off the bottom in the water column. The rigging, adjusting, and fishing of trawl gear is complex. Fishermen work to configure their gear such that it requires the minimum horsepower to tow, while maintaining configuration of the net. Inefficiently rigged gear increases drag and uses more fuel.

The mouth of a trawl net is spread horizontally in the water column by trawl doors (otter boards) located ahead of the net (Figure 2-1). The doors, which are generally made of metal, are pushed apart and down by hydrodynamic forces and by their own weight. Some increase their spread by bottom friction. Fishermen choose trawl doors based on the horsepower of their vessel and the type of fish they pursue.

Trawl nets can vary in size from small to very large. The trawl net is wide at the mouth, tapering to an intermediate piece that is attached to the codend (Figure 2-1). The mesh sizes for the net and codend are regulated to allow undersized species to escape during fishing.

Trawl nets are generally made of polyethylene (PE) or high-tensile PE. Some older nets are made of nylon fibers. Most PE nets are constructed of 4-millimeter (mm) or 5-mm twine and web. Some of the heavier nets may be made of 6-mm twine, and some small nets may be constructed of 3-mm twine. Tougher netting is used around bottom contact areas (where wear occurs) and around the headrope to protect the web from damage from the floats. Lighter netting is used on the top and the main body or belly of the net.

The top of the mouth of the net is called the headrope (Figure 2-1). The headrope usually overhangs the footrope (referred to as hooded) to ensure that fish disturbed by the footrope do not escape upwards, but

rather are shepherded down into the net and codend. The footrope is directly attached to the lower leading edge of the net.

The riblines go fore and aft in the net to provide strength (Figure 2-1), help provide security in event of a tear in the net, and prevent tears from going all the way around the net. Midwater and bottom trawl nets are attached by sets of bridles (upper and lower bridles) to the doors, or they may be attached to mud gear, which, in turn, is attached to the doors. Bridles are made of cable; they hold the net open as it is towed and help herd fish into the path of the trawl net. Individual fishermen select the length of these bridles and their angle based on their vessel and the herding characteristics of the target species.

3.4.1.1 Midwater Trawl

Midwater trawl (see Figure 3-8 in NMFS 2005a) means a trawl in which the doors and footrope of the net remain above the seabed (50 CFR 660.11). A midwater trawl has no rollers or bobbins on any part of the net or its component wires, ropes, and chains (50 CFR 660.11). Midwater trawl gear must have unprotected footropes at the trawl mouth, and the footrope of midwater gear may not be enlarged by encircling it with chains or by any other means (50 CFR 660.130). Ropes or lines running parallel to the footrope of midwater trawl gear must be bare and may not be suspended with chains or any other materials. Sweep lines, including the bottom leg of the bridle, must be bare. For at least 20 feet immediately behind the footrope or headrope, bare ropes or mesh of 16-inch minimum mesh size must completely encircle the net (50 CFR 660.130) (79 FR 71340, December 2, 2014).

Midwater trawl nets are used for both whiting and non-whiting midwater fisheries, and they are permitted only during the primary whiting season (May 15 to December 31) north of 40°10' N. latitude. Midwater trawls are permitted within or outside trawl RCA boundaries north of 40°10' N. latitude, but they are prohibited shoreward of trawl RCA boundaries south of 40°10' N. latitude. Midwater trawl nets are allowed year-round seaward of the trawl RCAs south of 40°10' N. latitude.

From 2011 to 2015, the average tow speed for catcher vessels in the shoreside Pacific whiting and mothership cooperative sectors was 3.1 nautical miles to 3.3 nautical miles per hour (Steiner et al. 2017a). In 2015, the average tow speed for non-whiting midwater trawl was 2.8 nautical miles per hour (Steiner et al. 2017a). Midwater trawls are generally towed faster than bottom trawls to stay with the schooling fish they target.

Midwater trawl nets require a large vertical as well as a horizontal mouth opening to catch schools of fish and to give the net stability during operation (NMFS 2005a). A midwater trawl net has very large meshes or parallel ropes in the front of the net to allow it to open to its full width. Mesh size decreases on the intermediate parts of the net and down into the codend. The minimum mesh size for the midwater trawl

nets is set by regulations, and it must measure no less than 3 inches between knots throughout the net and codend.

The wings of the net are very long and tall. To achieve the large opening, deep side panels are used, in addition to the top and bottom belly panels commonly found in bottom nets (Skamser 2003). Weights suspended from the lower bridle legs and footrope promote maximum vertical mouth opening. When fishing in the water column, or when fishing close to the bottom, as with bottom trawls, the relationship of the footrope to the head rope and the vertical opening may be adjusted (Sainsbury 1996; Skamser 2003). A midwater trawl net may be 900 feet or more long (274 meters) and have footropes that are 300 to 600 feet (91 to 183 m) long along the center and wings (Skamser 2003).

The codend of the midwater net (Figure 2-5) generally has four riblines made of synthetic rope that run down its length and expansion straps around the circumference of the codend to restrict the expansion of the netting and allow it to be hauled up the stern ramp (NMFS 2005a). Chafing gear is sometimes attached to the codend to protect it from abrasion on the stern ramp (or if the net touches the bottom). Chafing gear may cover the bottom and sides of the codend, but it is not permitted on the top of the codend (with certain exceptions) (50 CFR 660.130) (Figure 2-5).

3.4.1.2 Bottom Trawl

As described in regulations at 50 CFR 660.11, a bottom trawl (Figure 2-1) is a trawl in which the doors, the footrope of the net, or both are in contact with the seabed. Any trawl not meeting the requirements for a midwater trawl at 50 CFR 660.130(b) is considered a bottom trawl. Two types of bottom trawl are allowed in the groundfish fishery, large footrope and small footrope (see Figure 3-9 in NMFS 2005a). Large footrope trawl (Section 3.4.1.3) has a footrope diameter larger than 8 inches and no larger than 19 inches, including any rollers, bobbins, or other material encircling or tied along the length of the footrope (50 CFR 660.130). Small footrope trawl (Section 3.1.1; Section 3.4.1.4) must have a footrope diameter of 8 inches or smaller, including any rollers, bobbins, or other material encircling or tied along the length of the footrope. Selective flatfish trawl and Scottish seine are types of small footrope trawl (Section 3.4.1.4).

Bottom trawl nets and rigging are used to herd fish into the path of the net by noise and disturbance of the seabed (mud clouds, etc.) and by the turbulence created by the doors, bridles, and mudgear (Sainsbury 1996), causing fish to aggregate directly in front of the mouth of the net (Jennings et al. 2001). From 2011 to 2015, the average speed at which bottom trawl was towed was 2.4 nautical miles to 2.9 nautical miles per hour (Steiner et al. 2017a).

The footrope of bottom trawls may be weighted with chain or may be rope-wrapped cable when used on a soft bottom. If the net is to be towed over rough bottoms or over soft sea beds that may contain boulders,

rubber disks or rubber rollers (also called bobbins) are attached to the footrope under the center and wing sections of the net to allow the net to ride over obstacles (Section 3.4.1.3). These larger footropes may protect the netting more effectively, but they may also allow more opportunities for escape under the net (i.e., under the footrope) that would result in fewer fish passing back into the net (Rose et al. 2000).

The net type and net construction can vary between vessels and by the target species. Fishermen configure their gear to require the minimum horsepower for towing, while maintaining the desired configuration of the net. Drag, lift, thrust, and gravity are all considerations when configuring trawl gear. Inefficiently rigged gear increases drag, which increases the amount of fuel used (Muir 2015; Suuronen et al. 2012). Inefficient rigging may also reduce catch efficiency (e.g., increased gilled fish [i.e., wedged in trawl meshes], decreased catch or retention of marketable species, and increased catch of unmarketable species) and increase bottom impacts. A properly tuned set of door, sweeps, and net should have very light contact with the bottom, should have low drag, and, therefore, should require less horsepower and fuel burn for fishing (Muir 2015; Suuronen et al. 2012).

The net portion of a bottom trawl is not intended to drag along the bottom (Rose et al. 2000). To help keep the net and codend off the bottom, nets are tapered (Rose et al. 2000) and buoyed with floats that are attached to the headrope of the net and on the codend to help the net stay buoyant. Keeping the net off the bottom helps avoid getting sand and mud in the catch (especially in flatfish trawls) to improve product quality, allows the net to rise over rocks, and prevents abrasion of the codend even when towed over sandy bottom. However, floats cause drag and decrease fuel efficiency, so there are many things to be considered when attaching floats to the trawl gear (Muir 2015). Typically nets are designed to balance the floatation with resulting drag and decrease in fuel efficiency caused by the floats.

The codend of a bottom trawl net has two or four riblines made of synthetic rope that run down the length of the codend (Figure 2-1). Additionally, the codend has expansion straps around its circumference to restrict the expansion of the netting and allow it to be hauled up the stern ramp. Protective pieces of synthetic rope or other material (= chafing gear) can be attached to the codend to protect the netting from abrasion. With bottom trawls, chafing gear protects the codend from excess wear when it is towed up the trawl ramp and when it may drag against rock or over abrasive sandy bottom on the sea floor. Groundfish bottom trawl regulations restrict the amount, size, and attachment of chafing gear that can be used on the codend; chafing gear may encircle no more than 50 percent of the net’s circumference and may be used only on the last 50 meshes, measured from the terminal (closed) end of the codend. The prohibition against chafing gear on the trawl body of the net makes the net more vulnerable to damage and encourages fishers to operate in less rocky areas (66 FR 2338, January 11, 2001).

3.4.1.3 Large Footrope Trawl

Large footrope trawl gear (see Figure 3-9 in NMFS 2005a) has most commonly been used in areas that may have irregular substrate (rocks, boulders, or outcroppings), as well as along the continental slope and in deeper water. Current regulations prohibit the use of large footrope gear shoreward of the trawl RCAs. Restrictions on the use of footropes greater than 8 inches in diameter were established in 2000 to reduce access to aggregations of overfished species. In 2006, measures to protect EFH included the prohibition of large footrope trawl gear greater than 19 inches in diameter, including any rollers, bobbins, or other material encircling or tied along the length of the footrope (71 FR 27408, May 11, 2006). Large footrope trawl gear is designed to bounce over rock piles, allowing greater access to rocky habitats. Restrictions on the use of large footrope trawl gear have likely removed trawl effects from rocky habitats (Bellman 2004; Bellman et al. 2005).

3.4.1.4 Small Footrope Trawl (including Selective Flatfish Trawl [SFFT])

Fishers generally use small footrope trawl gear in areas that have a regular substrate (few rocks or outcroppings) and more widely on the continental shelf than on the continental slope; this is due, in large part, to regulatory requirements. Prior to 2005, the two-seam eastern trawls were primarily used for flatfish fishing in shallow waters and by vessels with lower horse power. The net is a low-rise net with a wide bottom and full wings (Skamser 2002). The traditional bottom net design for flatfish creates net mouth openings approximately 8 feet (2.4 m) in height or less (Sainsbury 1996) (Section 3.4.1.5). A small footrope often consists of rubber discs (approximately 3-inch to 4-inch diameter) hung on a cable (see Figure 3-9 in NMFS 2005a). Older footropes are sometimes a cable wrapped with rope to which the web is directly attached.

Selective Flatfish Trawl **–** Since 2005, the use of SFFT (Figure 2-3) has been required north of 40°10' N. latitude shoreward of the trawl RCA. The SFFT requirement was enacted in an effort to maintain nearshore flatfish trawl fisheries, while reducing the catch of canary rockfish and other overfished species. Previous management actions to reduce canary rockfish catch had greatly expanded the closed RCA by moving the boundary shoreward. The expanded RCAs decreased canary rockfish catch rates, but also severely limited access to productive flatfish stocks. Research trials (King et al. 2004; Hannah et al. 2005) and fishery-scale tests of SFFT under EFPs (Parker et al. 2004) showed a consistent 70 percent to 80 percent reduction in canary rockfish catch rates, providing a tool to allow flatfish trawling in traditional areas while reducing canary rockfish bycatch from levels projected for a fishery based on conventional trawls (King et al. 2004; Parker et al. 2004). Selective flatfish trawls (Figure 2-3) are very low-rise nets (i.e., approximately 4.5-foot headrope height; Hannah et al. 2005) with a cut-back headrope

design that allows them to catch bottom-tending fishes effectively, while avoiding species that are either distributed off-bottom or tend to rise when disturbed (King et al. 2004; Hannah et al. 2005).

The regulations for SFFT at 50 CFR 660.130(b) include a specific ratio between headrope and footrope length to ensure that selective flatfish trawls has a cut-back headrope (i.e., no overhanging "hood") to allow fish that swim upward at the mouth of the trawl an opportunity to escape (Figure 2-3). The regulations defined several measures to restrict overall trawl height or "rise" and height of the trawl wings. These included a restriction on the location of headrope floats, an upper limit on footrope length (to limit the scale of the trawl), and a 3-foot maximum length for the breastlines of the net (Figure 2-3). The regulatory language (50 CFR 660.130(b)) was a compromise between ease of enforcement and the complexity needed to ensure that all SFFTs would incorporate essential design features.

Scottish Seine - Scottish seines are a type of demersal seine considered as small footrope trawl gear (see Figure 2 in Suuronen et al. 2012). Demersal seine means a net designed to encircle fish on the seabed. The demersal seine is characterized by having its net bounded by lead-weighted ropes that are not encircled with bobbins or rollers. Demersal seine gear is fished without the use of steel cables or trawl doors. On the West Coast, it is used in the nearshore and shelf areas to fish flatfish such as sand dabs, petrale sole, English sole, and chilipepper rockfish.

This fishing technique uses a single boat that surrounds an area of water with very long seine ropes (warps) with a net in the center. In some ways, this gear is similar to trawl gear in that it harvests bottom fish by herding the fish with gear (the seine ropes) that is in contact with the seabed. However, this gear does not use doors to spread the net; the two warps spread the net. Additionally, the net is like a trawl net, except it of lighter construction and has a small, light footrope. In California this gear is used on smooth 'green mud' bottom in areas with good upwelling, with the fishermen returning to the same grounds year after year.

3.4.1.5 Bottom Trawl – Headrope Height, Headrope Shape, and Terminology

Headrope height and shape varies among groundfish bottom trawls and may influence species and size of fish caught trawling. Table 3-19 provides headrope and footrope characteristics of various bottom trawls, sorted by vertical opening (headrope height). Trawls included in Table 3-19 are shown for illustrative purposes only; numerous net manufacturers create various bottom trawls with characteristics that may differ from those shown here. In addition, fishermen can make various adjustments to a trawl to increase (or decrease) vertical opening and net spread. Finally, factors such as fishing depth, towing speed, door type, warp length, etc., may affect the vertical opening and spread of a trawl. The examples shown in Table 3-19 demonstrate that SFFT exhibits the lowest vertical opening (average 4.5 feet) (Hannah et al.

2005), whereas the Nor'eastern trawl (four-seam net) exhibits the highest vertical opening (20 to 26 feet) (von Szalay 2003). Hereafter, terminology of trawl type will be associated with vertical opening as follows:

- SFFT (two-seam trawl; vertical opening averages 4.5 feet)
- Low-rise trawl (two-seam trawl; vertical opening is generally 4.5 to 9 feet)
- Combination high-rise trawl (four-seam trawl; vertical opening is generally 12 to 20 feet)
- High rise trawl (four-seam trawl; vertical opening is greater than 20 feet)

Hooded or cut-back features of the trawl depend on the ratio of headrope length to footrope length (Figure 2-1). If the headrope is shorter than the footrope, then the top of the net will extend beyond the footrope and create a "hood." If the headrope is longer than the footrope, then the headrope will be aft of the footrope and create a "cut-back" (Figure 2-3). Groundfish regulations require that the headrope be not less than 30 percent longer than the footrope for SFFTs (Section 2.4). This ratio was based on dimensions of the experimental trawl used by Hannah et al. (2005), which showed a ratio between headrope and footrope length of approximately 29 percent.

Historically, low-rise trawls such as Eastern and Pusti trawls (two-seam trawls) have been used to target benthic species (e.g., flatfish), whereas high-rise (four-seam) trawls have been used to target roundfish (e.g., rockfish) that may be caught 3 fm to 4 fm (or more) off the bottom (Fisher 1972) (Table 3-19). Combination trawls were designed to catch both flatfish and various roundfish species, and they were designed to provide flexibility for fishermen by providing the ability to use the trawls over various substrates to target flatfish or roundfish, as well as to tow with low- or high-horse powered vessels (Fisher 1972).

Table 3-19. Examples of bottom trawls and associated footrope length, headrope length, and vertical opening. The headrope characteristic (hooded or cut-back) depends on the ratio of headrope length to footrope length. Terminology used herein for trawl type (SFFT, low-rise trawl, combination trawl, and high-rise trawl) is dependent on vertical opening.

Trawl	Footrope Length (feet)	Headrope Length (feet)	Hooded or Cut-back Trawl	Vertical Opening (feet)	Target Species	Trawl type
SFFT [a]	102	132	Cut-back	4.5	Flatfish	SFFT
400 Eastern [b, c]	94 – 95	69 - 71	Hooded	4.5 - 6.5	Flatfish	Low-rise
83-112 Eastern [c, d]	112	83	Hooded	6 - 9	Flatfish	Low-rise
Aberdeen [a]	105	89	Hooded	15	Flatfish and roundfish	Combination
Atlantic-Western Model IV-A [e]	78	54	Hooded	12 - 16	Flatfish and roundfish	Combination
Atlantic-Western Model II-A [e]	107	75	Hooded	18 - 20	Flatfish and roundfish	Combination
Nor'eastern [b]	121	89	Hooded	20 - 26	Roundfish	High-rise

[a] Source: Hannah et al. (2005)
[b] Source: von Szalay (2003)
[c] Source: Wathne (1977)
[d] Source: Weinberg and Somerton (2006)
[e] Source: Fisher (1972)

3.4.2 Trawl Effort and Distribution

3.4.2.1 Bottom Trawl Effort and CPUE

Section 7.4 in the Groundfish FMP (Council 2016a) identifies reductions in fishing effort as a way to reduce adverse impacts of bottom trawling. The assumption is that reduced fishing effort correlates with a decline in the frequency and extent of gear contact with benthic habitat constituting groundfish EFH. Section 7.4 of the Groundfish FMP cites various extant measures to limit capacity, "loosely defined as the number, size, and configuration of vessels participating in a fishery." These include state and Federal license limitation programs (LE), an industry/government permit and vessel buyback program for Federal trawl-endorsed permits implemented in 2003, and the trawl rationalization program, which implemented IFQ management in the shoreside trawl fishery and co-op management in the at-sea whiting fishery. Past Groundfish Harvest Specification EISs (e.g., Council and NMFS 2015), the Amendment 20 EIS (Council

and NMFS 2010a), and the Five-year Review (NMFS and Council 2017) describe these programs in detail.

Bottom trawl effort dropped with implementation of the catch share program, as shown in Figure 3-7. This decrease in effort was expected (Council and NMFS 2010a) and is, in part, due to gear switching (from bottom trawl to fixed gear) (Figure 3-7) and to vessel consolidation (NMFS and Council 2017).

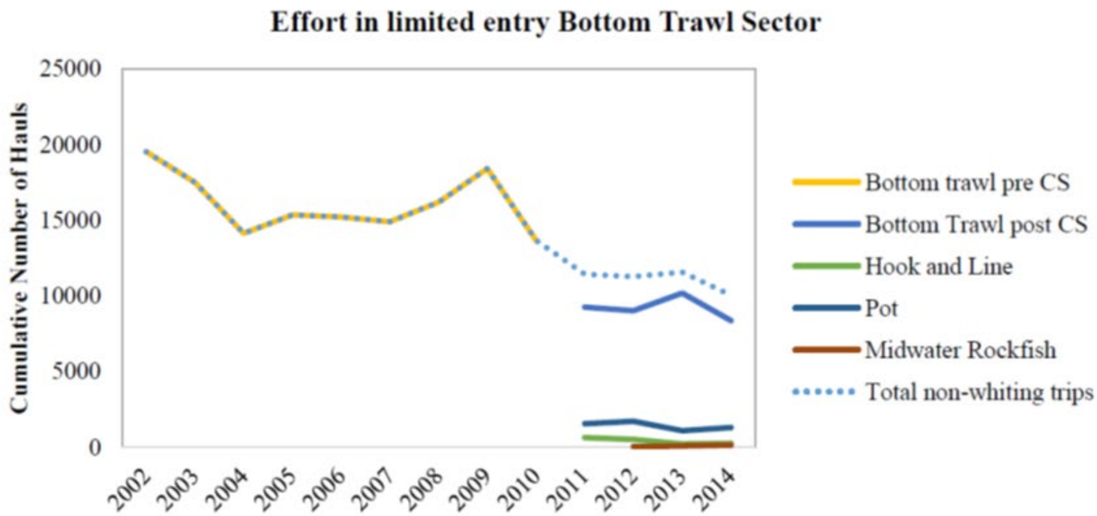

Figure 3-7. Coastwide effort (measured as number of hauls) in the LE trawl sector from 2002 to 2014. Source: NMFS and Council (2017), Figure 3-105.

Figure 3-8 shows effort (number of trips) along with groundfish landings (lbs) by West Coast bottom trawl vessels from 1994 to 2016. Effort and groundfish landings exhibited similar trends across years until approximately 2003, when effort continued to decline, but landings leveled off or increased. The difference between annual groundfish landings and number of trips is most pronounced beginning in 2011, when the catch share program started (Figure 3-8). Corresponding to these different rates of change has been a consistent increase in CPUE beginning in 2003 (Figure 3-9). This increase in CPUE since 2003 may be due to a variety of factors, including improved efficiency and technology, increasing abundance and ACLs for a variety of stocks (e.g., widow rockfish), and increased fishing areas because of recent trawl RCA reductions (Section 3.1.3).

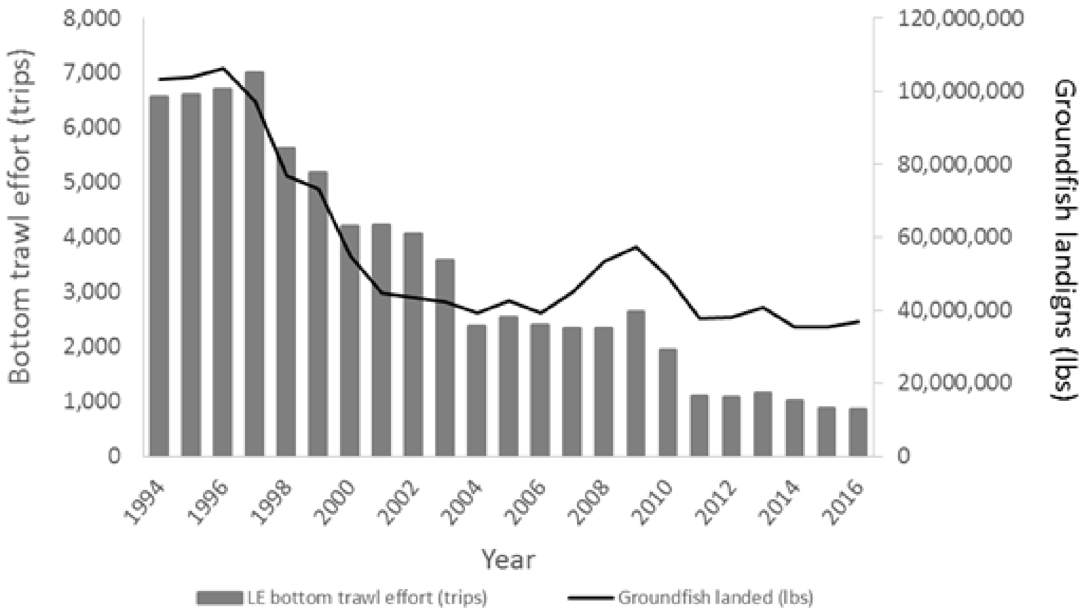

Figure 3-8. Annual total fleetwide trips (bar) and groundfish landings (lbs; line) in the shoreside LE bottom trawl sector. Source: PacFIN.

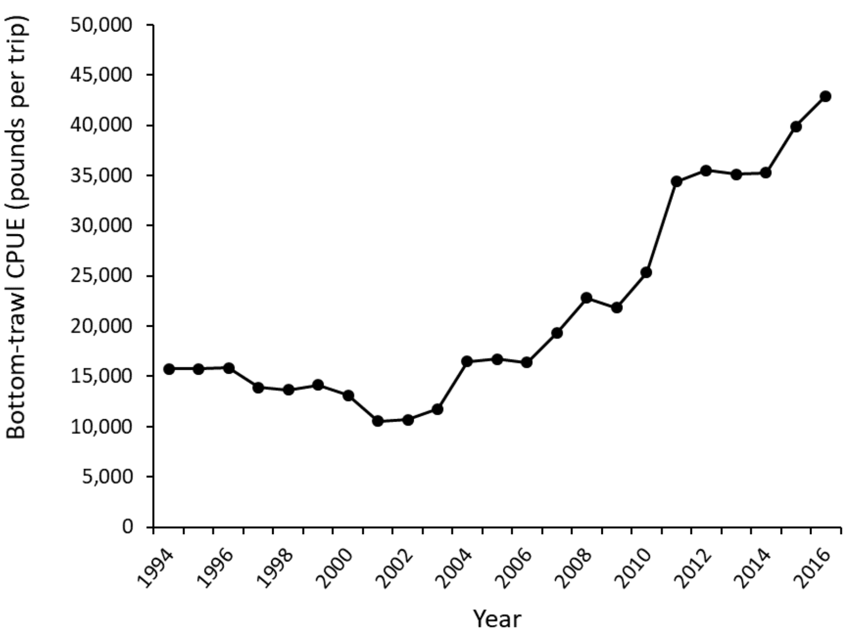

Figure 3-9. Annual catch-per-unit-effort (groundfish landings in lbs relative to coastwide trips) for the shoreside LE bottom trawl sector. Source: PacFIN.

3.4.2.2 Spatial Distribution of Bottom Trawling - Coastwide

The distribution of bottom trawling has changed over the past 15 years (Figure 3-10), largely due to management measures (NMFS and Council 2017; Somers et al. 2017b). The geographic distribution was broadest by latitude and longitude prior to implementing the regulatory provisions of Amendment 19 in 2005 (EFH designations) (Council 2015). In the early 2000s, the need to constrain the catch of overfished rockfish species brought about regulatory changes to limit the footrope size to 8 inches or smaller inside of 100 fm (see Section 3.4.2.4). This gear regulation not only helped restrict catches of overfished rockfish species, it dramatically changed the spatial distribution of the trawl fishery out of rocky habitat areas (Council 2012). Regulations associated with Amendment 19 included areas that were closed to specific bottom contact gear (trawl gear only or all bottom contact gear) (Council 2012). Additional regulations as a result of Amendment 19 further restricted gear types to footropes no larger than 19 inches outside of 100 fm and banned use of dredges and beam trawls (Council 2012). The bottom trawling footprint was reduced even more after the inception of the catch share program in 2011 (Figure 3-10), largely because of vessel consolidation, the continued decline in the number of buyers, individual accountability (e.g., IFQ for choke species, such as canary rockfish, was needed to cover vessel or permit limits), and gear switching. The reduction in the geographic extent since the 2002 to 2006 period is most prominent in shallow waters off Oregon, all depths off southern California, and in shallow waters off central and northern California (Figure 3-10).

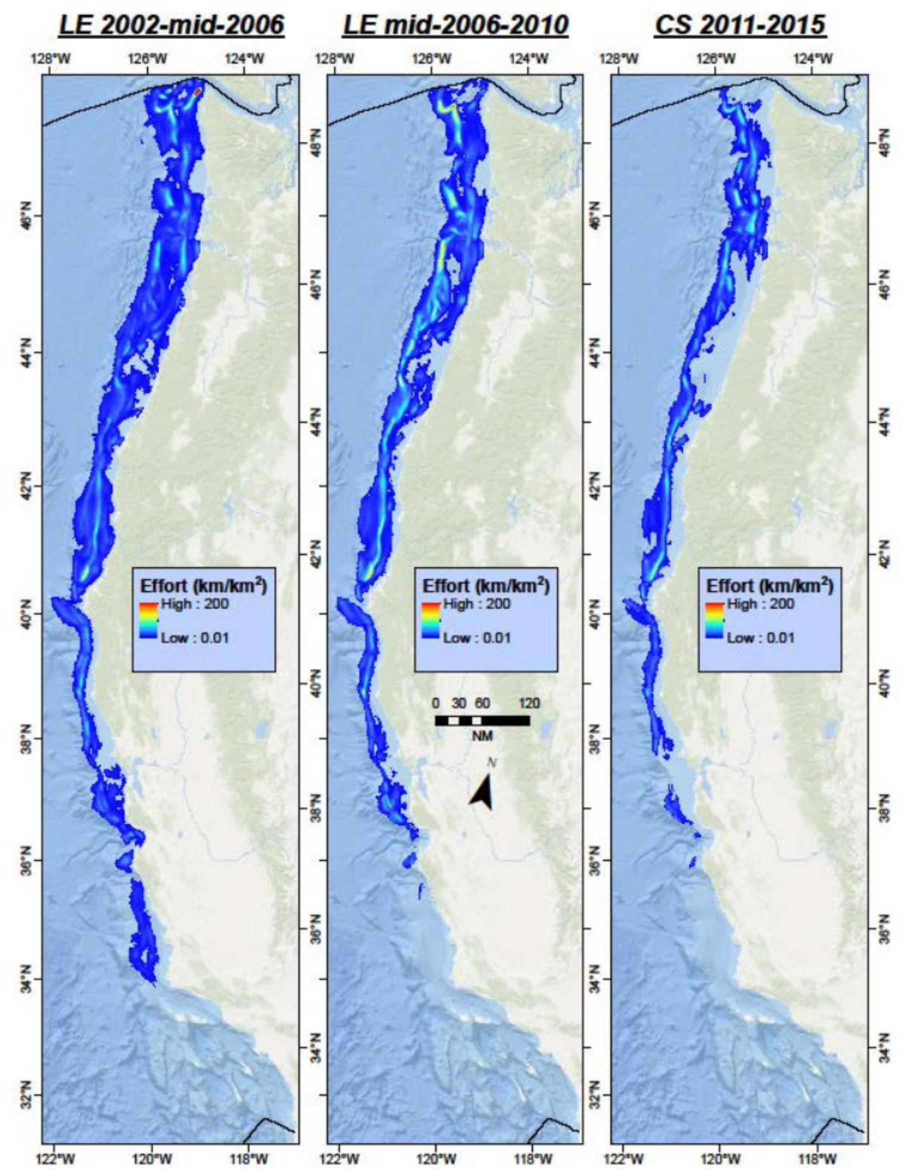

Figure 3-10. Spatial distribution and intensity of bottom trawl fishing effort within three relevant periods, as described in the text. The density values for the color ramps for each map panel are equal, so pixel-by-pixel comparisons can be made. The highest (red) and lowest (blue) values are set arbitrarily so that areas of relatively high and low fishing intensity can be compared across periods. Source: Somers et al. 2017b.

3.4.2.3 Geographic, Seasonal, and Depth Distribution of Bottom Trawling North of 42^o N. latitude and between 42^o and 40^{o}10' N. latitude

Recent bottom trawling effort by area, season, and depth is provided here for the area north of 40^{o}10' N. latitude. Although 40^{o}10' N. latitude represents one of the IFQ management lines (Section 2.7), we further

divide this area at 42° N. latitude (the Oregon/California border) to add resolution to the SFFT analysis in Section 4.3.

During the winter season (November to April), the 2015 bottom trawling effort north of 42° N. latitude was more than 8 times higher in deep water (more than 100 fm) than in shallower water (Figure 3-11). The opposite occurred during the summer season (May to October) north of 42° N. latitude, when most bottom trawling effort took place in shallow water (i.e., less than 100 fm). The pattern of 2015 bottom trawling effort was much different in the area between 40°10' N. latitude and 42° N. latitude (Figure 3-11), where (a) bottom trawling effort overall was much lower than observed north of 42° N. latitude and (b) bottom trawling effort was greatest at deeper depths (more than 100 fm) during both summer and winter seasons.

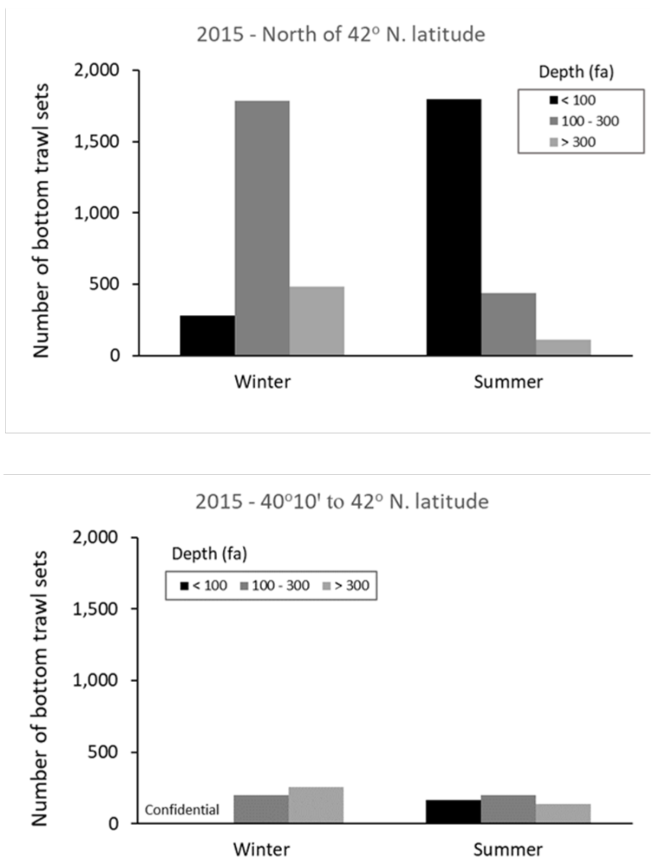

Figure 3-11. Bottom trawling effort (number of sets) in the catch share program during 2015 by season and depth strata for the areas (a) north of 42° N. latitude and (b) 40°10' N. latitude to 42° N. latitude. Seasons are winter (November to April) and summer (May to October), similar to definitions provided in Northwest Fisheries Science Center (NWFSC) (2017). Depth categories are less than 100 fm, 100 fm to 300 fm, and greater than 300 fm.

Bottom trawling effort shoreward of the trawl RCA (e.g., less than 100 fm) recently increased coastwide (including the areas north of 42° N. latitude and between 40°10' and 42° N. latitude), because of increased ACLs for canary rockfish and widow rockfish (Table 3-2; Table 3-3), and subsequently increased trawl allocations (Table 3-16). This increase in canary rockfish trawl allocation has allowed bottom trawl fishermen to increase targeting of shelf species (e.g., semi-pelagic or pelagic species, such as yellowtail rockfish and widow rockfish, and benthic species such as flatfish) with much less concern of exceeding canary rockfish IFQs than prior to the increase in ACLs. As a result, a large increase in catch of shelf species by IFQ fisheries was expected and observed during 2017 (Agenda Item F.2, Attachment 3, April 2018) by bottom trawl (e.g., Figure 3-12) and midwater trawl (Section 3.4.2.5).

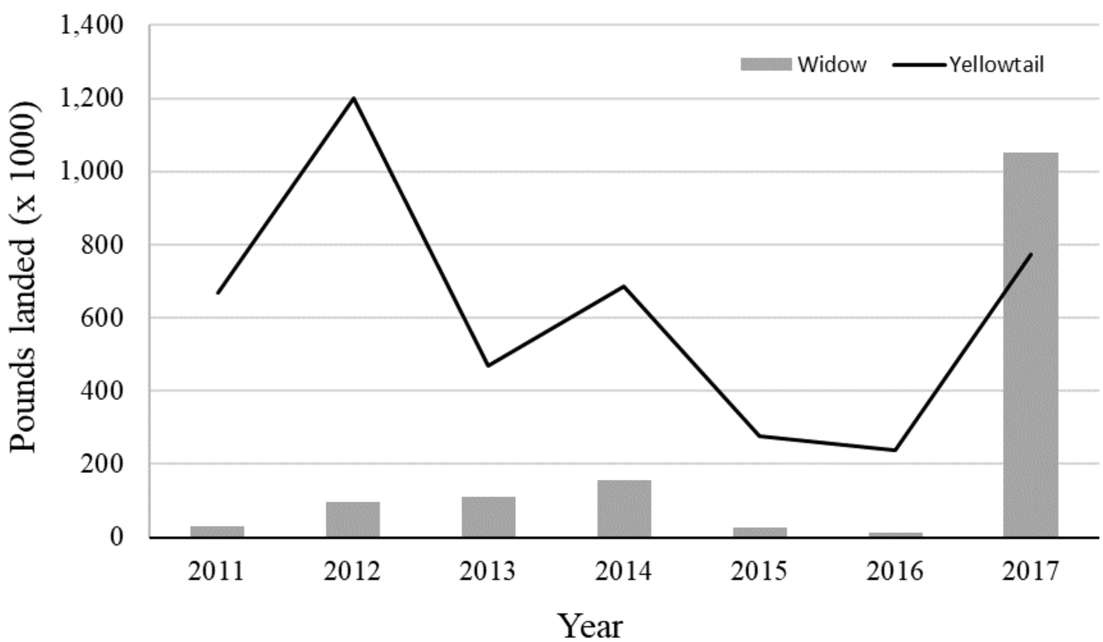

Figure 3-12. Bottom trawl landings of widow rockfish and yellowtail rockfish during the catch share program (2011 to 2017). Most bottom trawl landings of these species during 2017 were made by participants in the trawl gear EFP (Section 4.3.1.1). Source: PacFIN (March 29, 2018).

3.4.2.4 Bottom Trawl Footrope and Fishing Location/Habitat

Impacts on bottom habitat and species composition of catches by bottom trawl are correlated with footrope diameter (Section 3.4.1.3; Section 3.4.1.4). The Council implemented small footrope requirements for bottom trawls in 2000 to reduce the impact and incentive for trawling activities in mixed (boulder) and hard substrates where several of the overfished rockfish species congregated (65 FR 221,

January 4, 2000). This small footrope requirement is currently in regulation when fishing shoreward of the trawl RCA. Bellman (2004) and Bellman et al. (2005) demonstrated significant shifts in effort away from rock habitat after the small-footrope requirement was implemented. For example, fishing intensity in rock habitat decreased 69 to 93.7 percent, depending on the reference site, after the small footrope gear regulation became effective (Bellman et al. 2005). Hannah and Freeman (2000) and Hannah (2003) also showed significant changes in the spatial distribution of bottom-trawl effort in relation to areas of prime habitat for rockfish after the small footrope restriction was implemented. Some of this shift away from rockfish habitat may be attributed to trip limits (Hannah 2003).

3.4.2.5 Midwater Trawl Effort

Pacific whiting landings by catcher-processor and mothership portions of the at-sea fleet and by the shoreside midwater sector have varied from 2002 to 2015. Effort by these Pacific whiting fisheries depends mostly on variations in quota, price, and abundance of Pacific whiting (Somers et al. 2017b) and avoidance of bycatch species (i.e., darkblotched rockfish, POP, and salmon) (Council and NMFS 2015). The shoreside whiting fleet generally produces the most hauls and towing hours annually relative to the other whiting fleets, and it reached more than 7,000 trawling hours in 2015 (Somers et al. (2017b). The shoreside non-whiting trawl fishery, which primarily targets widow and yellowtail rockfish (Section 3.3.1.4), has demonstrated the lowest effort of all the midwater fisheries during the catch share program, ranging from 17 trawling hours to 228 trawling hours per year from 2011 to 2015 (Somers et al. (2017b). However, effort by this non-whiting midwater trawl fishery has increased each year since 2011 (Somers et al. 2017b) (see below).

Although Pacific whiting trawl effort varies and depends on fluctuating ACLs and other factors (see above), non-whiting midwater trawling effort is expected to increase since widow rockfish and canary rockfish have become rebuilt (NMFS 2016a; Council 2016d; see Section 3.2.1.1); this has resulted in large increases in the ACLs (Table 3-2; Table 3-3) and, subsequently, the trawl allocation (Table 3-16) for these stocks. Midwater trawling has historically been a favored gear type to harvest widow rockfish and yellowtail rockfish, and to a lesser degree, chilipepper rockfish (Council and NMFS 2014). NMFS (2016a) projected dramatic increases in widow rockfish catch coincident with large increases in their allocations and projected increased catches of yellowtail rockfish (and widow rockfish) since canary rockfish became rebuilt. Canary rockfish was a choke species that limited directed midwater trawling effort for yellowtail rockfish (Table 3-16). Council and NMFS (2014) also projected that increased access to widow rockfish would provide access to other pelagic species, particularly yellowtail rockfish in the north.

Annual non-whiting midwater trawl landings of widow rockfish and yellowtail rockfish can represent a blunt proxy of fishing effort. Previous descriptions of non-whiting midwater trawl effort (e.g., trawl hours) are shown only through 2015 because logbook data for 2016 were not available (e.g., NMFS and Council 2017). As such, non-whiting midwater trawl landings from 1994 through most of 2017 are provided in Figure 3-13 (source is PacFIN fish ticket data, downloaded on December 6, 2017). The highest landings of both yellowtail rockfish and widow rockfish by non-whiting midwater trawl since 1994 occurred in 2000, when landings of yellowtail rockfish exceeded 5 million pounds, and widow rockfish landings reached 8 million pounds. Widow rockfish was declared overfished in 2001, prompting regulations that resulted in large reductions in widow rockfish landings, starting in 2002. Widow rockfish landings by midwater trawl were virtually eliminated beginning in 2003 until the inception of the catch share program in 2011. Non-whiting midwater trawl effort (Somers et al. 2017b) and landings of yellowtail rockfish and widow rockfish (Figure 3-13) increased annually from 2011 through 2015. Yellowtail rockfish landings dropped in 2016, whereas widow rockfish catch increased dramatically through the end of 2017, nearly equaling the landings shown in 2000. This suggests a dramatic increase in non-whiting midwater trawling effort, as projected by NMFS (2016a).

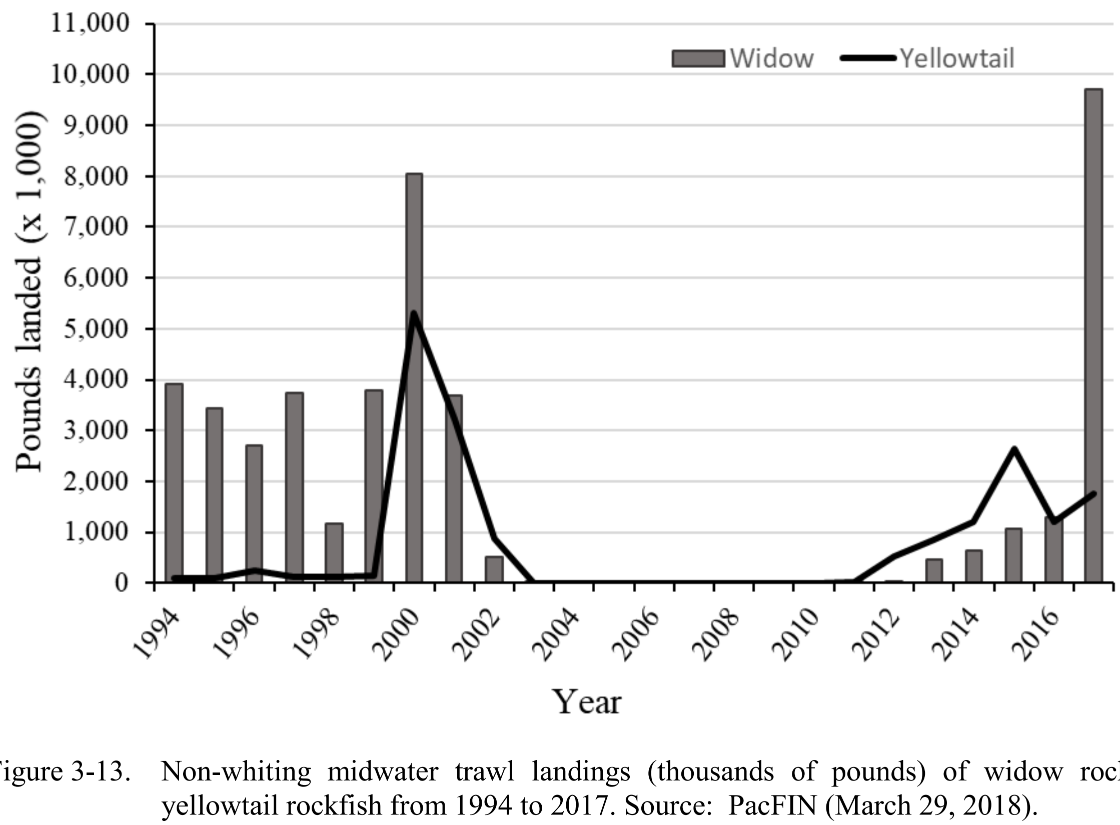

Figure 3-13. Non-whiting midwater trawl landings (thousands of pounds) of widow rockfish and yellowtail rockfish from 1994 to 2017. Source: PacFIN (March 29, 2018).

3.4.2.6 Spatial Distribution of Midwater Trawling

The spatial distribution of the at-sea midwater trawl fleet was shown by Somers et al. (2017b) and by Council and NMFS (2014). The geographic distribution of this fleet has been influenced by (a) areas where marketable whiting can be found, (b) areas that may demonstrate relatively low bycatch rates of overfished or prohibited species, and (c) areas (latitudes) where the at-sea fleet is allowed to operate through regulation (Council and NMFS 2015). Although the at-sea midwater trawl fleet operates mostly off the Oregon and Washington coasts (to the Canadian border), most effort has been focused off central Oregon (to around 43° N. latitude) (Somers et al. 2017b). At-sea midwater trawling effort relative to EFHCAs was shown by Council and NMFS (2014).

The spatial distribution of shoreside whiting midwater trawling effort, also described by Somers et al. (2017b), is shown in Figure 3-14 relative to EFHCAs. Shoreside whiting effort occurred along the entire West Coast from northern California to the Canadian border, with most effort distributed between or near the 100-fm and 200-fm contours. Figure 3-14 shows hot spots off the central Oregon coast and the central Washington coast. Although this midwater fishery tended to fish shallower than the easternmost FHCAs, fishing took place over EFHCAs in areas shallower than 200 fm and north of 42° N. latitude (Figure 3-14).

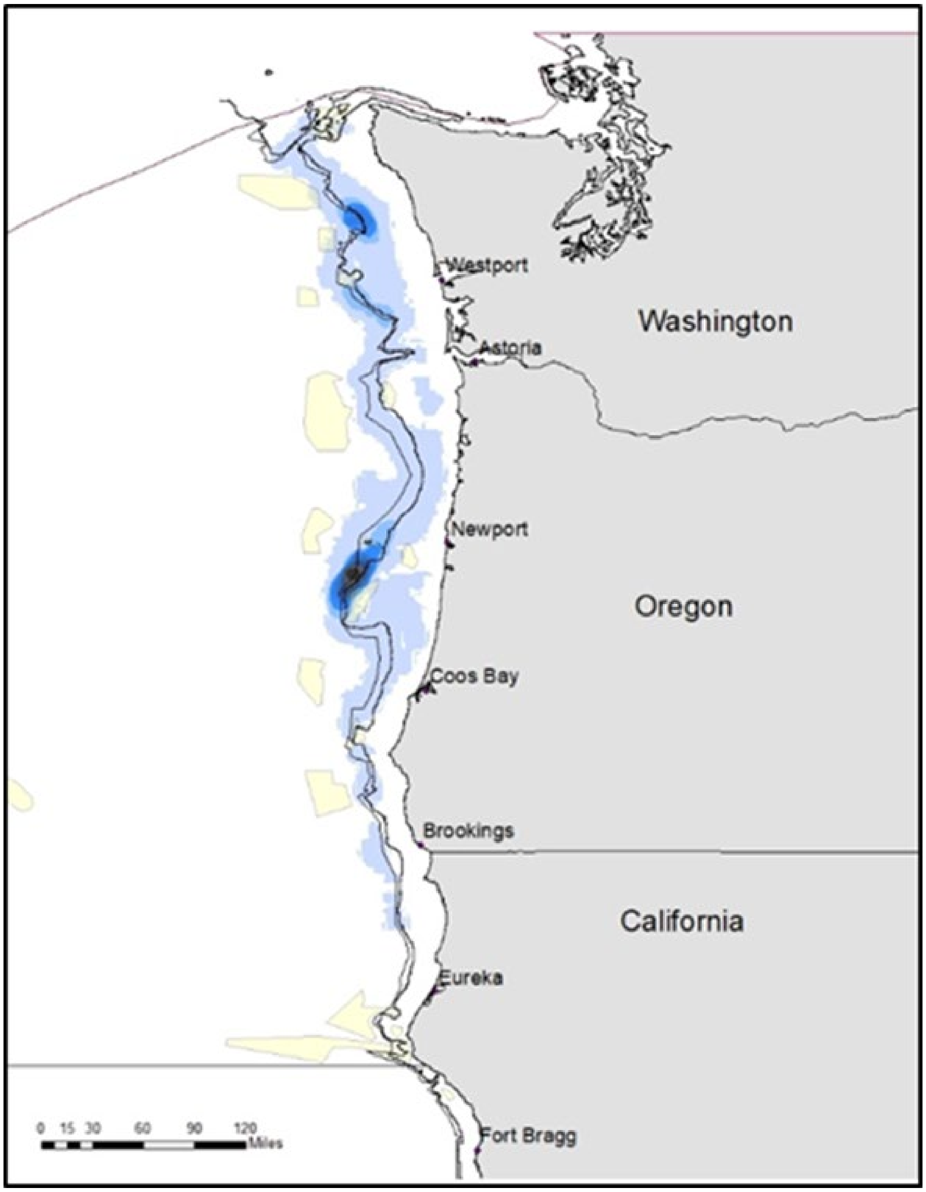

Figure 3-14. Point density plot of shoreside whiting midwater trawl sets from 2011 to 2015 (blue). EFH conservation areas are shown in yellow, and both 100-fm and 200-fm trawl RCA lines are provided for reference (solid lines). Each set was assigned a 10-mile diameter around the set location. Darker colors represent increasing number of overlapping haul areas. Source: WCGOP observer data.

Non-whiting midwater trawling effort was low during 2011 to 2015 (Section 3.4.2.5), and it was concentrated in only a few discrete areas (Figure 3-15). Most non-whiting midwater trawling occurred off central Washington and off Astoria. Some midwater effort also occurred off Newport (some locations are not shown due to confidentiality). Although the fringes of the density plots overlapped the edge of a few EFHCAs (e.g., Grays Canyon and Daisy Bank) (Figure 3-15), none of the set- or up-locations fell within any EFHCAs.

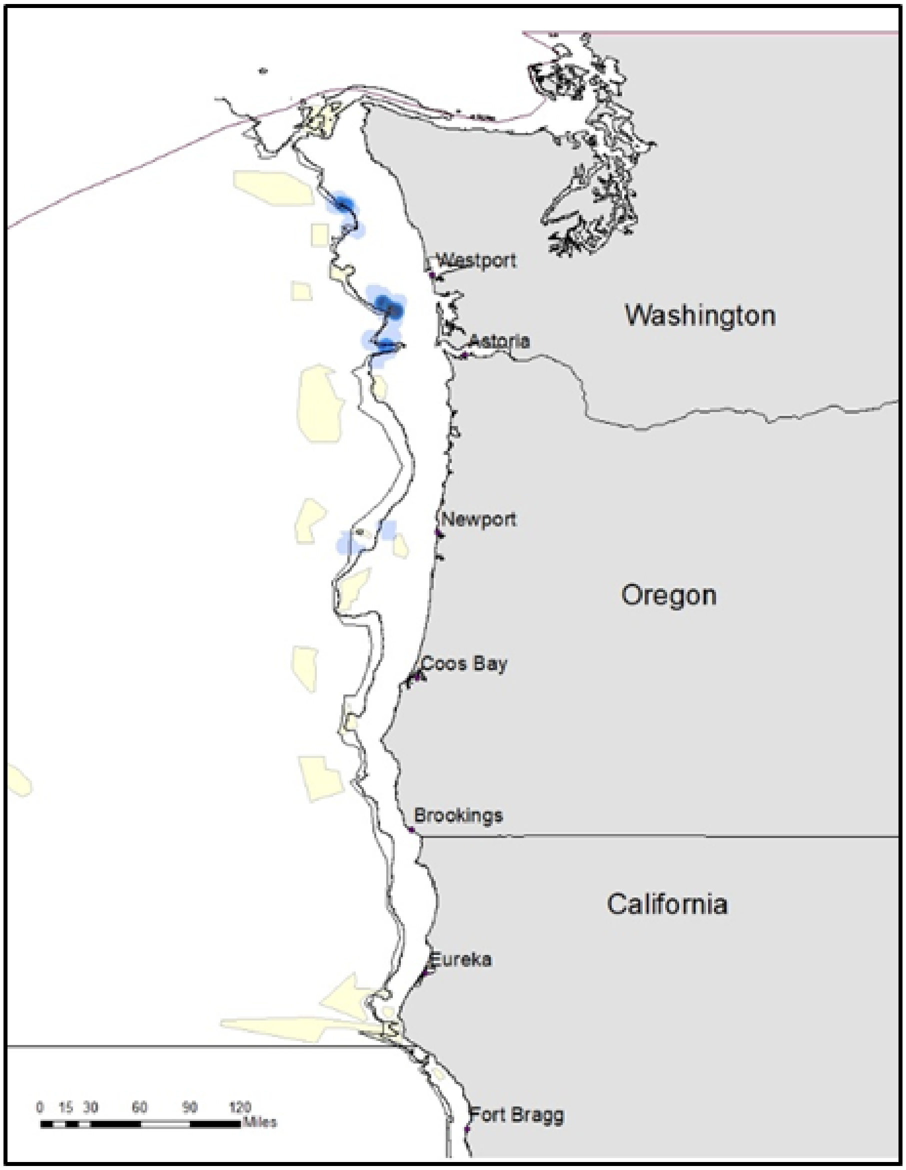

Figure 3-15. Point density plot of non-whiting midwater trawl sets that targeted widow and yellowtail rockfish from 2011 to 2015 (blue). EFH conservation areas are shown in yellow, and both 100-fm and 200-fm trawl RCA lines are provided for reference (solid lines). Each set was assigned a 15-mile diameter around the set location. Darker colors represent increasing number of overlapping haul areas. Source: WCGOP observer data.

It is expected that the spatial distribution of non-whiting midwater trawling shown in (Figure 3-15) would expand as widow rockfish and canary rockfish trawl allocations (Table 3-16) and midwater trawling effort increases (Figure 3-13). The spatial distribution of non-whiting midwater trawling north of 40°10' N. latitude from 1999 to 2001 (Figure 3-16), when widow and yellowtail rockfish landings were high (Figure 3-13), represents the potential spatial expansion for the non-whiting midwater trawl fleet under the increased trawl allocations for widow rockfish and canary rockfish (Table 3-16). These data demonstrate that most non-whiting midwater trawling took place between 100 fm and 200 fm from the Canadian

border to Eureka, California. Most hauls took place off northern Washington and off the coast of Westport, Astoria, Newport, and Eureka (Figure 3-16). During these high-effort years, many of the non-whiting midwater hauls took place over EFHCAs (established in 2000) that were generally shallower than 200 fm. Non-whiting midwater trawling over EFHCAs north of 40°10' N. latitude would likely increase as midwater trawling effort increased, similar to that shown in Figure 3-16.

Non-whiting midwater trawling for widow rockfish and chilipepper rockfish also occurred between Fort Bragg and Monterey, California during the 1999 to 2001 period. Although non-whiting midwater trawling could expand in areas south of 40°10' N. latitude, it is unlikely that the distribution of effort in the foreseeable future would resemble historical patterns (i.e., 1999 to 2001) due to management measures implemented to rebuild co-occurring depleted rockfish species (particularly bocaccio) (Council 2016d) and to current regulations at 50 CFR 660.130(c)(3)(ii) that prohibit midwater trawling shoreward of trawl RCA boundaries when fishing south of 40°10' N. latitude.

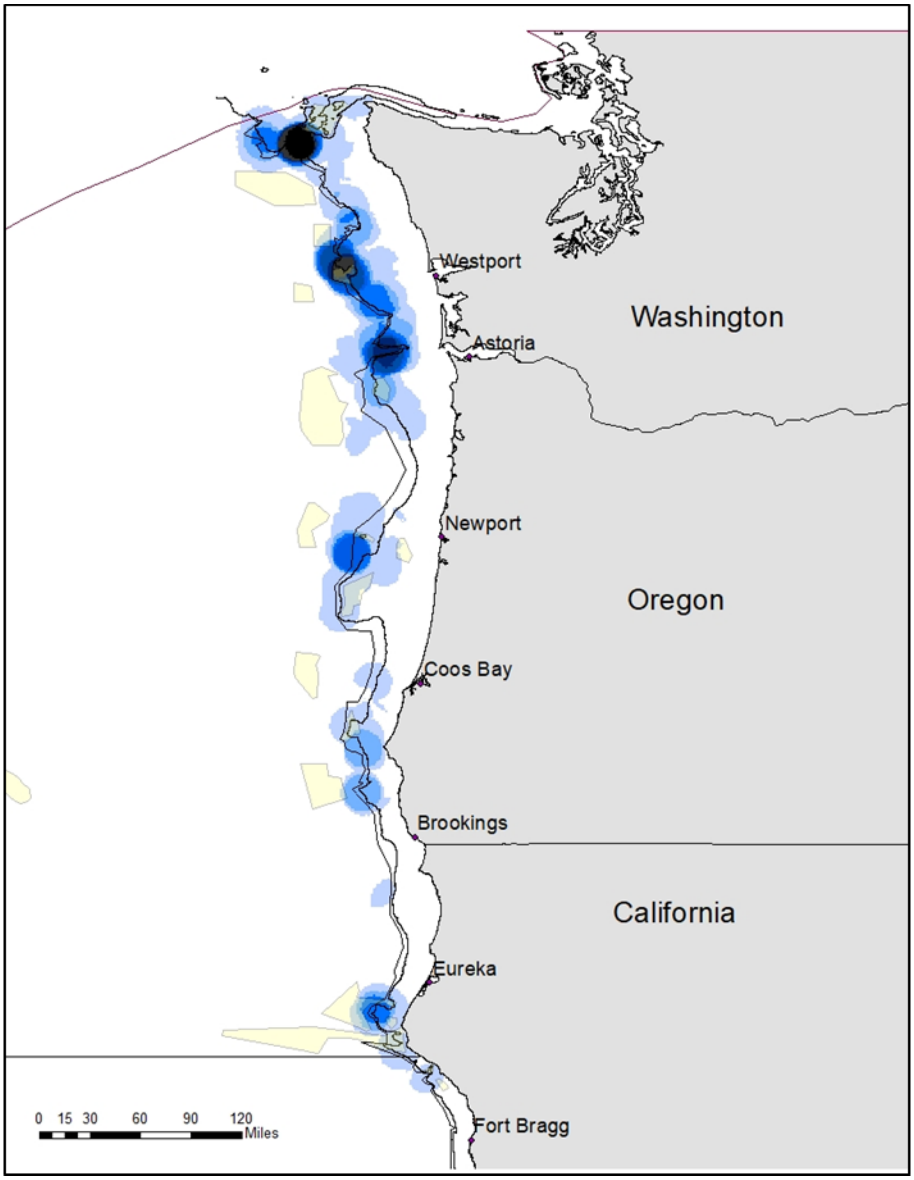

Figure 3-16. Point density plot of non-whiting midwater trawl sets that targeted widow and yellowtail rockfish from 1999 to 2001 (blue). EFH conservation areas are shown in yellow, and both 100-fm and 200-fm RCA lines are provided for reference (solid lines). Each set was assigned a 10-mile diameter around the set location. Darker colors represent increasing number of overlapping haul areas. Source: PacFIN logbook data

3.4.2.7 Bottom Contact by Midwater Trawl

Midwater trawls (Section 3.4.1.1) are generally towed above the ocean floor (pelagic), although they may be used near the bottom where several components could contact or affect the seabed (NMFS 2005a). Variations in the composition and design of these components influence their effects on benthic ecosystems. Of the major components, trawl doors affect the smallest area of seabed, though trawl door marks are the most recognizable and frequently observed effect of trawls on the seabed. On most trawls

(bottom and midwater), the netting itself is not designed to contact the seabed directly, and anything that protrudes far enough above the seabed to contact the netting has already been contacted by the footrope (NMFS 2005a).

Amendment 19 to the Groundfish FMP (Council 2005b) shows that midwater trawl gear is not normally deployed to make bottom contact, but bottom contact by midwater trawl gear is known to occur intermittently. Council and NMFS (2014) illustrated that the most important regulatory constraint in terms of hard bottom habitat protection is the bare footrope requirement on all midwater nets; the vulnerability of pelagic trawls to damage precludes their operation on rough and hard substrates. Numerous disincentives for midwater fishermen to fish close to the substrate were described by Council and NMFS (2014) (see Section 4.2.1.2.5). Council (2012) stated the following:

> "Bycatch of corals and sponges in the at-sea hake fleet, as recorded by observers of the At-sea Hake Observer Program (ASHOP) is relatively rare. This is most likely due to the fact that the at-sea hake (whiting) fleet uses mid-water trawl gear, which typically does not contact the seafloor."

Nonetheless, there has been debate regarding the amount of contact that midwater trawls make with the sea bed, both within and outside of EFHCAs.

Currently, midwater trawls used in West Coast fisheries are not outfitted with sensors that directly measure seafloor contact. Without direct measure of seafloor contact, most predictions have been based on indices of the presence of benthic or demersal fish and invertebrate taxa in the catch (e.g., Appendix A in Council 2015). However, these estimates of bottom contact come with a great deal of uncertainty, especially within the EFHCAs. Council (2015) discussed factors that could contribute to either over- or underestimates of seafloor contact within EFHCAs by midwater trawl. Factors include (a) life history of benthic organisms and how that influences their availability to capture and retention in midwater trawl, (b) those relating to uncertainty in the location of midwater trawls, (c) escapement of benthic organisms from the trawl, and (d) others. For example, if a species makes regular excursions into the water column higher than 2 m, then seafloor contact associated with that taxa would be overestimated. On the other hand, if benthic species drop out of the trawl before reaching the codend (i.e., escape) then seafloor contact could be underestimated.

Numerous estimates of bottom contact by midwater trawl within EFHCAs are available, and are dependent on various assumptions. Some of those estimates follow:

- Less than 12 percent of whiting midwater hauls (including tribal fisheries) were within EFHCAs greater than 0 percent of the haul length (Council 2015), whereas approximately 6 percent of whiting midwater hauls were within EFHCAs greater than or equal to 50 percent of the haul length. Depending on assumptions made regarding length of haul within EFHCAs, bottom contact by whiting midwater trawls may range from approximately 1 percent to 10 percent of the hauls made within EFHCAs. Using point estimates of haul location (start or end haul locations within EFHCAs), bottom contact would be as high as 19 percent of the hauls within EFHCAs. Council (2015) also showed that whiting midwater hauls are typically towed over soft bottom; less than 10 percent of whiting midwater hauls were conducted over mixed or hard bottom.
- Wakefield and McClure (2014) analyzed at-sea whiting fishery data, and demonstrated that (a) 4.7 percent of at-sea whiting hauls may be within EFHCAs, (b) 12.1 percent of the hauls within EFHCA contained at least one benthic taxa, and (c) 22.8 percent of hauls made outside of EFHCA included at least one benthic taxa. Wakefield and McClure (2014) also provided the percent of shoreside whiting trips that contained at least one benthic taxa; interpretation of those results are difficult because the analysis was conducted at the trip level rather than the haul level.
- Members of the midwater fishing industry provided information on frequency of midwater whiting hauls inside and outside of EFHCAs using VMS, likelihood of midwater trawls touching the bottom using headrope sensors, and possibility that some of the benthic taxa used to indicate bottom contact (e.g., thornyheads and rex sole) may occasionally be off-bottom and vulnerable to capture by midwater trawls without the gear contacting the substrate (Agenda Item E.5.b, Public Comment, April 2015; Agenda Item E.5.b, Supplemental Public Comment 4, April 2015).
- Oceana suggested high bottom contact rates (Agenda Item E.5.b, Supplemental Public Comment 5, April 2015) using data from Wakefield and McClure (2014).

The Council selected final preferred alternatives for Amendment 28 analysis (EFH – RCA) at its April 2018 Council meeting (Agenda Item F.3, Situation Summary, April 2018). Updated impact analyses were also provided at that meeting by the Project Team (Agenda Item F.3.a, Project Team Report 1, April 2018). Tentative conclusions that can be made from past estimates of bottom contact by whiting midwater trawls include the following:

1. Some midwater trawl hauls contact the ocean bottom during some portion of the haul.
2. When bottom contact is made, there is uncertainty whether that bottom contact is inside or outside the EFHCAs.
3. Indices of bottom contact are uncertain (i.e., the indices may produce overestimates or underestimates of bottom contact).

Estimates regarding the length of time that midwater hauls may contact the bottom within a haul are not available; however, it is likely that any contact with the seabed would be intermittent and occasional within hauls (Council 2005b).

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4 ENVIRONMENTAL CONSEQUENCES

This section analyzes impacts associated with the alternatives described in Section 2. This EA references analyses for Amendment 20 and 21 (Council 2010a; Council 2010b) and the biennial harvest specifications (Council and NMFS 2015; NMFS 2016a), which analyzed the impacts of the fishery under the current management regime and fishing levels on the biological and human environments. This EA also references EAs that analyzed relaxing chafing gear requirements for midwater trawls (Council and NMFS 2014) and removing selective flatfish trawl and minimum mesh size requirements under an EFP for trips north of 42° N. latitude and shoreward of the trawl RCA (NMFS 2017b).

4.1 Document Organization, Methodology, and Considerations

The sections below detail how this chapter is organized. They are broken down by organization, definition of impact levels, considerations applied in establishing definitions, and mitigation measures.

4.1.1 Section Organization

This section contains comparative analyses of the impacts of each alternative in the context of individual components of the affected environment presented in Section 3. Analysis of like or related issues are grouped within the same section to reduce redundancy and to consider potential synergistic effects. Issue A (minimum mesh size), Issue C (codend regulations), and Issue E (chafing gear) are grouped for analysis in Section 4.2. Issue B (measuring mesh size) is included with issues A, C, and E in Section 4.2, but it is not analyzed in detail because Issue B is largely administrative and would have no impact on fishing operations (see Section 2.2). Issue F (multiple gears onboard), Issue G (fishing in multiple areas), and Issue H (fishing before catch is stowed) are analyzed in Section 4.4. Issue D (selective flatfish trawl) is analyzed separately in Section 4.3.

4.1.2 Definition of Impact Levels

In defining the impact level, we consider uncertainty, fisherman decisions, and available mitigation (e.g., Section 4.1.3). Impacts of the action alternatives are described relative to the associated No-action Alternative. The direction of impacts for the action alternatives relative to no-action alternatives may be positive or negative. Impact levels for the action alternatives are defined as follows:

- No change in impact: No or negligible additional effect would be experienced
- Low in impact: Minor effect; the impact would be slight but detectable
- Medium impact: Medium effect; the impact would be readily apparent
- High impact: Major effect; the impact would be greatly positive or severely negative
- Unknown Impact: Insufficient information is available

4.1.3 Considerations when Defining Level of Impact: Uncertainty and Fishermen's Decisions

Various considerations should be made prior to defining impact levels. Some of those considerations are provided here, as well as in Section 3.4.2 (trawl effort and distribution), Section 4.1.4 (mitigation measures in the catch share program), Section 4.2.2.1 (considerations when defining the impact of Issues A, C, and E on the biological environment), and Section 4.3.1 (considerations when defining the impact of SFFT on the human environment).

4.1.3.1 Uncertainty

Uncertainty could play a role in the determination of the assigned impact level. For example, given the same analytical comparison, negative impacts would be deemed higher for an analysis that includes high levels of uncertainty compared to the same analysis that includes much lower levels of uncertainty.

Impacts of alternatives (e.g., bycatch) would be monitored with a high level of certainty, given that the catch share program requires 100 percent monitoring (observer or EM) (Section 3.3.6). Full observer or EM coverage produces timely and accurate data regarding catch and fishing locations. However, even with 100 percent monitoring, it may be difficult to discern the cause of an impact (such as increased catch of undersized fish), because the impact could be caused by many potentially confounding factors such as decreased mesh size, increased use of double-wall codends, or a large recruitment event. Nonetheless, the catch share program provides near-real time catch reporting by observers, catch monitors, and EM, which allows for timely implementation of management measures required to reduce or eliminate unforeseen negative impacts, if needed (e.g., implement area closures in response to high salmon catch, regardless of whether that increase in catch was due to elimination of selective flatfish trawl gear or reduced mesh size) (Matson and Erickson 2017; NMFS 2017a).

Some uncertainties of the impact analyses may include future changes in the following:

- Fishing practices (e.g., gear)
- Fishing location
- Fishing effort
- Stock assessments and resulting ACLs
- Markets
- Climate, ocean acidification, and hypoxia and resulting effects to fish stocks (e.g., productivity, species distribution, habitat condition, and species interactions)

NMFS and Council (2017) described changes in fishing practices, fishing locations, fishing effort, ACLs, and markets over the initial five years of the catch share program. It is uncertain how these aspects of the

fishery may change during the next five years, with or without implementation of action alternatives. Uncertainty in the first three bullets (above) may be driven by future stock assessments, markets (regional, national, and international), and climate change. It is important to be aware of these and other uncertainties when considering the results of the analyses in this EA. It is also important to understand that these uncertainties would affect the impacts of no-action alternatives as well as action alternatives. These uncertainties are mitigated by the measures built into the catch share program as described in Section 4.1.4; therefore, they are not significant under either the no-action or any of the action alternatives.

4.1.3.2 Fishermen Decisions

The impacts of fishing depend not only on fishing gear, but also on fishermen decisions (Babcock and Pikitch 2000; Branch et al. 2006) and behavior of fish relative to the fishing gear (Winger et al. 2010) (Appendix E). Fishermen, under various management, weather, and economic constraints and considerations, choose where, when, and how to fish. The decisions fishermen make before setting their gear ultimately influence catch of target and bycatch species, income, expense, safety, and habitat impacts.

Some decisions fishermen make are influenced by Amendment 20 provisions that include incentives to reduce bycatch and discard mortality (Council and NMFS 2010a). The catch share program was created to provide participants with more individual accountability regarding catch and bycatch relative to pre-catch share management. This was done by making fishermen accountable for their entire catch (not just the landed species) and by implementing 100 percent observer coverage on trips (Section 3.3.6.1; NMFS and Council 2017). The program was designed to increase fishermens' flexibility as to when, where, and how they fish and to incentivize practices that decrease catch of constraining stocks.

Discards have declined during the time the catch share program has been in place (Section 3.2.1.3) (NMFS and Council 2017). The reduction in discards could have multiple causes, including decreases in overall fishing effort (see Section 3.4.2), landing species rather than discarding them, changes in gear (for example, using halibut excluder gear [Lomeli and Wakefield 2015]), and changes in fishing behavior (NMFS and Council 2017). Some examples of incentives and tools that may influence fishermen behavior to reduce bycatch and discard, coupled with 100 percent observation of trips and hauls, include the following:

- Economics
  - Because all catch is accounted for, there is an economic incentive to minimize the catch of unmarketable IFQ species (e.g., undersized fish).
- Cooperative Agreements (Section 3.3.4; Section 3.3.6)
  - Whiting mothership, catcher-processor, and shoreside midwater trawl sectors operate under membership agreements, which define whiting harvesting rules and limits for catch of

overfished or protected species and (NMFS and Council 2017). For example, the mothership cooperative membership agreement includes rules and definitions such as precautionary closures of past bycatch hotspots, night fishing restrictions, test tows when entering a new fishing area, and sanctions against vessels that exceed a bycatch rate within a seasonal pool (NMFS and Council 2017). Penalties for not adhering to cooperative agreements can be severe. In addition, members of fishing cooperatives receive reports that include information on catch, bycatch rates, maps of bycatch hotspots, and other useful data aimed at avoiding bycatch.

- Enforcement and Individual Fishing Quotas (Section 3.3.6)
  - Penalties for shoreside IFQ participants may be severe if IFQs or annual vessel limits are exceeded (NMFS and Council 2017). The most extreme penalty was experienced by two shoreside IFQ vessels during 2015 and 2016; both exceeded annual vessel limits and were required to stop fishing in the IFQ fishery for the remainder of the year, and in one case, multiple years, until the quota deficit could be covered. Events like these tend to encourage fishermen to be extremely risk-averse in their fishing location choices (NMFS and Council 2017).
- Marine Stewardship Council (MSC) Certification and Public Perception
  - Fishing sustainably and responsibly is an important consideration for catch share participants. The MSC is an international non-profit organization that designed a fisheries certification and seafood-labeling program to promote sustainable fishing (http://www.msc.org). The Pacific whiting midwater trawl fishery and the West Coast LE groundfish trawl fishery have earned the MSC certification as sustainable and well-managed fisheries. The need to preserve MSC certification, which will expire in 2019 for both fisheries unless renewed, provides incentive to maintain or to reduce current impact levels on fish stocks and the marine ecosystem. The incentive for maintaining this certification may be driven partially by economics (i.e., improved demand for certified-fishery products; https://www.msc.org/global-impacts/consumer-awareness). In addition, groundfish fishermen want the public to view the fishery in a positive light, and they have testified that it would be irrational to destroy habitat and overfish (NMFS and Council 2017).

4.1.4 Mitigation Measures in the Catch Share Program

The definition of mitigation in NEPA regulations includes avoiding potential impacts and limiting the degree or magnitude of an effect (40 CFR 1508.8).

The primary risk of the action alternatives to the biological environment (particularly Issues A, C, D, and E) (Section 2) is increased catch of undersized but marketable species (e.g., small rex sole) or increased catch of unwanted species (e.g., protected, overfished, or other unmarketable species) that may be discarded at sea, ground into fishmeal, or disposed of in some other way. The primary risk of the action alternatives to the physical environment (particularly Issues C and E) (Section 2) is increased bottom contact over sensitive habitat.

The action alternatives may provide flexibility for fishermen to mitigate potential negative impacts to the biological and physical environments. This would occur by allowing for gear modifications to reduce bycatch, increase fishing efficiency (i.e., CPUE), and decrease fishing effort.

The following is a summary of measures that are built into the catch share program and that may mitigate the potential risk of the proposed action. They would be in place under any of the alternatives, including the No-action Alternatives.

Existing mitigation measures:

- Implementation of the catch share program increased flexibility for fishermen to decide where, when, and how to fish, resulting in decreased discard and increased fishing efficiency (e.g., higher CPUE for target species) relative to the era of trip-limit management (Section 3.2.1.3; Section 3.4.2.1; Section 3.4.2.5).
- Catch controls in the catch share program (e.g., harvest specifications, shoreside IFQ and IBQ, and at-sea cooperatives) consistently maintain harvest below the OFLs and ACLs (Section 3.2.1.1) and below trawl allocations (Section 3.3.2).
- Management and monitoring structure of the catch share program (Section 3.3.6), which includes 100 percent monitoring and reporting of landed and discarded catch, reduces uncertainty in fishing mortality estimates and provides the basis for individual accountability and incentive to reduce bycatch (e.g., through voluntary avoidance or use of selective gear; see Section 1; Section 3.3.1; Section 4.1.3.2; Section 4.2.2.1). Catch reporting is in near-real time for some species (e.g., Agenda Item H.5.a, GMT Report 1, March 2018).
- Area management is applied to reduce catch of target or non-target species, such as RCAs (Section 3.1.3) and bycatch reduction areas (BRAs). BRAs can be used to close depths shallower than a specified depth contour to vessels using midwater gear to minimize impacts on groundfish or any

prohibited or protected species, such as salmon. A block area closure (BAC) is an additional area-management tool under consideration that is proposed under Amendment 28. BACs would be similar to RCAs, but could be used to reduce bycatch at a finer resolution (see Section 5).

- A small footrope requirement for bottom trawl shoreward of the trawl RCA (coastwide) is designed to reduce trawling in rocky habitats and constrain the catch of overfished rockfish species (Section 3.4.2.4).
- Extensive EFHCA closures are designed to protect the seabed and associated habitat from bottom trawling (Section 3.1.2) (Council and NMFS 2018). Locations of bottom trawl EFHCAs are illustrated in Figure 3-15. Additional EFHCA protections are currently being considered (Agenda Item F.3, Situation Summary, April 2018) (see Cumulative Effects, Section 5).
- Reductions in trawling effort are imposed due to state and Federal license limitation programs (LE) and the vessel buyback program, each implemented prior to the catch share program, and gear switching and vessel consolidation resulting from provisions of the catch share program (Section 3.4.2.1; Section 3.4.2.5). Each of these actions decreased discard of target and non-target species (Section 3.2.1.3) and reduced bottom contact by bottom trawl (NMFS and Council 2017).
- Terms and conditions provided by biological opinions ensure catch of protected species remain below levels prescribed in the ITS (e.g., NMFS 2017a).
    - Additional mitigation measures needed to ensure that salmon bycatch remains below ITS levels are being developed under the 2019-2020 harvest specification and management measures (Agenda Item E.4.a, Supplemental GMT Report 2, June 2018) and through additional Council meetings (e.g., Agenda Item H.3, Attachment 1, Preliminary Year-at-a-Glance Summary, June 2018).
- Various management actions can be taken to address ESA requirements through inseason Council action or, potentially, through automatic authorities if catch becomes a concern (Agenda Item F.5.a, Supplemental GMT Report 3, April 2018; Agenda Item E.4.a, Supplemental GMT Report 2, June 2018) (Council 2016a; NMFS 2017a).
- Fishermen currently use the following measures to reduce bycatch of non-groundfish species: halibut excluder devices, cameras to evaluate and improve gear performance, meshes larger than the regulated minimum to decrease bycatch and improve gear performance, and communication and coordination to avoid high-bycatch areas (Section 4.2.2.1).
- Fishermen may voluntarily stop fishing, move, or change fishing gear to avoid high bycatch events.

Mitigation measures built into the action alternatives include increased flexibility to construct and use more effective and efficient trawls (e.g., ability to experiment with and use improved selective devices) (Section 4.2.2.1), which may result in higher CPUE, lower fishing effort, improved fishing efficiency, and reduced discarding.

4.2 Impacts of Mesh Size (A1 to A3), Measuring Mesh Size (B1 and B2), Codend Regulations (C1 and C2) and Chafing Gear (E1 to E3)

Section 4.2 evaluates the impacts of the alternatives resulting from changing trawl gear minimum mesh (A1 to A3), definition of trawl mesh size measurements (B1 and B2), codend regulations (C1 and C2), and chafing gear requirements (E1 to E3). Detailed descriptions for each of these issues and alternatives are provided in Section 2, and a summary of Council FPAs is provided in Table 2-9. In all cases, the Council chose the least restrictive alternative for its FPA. The alternatives are analyzed by environmental component: physical (Section 4.2.1), biological (Section 4.2.2), and socioeconomic (Section 4.2.3).

Issue B (measuring mesh size) (Section 2.2) would have no impact on the physical environment, the biological environment, or the socioeconomic environment. Alternative B2 represents administrative action needed to keep regulations on minimum mesh size up to date with new technologies so that they can be enforced properly. As such, this issue is not included in the following analyses.

4.2.1 Physical Environment

Discussion of impacts on the physical environment incorporates habitat and EFH. Impacts of no-action alternatives across issues are described in Section 4.2.1.1. Impacts of action alternatives (Section 4.2.1.2) are compared directly to those of the no-action alternatives. Only habitat impacts are analyzed in detail within Section 4.2.1. Ecosystem impacts (e.g., catch of forage fish) are analyzed in Section 4.2.2. Only issues A, C, and E are evaluated in this section. Issue B (definition of mesh size measurements) was omitted from this analysis because changing the definition is not expected to affect fishing practices (see Section 4.2).

4.2.1.1 No-action Alternatives (Issues A, C, and E)

The action alternatives shown for Issue A (decrease or eliminate minimum codend mesh size requirements), Issue C (allow double-wall codends), and Issue E (reduce or eliminate chafing gear requirements) would not be implemented under the No-action Alternatives (A1, C1, and E1), and groundfish trawl vessels would continue to comply with the existing requirements and regulations shown Section 2.

The most common and direct effect of fishing on groundfish habitat results from fishing gear coming in contact with bottom habitats. These effects are described in Section 3.1 and consist of impacts on the physical environment/EFH/habitat from fishery management actions that generally affect the location of fishing (i.e., on more or less sensitive habitats) or the amount of effort (i.e., amount of time gear is in contact with the seafloor).

Under the No-action Alternatives, the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3), at least in the short term (2-6 years). Landings and revenue may fluctuate over the long-term under the No-action Alternatives, however, as ACLs and markets may fluctuate over the long-term. Changing ACLs, trawl allocations, and markets under the No-action Alternatives may also lead to shifts in fishing behaviors, fishing strategies, trawling effort, or distribution in effort (see Section 3.4.2). For example, non-whiting midwater trawl landings of widow rockfish increased by more than 600 percent in 2017 compared to 2016 (Figure 3-13) as a result of increased trawl allocations (Table 3-16); the number of midwater rockfish trips doubled during that same time period (PacFIN).

Even though trawling effort and fishing strategies may shift over time under the No-action Alternatives, vessels would continue to comply with existing gear and fishing area requirements. Vessels would not change where they are currently allowed to fish. Regulations permitting vessel transit of RCAs and restrictions from trawling within trawl RCAs would continue. EFH protections would continue to prohibit bottom contact gear, including bottom trawl, from specific areas designated as EFHCAs. Furthermore, footrope restrictions would continue, and they would, therefore, provide additional protection for rock habitats that may not be closed to bottom contact gear (Section 3.4.2.4). Chafing gear would continue to be restricted to the last 50 meshes of the codend for bottom trawl, a provision originally intended to disincentive fishing over rocky bottom with small footrope trawls. Midwater trawl regulations that provide disincentives for bottom contact (Section 3.4.1.1; Council and NMFS 2014) would also remain in place. Therefore, continuation of fishing activity under the No-action Alternatives (A1, C1, and E1) is not expected to have additional adverse effects on the physical environment/habitat/EFH beyond what has previously been analyzed.

4.2.1.2 Action Alternatives (Issues A, C, and E)

Regarding the alternatives for codend and chafing gear specifications (Issues A, C, and E), the primary change in physical impact compared to the No-action Alternative is in relation to contact with the physical habitat (e.g., substrate and associated habitat). Reducing mesh size (Issue A) and increasing net protection (Issues C and E) could increase bottom trawl effort targeting semi-pelagic rockfish species or longspine

thornyhead (Section 4.2.2; Section 4.2.3) and could, therefore, result in some redistribution of effort (see NMFS 2017b). However, bottom trawl vessels would still have to comply with existing RCA and EFHCA closures, which prevent bottom trawling in more vulnerable habitats (NMFS 2005a). In addition, any such effect would likely be further limited by continued small-footrope requirements shoreward of trawl RCAs (Section 3.4.2.4) and improved CPUE (Section 3.4.2.1). NMFS (2017b) provided similar conclusions in an EA that analyzed impacts on the physical environment of an EFP that would eliminate minimum mesh size requirements shoreward of trawl RCAs north of 42º N. latitude. Their conclusions included the following: (a) "it is widely believed that restricting footrope diameter to 8 inches or less shoreward of trawl RCAs has been very effective in limiting effort in high relief areas (Council 2005b)" and (b) "if exemptions are effective at increasing efficiency, fewer tow hours may be necessary to attain allocations, reducing impacts of the groundfish fishery overall."

There has been concern that if codend and chafing gear specifications are relaxed, that gear may be "armored" to the extent that bottom trawling over rock habitat may increase (Agenda Item G.8.a, Supplemental GMT Report, March 2016). Extensively armoring the trawl is unlikely for many reasons, including (a) increased drag and decreased flow (Hansen and Tørring 2012; Suuronen et al. 2012), (b) increased expense while hauling due to increased fuel consumption (Hansen and Tørring 2012; Suuronen et al. 2012; Muir 2015), (c) increased expense to purchase smaller mesh, additional chafing gear, and double-wall nets, and (d) increased retention of undersized and unmarketable fish (Section 4.2.2; Suuronen et al. 2012). Increased drag may not only increase fuel consumption, but may also reduce fishing efficiency, such as reducing door spread of the trawl net (Madsen and Holst 2002; Suuronen et al. 2012).

The regulation for restricting chafing gear to last 50 groundfish trawl meshes was implemented to discourage groundfish bottom trawling over rocky habitat (66 FR 2338, January 11, 2001). Although chafing gear coverage restrictions were updated for midwater trawl in 2014 (79 FR 71340, December 2, 2014), chafing gear coverage restrictions for bottom trawl remain unchanged since 2001.

Research by Bellman (2004) and Bellman et al. (2005) demonstrated that bottom trawl footrope size, rather than chafing gear or other protective netting, could have a pronounced impact on the spatial distribution of bottom trawling relative to rock habitat (Section 3.4.2.4). Fishing over hard bottom with a small-footrope bottom trawl shoreward of the trawl RCA (i.e., a line approximating the 100-fm contour), where large footropes are prohibited and boulders may be present, could increase the incidence of hang-ups, even if fishermen were to extensively armor their trawl gear, because small footropes would more readily become wedged under boulders or outcroppings than large footropes; large footrope trawls are more likely to roll or bounce (hop) over boulders and other outcroppings (Section 3.4.1.3). In addition, boulders and other debris would tend to enter the trawl over small footropes more readily than over large footropes (Rose et al.

2000). Damage to nets by boulders and debris passing through the body, intermediate (i.e., netting immediately in front of the codend) (Section 3.4.1), and codend could be severe. Protective netting on the outside of the trawl would not protect small-footrope trawls from this type of damage if fished in rock habitat. Fishing over rock bottom with small footrope trawls could, therefore, create safety and economic concerns for fishermen.

On most trawls, the netting itself is not designed to directly contact the substrate (Rose et al. 2000). In addition, chafing gear or other materials are generally not designed to keep bottom trawls from hanging up on boulders, especially forward of 50 meshes from the terminal end of the codend. The net and the terminal end of the codend are generally some distance off the bottom while towing, due to the tapered-net construction (Figure 2-1) (Rose et al. 2000), to floats added to the net, and to the catch of fish with air bladders (e.g., rockfish). The terminal end of the codend may occasionally bounce or drag on the bottom, especially if weighted down with rock, debris, or flatfish (without air bladders), but this is likely infrequent, especially when targeting rockfish. Stewart and Robertson (1985) showed that codends seldom touch the bottom, unless debris and boulders enter the net and drag it to the sea bed. The doors, sweeps, and footropes of traditional bottom trawls are the components that typically maintain contact with the seabed (Rose et al. 2000). Hence, in these cases, it is unlikely that additional protection (i.e., armoring the bottom trawl forward of the last 50 codend meshes) would provide much additional protection from tearing and hang-ups on boulders. Too much additional net and rope materials added to the trawl could, instead, decrease flow and increase drag (Section 3.3.3) and, therefore, weight the net down and increase the potential for hang-ups over rocky bottom. Note that some fishermen are using innovative bottom trawl gear that reduces bottom contact by doors and footropes (Hansen and Tørring 2012; Suuronen et al. 2012), which would likely raise the webbing even farther off bottom while towing.

4.2.1.2.1 Mesh Size (Alternative A2 - Minimum Mesh Size of 4 inches)

Under Alternative A2, the minimum mesh size would be reduced from 4.5 inches to 4 inches for bottom trawl (Section 2.1). The minimum mesh size for midwater trawl would remain at 3 inches.

Reducing the minimum mesh size by 0.5 inch for bottom trawl would not change impacts on the location that fishermen might fish or on fishing effort (and, therefore, bottom impacts) compared to the No-action Alternative. Applying this mesh-size reduction throughout the codend and intermediate portions of the net would provide little additional protection to the net from bottom impacts (see Section 4.2.1.2), could increase catch of undersized or unmarketable sized fish (e.g., Pikitch et al. 1990; see Section 4.2.2), and could create additional drag (see Section 3.3.3 and Section 4.2.1.2). In addition, although a decrease in

minimum mesh size to 4.0 inches might assist with the development and installation of selective devices relative to the No-action Alternative, which could affect fishermen's decisions, (Section 4.1.3.2), it is unlikely that the change would be large enough to encourage detectable changes in fishing effort or the distribution of trawling effort.

Alternative A2 would likely result in no change in impact on the physical environment/habitat/EFH relative to the No-action Alternative (A1). The basis for this conclusion, including those shown in the previous paragraph, are as follows:

(a) EFH protections would continue to prohibit bottom contact gear, including bottom trawl, from specific areas designated as EFHCAs.
(b) Footrope restrictions would continue and would, therefore, provide additional protection to rock habitats that may not be closed to bottom contact gear.
(c) Various disincentives would prevent reducing mesh size throughout the codend and intermediate portions of the net (e.g., cost, increased drag, increased catch of small, unmarketable fish)
(d) Increased efficiency could lead to a reduction in bottom trawling effort and would, thus, mitigate potential negative impacts.

See Section 3.4.2 (trawl effort and distribution), Section 4.2.1.2 (description of the action alternatives), and Section 4.1.4 (mitigation measures) for more detail.

4.2.1.2.2 Mesh Size (Alternative A3 - No Minimum) (Council's FPA)

Minimum mesh size requirements would be removed from regulation for bottom and midwater trawl under Alternative A3 (Section 2.1) (Table 2-9). The primary purpose for this alternative is to improve efficiency and flexibility for individual trawl fishermen to facilitate the use or construction of excluder devices or decrease gilling when targeting semi-pelagic rockfishes (Section 2.1). It is unlikely that fishermen would significantly reduce mesh size throughout the codend, intermediate, and/or body of the trawl to create less selective fishing gear because this may increase the catch of undersized IFQ or other unwanted species, decrease the efficiency of the trawl, and increase fuel consumption (see Section 3.3.2, Section 4.1.3.2, Section 4.2.2, and Section 4.2.2.1). Allowing unmarketable or undersized fish to escape trawl gears could provide a significant benefit to the ecosystem, harvesters, and processors (see Section 4.2.2 and Section 4.2.3).

Bottom trawl - Although eliminating the minimum mesh size for bottom trawl could result in a shift in fishing effort to deeper waters (e.g., to target small-size longspine thornyhead) or shallower waters (e.g., to target pelagic and semi-pelagic rockfish species (Section 3.4.2; Section 4.2.1.2), Alternative A3 would likely have no change in impact on the physical environment/habitat/EFH relative to the No-action

Alternative (A1) for reasons similar to those shown under Alternative A2 (Section 4.2.1.2.1), which included the following:

(a) EFHCA protected habitat (Section 3.1.2)
(b) Footrope restrictions that may provide additional protection to rock habitats not closed to bottom contact gear (Section 3.4.2.4)
(c) Various disincentives that would prevent reducing mesh size throughout the codend and intermediate portion of the net (e.g., cost, increased drag, increased catch of small, unmarketable fish)
(d) Increased efficiency may lead to a reduction in bottom trawling effort, and thus mitigate potential negative impacts.

See Section 3.4.2 (trawl effort and distribution), Section 4.2.1.2 (description of the action alternatives), and Section 4.1.4 (mitigation measures) for more detail**.**

Midwater trawl - There is currently no need for midwater trawl fishermen to reduce the minimum mesh size throughout their trawl gear because the current minimum 3-inch mesh is sufficient for preventing excessive gilling of midwater species (e.g., widow and yellowtail rockfish), while maintaining high catch rates (see Pikitch et al., 1988). In addition, various disincentives exist that would prevent decreasing the minimum mesh throughout the codend and intermediate portion of the net of midwater trawls, including increased cost, increased drag, increased fuel consumption (Section 3.3.3), and increased catch of small, unmarketable fish (Section 4.2.1.2; Section 4.2.2). Also, midwater trawl regulations are in place that provide disincentives for bottom contact (Section 3.4.1.1) (Council and NMFS 2014). Therefore, this action would not influence fishing decisions regarding fishing location or fishing effort beyond that shown under the No-action Alternative. As such, eliminating the 3-inch mesh size requirement for midwater trawl would likely result in no change in impact on the physical environment/habitat/EFH compared to the No-action Alternative (A1).

4.2.1.2.3 Codend Regulations (Alternative C2 - No Codend Restrictions)

Alternative C2 would remove codend restrictions, including the prohibition on double-wall codends (Section 2.3). This alternative could provide flexibility necessary to reinforce webbing in certain areas of the trawl that could facilitate escapement of fish through escape panels (e.g., reinforced webbing to attach ramps, funnels, or other selective devices to codend or intermediate meshes) and to prevent abrasion of the net from various trawl components, such as restraining straps (Section 3.4.1). This action also could reduce escapement of smaller fish by reducing the effective mesh size (e.g., by blocking meshes) and increase net protection by armoring the trawl (Section 4.2.1.2).

Bottom trawl - Eliminating codend restrictions for bottom trawl (i.e., allowing double-wall codends) could result in a shift in fishing effort to deeper waters (e.g., to target small-size longspine thornyhead) or a shift to fishing over more sensitive bottom habitat (e.g., rocky bottom) (Section 4.2.1.2). However, these actions are unlikely for reasons similar to those shown for Alternative A3 (eliminating minimum mesh size requirements), including the following:

(a) Continued EFHCA protection from bottom trawl (Section 3.1.2)
(b) Footrope restrictions that may provide additional protection to rock habitats not closed to bottom contact gear (Section 3.4.2.4)
(c) Various disincentives that would prevent using complete double-wall codends (e.g., cost, increased drag, increased catch of small, unmarketable fish)
(d) Increased efficiency may lead to a reduction in bottom trawling effort, and thus mitigate potential negative impacts.

See Section 3.4.2 (trawl effort and distribution), Section 4.2.1.2 (description of the action alternatives), and Section 4.1.4 (mitigation measures) for more detail**.** Therefore, eliminating codend requirements for bottom trawl would likely result in no change in the impact on the physical environment/habitat/EFH compared to the No-action Alternative (C1).

Midwater trawl - Various disincentives exist that would prevent use of double-wall codends in the midwater trawl fishery throughout the codend (Section 4.2.1.2), including increased cost, increased drag, increased fuel consumption, and increased catch of small, unmarketable fish. Also, midwater trawl regulations are in place that provide disincentives for bottom contact (Section 3.4.1.1) (Council and NMFS 2014). This action is not expected to influence fishing decisions regarding fishing location or fishing effort by midwater trawl fishermen beyond that shown under the No-action Alternative. Therefore, eliminating codend requirements for midwater trawl, would likely result in no change in the impact on the physical environment/habitat/EFH compared to the No-action Alternative (C1).

4.2.1.2.4 Chafing Gear (Alternative E2 - Bottom Trawl Regulations Align with Midwater Trawl)

Under Alternative E2, the bottom trawl chafing gear regulations would be revised to align with recent changes to midwater trawl chafing gear restrictions specified in regulation at 50 CFR 660.130(b)(4)(i) and (ii) (Section 2.5). Chafing gear could extend the length of the codend (as opposed to covering only the last 50 meshes of the codend as is allowed under current regulations (Alternative E1) and could cover the bottom and sides of the codend to the top riblines (as opposed to encircling no more than 50 percent of the codends circumference) (see Figure 2-5).

Chafing gear is necessary to minimize damage to the codend netting from wear against the stern ramp and trawl alley during net retrieval, as well as occasional contact with the ocean floor (Section 3.4.1, Section 4.2.1.2, and Section 4.2.3). For example, there may be portions of the underside of the codend or intermediate that may bounce along sandy bottom once weighed down with flatfish. Sand is abrasive and may cause gear damage to meshes of the front half of the codend (or aft part of the intermediate portion of the net). Operations may vary among fishermen (target species, net type, etc.) and may require different designs for chafing gear to protect the net from damage.

The restricted length of chafing gear for bottom trawl (i.e., restricted to the last 50 meshes of the codend) was originally intended only for small footrope trawl (68 FR 11182, March 7, 2003). Restricting chafing gear coverage to the last 50 codend meshes of small footrope bottom trawls was implemented to discourage trawling in rocky areas. In 2007, regulations were published that inadvertently eliminated the language which applied the 50-mesh codend restriction to small footrope gear only, such that the 50-mesh limitation subsequently applied to all bottom groundfish nets, including large footrope trawl (Council and NMFS 2014).

It is unlikely that liberalizing chafing gear restrictions would result in expanded fishing effort over rocky habitats relative to the No-action Alternative (Section 4.2.1.2 and Section 4.2.2.1), which was a concern of the GMT (see Agenda Item G.9.a, Supplemental GMT Report, March 2016). As shown by Bellman (2004) and Bellman et al. (2005), fishing location (rock versus soft bottom) depends on footrope type (Section 3.4.2.4 and Section 4.2.1.2). GAP members responding to questions from the Council following presentation of a GAP Report (Agenda Item G.8.a, Supplemental GAP Report, March 2016), stated, “The size of the footrope, not chafing gear, determines where I fish.”

The potential impact of increased chafing gear coverage would be increased damage to the benthic environment. However, EFHCA protections from bottom trawling (Section 3.1.2) and footrope restrictions (Section 3.4.2.4) may prevent bottom trawling in most sensitive habitats, regardless of the amount of chafing gear coverage. It is unclear, however, whether some fishermen may perceive that the additional protection of the codend might provide additional protection to the net while fishing rocky habitats. Therefore, it is expected that disincentives described here and elsewhere (e.g., Section 4.1.3 [fishermen decisions]; Section 4.1.4 [mitigation]; Section 4.2.1.2 [relationship between trawling and bottom contact]) would result in no change in impact (for cases where disincentives of fishing rocky bottom are completely effective) to low-negative impact (for cases where some fishermen might attempt fishing over rocky habitat) on the physical environment/habitat/EFH of Alternative E2 compared to the No-action Alternative (E1).

4.2.1.2.5 Chafing Gear (Alternative E3 - No Chafing Gear Restrictions) (Council's FPA)

Alternative E3 would remove both groundfish bottom trawl and midwater trawl chafing gear restrictions. This would include chafing gear length, attachment points, mesh size, and circumference of the net that could be covered (Section 2.5) (Table 2-9).

Bottom trawl - Relative to Alternative E2, Alternative E3 would allow additional chafing gear to the top of the codend and on any part of the net in front of the codend (i.e., on the intermediate portion of the net and the body of the trawl). Similar to the discussion shown under Alternative E2, it is unlikely that fishermen would attach large sections of chafing gear to these additional sections for added net protection, because doing so would increase fuel consumption and reduce the fishing efficiency (Section 3.3.3). In addition, Alternative E3 would provide little to no additional net protection from bottom contact compared to Alternative E2, because the top of the net and the tapered portion of the net in front of the codend rarely contact the seabed (Section 4.2.1.2). The ability to fish in rocky habitat depends more on footrope size than chafing gear coverage (Section 3.4.2.4). Finally, EFHCA protections (Section 3.1.2) prevent bottom trawling in most sensitive habitats. Therefore, similar to Alternative E2, Alternative E3 would likely result in no change in impact (for cases where disincentives of fishing rocky bottom are completely effective) to low-negative impact (for cases where some fishermen might attempt fishing over rocky habitat) on the physical environment/habitat/EFH relative to the No-action Alternative (E1) for bottom trawl.

Midwater trawl – Vessels are currently permitted to use midwater trawl gear in EFHCAs, and this gear type could intermittently contact bottom habitat (Section 3.4.2.7). Although most midwater hauls are outside of EFHCAs (Figure 3-14 and Figure 3-15), a concern expressed during scoping of this EA was that fishermen could armor the midwater trawl and fish closer to the bottom or tops of pinnacles under Alternative E3 compared to the No-action Alternative. However, Council and NMFS (2014) described numerous disincentives for midwater fishermen to fish close to the substrate. These disincentives included the following:

(a) Risk of damage to the net from snagging or hanging on hard bottom would not be lessened by increases chafing gear coverage.

(b) There is reduced gear efficiency, and operating costs increase when bottom contact occurs.

(c) Bare footropes, sweeps, and 16-inch mesh size restriction for the first 20 feet on the front of the net make the gear impractical or ineffective for fishing hard on the bottom (soft or hard bottom).

(d) Wear patterns on nets indicate that when bottom contact occurs, it typically occurs at the very end of the codend, which is protected by chafing gear under the No-action Alternative (E1). Council

> and NMFS (2014) showed "No amount of chafing gear coverage will protect a midwater net from damage or hang up if contact is made with the net on rough or hard bottom habitat."

Alternative E3 would not likely add meaningful protection to the midwater net from damage caused by rocky bottom (e.g., additional chafing gear on the top of the net); therefore, it is expected that there would be no change in fishermen's behavior, fishing location, or fishing effort compared to Alternative E1. In addition, for reasons similar to those provided by Council and NMFS (2014), and reasons described in Section 3.3.3 (fuel and gear expense), Section 3.4.2.7 (bottom contact by midwater trawls), Section 4.1.3.2 (fishermen decisions), and Section 4.2.1.2 (description of action alternatives), it is expected that there would be no change in the impact on the physical environment/habitat/EFH under Alternative E3 by midwater trawl compared to the No-action Alternative (E1).

4.2.2 Biological Environment

This section evaluates the biological impacts of Issue A (minimum mesh size), Issue C (codend), and Issue E (chafing gear) (Section 2). Section 4.2.2.1 considers the analytical approach when defining biological impact. Section 4.2.2.2 considers the impacts on groundfish species, which includes target and non-target groundfish species. Section 4.2.2.3 considers the impacts on non-target non-groundfish species, which includes prohibited species (salmon, Pacific halibut, and Dungeness crab), protected species (Chinook salmon, green sturgeon, and eulachon), and other non-groundfish species (pink shrimp, forage fish, CPS, and HMS).

Although many researchers have shown that mesh size could affect the escape probability of fishes from trawls (Graham 2010), it has also been suggested that the number of codend layers (Issue C) and chafing gear specifications (Issue E) might affect escapement (Council 2005b) by masking codend meshes and effectively reducing mesh size (Agenda Item G.8.a, Supplemental GMT Report, March 2016). This potential of synergistic biological impacts of mesh size, codend layers, and chafing gear was suggested in Amendment 18 and Amendment 19 (Council 2005b) when describing the evolution of trawl-gear specifications, along with the reasons for the gear changes:

> "In the early-mid 1990s, the Council engaged the trawl industry in a series of discussions on modifying trawl nets to minimize juvenile fish bycatch. Since 1995, bottom trawl nets have been required to be constructed with a minimum mesh size of 4.5 inches, and pelagic trawl nets with a minimum mesh size of three inches. Minimum net mesh sizes are intended to allow immature fish to pass through trawl nets. To ensure the success of minimum mesh size restrictions in allowing juvenile fish to escape trawl nets, the Council

> also developed restrictions preventing trawlers from using a double-wall codend. Further restrictions related to this objective include prohibitions on encircling the whole of a bottom trawl net with chafing gear and restrictions on the minimum mesh size of pelagic trawl chafing gear…."

4.2.2.1 Analytical Approach – Considerations when Defining Level of Biological Impact

This section evaluates whether modifying or eliminating minimum mesh size regulations (Issue A), codend regulations (Issue C), and chafing gear restrictions (Issue E) may enhance or diminish net selectivity (i.e., size or species that are retained by the trawl relative to those that may escape from the trawl) for trawl participants in the catch share program. Numerous considerations were described in Section 3.4.2 (trawl effort and distribution), Section 4.1.3 (considerations when defining the level of impact), Section 4.1.4 (mitigation measures), and Appendix E (fish behavior in and around trawls). These considerations should be evaluated when describing or defining the potential biological impact of the action alternatives.

Once fishermen decide where, when, and how to fish (e.g., Section 4.1.3.2), then interactions between the fishing gear and the biological environment begin. These decisions result in choice of fishing location, gear type (e.g., SFFT or high-rise hooded trawl with large footrope), and how the gear is fished (e.g., towing speed and gear adjustments) (Section 3.4.1). The fishermen's decisions result in a specific array of potential species and habitats that may be encountered during a trip.

Graham (2010) stated "where fisheries are regulated based on landings rather than catches, the most cost-effective option available is to discard unwanted catches rather than to use technical solutions to avoid initial capture." Incentives are necessary for fishermen to apply technology, such as optimal mesh size, mesh shape of codends and intermediate portions of the net, or installation of selective devices (e.g., escape panels). The catch share program includes incentives to minimize bycatch and maximize efficiency (Section 4.1.3.2 [fishermen decisions]; Section 4.1.4 [mitigation measures]), and it was designed to monitor all catch (including discards) (Section 3.3.6.1; NMFS and Council 2017). The large reduction in discards immediately following the implementation of the catch share program demonstrates the influence that program incentives may have on fishermen's behavior and fishing methods (Section 3.2.1.3) (NMFS and Council 2017).

<u>Incentives to Reduce Catch of Undersized and Unwanted Fish and Invertebrates</u>

Fishermen will not necessarily build complete codends and intermediate (or other portions of the trawl) with the smallest mesh size allowed by regulation (or use extensive small-mesh chafing gear or complete codends constructed with double-wall meshes). These types of gear changes could result in the following:

(a) Increase drag and decrease flow (Hansen and Tørring 2012; Suuronen et al. 2012).

(b) Increase expense while hauling due to increased fuel consumption (Hansen and Tørring 2012; Suuronen et al. 2012; Muir 2015).

(c) Increase costs of purchasing smaller mesh, additional chafing gear, and double-wall nets.

(d) Increase retention of undersized and unmarketable fish if encountered (Suuronen et al. 2012).

Fishermen have demonstrated that they may use meshes larger than the regulated minimum mesh size. For example, although 3.0-inch mesh codends were allowed on bottom trawl when fishing with roller gear during the 1980s, some fishermen (not all) opted to fish with roller gear and codend meshes that were 4.5 inches or larger (ODFW, unpublished data),[15] while targeting the DTS complex over soft bottom to reduce catch of undersized and unmarketable fish (D. Erickson, personal observation). Some fishermen opted to use 5-inch mesh codends (ODFW, unpublished data) to reduce discarding during the era when there was no individual accountability (D. Erickson, personal observation). Similar application of mesh sizes larger than the regulatory minimum has been observed in Alaska under its catch share program. The GMT stated, in response to Council questions following its presentation of Agenda Item G.8.a, Supplemental GMT Report, March 2016, that the bottom trawl fishery in Alaska has no minimum mesh size in regulation (ftp://ftp.pcoucil.org/pub/R1603_March_2016_Recordings/3-14-16pm1Copy.mp3), but that fishermen generally use 4.0-inch to 4.5-inch mesh as the most appropriate mesh size.

Incentives associated with the catch share program (Section 4.1.4 [mitigation]; Section 4.1.3.2 [fishermen decisions]) likely will continue to encourage most participants to use gear that is efficient and effective for catching marketable species and sizes, while excluding unmarketable species and sizes. In the case of IFQ species, for example, IFQs create an incentive to reduce the catch of small and juvenile fish. All catch, including discards, by IFQ species are counted against a vessel's IFQs. This creates a strong incentive to maximize the value of one's IFQs by maximizing the amount of catch that can be sold. This, in turn, creates an incentive to increase, rather than to decrease, the selectivity of one's gear to avoid smaller fish that would bring lower value.

[15] Data collected by the Oregon Fish Commission Trawl Fleet Survey (Source: Oregon Department of Fish and Wildlife, Marine Resources Program, Newport, Oregon).

Some participants in the catch share program currently use meshes larger than the minimum mesh size, such as 5-inch mesh between knots (Appendix C; ODFW, unpublished data),[16] some have installed excluders, escape panels, and other non-mandatory selective devices to reduce catch of certain species such as salmon and halibut (e.g., WCGOP database; P. Kujala, pers. comm., F/V *Cape Windy*; M. Lomeli, pers. comm., PSMFC), and many have borrowed cameras from NMFS to observe their gear and fish behavior to improve selectivity and gear efficiency (W. Wakefield, pers. comm., NMFS). A presentation at the 2016 Gear Workshop showed that cameras have been critical in identifying what works and what does not work when modifying gear, and they have allowed fishermen to make small adjustments leading to large changes in bycatch, yield, and quality (Agenda Item G.5.a, Supplemental Workshop Report, June 2016). For example, West Coast fishermen have successfully installed separator panels in trawls to sort longnose and big skate prior to reaching halibut excluders, where they would otherwise escape (P. Kujala, pers. comm., F/V *Cape Windy*). Catch share participants have also made voluntary decisions regarding selection of fishing location to reduce bycatch of overfished species in both the bottom trawl sector (Section 3.4.2.2 [spatial distribution of bottom trawling]) and the whiting midwater trawl sectors (Agenda Item G.2.b, Public Comments, June 2016). These types of actions by catch share participants demonstrate the power of the incentives built into the catch share program to promote selective fishing by trawl participants.

<u>Other Factors that Affect Fish Escapement from Trawl Meshes</u>

Numerous factors unrelated to gear specifications affect size selectivity of fishes in trawls. Escapement through meshes depends on light, water temperature, flow (Winger et al. 2010), open and available meshes (Erickson et al. 1996; Suuronen et al. 1997a), and other extrinsic and intrinsic factors (Winger et al. 2010). Codend meshes may be blocked by catch (i.e., advancing catch bulge), fish that are gilled or wedged between meshes, exhausted fish laying against the meshes, or dense concentrations of fish entering the codend or intermediate portions of the net (Erickson et al. 1996; Suuronen et al. 1997a).

Diamond meshes in two-seam codends are typically closed while towing, except for meshes immediately in front of the accumulated catch (Stewart and Robertson 1985; Suuronen et al. 1997a). The catch bulge enables these meshes to open, and it is in this portion of the two-seam codend that most fish will typically escape (Stewart and Robertson 1985; Suuronen et al. 1997a). Intuitively, selection likely would improve by increasing the number of open meshes (i.e., farther ahead of the catch bulge) (Graham 2010). Although it

[16] Unpublished data obtained through questionnaires. Surveys were conducted in 2012. Oregon Department of Fish and Wildlife, Marine Resources Program, Newport[17] Weigh-back fish are too small, damaged, or exhibit some other problem; processors do not pay harvesters for weigh-backs.

has been shown that undersized fish may escape codend or intermediate meshes well in advance of the catch bulge (e.g., Erickson et al. 1996), other researchers have shown that some species may only attempt to escape when close to the accumulated catch in the codend, despite having opportunities to escape through open square meshes throughout the codend (Graham 2010).

Fishermen's Ability to Affect Size- and Species-selective Properties of Trawls

Regardless of net regulations (e.g., minimum mesh size, prohibition of double-wall codends, and chafing gear restrictions), fishermen can influence selectivity before fish enter the net (Section 4.1.3.2) and after fish are inside of the net (see above). Studies have shown that, in addition to mesh size and shape, the probability of escapement for fish already inside of the trawl can be influenced by other net specifications such as hanging ratio (equal to the length of webbing versus the length of ribline to which the webbing is attached) (O'Neill and Mutch 2017), net circumference (i.e., number of meshes per panel for four-panel codends), twine diameter (Graham et al. 2009; Madsen and Valentinsson 2010; O'Neill and Mutch 2017), and use of double twine instead of single twine (Madsen and Valentinsson 2010). Smaller hanging ratios and larger net circumference (for a given mesh size) may result in meshes being more closed than larger hang ratios and smaller circumference (Graham et al. 2009), and could result in reduced size selectivity. Other net specifications, such as twine diameter, twine material, and single-twine versus double-twine mesh may also affect size selectivity in trawls; stiffer and thicker twine may reduce escapement (Graham et al. 2009; Madsen and Valentinsson 2010; O'Neill and Mutch 2017). Finally, selective devices (e.g., escape panels and horizontal separators) may be installed to enhance species- or size-selectivity (Graham 2010; O'Neill and Mutch 2017). Therefore, selectivity and variability in selectivity depend on these and other factors, many of which can be adjusted by fishermen.

Escape Mortality

Escapement from trawl gear may occur at fishing depth during the tow (Erickson et al. 1996; Graham 2010), or during haul back when flow within the trawl becomes slack or turbulent at various times throughout the haul-back process (Broadhurst et al. 2006; Madsen and Valentinsson 2010). Mortality of fish escaping trawls during the haul-back process is likely greater than at towing depth, especially for those fish that escape near the surface (Suuronen and Erickson 2010).

Mortality of escaping fish depends on numerous factors, including species, fish size, water temperature, and light (Broadhurst et al. 2006; Suuronen and Erickson 2010). Escape mortality has been shown to be inversely correlated with fish size (Broadhurst et al. 2006). This may be due to poorer sustained swimming endurance and swimming ability of small fish relative to large fish. Smaller fish may have more frequent

contact with webbing while inside of the net or during escapement through meshes (Broadhurst et al. 2006; Suuronen and Erickson 2010).

Escape mortality through selective devices (e.g., grids, grates, or escape panels) may be lower than escape mortality through meshes (Suuronen and Erickson 2010). In addition, promoting escapement through selective devices early in the capture process (as far forward in the trawl as possible) could reduce escape mortality relative to fish that escape codend meshes in the aft portion of the trawl (Suuronen and Erickson 2010).

Impacts of size and species selectivity at the population and ecosystem levels

It has been assumed that catch of undersized or smaller fish within a population (e.g., prior to reaching sexual maturity) may reduce population productivity relative to gear that would allow those smaller fish to escape (e.g., Agenda Item G.8.a, Supplemental GMT Report, March 2016; NMFS 2017c). This historical philosophy of selective fishing (e.g., improved population productivity as selection for larger individuals or certain species increases) has come under scrutiny during the past decade, and there is growing concern whether selective fishing is compatible with ecosystem-based fisheries management (EBFM) and sustainable fisheries (e.g., Zhou et al. 2010; He et al. 2016). For example, selectively harvesting large fish, while allowing smaller individuals to escape fishing gears could decrease population productivity by favoring genotypes that promote slow-growing and late-maturing individuals (Swain et al. 2007; Zhou et al. 2010; Berkeley et al. 2011). Potential outcomes of this example could include changes in life history characteristics at the population level, including reduced fecundity and growth rate. In addition, selectively removing older rockfish from a population (i.e., oldest female rockfish) may result in reduced larval survival (Berkeley 2006; Berkeley et al. 2011). In other words, there is evidence that suggests highly selective fishing could lead to reduced productivity and produce undesirable impacts to ecosystems. This has led some to suggest the need for a balanced exploitation or harvest approach, where a combination of smaller and larger fish are harvested to prevent genetic shifts at the population level (Zhou et al. 2010; He et al. 2016).

This paradigm shift in fisheries management should be considered when evaluating potential impacts of the action alternatives on the biological environment. For example, one question to consider is whether an increase in catch of small fish would cause a negative or positive impact on population productivity and the ecosystem. The West Coast groundfish fishery is currently managed under the assumption that if fishing mortality is maintained below the OFL, the likelihood of adverse impacts of fishing activities on genetic structure and reproductive success is reduced (Council and NMFS 2015).

In addition to potential genetic and life history impacts of selectively harvesting larger individuals from a population (see above), the impacts of harvesting immature fish at low or moderate levels may be less than suggested during the scoping process. For example, the GMT stated that "…if someone catches their individual quota with 10 immature fish instead of one large fish, ten times as many fish would be harvested for the same quota (increased exploitation rate), and 10 immature fish would be harvested prior to spawning (zero spawning potential)." Some of these undersized fish would not reach spawning age, had they escaped the trawl, due to natural mortality (Ricker 1975) and to escape mortality (Suuronen and Erickson 2010); the relationship would not be one to one. Notwithstanding, if fishing mortality of immature fish were to increase to a high level relative to fishing mortality of mature fish, then stock status would be negatively affected (Vasilakopoulos et al. 2011).

4.2.2.2 Groundfish (Target and Non-target Species)

Target and non-target groundfish species are described in Section 3.2.1. Potential biological impacts of the catch share program on target and non-target groundfish species are described and analyzed collectively (instead of separately) within this section. Analyses will be shown for key species (i.e., those for which data are prevalent); results may be applied to similar species caught in similar environments. For example, impacts of mesh size changes may be demonstrated for Dover sole across various mesh sizes, then generalized for other flatfishes caught by the DTS fishery.

4.2.2.2.1 No-action Alternatives (Issues A, C, and E)

The action alternatives shown for Issue A (decrease or eliminate minimum codend mesh size requirements), Issue C (allow double-wall codends), and Issue E (reduce or eliminate chafing gear requirements) would not be implemented under the No-action Alternatives (A1, C1, and E1). Vessels would continue to comply with the existing requirements and regulations summarized in Section 2.

The primary effect of fishing on the biological environment is fishing mortality. These effects are described in Section 3.2.1 and consist of impacts on target and non-target groundfish species that generally affect stock status.

Under the No-action Alternatives (A1, C1, and E1), the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3), at least in the short term (2-6 years). Landings and revenue may fluctuate over the long-term under the No-action Alternatives, however, as ACLs and markets may fluctuate over the long-term. Changing ACLs, trawl allocations, and markets under the No-action Alternatives may also lead to shifts in fishing behaviors, fishing strategies, trawling effort, or distribution in effort (see Section 3.4.2). For example, non-whiting midwater trawl landings of widow rockfish increased by more than 600 percent in 2017 compared to 2016

(Figure 3-13) as a result of increased trawl allocations (Table 3-16); the number of midwater rockfish trips doubled during that same time period (PacFIN).

Even though trawling effort, fishing strategies, and total fishing mortality may shift over time under the No-action Alternatives, vessels would continue to comply with existing mitigation measures and incentives built into the catch share program (Section 4.1.4), as well as regulations carried over from the era prior to the catch share program (Section 1.3.2). These regulations, mitigation measures, and incentives were designed, in part, to prevent overfishing and excessive discarding. Minimum mesh size, codend, and chafing gear regulations under the No-action Alternatives may help prevent catch of small-bodied animals (e.g., undersized groundfish). Under the No-action Alternatives, mitigation measures and incentives are expected to continue holding fishing mortality of target and non-target groundfish below or near ACLs and trawl allocations. All trawl-dominant groundfish species that have been assessed are currently classified as healthy (biomass greater than MSY target) (Table 3-4), and would be expected to remain healthy under the No-action Alternatives, even as ACLs and fishing mortality fluctuate. Finally, mitigation measures and incentives built into the catch share program discourages catch and discarding of undersized or unwanted groundfish, resulting in discard rates that are much lower than observed prior to the catch share program (Section 3.2.1.3) (NMFS and Council 2017). Therefore, continuation of fishing activity under the No-action Alternatives (A1, C1, and E1) is not expected to have additional adverse effects on target and non-target groundfish stocks beyond what has previously been analyzed.

4.2.2.2.2 Action Alternatives (Issues A, C, and E)

If mesh size, chafing gear, or double-wall codend changes are made throughout the codend and/or intermediate portion of the net (or even farther in front of the net) in a manner that would create less selective trawls, then catches of undersized or unwanted groundfish could increase if fishing occurred in areas where those smaller or unwanted fish are present and if no other measures are taken to eliminate this bycatch (see below). Economics, MSC certification, net functionality (e.g., maintain adequate flow), individual accountability, and other incentives built into the catch share program (NMFS and Council 2017) would likely prevent such actions from occurring on a large scale (Section 4.1.3; Section 4.1.4; Section 4.2.2.1).

NMFS and Council (2017) and Section 3.2.1.3 provide examples of large reductions in discarding of undersized and unwanted groundfish by trawl vessels immediately after the implementation of the catch share program. Gear regulations, trawl RCA boundaries, and stock status were relatively similar between 2010 (trip-limit management) and 2011 (first year of the catch share program). Therefore, the contrast in

discarding of groundfish between 2010 and 2011 (Section 3.2.1.3) is most likely due to incentives and flexibility built into the catch share program, rather than other factors such as large changes in ACLs and markets. Discarding has remained low relative to the pre-catch share period during 2011 to 2015 (NMFS and Council 2017) and 2016 to 2017 (Table 3-7; Table 3-8), suggesting that this reduction in catch of unwanted fish will likely continue under the catch share program. The incentives and flexibility built into the catch share program may be the primary drivers that caused a shift in fishermen behavior beginning 2011 resulting in the reduction in discards (Section 3.2.1.3) (NMFS and Council 2017). Industry has repeatedly stated that the catch share program provides incentives necessary to encourage responsible and efficient fishing operations (see Appendix B; Appendix C).

Even though catch of undersized and unwanted species (and, therefore, discards) in the groundfish trawl fishery have decreased considerably since the inception of the catch share program, fleet-wide attainment of the trawl allocation has also decreased to low levels for most species (NMFS and Council 2017). This action is intended to provide more flexibility in the configuration and use of gear for catch share participants, to foster innovation, allow more optimal harvest, and ensure that conservation objectives are met (Section 1.2). Fishermen have stated that flexibility in minimum mesh size regulations, codend regulations, and chafing gear regulations is necessary to enable free design and to experiment with their gear to optimize harvest and further reduce bycatch (Appendix B; Appendix C**)**.

4.2.2.2.2.1 Mesh Size (Alternative A2 – Minimum Mesh Size of 4 inches)

Reducing minimum mesh size requirements from 4.5 inches to 4.0 inches for bottom trawl (Section 2.1) could increase the catch of smaller fish compared to the No-action Alternative. The reduction in the length at 50 percent retention (L_{50}) can be estimated using known L_{50} values for fish caught by 4.5-inch mesh codends and projecting L_{50} values for smaller meshes, such as 4.0-inch mesh codend (see Lomeli et al. 2017). Using this method, projections suggest that L_{50} values using a 4-inch mesh codend would be reduced by 14.5 percent for sablefish (i.e., from 42.2 cm to 36.1 cm) and by 13 to 14 percent for the remaining rockfish and flatfish species relative to L_{50} values using the 4.5-inch codend (Table 4-1).

Even though smaller fish might be retained in the 4.0-inch mesh net compared to the 4.5-inch mesh net (Table 4-1), potential impacts on immature fish would be expected to vary by species because immature fish may or may not be available to groundfish trawls in the areas in which the fleet operates (see Alternative A3 below), or immature fish may be too small to be retained by 4.0-inch meshes (i.e., most would escape after entering the trawl). For example, even though the projected L_{50} for rex sole might decrease from 34.8 cm (13.7 inches) under the No-action Alternative to 30.1 cm (11.9 inches) under Alternative A2 (Table 4-1), there would be no increase in catch of immature rex sole because they would

be too small to be retained by 4.0-inch meshes (Perez-Comas et al. 1996). There would be some cases, however, where use of 4.0-inch mesh nets could increase the catch of immature groundfish. For example, the projected L_{50} for petrale sole using a 4.0-inch net would be 24.4 cm (9.6 inches) (Table 4-1), whereas the length at 50 percent maturity (M_{50}) would be 38 cm for males (14.9 inches) and 41 cm for females (16.1 inches) (Council 2016d).

The L_{50} projections shown in Table 4-1 assume that fishermen would have no incentive to avoid or reduce catch of undersized groundfish, which is no longer the case under the catch share program (Section 4.1.3.2 [fishermen decisions]; Section 4.2.2.1 [considerations]). Under the assumption that fishermen (a) would construct and use a complete 4-inch mesh codend (and possibly intermediate or meshes farther forward), (b) would fish in areas with concentrations of groundfish near to or smaller than species-specific L_{50}, and (c) would not manipulate gear to improve selectivity (e.g., install selective devices, open meshes, adjust towing speed and towing locations), then the retention of small groundfish (immature individuals or smaller species) would likely increase relative to the No-action Alternative (A1) for some groundfish species. However, fishermen would be unlikely to reduce their mesh size by 0.5 inches throughout their net because the intent of this regulation was to reduce the potential for mesh-size violations (Section 2.3), rather than to increase catch of small but valuable fish (e.g., longspine thornyhead) or to reduce gilling when targeting pelagic rockfishes. In addition, because fishermen are influenced by Amendment 20 provisions that include incentives to reduce bycatch and discard mortality (Section 4.1.3.2; Section 4.2.2.1), and numerous mitigation measures are in place to ensure that groundfish catches remain below the trawl allocation and the ACL (Section 4.1.4) (Council and NMFS 2015; NMFS 2015), implementation of Alternative A2 would likely result in no change in the impact on target and non-target groundfish relative to the No-action Alternative (A1). Changes in size of fish caught and stock productivity would likely not be measurable relative to the No-action Alternative (A1).

Table 4-1. Projected length at 50 percent retention (L_{50}) for 4.0-inch mesh, using results of mesh size studies conducted onboard United States West Coast groundfish trawl vessels by Lomeli et al. (2017) and Perez-Comas et al. (1998). Actual codend mesh sizes (averaged across experimental codends), and associated and L_{50} values are shown. The projected L_{50} was estimated by methods shown in Lomeli et al. (2017).

Study	**Experimental codend mesh size (average, between knots)**	**Species**	**Study L_{50}**	**Projected L_{50} (101.6 mm or 4.0-inch mesh)**
Lomeli et al. (2017)	119 mm diamond (4.7 in)	Sablefish	42.2 cm (16.6 in)	36.1 cm (14.2 in)
		Dover sole	34.9 cm (13.7 in)	29.8 cm (11.8 in)
		Rex sole	33.1 cm (13.0 in)	28.2 cm (11.1 in)
		Shortspine thornyhead	28.4 cm (11.2 in)	24.3 cm (9.6 in)
Perez-Comas et al. (1998)	117.5 mm diamond (4.6 in)	Dover sole	33.8 cm (13.3 in)	29.2 cm (11.5 in)
		Rex sole	34.8 cm (13.7 in)	30.1 cm (11.9 in)
		Shortspine thornyhead	29.5 cm (11.6 in)	25.5 cm (10.0 in)
		POP	37.3 cm (14.7 in)	32.2 cm (12.7 in)
		Canary rockfish	35.5 cm (14.4)	30.7 cm (12.1 in)
		Yellowtail rockfish	36.0 cm (14.0 in)	31.1 cm (12.2 in)
		Widow rockfish	34.5 cm (13.6 in)	29.9 cm (11.8 in)
		Arrowtooth flounder	37.1 cm (14.6 in)	32.1 cm (13.0 in)
		English sole	29.5 cm (11.6 in)	25.5 cm (10.0 in)
		Petrale sole	28.2 cm (11.1 in)	24.4 cm (9.6 in)

4.2.2.2.2.2 Mesh Size (Alternative A3 –No Minimum) (Council's FPA)

Under Alternative A3, there would be no minimum mesh size for bottom trawl or midwater trawl, except the restriction that affects the 20 feet immediately behind the footrope or headrope on midwater trawl nets (Section 2.1). This alternative would allow fishermen to configure the gear in a way that is most efficient to catch marketable target and non-target groundfish species and avoid (exclude) unwanted and unmarketable sizes of groundfish (Agenda Item G.8.a, Supplemental GAP Report, March 2016). For example, one intent of this alternative would be strategic use of smaller mesh size to facilitate use or construction of excluder devices (e.g., flexible grates) and herding or guiding panels (e.g., Agenda Item I.7.c, Supplemental Public Comment PowerPoint, April 2011; Agenda Item G.8.a, Supplemental GAP Report, March 2016; Ferro and Kynoch, 2006; Graham 2010; O'Neill and Mutch 2017).

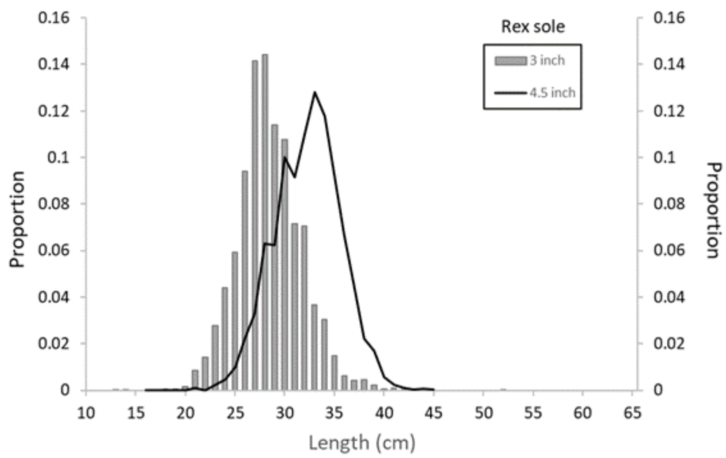
Midwater or bottom trawl fishermen would not likely purchase codends and intermediates that consist entirely of meshes smaller than 3 inches. Midwater trawling is generally species-selective; catch and discard of small fish while using 3-inch mesh in the midwater trawl fishery is generally low (Somers et al. 2017a). For example, the current minimum mesh size of 3 inches for midwater trawl performs well for minimizing gilling of large pelagic rockfish, such as yellowtail rockfish, widow rockfish, and canary rockfish (Appendix B) (Pikitch et al. 1990), while retaining target species (e.g., Pacific whiting, yellowtail rockfish, and widow rockfish). Reducing the mesh size of the midwater codend to something smaller than 3 inches could increase catch and discard of small fish. In addition, reducing codend and intermediate mesh size (throughout the sections) could increase drag and decrease flow (Section 3.3.3; Section 4.2.2.1), subsequently decreasing fishing efficiency (Madsen and Holst 2002; Suuronen et al. 2012). Based on this reasoning, it is unlikely that fishermen would use meshes smaller than 3 inches throughout midwater (or bottom) trawls. They may, however, strategically use meshes that are smaller than 3 inches in specific locations of the net to improve size or species selectivity (e.g., for the installation of selective devices).

Although it is unlikely that most trawl fishermen would construct complete codends with mesh sizes smaller than those they are using under current regulations (i.e., No-action Alternative, A1) (see Section 4.2.2.1), some groundfish bottom trawlers may use complete 3-inch mesh codends to target widow rockfish or yellowtail rockfish on the continental shelf to avoid gilling (Appendix B; Appendix C; Section 4.2.3). It is likely, however, that relatively few bottom trawl fishermen would opt for this arrangement (Section 4.2.2.1; Section 4.2.3), especially once midwater trawling is allowed (see results of the trawl gear EFP; Appendix D).

The potential increase in catch of immature fish, and the associated potential of reduced productivity of the stocks, has been the primary concern of reducing or eliminating mesh size requirements (Agenda Item G.8.a, Supplemental GMT Report, March 2016). This potential increase in catch of small and immature groundfish was evaluated using data from Pikitch et al. (1990). Length-frequency distributions of groundfish caught by 3.0-inch and 4.5-inch mesh codends were compared for sablefish, lingcod, shortspine thornyhead, yellowtail rockfish, widow rockfish, redstripe rockfish, canary rockfish, POP, rex sole, Dover sole, arrowtooth flounder, English sole, and petrale sole. For this analysis, the percent of small fish retained within each codend (3.0-inch mesh and 4.5-inch mesh) was evaluated. Small fish were defined as rockfish and flatfish 30 cm or less (arbitrary, but also near the minimum market size for this groups of species (see Section 4.2.3), lingcod 60 cm or less (equal to the minimum size limit), and sablefish 56 cm or less (equal to the regulated size limit during the trip limit era).

Differences in the lengths of fish caught between the 4.5-inch mesh and the 3.0-inch mesh codends varied among species. A much higher percentage of small fish would be retained within the 3.0-inch mesh codend

(if encountered) than within the 4.5-inch mesh codend for rex sole (Figure 4-1), shortspine thornyhead, and redstripe rockfish (Appendix F). The absolute difference in percent retention of small fish between the two codends for these extreme cases ranged from 20.1 percent of the catch for redstripe rockfish (i.e., small redstripe rockfish consisted of 46.6 percent of the catch in the 3.0-inch mesh codend and 26.1 percent of the catch in the 4.5-inch mesh codend) to 46 percent of the catch for rex sole. The other extreme was shown for widow rockfish (Figure 4-1), sablefish, yellowtail rockfish, canary rockfish, petrale sole, arrowtooth flounder, and sablefish (Appendix F). For these groundfish species, the difference in percent retention of small fish between the two codends was 0 percent to 3.6 percent. The remaining groundfish species showed intermediate differences in the retention of small fish between mesh sizes, ranging from absolute differences of 10 percent for lingcod to 15 percent for Dover sole (Appendix F). For example, for Dover sole, the percent of the catch equal to or smaller than 30 cm was 16.7 percent for the 3.0-inch mesh codend and 2.1 percent for the 4.5-inch mesh codend.



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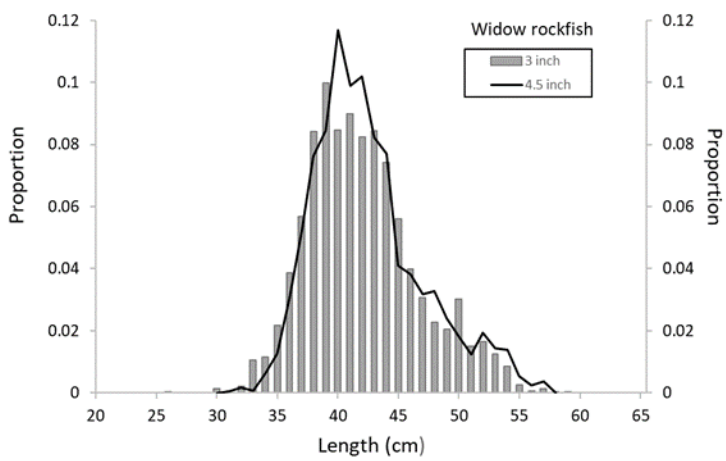

Figure 4-1. Weighted length frequency distributions of rex sole (top panel) and widow rockfish (bottom panel) caught by bottom trawl while using 3-inch mesh codends (bar) and 4.5-inch mesh codends (line) from 1988 to 1990. An alternate haul method was used; only balanced blocks were included (i.e., those with blocks where both 3.0-inch and 4.5-inch mesh codends were used). Source: Pikitch et al. 1990 and Wallace (unpublished).

It is generally thought that decreasing mesh size may increase the harvest of small fish before they are able to reproduce and will, therefore, reduce stock productivity (e.g., Agenda Item G.8.a, Supplemental GMT Report, March 2016; NMFS 2017b). However, potential differences in catch of immature fish between 3.0-inch and 4.5-inch mesh codends may vary with species. In some cases, there may be large differences in the percentage of immature fish retained within the 3.0-inch mesh net versus the 4.5-inch mesh net (Figure 4-2); in other cases, there may be little to no difference in the percentage of immature fish caught within the smaller mesh net versus the larger mesh net (Figure 4-2; Figure 4-3). Additional length frequency distributions, along with the length at M_{50} are shown in Appendix G for shortspine thornyhead, sablefish, English sole, yellowtail rockfish, widow rockfish, and redstripe rockfish. The sample size of length by sex is small for petrale sole and lingcod; therefore, they are not included in the appendix.

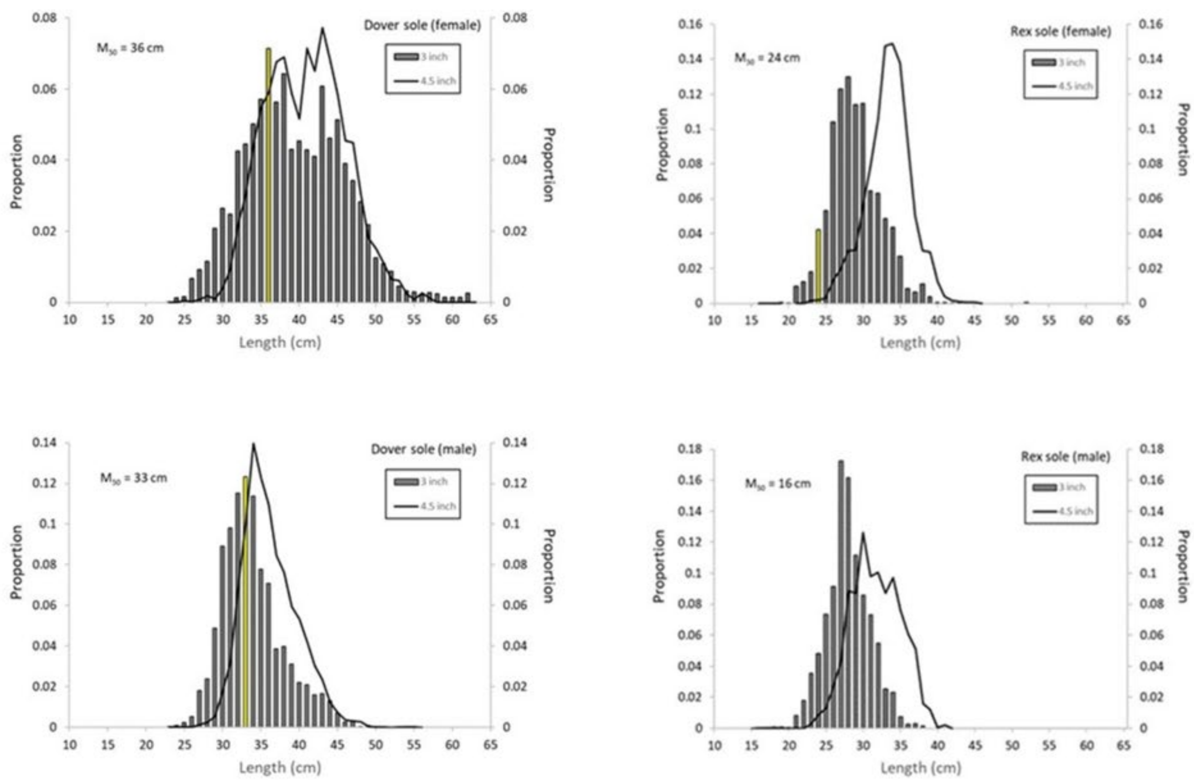

Figure 4-2. Weighted length frequency distributions of female and male Dover sole (left panels) and rex sole (right panels) caught by bottom trawl while using 3.0-inch mesh codends (bar) and 4.5-inch mesh codends (line) from 1988 to 1990. An alternate haul method was used; only balanced blocks were included (i.e., those blocks that included hauls with both 3.0-inch and 4.5-inch mesh codends). The light-colored bar represents M_{50}. Sources for maturity estimates were summarized by Perez-Comas et al. (1998). Data used to generate length frequency distributions were described in Pikitch et al. (1990), Perez-Comas et al. (1998), and Wallace (unpublished).

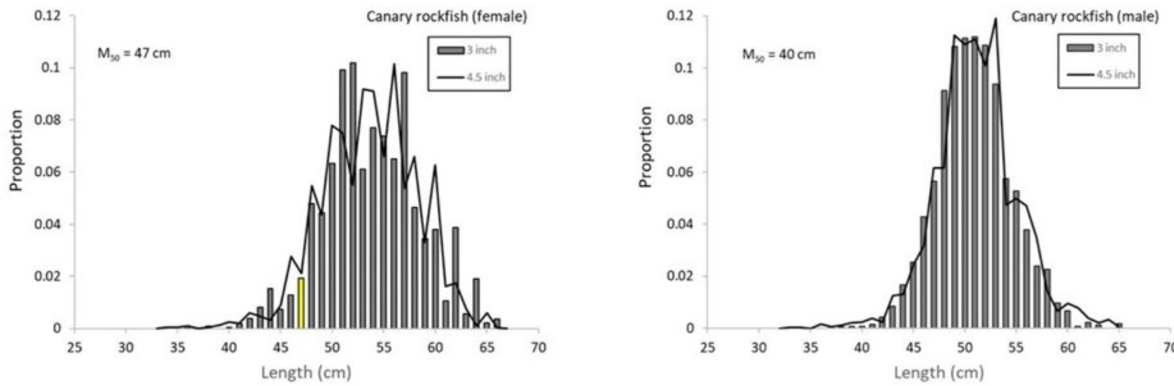

Figure 4-3. Weighted length frequency distributions of female and male canary rockfish caught by bottom trawl while using 3.0-inch mesh codends (bar) and 4.5-inch mesh codends (line) during 1988 to 1990. The light-colored bar represents M_{50}. Sources for maturity estimates were summarized by Perez-Comas et al. (1998). Data used to generate length frequency distributions were described in Pikitch et al. (1990), Perez-Comas et al. (1998), and Wallace (unpublished).

Figure 4-2 and Figure 4-3 show that, in some cases, reducing trawl mesh sizes from 4.5 inches to 3.0 inches throughout the net could increase the catch of undersized fish if there was little incentive to avoid catch of unmarketable or undersized fish, as was the case during the 1980s and 1990s. Under the trawl catch share program, however, vessels have substantial incentive to avoid the catch of small, unmarketable groundfish for which quota is required (Section 4.1.3.2 [fishermen decisions]; Section 4.2.2.1 [considerations]). For each pound of these fish caught, fishermen must use a pound of quota, forgoing their opportunity to use that quota to cover catch for which they can get paid. The effect of catching small fish that must be covered with quota is a reduction of vessel revenue (i.e., no payment will be made for undersized fish), as well as additional sorting time (workload) for the vessel's crew and processor's employees (Section 4.2.3 [socioeconomics]). Provisions of the catch share program (e.g., 100 percent observation of catch through EM, observers and plant monitors) ensures individual accountability (Council and NMFS 2010) that influences fisherman's decisions. Other incentives (e.g., MSC certification) also influence the behavior of catch share participants (Section 4.1.4 [mitigation]; Section 4.1.3.2 [fishermen decisions]; Section 4.2.2.1 [considerations]; Section 4.2.2.2.2 [action alternatives]).

It is unlikely that most fishermen would build complete codends or nets with mesh sizes smaller than what they are currently using (Section 4.2.2.1) because doing so could decrease flow, increase drag (Section 3.3.3), increase catch of undersized fish (Figure 4-2) and decrease fishing efficiency. Instead, it is more likely that fishermen would strategically use smaller mesh size to facilitate the use or construction of

excluder devices (e.g., flexible grates) and herding or guiding panels (see the first paragraph in this subsection), which may be used to further reduce catch of undersized groundfish.

Taking into consideration information from the preceding paragraphs in this subsection, the mitigation measures available to restrain catch of groundfish below trawl allocations and ACLs (Section 4.1.4) and the observed decrease in bycatch since the inception of the catch share program (Section 3.2.1.3), it is expected that Alternative A3 would result in no change in impact to low-negative impact on target and non-target groundfish compared to the No-action Alternative (A1). Even though most fishermen would likely use smaller meshes strategically (i.e., to improve function of selective devices) while continuing to build nets with mesh sizes similar to mesh sizes used under the No-action Alternative, it is uncertain whether others might use smaller meshes throughout their net or codend to retain smaller fish (e.g., target longspine thornyhead). Thus, the expected impacts for Alternative A3 would range from no change in impact (most use meshes similar to the No-action Alternative) to low-negative impact (due to uncertainty of whether some will use codends fully constructed of small meshes).

Concern Regarding Stock Assessments: The GMT raised concerns about the impacts of reducing net mesh sizes to stock assessments. They noted that elimination of mesh size requirements under Alternative A3 could change selectivity of trawl gear, and a mix of mesh sizes used in the fishery could increase uncertainty in stock assessments (Agenda Item G.8.a, Supplemental GMT Report, March 2016). However, the SSC stated that "Although it is impossible to fully anticipate all effects, it is unlikely that the proposed changes to gear construction regulations and enforcement (minimum mesh sizes, measuring mesh size, codend regulations, selective flatfish trawl, chafing gear) would present any insurmountable problems in maintaining high-quality data for assessment purposes" (Agenda Item G.8.a, Supplemental SSC Report, March 2016).

Stock assessments already deal with a wide range of gear specifications and fishing patterns that may affect gear selectivity under the No-action Alternative (A1), so it is expected that assessors could deal with potential changes in gear selectivity under Alternative A3. Bottom trawl participants in the catch share program currently use codends with mesh measurements ranging from 4.5 to 5.5 inches (ODFW, Marine Resources Program, unpublished data). Catch share participants who fish seaward of the RCA with bottom trawl are allowed to use roller gear or mudgear on the footrope (large or small footrope), and they may use various bottom trawl types (e.g., SFFT, low-rise hooded Eastern trawls, or combination high-rise Aberdeen trawls [Table 3-19]), halibut excluder devices, skate sorting devices, and various twine diameters, hanging ratios, and other net specifications (Section 4.2.2.1), all of which affect selectivity. In addition, fishermen's decisions that affect selectivity (where, when, and how to fish) vary among individuals, and they change as ACLs and trawl allocations for key species change (Section 4.1.3.2). Based on this information, there

would likely be no change in impact on stock assessments under Alternative A3 relative to the No-action Alternative (A1).

4.2.2.2.2.3 Codend Regulations (Alternative C2 - No Codend Restrictions)

Current regulations allow only single-wall codends in any trawl; double-wall codends are prohibited, and chafing gear cannot be used to create a double-wall codend (Section 2.3). Alternative C2 would remove codend restrictions, including the prohibition on double-wall codends. The single-wall codend regulation was put into effect in 1992, along with mesh size and chafing gear regulations, to reduce harvest and discard of small, juvenile groundfish and to improve selectivity. Part of the reason for this 1992 regulation was that some fishermen used double-wall codends to increase catch of small but valuable longspine thornyhead in deeper waters after the minimum mesh was raised (Brad Pettinger, Trawl Fisherman, response to Council questions under Agenda Item G.8.a, Supplemental GAP Report, March 2016). Allowing entire double-wall codends may reduce the effective mesh size through masking codend meshes and could increase the catch of small fish (56 FR 46401, September 12, 1991; 57 FR 12212, April 9, 1992; Agenda Item G.8.a, Supplemental GMT Report, March 2016; Matsushita et al. 1996; Özbilgin and Tosunoğlu 2003), if the entire codend were constructed of double meshes.

Reasons for not building complete double-wall codends may be similar to the reasons that most fishermen would not use meshes sizes much smaller than current practices (see Section 3.3.3 [fuel and gear costs]; Section 3.3.6 [management and monitoring]; Section 4.1.3.2 [fishermen decisions]; Section 4.1.4 [mitigation]; Section 4.2.2.1 [considerations]; Section 4.2.2.2.2 [Alternative A3]), which include various disincentives such as economics, cost, increased drag, increased fuel consumption, decreased flow, increased catch of small and unmarketable fish, decreased fishing efficiency, loss of MSC certification, and individual accountability. The GMT noted that "the degree to which more liberal codends would be an issue depends on what actions are taken by industry that has stated it has an incentive not to use a double-wall construction of codends" (Agenda Item G.8.a, Supplemental GMT Report, March 2016). Members of the GAP commented at the March 2016 Council meeting (Agenda Item G.8.a, Supplemental GAP Report, March 2016), "My codend is 4.5 inches. Last time I used a double codend was JV [joint venture] for yellowfin sole. Can't think of a reason to use [a complete] double-wall codend."

While it is unlikely that many (or any) participants in the catch share program would build and use complete double-wall codends (see above), participants may strategically use double-wall mesh in the codends to reduce wear in specific areas of the net (e.g., under restraining straps) (Figure 2-5), improve function of selective devices to reduce catch of unwanted species, or provide strength and rigidity to

specific sections of the net for attaching underwater cameras (S. Skamser, pers. comm., Foulweather Trawl).

There are numerous business disincentives for using complete double-wall codends (see the previous paragraph), and taking into consideration the mitigation measures available to restrain catch of groundfish below trawl allocations and ACLs (Section 4.1.4). Thus, eliminating codend requirements for midwater and bottom trawl would likely result in no change in impact on target and non-target groundfish compared to the No-action Alternative (C1).

4.2.2.2.2.4 Chafing Gear (Alternative E2 – Bottom Trawl Regulations Align with Midwater Trawl)

Under Alternative E2, chafing gear on groundfish bottom trawls could be extended throughout the entire length of the codend (as opposed to covering only the last 50 meshes of the codend as shown under E1). Chafing gear could cover the bottom and sides of the codend to the top riblines (as opposed to encircling no more than 50 percent of the codend circumference) (Section 2.5).

Increasing chafing gear coverage (Alternative E2) could raise the catch of small fish, if encountered, relative to the No-action Alternative (E1) by increasing the number of meshes that might be blocked (or masked) by chafing gear (Stewart and Robertson 1985; Council 1994; Agenda Item G.8.a, Supplemental GMT Report, March 2016). However, studies suggest that if chafing gear meshes are larger than codend meshes, and if chafing gear is hung relatively loosely over codend meshes (i.e., chafing gear is wider than the codend panel and is not attached at the terminal end), then chafing gear may not have a measurable effect on codend selectivity. Therefore, it would not likely increase retention of undersized fish due to blocked meshes (Moderhak 1993; Tosunoğlu et al. 2003).

Most fishermen would be unlikely to build chafing gear with small meshes (e.g., chafing gear mesh size equal to codend mesh size) that would lay tight to the codend meshes, or chafing gear that might cover more of the codend than necessary, because doing so could decrease flow, increase drag (Section 3.3.3), and increase the catch of undersized fish. Flow within the net is essential for adequate escapement of undersized fish (Briggs 1981; Moderhak 1993; West Coast Trawlers' Network 2016). Furthermore, many species escape through the top panel meshes of the codend or the intermediate portion of the net (Erickson et al. 1996; Suuronen et al. 1997b; Frandsen et al. 2010). Finally, other factors may influence net selectivity much more than chafing gear, such as fish or debris blocking codend meshes, other net specifications (e.g., mesh size, mesh shape, and twine thickness) that are controlled by fishermen, and conditions that are not controlled of fishermen, such as temperature, light, and sea state (Section 4.2.2.1). Therefore, the additional chafing gear coverage of the side or bottom codend panels under Alternative E2 may have no measurable effect on codend selectivity relative to the No-action Alternative (E1) for bottom trawl.

As shown for Alternative A3 (Section 4.2.2.2.2.2), under the trawl catch share program, vessels have various incentives to avoid the catch of small, unmarketable groundfish for which quota is required (Section 4.1.3.2 [fishermen decisions]; Section 4.2.2.1 [considerations]). For each pound of these fish caught, fishermen must use a pound of quota, forgoing their opportunity to use that quota to cover catch for which they can get paid. The effect of catching small fish that must be covered with quota is a reduction of vessel revenue (i.e., no payment will be made for undersized fish), as well as additional sorting time (workload) for the vessel's crew and processor's employees (Section 4.2.3). Provisions of the catch share program (e.g., 100 percent observation of catch through EM, observers, and plant monitors) ensure individual accountability (Council and NMFS 2010) that influences fishermen decisions. Other incentives (e.g., MSC certification) also influence the behavior of catch share participants (Section 4.1.3.2; Section 4.2.2.1; Section 4.2.2.2.2). On this basis, regardless of the amount and continuity of chafing gear allowed on a codend, fishermen's incentive is to configure the gear and select fishing locations to avoid catching undersized groundfish. Thus, they may not use the maximum amount of chafing gear, minimum mesh size, etc. to the degree allowed under any particular alternative. In addition, several available mitigation measures can restrain catch of groundfish below trawl allocations and ACLs (Section 4.1.4). For these reasons, Alternative E2 is expected to result in no change in impact on target and non-target groundfish relative to the No-action Alternative (E1).

4.2.2.2.2.5 Chafing Gear (Alternative E3 – No Chafing Gear Restrictions) (Council's FPA)

Under Alternative E3, chafing gear restrictions would be eliminated for bottom trawl and midwater trawl gear. Chafing gear would be allowed without any restrictions (Section 2.5).

The potential for increased catch of small groundfish due to blocked meshes under Alternative E3 could be greater than that described for Alternative E2 (Section 4.2.2.2.2.4). Under Alternative E3, chafing gear could encircle the entire codend or any part of the net (including the top panel). Under Alternative E2, chafing gear would only be allowed on the bottom and side panels of the codend (Section 2.5). However, researchers have shown there is no detectable difference in selectivity between codends with and without top-side chafing gear if the chafing gear consists of larger meshes than the codend mesh size (e.g., two times larger) and if the chafing gear is attached to the codend loosely (i.e., to allow space between the top-side chafing gear and the codend meshes) (Clark 1958; Hylen 1966; Beltestad 1977). For those species that escape through the top meshes of codends and intermediates (e.g., Erickson et al. 1996; Suuronen et al. 1997b; Frandsen et al. 2010), properly hung top-side chafing gear with large meshes may not block or mask codend meshes and, therefore, may not measurably impede escapement.

It is unlikely that most fishermen would build chafing gear with small meshes (e.g., chafing gear mesh size equal the codend mesh size) that would be tight to the codend, or chafing gear that might cover more of the codend or net than necessary, because doing so could decrease flow (Section 3.3.3; Section 4.2.2.2.2.4) and increase catch of undersized fish (Section 4.2.2.2.2.4). In addition, it is unlikely any United States West Coast trawler (midwater or bottom trawl) would attach large sections of chafing gear to the top panel of a trawl to protect netting, because the modern-day net design (i.e., tapered nets) and use of floats largely prevents codends from twisting and being towed upside down.

Factors such as net specifications (e.g., twine thickness, mesh size, and hanging ratio), environmental conditions (temperature, light, and sea state), and catch rate or catch volume (e.g., fish or debris blocking meshes or preventing other fish from reaching the meshes) would likely have a much larger influence on net selectivity than expanding coverage of chafing gear (Section 4.2.2.1). Also, as shown for Alternative A3 (no minimum mesh size), there is incentive to avoid the catch of small, unmarketable groundfish for which quota is required (see Section 4.1.3.2; Section 4.2.2.2.2.4). On this basis, regardless of the amount and continuity of chafing gear allowed on a codend, the incentive of fishermen is to configure the gear and select fishing areas to avoid catching undersized groundfish. Thus, they may not use the maximum amount of chafing gear, minimum mesh size, etc., to the degree allowed under any particular alternative. In addition, several mitigation measures are available to restrain catch of groundfish below trawl allocations and ACLs (Section 4.1.4). Therefore, like Alternative E2, Alternative E3 would likely result in no change in impact on target and non-target groundfish compared to the No-action Alternative (E1) for groundfish bottom trawl and midwater trawl.

4.2.2.3 Non-Target, Non-Groundfish Species (Protected and Non-protected Species)

Non-target, non-groundfish species (protected species and non-protected species) with similar habitat preferences may co-occur with targeted groundfish species. Co-occurrence and bycatch of non-groundfish species in trawl fisheries are shown for prohibited species in Section 3.2.2 (i.e., Pacific salmon, Pacific halibut, and Dungeness crab), protected species in Section 3.2.3 (e.g., certain salmon ESUs, southern DPS eulachon, and southern DPS green sturgeon), and for other non-target, non-groundfish species in Section 3.2.4 (e.g., pink shrimp, forage fish, CPS, and HMS).

Biological impacts of the catch share program on non-target, non-groundfish species are described and analyzed across species groups (i.e., collectively, instead of separately). For example, protected and non-protected species are analyzed within the same section. Analyses within this section will focus on potential impacts on the most sensitive species or species that would most likely encounter trawl gear.

Many non-groundfish species described in Section 3.2 are either rarely encountered by trawl participants in the catch share program, are small enough to escape codend or net meshes once inside a trawl, or are generally too large to escape codend or net meshes once inside the trawl. Many of these species or species groups will not be specifically analyzed further in this section. Most conclusions drawn in Section 4.2.2.2 for groundfish species can be applied to non-groundfish species.

Of the protected species shown in Section 3.2.3, some analyses will be provided for eulachon and Chinook salmon. The remaining protected species would likely not be measurably affected by the action alternatives. For example, green sturgeon, marine mammals, sea birds, and sea turtles would not be affected by these action alternatives (A, C, and E) because of their large size relative to current minimum mesh size regulations (e.g., escapement of these species from trawl meshes would be independent of mesh size, codend regulations, and chafing gear coverage). ESA-listed coho salmon would not be affected by the action alternatives because coho salmon (listed and unlisted) are caught in low numbers. In addition, most trawl-caught coho salmon are unlisted natural-origin or hatchery fish (NMFS 2017a). Finally, all other species of salmon and steelhead (listed or unlisted) are caught in low numbers and would, therefore, not be affected by the proposed action (Table 3-9).

Analyses will not be provided on a species-specific basis for any of the remaining non-groundfish species. The effects on the remaining non-groundfish species would likely be similar to Chinook salmon and eulachon (below), or similar to those shown for similar-size groundfish species occurring in similar habitats (e.g., pelagic, semi-pelagic, or benthic habitats) (see Section 4.2.2.2). For example, participants in the catch share program (Section 3.2.4), rarely catch pink shrimp, most forage fish, CPS, and HMS species (with a few exceptions for midwater whiting trawl), and it is unlikely that catch of these species would increase measurably under any of the action alternatives (A, C, and E) relative to the No-action Alternatives. Changes in gear that may reduce size selectivity in trawls would not change retention of large-bodied animals, such as Dungeness crab, Pacific halibut, and most HMS, because these animals are unable to escape the 4.5-inch minimum mesh size allowed under the No-action Alternative. Likewise, results of the eulachon analyses (below) could generally be applied to other small species, such as forage fish and shrimp. On the other hand, strategic use of small meshes and double-wall netting could be used to improve escapement of any species by providing additional options for installation of selective devices (Section 4.2.2.1).

Take of ESA-listed species will continue to be monitored under the ITS for that species or species group; NMFS and the Council can take mitigation measures when catch exceeds or approaches various annual take thresholds (NMFS 2012; NMFS 2017a). For example, the ITS Term & Condition 3c (NMFS 2017a) requires development of an automatic action that could be used to close a sector (whiting or non-whiting)

automatically if Chinook salmon bycatch thresholds were exceeded (Section 3.2.3.1). In addition, other management measures (e.g., time/area closures) may mitigate potential negative impacts of the action alternatives (Section 4.1.4).

4.2.2.3.1 No-action Alternatives (Issues A, C, and E)

The action alternatives shown for Issue A (decrease or eliminate minimum codend mesh size requirements), Issue C (allow double-wall codends), and Issue E (reduce or eliminate chafing gear requirements) would not be implemented under the No-action Alternatives. Vessels would continue to comply with the existing requirements and regulations summarized in Section 2.

The primary effect of fishing on the biological environment is fishing mortality. These effects are described in Section 3.2.2 (prohibited species), Section 3.2.3 (protected species), and Section 3.2.4 (other non-target non-groundfish species).

Under the No-action Alternatives (A1, C1, and E1), trawling effort and fishing strategies may fluctuate as ACLs and markets for groundfish fluctuates (See Section 4.2.2.2.1). For example, the trawl allocations increased by more than 600 percent for widow rockfish and more than 1,600 percent for canary rockfish in 2017 compared to 2016 (Table 3-16); the number of midwater landings (and trips) more than doubled in 2017 compared to 2016 (PacFIN). It is expected, therefore, that bycatch of non-groundfish may fluctuate as trawling effort and fishing strategies change under the No-action Alternatives.

Even though trawling effort and fishing strategies may shift over time under the No-action Alternatives, vessels would continue to comply with existing mitigation measures and incentives built into the catch share program (Section 4.1.4), as well as regulations carried over from the era prior to the catch share program (Section 1.3.2), that were designed, in part, to prevent overfishing of groundfish and prevent excessive discarding. These constraints and mitigation measures designed for groundfish (Section 4.1.4) may also continue to constrain catches of non-groundfish species. Minimum mesh size, codend, and chafing gear regulations under the No-action Alternatives may help prevent catch of small-bodied animals (e.g., eulachon). Some mitigation measures were built into the catch share program to restrain mortality of non-groundfish below management thresholds (e.g., IBQ for Pacific halibut). The ITS Terms and Conditions in biological opinions (e.g., 2017 salmon biological opinion) and mitigation measures developed through the Council process (e.g., harvest specifications and management measures) would likely continue to restrain catch of prohibited species below ITS levels under the No-action Alternative, even as effort and fishing strategies change. Finally, the Council and NMFS can implement measures to reduce catch of non-groundfish species when there is a conservation concern. Therefore, continuation of

fishing activity under the No-action Alternatives (A1, C1, and E1) is not expected to have additional adverse effects on non-target non-groundfish stocks beyond what has previously been analyzed.

4.2.2.3.2 Action Alternatives (Issues A, C, and E)

4.2.2.3.2.1 Mesh Size (Alternative A2 – Minimum Mesh Size of 4 inches)

Under Alternative A2, the minimum mesh size would be reduced from 4.5 inches to 4.0 inches for groundfish bottom trawl. Under the assumptions that fishermen would construct and use a complete 4.0-inch mesh codend (and possibly intermediate or meshes farther forward), would fish in areas with concentrations of small non-groundfish species (protected or non-protected species), and would not manipulate gear or fishing location to improve selectivity (e.g., install selective devices), the retention of small non-groundfish species such as eulachon could increase under Alternative A2 relative to the No-action Alternative (A1).

Potential changes in the amount of non-groundfish species (including protected and prohibited species) caught under Alternative A2 would likely not be measurable relative to No-action Alternative. Many of the reasons that resulted in no change in impact of Alternative A2 for groundfish species (see Section 4.2.2.2.2.1) would also apply to non-groundfish species. For example, there would be little economic or biological incentive or benefit to reducing mesh size to 4.0 inches for bottom trawl; the primary purpose for this this alternative is to reduce incidence of mesh-size violations (Section 2.1). In addition, several other factors may have a much larger influence on size selectivity than reducing codend mesh size by 0.5 inch, such as whole-net selectivity, fishermen's decisions of where, when, and how to fish, and other net specifications (e.g., hanging ratio, mesh orientation, and twine diameter). These other factors that may influence selectivity were described for groundfish species in Section 4.2.2.2.2.1, and they would affect selectivity of non-groundfish species in a similar manner. Therefore, implementation of Alternative A2 would likely result in no change in impact on non-target non-groundfish (protected and non-protected species) relative to the No-action Alternative (A1).

4.2.2.3.2.2 Mesh Size (Alternative A3 –No Minimum Mesh Size) (Council's FPA)

Under Alternative A3, there would be no minimum mesh size for bottom or midwater trawl. The exception would be the restriction that affects the 20 feet immediately behind the footrope or headrope on midwater trawl nets.

Salmon (protected and non-protected salmon): Three databases were analyzed to evaluate the potential changes of size selectivity for salmon under Alternative A3 relative to the No-action Alternative: (a) West Coast bottom trawl surveys (triennial and slope-shelf surveys conducted in 1998 to 2014), (b) LE or catch

share groundfish bottom trawl data from WCGOP (2002 to 2015), and (c) shoreside whiting and non-whiting midwater trawl data from WCGOP (2002 to 2016) (Table 4-2). Codend (or codend-liner) mesh size, towing speed, and towing duration varied among the datasets (Table 4-2).

Table 4-2. Databases and associated trawl specifications used for salmon length frequency distributions.

Database	Years	Codend or Codend-liner Mesh Size (inches)	Towing Duration (hours)	Towing Speed (knots)	Headrope Height (feet)
West Coast triennial or annual bottom trawl surveys	1998 to 2014	Codend liner: 1.25 to 1.5[a]	0.25 to 0.5[ab]	2.2 to 3.0[ab]	Slope/shelf survey = 15.4 to 17.3[c] ; Triennial survey = 21.3 to 26.9[c]
Catch share bottom trawl (WCGOP)	2011 to 2015	Codend: 4.5 minimum	3 to 4[d]	2.4 to 2.9[e]	Variable
Catch share non-whiting midwater trawl (WCGOP)	2011 to 2016	Codend: 3 minimum	1 to 2[d]	2.8[e]	Variable
Catch share shoreside-whiting midwater trawl (WCGOP)	2011 to 2016	3 minimum	1.5 to 4[d]	3.1 to 3.3[e]	Variable

[a/]Source: Dark et al. (1989) and Stauffer (2003)
[b/]Source: Cope and Haltuch (2012)
[c/]Source: West Coast Groundfish Bottom Trawl Survey, NOAA Fisheries, NWFSC/FRAM, 2725 Montlake Blvd. East, Seattle, WA 98112. Accessed at https://www.nwfsc.noaa.gov/data/map
[d/]Approximate mean towing duration (hours) from Figure 3 and Figure 10 in Somers et al (2017b)
[e/]Source: Steiner et al. (2017a) and Section 3.4.1

The smallest Chinook salmon caught by trawl (Figure 4-4) was similar between trawls with small-mesh codends (i.e., survey trawl gear and midwater trawl gear) and commercial groundfish bottom trawls with larger-mesh codends. Selective flatfish trawls were omitted from these analyses to prevent confounding effects of escapement over the cut-back headrope. Commercial groundfish bottom trawl and survey trawl gear (Table 4-2) both caught Chinook salmon as small as 18 cm fork length (FL) (Figure 4-4a). Although the relative amount of Chinook salmon at the right- and left-hand tails of the curves appear to be greater for commercial bottom trawls than for survey trawls, the overall shapes of the two curves are similar (i.e., minimum length, maximum length, and average length), suggesting that Chinook salmon bycatch using commercial groundfish bottom trawl would likely be independent of net mesh size (average length was 55.8 and 56.0 cm FL for commercial and survey trawl, respectively). Likely explanations for this similarity between gears are that Chinook salmon encountered by bottom trawl are too large to pass through 4.5-inch meshes or salmon behavior may preclude them from attacking and attempting to escape codend meshes. The 4.5-inch mesh groundfish bottom trawl also caught Chinook salmon that were as small or smaller than

Chinook salmon caught with smaller-mesh midwater trawl gear (Figure 4-4b). Note that larger salmon were retained by midwater trawl than by groundfish bottom trawl. This difference could be caused by differences in towing speed (Table 4-2); faster towing speeds may catch larger, faster-swimming fish. Alternatively, differences in Chinook salmon size between bottom trawl and midwater trawl could be due to differences in the size of gear (i.e., vertical opening) or to difference in location of capture (i.e., pelagic versus bottom habitat).

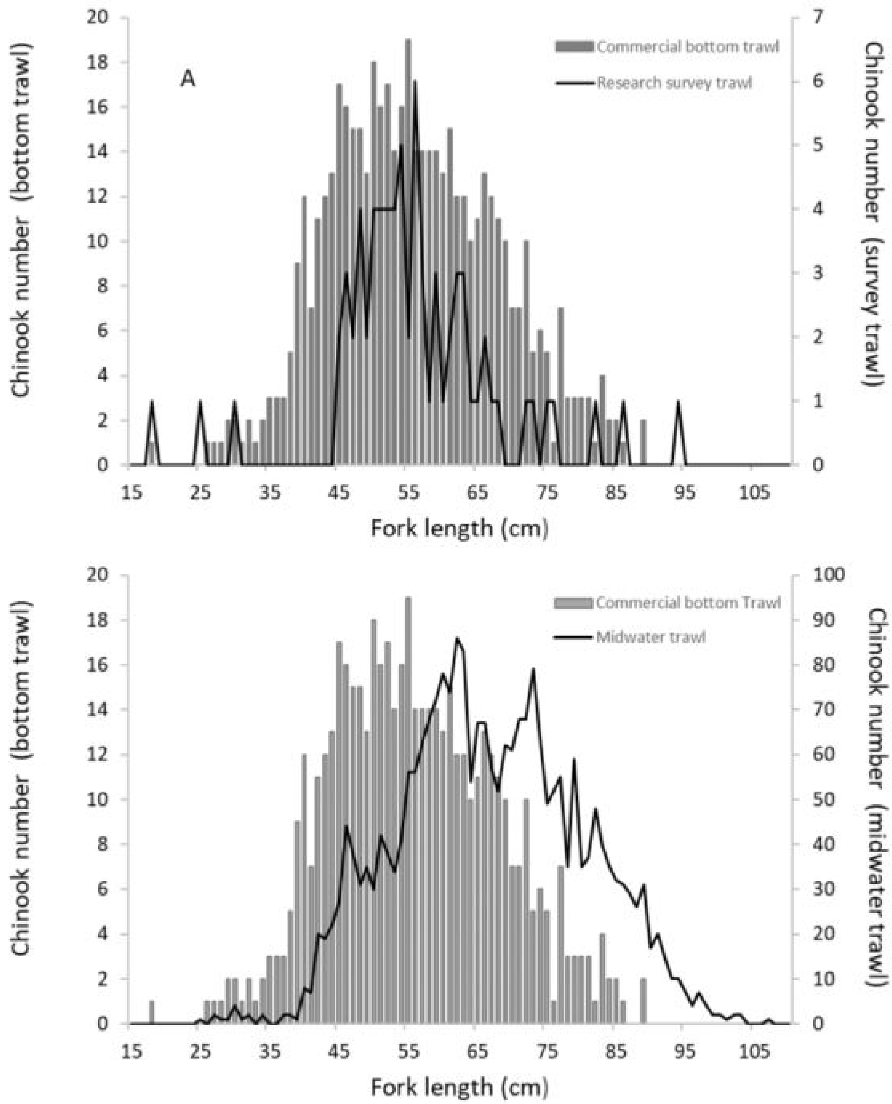

Figure 4-4. Chinook salmon length frequency distributions from (a) commercial groundfish bottom trawl hauls from 2002 to 2015 (bar) and West Coast bottom trawl survey hauls from 1979 to 2015 (line) and (b) commercial groundfish bottom trawl hauls from 2002 to 2015 (bar) and groundfish midwater trawl hauls from 2002 to 2015 (line). Chinook salmon caught by selective flatfish trawl were omitted. Source: WCGOP, NOAA Fisheries, NWFSC; Groundfish Bottom Trawl Survey, NOAA Fisheries, NWFSC/FRAM (https://www.nwfsc.noaa.gov/data/map); PSMFC EM Program (https://www.psmfc.org/program/electronic-monitoring-program)

Figure 4-4 suggests that eliminating minimum mesh size requirements under Alternative A3 would not increase the catch of Chinook salmon relative to the No-action Alternative (A1); there is no evidence to

suggest that more salmon would be caught with smaller meshes. Eliminating mesh size requirements could, however, improve the installation or function of selective devices in the trawls to reduce salmon catch. Numerous midwater trawl fishermen use salmon excluders (e.g., Lomeli and Wakefield 2012) in their trawls (WCGOP database). This action could provide for more effective salmon excluders for midwater trawl gear, and could provide alternatives for bottom trawl fishermen to install salmon excluder devices in codends or intermediate portions of the net (see Section 4.2.2.1; also see the beginning of this section). Therefore, it is expected that Alternative A3 would have no change in impact (if excluders use or function is not improved) to a low positive change in impact (if excluder use or function is improved) on salmon relative to the No-action Alternative (A1) for both bottom and midwater trawl.

Eulachon: Gustafson et al. (2017) suggested that the overall (low) magnitude of eulachon bycatch by United States West Coast groundfish fisheries is due to either limited interaction with eulachon in these fisheries or because most eulachon encounters result in fish escaping or avoiding trawl gear. They stated that minimum mesh size regulations in the midwater trawl (3.0 inches) and bottom trawl (4.5 inches) fisheries would likely allow most eulachon to pass through open meshes readily, unless the codend became plugged with fish. Table 3-14 and Figure 3-6 support Gustafson et al. (2017) regarding the potential size selection properties of commercial groundfish trawls (3.0-inch or 4.5-inch mesh codends) relative to trawls used by the slope/shelf surveys (Table 4-2).

Eulachon catch by groundfish fisheries has been relatively low, even during years of high eulachon abundance (Table 3-14). The level of mortality in the groundfish fishery (less than 5,113 individuals annually), is exceptionally low compared to the probable total numerical abundance of the species. For example, Gustafson et al. (2016) showed that the estimated spawning biomass in the Columbia River, which represents one of several spawning rivers for eulachon (southern DPS), was 123.6 million individuals in 2015. The level of mortality in the groundfish fishery is also very low compared to small mesh fisheries, such as pink shrimp trawl fisheries (Section 3.2.3.3).

It is unlikely that participants in the catch share program would construct and use complete codends with meshes smaller than 3 inches under Alternative A3; most fishermen would likely continue using codends (and other large sections of their trawl) with mesh sizes similar to those currently used (Section 4.2.2.1; Section 4.2.2.2.2.2), with the exception of strategically placed small meshes that may benefit the installation and functionality of selective devices. Use of smaller meshes may allow for the development of selective devices that could reduce the catch of small fish, such as eulachon (O'Neill and Mutch 2017). As such, Alternative A3 would likely have no change in impact (if excluder use or function is not improved) to low positive change in impact (if excluder use or function is improved) for eulachon relative to the no-Action alternative (A1) for both bottom and midwater trawl.

4.2.2.3.2.3 Codend Regulations (Alternative C2 - No Codend Restrictions)

Alternative C2 would remove codend restrictions for groundfish bottom trawl and midwater trawl, including the prohibition on double-wall codends (Section 2.3). Potential biological impacts on non-target non-groundfish under this alternative would be similar to those shown for groundfish (Section 4.2.2.2.2.3) and would include increased mortality of small non-groundfish species due to blocked meshes by the second codend layer. However, these impacts would occur only if fishermen opted to construct complete double-wall codends, which is unlikely because doing so may increase expense, increase drag, increase fuel consumption, decrease flow, increase catch of small and unmarketable fish, and decrease fishing efficiency (see Section 4.2.2.2.2.3 for more detail). In addition, relative to the No-action Alternative (C1), Alternative C2 would not likely result in increased fishing effort or changes in fishing locations (Section 4.1.3; Section 4.2.1.2.3). Therefore, because there are numerous disincentives for using complete double-wall codends, and considering the mitigation measures available to reduce catch of non-groundfish species if a conservation concern emerges (Section 4.1.4), eliminating codend requirements for bottom and midwater trawl likely would result in no change in impact for non-target non-groundfish species compared to the No-action Alternative (C1).

4.2.2.3.2.4 Chafing Gear (Alternative E2 – Bottom Trawl Regulations Align with Midwater Trawl Regulations)

Under Alternative E2, chafing gear on groundfish bottom trawls could be extended throughout the entire length of the codend (as opposed to covering only the last 50 meshes of the codend as shown under E1) and could cover the bottom and sides of the codend to the top riblines (as opposed to encircling no more than 50 percent of the codends circumference) (Section 2.5).

Expanding chafing gear coverage (Alternative E2) could raise bycatch of small non-groundfish, if encountered, relative to the No-action Alternative (E1) by increasing the number of meshes that might be blocked (or masked) by chafing gear. However, studies show that if chafing gear meshes are larger than codend meshes, and if the gear is hung relatively loosely over codend meshes, then it may not have a measureable effect on codend selectivity or increase in bycatch of small fish (see Section 4.2.1.2.4 for more detail).

Trawl participants in the catch share program have numerous incentives to avoid bycatch of unmarketable species (e.g., non-groundfish), which include individual accountability (Council and NMFS 2010), MSC certification, and others (Section 4.1.3.2; Section 4.2.2.1). In addition, relative to the No-action Alternative (E1), Alternative E2 would likely not result in increased fishing effort or changes in fishing locations (Section 4.1.3; Section 4.2.1.2.4). Therefore, Alternative E2 would have similar effects on non-groundfish

as shown for groundfish in Section 4.2.2.2.2.4, and Alternative E2 likely would have no change in impact for non-groundfish compared to the No-action Alternative (E1).

4.2.2.3.2.5 Chafing Gear (Alternative E3 – No Chafing Gear Restrictions) (Council's FPA)

Under Alternative E3, chafing gear restrictions would be eliminated for groundfish bottom trawl and midwater trawl gear. Chafing gear would be allowed without any restrictions (Section 2.5).

Expanding chafing gear coverage (Alternative E3) could raise bycatch of small non-groundfish, if encountered, relative to the No-action Alternative (E1) by increasing the number of meshes that might be blocked (or masked) by chafing gear. However, studies show that if chafing gear meshes are larger than codend meshes, and if chafing gear is hung relatively loosely over codend meshes, then chafing gear may not have a measureable effect on codend selectivity or increase bycatch of small fish (see Section 4.2.2.2.2.5 for more detail). In addition, it is unlikely that fishermen would attach large sections of chafing gear to the top panel or other parts of the trawl in front of the codend because abrasion of codend meshes is not likely to occur in these areas of the net (e.g., tapered sections or top) (Section 3.4.1.2; Section 4.2.1.2) and various disincentives (e.g., cost, drag, etc.) would prevent most fishermen from using excessive chafing gear on groundfish trawls (Section 4.2.2.1). In addition, relative to the No-action Alternative (E1), Alternative E3 would not likely result in increased fishing effort or changes in fishing locations (Section 4.1.3; Section 4.2.1.2.5). Therefore, Alternative E3 likely would have no change in impact for non-groundfish relative to the No-action Alternative (E1).

4.2.3 Socioeconomic Environment

This section evaluates the socioeconomic impacts of the Issue A (minimum mesh size) Issue C (codend), and Issue E (chafing gear) (Section 2). The action alternatives under each issue are intended to provide more flexibility in the configuration and use of gear for participants in the catch share program. This is expected to foster innovation and allow for more optimal harvest operation (i.e., reduce costs and increase revenues), simplify enforcement, and indirectly benefit first receivers/processors. The following analyses, therefore, focus on the impacts of Issue A, Issue C, and Issue E on harvesters, first receivers/processors, and communities. Although relaxing restrictions under Issues A, C, and E may provide some positive benefit for enforcement (e.g., less workload if mesh size restrictions are eliminated), impacts on management are not elaborated herein.

Impacts of no-action alternatives across issues are described in Section 4.2.3.1. Impacts of action alternatives are compared directly to the No-action Alternatives.

The gear issues under the proposed action (A, C, and E) provide flexibility for gear configurations. The action alternatives associated with these gear issues are, therefore, expected to provide some level of benefit through this flexibility. Because modifying gear within the new regulatory regime to better fit targeting strategies is optional and up to the discretion of the operator, some vessels may choose not to modify gear operations and, thus, would not be affected by the potential gear modifications under the proposed action. For vessels, such as those participating in current exempted fishing permits testing new gear configurations (Section 4.3.1.1), that do anticipate changing their gear use under the proposed action, effects would be expected to be positive. Many, if not all, of the vessels that wish to change their gear have invested in modifications to participate under the exempted fishing permit, which reduces the costs of electing to change gear on the vessels once new regulations are implemented.

With increased flexibility may come increased opportunity. It is possible that annual variable costs may increase for harvesters increasing their days at sea or experimenting with new gear types; however, costs are not predicted to increase as a proportion of revenue in the long run, as vessels would seek to increase revenue with new gear configurations. In the short run, expenditures on new gear may decrease net operating revenue and, perhaps, discourage marginally profitable vessels from pursuing new gear strategies. Economic Data Collection data indicates that 2016 fixed and variable expenditures accounted for 59 cents of every dollar of revenue in the DTS bottom trawl sector, 60 cents in the non-whiting, non-DTS bottom trawl sector, 64 cents in the whiting sector, and 75 cents in the non-whiting midwater trawl sector. With the opportunities in the midwater trawl sector expanding in recent years, it is possible that increasing gear expenses for that fishery relative to other target fisheries are explained by purchases or modifications to nets, which account for 10 cents of every dollar for midwater trawl fishing gear compared to 4 to 5 cents in the other trawl target fisheries.

The lower quartile of vessels participating in shoreside whiting and DTS bottom trawl have a total cost net revenue of $40 thousand and $19 thousand, respectively. The lower half of vessels participating in non-whiting midwater trawl and other bottom trawl fisheries had total cost net revenue of less than $25 thousand and $14 thousand. This, coupled with the estimated cost of net modifications, may provide an indication of the scale at which vessels can afford to benefit from the flexibility provisions in this proposed action in the near future. The cost to replace chafing gear ranges from $400 to $500 for bottom trawlers (S. Skamser, pers. comm., Foulweather Trawl). Additional chafing gear could extend the life (currently 2 to 3 years) of a codend by 10 percent to 20 percent. A new codend for bottom trawl ranges from $4,000 to $5,500, depending on the size of the vessel and target species. Non-whiting midwater trawl codends range from $6,000 to $7,000, with the entire midwater trawl net ranging from $30,000 to $40,000 in 2018. Whiting trawl cod ends handle higher volumes, and are thus made of stronger material and are more

expensive, at $117,000 to $143,000 for a life of 10 years. The remaining sections of the net range from $65,000 for whiting vessels with lowest horsepower to $120,000 for whiting vessels with greatest horsepower. With the cost for a new net in most cases equal to or greater than the vessel's net revenue for the year, it is unlikely that most vessels would immediately purchase a new net as a result of these provisions. It is more likely that, after wear and tear, a subset of vessels would choose to incorporate new gear configurations in replacement purchases. This would mean that the potential benefits of this rule may be somewhat delayed and staggered over the next 3 to 10 years, depending on the fishery. With salmon, halibut, cowcod, and yelloweye rockfish still constraining, it is possible some vessels would feel less comfortable with the risk of experimenting with new gear, while the mesh size (Issue A), codend (Issue C), and chafing gear (Issue E) provisions may allow some vessels the flexibility to further integrate cameras and excluders to limit catch of constraining species and to better protect their gear.

4.2.3.1 No-action Alternatives

The action alternatives shown for Issue A (decrease or eliminate minimum codend mesh size requirements), Issue C (allow double-wall codends), and Issue E (reduce or eliminate chafing gear requirements) would not be implemented under the No-action Alternatives (A1, C1, and E1), and vessels would continue to comply with current requirements and regulations shown in Section 2.

Under the No-action Alternatives, the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3). Notable increases of ACLs in 2017 relative to 2016 are shown in Table 3-2 and Table 3-3 for previously constraining species such as canary rockfish (1,271 percent), widow rockfish (575 percent), bocaccio (118 percent), darkblotched rockfish (85 percent), and POP (71 percent), as well as increases for target species such as petrale sole (43 percent). The rebuilding of recently overfished species is expected to drive increased catch and revenue in the coming years under the No-action Alternatives. This trend is observable in 2017: for the non-whiting, trawl gear component of the fishery in 2017, inflation adjusted, non-EFP revenue increased 22 percent over the 2011 to 2016 average, and non-EFP landings increased by 68 percent. Landings and revenue are expected to continue to increase under the No-action Alternatives, at least in the short-term (2 to 6 years), with increased ACLs and trawl allocations to the extent that processors can access markets generally lost to foreign imports during the rebuilding period. Landings and revenue may fluctuate over the long-term under the No-action Alternatives, however, as ACLs and markets may fluctuate over the long-term.

Fishing behaviors and strategies are expected to shift as ACLs and markets change. Over the short-term, fishing behaviors and strategies would likely change in response to increasing ACLs and quota for previously constraining overfished species. Correspondingly, under the No-action Alternatives, revenue

and benefits to harvesters, first receivers/processors, and communities would likely rise in proportion to increases in ACLs and trawl allocations.

While these benefits to the socioeconomic environment are expected under the No-action Alternative over the short-term, the operational flexibility of harvesters would continue to be restricted compared to the action alternatives. Under the No-action Alternatives (A1, B1, E1), vessels would continue to comply with existing gear requirements. These regulations, developed to limit the catch of restricted species during rebuilding, may artificially suppress catch below the levels supportable by markets when catch limits are set equal to optimum yield. To the extent that markets can be developed for new or returning products, increasing harvest opportunity may raise the indirect cost of not being able to access higher ACLs and trawl allocations under the No-action Alternatives relative to the Action Alternatives due to the No-action Alternative gear restrictions.

4.2.3.2 Mesh Size (Alternative A2 – Minimum Mesh Size of 4 inches)

Under Alternative A2, the minimum mesh size would be reduced from 4.5 inches to 4 inches for bottom trawl (Section 2.1). If fishermen reduced mesh size throughout their nets (e.g., the entire codend and intermediate portion of the net) under Alternative A2, and if other gear configurations remained unchanged (e.g., hanging ratio and twine diameter) (Section 4.2.2.1), there could be some decrease in the size of fish retained in the net (Section 4.2.2.2.2.1). This could result in an increase in discarding at sea or an increase of small fish delivered to first receivers/processors. For example, the L_{50} for Dover sole could decrease from approximately 34.9 cm (13.7 inches) using 4.5-inch diamond mesh to 29.8 cm (11.8 inches) using 4.0-inch diamond mesh, which is smaller than the minimum market size of approximately 33 cm (Lomeli et al. 2017). However, disincentives of catching small and unmarketable fish were described in Section 4.1.3.2 and Section 4.2.2.1. Other disincentives of catching smaller fish would include increased sorting time on deck (Pikitch et al. 1990) and reduced payment for a portion of the catch, or no payment for weigh-backs[17] when delivering to first receivers/processors (A. Bornstein, pers. comm., Bornstein Seafoods, Inc.).

Allowing fishermen to reduce mesh size to 4.0 inches would provide additional flexibility to experiment with different mesh shapes and sizes to optimize catch. Square mesh nets perform differently than meshes hung in the diamond orientation; ease of escapement for fishes depends not only on their size, but also on their morphology relative to mesh shape (Appendix E). For example, knotless square mesh (Pikitch et al., 1990) or knotted meshes hung to the riblines at 90-degree orientation (T-90) (Lomeli et al., 2017) may

[17] Weigh-back fish are too small, damaged, or exhibit some other problem; processors do not pay harvesters for weigh-backs.

increase the catch of smaller flatfish, while simultaneously reducing the catch of smaller roundfish (e.g., sablefish). Wallace et al. (1996) demonstrated meshes hung in the square orientation were more effective in the "outer nearshore" (50 fm to 100 fm) than similar-size diamond mesh codends; they showed that using 4.5-inch square mesh codends in the outer near shore could result in higher utilized catch weight per hour and lower discard rate per hour than the 4.5-inch diamond mesh codend. Lomeli et al. (2017) also showed that T90 codends (which emulate square mesh) have the potential to improve catch utilization for the DTS fishery; lengths at 50 percent retention were smaller for flatfishes, but they were larger for roundfishes for the 4.5-inch T90 codend compared to a 4.5-inch diamond mesh codend at depths of 170 fm to 340 fm. Although square mesh smaller than 4.5 inches has not been tested with groundfish trawls, Alternative A2 would allow harvesters to experiment with an assortment of mesh sizes (e.g., to 4.0 inches) and mesh shapes to optimize catch in these mixed species fisheries. For example, sides and bottom of four-seam codends could consist of 4.5-inch diamond mesh to allow escapement of undersized flatfish and the top panel of the codend could consist of a 4.0-inch square mesh to allow escapement of small sablefish.

Impact on Harvesters

Alternative A2 would not change the minimum mesh size requirement for midwater trawl; therefore, there would be no impact on harvesters using midwater trawl. For bottom trawl, disincentives shown above (in this section) would prevent harvesters from reducing mesh size throughout the net if doing so would result in increased catch of unmarketable fish.

Reasons fishermen cite to reduce or eliminate minimum mesh size requirements include flexibility to experiment with trawl gear to reduce the catch of unwanted species or sizes, to increase catch of marketable fish (e.g., improved use of selective devices; Section 4.2.2.1), and to reduce gilling when targeting rockfish (Appendix B) (Section 4.2.2.2.2.2). Reducing the minimum mesh size requirement from 4.5 inches to 4.0 inches would not likely improve the function or use of most selective devices, because many of these devices require mesh sizes much smaller than 4.0 inches to be effective (e.g., chutes, ramps, and separators) (Graham 2010; O'Neill and Mutch 2017). Also, this small reduction in mesh size would not likely reduce gilling when targeting pelagic or semi-pelagic rockfishes compared to gilling in 4.5-inch mesh nets. However, allowing 4.0-inch mesh in groundfish bottom trawl nets would provide flexibility for harvesters to experiment with and use 4-inch square mesh or T-90 mesh nets, potentially increasing fishing efficiency while reducing discard (Wallace et al. 1996; Lomeli et al. 2017) (Appendix E). Another potential benefit that fishermen sought under this alternative was accommodating the inconsistency of available netting in meeting the minimum mesh size requirement of 4.5 inches and, subsequently reducing concerns over violation of minimum mesh size requirements (Agenda Item I.5.a, Attachment 4, November 2012). Although data show that under the No-action Alternative, mesh size violations are rare and few citations

are issued (Table 3-18), reducing the potential of receiving violations caused by net shrinkage could benefit some harvesters. Based on this information, it is expected that Alternative A2 would have a low-positive change in impact for harvesters, compared to the No-action Alternative (A1).

Impact to First Receivers/Processors

Because Alternative A2 would provide harvesters with some flexibility to use mesh size to improve the functionality and efficiency of their nets, processors might realize some improved quality and quantity of fish deliveries. Fishermen could use this increased flexibility to choose mesh sizes and shapes to optimize their ex-vessel revenue while minimizing quota costs (see above). As a result, species composition, amount of fish landed, and quality of deliveries (e.g., size of fish) to first receivers/processors could improve under Alternative A2 relative to the No-action Alternative (Alternative A1). Therefore, Alternative A2 would likely have a low-positive change in impact on first receivers/processors compared to the No-action Alternative (A1).

Impact on Communities

Increased vessel revenue and resulting benefits to communities would be diffuse and not likely detectable at the community level in most ports. The low-positive benefits to harvester and processors under A2 would have no change in impact to a low-positive change in impact on select trawl-focused communities (such as Astoria and Newport) compared to the No-action Alternative (A1). Benefits would depend on the level of gear innovation and the ability of processors to find markets for products in each community. This alternative could increase the value of landed fish, as well as the frequency of landings or the volume of landings. As such, there could be an increase in jobs or income under Alternative A2 relative to No-action Alternative (A1).

4.2.3.3 Mesh Size (Alternative A3 – No Minimum Mesh Size) (Council's FPA)

Under Alternative A3, there would be no minimum mesh size for bottom or midwater trawl. The exception would be the restriction affecting the 20 feet immediately behind the footrope or headrope on midwater trawl nets (Section 2.1).

Impact on Harvesters

The historic restriction of minimum mesh sizes has limited fishermen's access to healthy groundfish stocks by reducing the efficiency of fishing operations, lowering participants' return on investment, and disincentivizing participation in the fishery. Without the minimum mesh size requirement, fishermen could run more efficient operations and experiment with excluders and various combinations of mesh size and

mesh shape (square or T-90 mesh) to reduce bycatch while improving sustainability of the fishery and increasing the likelihood of attainment of trawl allocations.

Incentives and the management structure of the catch share program have changed the way participants operate relative to the 1980s and 1990s (Section 1 [introduction]; Section 4.1.3.2 [fishermen decisions]; Section 4.1.4 [mitigation]; Section 4.2.2.1 [considerations]). Participants likely would use mesh size and mesh shape strategically (Pikitch et al. 1990; Lomeli et al. 2017) to maximize catch value while minimizing discarding.

Without the incentives of the catch share program, fishermen might have less concern about gear selectivity and minimizing bycatch of unmarketable fish and invertebrates. However, there would be costs for using non-selective fishing gear. For example, although Pikitch et al. (1990) showed a large increase in dollars per trawling hour (DPH) using 3-inch mesh ($311/hour) instead of 4.5-inch mesh ($246/hour) for the DTS fishery in the 1980s, they also showed a substantial increase in discards (499 pounds/hour for 3-inch mesh and 243 pounds/hour for 4.5-inch mesh) and in catch-sorting time (109 minutes for 3-inch mesh and 68 minutes for 4.5-inch mesh). However, discarding has already been substantially reduced since the catch share program began in 2011 (Section 3.2.1.3), largely due to incentives built into the program (NMFS and Council 2017). These incentives have led to increased use of halibut and salmon excluders, use of mesh sizes larger than the regulated minimum mesh size, use of cameras to improve trawl-gear function, and voluntary avoidance of areas with high bycatch (Section 4.1.3.2; Section 4.2.2.1)

It is unlikely that midwater or bottom trawl fishermen would purchase complete codends and intermediates with meshes smaller than 3 inches (see Section 4.2.2.2.2.2). Both midwater and bottom trawl harvesters may, however, strategically use meshes that are smaller than 3.0 inches in specific locations of the net to improve size or species selectivity (e.g., for installation of selective devices) (e.g., O'Neill and Mutch 2017) (Appendix B; Appendix C) (Section 4.2.2.1). However, with more flexibility to customize gear to optimize their operations, fishermen who target rockfish using bottom trawl (especially pelagic rockfish such as widow and yellowtail rockfish), may use meshes smaller than 4.5 inches (e.g., 3-inch mesh) to reduce gilling (Pikitch et al. 1990), without appreciably increasing the catch of smaller, unmarketable fish (Appendix F). Reducing the amount of gilling is expected to reduce time crew must spend removing gilled fish from meshes. Finally, 3.0-inch meshes that remain open throughout rockfish-targeted hauls (i.e., that are not blocked with gilled fish) may provide improved fishing efficiency relative to a 4.5-inch mesh codend that is plugged with gilled fish (e.g., Madsen and Holst 2002). As such, eliminating mesh size requirements may provide flexibility for fishermen to reduce the catch of undersized fish (e.g., rex sole) or unwanted fish such as Pacific halibut or salmon (Section 4.2.2.1), while increasing the catch of marketable

fish. These benefits may be realized by non-whiting bottom trawl, non-whiting midwater trawl, and whiting (shoreside and at-sea) harvesters.

Benefits of Alternative A3 for harvesters, as described by fishermen in Appendix B; Appendix C, include flexibility to experiment with trawl gear to reduce catch of unwanted species, to increase catch of marketable fish (see Section 4.2.2.1) and to reduce gilling when targeting rockfish. These expected benefits are largely supported by the analysis in this section, at the beginning of Section 4.2.3, and the analysis in Section 4.2.2.2.2.2 (biological impacts of Alternative A3). Removing minimum mesh size requirements would likely improve the function or use of selective devices and reduce gilling when targeting pelagic or semi-pelagic rockfishes, thereby increasing efficiency of the fishery overall. Finally, this alternative would benefit fishermen who had concerns with minimum-mesh size violations (i.e., the purpose of Alternative A2); those concerns would be eliminated under Alternative A3.

In the short run, some vessels might invest in experimental gear and target new species at a net loss, based on a combination of the expense of new gear and lower-than-expected revenue. Failure to increase revenues may result from unsuccessful harvest strategy or a lack of markets for new products. Rational choice theory indicates that, in the long run, entities would take advantage of flexibility in gear configuration if doing so would increase their profits (see Section 4.2.3). Based on potential benefits described in the preceding paragraphs, and absence of compliance costs, the flexibility provided under Alternative A3 would likely result in a low positive change in impact for some harvesters using bottom trawl and midwater trawl relative to the No-action Alternative (A1).

Impact on First Receivers/Processors

Because Alternative A3 would provide harvesters with the most flexibility to use mesh size to improve the functionality and efficiency of their nets, processors might realize improved quality and quantity of fish deliveries. Fishermen would likely use this increased flexibility to choose mesh sizes, combined with improved use of selective devices and mesh shapes, to optimize their ex-vessel revenue while minimizing quota costs (see above). Therefore Alternative A3 would likely have a low positive change in impact on first receivers/processors compared to the No-action Alternative (A1).

Impact on Communities

Alternative A3 would affect communities hosting first receivers/processors and homeports highly engaged in groundfish bottom trawling and midwater trawling (Section 3.3.5). Although eliminating minimum mesh size requirements may benefit some harvesters and first receivers/processors, it may be difficult to measure the impact on fishing communities. For example, if Alternative A3 increased fishing efficiency by 5 percent or 10 percent relative to the No-action Alternative (A1), positive impacts may be clearly detectable

or measureable for harvesters and first receivers/processors, but may not be as detectable at the community level. As such, Alternative A3 would likely result in no change in impact to a low-positive change in impact on communities compared to the No-action Alternative (A1).

4.2.3.4 Codend Regulations (Alternative C2 - No Codend Restrictions)

The No-action Alternative (C1) allows only single-wall codends in any trawl; double-wall codends are prohibited, and chafing gear cannot be used to create a double-wall codend (Section 2.3). Alternative C2 would remove codend restrictions, including the prohibition on double-wall codends.

Impact to Harvesters

There is no incentive or economic benefit for participants in the catch share program to construct and use complete double-wall codends (Section 4.2.2.2.2.3). Reasons that fishermen may not use complete double-wall codends are similar to reasons that most fishermen would not use mesh sizes much smaller than what is currently used throughout most of the codend or intermediate portion of the net (Section 3.3.3; Section 3.3.6; Section 4.1.3.2; Section 4.2.2.1; Section 4.2.2.2.2). These reasons include expense, increased drag, increased fuel consumption, decreased flow, increased catch of small and unmarketable fish, retention of MSC certification, and individual accountability (i.e., the need to own or lease IFQ to cover groundfish). Instead, fishermen would most likely use double-mesh webbing strategically to protect their gear while maintaining or improving selective properties of their trawls (Section 4.2.2.1).

Current regulations allow areas of double-wall webbing no wider than 16 inches under or over transfer cables, lifting or splitting straps, riblines, and restraining straps for midwater trawl gear (shown at regulation 50 CFR 660.130 (4)(ii)). Alternative C2 could provide similar or improved flexibility for bottom trawl. Therefore, Alternative C2 would provide flexibility for catch share participants (midwater and bottom trawl) to enable strategic protection of additional areas of their fishing gear without increasing catch of undersized or unwanted fish. In addition, this alternative could provide for reinforced webbing in certain areas of the midwater or bottom trawls that could facilitate escapement of fish through escape panels (e.g., reinforced webbing to attach ramps, funnels, or other selective devices to codend or intermediate meshes) or provide stability for mounting underwater cameras. Finally, harvesters might benefit from relaxed restrictions shown under Alternative C2, as they would no longer be in violation of codend regulations by using chafing gear that created double-wall codends. Eliminating this restriction would reduce the potential for compliance issues.

In the short run, some vessels could invest in experimental gear and target new species at a net loss from the combination of new gear expense and lower than expected revenue. Failure to increase revenues may result from unsuccessful harvest strategy or a lack of markets for new products. Rational choice theory

indicates that, in the long run, entities will take advantage of flexibility in gear configuration if doing so increases their profits (see Section 4.2.3). Based on potential benefits described in the preceding paragraphs, and the absence of compliance costs, the flexibility provided under Alternative C2 would likely have a low positive change in impact for some harvesters using bottom trawl and midwater trawl relative to the No-action Alternative (C1).

Impact to First Receivers/Processors

Even though Alternative C2 may provide flexibility for harvesters to protect areas of the net strategically and might potentially improve the performance of their fishing gear (e.g., for installation of selective devices), catch quality or catch quantity would not likely change measurably compared to the No-action Alternative (C1). As such, Alternative C2 would not likely change the impact on first receivers/processors compared to the No-action Alternative (C1).

Impact on Communities

Alternative C2 would impact harvesters in communities that are highly engaged in groundfish bottom trawling (Section 3.3.5), but it is unlikely that any potential increase in revenue (or decrease in expenses) for harvesters would be measurable at the community level. As such, Alternative C2 would not likely impact communities compared to the No-action Alternative (C1).

4.2.3.5 Chafing Gear (Alternative E2 – Bottom Trawl Regulations Align with Midwater Trawl Regulations)

Under Alternative E2, groundfish bottom trawl chafing gear could be extended throughout the entire length of the codend (as opposed to covering only the last 50 meshes of the codend as shown under Alternative E1) and could cover the bottom and sides of the codend to the top riblines (as opposed to encircling no more than 50 percent of the codends circumference). The minimum mesh size for chafing gear would equal the minimum mesh size requirement that applies throughout the net (for example, as currently specified in regulation at 660.130(b)(2)). More detail regarding current chafing gear regulations and regulations associated with Alternative E2 can be found in Section 2.5. Research describing the impacts of chafing gear to selectivity, and application of chafing gear by West Coast trawl fishermen (historically and presently) are also described in Section 4.2.2.2.2.4.

Impacts on Harvesters

The restrictions on chafing gear use have increased the cost of fishing, particularly over the long term. By removing this regulation, fishermen could strategically protect their nets and spend the savings spent

replacing and maintaining nets on other aspects of their operations, such as improving attainment of target and non-target stock allocations.

The life of a codend with chafing gear coverage on the bottom and sides is reported to be approximately 5 to 15 years (Council and NMFS 2014). The life of a codend without chafing gear is estimated to be two to five years. Net builders report that codend useful chronological life depends largely on the amount of fish caught. Alternative E2 may increase the life of the trawl due to preventing abrasion of the webbing on the stern ramp (e.g., in front of the last 50 codend meshes), preventing abrasion of the webbing when the codend contacts the ocean substrate, and allowing fishermen to attach the chafing gear to the top riblines instead of to the side of the webbing (see Section 4.2.1.2).

Depending on the type of net purchased, bottom trawl codends can cost anywhere from $4,000 to $5,500 per net. With less restricted chafing gear requirements, the life of a bottom trawl might increase 10 to 20 percent (S. Skamser, pers. comm., Foulweather Trawl). Using chafing gear to protect bottom trawl codends would, thus, lower the rate of net replacement, decreasing average yearly costs to the fishery of codend replacement by $13,320 to $15,000, assuming at least 60 percent of the groundfish fishery as whole uses bottom trawl gear (PacFIN, 2017). The actual value of savings would depend on the makeup of the fishery itself in any given year.

Other economic benefits to harvesters are described in Section 4.2.3. In addition to economic benefits, Alternative E2 may result in less ambiguity and fewer citations or warnings for fishermen compared to Alternative E1. This is because codend coverage to the riblines is more straight-forward than covering 50 percent of the circumference. Also, the length of chafing gear allowed would not depend on mesh size under Alternative E2, whereas the length of chafing gear would depend on mesh size under the No-action Alternative (E1).

In the short run, it is possible some vessels could invest in experimental gear and new target species at a net loss, due to the combination of expense on new gear and lower than expected revenue. Failure to increase revenues may result from unsuccessful harvest strategy or a lack of markets for new products. Rational choice theory indicates that, in the long run, entities will take advantage of flexibility in gear configuration if doing so increases their profits (see Section 4.2.3). Based on potential benefits described in the preceding paragraphs, and absence of compliance costs, the flexibility provided under Alternative E2 would likely have a low positive change in impact for some harvesters using bottom trawl relative to the No-action Alternative (E1).

Impact on First Receivers/Processors

Even though Alternative E2 may enable strategic protection of areas of the net, catch quality (e.g., amount) or catch quantity (e.g., size) would not likely change compared to the No-action Alternative (E1). As such, Alternative E2 would likely not change have no change in impact on first receivers/processors compared to the No-action Alternative (E1).

Impact on Communities

Alternative E2 would impact harvesters in communities that are highly engaged in groundfish bottom trawling (Section 3.3.5), but any potential increase in revenue (or decrease in expenses) for harvesters would unlikely be measureable at the community level. As such, Alternative E2 would not change the impact on communities compared to the No-action Alternative (E1).

4.2.3.6 Chafing Gear (Alternative E3 – No Chafing Gear Restrictions) (Council's FPA)

Under Alternative E3, chafing gear restrictions would be eliminated for bottom trawl and midwater trawl gear (Section 2.5). Chafing gear could be used, but regulations would not restrict how much of the codend or net it would cover or where it would be connected to the net. Research describing the impacts of chafing gear on selectivity and application of chafing gear by West Coast trawl fishermen (historically and presently) are described in Section 4.2.2.2.2.4.

Impacts on Harvesters

The restrictions on chafing gear use have increased the cost of fishing, particularly over the long term. By removing this regulation, fishermen will be able to protect their nets strategically and to spend their savings on replacing and maintaining nets, as well as on other aspects of their operations, such as improving attainment of allocations of target stocks.

It is unlikely that midwater or bottom trawl fishermen would completely encircle their codend (or more of the net) with chafing gear under Alternative E3. Doing so might increase the catch of unwanted and undersized species and affect trawling efficiency (see Section 4.2.2.2.2.5).

The life of a codend with chafing gear coverage on bottom and sides is reported to be approximately 5 to 15 years (Council and NMFS 2014). The life of a codend without chafing gear is estimated to be two to five years. Net builders report that codend useful chronological life depends largely on the number of fish caught. Alternative E3 may increase the life of the trawl due to preventing abrasion of the webbing on the stern ramp (e.g., in front of the last 50 codend meshes), preventing abrasion of the webbing when the

codend contacts the ocean substrate, and enabling strategic attachment of chafing gear to any section of the net (Section 4.2.1.2).

Depending on the type of net purchased, bottom trawl codends can cost anywhere from $4,000 to $5,500 per vessel. With less restricted chafing gear requirements, the life of a bottom trawl codend can be increased 10 percent to 20 percent (S. Skamser, pers. comm., Foulweather Trawl). Using chafing gear to protect bottom trawl codends would, thus, lower the rate of net replacement, decreasing average yearly costs to the fishery of codend replacement by $13,320 to $15,000, assuming at least 60 percent of the groundfish fishery as whole uses bottom trawl gear (PacFIN, 2017). The actual value of savings would depend on the makeup of the fishery itself in any given year. Other economic benefits to harvesters are described in Section 4.2.3.

There would be no ambiguity regarding required attachment points or amount or locations on the net that could be covered under Alternative E3, whereas there may be some ambiguity associated with codend coverage and attachment points under the No-action Alternative (E1) (Section 4.2.3.5). Other benefits of increased chafing gear coverage were described by Council and NMFS (2014) for midwater trawl chafing gear; similar benefits could be achieved for bottom trawl gear.

In the short run, some vessels could invest in experimental gear and target new species at a net loss from the combination of expense of new gear and lower than expected revenues. Failure to increase revenues may result from unsuccessful harvest strategy, or a lack of markets for new products. Rational choice theory indicates that, in the long run, entities will take advantage of flexibility in gear configuration if doing so increases their profits (see Section 4.2.3). Based on potential benefits described in the preceding paragraphs, and the absence of compliance costs, the flexibility provided under Alternative E3 would likely have a low positive change in impact for some harvesters using bottom trawl and midwater trawl relative to the No-action Alternative (E1).

Impact on First Receivers/Processors

Even though Alternative E3 may enable harvesters to protect areas of the net strategically, catch quality (e.g., amount) or catch quantity (e.g., size) would not likely measurably change compared to the No-action Alternative (E1). As such, Alternative E3 have would likely cause no change in impact on first receivers/processors compared to the No-action Alternative (E1).

Impact on Communities

Alternative E3 would impact harvesters in communities that are highly engaged in groundfish bottom trawling (Section 3.3.5), but any potential increase in revenue (or decrease in expenses) for harvesters

would not likely be measureable at the community level. As such, Alternative E3 would have no change in impact on communities compared to the No-action Alternative (E1).

4.3 Impacts of Selective Flatfish Trawl (D1 to D3)

This section evaluates the impacts of relaxing or removing SFFT requirements (D1 to D3). Detailed descriptions for alternatives D1 to D3, including NMFS Alternative D3, Sub-option 1, are provided in Section 2.4. A summary of Council FPAs and NMFS Alternative D3, Sub-option 1 is provided in Table 2-9.

4.3.1 Analytical Approach – Considerations when Defining Impacts of SFFT

The sections below describe the analytical approach used to define SFFT effects. Trawl gear EFP results and area analyses are included in the discussions below.

4.3.1.1 Preliminary Results of the 2017 and 2018 Trawl Gear EFPs

Trawl gear EFPs in effect during 2017 and 2018 exempted SFFT gear requirements shoreward of the trawl RCA north of 42° N. latitude (NMFS 2017b) (Appendix D). Results of these EFPs provide some inferences regarding the potential impact of Alternative D3 relative to Alternative D1.

Although fishing effort shoreward of the RCA north of 40°10' N. latitude would likely increase under Alternative D3 relative to the No-action Alternative (i.e., to target pelagic and semi-pelagic rockfishes) (Section 4.3.2.3), results of the 2017 and 2018 EFPs suggest this increased effort would primarily occur outside of the whiting season when midwater trawls are prohibited (Appendix D). When midwater trawling is allowed, most catch share participants would likely use only midwater trawl gear to target pelagic and semi-pelagic rockfishes (e.g., widow rockfish and yellowtail rockfish) shoreward of the RCA (Appendix D). Some EFP participants targeting shelf flatfish (instead of pelagic rockfish) would likely use low-rise, hooded bottom trawls (e.g., 400-Eastern trawl with 6-foot vertical opening) (Table 3-19) with the intent to increase rockfish in their portfolio to add value and variety to the catch (Appendix C). However, some fishermen targeting shelf flatfish chose not to participate in the EFP, but instead continued using the SFFT to avoid bycatch of Pacific whiting and a large year class of undersized sablefish (P. Kujala, pers. comm., F/V *Cape Windy*).

During the 2017 trawl gear EFP, data suggest that most EFP trips took place prior to the whiting season (before May 15) using modified midwater trawls defined as bottom trawl in regulation (Appendix D), instead of using typical bottom trawl gear with high vertical openings (Table 3-19). This modified midwater trawl gear is fished off bottom, precisely as midwater gear is fished. Few EFP trips were

conducted using bottom trawl (or modified midwater trawl) after the whiting season began during 2017 (i.e., after May 15) when midwater trawl gear was allowed outside of the EFP (Appendix D).

Results of the 2018 trawl gear EFP where participants are exempt from SFFT requirements and can use multiple gears on a single trip (i.e., bottom trawl and midwater trawl) beginning January 1 (Appendix G) demonstrate that most EFP participants fished with midwater trawl to target widow and yellowtail rockfish shoreward of the RCA, whereas most bottom trawl hauls by EFP participants were seaward of the RCA (Appendix D). Similar to the 2017 EFP, some fishermen planned to participate in the 2018 EFP to target shallow-water flatfish using low-rise hooded trawls (Table 3-19), but they chose to continue using an SFFT shoreward of the RCA to avoid bycatch of Pacific whiting and a large year class of small sablefish (P. Kujala, pers. comm., F/V *Cape Windy*).

Both 2017 and 2018 trawl gear EFPs demonstrated that eliminating the SFFT requirements shoreward of the RCA north of 40°10' N. latitude would result in a large increase in landings of widow and yellowtail rockfish during winter months relative to the No-action Alternative (Appendix D) and, therefore, would likely result in increased fishing effort shoreward of the RCA north of 40°10' N. latitude prior to May 15. Summaries of groundfish and prohibited species catch by the EFPs are provided for 2017 (Agenda Item H.8.a, Supplemental NMFS Report 1, March 2018) and through August 13, 2018 (Agenda Item I.8.a, Supplemental NMFS Report, September 2018).

4.3.1.2 Analyses North of 40° N. Latitude and between 42° and 40°10' N. Latitude

Although Alternatives D1 to D3 reflect changes to SFFT requirements north of 40°10' N. latitude (Section 2.4), this analysis also discusses two smaller areas (north of 42° N. latitude and the area between 40°10' and 42° N. latitude). The 42° N. latitude line is the state boundary between Oregon and California. This discussion better characterizes geographic impacts throughout this IFQ-management area and incorporates 2017 and 2018 groundfish trawl gear EFP data (Section 4.3.1.1) (Appendix D). In addition, the 2017 and 2018 trawl gear EFPs only provide bottom groundfish trawl data for participants exempt from SFFT restrictions for the area north of 42° N. latitude. Finally, the 2017 salmon biological opinion (NMFS 2017a) demonstrated higher uncertainty of trawl impacts to ESA-listed salmon south of 42° N. latitude as compared to the area north of 42° N. latitude. Because of these reasons, Alternative D3, NMFS Sub-option 1 was added to this EA (see Section 2.4) to contrast impacts of removing SFFT-area requirements north of 40°10' N. latitude with the impacts of removing SFFT-area requirements north of 42° N. latitude.

4.3.2 Physical Environment

Impacts of the No-action Alternative (D1) are described in Section 4.3.2.1. Impacts of Alternative D2, (Section 4.3.2.2), Alternative D3 (Section 4.3.2.3) and Alternative D3, NMFS Sub-option 1 (Section 4.3.2.4) are compared directly to those of the No-action Alternative.

4.3.2.1 No-action Alternative (Alternative D1)

Under the No-action Alternative (D1), the SFFT is defined as a two-seam trawl with a low, cut-back headrope (Section 2.4) that is required shoreward of the trawl RCA north of 40º10' N. latitude (Section 3.4.1.4). Alternative D1 affects only groundfish bottom trawl, which is prohibited from use within EFHCAs and trawl RCAs (Figure 2-4) (Section 3.1). Under Alternative D1, groundfish bottom trawl vessels would continue to comply with existing requirements and regulations shown in Section 2.4.

The most common and direct effect of fishing on groundfish habitat results from fishing gear coming in contact with bottom habitats. These effects are described in Section 3.1 and consist of impacts on the physical environment/EFH/habitat from fishery management actions that generally affect the location of fishing (i.e., to more or less sensitive habitats) or the amount of effort (i.e., amount of time gear is in contact with the seafloor).

Under the No-action Alternative (D1), the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3), at least in the short term (2-6 years). Landings and revenue may fluctuate over the long-term under the No-action Alternative, however, as ACLs and markets may fluctuate over the long-term. Changing ACLs, trawl allocations, and markets under the No-action Alternative may also lead to shifts in fishing behaviors, fishing strategies, trawling effort, or distribution in effort (see Section 3.4.2). For example, trawlers targeting shallow-water flatfish are no longer constrained by low canary rockfish IFQ, as they were prior to 2017.

Even though bottom trawling effort and fishing strategies may shift over time under the No-action Alternatives, vessels would continue to comply with existing gear and fishing area requirements. Vessels would not change where they are currently allowed to fish. Regulations permitting vessel transit of RCAs and restrictions from trawling within trawl RCAs would continue. EFH protections would continue to prohibit bottom contact gear, including bottom trawl, from specific areas designated as EFHCAs. Furthermore, footrope restrictions would continue, and they would, therefore, provide additional protection to rock or sensitive habitats that may not be closed to bottom contact gear (Section 3.4.2.4). Chafing gear would continue to be restricted to the last 50 meshes of the codend for bottom trawl, a provision originally intended to disincentive fishing over rocky bottom with small footrope trawls. Therefore, continuation of

fishing activity under the No-action Alternative (D1) is not expected to have additional adverse effects on the physical environment/habitat/EFH beyond what has previously been analyzed.

4.3.2.2 Selective Flatfish Trawl (Alternative D2 - Two-seam or four-seam net)

Under Alternative D2, the SFFT definition would be modified to allow either a two-seam or a four-seam net. The alternative would retain the other gear and area restrictions shown for the No-action Alternative (Section 2.4).

This action alternative would change the design of the trawl net, but the effects on bottom habitat would be the same as those described in the No-action Alternative. Relative to the No-action Alternative (D1), **t**his action alternative would not change the impact on the locations where fishermen might fish, nor would it change the impact on fishing effort. In addition, EFH protections would continue to prohibit bottom contact gear, including bottom trawl, from specific areas designated as EFHCA, bottom trawling would continue to be prohibited within RCAs, and footrope restrictions would continue, providing additional protection for rock habitats that may not be closed to bottom contact gear. Section 4.2.1.2 provides additional justification for this conclusion. Alternative D2 would likely cause no change in impact on the physical environment/habitat/EFH relative to the No-action Alternative (D1) north of 42º N. latitude and between 42º N. latitude and 40º10' N. latitude.

4.3.2.3 Selective Flatfish Trawl (Alternative D3 – retain SFFT definition but eliminate SFFT requirement) (Council Preferred)

Alternative D3 is the same as Alternative D2, except that area restrictions north of 40°10′ N. latitude would be eliminated. The SFFT would no longer be required shoreward of the trawl RCA north of 40°10′ N. latitude (Section 2.4), with the exception of groundfish bottom trawling within the Klamath and Columbia River Conservation Zones where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a). The eliminated area restriction would be replaced with a small footrope requirement (e.g., equivalent to the requirement south of 40°10′ N. latitude).

Eliminating SFFT requirements north of 40°10′ N. latitude could result in higher fishing effort shoreward of the RCA than observed during recent years (Section 4.3.1), because one intent of this alternative is to improve targeting efficiency for pelagic and semi-pelagic rockfish species (e.g., widow and yellowtail rockfish) that occupy the continental shelf, but are no longer overfished (Section 2.4; Section 4.3.1). This increase in targeting efficiency for semi-pelagic rockfishes would likely be accompanied with an increase in fishing effort shoreward of the RCA, as demonstrated by the participation in the 2017 trawl gear EFP (Section 4.3.1.1) and the increase in landings of widow and yellowtail rockfish by groundfish bottom trawl during 2017 (Figure 3-12).

Targeting efficiency could be improved by using bottom-tending combination trawls or high-rise bottom trawls that exhibit a much larger vertical opening than SFFTs (Table 3-19). However, most bottom trawlers that would fish shoreward of the trawl RCA with a low-rise or high-rise bottom trawl that tend to the bottom (e.g., 400-Eastern trawl) are not expected to increase their fishing effort (e.g., trawling hours), but instead use the higher, hooded headrope trawl during their normal flatfish-directed hauls to add value to their catch (Appendix B).

Most of the potential increase in bottom trawling effort shoreward of the trawl RCA experienced under Alternative D3 would likely occur prior to May 15th by vessels using modified midwater trawls (defined as bottom trawls in regulation). This was observed during the 2017 trawl gear EFP (Section 4.3.1.1). These bottom trawls were fished off bottom and, therefore, may only occasionally contact the seabed, similar to midwater trawls (Section 3.4.2.7). This suggests that, even though bottom trawling effort shoreward of the trawl RCA would likely increase under Alternative D3, most of the additional effort would likely be by fishermen using pelagic or semi-pelagic trawls prior to May 15th to target widow rockfish and yellowtail rockfish, similar to that observed during the 2017 trawl gear EFP.

Although Alternative D3 might result in some increase in bottom trawling effort on the continental shelf, this alternative would not likely change the types of habitat that could be fished. Footrope requirements would remain the same, which would continue to discourage bottom trawling over rocky bottom (Section 4.2.1.2.4) (Bellman 2004; Bellman et al. 2005). In addition, EFHCA protections for bottom contact gear would remain in place. Finally, much of the increase in fishing effort would be above bottom prior to May 15th using a pelagic bottom trawl (Section 4.3.1.1) instead of a bottom-tending bottom trawl. Finally, effort has decreased overall since the inception of the catch share program (NMFS and Council 2017), and this would mitigate at least some of the increase in effort that might result from implementation of Alternative D3 (Section 4.1.4).

Based on information in the previous paragraphs, Alternative D3 would likely have no change in impact on the physical environment/habitat/EFH relative to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude.

4.3.2.4 Selective Flatfish Trawl (Alternative D3, NMFS Sub-option 1 – retain SFFT definition but eliminate SFFT requirement north of 42° N. latitude)

Alternative D3, NMFS Sub-option 1 is the same as Alternative D3, in that the SFFT would no longer be required shoreward of the trawl RCA north of 42° N. latitude (Section 2.4), with the exception of groundfish bottom trawling within the Columbia River Conservation Zones where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a). Under this Sub-

option, the SFFT differs from Alternative D3 in that SFFT would remain a requirement for groundfish bottom trawls shoreward of the trawl RCA between 42º N. latitude and 40º10' N. latitude. The eliminated area requirement north of 42º N. latitude would be replaced with a small footrope requirement (e.g., equivalent to the requirement south of 40°10′ N. latitude).

Because Alternative D3, NMFS Sub-option 1 represents less of a change from No Action than the Council Preferred Alternative D3, and based on reasoning shown for the Council preferred Alternative D3 in Section 4.3.2.3, Alternative D3, NMFS Sub-option 1 would likely have no change in impact on the physical environment/habitat/EFH relative to either the No-action Alternative (D1) or Alternative D3 north of 42º N. latitude or between 42º N. latitude and 40º10 N. latitude (Table 4-5).

4.3.3 Biological Environment

Impacts of the alternatives on groundfish (target and non-target groundfish) are described in Section 4.3.3.1, whereas impacts of the alternatives on non-groundfish (protected and non-protected species) are described in Section 4.3.3.2. Impacts of the action alternatives and sub-options (Alternative D2, Alternative D3, and Alternative D3 NMFS Sub-option 1) are compared directly to those of the No-action Alternative (D1).

4.3.3.1 Groundfish (Target and Non-target Species)

Target and non-target groundfish species in the catch share program are described in Section 3.2.1. Potential biological impacts on target and non-target groundfish species are described and analyzed collectively (instead of separately) within this section. Analyses will be shown for key species or species groups (e.g., those for which data are prevalent); results may be applied to similar species caught in similar environments. For example, the impacts of eliminating SFFT requirements may be demonstrated for widow rockfish, then generalized for other pelagic or semi-pelagic rockfishes or roundfishes that may be caught over the continental shelf.

Affected Groundfish Species

King et al. (2004) and Hannah et al. (2005) described expected catch differences between trawls with cut-back and low headropes (hereafter referred to as SFFT) and trawls with overhanging (hooded) headropes designed with a higher vertical opening than the SFFT. Hannah et al. (2005) used a modified four-seam Aberdeen combination trawl with a vertical opening of approximately 15 feet as the control net, whereas they used a SFFT with a vertical opening of approximately 4.5 feet as the experimental net. King et al. (2004) also used a modified four-seam Aberdeen combination trawl as the control, but with a lower vertical

opening (approximately 6.4 feet) than the control used by Hannah et al (2005). King et al. (2004) compared catches of the control trawl to an SFFT with a vertical opening of approximately 4.1 feet.

King et al. (2004) compared hauls using the two gear types over the continental shelf, whereas Hannah et al. (2005) compared sets made with the two gear types over the continental slope. Although King et al. (2004) demonstrated increased catch of numerous flatfish species using the SFFT relative to the combination trawl (Table 4-3), their results were confounded by differences in footrope length between the trawls; the footrope of the SFFT was longer than the footrope of the combination trawl. Since flatfish tend to the bottom and display herding behavior, the King et al. (2004) study likely would show higher flatfish catches for the SFFT than for the combination trawl. Hannah et al. (2005), who used similar footrope lengths for both trawl types, showed no difference in catch of most flatfish between trawl types (Table 4-3).

Both King et al. (2004) and Hannah et al. (2005) demonstrated that larger rockfish species, such as redstripe rockfish and canary rockfish that may school a few meters off-bottom, were more frequently caught by the combination trawl (with higher, hooded headrope) than by the SFFT (Table 4-3). They showed that pelagic or semi-pelagic species, or fish with strong swimming abilities, are more likely to escape over the wings or over the low, cut-back headrope of the SFFT than over the hooded headrope of combination or high-rise trawls. They concluded that the SFFT was effective for separating large rockfish species from flatfish, but that many smaller rockfishes encountering the SFFT would still be retained by the net. Difference in catch between rockfish and flatfish by the SFFT is due to differences in swimming ability and behavior; Rose (1996) and Ryer (2008) demonstrated that soles remained close to the seabed and swam downward or turned and swam toward the codend as bottom trawls overcame them.

The SFFTs King et al. (2004) and Hannah et al. (2005) used were two-seam trawls, which have a tendency to exhibit lower flow and more closed meshes than four-seam trawls (Section 4.2.2.1). Once fish are inside the trawl, four-seam nets may allow escapement of undersized fish through open meshes more readily than through closed meshes of two-seam trawls.

Similar to rockfishes, roundfishes that may swim off bottom or are strong swimmers are expected to escape SFFTs more readily than hooded trawls with higher vertical openings. For example, King et al. (2004) and Hannah et al. (2005) showed lower catch of Pacific whiting using the SFFT than when using the hooded combination trawl (Table 4-3). Hannah et al. (2005) also showed lower catch of sablefish using the SFFT, while King et al (2004) showed more.

Table 4-3. Paired catch comparisons of groundfish catch weight (kg) between SFFT and hooded combination trawl with higher vertical opening (see Table 3-19). Species that may be caught by trawl on the continental shelf (e.g., less than 100 fm) are shown. Symbols are as follows: Significantly larger catch weight ($p < 0.05$) for the SFFT relative to the hooded combination trawl (+); significantly smaller catch weight ($p < 0.05$) for the SFFT relative to the hooded combination trawl (–); not significantly different (NS) between trawl types; Not applicable (NA) is shown for species that were not reported caught by the studies.

Species[a]	**King et al. 2004[b]**	**Hannah et al. 2005[c]**
Dover sole	+	NS
Slender sole	+	+
Petrale sole	+	NS
English sole	+	NA
Flathead sole	–	NA
Arrowtooth flounder	NS	–
Pacific whiting	–	–
Sablefish	+	–
Canary rockfish	–	NA
Redstripe rockfish	–	NA
Large shortspine thornyhead	–	–
Small rosethorn rockfish	+	+
Longnose skate	+	NS
Sandpaper skate	+	–

[a/]Species for which significant differences in catch weight between trawl types are shown (for at least one of the two studies).
[b/]Footrope was longer for the SFFT than for the control trawl; study was conducted on the continental shelf.
[c/]Footrope length was similar between the SFFT and the control trawl; study was conducted on the continental slope

<u>Size selectivity by SFFT relative to high-rise trawls</u>

Hannah et al. (2005) showed no meaningful differences in average size of flatfish caught between SFFTs and the hooded combination trawl. They did, however, demonstrate that average size of roundfish and rockfish was typically larger for the hooded combination trawl (15-foot vertical opening) than for the SFFT (4.5-foot vertical opening). Larger fish have better chances of escaping a low-rise, cut-back trawl because of superior swimming abilities (Wardle 1975; He 1993; Videler and He 2010).

4.3.3.1.1 No-action Alternative (Alternative D1)

Under the No-action Alternative (D1), the SFFT is defined as a two-seam trawl with a low, cut-back headrope (Section 2.4) that is required shoreward of the trawl RCA north of 40°10' N. latitude (Section 3.4.1.4). Alternative D1 affects only groundfish bottom trawl. Under Alternative D1, groundfish bottom trawl vessels would continue to comply with existing SFFT requirements and the regulations shown in Section 2.4.

The primary effect of fishing on the biological environment is fishing mortality. These effects are described in Section 3.2.1 and consist of impacts on target and non-target groundfish species that generally affect stock status.

Under the No-action Alternative (D1), the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3), at least in the short term (2-6 years). Landings and revenue may fluctuate over the long-term under the No-action Alternative, however, as ACLs and markets may fluctuate over the long-term. Changing ACLs, trawl allocations, and markets under the No-action Alternative may also lead to shifts in fishing behaviors, fishing strategies, trawling effort, or distribution in effort (see Section 3.4.2). For example, trawlers targeting shallow-water flatfish are no longer constrained by low canary rockfish IFQ, as they were prior to 2017.

Even though trawling effort, fishing strategies, and total fishing mortality may shift over time under the No-action Alternative, vessels would continue to comply with existing mitigation measures and incentives built into the catch share program (Section 4.1.4), as well as regulations carried over from the era prior to the catch share program (Section 1.3.2). These regulations, mitigation measures, and incentives were designed, in part, to prevent overfishing and excessive discarding. Under the No-action Alternative, pelagic and semi-pelagic groundfish (e.g., canary rockfish and spiny dogfish shark) may readily avoid capture in SFFTs by escaping over the headrope and wings. This, and other mitigation measures and incentives are expected to continue holding fishing mortality of target and non-target groundfish below or near ACLs and trawl allocations under the No-action Alternative. All trawl-dominant groundfish species that have been assessed are currently classified as healthy (biomass greater than MSY target) (Table 3-4), and would be expected to remain healthy under the No-action Alternative, even as ACLs and fishing mortality fluctuate. Finally, mitigation measures and incentives built into the catch share program discourages catch and discarding of undersized or unwanted groundfish, resulting in discard rates that are much lower than observed prior to the catch share program (Section 3.2.1.3) (NMFS and Council 2017). Therefore, continuation of fishing activity under the No-action Alternative (D1) is not expected to have additional adverse effects on target and non-target groundfish stocks beyond what has previously been analyzed.

4.3.3.1.2 Selective Flatfish Trawl (Alternative D2 - Two-seam or four-seam net)

Under Alternative D2, the SFFT definition would be modified to allow either a two-seam or a four-seam net with no more than four riblines (excluding the codend). The other gear and area restrictions shown for the No-action Alternative would be retained (Section 2.4).

Most diamond meshes in two-seam nets are typically closed while towing, except for immediately in front of the catch bulge (Stewart and Robertson 1985; Suuronen et al. 1997a). Most GAP and public comments (Appendix C) suggested that a four-seam net provides better flow than a two-seam net (e.g., due to more open meshes), which may enhance rigidity of flexible sorting grids, thereby improve species selectivity (Agenda Item G.8.b, Supplemental GAP Report, November 2011) and catch fish better (Agenda Item I.7.c, Supplemental Public Comment Power Point, April, 2011). It is also expected that escapement of small groundfish through meshes would increase in four-seam nets relative to two-seam nets because more open meshes may result in better flow and more space for escapement (e.g., Section 4.2.2.1). Finally, improved flow within nets has been shown to improve fishing efficiency (e.g., Madsen and Holst 2002), which may increase catch of marketable target and non-target groundfish (e.g., widow rockfish, yellowtail rockfish, and Pacific cod) and reduce bycatch of small or unmarketable groundfish (e.g., undersized redstripe rockfish, rosethorn rockfish, sanddabs).

Because the current SFFT definition (Section 2.4) allows four-seam codends (i.e., the net preceding the codend must be two-seam, but codends may be four-seam), the improvement to flow by switching to a complete four-seam net is somewhat uncertain. Flow through the net using four-seam trawls would likely improve, especially in those cases where most codend meshes become blocked with fish (catch and gilled fish), but the level of improvement is unknown.

Alternative D2 would likely improve species and size selectivity (for certain groundfish species) relative to the No-action Alternative (D1) shoreward of the RCA north of 40°10' N. latitude if flow and open meshes were increased, and if four-seam nets would improve the function of excluder devices. This impact on target and non-target groundfish stocks would be most pronounced north of 42° N. latitude during the summer period (Section 3.4.2.3); bottom trawling effort (absolute fishing effort and effort per mile of coastline) is greater north of 42° N. latitude than between 42° and 40°10' N. latitude.

Detectable improvement in species or size selectivity under Alternative D2 would require that most catch share participants who fish bottom trawl shoreward of the trawl RCA north of 40°10' N. latitude convert their two-seam SFFT to four-seam nets. However, it is uncertain whether fishermen would replace their SFFT gear with four-seam nets, especially considering the GAP's most recent position on this alternative (Agenda Item G.8.a, Supplemental GAP Report, March 2016) and the uncertainty regarding improvement to flow. Based on this information, implementation of Alternative D2 is expected to have no change in impact to low-positive change in impact on target and non-target groundfish compared to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude. No change in impact would be expected if flow were not improved using four-seam nets compared to two-seam SFFTs and/or fishermen would choose not to replace their trawls with a four-seam SFFT. Low-positive change in

impact compared to the No-action Alternative would be expected if fishermen would convert to four-seam SFFTs and flow were improved.

4.3.3.1.3 Selective Flatfish Trawl (Alternative D3 –eliminate SFFT requirements) (Council's FPA)

Under Alternative D3, the SFFT definition would be modified to allow a two-seam or a four-seam net with no more than four riblines, while retaining the other gear restrictions (Section 2.4). However, the area requirement north of 40°10′ N. latitude would be eliminated, with the exception of groundfish bottom trawling within the Klamath and Columbia River Conservation Zones where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a).

Both 2017 and 2018 trawl EFPs demonstrated that eliminating the SFFT requirements shoreward of the trawl RCA north of 40º10' N. latitude (Alternative D3) could result in increased fishing effort shoreward of the trawl RCA (Section 4.3.2.3) and increased landings of widow and yellowtail rockfish during winter months relative to the No-action Alternative (Section 4.3.1.1). Thus, Alternative D3 would likely result in higher attainment of the trawl allocations for pelagic rockfish such as widow and yellowtail rockfish (see Figure 3-12).

If bottom trawling effort were to increase shoreward of the RCA under Alternative D3 during winter months (i.e., before midwater trawling is permitted) (Section 4.3.1.2), then some decrease in fishing effort seaward of the trawl RCA could occur during the January through mid-May period. For example, some vessels may opt to target pelagic rockfish shoreward of the RCA instead of DTS species seaward of the RCA; the trip type might be considered a replacement trip rather than an additional trip. This may result in a decrease in fishing effort seaward of the RCA and subsequently decreased catch of DTS and other slope-groundfish relative to the No-action Alternative (D1). This decrease in effort seaward of the RCA (number of trips) would not likely reflect a one-to-one relationship with increased effort shoreward of the RCA (number of trips), because some vessels may fish multiple gears on a single trip if Alternative F3 were adopted (see Section 4.4). Results of the 2018 trawl EFP supports this conclusion. Some 2018 EFP participants fished seaward of the trawl RCA using bottom trawl and shoreward of the trawl RCA using midwater trawl during the same trip (Section 4.3.1.1) (Appendix D). In addition to the likelihood of increased catch of pelagic rockfishes shoreward of the trawl RCA, implementation of Alternative D3 could result in increased catch of other pelagic or semi-pelagic groundfish species (e.g., Pacific whiting, sablefish, and spiny dogfish shark) over the continental shelf (Section 4.3.1.1).

The management and monitoring structure of the catch share program (Section 3.3.6), which includes 100 percent monitoring and near real-time reporting of the landed and discarded catch (Section 3.3.6; Section 4.2.2.3), would likely ensure that groundfish catches would remain below trawl allocations (Table 3-16)

and ACLs (e.g., Section 3.2.1). If catches were to approach an ACL or trawl allocation, then various actions may be implemented to mitigate unexpected high catch rates (e.g., Section 4.1.4). In addition, incentives built into the catch share program have resulted in voluntary measures taken by the trawl fleet to avoid unnecessary bycatch (Section 4.1.3.2). Furthermore, increased efficiency (e.g., due to more open meshes due to use of four-seam trawl, improved flow, and improved function of selective devices) may lead to some reduction in bottom trawling effort, increased catch of larger marketable fish, and decreased catch of small unwanted species, which would mitigate for potential negative impacts of Alternative D3 (Section 3.4.2.1). Other mitigation measures are in place to ensure that groundfish catch would not exceed the trawl allocation or ACL (Section 4.1.4). As such, Alternative D3 would likely have no change in impact on target and non-target groundfish relative to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude.

4.3.3.1.4 Selective Flatfish Trawl (Alternative D3, NMFS Sub-option 1 – retain SFFT definition but eliminate SFFT requirement north of 42° N. latitude)

Alternative D3, NMFS Sub-option 1 is the same as Alternative D3, in that the SFFT would no longer be required shoreward of the trawl RCA north of 42° N. latitude (Section 2.4), with the exception of groundfish bottom trawling within the Columbia River Conservation Zone where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a). Under this Sub-option, the SFFT differs from Alternative D3 in that SFFT would remain a requirement for groundfish bottom trawls shoreward of the trawl RCA between 42° N. latitude and 40°10' N. latitude. The eliminated area requirement north of 42° N. latitude would be replaced with a small footrope requirement (e.g., equivalent to the requirement south of 40°10′ N. latitude).

Because Alternative D3, NMFS Sub-option 1 represents less of a change from No Action than the Council Preferred Alternative D3, and based on reasoning shown for the Council Preferred Alternative D3 in Section 4.3.3.1.3, Alternative D3, NMFS Sub-option 1 would likely have no change in impact on target and non-target groundfish relative to either the No-action Alternative (D1) or Alternative D3 north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude (Table 4-5).

4.3.3.2 Non-target Non-Groundfish Species (Protected, Prohibited, and other Non-target Species)

Non-target non-groundfish species are described in Section 3.2.2, Section 3.2.3, and Section 3.2.4. Species-specific analyses were performed only for Chinook salmon, green sturgeon, eulachon, and Pacific halibut in this section. For brevity, potential biological impacts of the action alternatives (D2 and D3) on most non-target non-groundfish species are described across species groups or functional groups based on swimming ability, size, and habitat (where the species lives; whether benthic or pelagic).

Swimming ability plays a vital role in terms of fish escaping from fishing gear (He 1973) (Appendix E). Videler and He (2010) described swimming-related adaptations and endurance as a function of size and species group. For example, pelagic species have a better swimming endurance than benthic species, and larger individuals within a species exhibit better swimming endurance than smaller individuals (He 1973; Videler and He 2010). In addition, fish behavior at the mouth of the trawl (Appendix E) varies among species and among functional groups. Rose (1996) described large (> 50 cm) Pacific halibut as strong swimmers that mostly swam 1 m above the seafloor during initial stages of capture by bottom trawl, but ascended more than 1 m off bottom just before drifting or swimming back into the trawl, whereas he described soles as weaker swimmers that swam close to the seabed during the herding process and either dive toward the seabed (i.e., under the footrope) or swim straight back into the net as the trawl overcame them.

Definitions of functional groups for this analysis are as follows:

- Benthic and weak swimming species: Animals that remain close to the seabed, and that exhibit poor swimming endurance and fatigue quickly (Videler and He 2010). Once overcome by the trawl, these species typically fall straight back into the trawl or attempt to escape through the bottom or sides of the net. These species have limited ability to swim upwards as the trawl overcomes them. Benthic or weak swimming non-groundfish would include invertebrates, non-FMP soles (deepsea sole, longfin sanddab, and slender sole), sculpins, snailfishes, rays, some skates (e.g., starry skate), poachers, eelpouts, grenadiers, combfishes, and spotted ratfish.
- Pelagic and strong swimming species: Animals that remain off the seabed, and in many cases, far above the seabed, and that exhibit exceptional swimming endurance (Videler and He 2010). Pelagic fishes that encounter a bottom trawl would likely swim upwards as the trawl approaches (or as they enter the trawl), similar to large semi-pelagic rockfishes described by Hannah et al. (2005). Examples of pelagic fishes include HMS species, CPS species, and forage fishes. Note that smaller fish of the same species would have less swimming endurance than larger fish (see above).

Many non-groundfish species described in Section 3.2 are rarely encountered by groundfish bottom trawl gear (e.g., HMS species), escape trawls through trawl meshes (e.g., Section 4.2.2.2.2.2), or may escape over the headrope or wings (e.g., HMS and CPS species) (Appendix E) (Hannah et al. 2005). Conversely, invertebrates and some groups of fish may be unable to avoid any type of bottom trawl and may be too large to escape codend or net meshes once inside the trawl. Many of these species or species groups will not be specifically analyzed further in this section, but will be addressed in general terms based on their functional group. Most conclusions drawn in Section 4.3.3.1 for groundfish species can be applied to non-

groundfish species. For example, results shown for benthic-oriented groundfish (e.g., flatfish) could be applied to benthic or weak-swimming, non-groundfish such as sculpins, snailfishes, and rays.

Of the protected species shown in Section 3.2.3, some analyses will be provided for eulachon, Chinook salmon, and green sturgeon. The action alternatives (Alternative D2, Alternative D3, and Alternative D3 NMFS Sub-option 1) are expected to cause no change in impact on the remaining protected species relative to the No-action Alternative (D1) (see Section 4.2.2.3).

Of the non-groundfish species that are prohibited and that are shown in Section 3.2, some analysis will be provided for Pacific halibut. Hannah et al. (2005) showed higher catch rates of Pacific halibut for high-rise trawls than for SFFT. Impacts on non-protected (but prohibited) salmon can be inferred from results shown for protected Chinook salmon (see previous paragraph). It is unlikely that the action alternatives (D2, D3, and D3 NMFS Sub-option 1) would result in a change in impact on Dungeness crab (or other invertebrates) compared to the No-action Alternative because their capture depends on footrope and sweep length (i.e., herding), rather than on headrope height.

4.3.3.2.1 No-action Alternative (Alternative D1)

Under the No-action Alternative (D1), the SFFT is defined as a two-seam trawl with a low, cut-back headrope (Section 2.4) that is required shoreward of the RCA north of 40°10' N. latitude (Section 3.4.1.4). Alternative D1 affects only groundfish bottom trawl. Under Alternative D1, groundfish bottom trawl vessels would continue to comply with existing SFFT requirements and regulations shown in Section 2.4.

The primary effect of fishing on the biological environment is fishing mortality. These effects are described in Section 3.2.2 (prohibited species), Section 3.2.3 (protected species), and Section 3.2.4 (other non-target non-groundfish species).

Under the No-action Alternative (D1), trawling effort and fishing strategies may fluctuate as ACLs and markets for groundfish fluctuates (See Section 4.2.2.2.1). For example, trawlers targeting shallow-water flatfish are no longer constrained by low canary rockfish IFQ, as they were prior to 2017. It is expected, therefore, that bycatch of non-groundfish may fluctuate as trawling effort and fishing strategies change under the No-action Alternative.

Even though trawling effort and fishing strategies may shift over time under the No-action Alternatives, vessels would continue to comply with existing mitigation measures and incentives built into the catch share program (Section 4.1.4), as well as regulations carried over from the era prior to the catch share program (Section 1.3.2), that were designed, in part, to prevent overfishing of groundfish and prevent excessive discarding. These constraints and mitigation measures designed for groundfish (Section 4.1.4)

may also continue to constrain catches of non-groundfish species. Under the No-action Alternative, strong swimming and pelagic species (e.g., salmon and Pacific halibut) may readily avoid capture in SFFTs by escaping over the headrope and wings. Some mitigation measures were built into the catch share program to restrain catch of non-groundfish below management thresholds (e.g., IBQ for Pacific halibut). The ITS Terms and Conditions in biological opinions (e.g., 2017 salmon biological opinion) and mitigation measures developed through the Council process (e.g., harvest specifications and management measures) would likely continue to restrain catch of prohibited species below ITS levels under the No-action Alternative, even as effort and fishing strategies change. Finally, the Council and NMFS can implement measures to reduce catch of non-groundfish species when there is a conservation concern. Therefore, continuation of fishing activity under the No-action Alternative (D1) is not expected to have additional adverse effects on non-target non groundfish stocks beyond what has previously been analyzed.

4.3.3.2.2 Selective Flatfish Trawl (Alternative D2 – Two-seam or four-seam net)

Under Alternative D2, the SFFT definition would be modified to allow either a two-seam or a four-seam net. The other gear and area restrictions would be retained for the No-action Alternative (D1) (Section 2.4).

Benefits of Alternative D2 to non-groundfish compared to the No-action Alternative may be similar to those shown for groundfish (see Section 4.3.3.1.2). They would include increased escapement of small animals through more open meshes (e.g., forage fish, shrimp, eulachon, and other small species) and increased escapement of Pacific halibut using halibut excluder devices (e.g., Agenda Item I.7.c, Supplemental Public Comment PowerPoint, April 2011).

Four-seam nets may provide better flow than two-seam nets due to more open meshes, which may provide for improved flow, increased rigidity of flexible sorting grids, and more open meshes compared to two-seam nets. Although flow inside of the net likely would increase using a four-seam net (Alternative D2) compared to a two-seam net (Alternative D1), the amount of increase is uncertain. In addition, it is uncertain whether many participants in the catch share program would replace their two-seam SFFTs with four-seam SFFTs. More detail regarding improved gear performance and improved fishing efficiency of four-seam trawls (Alternative D2) relative to two-seam trawls (Alternative D1) is described in Section 4.2.2.1 (considerations) and Section 4.3.3.1.2 (groundfish Alternative D2).

Based on reasons similar to those shown for groundfish (Section 4.3.3.1.2), implementation of Alternative D2 is would likely have no change in impact to low-positive change in impact on non-target non-groundfish species (including protected species) compared to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude. No change in impact would be expected if flow were not improved using four-seam SFFTs compared to two-seam SFFTs and/or if fishermen chose

not to replace their trawls with four-seam nets. Low-positive impacts would be expected if fishermen converted to four-seam SFFTs and flow improved.

4.3.3.2.3 Selective Flatfish Trawl (Alternative D3 – retain SFFT definition but eliminate SFFT requirements) (Council's FPA)

Under Alternative D3, the SFFT definition would be modified to allow a two-seam or a four-seam net, while retaining the other gear restrictions (Section 2.4). However, the area restrictions north of 40°10′ N. latitude would be eliminated, with the exception of groundfish bottom trawling within the Klamath and Columbia River Conservation Zones where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a). Groundfish trawl vessels would be allowed to use any small footrope trawl shoreward of the trawl RCA.

Benthic and weak swimming species

For benthic and weak swimming species (e.g., sculpins, invertebrates, etc.), there would likely be no difference in escapement over the headrope or wings (Figure 2-1) between SFFTs and hooded trawls with larger vertical openings that tend to the bottom. For example, escapement in this area of the trawl (see Section 4.2.2.1) would likely be no different between trawl types for species that might be easily herded between the wings and that would not swim up into the water column as the trawl approached and overtook them. Hannah et al. (2005) showed no difference in the catch of most benthic groundfish species (e.g., most flatfish and sandpaper skate) between an SFFT and a combination high-rise trawl, and Rose (1996) and Ryer (2008) showed that flatfish behavior at the mouth of the trawl is to remain near the seabed as being overcome by the trawl. The same result would be expected for most benthic non-groundfish species, such as sculpin, snailfish, rays, Dungeness crab, tanner crab, and other invertebrates. However, some small non-groundfish (e.g., sculpins and invertebrates) that enter the trawl would likely more readily escape trawl meshes from four-seam, high-rise trawl (Alternative D3) than from two-seam SFFT (Alternative D1) due to differences in open meshes and flow (see Section 4.3.3.2.2).

The previous paragraph assumes that, in the absence of SFFT requirements, fishermen would fish with a traditional four-seam, high-rise bottom trawl to target semi-pelagic rockfishes on the shelf. However, results of the 2017 trawl gear EFP demonstrated that most EFP participants modified midwater gear to become legal bottom trawl gear (Section 4.3.1.1). This type of gear modification, which would allow the gear to be fished off bottom, would result in lower impacts on benthic or weak swimming species relative to bottom-tending gear (NMFS 2017c). In addition, towing duration for midwater trawls or pelagic trawls (i.e., modified midwater trawl) is typically shorter than for bottom trawls (Somers et al.

2017b). Finally, midwater or bottom trawling while targeting schools of yellowtail rockfish or widow rockfish typically results in little bycatch (Tagart 1980; Somers et al. 2016; NMFS 2017b).

Given the considerations described above, Alternative D3 would likely result in no change in impact (if fishermen use high-rise bottom trawls that tend to the bottom) to low-positive change in impact (if fishermen use bottom trawls fished off bottom) on benthic, weak swimming non-groundfish species relative to the No-action Alternative (D1) north of 42º N. latitude and between 42º N. latitude and 40º10' N. latitude. If low-positive impacts were to occur, they would be most pronounced north of 42º N. latitude because most fishing effort shoreward of the RCA during the summer season occurs in the northern area (Section 3.4.2.3).

<u>Pelagic and strong swimming species (except Pacific halibut, salmon, eulachon, and green sturgeon)</u>

Although Hannah et al. (2005) and King et al. (2004) demonstrated pelagic or semi-pelagic groundfish may be caught more frequently by hooded trawls (low-rise and high-rise) than by SFFT, encounters with most pelagic non-groundfish species (e.g., HMS, CPS, and some forage fish species) would not likely increase measurably under Alternative D3 relative to the No-action Alternative (D1). These species are typically caught higher in the water column than the headrope of a high-rise bottom trawl or are typically caught farther offshore than the 100-fm isobath (see Section 3.2.4). Catch of pelagic non-groundfish species by bottom trawl (CPS and HMS species) under Alternative D3 would likely continue to be low. In addition, small pelagic non-groundfish species (e.g., forage fish) that enter the trawl likely would more readily escape trawl meshes from four-seam trawl (Alternative D3) than from two-seam SFFT (Alternative D1) due to differences in open meshes and flow, although the level of improved flow and escapement through open meshes is uncertain (see Section 4.3.3.2.2).

There were only a few years (2002 through 2004) where groundfish hauls using hooded trawls shoreward of the trawl RCA were observed. Therefore, there is some uncertainty regarding the impact on pelagic and strong swimming species under Alternative D3 compared to Alternative D1 for hooded bottom trawls that tend to the bottom. However, because most CPS and HMS species are caught in relatively low amounts in bottom and midwater trawl, and because of reasons stated in the previous paragraph, the expected change in impact of Alternative D3 compared to the No-action Alternative (D1) is expected to be negligible.

Results of the 2017 trawl gear EFP demonstrated that most EFP participants modified midwater trawl gear to become legal bottom trawl gear until use of midwater trawls became legal on May 15 (Section 4.3.1.1). This type of gear modification, which would allow the gear to be fished off bottom, is expected to have higher impacts on pelagic non-groundfish species than expected from bottom-tending gear, but these additional impacts are expected to be negligible (NMFS 2017c). For example, historical accounts of the

widow rockfish fishery in the 1980s indicate that widow rockfish schooling behavior resulted in tows that were highly selective (Tagart 1980). This information is supported by recent observer data from the WCGOP that showed midwater rockfish trips in 2015 landed few species other than their target species (Somers et al., 2016). In addition, this type of gear modification under Alternative D3 would likely occur during a limited period (i.e., January 1 to May 15) (Section 4.3.1.1) and in a limited area (i.e., shoreward of the RCA north of 40°10' N. latitude). Finally, towing duration for midwater trawls or pelagic trawls (i.e., modified midwater trawl) is typically shorter than for bottom trawls (Somers et al. 2017b).

Constraints and mitigation measures designed for groundfish would likely constrain catches of non-groundfish species; non-groundfish bycatch would continue to be mitigated as described in Section 4.1.4. In addition, incentives designed as part of the catch share program, combined with other incentives such as MSC certification, influence fishermen voluntarily to avoid bycatch of groundfish and non-groundfish species (Section 4.1.3, Section 4.2.2.1). Finally, the Council and NMFS can implement measures to reduce catch of non-groundfish species when there is a conservation concern.

Alternative D3 is expected to have no change in impact to low negative change in impact on pelagic, strong-swimming, non-groundfish species, such as HMS and CPS species, relative to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude. Although available information suggests no change in impacts compared to the No-action Alternative, there is some uncertainty associated with catch of some pelagic non-groundfish species due to limited observer coverage for hooded bottom trawls shoreward of the RCA. If low-negative impacts were to occur, they would be most pronounced north of 42° N. latitude because most fishing effort shoreward of the trawl RCA during the summer season occurs in the northern area (Section 3.4.2.3).

Pacific halibut

Under similar conditions (e.g., towing location, towing speed, and footrope length), Pacific halibut bycatch (Section 3.2.2.2) likely would be greater using a traditional high-rise trawl or low-rise hooded trawl (Table 3-19) than using a SFFT (Rose 1996; Hannah et al. 2005). However, Pacific halibut mortality in the groundfish trawl fishery is managed with IBQ. All vessels must have enough IBQ to cover their incidental catch of legal and sub-legal size Pacific halibut bycatch mortality north of 40°10′ N. latitude. This incentive, along with other incentives built into the catch share program (Section 4.1.3.2; Section 4.2.2.1), resulted in a substantial decrease in bycatch of Pacific halibut by bottom trawl during the catch share program relative to previous years. Pacific halibut mortality has remained more than 50 percent lower than the Pacific halibut IBQ since the inception of the program (see Figure 1 in Jannot et al., 2016a). Pacific halibut mortality likely would remain far below the trawl allocation under Alternative D3, similar to the No-action Alternative (D1). For example, even though more halibut may enter a traditional high-rise

bottom trawl than an SFFT (Rose 1996; Hannah et al. 20005), halibut excluder devices installed in four-seam trawls (e.g., under Alternative D3) may be more effective at promoting their escapement than excluder devices installed in two-seam trawls (e.g., Alternative D1) (Section 4.3.3.2.2) (Agenda Item I.7.c, Supplemental Public Comment PowerPoint, April 2011) (Appendix C). Use of halibut excluders might increase under Alternative D3 if the devices function best when installed in four-seam trawls.

Results of the 2017 trawl gear EFP demonstrated that most EFP participants modified midwater gear to become legal bottom trawl gear (Section 4.3.1.1). This type of gear modification would decrease Pacific halibut mortality when compared to bottom-tending gear, because the gear would be fished off-bottom. In addition, some fishermen may opt to use low-rise hooded trawls, such as an Eastern trawl (Table 3-19), which would tend to catch fewer halibut than a high-rise hooded trawl. Finally, others would opt for SFFT to reduce bycatch of other species, such as small sablefish or Pacific whiting (Section 4.3.1.1). Based on the information in the preceding paragraphs, Alternative D3 would likely result in no change in impact on Pacific halibut relative to the No-action Alternative (D1) north of 42° N. latitude and between 42° and 40°10' N. latitude.

Eulachon

Most commercial bottom trawl encounters with eulachon take place shoreward of the RCA and north of 42° N. latitude (Section 3.2.3.3). Under Alternative D3, therefore, more eulachon likely would be encountered by a high-rise bottom trawl than by a SFFT under the No-action Alternative (D1).

Eulachon entering the trawl likely would more readily escape trawl meshes from a four-seam SFFT (Alternative D3) than from a two-seam SFFT (Alternative D1) due to differences in open meshes and flow. The level of this improved escapement is uncertain, however, because the amount of improvement to flow in a four-seam net compared to a two-seam net is uncertain (see Section 4.3.3.2.2 for more detail). Although escapement may increase through more open meshes, the fate of eulachon escaping trawls is uncertain (Section 4.2.2.1).

Results of the 2017 trawl gear EFP demonstrated that most EFP participants modified midwater trawls to become legal bottom trawl gear (Appendix D). Although more eulachon may enter a modified midwater trawl relative to an SFFT, most eulachon likely would escape through meshes (Section 4.3.3.2.2). No eulachon were reported caught during the 2017 EFP (where modified midwater trawls were primarily used) (Section 4.3.1.1). As of August 13, 2018, 67 eulachon were caught by 2018 EFP participants using bottom trawl north of 42° N. latitude (Agenda Item I.8.a, Supplemental NMFS Report 1, September 2018). No eulachon have been caught by EFP participants using midwater trawl as of August 13, 2018.

Under Alternative D3, fishermen would likely use modified midwater trawls only during a limited period (i.e., January 1 to May 15), similar to what occurred during the 2017 trawl gear EFP. Towing duration for these pelagic trawls would likely be similar to towing duration described for midwater trawls by Somers et al. (2017b), which is typically shorter than towing duration for bottom trawls. The shorter towing duration could result in lower encounters with eulachon than might occur using a traditional high-rise or low-rise bottom-tending trawl when targeting flatfish or pelagic rockfish. For those fishermen opting to use low-rise hooded trawls to target flatfish, fewer eulachon would likely be encountered than for fishermen opting to use high-rise bottom trawls. The purpose of using low-rise bottom trawl (Table 3-19) may be to increase catch composition of rockfish while targeting flatfish (Appendix B). Finally, some fishermen likely would voluntarily continue using an SFFT while targeting flatfish to reduce bycatch of other species, such as small sablefish or Pacific whiting (Section 4.3.1.1); for those cases, no change in impact on eulachon would occur compared to the No-action Alternative.

Mortality of eulachon is would not likely increase measurably under Alternative D3 relative to the No-action Alternative (D1). However, an impact up to low-negative would be assumed because of the likelihood of some unaccounted mortality (i.e., escape mortality) (Section 4.2.2.1). This impact would not be significant, given the reduction in fishing effort (e.g., through consolidation, etc.) and other mitigation measures of the catch share program available for management (Section 4.1.4). In addition, the 2018 eulachon biological opinion (NMFS 2018a) concluded minimal detrimental impacts of the trawl fishery to sDPS eulachon, even after considering the potential of mortality for eulachon that may escape trawl meshes.

Given the considerations shown above, Alternative D3 would likely result in no change in impact to low-negative change in impact (due to uncertainty) for eulachon relative to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude. If low-negative impacts were to occur, they would be most pronounced north of 42° N. latitude because most fishing effort shoreward of the trawl RCA during the summer season occurs in the northern area (Section 3.4.2.3). In addition, eulachon density is highest north of 42° N. latitude (Section 3.2.3.3).

Green sturgeon

Because green sturgeon occur only in shallow oceanic waters, an increase in traditional bottom-trawling effort shoreward of the RCA (Section 4.3.1) would be expected to increase the bycatch of green sturgeon. In addition, green sturgeon are strong swimmers (Erickson and Hightower 2007) and can swim over the low-rise headrope or low wings of SFFTs, similar to other strong swimming roundfish described by Hannah et al. (2005) and Videler and He (2010). As such, bycatch of green sturgeon by traditional high-rise

or hooded bottom trawls would likely be greater than bycatch of green sturgeon using SFFT, given all else being equal (towing location, towing speed, footrope length, etc.).

According to the biological opinion (NMFS 2012), NMFS expects take to remain below 28 southern DPS green sturgeon per year and not to exceed 86 southern DPS green sturgeon per year in no more than two years within nine consecutive years. Southern DPS green sturgeon bycatch ranged from 0 to 21 fish per year from 2002 through 2015 (Section 3.2.3.2). Zero to 13 southern DPS green sturgeon were taken annually by bottom trawl from 2002 through 2004, a period when bottom trawling effort was more than 2 times higher than current fishing effort (Section 3.4.2.1) and prior to development and use of SFFT (i.e., hooded low-rise and hooded high-rise bottom trawls were used shoreward of the RCA prior to 2005).

Most bottom trawling effort shoreward of the trawl RCA takes place north of 42° N. latitude (Section 3.4.2.3). Lee et al. (2017) showed that approximately half of the green sturgeon caught north of 42° N. latitude are southern DPS green sturgeon, and the other half represent northern DPS green sturgeon (not threatened under ESA). On the other hand, almost all green sturgeon caught off California may represent southern DPS green sturgeon (Lee et al. 2017).

Green sturgeon aggregate at specific sites in nearshore-oceanic waters (Section 3.2.3.2) (Erickson and Hightower 2007; Lindley et al. 2008; Payne et al. 2015). When green sturgeon are encountered by bottom trawl, they are typically caught in low numbers (e.g., one to three fish in a haul) (NMFS 2017c). Although some green sturgeon are likely caught while migrating within their migratory corridor (from close to shore to bottom depths of 60 fm) (Erickson et al. 2008; Payne et al. 2015), most bycatch would likely occur at their aggregation sites (e.g., Payne et al. 2015), unless those locations were voluntarily avoided by trawl fishermen. Under the catch share program, incentives are strong to avoid such bycatch (e.g., Section 4.1.3.2; Section 4.2.2.1; Section 4.3.1).

NMFS will continue to monitor green sturgeon bycatch rates inseason, track bycatch levels, and make the information available to fishery participants inseason (NMFS 2017c) (Section 3.2.3.2). Given that green sturgeon may concentrate in predictable areas, three or fewer green sturgeon are typically caught in a bottom trawl haul, when encountered, and green sturgeon bycatch is monitored and reported in season, NMFS, the Council, and the industry would likely have ample notice to respond to bycatch events and maintain bycatch below levels shown in the 2012 biological opinion (NMFS 2012).

Because fishermen could modify their bottom trawl gear to fish off-bottom under this action alternative (e.g., prior to May 15) (Section 4.3.1.1), impacts on green sturgeon could be lower than described in the paragraph above because the pelagic bottom trawl gear would be fished well above the typical swimming height of green sturgeon. For those fishermen opting to use low-rise hooded trawls, fewer green sturgeon

would likely be encountered than for fishermen opting to use high-rise bottom trawls; the purpose of using low-rise hooded bottom trawl may be to increase catch composition of rockfish while targeting flatfish (Appendix B). Finally, some individuals targeting shallow-water flatfish did not fish under the EFP with hooded trawls; instead, they voluntarily chose to continue using the SFFT shoreward of the RCA to avoid bycatch of whiting and a large year class of undersized sablefish (P. Kujala, pers. comm., F/V *Cape Windy*). Under Alternative D3, some fishermen would continue using SFFT to target shallow-water flatfish, even if not required to do so. No green sturgeon were encountered during the 2017 trawl gear EFP using bottom trawl (Section 4.3.1.1), and none have been encountered during the 2018 trawl gear EFP through August 13, 2018, by bottom trawl or midwater trawl (Agenda Item I.8.a, Supplemental NMFS Report 1, September 2018).

Based on the information in the preceding paragraphs, Alternative D3 is expected to have no change in impact (if "bottom trawls" are fished off bottom or SFFTs are used shoreward of the trawl RCA) to low-negative impact (if fishermen use low-rise or high-rise hooded bottom trawls shoreward of the trawl RCA) for sDPS green sturgeon relative to the No-action Alternative (D1) north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude. Mortality of southern DPS green sturgeon would not likely reach or exceed ITS levels under Alternative D3.

Chinook salmon

Chinook salmon are strong swimmers and capable of swimming over the low headrope or low wings of SFFTs, similar to other strong swimming roundfish described by Hannah et al. (2005) and Videler and He (2010). As such, bycatch of Chinook salmon by traditional high-rise or combination bottom trawls (Table 3-19) would likely be greater than bycatch of Chinook salmon using SFFT, given all else being equal. In addition, more larger and older Chinook salmon may be caught using hooded or high-rise trawls than when using SFFTs (Figure 3-4).

One conclusion stated in a recent NMFS Report (Agenda Item F.3.a, Supplemental NMFS Report, April 2017) was "Chinook bycatch would likely dramatically increase if the current requirement to use SFFT gear shoreward of the RCA in the area north of 40°10' N. latitude were lifted." The report also related that "...gear type itself is apparently driving the majority of difference in bycatch rate… ." These statements were based on a comparison of average bycatch rates (number of Chinook salmon/mt of landed groundfish) from 2002 to 2004 (prior to SFFT requirements) to average bycatch rates from 2005 to 2014 (years with SFFT requirements) (see Table 4 in Agenda Item F.3.a, Supplemental NMFS Report, April 2017). The report acknowledged numerous caveats that have to be considered when comparing data between eras. It acknowledged that era and gear type are not entirely separable, since bycatch rates in the area north of

40°10' N. latitude and shallower than 100 fm without the SFFT requirement could only be estimated from a separate (but adjacent) era of three years, from 2002 to 2004.

Although it is likely that Chinook salmon bycatch rates would be higher when using high-rise hooded trawls than when using SFFTs shoreward of the trawl RCA, given equal conditions (e.g., similar fishing locations, years, seasons, and incentives), it is unlikely that bycatch rates using hooded bottom trawls would increase on a scale of 64 times as shown in Table 4 of the report (Agenda Item F.3.a, Supplemental NMFS Report, April 2017), for several reasons. Chinook salmon bycatch varies considerably among years, which makes comparisons of average bycatch rates between eras difficult to interpret.

Matson and Erickson (2017) demonstrated high inter-annual variation in Chinook salmon bycatch for bottom trawl during the catch share program. Annual Chinook salmon bycatch by trawl during the catch share program (coastwide; all bottom trawl gear types) ranged from 175 fish (2011) to 996 fish (2015) (Table 3-9). Chinook salmon bycatch also varied substantially between 2003 (16,433 Chinook) and 2004 (1,758 Chinook) (Table 3-9) during a period when gear types were similar (i.e., only hooded bottom trawls were used). Hence, interannual variation in Chinook salmon bycatch is large within each of the two eras, and it should be considered when comparing average bycatch rates between eras.

Although we found that Chinook salmon bycatch rates (using trawling effort [tows] in the denominator) generally were higher from 2002 to 2004 than from 2005 to 2014, differences in Chinook salmon bycatch rates between eras cannot be attributed solely to the use of hooded trawls prior to 2005 versus use of SFFTs beginning in 2005. Chinook salmon bycatch rates shoreward of the trawl RCA and north of 40°10' N. latitude were extremely high during 2003 (2.2 salmon per tow), but they were low during 2004 (0.09 salmon per tow) (Source: WCGOP observer data); only hooded bottom trawls were used during both years (Table 3-19). Finally, Chinook salmon bycatch rates shoreward of the trawl RCA and north of 40°10' N. latitude during 2014 and 2015 using SFFT (0.09 and 0.07 Chinook per tow), were similar to bycatch rates shown in 2004 (0.09 Chinook per tow), when hooded trawls were used. As such, although gear type is expected to influence bycatch of pelagic species such as salmon (e.g., Hannah et al. 2005), gear type may not be driving most differences in bycatch rates between eras; other factors may have also contributed to the differences shown in the NMFS Report.

The 2017 salmon biological opinion (NMFS 2017a) expects Chinook salmon bycatch by non-whiting groundfish fisheries to remain below 5,500 individuals annually, though high bycatch levels might occasionally result in the fishery exceeding this guideline and accessing the Reserve described as part of the proposed action. Based on results of a simulation analysis, NMFS (2017a) demonstrated it is possible (but unlikely) that the non-whiting groundfish fishery may periodically have to use the Reserve. Total

Chinook salmon bycatch in the bottom trawl and non-whiting midwater trawl fishery ranged from 175 fish to 1,645 fish annually from 2011 to 2016 (Table 3-9). Chinook salmon bycatch by only bottom trawl during 2011 to 2016 ranged from 175 Chinook salmon to 996 Chinook salmon.

Most bottom trawl encounters with Chinook salmon occur seaward of the trawl RCA during the winter season (November to April) and shoreward of the RCA during the summer season (May to October) (Section 3.2.3.1). April appears to be a transition month between deep and shallow encounters (Figure 3-2). The largest and deepest catches of Chinook salmon by the bottom trawl fishery typically occur during winter (Figure 3-2; Figure 3-3).

Alternative D3 directly impacts the area shoreward of the RCA north of 40°10' N. latitude. The 2017 trawl gear EFP (Section 4.3.1.1) demonstrated that most EFP participation occurred prior to the whiting season (January 1 to May 15). Once the whiting season began, and midwater rockfish trawling was allowed, most participants opted out of the EFP and targeted widow and yellowtail rockfish using midwater trawl on the shelf. A similar trend is expected under Alternative D3. Because salmon encounters and catches are highest seaward of the trawl RCA during January, February, and March (Figure 3-2; Figure 3-3), Alternative D3 may have less of an impact on Chinook salmon bycatch during those months than one would expect. This shift in location of fishing effort to shallower waters to target pelagic rockfish may reduce salmon bycatch seaward of the trawl RCA. Chinook salmon bycatch shoreward of the trawl RCA would increase at the same time, but at a lower bycatch rate than in deeper waters during January to March. Bycatch and bycatch rates may be higher shoreward of the trawl RCA during April and May than in deeper waters (Figure 3-2; Figure 3-3). During this period, a shift in effort from deeper waters to shallower waters under Alternative D3 would be expected to increase bycatch of Chinook salmon.

Because fishermen would likely use modified midwater trawl gear (i.e., defined bottom trawl gear) while fishing prior to May 15 (Section 4.3.1.1) impacts on Chinook salmon could be greater than described above for high-rise bottom trawls that tend to fish on the bottom. Matson and Erickson (2017) demonstrated that Chinook salmon ECEs and overall bycatch rate may be higher for non-whiting midwater trawl than for traditional bottom trawl. Only five Chinook salmon were caught shoreward of the trawl RCA during the 2017 trawl gear EFP by participants using bottom trawl fished off-bottom (Section 4.3.1.1). Similar results have been reported for the 2018 trawl gear EFP; As of August 13, 2018, only one Chinook salmon has been caught by EFP participants using bottom trawl shoreward of the trawl RCA, and four Chinook salmon have been caught by 2018 EFP participants using midwater trawl (Agenda Item I.8.a, Supplemental NMFS Report 1, September 2018).

For those fishermen opting to use low-rise hooded groundfish trawls shoreward of the trawl RCA, fewer Chinook salmon would likely be encountered than for fishermen opting to use high-rise bottom trawls. The purpose of using low-rise bottom trawl may be to increase catch composition of rockfish while targeting flatfish (Appendix B). Some individuals who planned to target shallow-water flatfish with low-rise hooded trawls (Table 3-19) during the 2017 and 2018 trawl gear EFPs decided not to participate in the EFPs and continued using the SFFT shoreward of the RCA (Section 4.3.1.1). This non-mandatory use of SFFT to avoid bycatch when targeting shallow-water flatfish was also suggested by NMFS (Agenda Item F.3.a, Supplemental NMFS Report, April 2017) and in the 2017 salmon biological opinion (NMFS 2017a).

Authors of the 2017 salmon biological opinion (NMFS 2017a) reasoned that incentives and improved efficiencies associated with the catch share program, along with real-time, 100 percent monitoring and near-real-time data reporting, would mean that IFQ fishermen would selectively choose where, when, and how to fish to increase catch of target species yet minimize bycatch. These tools were not available to managers or fishermen in the 1980s and 1990s, when Chinook salmon bycatch was typically high. Incentives and fishermen's responses to those incentives were discussed in detail in Section 4.1.3, Section 4.1.3.2, and Section 4.3.1). Also, the catch share program and the vessel buyback program have resulted in significant fleet consolidation. These programs, combined with improved efficiencies, have increased catch per unit of effort of groundfish species (Figure 3-8; Figure 3-9) resulting in fewer trips and tows that may encounter salmon.

If a conservation concern arises, then various management actions may be implemented inseason or automatically to mitigate potential negative impacts of Alternative D3 (Section 4.1.4). This type of response is possible because of provisions of the catch share program (i.e., 100 percent monitoring and rapid catch reporting). For example, until alternative measures are implemented, the trawl RCA may be modified inseason to mitigate salmon bycatch if needed (Agenda Item F.3.b, Supplemental GMT Report 1, April 2018). Furthermore, the Council plans to consider additional bottom trawl mitigation measures for salmon (e.g., automatic authorities) at the November 2018 Council meeting. Finally, NMFS can close down the whiting or non-whiting trawl fisheries at any time if a conservation concern is perceived (e.g., if take exceeds bycatch thresholds described in the 2017 salmon biological opinion; NMFS 2017a).

Potential impacts and management responses described above apply to the area north of 42º N. latitude and the area between 40º10' and 42º N. latitude. However, the 2017 salmon biological opinion (page 2-123 in NMFS 2017a) showed "Significant uncertainty exists in the magnitude of ESU-specific impacts for fisheries in locations or time periods outside the available data. Areas south of 42° N. latitude and during the January-to-May period have particularly limited information." Estimates of ESU-specific impacts are largely derived from genetic samples of salmon caught by Pacific whiting fisheries, which historically have

fished only off Washington and Oregon and during May through December. As such, impacts on specific salmon ESUs are uncertain coastwide and most uncertain between 40°10' and 42° N. latitude.

In addition to the high uncertainty of ESU-specific impacts south of 42° N. latitude, uncertainty in catch and catch rates of salmon may be higher for bottom trawl shoreward of the trawl RCA between 42° N. latitude and 40°10' N. latitude than north of 42° N. latitude. Groundfish bottom trawling effort shoreward of the trawl RCA has been low in this southern area compared to effort north of 42° N. latitude (Figure 3-11), yet Chinook salmon ECEs have been shown to occur shoreward of the trawl RCA south of 42° N. latitude (Figure 3-3). In addition, the 2017 and 2018 trawl gear EFPs exempted SFFT requirements for harvesters fishing with bottom trawl shoreward of the trawl RCA north of 42° N. latitude (Section 4.3.1.1), but not for bottom-trawlers between 42° N. latitude and 40°10' N. latitude. Until more catch information is obtained in this southern area (e.g., through EFPs), the uncertainty of salmon catch and ESU-specific impacts of Alternative D3 shoreward of the trawl RCA between 42° N. latitude and 40°10' N. latitude will likely remain higher than the uncertainty of impacts shoreward of the trawl RCA north of 42° N. latitude.

Given the considerations shown above, including the level of uncertainty of ESU-level impacts and salmon catch rates using non-SFFT gear (especially south of 42° N. latitude), Alternative D3 is expected to a have low-negative change in impact on ESA-listed Chinook salmon north of 42° N. latitude and a medium-negative change in impact on ESA-listed salmon between 40°10' N. latitude and 42° N. latitude relative to the No-action Alternative (D1). Thus, even though Chinook salmon bycatch is not expected to reach or exceed thresholds shown in the 2017 salmon biological opinion (NMFS 2017c) under Alternative D3, the overall change in impact of Alternative D3 to ESA-listed salmon, compared to No Action (D1), is expected to be medium-negative due to the uncertainty of ESA-specific impacts and due to the uncertainty in salmon catch rates using non-SFFT gear shoreside of the trawl RCA between 42° N. latitude and 40°10' N. latitude.

4.3.3.2.4 Selective Flatfish Trawl (Alternative D3, NMFS Sub-option 1 – retain SFFT definition but eliminate SFFT requirement north of 42° N. latitude)

Alternative D3, NMFS Sub-option 1 is the same as Alternative D3, in that the SFFT would no longer be required shoreward of the trawl RCA north of 42° N. latitude (Section 2.4), with the exception of groundfish bottom trawling within the Columbia River Conservation Zone where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a). Under this Sub-option, the SFFT differs from Alternative D3 in that SFFT would remain a requirement for groundfish bottom trawls shoreward of the trawl RCA between 42° N. latitude and 40°10’ N. latitude. The eliminated

area requirement north of 42° N. latitude would be replaced with a small footrope requirement (e.g., equivalent to the requirement south of 40°10′ N. latitude).

Because Alternative D3, NMFS Sub-option 1 requires the use of SFFT shoreward of the trawl RCA between 42° N. latitude and 40°10' N. latitude, the impacts to all non-groundfish would be the same as the No-Action Alternative (D1) between 42° N. latitude and 40°10' N. latitude, and the same as the Council Preferred Alternative (D3) north of 42° N. latitude. In addition, with the exception of ESU-listed salmon, the overall (coastwide) impacts of Alternative D3 NMFS Sub-option 1 to non-groundfish are expected to be similar to the impacts shown for Alternative D3 (Section 4.3.3.2.3) because most bottom trawling effort shoreward of the trawl RCA occurs north of 42° N. latitude (Figure 3-11). A summary of expected change in impacts of Alternative D3, NMFS Sub-option 1 compared to No Action (D1) for non-groundfish species north of 42° N. latitude follows.

- <u>Benthic, weak swimming species</u>: Alternative D3, NMFS Sub-option 1 is expected to have no change in impact (if fishermen use high-rise bottom trawls that tend to the bottom) to low-positive change in impact (if fishermen use bottom trawls fished off bottom) north of 42° N. latitude.
- <u>Pelagic, strong-swimming species</u>: Alternative D3, NMFS Sub-option 1 is expected to have no change in impact to low negative change in impact on pelagic, strong-swimming, non-groundfish species, such as HMS and CPS species, relative to the No-action Alternative (D1) north of 42° N. latitude. Although available information suggests no change in impact compared to the No-action Alternative, there is some uncertainty associated with catch of some pelagic non-groundfish species due to limited observer coverage for hooded bottom trawls shoreward of the RCA.
- <u>Pacific halibut</u>: Alternative D3, NMFS Sub-option 1 is expected to have no change in impact on Pacific halibut relative to the No-action Alternative (D1) north of 42° N. latitude.
- <u>Eulachon</u>: Alternative D3, NMFS Sub-option 1 is expected to have no change in impact to low-negative change in impact (due to uncertainty) for eulachon relative to the No-action Alternative (D1) north of 42° N. latitude.
- <u>Green sturgeon</u>: Alternative D3, NMFS Sub-option 1 is expected to have no change in impact (if "bottom trawls" are fished off bottom or SFFTs are used shoreward of the trawl RCA) to low-negative change in impact (if fishermen use low-rise or high-rise hooded bottom trawls shoreward of the trawl RCA) for green sturgeon relative to the No-action Alternative (D1) north of 42° N. latitude.
- <u>ESA-listed salmon</u>: Alternative D3, NMFS Sub-option 1 is expected to a have low-negative impact on ESA-listed salmon relative to the No-action Alternative (D1) north of 42° N. latitude.

4.3.4 Socioeconomic Environment

This section evaluates the socioeconomic impacts of Issue D (selective flatfish trawl) (Section 2.4). This action alternative is intended to provide more flexibility in the configuration and use of gear for participants in the catch share program, which would foster innovation and allow for more optimal harvest operation (i.e., reduce costs and increase revenues) and indirectly benefit first receivers/processors. Impacts of the alternatives on the socioeconomic environment are described for harvesters, first receivers/processors, and communities. Even though relaxing SFFT restrictions may provide some positive benefit for enforcement (e.g., less workload if the SFFT requirement is eliminated), impacts on management are not elaborated herein.

Impacts of the No-action Alternative (D1) are described in Section 4.3.4.1. Impacts of Alternative D2 (Section 4.3.4.2), Alternative D3 (Section 4.3.4.3), and Alternative D3 NMFS Sub-option 1 (Section 4.3.4.4) are compared directly to those of the No-action Alternative.

4.3.4.1 No-action Alternative (Alternative D1)

The action alternatives shown for Issue D (selective flatfish trawl) (Section 2.4), would not be implemented under the No-action Alternative (D1). Vessels would continue to comply with the existing requirements and regulations shown in Section 2.4.

Under the No-action Alternative, the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3). Notable increases of ACLs in 2017 relative to 2016 are shown in Table 3-2 and Table 3-3 for previously constraining species such as canary rockfish (1,271 percent), widow rockfish (575 percent), bocaccio (118 percent), darkblotched rockfish (85 percent), and POP (71 percent), as well as increases for target species such as petrale sole (43 percent). The rebuilding of recently overfished species would likely drive increased catch and revenue in the coming years under the No-action Alternative. This trend was observable in 2017: for the non-whiting, trawl gear component of the fishery in 2017, inflation adjusted, non-EFP revenue increased 22 percent over the 2011 to 2016 average, and non-EFP landings increased by 68 percent. Landings and revenue are expected to continue to increase under the No-action Alternative, at least in the short-term (2 to 6 years), with increased ACLs and trawl allocations to the extent that processors can access markets generally lost to foreign imports during the rebuilding period. Landings and revenue may fluctuate over the long-term under the No-action Alternative, however, as ACLs and markets may fluctuate over the long-term.

Fishing behaviors and strategies are expected to shift as ACLS and markets change. Over the short-term, fishing behaviors and strategies would likely shift to reflect increasing ACLs and quota for previously constraining overfished species. Correspondingly, under the No-action Alternative, revenue and benefits to

harvesters, first receivers/processors, and communities would likely rise in proportion to increases in ACLs and trawl allocations.

While these benefits to the socioeconomic environment would be expected under the No-action Alternative, the operational flexibility of harvesters would continue to be restricted compared to the action alternatives. Under the No-action Alternative (D1), vessels would continue to comply with existing gear requirements. These regulations, developed to limit catch of restricted species during rebuilding, may artificially suppress catch below the levels supportable by markets when catch limits are set equal to optimum yield. To the extent that markets can be developed for new or returning products, increasing availability of harvest opportunity may raise the indirect cost of not being able to access higher trawl allocations under the No-action Alternative relative to the action alternatives due to the No-action Alternative gear restrictions.

4.3.4.2 Selective Flatfish Trawl (Alternative D2 - Two-seam or four-seam net)

Under Alternative D2, the SFFT definition would be modified to allow either a two-seam or a four-seam net with no more than four riblines (excluding the codend), while retaining the other gear and area restrictions shown for the No-action Alternative (Section 2.4). The original purpose of this alternative was to allow more flexibility for installation of a flexible grate (e.g., halibut excluder devices) (Agenda Item I.5.a, Attachment 4 – Gear Workshop Report, November 2012). It was suggested at previous Council meetings that a four-seam net would provide better flow than a two-seam net (e.g., due to more open meshes), which may (a) enhance rigidity of flexible sorting grids, thereby improving species selectivity (i.e., reduce bycatch) for species such as Pacific halibut, (b) catch target fish better, and (c) improve escapement of small groundfish (Section 4.2.2.1; Section 4.3.3.1.2). Improved flow within nets may increase fishing efficiency and catch of marketable target and non-target groundfish (e.g., widow rockfish, yellowtail rockfish, and Pacific cod), while reducing bycatch of small or unmarketable groundfish (e.g., undersized redstripe rockfish, rosethorn rockfish, and sanddabs) (Section 4.3.3.1.2).

Because the SFFT definition allows four-seam codends under the No-action Alternative (i.e., the net preceding the codend must be two-seam, but codends may be four-seam), the improvement to flow by switching to a complete four-seam net is somewhat uncertain. Flow would likely improve, but the level of improvement is unknown (Section 4.3.3.1.2).

Impact on Harvesters

It is uncertain whether harvesters targeting flatfish shoreward of the trawl RCA north of 40°10' N. latitude would convert their two-seam SFFT to a four-seam net, especially considering the GAP's most recent position on this alternative (Agenda Item G.8.a, Supplemental GAP Report, March 2016). Based on this

information, implementation of Alternative D2 is expected to result in no change in impact to low-positive change in impact on harvesters using bottom trawl north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude compared to the No-action Alternative (D1). No change in impact would be expected if use of four-seam SFFTs would result in little to no improvement for fishing efficiency and fishermen would not convert to four-seam SFFTs. On the other hand, if fishing efficiency would improve using a four-seam SFFT, then the impact on harvesters targeting flatfish shoreward of the RCA north of 40°10' N. latitude would be expected to be low-positive compared to the No-action Alternative.

Impact on First Receivers/Processors

Because Alternative D2 would provide harvesters with the flexibility to use four-seam SFFTs while targeting flatfish shoreward of the trawl RCA north of 40°10' N. latitude, processors might realize improved quality and quantity of fish deliveries (see Impacts on Harvesters, above). However, because of the uncertainty over whether efficiency would improve using four-seam SFFTs compared to two-seam SFFTs (Agenda Item G.8.a, Supplemental GAP Report, March 2016), Alternative D2 would likely result in no change in impact (if fishermen do not convert to four-seam SFFTs) to low-positive (if flow improves using a four-seam SFFT and fishermen use four-seam trawls) impact on first receivers/processors north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude compared to the No-action Alternative (D1).

Impact on Communities

Any potential impact of Alternative A2 would affect communities hosting first receivers/processors and homeports highly engaged in groundfish bottom trawling (Section 3.3.5). These potential impacts would likely be most pronounced during the summer flatfish fishery north of 42° N. latitude (Section 3.4.2.3). Although allowing harvesters the flexibility to use four-seam SFFTs while targeting flatfish shoreward of the RCA north of 40°10' N. latitude may result in low-positive impacts for some harvesters and first receivers/processors, the potential impact at the community level may not be measurable. As such, Alternative D2 is expected to have no change in impact on communities north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude compared to the No-action Alternative (D1).

4.3.4.3 Selective Flatfish Trawl (Alternative D3 – retain SFFT definition but eliminate SFFT requirements) (Council's FPA)

Under Alternative D3, the SFFT definition would be modified to allow a two-seam or a four-seam net with no more than four riblines (excluding the codend), while retaining the other gear restrictions (Section 2.4). However, the area restrictions north of 40°10′ N. latitude would be eliminated; the SFFT would no longer be required shoreward of the RCA north of 40°10′ N. latitude. This area restriction would be replaced with a small footrope requirement equivalent to the requirement south of 40°10′ N. latitude. Alternative D3

would allow fishermen to configure their gear in a way that is most efficient to catch their target species (e.g., widow rockfish, yellowtail rockfish, or benthic shelf species) and to avoid unwanted and unmarketable species (e.g., Pacific halibut) (Agenda Item G.8.a, Supplemental GAP Report, March 2016). This action would likely improve species and size selectivity for certain groundfish species relative to the No-action Alternative (D1) shoreward of the RCA north of 40º10' N. latitude.

Impact on Harvesters

Continuing to restrict non-SFFT gear in areas shoreward of trawl RCAs north of 40°10′ N. latitude since rockfish stocks have been rebuilt would physically prevent fishermen from accessing healthy pelagic rockfish stocks. While the regulations were meant to allow stock rebuilding for previously overfished rockfish (e.g., canary rockfish), the rockfish stocks in the area have since been rebuilt (Section 3.2.1), but access to catch in this area has remained limited. By allowing vessels to fish with non-SFFT gear in areas shoreward of RCAs north of 40°10′ N. latitude, attainment of trawl allocations of pelagic rockfishes and other groundfish would likely improve.

Under Alternative D3, groundfish bottom trawl harvesters could choose whether to use various types of small footrope trawls shoreward of the RCA north of 40º10' N. latitude. These trawls may range from an SFFT with a low cut-back headrope to a high-rise trawls with hooded headropes (Table 3-19). This flexibility may result in improved CPUE for pelagic or semi-pelagic species, allow for improved use and function of excluder devices or other selective devices (e.g., halibut excluder devices), and may provide improved escapement for small fish, all of which may improve trawling efficiency (See Section 4.3.3.1).

Public comment at the November 2011 Council meeting indicated that fishermen “are not catching all of the fish that are allocated. [NMFS] can either reduce cost or promote efficiency to catch more fish.” (Rod Moore, West Coast Seafood Processors Association) (Appendix C). The five-year review of the trawl catch share program (NMFS and Council 2017) and information provided herein support this statement. Examples are as follows:

- Attainment of the trawl allocation for pelagic or semi-pelagic rockfishes (e.g., widow rockfish and yellowtail rockfish) has averaged less than 50 percent from 2011 to 2017 (Table 3-17), and the average attainment for other species targeted shoreward of the RCA, with the exception of petrale sole (e.g., including lingcod, Pacific cod, Dover sole, English sole, starry flounder, and other flatfish) ranged from 1.3 percent to 25.5 percent (Table 3-17).
- Ex-vessel prices for groundfish have increased at a slow rate since 1995. In particular, ex-vessel prices have increased less than 36 percent since 1995 for most species that are typically caught by

LE trawl shoreward of the RCA (Figure 4-5). There are a few exceptions: some species (e.g., English sole) have experienced decreased ex-vessel prices and some species (e.g., lingcod) have experienced dramatic increases in ex-vessel prices over the 20-year period.

- Meanwhile, expenses for harvesters have increased more quickly than have ex-vessel prices. Catch share participants have had new expenses since the start of the catch share program (e.g., expense of 100 percent observer coverage and collection of cost recovery fees) (NMFS and Council 2017) Other costs have also increased, such as a 144 percent increase in the United States retail price for No. 2 diesel over the 20-year period (Source: https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_a.htm).

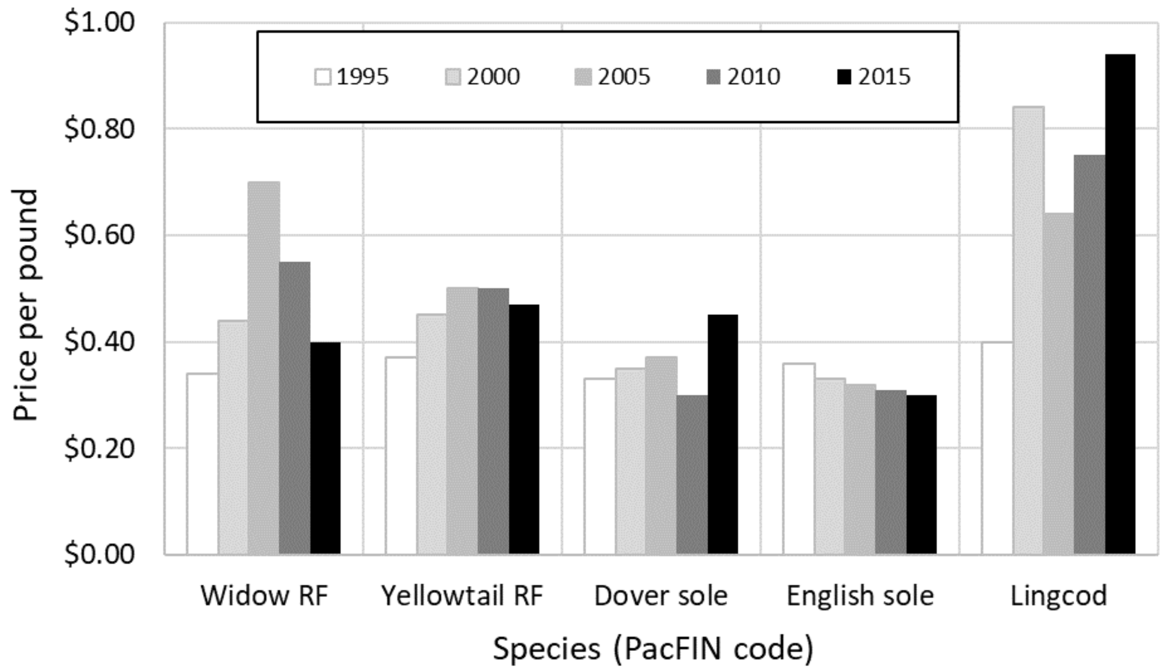

Figure 4-5. Ex-vessel price (average price per pound) paid to LE trawl vessels during 1995, 2000, 2005, 2010, and 2015 for species that are frequently encountered shoreward of the RCA and north of 40°10' latitude. Only Dahl Sector Code “4” is included (= shoreside non-whiting trawl sector). Prices were obtained for PacFIN species codes WDOW (widow rockfish), YTRK (yellowtail rockfish), DOVR (Dover sole), EGLS (English sole), and LCOD (lingcod).

Under Alternative D3, in combination with increasing trawl allocations (Table 3-16) for pelagic and semi-pelagic rockfish species (e.g., widow rockfish and canary rockfish), harvesters would likely target pelagic and semi-pelagic rockfishes using hooded bottom trawls shoreward of the RCA. Hannah et al. (2005), King et al. (2004), and Parker et al. (2004) showed that catch rates of pelagic or semi-pelagic fishes could be

substantially higher using hooded trawls (Table 3-19) than when using SFFTs. This was demonstrated during 2017, when bottom trawl landings of widow and yellowtail rockfish increased substantially (Section 3.4.2.3) during the prosecution of a trawl gear EFP that exempted bottom trawl harvesters from SFFT requirements shoreward of the RCA north of 42º N. latitude (Section 4.3.3.1.3; Appendix D). Under Alternative D3, some harvesters targeting shelf flatfish (instead of pelagic rockfish) would likely use low-rise hooded bottom trawls (e.g., 400-Eastern trawl with 6-foot vertical opening) to increase rockfish in their portfolio, adding value and variety to the catch (Appendix C). This fishing strategy would be expected to occur mostly during May to October and north of 42º N. latitude (Section 4.3.1.1).

In a series of community hearings about the catch share program, multiple constituents spoke to the importance of increasing access to midwater stocks before the whiting season start date of May 15. Enough midwater rockfish species comingle with whiting to satisfy current market demand during the whiting season. Harvesters at hearings in Eureka, Coos Bay, Astoria, Newport, and Westport explained the potential upside of gear modifications relative to providing markets with rockfish prior to the whiting season start date; based on public comment, this aspect of the proposed action would likely provide the most benefits to harvesters (and downstream processors and communities):

> "Rockfish comes in when the whiting season starts up on May 15 and there would be a glut if rockfish targeting started at the same time [because current regulations don't allow the use of midwater trawl to target rockfish until the start of the whiting season]. With a glut of rockfish, it would have to be frozen whole round–a much lower-price product form" (Westport 5 Year Review Community Hearing).

This public comment is born out in observed behavior in the trawl gear EFP, where many of the bottom trawls used prior to May 15 were modified midwater trawls fished off-bottom while targeting widow or yellowtail rockfish (see Appendix D for more detail). Under Alternative D3, most targeting of pelagic rockfishes by high-rise bottom trawls (or modified midwater trawls) shoreward of the RCA would likely occur prior to the primary whiting season (prior to May 15). Once the primary whiting season began, most harvesters would likely target pelagic rockfishes using midwater trawl gear, as demonstrated by the 2017 trawl gear EFP (Section 4.3.3.1.3; Appendix D).

Bottom trawl catch rates (and total landings) of pelagic or semi-pelagic species (e.g., rockfishes) would likely increase north of 40º10' N. latitude, especially from January 1 to May 15 (Section 4.3.1.1). In addition, improved flow and function of selective devices (e.g., halibut excluder device) of four-seam trawls under Alternative D3 may provide these bottom trawl harvesters with more flexibility to decrease catch of bycatch species, while increasing catch of target species (Section 4.3.4.2)

One of the major stocks that this change in gear use would target is yellowtail rockfish, a stock that had an average attainment of 34 percent of the trawl allocation from 2011 to 2017 (Table 3-17). In 2017, while the trawl gear EFP was in effect (Section 4.3.1.1), attainment of the trawl allocation increased to 60 percent (Table 3-17). The average yearly value of yellowtail rockfish landings from 2011 to 2016 was $1.2 million; under the 2017 EFP, the landings were valued at roughly $2.8 million, an increase of $1.6 million in revenue to the fishery (Source: NOAA IFQ Program for Pacific Coast Groundfish, PacFIN, July 12, 2018). As the removal of the gear restriction shoreward of trawl RCAs north of 40°10' N. latitude would provide similar access to yellowtail as that under the EFP, this trend of increased yellowtail revenue would likely be repeated in future seasons, should Alternative D3 be adopted.

Sixteen vessels participated in the SSFT EFP in 2017; these vessels had 2017 landings (in all shorebased West Coast fisheries), averaging about $84,000 higher than their 2013 to 2016 average, for an additional $1.3 in ex-vessel revenues across all EFP vessels. Non-EFP vessels had an increase of about $61,000 in their fishing portfolio revenues, likely benefiting from the increasing ACLs and trawl allocations described above in the No-Action Alternative. These vessels experienced an increase of $6.5 million compared to 2013 to 2016 totals. IFQ-participants had an additional $7.9 million in landings (in all shorebased West Coast fisheries) from January to July. This is about $23,000 higher on average than vessels that did not choose to participate in the EFP. Vessels that choose to participate in an EFP are likely different than those that do not; thus, gains to these vessels would likely predict gains for future entrants. Most vessels that participated in the EFP in the first half of 2017 did not have EFP landings in the same period in 2018 (the number of returning vessels is less than three; thus, they cannot be reported due to confidentiality restrictions). In 2018, 15 vessels have had landings in the expanded EFP. If vessels can continue to experiment with new gear configurations to target the dramatically increased ACLs, in particular for pelagic rockfish species, benefits currently confined to a small subset of trawl vessels could expand as trawlers learn about new gear configurations from early adopters.

The benefits described in the preceding paragraphs depend on vessels' willingness to experiment with gear modifications and new fishing strategies, along with availability of other fishing opportunities. Actual participation in the 2017 and 2018 EFP was relatively low, likely due to a particularly lucrative shrimp fishery during those years. The increase in landings and revenue may be low in high-opportunity years in substitute fisheries; however, the flexibility offered under this provision to access previously underutilized stocks when they otherwise could not be delivered to markets would likely generally support redevelopment of markets for rockfish lost during rebuilding years. As markets continue to develop, prices may rise, and vessels may benefit by increasing rockfish landings in the beginning of the year. Based on the information above, Alternative D3 could have a medium-positive impact on harvesters using bottom trawl

shoreward of the trawl RCA north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude compared to the No-action Alternative (D1).

Impact on First Receivers/Processors

Low attainment of the groundfish trawl allocation since the initiation of the catch share program (Table 3-16) has contributed to a smaller and/or inconsistent supply to processors. As a result, the number of shoreside processors and the average variable cost net revenue have steadily declined since initiation of the catch share program (NMFS and Council 2017). Processors report that their profits have been affected by difficulties in keeping workers steadily employed due to instability of groundfish landings, which makes it more difficult for processors to provide a steady supply of groundfish to retailers. Without a predictable supply, processors have a difficult time securing premium markets (fresh, for example); instead, they may have to rely on less discriminating protein markets that offer lower prices (NMFS and Council 2017).

NMFS and Council (2017) also showed that global markets may influence the demand for groundfish products. The long rebuilding periods for the overfished species in this fishery may have caused a loss of historical markets. NMFS and Council (2017) suggested that because landings of overfished species such as canary rockfish, widow rockfish, lingcod, and petrale sole fell precipitously beginning in the early 2000s, markets adjusted through substitution with other species, foreign imports (e.g., tilapia), or other forms of protein. This is supported by Figure 4-6, which demonstrates that imported fish products increased as West Coast groundfish landings decreased. Note the difference in scale between the two axes.

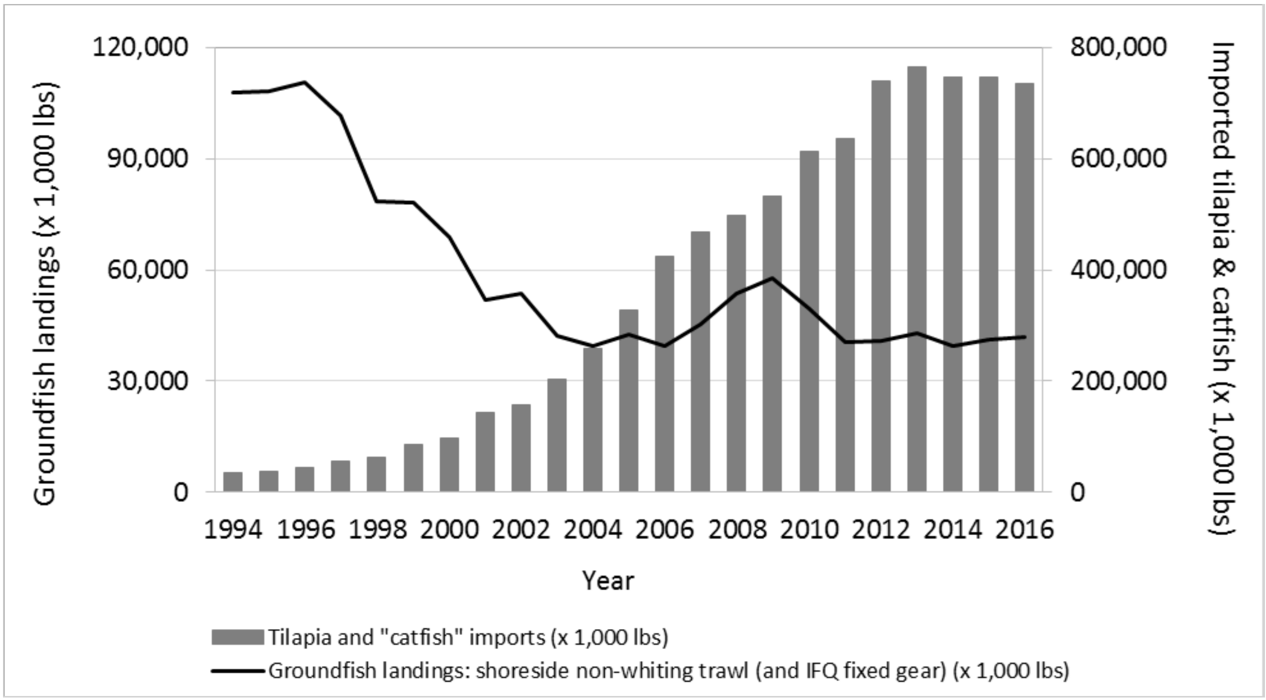

Figure 4-6. Annual imports of tilapia and "catfish" (e.g., swai) into the United States (bar; thousands of pounds) compared to annual West Coast landings of groundfish by non-whiting trawl vessels (line; thousands of pounds). Landings data include IFQ fixed gear vessels operating under the gear switching provision of the catch share program. Foreign import data was queried from the NOAA Office of Science Technology website at the following address: https://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/applications/annual-product-by-countryassociation. Groundfish landings data were obtained from PacFIN. Data were downloaded on May 22, 2017.

Alternative D3 would provide harvesters with the flexibility to use various small footrope bottom trawls (Section 3.4.1.4) shoreward of the trawl RCA north of 40°10' N. latitude. Therefore, the harvest of pelagic or semi-pelagic groundfish would likely increase substantially, and the supply of pelagic rockfishes (and other groundfish) would likely become more consistent throughout the year compared to the No-action Alternative (D1). Under the No-action Alternative, pelagic rockfishes would be available in appreciable amounts only when midwater trawling was allowed (May 15 to December 31). Other fresh groundfish species may also be less available because of difficulties retaining skilled labor (i.e., groundfish filters) due to inconsistent groundfish landings under the No-action Alternative (NMFS and Council 2017). The 2017 trawl gear EFP was initiated on February 24, 2017 (Section 4.3.1.1). As a result, landings of widow and yellowtail rockfish increased for the fishery as a whole (amount, frequency, and consistency throughout the year) relative to previous years (Section 3.4.2.3). The trawl gear EFP was extended to 2018, which also allowed non-whiting midwater trawling prior to May 15th (Section 4.3.1.1). These EFPs enabled harvesters

to provide a continuous, year-around supply of groundfish to first receivers/processors. As a result, fresh widow rockfish and other groundfish species have become available to consumers at local, regional, and national-chain grocery stores. For example, fresh widow rockfish has become available daily at numerous central Washington grocery stores (local markets and national chains) throughout the year; these markets are now receiving consistent and frequent deliveries of fresh groundfish from West Coast processors (D. Erickson, personal observation).

Based on the reasoning in the previous paragraphs and under the section "Impact on Harvesters." Alternative D3 is expected to provide first receivers/processors with improved quality (e.g., more large fish) and quantity of groundfish deliveries on a consistent basis throughout the year. Therefore, Alternative D3 would likely have a medium-high positive change in impact on first receivers/processors compared to the No-action Alternative (D1).

Impact on Communities

Because Alternative D3 is expected to improve quality and consistency of groundfish landings (see Impact on First Receivers/Processors, above), immediate impacts of the alternative would be most pronounced at ports north of 40°10' N. latitude engaged in groundfish bottom trawling. However, the flexibility afforded by Alternative D3 to harvesters may also enable other ports that lost processors and associated infrastructure (NMFS and Council 2017) to begin processing or increase processing to substantially higher levels. The potential for increased landings and consistent landings of groundfish under Alternative D3 would likely increase year-around employment (e.g., full-time filters) and other infrastructure that supports commercial fishing activities (see NMFS and Council 2017). As such, Alternative D3 is would likely have a medium positive change in impact on trawl communities north of 42° N. latitude and between 42° N. latitude and 40°10' N. latitude when compared to the No-action Alternative.

4.3.4.4 Selective Flatfish Trawl (Alternative D3, NMFS Sub-option 1 – retain SFFT definition but eliminate SFFT requirement north of 42° N. latitude)

Alternative D3, NMFS Sub-option 1 is the same as Alternative D3, in that the SFFT would no longer be required shoreward of the trawl RCA north of 42° N. latitude (Section 2.4), with the exception of groundfish bottom trawling within the Columbia River Conservation Zone where the SFFT would be required to reduce trawl impacts on ESA-listed salmon (page 2-188 in NMFS 2017a). Under this Sub-option, the SFFT differs from Alternative D3 in that SFFT would remain a requirement for groundfish bottom trawls shoreward of the trawl RCA between 42° N. latitude and 40°10′ N. latitude. The eliminated

area requirement north of 42° N. latitude would be replaced with a small footrope requirement (e.g., equivalent to the requirement south of 40°10′ N. latitude).

Because Alternative D3, NMFS Sub-option 1 requires the use of SFFT shoreward of the trawl RCA between 42° N. latitude and 40°10' N. latitude, the socioeconomic impacts would be the same as the No-Action Alternative (D1) between 42° N. latitude and 40°10' N. latitude, and the same as the Council Preferred Alternative (D3) north of 42° N. latitude. In addition, the overall (coastwide) impacts of Alternative D3 NMFS Sub-option 1 to harvesters, processors, and communities are expected to be similar to the impacts shown for Alternative D3 (Section 4.3.3.2.3) because most bottom trawling effort shoreward of the trawl RCA occurs north of 42° N. latitude (Figure 3-11). A summary of expected change in impacts of Alternative D3, NMFS Sub-option 1 compared to No Action (D1) for the socioeconomic environment north of 42° N. latitude follows. See Section 4.3.3.2.3 for more detail.

- Harvesters: Alternative D3, NMFS Sub-option 1 is expected to have a medium-positive impact on harvesters using bottom trawl shoreward of the trawl RCA north of 42° N. latitude compared to the No-action Alternative (D1).
- First receivers/processors: Alternative D3, NMFS Sub-option 1 is expected to have a medium-positive change in impact on first receivers/processors north of 42° N. latitude compared to the No-action Alternative (D1).
- Communities: Alternative D3, NMFS Sub-option 1 is expected to have a medium-positive change in impact on trawl communities north of 42° N. latitude compared to the No-action Alternative (D1).

4.4 Impacts of Multiple Trawl Gears On Board (F1 to F3), Fishing in Multiple IFQ Management Areas (G1 to G3), and Bringing a New Haul On Board before Previous Catch is Stowed (H1 and H2)

The sections below present the impacts of Alternatives F1 to F3, G1 to G3, and H1 to H2. The subsections are broken into physical, biological, and socioeconomic discussions.

4.4.1 Physical Environment

The subsections below address the physical environment. They are divided by alternative.

4.4.1.1 No-action Alternatives (Issues F, G, and H)

Under the No-action Alternatives (F1, G1, and H1), groundfish trawl vessels would continue to comply with existing gear and sorting requirements. These requirements were described in Sections 2.6, 2.7, and 2.8.

Under No-action Alternative F1, groundfish trawl vessels would continue to be allowed to carry either midwater trawl or bottom trawl gear types, but not both types simultaneously on the same trip, as specified in regulations at 50 CFR 660.130(b). The catch share program requires 100 percent monitoring through observer coverage or EM, which further aids in ensuring compliance with gear restrictions inside RCAs. Shoreside IFQ vessels would continue to be allowed to carry multiple types of midwater trawl gear or bottom trawl gear types, but not both midwater and bottom trawl gear on the same trip. Vessels would continue to be required to declare gear type when leaving port to begin a fishing trip.

Under No-action Alternative G1, regulations specified at 50 CFR 660.140(c)(2) would continue to prohibit shoreside IFQ trawl vessels from fishing in more than one of the four IFQ management areas during a single fishing trip. This restriction was implemented with the 2011 catch share program, and it was intended to simplify tracking species complexes and application of different management measures specific to each area. Retained and discarded species catch tracking is performed by observers, EM, and shoreside catch monitors. IFQ species and gear types are reported by first receivers on fish tickets. Requiring vessels to fish entirely in a single management area during the same trip further simplifies the reporting of IFQ species while at sea and upon landing.

Under No-action Alternative H1, regulations at 50 CFR 660.112(b)(1)(xi) would continue to prohibit shoreside IFQ trawl vessels from bringing a new haul on board before all catch from a previous haul had been stowed. Included during 2011 catch share implementation, this regulation was intended to aid observers in completing sampling duties. Limiting the number of hauls on deck to one enables observers to collect samples of catch easily and accurately represent species composition at the haul level.

The most common and direct effect of fishing on groundfish habitat results from fishing gear contacting bottom habitats. These effects are described in Section 3.1 and consist of impacts on the physical environment/EFH/habitat from fishery management actions that generally affect the location of fishing (i.e., to more or less sensitive habitats) or the amount of effort (i.e., amount of time gear is in contact with the seafloor).

Under the No-action Alternatives, the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3), at least in the short term (2-6 years). Landings and revenue may fluctuate over the long-term under the No-action Alternatives, however, as ACLs and markets may fluctuate over the long-term. Changing ACLs, trawl allocations, and markets under the No-action Alternatives may also lead to shifts in fishing behaviors, fishing strategies, trawling effort, or distribution in effort (see Section 3.4.2). For example, non-whiting midwater trawl landings of widow rockfish increased by more than 600 percent in 2017 compared to 2016 (Figure 3-13) as a result of increased trawl allocations (Table 3-16); the number of midwater rockfish trips doubled during that same time period (PacFIN).

Even though trawling effort and fishing strategies may shift over time under the No-action Alternatives, vessels would continue to comply with existing gear and fishing area requirements. Vessels would not change where they are currently allowed to fish. Regulations permitting vessel transit of RCAs and restrictions from trawling within trawl RCAs would continue. EFH protections would continue to prohibit bottom contact gear, including bottom trawl, from specific areas designated as EFHCAs. Furthermore, footrope restrictions would continue, and they would, therefore, provide additional protection for rock habitats that may not be closed to bottom contact gear (Section 3.4.2.4). Chafing gear would continue to be restricted to the last 50 meshes of the codend for bottom trawl, a provision originally intended to disincentive fishing over rocky bottom with small footrope trawls. Midwater trawl regulations that provide disincentives for bottom contact (Section 3.4.1.1; Council and NMFS 2014) would also remain in place. Therefore, continuation of fishing activity under the No-action Alternatives F1, G1, and H1 would not have additional adverse effects on the physical environment beyond what has previously been analyzed.

4.4.1.2 Multiple Trawl Gears On Board (Alternative F2 and Alternative F3)

Alternatives F2 and F3 would allow shoreside IFQ vessels to carry both midwater and groundfish bottom trawl gear on the same trip. Under Alternative F2, multiple trawl gear types could be carried by a vessel simultaneously (midwater and bottom trawl), but would not be fished on the same trip. Under Alternative F3, shoreside IFQ vessels would be allowed to carry and fish with both midwater and groundfish bottom trawl gear on the same trip. As under the No-action Alternatives, vessels would continue to be required to

carry at-sea observers to provide 100 percent catch accounting and compliance monitoring. In addition to vessel gear declarations, observers and EM would provide independent verification of gear type used to fish during a given haul and trip. All shoreside IFQ trawl vessels would be subject to a 100-percent at-sea monitoring coverage requirement, by observers or EM. This requirement would help to ensure accurate reporting of trawl gear type at the haul level.

Alternatives F2 and F3 would not change where shoreside IFQ vessels currently operate at sea or where catch is landed compared to the No-action Alternative. None of the action alternatives would ultimately change how much or how little trawl gear is used, or whether and how gear interacts with the ocean floor. Restrictions and mitigation measures for gear interactions with RCAs and EFHCAs would continue as under the No-action Alternative. Overall, Alternatives F2 and F3 would likely result in no change in impact on the physical environment/habitat/EFH compared to the No-action Alternative (F1).

4.4.1.3 Fishing in Multiple IFQ Management Areas (Alterative G2 and Alternative G3)

Under Alternatives G2 and G3, shoreside IFQ trawl vessels would be allowed to fish in multiple IFQ management areas on a single trip. Under Alternative G2, shoreside IFQ trawl vessels would be allowed to fish in multiple areas, provided tows would not cross IFQ management lines, and catch would be sorted by the management area where fishing occurred.

Catch from different IFQ management areas would be reported separately on fish tickets by first receivers. This requirement would maintain IFQ species and tracking in the same manner as the No-action Alternative. Under Alternative G3, shoreside IFQ trawl vessels would be allowed to fish in multiple IFQ management areas during a single tow (i.e., they could tow across an IFQ management line). This alternative would allow vessels to stow catch together from different management areas after observer sampling or accounting under EM protocol. Three IFQ accounting options for reporting catch by management area are under consideration: conservative, pro-rata, or port of landing, described in detail in Section 2.7. Under all three accounting options, observer monitoring, EM, and VMS would be used to aid accurate reporting regarding where trawl vessels are most active when fishing in multiple IFQ areas. These accounting options are administrative in nature, and they would not provide incentive to increase effort in current areas fished or to fish in new areas than those fished under the No-action Alternative.

Alternatives G2 and G3 would not likely increase fishing effort within IFQ management areas beyond current levels. Under these action alternatives, vessel interactions with EHFCAs and RCAs would be limited to the same extent as the No-action Alternative. Regulations permitting vessel transit of RCAs and restrictions for trawling within them would continue under Alternatives G2 and G3 as they have under the

No-action Alternative. Alternatives G2 and G3 and related accounting suboptions would result in no change in impacts on the physical environment/habitat/EFH compared to the No-action Alternative.

4.4.1.4 Bringing a New Haul on Board before the Previous Catch is Stowed (Alternative H2)

Under Alternative H2, shoreside IFQ trawl vessels would be allowed to bring a haul on board before all catch from a previous haul has been stowed. The vessel would have to ensure that catch from separate hauls would not mix on deck until the observer could complete all necessary sampling duties for the previous haul. For vessels fishing with EM, catch from different hauls must be kept separate on deck until fully documented according to protocols established in the specific vessel's monitoring plan.

Under Alternative H2, vessels would be unlikely to change where they fish. Alternative H2 would not create incentives to fish in new locations or to increase the frequency of vessel interactions with RCAs and EFHCAs. Vessels would continue to comply with RCA gear restrictions and transit requirements. Therefore, action alternative H2 would not change the impact on the physical environment/habitat/EFH compared to the No-action Alternative (H1).

4.4.2 Biological Environment

Impacts of issues F, G, and H on the biological environment are described and summarized in the following sections. They are broken down by alternative. Groundfish (target and non-target) and non-groundfish species (protected and non-protected) are analyzed and discussed collectively within each of the no-action alternative and the action-alternative sections.

4.4.2.1 No-action Alternatives (Issues F, G, and H); Groundfish and Non-groundfish Species

Under the No-action Alternatives (F1, G1, and H1), groundfish trawl vessels would continue to comply with existing gear and sorting requirements. These requirements were described in Sections 2.6, 2.7, and 2.8.

Under No-action Alternative F1, groundfish trawl vessels would continue to be prohibited from carrying both midwater and groundfish bottom trawl gear simultaneously on the same trip. Vessels would have to return to port to change gear types (groundfish bottom trawl or midwater trawl) between trips before resuming fishing activity.

Under No-action Alternative G1, shoreside IFQ trawl vessels would continue to be prohibited from fishing in more than one IFQ management area on a single trip. Vessels would have to end a fishing trip and offload all catch before fishing in a different management area.

Under the No-action Alternative H1, shoreside IFQ trawl vessels would continue to be prohibited from bringing a new haul on board before stowing all catch from a previous haul. Included during 2011 catch share implementation, this regulation was intended to aid observers in completing sampling duties.

The primary effect of the fishing to the biological environment is fishing mortality. These effects are described in Section 3.2.1 (groundfish), Section 3.2.2 (prohibited species), Section 3.2.3 (protected species), and Section 3.2.4 (other non-target non-groundfish species).

Under the No-action Alternatives (F1, G1, and H1), the trawl sector would likely increase catch and revenue proportional to increasing trawl allocations (Table 3-16) and ACLs (Table 3-2; Table 3-3), at least in the short term (2-6 years). Landings and revenue may fluctuate over the long-term under the No-action Alternatives, however, as ACLs and markets may fluctuate over the long-term. Changing ACLs, trawl allocations, and markets under the No-action Alternatives may also lead to shifts in fishing behaviors, fishing strategies, trawling effort, or distribution in effort (see Section 3.4.2). For example, non-whiting midwater trawl landings of widow rockfish increased by more than 600 percent in 2017 compared to 2016 (Figure 3-13) as a result of increased trawl allocations (Table 3-16); the number of midwater rockfish trips doubled during that same time period (PacFIN).

Even though trawling effort, fishing strategies, and total fishing mortality may shift over time under the No-action Alternatives, vessels would continue to comply with existing mitigation measures and incentives built into the catch share program (Section 4.1.4), as well as regulations carried over from the era prior to the catch share program (Section 1.3.2). These regulations, mitigation measures, and incentives were designed, in part, to prevent overfishing and excessive discarding. Under the No-action Alternatives, mitigation measures and incentives are expected to continue holding fishing mortality of target and non-target groundfish below or near ACLs and trawl allocations. All trawl-dominant groundfish species that have been assessed are currently classified as healthy (biomass greater than MSY target) (Table 3-4), and would be expected to remain healthy under the No-action Alternatives, even as ACLs and fishing mortality fluctuate. Finally, mitigation measures and incentives built into the catch share program discourages catch and discarding of undersized or unwanted groundfish, resulting in discard rates that are much lower than observed prior to the catch share program (Section 3.2.1.3) (NMFS and Council 2017).

The constraints and mitigation measures designed for groundfish (see the previous paragraph) may also continue to constrain catches of non-groundfish species. Some mitigation measures were built into the catch share program to restrain mortality of non-groundfish below management thresholds (e.g., IBQ for Pacific halibut). The ITS Terms and Conditions in biological opinions (e.g., 2017 salmon biological opinion) and mitigation measures developed through the Council process (e.g., harvest specifications and

management measures) would likely continue to restrain catch of prohibited species below ITS levels under the No-action Alternative, even as effort and fishing strategies change. Finally, the Council and NMFS can implement measures to reduce catch of groundfish or non-groundfish species when there is a conservation concern.

Based on the reasoning described in the paragraphs above, continuation of fishing activity under the No-action Alternatives (F1, G1, and H1) is not expected to have additional adverse effects on groundfish or non-groundfish stocks beyond what has previously been analyzed.

4.4.2.2 Multiple Trawl Gears On Board (Alternative F2 and Alternative F3); Groundfish and Non-groundfish Species

Under Alternative F2, shoreside IFQ trawl vessels would be allowed to carry multiple types of trawl gear, both midwater and groundfish bottom trawl, on the same trip. Alternative F2 would not change ACLs or allocations of target and non-target groundfish. Allowing vessels to carry multiple gears on board would not change bycatch of or mitigation measures for non-target non-groundfish species. Overall, Alternative F2 would have no change in impact on groundfish, non-target non-groundfish species, and protected species compared to No-action Alternative (F1).

Under Alternative F3, shoreside IFQ trawl vessels would be allowed to carry, as well as to fish with multiple trawl gear types on the same trip. Vessels would, for instance, be allowed to complete a haul for a preferred IFQ species with midwater trawl gear, then subsequently move to a new location and target a different IFQ species or complex using bottom trawl gear (or vice-versa). Implementing Alternative F3 would change fishing practices. For instance, vessels could avoid using groundfish bottom trawl gear when it might result in high catch of prohibited species such as Pacific halibut; instead, they could target pelagic species in the same area by switching trawl gear type to midwater trawl. In line with goals of the catch share program, carrying multiple trawl gear types may provide increased flexibility for vessels to avoid and reduce bycatch of non-target and protected species while maximizing use of quota pounds. However, NMFS does not anticipate this change in practice would affect how vessels impact groundfish, non-groundfish, and protected species compared to the No-action Alternative. Alternative F3 would not open new areas to fishing or change current gear-based area restrictions. This action would not provide incentives to fish in new areas. Vessel would continue to fish in the same areas as under the No-action Alternative.

Under Alternative F3, shoreside IFQ trawl vessels using multiple trawl gear types would have to separate and stow catch by gear type. Catch would be reported separately by gear type on fish tickets upon landing at first receiver sites. VMS and monitoring requirements would remain in place, and vessels would

continue to be required to declare gear type. These measures would continue to ensure vessel accountability for gear use and compliance with area restrictions and would ensure that catch would not exceed trawl allocations or ACLs.

Under Alternative F3, the timing and the location of harvest would not likely change. Overall harvest would be expected to increase as vessels were expected to attain more of their allocation per unit of effort by matching optimal gear to target species during the same trip. As all catch must be accounted for with IFQ, and impacts from full attainment of all IFQ were considered in the 2017–18 Harvest Specifications EA, the increase in catch would not likely pose a threat to exceed the ACL. Catch would continue to be reported in real time on fish tickets and through on-the-water monitoring, and it would be assessed annually (e.g., through the Groundfish Mortality Reports). Any increased catch in the groundfish fishery that might trigger a conservation concern could be addressed with appropriate mitigation measures implemented through Federal/state authorities or pursuant to the Groundfish FMP. Therefore, Alternatives F2 and F3 would have no change in impact on target and non-target groundfish, and non-target non-groundfish species when compared to the No-action alternative.

4.4.2.3 Fishing in Multiple IFQ Management Areas (Alternative G2 and Alternative G3); Groundfish and Non-groundfish Species

Species are divided into groundfish and non-groundfish species. They are broken down by Alternative.

Alternative G2

Under Alternative G2, shoreside IFQ trawl vessels would be allowed to fish in multiple management areas on the same trip. Alternative G2 would require vessels to sort and stow their catch by management area for delivery. First receivers would be required to report catch from different management areas on separate fish tickets, or different lines on the same fish ticket for each area fished. The catch Share program requirement for 100 percent monitoring on the water through observers or EM would ensure haul level accounting of species composition and IFQ tracking. These measures would enable tracking species retained for catch accounting and stock assessment data, and they would help to ensure that catch would not be misreported, which may, over time, lead to a negative impact on fish stocks. Under this alternative, the timing and the location of harvest would not be likely to change.

Alternative G2 would not change ACLs, or sector allocations for target and non-target groundfish species. Alternative G2 would not change bycatch of non-groundfish non-target species; mitigation measures for non-target, non-groundfish species would remain in place under this action alternative. Therefore, Alternative G2 would have no change in impact on target and non-target groundfish, or on non-target non-groundfish species when compared to the No-action Alternative (G1).

Alternative G3

Under Alternative G3, shoreside IFQ trawl vessels would be allowed to fish in multiple management areas on a single trip, and they would be allowed to tow across management lines during a single haul. Under this alternative, catch from multiple management areas would not have to be sorted and stowed separately, and it would be allowed to mix in the vessel hold. Catch mixed from multiple management areas would be tracked on delivery at first receiver sites using one of three accounting options under consideration; Conservative, Pro-rata, and Port of Landing, described in detail in Section 2.7.

Accounting Options

Biological impacts of the accounting options would differ. They are examined separately below. Under each accounting option, first receivers would provide information on fish tickets for all management areas fished by a vessel.

Under the Conservative Option, quota pounds would be deducted from each vessel's IFQ allocation according to measures from the management area and with more restrictive or conservative harvest limits. This option would reduce the likelihood of negative impacts over time, which could result from misreporting catch in a less restrictive area than the one in which it was caught, if fishing in multiple areas. As the most restrictive harvest limits for target and non-target groundfish, mitigation measures for non-target non-groundfish species would always apply to catch from multiple management areas.

Under the Council preferred Pro-rata Option, total catch would be assigned to an area, and quota pounds would be deducted from vessel accounts based on the number of hauls in each management area (e.g., if six hauls came from one area, and two from another, the total landing weight and quota pounds would be split six to two between the two areas reported on the fish ticket.) Fish tickets would have be accurate in capturing the proportion of areas fished and the total landing weight. At-sea monitoring both by observers and EM along with shoreside catch monitors would ensure veracity of catch location and composition at landing.

Under the Port of Landing Option, catch would be assigned to and quota pounds be deducted from only the management area in which it is landed. Crediting catch to the port of landing was routine prior to implementation of the catch share program. This option may create spatial issues over time if catch from one IFQ management area is repeatedly landed in ports within a different IFQ management area.

Effects of Alternative G3 and Sorting Options

Under Alternative G3 and the three sorting options, shoreside IFQ trawl vessels would have improved flexibility when selecting harvest strategies to best use available IFQ. This action alternative would likely

change fishing practices in some aspect, especially for vessels near IFQ management lines. Provisions of the catch share program and associated management measures would continue to ensure accurate catch monitoring and catch reporting, both at-sea and onshore. Data quality would be maintained at levels needed for effective in-season management of the fishery and for stock assessments used to develop catch limits and harvest guidelines. Management measures would ensure continued accurate monitoring and reporting of catch, and maintain quality catch at sea and landing data used to manage the fishery in season and for stock assessments used to develop catch limits and harvest guidelines. The direct effects of this action would be administrative in nature due to somewhat increased management complexity in tracking catch between different management areas. This effect is described in more detail in Section 4.4.3.3. Based on industry feedback, it is anticipated that vessels towing across management lines would likely occur infrequently. (Agenda Item G.8.a, Supplemental GAP Report, March 2016). Alternative G3 would not modify ACLs, sector allocations for target and non-target species, or protected species incidental take limits. One-hundred percent monitoring through on-board observers or EM, along with VMS, would aid in ensuring accurate haul level reporting of catch and management areas fished. Therefore**,** Alternatives G3 and associated catch accounting options would have no change in impact on target and non-target groundfish, and non-target, non-groundfish species when compared to the No-action Alternative G1.

4.4.2.4 Bringing a New Haul on Board before Previous Catch is Stowed (Alternative H2); Groundfish and Non-groundfish Species

Under Alternative H2, shoreside IFQ trawl vessels could bring a new haul on board while catch from a previous haul is still on deck. Vessels would have to ensure that on board observers completed all necessary sampling duties for a haul before catch from different hauls could be mixed on deck.

Alternative H2 may offer shoreside IFQ trawl vessels increased operational flexibility. Often, completely sorting and stowing catch from a haul in the trawl fishery can take several hours. There are instances when the on-board observer may not require all catch to be removed from the deck and stowed before successfully completing sampling duties.

Current regulations at 660.140 (h)(viii)(I), detailed in Section 2.8, that require groundfish trawl vessels to provide observers with reasonable assistance and accommodations (time and space to work) to complete sampling duties would remain in place. These measures would help to maintain the quality of observer data used to manage the fishery. Additionally, vessels operating under EM would have to keep catch from different hauls separated on deck until they fully documented that they followed EM sampling protocols. However, Alternative H2 could affect accurate and timely reporting of real-time fisheries data used to manage the trawl fishery in-season and to maintain harvest guidelines, and this could have biological

impacts. This action would shift pressure onto observers to complete all required sampling duties for an earlier haul before a new one could be brought aboard. The increased pressure to complete sampling quickly and to allow the next haul on board could, for example, result in observers making data-recording errors and might reduce sample sizes. Degraded observer data could have indirect negative impacts over time if stock assessment data were affected, and catch of protected and prohibited species were misreported. Current measures requiring reasonable assistance and accommodations for observers would have to be enforced adequately to ensure that observer data would not be compromised from increased pressure to complete sampling duties. Enforcement issues on vessels that do not provide reasonable assistance under Alternative H2 would have to be thoroughly documented by observers. Training protocols would have to be reinforced to avoid circumstances where degraded data may result from increased pressure on observers to complete sampling duties.

Alternative H2 would not modify ACLs or sector allocations for groundfish and non-groundfish species. Alternative H2 would not likely cause biological impacts on protected species through inadequately reported vessel interactions and incidental take. Any increased catch in the groundfish fishery that might trigger a conservation concern could be addressed with appropriate mitigation measures implemented through other Federal/state authorities or pursuant to the Groundfish FMP. Due to the potential reporting issues resulting from Alternative H2, implementation of Alternative H2 would likely result in a low-negative biological impact on target and non-target groundfish and non-target, non-groundfish species compared to the No-action Alternative (H1).

4.4.3 Socioeconomic Environment

This section evaluates the socioeconomic impacts of Issue F (multiple trawl gears), Issue G (multiple management areas), and Issue H (new haul on board). Impacts of the alternatives on the socioeconomic environment are described for all categories (harvesters, first receivers/processors, and communities) within each issue and its alternatives. Because each issue and alternative would likely have different impacts for each component of the socioeconomic environment described in Section 3.3, the descriptions of effects are presented separately by category for each alternative. Although removing restrictions under Issues F, G, and H may impact some aspects of management (e.g., data tracking), impacts on management that do not affect the socioeconomic environment are not elaborated herein.

4.4.3.1 No-action Alternatives (Issues F, G, and H)

Under the No-action Alternatives (F1, G1, and H1), groundfish trawl vessels would continue to comply with existing gear and sorting requirements. These requirements were described in Sections 2.6, 2.7, and 2.8.

Under Alternative F1, shoreside IFQ trawl vessels would continue to be prohibited from carrying multiple trawl gear types on the same trip. Vessels would continue to return to port to swap out gear when switching between target IFQ species caught with midwater trawl or groundfish bottom trawl. Vessels traveling to and from port to swap groundfish trawl gear would continue to experience associated operating costs (fuel, food, and observer days) and exposure to risks associated with more time at-sea and numbers of bar crossings.

Under No-action Alternative G1, current regulations would continue to restrict the ability of fishermen to optimize fishing effort when operating near IFQ management area lines. Shoreside IFQ trawl vessels fishing near these management lines would have to tow up to the line, retrieve gear, and reset away from the line. Harvesters might have to expend extra fuel and pay for additional observer days at sea due to the need to return to port to end a fishing trip before beginning a new trip in an adjacent management area. Due to this practice, vessels would continue to incur operational costs from fuel use and daily observer coverage, and they would continue to have impaired access to groundfish stocks. In addition, these fishermen would be exposed to additional risks associated with more time at-sea and numbers of bar crossings.

Under No-action Alternative H1, shoreside IFQ trawl vessels would continue to be required to clear the deck and stow all catch from a previous haul before a new haul could be brought on board. For some groundfish vessels that target multi-species complexes during the same haul, this task can be time-consuming, potentially reducing operational flexibility and efficiency. The time required for vessels to sort and stow catch completely can vary based on haul size and catch complexity, as well as a number of other factors, including vessel layout, number of crew members, crew experience, and weather. Reduced operational flexibility for trawl vessels carrying observers would potentially occur under circumstances when catch requires multiple hours to sort and stow. Unless influenced by a combination of these factors, the amount of time to completely sort and stow catch can often be accomplished before the next haul is ready to be brought on board.

Under the No-action Alternatives, the trawl sector would likely increase catch and revenue proportional to increasing ACLs (Table 3-2; Table 3-3) and trawl allocations (Table 3-16). Notable increases of ACLs in 2017 relative to 2016 are shown in Table 3-2 and Table 3-3 for previously constraining species such as canary rockfish (1,271 percent), widow rockfish (575 percent), bocaccio (118 percent), darkblotched rockfish (85 percent), and POP (71 percent), as well as increases for target species such as petrale sole (43 percent). The rebuilding of recently overfished species is expected to drive increased catch and revenue in the coming years under the No-action Alternatives. This trend is observable in 2017: for the non-whiting, trawl gear component of the fishery in 2017, inflation adjusted, non-EFP revenue increased 22 percent over

the 2011 to 2016 average, and non-EFP landings increased 68 percent. Landings and revenue would likely continue to increase under the No-Action Alternatives with increased ACLs and trawl allocations to the extent that processors could access markets generally lost to foreign imports during the rebuilding period. Landings and revenue may fluctuate over the long-term under the No-action Alternatives, however, as ACLs and markets may fluctuate over the long-term.

Fishing behaviors and strategies are expected to shift as ACLs and markets change. Over the short-term, fishing behaviors and strategies would likely change in response to increasing ACLs and quota for previously constraining overfished species. Correspondingly, under the No-action Alternatives, revenue and benefits to harvesters, first receivers/processors, and communities would likely in proportion to increases in ACLs and trawl allocations.

While these benefits to the socioeconomic environment are expected under the No-action Alternatives over the short-term, the operational flexibility of harvesters would continue to be restricted compared to the action alternatives. Under the No-action Alternatives (F1, G1, and H1), vessels would continue to comply with existing requirements. These regulations may artificially suppress catch below the levels supportable by markets when catch limits are set equal to optimum yield. To the extent that markets can be developed for new or returning products, increasing harvest opportunity may increase the indirect cost of being unable to access higher ACLs under the No-action Alternatives relative to the action alternatives due to the No-action Alternatives' gear restrictions.

4.4.3.2 Effects of Alternatives F2 and F3 (Multiple Gears on Board)

The sections below are broken into three categories. These categories are impact on harvesters, impact on processors/.first receivers, and impact on communities.

<u>Impact on Harvesters</u>

Under Alternative F2, shoreside IFQ trawl vessels could carry both midwater and bottom trawl gear simultaneously on the same trip. Vessels would continue to be prohibited from fishing with both midwater and bottom trawl gear types on the same trip. Prohibiting vessels from fishing with multiple types of gear in a single trip would reduce flexibility and increase costs of participating in the fishery, limiting access to fishable stocks. By allowing vessels more options on a single trip, vessels would more likely successfully contribute to attainment of the trawl allocation for the stocks they encountered. Allowing harvesters to carry multiple trawl gears is would likely provide improved operation flexibility and increased efficiency. After offloading, the vessel could immediately depart to fishing grounds and target a different IFQ species complex using the appropriate trawl gear type without having to return to port to swap gear. By removing

the need for vessels to run to and from port where gear is stored, Alternative F2 would allow harvesters to reduce the cost of fuel, food, and payments for observer coverage days.

In 2016, fuel costs represented approximately 9.1 percent of total daily variable costs for trawl vessels (from FISHEyE retrieved July, 12 2018). Vessels must pay for daily observer coverage, based on a 24-hour clock, such that each day would incur the cost of paying full-day observer fees. In 2016, observer coverage represented 8.6 percent of daily variable costs for trawl vessels (from FISHEyE retrieved July 12, 2018). Reducing the number of days at sea running to swap gear would potentially allow vessels to save on the cost of fuel and observer coverage over time. Under F2, vessels would carry additional gear on board and potentially spend fewer days at sea running from port, to fishing ground, to delivery sites. Therefore, Alternative F2 would have low positive socioeconomic impact on harvesters compared to the No-action Alternative (F1).

Under Alternative F3, shoreside IFQ trawl vessels could carry and fish with both midwater and groundfish bottom trawl gear on the same trip. Vessels could potentially save additional time at sea compared to Alternative F2, further reducing daily costs of fuel and observer coverage. Compared to Alternative F2, Alternative F3 would allow vessels to switch target IFQ species complexes harvested with either midwater or groundfish bottom trawl on the same trip without having to offload catch and begin a new fishing trip. Under this alternative, catch from different trawl gear types would have to be stowed and accounted for separately by gear type on landing (Decision Summary Document, Council, March 2016). Alternative F3 would allow greater flexibility for harvesters while at sea when choosing how best to use quota pounds. Vessels would potentially be able to maximize attainment of IFQ by carrying and fishing with both midwater and bottom trawl gear on the same trip.

In 2016, six vessels switched once between bottom trawl and midwater gears, and three vessels switched an average of 2.6 times in the year, for a total 14 switches. Similarly, in 2015, ten vessels switched between bottom trawl and midwater trawl an average of twice each. At a half-day transit in and out, an estimate of 15 to 20 at-sea days per year would be spent per vessel transiting back to port to change gear types. Given average variable cost per day of about $6,000 for whiting and groundfish trawling in 2016 (EDC FISHEyE data), those 15 to 20 days would cost the fishery $90,000 to $120,000 per year, costs that could be saved if Alternative F3 were adopted. By more easily responding to live requests from processors, harvesters could limit mismatch between harvest portfolios and market demand. This flexibility may limit the quantity of weighbacks or catch that must be sold as fishmeal, potentially increasing average income for vessels that could more closely match the desires of the market. The number of vessels that would benefit from this provision would not likely increase substantially beyond the ten observed in 2015, as vessels likely had more incentive to switch in that year with a difficult whiting season. By increasing operational flexibility to

maximize use of quota pounds, and by decreasing days at sea and the number of times required to cross the bar, Alternative F3 may save on fuel and observer costs, and improve safety for a small subset of vessels that participate in midwater and bottom trawl fisheries. As such, Alternative F3 would have low positive socioeconomic impacts on harvesters compared to the No-action Alternative.

Impact on Processors/First Receivers

Under Alternative F2, shoreside IFQ trawl vessels allowed to carry multiple types of groundfish trawl gears could more easily respond to requests from processors to target specific IFQ species. The vessel could complete landing catch at the first receiver site or processor and immediately begin a new trip to target a different IFQ species complex without having to return to port to swap out trawl gear types. For instance, after offloading catch harvested using groundfish bottom trawl gear, the vessel could more easily satisfy demand from the receiving processor, subsequently targeting midwater trawl species, if it already had such gear on board. Processors could likely supply markets with desired fish species more quickly if vessels had improved flexibility to coordinate with them. However, processors reported that contracts are generally negotiated months or years in advance, which may limit their ability to benefit from this provision. Improved coordination between harvesters and processors would result in marginally greater operational efficiency for both. Under Alternative F2, processors/first receivers would experience low positive change in socioeconomic impacts compared to the No-action Alternative.

Alternative F3 would indirectly provide processors with improved operational flexibility to respond to market demands. Input from members of the processing sector indicated this action would potentially allow vessel operators to respond more easily to their requests to target specific IFQ species while at sea. The ability to fish multiple gears during a single trip would allow shoreside IFQ trawl vessels to coordinate with processors to align their harvest portfolios with market demand so that the value of catch could be maximized (Agenda Item G.5.a Supplemental Workshop Report. June 2016. Page 45, 72-3.). Under Alternative F3 vessels would have to keep catch separated by gear type, and first receivers/processors would have to track landings with different gear on separate fish tickets, or separate lines of the same fish ticket. This requirement may somewhat increase the complexity and time required for processors to offload vessels (Agenda Item G.8.a, Supplemental GMT Report, March 2016). Given the small number of vessels able to carry multiple gears on board and switch fishing strategies mid-trip, the socioeconomic effects of Alternative F3 on first receivers and processors would have low positive change in impact compared to the No-action Alternative.

Impact on Communities

Improved flexibility for harvesters and processors to coordinate operations and improve efficiency may produce detectable socioeconomic impacts in communities involved in trawling. Communities with the most active bottom trawl activity include Astoria, Newport, Coos Bay, Brookings, Eureka, and Fort Bragg (NMFS and Council 2017). Fishing communities in the groundfish fishery without first receivers/processors, or communities less active in trawling would be less likely to experience socioeconomic effects from Alternative F2. Vessels allowed to carry multiple gear types under Alternative F2 would still have to end a fishing trip before switching trawl gear types, providing more operational flexibility compared to the No-action Alternative. Any increase in revenue resulting from this alternative would benefit communities engaged in trawling. Under Alternative F2, communities hosting first receivers/processors and homeports active in trawling would experience no change in impacts to low positive change in impacts compared to the No-action Alternative (F1), depending on the level of harvest behavioral change.

Under Alternative F3, vessels and processors would have increased operational flexibility to more easily coordinate (compared to No-action and Alternative F2) and align harvest portfolios with market demands and to maximize the value of the catch. To the extent that harvesters and first receivers/processors would realize an increase in net revenue from the use of multiple trawl gear types on the same trip, those benefits would likely be localized to areas with established trawl presence. These communities would likely experience either no change in impacts or low positive change in impacts compared to the No-action Alternative due to potential increased revenue to processors under Alternative F3.

4.4.3.3 Fishing in Multiple Management Areas (Issue G)

The sections below are broken into three categories. These categories are impact on harvesters, impact on processors/first receivers, and impact on communities.

Impact on Harvesters

Under Alternative G2, shoreside IFQ trawl vessels would be allowed to fish in multiple management areas during the same trip. This alternative would provide increased flexibility for vessels frequently operating near management lines (Agenda Item G.8.a, Supplemental GMT Report, March 2016). Under Alternative G2, vessels could move to a different management area between hauls, rather than between fishing trips. This action alternative would improve vessels' ability to use available quota pounds, while reducing the cost of fuel and time at sea. By reducing time at sea and the number of hauls a vessel may require to complete a trip, the socioeconomic effects of Alternative G2 would likely have low-positive change in impacts on harvesters compared to the No-action Alternative.

Alternative G3 would permit shoreside IFQ trawl vessels to fish in multiple management areas on the same trip (as under G2), as well as allowing trawling across management lines. Under this alternative, vessels could fish in multiple management areas on the same tow. Harvesters have expressed interest in only trawling across the management line at 40°10′ N. latitude. It is neither anticipated nor likely that more than a small number of harvesters would take advantage of the provision under Alternative G3 (Agenda Item G.8.a, Supplemental GAP Report, March 2016).

Under Alternative G3, shoreside IFQ trawl vessels frequently operating near management lines would benefit from the operational flexibility to tow across lines. If vessels encountered a line dividing management area while towing, they would not have to haul back gear and reset to start a new haul on the other side of the area line. Vessel towing across lines could reduce the number of hauls and, therefore, the amount of fuel spent trawling and maneuvering the vessel to optimize harvest, potentially increasing attainment of their trawl quota for the few vessels that are currently hampered by their inability to cross management lines. By reducing time at sea and the number of hauls a vessel may require to complete a trip, the socioeconomic effects of Alternative G3 would likely have a low positive change in impacts on harvesters compared to the No-action Alternative.

Impact on Processors/First Receivers

Alternative G2 would provide vessels with increased flexibility when selecting harvest strategies to reduce operating costs and maximize quota pounds. The ability to fish multiple areas during a single trip would allow vessels to coordinate with orders from processors across management area lines. Processors could respond to purchase orders in a timelier fashion because vessels could fish in multiple areas. Processors could contact the harvester immediately, and the harvester could respond to the order and deliver, even if the vessel were in a different area than the processor. Based on industry response, this alternative would most likely provide an advantage to vessels operating near the 40°10′ N. latitude management line, and it would, subsequently, affect adjacent processors (Agenda Item G.8.a, Supplemental GMT Report, March 2016). NMFS does not anticipate a detectable increase in landings at first receiver sites and processors directly resulting from this action alternative. Because the number of affected processors would be limited geographically, and the benefit would be diffuse, the indirect socioeconomic effects of Alternative G2 on processors and first receivers would be a low-positive change in impacts compared to the No-action Alternative (G1).

Alternative G3 would allow shoreside IFQ trawl vessels to fish multiple areas during a single trip and haul, and it would enable processors/first receivers more easily to coordinate orders with vessels operating in neighboring management areas. Under Alternative G3 and the Council's preferred Pro-Rata Option, catch

from different areas would be reported separately on fish tickets by first receivers, and vessel quota pounds would be deducted according to the ratio of hauls in each area. Under Alternative G3, processors may experience increased complexity when handling deliveries; the number of hauls in each management area would have to be tracked and reported on fish tickets, and total catch weight would have to be divided by the ratio of hauls (Agenda Item G.9.a, NMFS Report, June 2016).

Despite minor operational burdens as a result of increased catch accounting complexity, and some positive effects on processors/first receivers located near management lines, the overall impact on processors/first receivers would likely be low positive. Alternative G3 would not change the areas open for fishing or the gear configurations allowed for removal. Thus, the expected volume of catch and species composition of catch would be unlikely to change compared to the No-action Alternative. By increasing operational flexibility of processors to coordinate with harvesters to attain catch, Alternative G3 would have a low positive change in impacts on processors/first receivers compared to the No-action Alternative.

Impact on Communities

Alternative G2 would likely have the greatest positive impact on vessels coming from home ports near the management area dividing lines. As described in Section 2.7, IFQ management area lines bisect the Humboldt County and the central California coast. The few vessels that regularly fish both north and south of IFQ management lines are likely to benefit most from Alternative G2, experiencing a low-positive impact, while most vessels that typically fish in one management area or do not frequently change the management area they are targeting, would experience no change in impacts. Thus, Alternative G2 would likely have a low positive impact on fishing communities near the dividing lines compared to the No-action Alternative.

Port communities located near management lines would particularly benefit under Alternative G2, as vessels from these communities would likely interact the most with nearby management lines. Under Alternative G3, reduced costs of operation for vessels from home ports located near management lines would have no change in impacts to low positive change in impacts on fishing communities overall, compared to the No-action Alternative (G1).

Under Alternative G3, shoreside IFQ trawl vessels could fish in multiple IFQ management areas on the same haul. Compared to Alternative G2 and the No-action Alternative, Alternative G3 would offer increased operational flexibility for vessels to use quota pounds for IFQ species complexes occurring in different areas. Under Alternative G3, vessels could fish on either side of the management line during a single haul without having to end a trip before entering a new area. Further reduced cost of operations to these vessels would potentially provide a low positive change in socioeconomic impacts on home port

communities compared to the No-action Alternative. Accounting suboptions would not likely cause any change in socioeconomic impacts on communities. Under Alternative G3, reduced costs of operation for vessels from home ports located near management lines would have no change to a low positive change in impacts on fishing communities overall, compared to the No-action Alternative (G1), for reasons similar to those described for Alternative G2**.**

4.4.3.4 Bringing a New Haul on Board before Previous Catch is Stowed (Issue H)

The sections below are broken into three categories. These categories are impact on harvesters, impact on processors/first receivers, and impact on communities.

Impact on Harvesters

Under Alternative H2, shoreside IFQ trawl vessels could bring a new haul on board while catch from a previous haul is still on deck, provided the observer could complete all necessary sampling duties, or EM protocol could be followed for each haul. These two activities would have to be completed before separate hauls could be mixed.

Harvesters could more easily avoid foul weather by being able to haul back gear earlier and return to port, improving safety at sea. If vessels experienced gear hang-ups or net rips, Alternative H2 would allow vessels to bring the damaged gear and any catch on board back to port while catch from an earlier haul was on deck. Crew would not have to wait until all earlier catch had been cleared from deck to start time-consuming repairs on damaged gear, as mentioned in the March 2016 GAP Report (Agenda Item G.8.a, Supplemental GAP Report). Alternative H2 would provide flexibility to address these types of situations more easily and satisfy reporting for enforcement concerns than under the No-action Alternative. In this case, Alternative H2 would likely have a low-positive change in impacts on harvesters compared to the No-action Alternative. NMFS anticipates that this alternative may also cause some low negative impacts on harvesters; safety might be compromised for crew and observers if the deck became crowded with catch from two different hauls.

Alternative H2, therefore, would trade off some safety in the event of an overcrowded deck, but would provide an increased ability to avoid unsafe environmental conditions (e.g., worsening weather conditions and sea state). Overall, due to increased operational flexibility, Alternative H2 would have a low positive change in impact on harvesters compared to the No-action Alternative.

Impact on First Receivers/Processors

Under Alternative H2, shoreside IFQ trawl vessels could bring a new haul on board before all catch from a previous haul was stowed. This would not likely result in a detectable change in catch quality or

composition. This alternative would not restrict timing of deliveries to processors, as catch that must be sorted would continue to be sorted and stowed by vessels before it was offloaded. Therefore, Alternative H2 would have no change in impacts on processors and first receivers compared the No-action Alternative.

<u>Impact on Communities</u>

Under Alternative H2, shoreside IFQ trawl vessels could bring a new haul on board before catch from a previous haul was stowed. This alternative would not likely change impacts on first receivers compared to the No-action Alternative; therefore, there would be no change in impacts on communities hosting processors/first receivers. Any effects on communities resulting from benefits for harvesters would be diffuse and would not likely be detectable at the community level. Therefore Alternative H2would likely have no change in impact on fishing communities compared to the No-action Alternative.

4.5 Synergy and Conflicts among Alternatives

Some alternatives of this action may have synergistic effects if implemented simultaneously. In addition, there may be some conflict or ambiguity if a mixture of FPAs and No-action Alternatives were adopted and implemented into regulation. Potential synergy among FPAs and conflicts between FPAs and No-action Alternatives are described in this section.

4.5.1 Alternative A3 (Eliminate Mesh Size Restrictions), Alternative C2 (Eliminate Codend Restrictions), and Alternative E3 (Eliminate Chafing Gear Restrictions)

The three alternatives are described below. The discussion is divided into synergistic effects and conflicts of selected FPAs and No-action Alternatives.

<u>Synergistic Effects</u>

Some commenters have suggested that removing mesh size restrictions (A3), codend restrictions (C2), and chafing gear restrictions (E3) could (a) armor the trawl to an extent that fishermen would synergistically increase groundfish bottom trawling effort over rocky and sensitive habitat and (b) reduce the effective size of mesh openings to the point of synergistically increasing the retention of small animals. In isolation, these FPAs would likely have no to a low-negative change in impacts on the physical environment, low-negative to low-positive change in impacts on the biological environment, and no change in impact to low-positive change in impact on the socioeconomic environment, all compared to their respective No-action Alternatives (Section 4.6). Because fishermen would probably strategically combine these alternatives to improve fishing efficiency and to better protect nets (Section 4.2.1; Section 4.2.2), there would likely be no synergistic effect on bottom habitat (due to EFHCA protections and footrope requirements), but increased positive synergistic effects on the biological environment and on the socioeconomic environment (due to

increased flexibility that is expected to improve fishing efficiency of trawl gear, increased or improved use of selective devices, increase protection to the net, and reduce enforcement violations). Allowing these actions simultaneously would provide fishermen with multiple potential combinations of gear modifications that would enable them to achieve optimal harvest for their operations, reduce catch of unwanted species or sizes, and better attain the trawl allocation. This, in turn, would likely result in increased positive effects for processors/first receivers and communities, as well as increased positive biological effects for some species.

<u>Conflicts between Selected FPAs and No-action Alternatives</u>

Because Issues A, C, and E are related, there may be some consequences if a mix of No-action Alternatives and FPAs were implemented under this action. Examples of some potential conflicts are described below.

Mesh Size FPA (A3) vs Chafing Gear No-action Alternative (E1): Under the chafing gear No-action Alternative (E1), current regulations show that chafing gear may be used only on the last 50 meshes, measured from the terminal (closed) end of the codend. This regulation has been in place since the 4.5-inch minimum mesh size regulation for groundfish bottom trawls was implemented. Should Alternative A3 and Alternative E1 be adopted and implemented into regulation, there would be a big difference in the length (in feet) of chafing gear that would be allowed for groundfish bottom trawl, depending on mesh size. For example, if Alternative A3 (no minimum mesh size) were adopted, fishermen using 3-inch mesh codends would have to use chafing gear no longer than approximately 12.5 feet, whereas fishermen using 4.5-inch mesh codends could use chafing gear no longer than approximately 18.8 feet. The result in this example could be increased damage to 3-inch mesh codends compared to 4.5-inch mesh codends.

*Chafing Gear FPA (E3) and Codend FPA (C2) vs Mesh Size No-action Alternative (A*1): Under the mesh size No-Action Alternative (A1), the minimum mesh size requirements of groundfish trawl gear, including chafing gear, would be 4.5 inches (bottom trawl) and 3.0 inches (midwater trawl). If the chafing gear FPA (Alternative E3) were adopted along with the No-action Alternative for mesh size (A1), then a minimum mesh size of 4.5 inches would still be required for chafing gear. Likewise, minimum mesh size regulations under the No-action Alternative (A1) would still be required for codends under Alternative C2 (no codend restrictions) if the mesh size No-action Alternative were adopted.

4.5.2 Alternative F3 (Multiple Trawl Gears) and Alternative G3 (Multiple IFQ Management Areas)

Alternative F3 and Alternative G3 may produce synergistic biological and socioeconomic effects. Alternative F3 would allow vessels to fish with both midwater and groundfish bottom-trawl gear on the same trip. Alternative G3 would allow vessels to fish in different IFQ management areas on the same trip.

Under Alternative F3 and Alternative G3, a vessel could, for instance, fish in one IFQ management area with midwater trawl gear and subsequently move into a different management area and fish with bottom-trawl gear. Catch from different gear types would be stowed separately to address concerns expressed by NMFS and the GMT regarding accurate reporting of catch and the information used to evaluate the selectivity of different gear types (Agenda Item G.8.a, Supplemental GMT Report, March 2016, Agenda Item G.9.a, NMFS Report, June 2016).

Under Alternative G3, catch from different areas could comingle and, under the Council preferred accounting option, would be assigned to IFQ management areas pro-rata based on the number of hauls occurring in each management area. Combined with Alternative F3, catch from multiple gears and multiple areas would be sorted and stowed separately by gear type to maintain accurate reporting and accounting of gear selectivity. Under Alternative G3 and Alternative F3, vessels fishing with multiple gears in multiple areas would increase the complexity of catch information compared to the No-action Alternative, or to individual Alternative F3 and Alternative G3. Separation of catch by gear type and on-the-water catch reporting by observers would ensure accurate accounting of catch. Under Alternative G3 and Alternative F3 combined, sorting requirements with continuation of real-time catch tracking would prevent the indirect biological impacts on groundfish, non-target non-groundfish, and protected species resulting from exceeding allocations (and, therefore, potentially ACLs) or misreporting of protected and prohibited species. As a result, Alternative F3 combined with Alternative G3 would have no additional biological impacts.

The combination of Alternative F3 and Alternative G3 could have some synergistic effects on first receivers and processors, resulting in increased complexity of landings. Processors would have to track catch from different gear types separately on fish tickets. Catch from different areas would have to be tracked and attributed according to one of the three accounting options. Preferred accounting Option 2 would require tracking hauls and gears between areas; as a result, offloads and fish tickets would be more complex. Some processors have expressed concern regarding increased complexity of offloads, but they also indicated that allowing vessels to fish with multiple gears in multiple areas would enable better coordination to align harvest portfolios with market demand and maximize catch value (Agenda Item G.5.a Supplemental Workshop Report. June 2016). Increased offload complexity for vessels fishing with multiple gears in multiple areas under this combination of alternatives would have a potential negative effect on harvesters and first receivers. Vessels with catch harvested using multiple trawl gear types and in multiple management areas might take additional time or processor personnel to offload. Processors have indicated a desire to increase the number of plant personnel to handle increased offload volume in response to improved catch attainment under the action alternatives. Vessels offloading catch from multiple

management areas using multiple gears would likely be an infrequent occurrence. Therefore, negative effects from increased offload complexity resulting from a synergy of Alternative F3 and Alternative G3 would be limited in frequency and scope. Vessels and processors/first receivers would predominantly benefit from improved operational flexibility and coordination under Alternative F3 and Alternative G3, and they could use such improved flexibility and coordination to compensate for any increase in offload complexity that may synergistically occur. Both harvesters and processors would still experience low-positive effects from increased operational flexibility and attainment described in Section 4.4.3.2 and Section 4.4.3.3.

4.5.3 Alternative H2 (Multiple Hauls on Deck) Effect on Alternative F3 (Multiple Trawl Gears) and/or Alternative G3 (Multiple IFQ Management Areas)

Alternative H2 combined with Alternative F3 and/or Alternative G3 could lead to a situation where a vessel that wishes to bring a new haul onboard may have catch remaining on deck from a previous haul made in a different area or with a different gear type relative to the new haul. This effect of combining Alternative F3 with Alternative G3 or Alternative H2 would have the potential to produce synergistic biological and socioeconomic effects. The biological and socioeconomic effects of synergies of Alternative H2, combined with Alternative F3 and Alternative G3 are summarized in Table 4-4.

Table 4-4. Synergistic effects of Council's preferred alternatives: Alternative H2 (multiple hauls on deck), Alternative F3 (multiple trawl gears), and Alternative G3 (multiple IFQ management areas).

Alternatives	**Synergistic Effects of Alternative H2 with F3 and G3. (Compared to effects of individual alternatives)**	
	Biological	**Socioeconomic**
H2: Vessel may bring a new haul on board before catch from a previous haul is completely stowed. Observer must complete all sampling duties required first. **F3:** Fishing with both midwater and bottom trawl gear would be allowed on same trip. Catch with different gear types would be stowed separately. **G3:** Fishing in multiple areas on the same trip and tow would be allowed. Catch from different areas may be stowed together.	**Target Species:** Low-negative If pressure on observer to sample and catch complexity becomes excessive, it could affect accuracy of reporting data used in stock assessments **Non-target Species:** Low-negative Some potential would exist for degraded catch data if pressure on observer to sample and catch complexity were to become excessive. **Protected and Prohibited Species**: Low-negative Some potential for misreported catch would exist if pressure on observer to sample and catch complexity were to become excessive.	**Harvesters:** No-change Would improve operational flexibility; safety could be compromised if deck were crowded with catch; vessel would have to sort and store catch from different gear types separately when bringing new haul on board. **First Receivers/Processors:** No change. **Communities:** No change.

Under Alternative H2 and Alternative F3, catch with different gear types under proposed regulations would require that catch be sorted and stowed separately according to gear type; they would not produce additional synergistic effects with Alternative H2 when catch from a previous haul using a different gear type was still on deck.

Under Alternative G3 and Alternative H2, a vessel could bring a new haul on board from a different area than that of the catch from the previous haul still on deck. Under this combination of alternatives, complexity of catch on deck would increase compared to the No-action Alternative. Under current regulations, the vessel would continue to have to ensure that the observer would have enough time between hauls to complete all sampling duties before catch from different areas could be mixed on deck. Synergies

between Alternative H2, Alternative F3, and Alternative G3 could potentially result in compromised vessel safety and reduced accuracy of observer data.

As described in Section 4.4.2.4, increased pressure by vessels on observers to sample quickly so a new haul could be brought on board would have the potential to compromise observer data under Alternative H2. Alternative F3 and Alternative G3 would increase complexity of catch and resulting information collected by observers when vessels used multiple gears in multiple areas. If catch from different gears and areas were to comingle before observer sampling, selectivity of trawl gear types and species composition of management areas would not be accurately represented in the observer data. Observer sample data would have to continue to reflect accurate representation of catch composition for different gear types and areas when under pressure from the vessel to complete sampling duties to bring a new haul on board. If the quality of observer data were reduced, the selectivity of different trawl gear types or species composition of an area may not be accurately represented. Compromised on-the-water observer data used in stock assessments and in-season management of prohibited and protected species when use of multiple gears or fishing in multiple areas occurred might negatively impact the biological environment over time.

Under Alternative H2, vessels would continue to be required to allow the observer enough time between hauls to complete sampling duties before catch from different areas could mix on deck. Vessels must not place additional pressure on observers to complete sampling duties to allow a new haul to be brought on board. After the observer completed sampling, catch from different areas would be allowed to mix. Catch from separate gears, regardless of area, would have to remain separate. Prioritizing separation of catch by gear type and continuing observer accommodation requirements would ensure accurate reporting and accounting of catch and would prevent indirect biological impacts on groundfish, non-target non-groundfish, and protected species resulting from exceeding trawl allocations (and, therefore, potentially ACLs) or misreporting of protected and prohibited species. As a result, synergies of Alternative H2 combined with Alternative F3 and Alternative G3 would potentially have a low-negative biological impact.

4.6 Summary of Impacts

Alternatives for the proposed action are described in Section 2. Impacts of the action alternatives (except Alternative B2, which is administrative) are summarized in Table 4-5. The summary of cumulative impacts is provided in Section 5.5. The no-action alternatives for each issue under the proposed action are as follows:

- Alternative A1 (Mesh Size): Minimum mesh size would be 4.5 inches for groundfish bottom trawl and 3.0 inches for midwater trawl. Minimum mesh size would apply throughout the groundfish trawl net, including chafing gear. Alternative A1 would apply to groundfish trawls coastwide.

- Alternative B1 (Measuring Mesh Size): Mesh size would mean the opening distance between opposing knots for all groundfish trawls, coastwide.
- Alternative C1 (Codend): Only single-wall codends may be used for all groundfish trawls, coastwide. Chafing gear could not be used to create double-wall codends.
- Alternative D1 (Selective Flatfish Trawl): The SFFT must be a two-seamed net with no more than two riblines, excluding the codend. Other definitions of the SFFT pertain to breastline length, floats, footrope length, and description of cut-back headrope. The definition would apply to all SFFTs coastwide. SFFTs would be required shoreward of the trawl RCA north of 40º10' N. latitude.
- Alternative E1 (Chafing Gear): For groundfish bottom trawl, chafing gear could encircle no more than 50 percent of the net's circumference and would be permitted only on the last 50 meshes of the codend. For midwater trawl, chafing gear could cover the bottom and sides of the codend and would not be permitted on the top codend panel, except for a band of mesh that may encircle the net under restraining straps and other trawl components, but must be no wider than 16 inches. This would apply coastwide.
- Alternative F1 (Multiple Trawl Gears): Groundfish vessels may not have both groundfish trawl gear and non-groundfish trawl gear, nor both bottom trawl gear and midwater trawl gear on board at the same time. Vessels may have more than one type of groundfish bottom trawl gear onboard. This would apply coastwide.
- Alternative G1 (Multiple IFQ Management Areas): Shoreside IFQ vessels could not fish in multiple IFQ management areas on a single fishing trip, and they must report catch by IFQ management area separately on fish tickets, coastwide.
- Alternative H1 (New Haul On Board Before Stowing Catch): Shoreside IFQ vessels would be prohibited from bringing a new haul on board until all catch from the previous haul had been stowed, coastwide.

Table 4-5. Summary of impacts of the action alternatives under the proposed action. Impacts levels are compared to no action, and are defined as follows: 0 = no change in impact, L = low change in impact, M = medium change in impact, H = high change in impact. The change in impacts may be positive (+) or negative (+) compared to No Action.

	Physical Environment	**Biological Environment**		**Socioeconomic Environment**			
Alternative	**Habitat/EFH**	**Groundfish**	**Non-target, Non-groundfish, Prohibited and Protected Species**	**Harvesters**	**First Receivers/ Processors**	**Communities**	**Affected Sector**
A2 (4-inch min. mesh)	0	0	0	L+	L+	0 to L+	Groundfish bottom trawl, coastwide
A3 (No minimum mesh size)	0	0 to L- (trawl) 0 (assessments)	0 to L+ (salmon) 0 to L+ (eulachon) 0 (others)	L+	L+	0 to L+	Groundfish trawl, coastwide
C2 (No codend restrictions)	0	0	0	L+	0	0	Groundfish trawl, coastwide
D2 (SFFT, two or four-seam net)	0	0 to L+	0 to L+ (all non-groundfish)	0 to L+	0 to L+	0	Groundfish bottom trawl, coastwide
D3 (SFFT, two- or four-seam net; no longer required north of 40º10' N. latitude)	0	0	0 to L+ (benthic, weak swimming) 0 to L- (pelagic, strong swimming) 0 (P. halibut) 0 to L- (eulachon) 0 to L- (green sturgeon) **M- (Chinook salmon)**	M+	M+	M+	Groundfish bottom trawl: definition coastwide; removal of area restriction north of 40º10' N. latitude

Alternative	Physical Environment	Biological Environment		Socioeconomic Environment			Affected Sector
	Habitat/EFH	Groundfish	Non-target, Non-groundfish, Prohibited and Protected Species	Harvesters	First Receivers/ Processors	Communities	
D3, NMFS Sub-option 1 (Same as D3, except SFFT no longer required north of 42°' N. latitude)	0	0	0 to L+ (benthic, weak swimming) 0 to L- (pelagic, strong swimming) 0 (P. halibut) 0 to L- (eulachon) 0 to L- (green sturgeon) **L- (Chinook salmon)**	M+	M+	M+	Groundfish bottom trawl: definition coastwide; removal of area restriction north of 42° N. latitude
E2 (Chafing gear, sides and bottom of codend may be covered)	0 to L- (bottom trawl)	0	0	L+	0	0	Groundfish bottom trawl, coastwide
E3 (No chafing gear restrictions)	0 to L- (bottom trawl) 0 (midwater)	0	0	L+	0	0	Groundfish trawl, coastwide
F2 (carry multiple trawl gear types)	0	0	0	L+	L+	0 to L+	Shoreside IFQ trawl, coastwide
F3 (carry and fish with multiple gear types)	0	0	0	L+	L+	0 to L+	Shoreside IFQ trawl, coastwide
G2 (fish in multiple IFQ areas on a trip)	0	0	0	L+	L+	0 to L+	Shoreside IFQ trawl, coastwide

	Physical Environment	Biological Environment		Socioeconomic Environment			
Alternative	**Habitat/EFH**	**Groundfish**	**Non-target, Non-groundfish, Prohibited and Protected Species**	**Harvesters**	**First Receivers/ Processors**	**Communities**	**Affected Sector**
G3 (fish in multiple IFQ areas on a trip or a haul)	0	0	0	L+	L+	0 to L+	Shoreside IFQ trawl, coastwide
H2 (Haul can be landed on deck before stowing catch from previous haul	0	L- (catch reporting issues; safety)	L-	L+ overall	0	0	Shoreside IFQ trawl, coastwide
Overall Impact of FPAs	L-	L-	L-	M+	M+	L+	

5 CUMULATIVE EFFECTS

The Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Part 1508.25) reference the need for a cumulative effects analysis (CEA). CEQ regulations define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other action." The purpose of a CEA is to consider the effects of the proposed action combined with the effects of many other actions on the human environment. The CEA assesses impacts that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective. Rather, the intent is to focus on those effects that are truly meaningful. The CEA baseline condition consists of the present condition of the affected resources plus the combined effects of past, present, and reasonably foreseeable future actions which are described below. The present condition of the affected resources is described in the affected environment (Section 3).

5.1 Geographic and Temporal Scope of the CEA

The geographic scope for the physical environment and biological environment is the West Coast EEZ. For the socioeconomic environment, the geographic scope is defined as those United States fishing communities directly involved in the harvest or processing of Council-managed resources, particularly those of the states of Washington, Oregon, and California.

The temporal scope of past and present actions for the affected resources encompasses actions that occurred since FMP implementation in 1982. The temporal scope of reasonably foreseeable future actions is based on the following two criteria:

1. Actions in the West Coast EEZ that affect the same resources affected by the proposed action. Administrative fishery management actions that have no discernible effect are not included.
2. Actions that are not speculative in that the action is defined to an extent that it can be analyzed, including actions for which the Council has decided on a Preliminary Proposed Alternative (PPA) or an FPA.

For this EA, there are three actions that meet these criteria as listed above. Based on the above criteria, the following reasonably foreseeable future actions are considered in this CEA.

Reasonably Foreseeable Future Action	Estimated Effective Date
Pacific Coast Groundfish Fishery 2019-2020 Harvest Specifications and Management Measures	January 1, 2019
Amendment 28 to the Pacific Coast Groundfish Fishery Management Plan (Refine and Expand Habitat Closed Areas and Change the Trawl Rockfish Conservation Area)	June 2019
Amendment 26 to the Pacific Coast Groundfish Fishery Management Plan (Allocation of Harvest Opportunity Between Sectors of the Pacific Coast Groundfish Fishery of Blackgill Rockfish and Other Species Managed in the Slope Rockfish Complex South of 40° 10' N. Latitude)	Mid to late 2019

The anticipated effects of these actions, as they pertain to fisheries, extend into the future, and they do not decrease. Therefore, we do not quantify a temporal scope for the effects of the reasonably foreseeable future actions.

5.2 Summary of Direct and Indirect Impacts of Proposed Action

The direct and indirect impacts of the proposed action are summarized in Section 4.6. See this section for additional information.

5.3 Past, Present, and Reasonably Foreseeable Future Actions

This section discusses the fishery-related and non-fishery-related past, present, and reasonably foreseeable future actions. The discussion does not include the proposed action.

5.3.1 Fishery-related Actions

The Council's management practices for the groundfish fishery are based in the statutory requirements of the MSA, which focus on ensuring that United States fishery resources and their habitats are conserved and maintained to provide optimum fishery yields on a continuing basis. The MSA's fishery management process is intended to provide the Council and NMFS with regular opportunities to assess the status of the fisheries and to make necessary adjustments to ensure that there is a reasonable expectation of meeting the MSA's requirements and the objectives of the groundfish FMPs. To the degree that the MSA-based regulatory regime is complied with, the cumulative impacts of past, present, and reasonably foreseeable future Federal fishery management actions on the affected resources should generally be associated with positive long-term outcomes in contrast with unregulated fishing effort and gear. Constraining fishing effort through regulatory actions can often have negative short-term socioeconomic impacts. These impacts are usually necessary to bring about long-term sustainability of a given resource, which should, in

the long term, promote positive effects on human communities, especially those that are economically dependent upon the managed stocks.

When the trawl catch share program was implemented in 2011, accountability measures were built into the program by applying vessel- and sector-specific harvester allocations and set-asides, as well as increased monitoring. The accountability measures encouraged harvesters to reduce bycatch of non-target species, including discarding undersized groundfish. Increased monitoring allowed for increased accuracy in bycatch estimates of non-groundfish species, including those managed under non-groundfish FMPs and protected species. Provisions were strengthened to ensure that the integrity of the observer monitoring program was maintained at the vessel level (i.e., vessels were prohibited from bringing a new haul on board the deck until all catch from the previous haul had been stowed).

Initial allocations in the catch share program under Amendment 20 and Amendment 21 were based on historical harvest levels in specific geographic management areas, as used in the harvest specifications. Historic management areas were based on stock distribution, and landings and have evolved overtime with new information and stock assessments. For each geographic management area, species specifications have been at the species level, or a species may be managed within a stock complex. Within the trawl catch share program, different species and complexes were allocated and managed by area, while vessels have been prohibited from fishing in different IFQ management areas during the same trip.

The Council implemented a fisheries ecosystem plan and, in 2016, modified all Council-managed FMPs to add protections for unmanaged forage fish. The groundfish FMP was modified and restrictions defined in regulation.

Biennially, the Council reviews the groundfish harvest specification, considers new information, and then establishes specifications for the next two-year period. Examples of a harvest specification include annual catch limits for a species or species complex. Examples of management measures include cumulative landing limits for commercial fisheries, rockfish conservation area boundary adjustments, bag limits, and seasons. Management measures are adjusted, as necessary, to control total fishing mortality.

Past and future harvest specifications contribute to the current status of managed stocks. Management measures directly or indirectly control catch, affecting stock status, fishing opportunity, harvester costs and net revenue, and personal income and employment in fishing communities. At its June 2018 meeting, the Council took final action and selected FPAs. The Council selected harvest control rules (HCRs) for four stocks that depart from the default HCRs used for 2017-18 harvest specifications (California scorpionfish, yelloweye rockfish, and lingcod north and south of 40°10' N latitude). Under the Council's

FPA, the yelloweye rockfish ACL would increase by 18 mt to 48 mt in 2019, and by 19 mt to 49 mt in 2020. The Council's FPAs included the following new management measures:

- Removal of automatic authority to close at-sea whiting fisheries if darkblotched rockfish or POP set-asides are exceeded; elimination of daily vessel limits in the IFQ trawl fishery; new sablefish and lingcod discard mortality rates for the IFQ trawl fishery
- Changing the seaward boundary of the non-trawl RCA between 40°10' N. latitude and 42° N. latitude
- Allowance to fish shoreward of the 40-fm line in the Western Cowcod Conservation Area by commercial and recreational fixed gear fisheries
- Stock complex reorganization (nearshore rockfish complex north of 40°10' N. latitude and the other fish complex coastwide)
- Modifying lingcod retention in the salmon troll fishery
- Addressing certain reasonable and prudent measures in NMFS' 2017 salmon biological opinion for impacts on ESA-listed salmon species under implementation of the Pacific Coast Groundfish Management Plan (NMFS 2017a)

The 2019-2020 harvest specifications would address the following three reasonable and prudent measures specified in the Biological Opinion Incidental Take Statement (NMFS 2017a) for the take of ESA-listed salmon in fisheries managed under the PCGFMP that must be implemented through the 2019-2020 biennial process:

a. Term and Condition 2a requires the Council to review the existing mechanisms in the FMP and related regulations for avoiding and reducing salmon bycatch, including the effectiveness of the Ocean Salmon Conservation Zone and BRAs. Based on this review the Council will make recommendations for increasing the effectiveness of these measures.
b. Term and Condition 3a requires the Council and NMFS to develop and implement initial regulations governing the Reserve of 3,500 Chinook as part of the 2019-2020 biennial specifications and management measures. These regulations will be designed to, among other things, allow for inseason action to prevent any sector guideline plus the full amount of the Reserve from being exceeded and to minimize the chance that the Reserve is used in three out of any consecutive five years.

c. Term and Condition 3c requires NMFS and the Council to develop and implement regulations governing closure of the fishery sector(s) when either the whiting or non-whiting fishery sector exceeds its Chinook bycatch guideline plus the Reserve.

Over the years, numerous actions have been taken to manage gear use in the trawl fisheries to meet the objectives of the FMP and the MSA. Prior to the catch share program, gear restrictions were used to limit effort in specific areas (i.e., EFH conservation areas), to reduce bycatch, and to increase size selectivity of certain species. To allow for escapement of small or undersized fish, historic fishery management actions were used to increase effective mesh size. The restrictions applied to net mesh, codend mesh, chafing gear mesh, coverage and attachment, and the use of double-wall codends. Midwater trawl chafing gear requirements were modified over time to align with requirements in the Alaska groundfish fishery, allowing gear to be used in both regions. Bottom trawl chafing gear restrictions were implemented to reduce fishing effort on more abrasive bottom substrate. Regulations that limited the protection on footropes at the front end of the net were implemented for midwater trawl to encourage the gear to remain off bottom. Footropes greater than 19 inches that allowed fishing in rocky habitat were prohibited, and large and small footrope trawl were defined. The use of large footrope trawl was prohibited in nearshore areas (shoreward of a line approximating 100 fm). To address concerns about overfished species catch and staying within the harvest specification specified for rebuilding, SFFT was introduced. This type of small footrope trawl was developed to maintain a nearshore flatfish trawl fishery while reducing the catch of overfished rockfish species.

In addition to gear restrictions, regulations specify where and when specific gears can be used. These time area restrictions have primarily been used to address concerns about the catch of listed salmonids and overfished species. Gear restrictions on the numbers and types of gears on a vessel were adopted prior to catch shares to aid enforcement in monitoring fishing activities in areas where certain types of fishing were restricted for either catch concerns or habitat concerns.

In 2005, the Council established EFH provisions for the groundfish fishery. The EFH provisions, along with long-term RCA restrictions, were considered by the Council in a 5-year EFH review.[18] The Council has compiled available information on West Coast groundfish habitat associations, fishing activities, prey species, and many other elements of groundfish EFH. The Council has proposed revisions to existing EFH Conservation Areas and RCA areas under Amendment 28. At its April 2018 meeting, the Council took final action and selected an FPA consisting of the following:

[18] https://www.pcouncil.org/groundfish/groundfish-essential-fish-habitat/

- Reopen the groundfish trawl RCA off Oregon and California to bottom trawling.
- Modify the current configuration of EFHCAs where groundfish bottom trawl gear is prohibited coastwide. This includes a new EFHCA prohibiting groundfish bottom trawl gear in most of the Southern California Bight.
- Prohibit use of all groundfish bottom contact gear in waters deeper than 3,500 meters.

In all, the Council took final action to reopen approximately 3,000 square miles to groundfish bottom trawling, close approximately 13,000 square miles (including almost all of the Southern California Bight), and close approximately 123,000 square miles to all bottom contact groundfish gear, in waters deeper than 3,500 meters.

NMFS is developing Amendment 26 (Blackgill Rockfish). In November 2015, the Council took final action to remove blackgill rockfish from the slope rockfish complex south of $40^{0}10'$ N. latitude and reallocate blackgill rockfish and the remaining species in the southern slope rockfish complex to trawl and non-trawl sectors as follows:

- Blackgill rockfish sector allocations: 41 percent to LE trawl and 59 percent to non-trawl sectors
- Remaining southern slope rockfish allocations: 91 percent to LE trawl and 9 percent to non-trawl sectors

5.3.2 Non-fishing Actions

Human-induced, non-fishing activities tend to be localized in nearshore areas and marine project areas where they occur. Examples of these activities include, but are not limited to, agricultural runoff, port maintenance, coastal development, marine transportation, marine mining, beach nourishment, dredging, and disposal of dredged material. These non-fishing activities introduce chemical pollutants and sewage and cause changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment. They pose a risk to all of the identified affected resources. Wherever these activities co-occur, they are likely to work additively or synergistically in their impact on the affected resources. Under ESA and EFH provisions of the MSA, NMFS may review these effects for projects authorized, permitted, or carried out by Federal agencies. For example, NMFS may review projects in "waters of the United States" permitted by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

The Bureau of Energy Management (BOEM) manages the exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf, including renewable

energy, oil and natural gas, and sand and gravel. In January 2018, BOEM announced a draft proposed program for responsibly developing the National Outer Continental Shelf Oil and Gas Leasing Program (National OCS Program) from 2019 to 2024 (BOEM 2018). The plan proposes to make over 90 percent of the total OCS acreage and more than 98 percent of undiscovered, technically recoverable oil and gas resources in federal offshore areas available to consider for future exploration and development. By comparison, the previous program put 94 percent of the OCS off limits. The draft proposed program proposes seven lease sales in the Pacific Region (two each for Northern California, Central California, and Southern California, and one for Washington/Oregon). There have been no sales in the Pacific Region since 1984. Currently there are 43 leases in producing status in the Southern California Planning Area.

Regional projects that are restorative or beneficial in nature include estuarine wetland restoration, offshore artificial reef creation, and eelgrass restoration. These types of projects improve habitats, including nursery habitats for several commercial groundfish species.

In 2012, the United States Coast Guard (USCG) established a standard for the allowable concentration of living organisms in ships' ballast water discharged in waters of the United States, with the intent of preventing and controlling invasions of aquatic nuisance species transported in ships' ballast water. In 2013, the Environmental Protection Agency (EPA) built on the USCG ballast water regulations and standards with general vessel permits for vessel discharges, limiting ballast water and pollutant discharge in United States waters.

Five national marine sanctuaries have been designated in the United States West Coast EEZ. The National Marine Sanctuaries Act authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries.

The U.S. Navy's Northwest Training Range Complex (NWTRC) conducts warfare training, research, development, testing and evaluation operations. These operations may occur in areas containing groundfish, protected species, and other affected resources.

The changing climate is recognized as a long-term trend that is occurring throughout the world. Climate is controlled by a variety of physical forces affecting the input of energy in the CCE and the distribution of energy and material through the system. Climatic shifts, like the short-term El Niños and La Niñas or long-term Pacific Decadal Oscillation may affect the CCE through amounts of upwelling and thus shifts in the trophic cascade. The changing climate contributes to ocean acidification and sea level rise.

5.4 Effects of Past, Present, and Reasonably Foreseeable Future Actions

The sections below describe cumulative effects on the physical environment, the biological environment, and the socioeconomic environment.

5.4.1 Physical Environment

The MSA requires, on an ongoing basis, that we base conservation and management measures on the best scientific information available (16 U.S.C. 1851(a)(2)) and that we consider actions to conserve and enhance EFH (16 U.S.C. 1855(b)). Together, those requirements anticipate a Federal fisheries management regime that results in additional direct and indirect positive effects on habitat through actions that protect EFH for federally managed species and that protect the ecosystem structure on which these species' productivity depends.

Since the implementation of the FMP, fishery management actions (amendments, biennial harvest specifications, and management measures) taken through the FMP processes have had positive trends for the cumulative effects of fisheries on habitat. EFH implementation of the trawl catch share program has had a positive effect on the physical environment as it has reduced the number of vessels on the water and overall trawl fishing hours, given increased efficiency and gear switching provisions. The Fishery Ecosystem Plan (Council 2013) added protections for unmanaged forage fish to the Groundfish FMP, which has had an indirect positive impact on the physical environment.

Increases in harvest specifications amounts for 2019-2020, particularly for yelloweye rockfish, could result increased fishing effort and negative habitat impacts compared to the 2017-2018 harvest specification levels. Of the new management measures evaluated in the 2019-2020 groundfish harvest specifications, only adjusting the seaward boundary of the non-trawl RCA and the shoreward, depth-based boundary in the Western CCA for open access fixed gear and recreational fisheries may have discernable impacts on groundfish EFH. This measure would open areas that were previously closed to fishing to gear types other than trawl, and it would apply to gear types with the potential to result in medium negative impacts (commercial pot and longline gear) to negligible impacts (recreational gear). The area of the non-trawl RCA proposed to be opened is 99.7 percent soft substrate with relatively few observations of habitat forming organisms. Soft substrate within the area to be open would unlikely be materially affected by fixed gear, while hard substrate may be negatively affected, for example by entanglement of line gear on outcrops or biogenic habitat and contact by fish pots. The effects of this proposed change would likely be negligible to medium negative impacts on the physical environment.

Amendment 28 is likely to allow some long-term RCA closures to be reopened, expanding the areas where bottom trawl gear may be used. Amendment 19 introduced EFHCAs to reduce impacts of bottom

contact gears in sensitive areas, and Amendment 28 would likely increase the total area of the EFHCAs, especially of EFHCAs with priority habitat. Therefore, although trawl RCA restrictions may be reduced under Amendment 28, there would likely be less access to sensitive EFH areas than were fished historically. The magnitude of the overall effects of Amendment 28 would likely be positive in the long term.

Amendment 26 would not likely change overall harvest levels or the magnitude or distribution of bottom trawl or non-trawl trawl effort. Therefore, would likely have no change in impacts on the physical environment.

Non-fishing actions would likely have localized negative impacts on habitat/EFH near the project or source. Wherever these activities co-occur, they would likely work additively or synergistically to decrease habitat quality. Exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf could adversely affect groundfish species and their habitat, although projects would undergo environmental review (e.g. NEPA, MSA, MMPA, and ESA) before being approved for implementation. Habitat restoration projects have improved habitats, including nursery habitats for several commercial groundfish species. Due to past and present adverse impacts from human activities on these types of habitat, restorative projects likely would have low positive effects at the local level. Ballast water regulations have been preventing and will continue to help control invasions of aquatic nuisance species transported in ships' ballast water, as well as pollutant discharge in United States waters. These regulations would positively affect groundfish habitat and the physical environment. The marine sanctuaries' science, education, and conservation programs provide positive indirect effects on the marine environment, including groundfish habitat. The U.S. Navy's NWTRC activities would occur in areas containing groundfish habitat, resulting in direct negative effects.

Climate changes may indirectly impact habitat and ecosystem productivity. The way in which climate forcing will affect EFH is not well understood. Effects would depend on the location of EFH and changes in climate forcing vectors such as water temperature and chemistry, currents, and upwelling. Cyclical changes have transient effects on the productivity of the constituent organisms and, thus, on CCE structure. These variations may be considered part of the baseline and would continue to occur in the future. Climate change would likely have medium to high negative impacts on CCE structure.

Overall, the past, present, and reasonably foreseeable future actions have had a low positive effect on the physical environment.

5.4.2 Biological Environment

Those past, present, and reasonably foreseeable future actions that may affect the biological environment, including groundfish, non-target non-groundfish, as well as prohibited and protected species, are described below. Actions with effects on the biological environment may be localized or broad in scope. However, positive actions that have broad implications likely have been, and will continue to be, taken to improve the conditions of groundfish, non-groundfish and protected species.

Fishery management actions taken through FMP processes, have had positive trends in the cumulative effects on the biological environment. The MSA requires, on an ongoing basis, that conservation and management measures be based on the best scientific information available, prevent overfishing and minimize bycatch (16 U.S.C. 1851(a)), and rebuild overfished fish stocks (16 U.S.C. 1854(e)). Together, those, and other MSA requirements, anticipate a Federal fisheries management regime that results in ongoing direct and indirect positive effects on managed groundfish stocks and associated non-groundfish species. Future fishery management actions would have no change in impact to medium positive effects on groundfish; therefore, they would continue ongoing positive trends for fish stocks managed under the MSA. In addition, past fishery management actions taken through the Council process have had a positive cumulative effect on ESA-listed and MMPA-protected species through reduction of fishing effort and implementation of gear requirements for bycatch minimization.

The catch share program (Amendment 20) and the biennial harvest specifications process have allowed for harvest of groundfish species at sustainable levels on a continuing basis. Since implementation of the catch share program, several overfished stocks have been rebuilt. Mesh size and chafing gear restrictions on midwater and bottom trawl have reduced the catch of smaller-size bycatch species, including any incidentally caught forage fish species, by allowing those species to escape through the trawl net top and side panels. The overall effect of the groundfish FMP is positive for the larger biological environment. Forage fish protection measures under the Fishery Ecosystem Plan may have a marginal positive effect on maintaining stock abundance of prey species for piscivorous groundfish and non-groundfish. There are no initiatives stemming from the Fishery Ecosystem Plan that would change interaction rates with protected species. Implementation of the catch share program has reduced groundfish and non-groundfish non-target species bycatch and greatly improved the availability of information on target species, groundfish and non-groundfish non-target species, forage fish, prohibited and protected species. Management measures aim to keep incidental take of protected species within specified thresholds and are adjusted as necessary to address conservation concerns.

Specifications of catch limits for 2019-2020 would continue to consider stock productivity and fishing mortality, and they would likely continue to be effective at ending and preventing overfishing. The proposed new management measures (including the stock complex reorganization proposals) could increase the risk of overfishing, but their effects would be mitigated by the catch share system, as described in Section 4.1.4. The management measures under consideration to address the 2017 salmon biological opinion (NMFS 2017a) are intended to limit the bycatch of salmon, and they would not directly control the catch of groundfish species. These measures would likely be negligible to modestly beneficial for salmon. Harvest policies or fishery performance would not likely change substantially. Therefore, specification and management measures would not likely result in a big change in the composition of incidentally caught non-groundfish.

Amendment 28 proposes to re-open trawl RCA closures to bottom trawl gear. Fishing effort might shift to other areas, including those proposed for reopening. Amendment 28 may result in minor changes in the composition of species caught due to minor shifts in areas fished coastwide. Opening new fishing areas would potentially increase attainment of the trawl allocation for some species. Catch of Dover sole and other flatfish species that are taken on the shelf during summer months would likely increase after removal of the trawl RCA. While higher attainment of underutilized groundfish species such as Dover sole is possible under Amendment 28, the overall catch limits would not change under Amendment 28. Although trawl RCA restrictions may be reduced under Amendment 28, there would likely be less access to sensitive EFH areas than were fished historically. This habitat protection would benefit groundfish and non-groundfish. Non-target species composition may change slightly due to the minor shifts in areas fished coastwide and would continue to be monitored. A shift in fishing effort could impact eulachon positively or negatively, but catch levels in the trawl fishery are relatively low compared to other fisheries and would be monitored (NMFS 2018a). It is unlikely that additional areas being closed or opened in combination with one another would change observation rates under the WCGOP (100 percent monitoring with EM or human observers), change the observed number of interactions, or alter the impacts on other protected resources.

Amendment 26 is not expected to change overall harvest levels or the magnitude or distribution of bottom trawl or non-trawl trawl effort. Therefore, impacts on non-groundfish and protected species would likely be neutral. Amendment 26 could provide stock-specific benefits for blackgill rockfish that management at the complex level does not provide. Overall, it would likely have no change in impact to low positive impacts on the biological environment.

Non-fishing actions would likely have localized negative impact on the biological environment near the project or source. Wherever these activities co-occur, they are likely to work additively or synergistically

to decrease the quality of the biological environment. Groundfish species that rely on nearshore habitats live close to greater concentrations of humans, and they are most likely to be affected by non-fishing human activities. In addition, water pollution may have a negative impact on pelagic species, whether they are introduced by point or non-point sources from land, by ships or energy installations at sea, or by nearshore aquatic human activities like port operations and aquaculture. Exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf could adversely affect groundfish, non-groundfish, and protected species, although projects undergo environmental review (e.g. NEPA, MSA, MMPA, and ESA) before being approved for implementation. Habitat restoration projects have improved habitats, including nursery habitats, for several commercial groundfish species. Due to past and present adverse impacts from human activities on these types of habitat, restorative projects likely would have low positive effects on the biological at the local level.

Ballast water regulations have been preventing and will continue to help control invasions of aquatic nuisance species transported in ships' ballast water, as well as pollutant discharge in United States waters. These regulations would positively affect groundfish, non-groundfish, and protected species. The marine sanctuaries' science, education, and conservation programs provide positive indirect effects on the marine environment, including groundfish, non-groundfish, and protected species. The U.S. Navy's NWTRC activities would occur in areas containing groundfish, non-groundfish, and protected species, resulting in direct negative effects on the biological environment.

Climate changes may indirectly impact the productivity of the biological environment. Warm-water phases in cyclical climate phenomena decrease the productivity of many groundfish stocks. Climate change may lead to range shifts, decreasing or increasing local abundance of groundfish. Climate change could positively or negatively affect non-groundfish or protected species population productivity and abundance, depending on the species and its requirements. This shifting interdependence affects species in different ways at different life stages. In other words, some climate conditions may be beneficial to the survival of larvae of a particular species, but they may have no effect on an adult of the same species. Water temperature, current patterns, water chemistry, and other features contributing to system dynamics, such as coastal upwelling, are likely to be affected by climate change. These physical factors, in turn, will affect biological components such as physiology, productivity, and species distribution. Section 4.5 of the Fishery Ecosystem Plan discusses the effects of climate change in greater detail. Statistical analyses of past climate data has improved our understanding of how climate has affected North Pacific ecosystems and associated marine species productivities. The net effect of climate change on the biological environment cannot be predicted. Overall, the past, present, and reasonably foreseeable future actions have had a medium positive effect on the biological environment.

5.4.3 Socioeconomic Environment

Those past, present, and reasonably foreseeable future actions that may affect the socioeconomic environment and the direction of those potential impacts are discussed below. The magnitude of the effects of these actions on the socioeconomic environment may be small when considered in the context of the large geographic and economic scope of the United States West Coast, but they are important to harvesters, processors, and fishing communities.

Fishery management actions taken through the FMP processes have had both positive and negative effects on human communities. Actions to bring United States West Coast fisheries management and catch limits into compliance with sustainability and conservation requirements of the 1996 Sustainable Fisheries Act amendments to the MSA had short-term and notable negative effects on fishing communities dependent on groundfish resources. Measures to rebuild overfished species have restricted access to healthy stocks over the past 15 years. However, since implementation of the catch share program and the rebuilding of several overfished stocks, revenues from groundfish fisheries have generally increased (NMFS and Council 2017). Continued careful management of FMP resources should have a long-term trend of neutral to positive effects on human communities. The catch share program has had a positive effect on harvesters as they were issued tradable allocations. However, consolidation of the fleet has resulted in less trawl revenue for some processors and communities. The forage fish initiative in the Fishery Ecosystem Plan has had neutral effects on the socioeconomic environment and has not resulted in substantially reduced harvest opportunities for managed species.

Increases in harvest specifications amounts for 2019-2020, particularly for yelloweye rockfish, could result in increased commercial and recreational fishing opportunities and revenues compared to the 2017-2018 harvest specification levels. Preliminary analysis indicates that West Coast groundfish communities would experience an increase of about 900 jobs and $60 million in income in 2019, mostly from changes in recreational access to scorpionfish in California. New management measures would be expected to have mixed socioeconomic impacts. Addressing certain reasonable and prudent measures in the 2017 salmon biological opinion (NMFS 2017a) would likely increase operational costs for groundfish trawl fisheries. Measures such as changes to the seaward boundary of the non-trawl RCA between 40°10' N. latitude and 42° N. latitude, as well as modifications to the allowable fishing depths in the Western CCA for commercial fixed gear and/or recreational fisheries, would likely result in modest socioeconomic benefit. Overall the 2019-2020 harvest specification would likely have a positive socioeconomic impact.

Under Amendment 28, fishing effort might shift to other areas, including those proposed for reopening, thereby mitigating the impacts of displaced landings and displaced revenues from the proposed closed

areas. Although groundfish bottom trawl landings are limited by trawl allocations, opening new fishing areas would give the fleet flexibility to optimize its fishing effort, including potentially increasing attainment of the trawl allocation for some species. Flexibility for operations and access to more fishing area with the potential for increased attainment in those areas would provide economic benefits for the fleet, supply chains, and associated coastal communities.

Amendment 26 would likely result in a lower allocation of blackgill rockfish to the LE trawl sector and the non-trawl sectors compared to what each sector caught between the 2003 and 2013. Ex-vessel revenue and personal income associated with harvesting and processing would be anticipated to decrease slightly. Amendment 26 could redistribute landings revenue from southern port areas to the northern port areas, or it could result in a mixed pattern of shifting landings revenue between northern and southern port areas. Overall, Amendment 28 would have mixed low negative and low positive impacts on the socioeconomic environment.

Many of the non-fishing actions are localized in nearshore areas and marine project areas where they occur. Therefore, the magnitude of those impacts on the socioeconomic environment would likely be mixed and limited in scope. It may, however, displace fishermen from project areas. Agricultural runoff may be much broader in scope, and the impacts of nutrient inputs to the coastal system may have larger magnitude. This may result in indirect negative impacts on the socioeconomic environment by reducing resource availability. As described above, NMFS has several ways it can review non-fishing actions of other federal or state agencies prior to permitting or implementation of those projects. This serves to minimize the extent and magnitude of indirect negative impacts that those actions could have on human communities. Habitat restoration projects would likely have indirect positive impacts on the socioeconomic environment if the projects would lead to increased fishing opportunities through greater stock abundance.

Ballast water regulations likely result in some cost to the shipping industry, but they would positively affect the socioeconomic environment in the long term through control of invasions of aquatic nuisance species. The marine sanctuaries may limit some activities, but, long term, they would likely have a positive socioeconomic impact through preservation, as well as science, education, and conservation programs. The U.S. Navy's NWTRC activities could displace fishermen, but they would have long-term positive impacts on the socioeconomic environment through enhancements of the safety and security of the United States.

Climate changes may indirectly impact the socioeconomic environment in positive and negative ways. Over the very long term (more than 10 years), sea level rise and changes in storm activity could increase

operational costs for maintaining and/or replacing fishery-related infrastructure in fishing communities. If infrastructure were not maintained or replaced in a port, fishery landings would be made elsewhere, reducing income for the affected port. Shifts in the distribution of economically important groundfish, such that less stock would be available to the fishery, would have adverse impacts. Despite the potential for neutral to medium negative short-term effects on the socioeconomic environment, the expectation is that there would be a medium positive long-term effect on socioeconomic environment due to the long-term sustainability of the groundfish resource.

5.5 Summary of the Cumulative Effects of the Proposed Action and Past, Present, Reasonably Foreseeable Future Actions

Section 2 of this EA described the alternatives analyzed and identified the Council's Final Preferred Alternative (FPA) for each of the eight trawl-gear issues analyzed in this EA. A NMFS Sub-option under Alternative D3 is also described in Section 2. Section 4 describes the impacts of each alternative and NMFS Sub-option 1 on the affected resources. Some alternatives may have synergistic effects if implemented simultaneously and Section 4.5 discusses the effects of this potential synergy. For all eight trawl-gear issues, the Council chose the least restrictive alternative for its FPA. Therefore, the synergistic effect of the FPA represents one end of the spectrum of environmental effects, the highest likelihood of adverse environmental effects and positive socioeconomic effects. The no action alternative represents the other end of the spectrum in that the existing gear regulations are the most restrictive alternative.

This section presents the magnitude and significance of the cumulative effects, which are the additive and synergistic effects of the FPA together with past, present, and reasonably foreseeable future actions. Using the FPA for this analysis discloses the biggest potential change in direct and indirect effects, and therefore the biggest potential change in cumulative effects. If, for any resource, the FPA together with past, present, and future actions does not result in a significant cumulative effect, then there would be no significant cumulative effect under any of the other less-restrictive alternatives.

The cumulative effects of the no action alternative are the same as the effects described in Section 5.4, Effects of Past, Present and Reasonably Foreseeable Future Actions, which summarizes the effects on each resource in the absence of any action alternatives. The following sub-sections describe the cumulative effects of the FPA. Any differences between alternatives, sub-options, or issue areas are highlighted in the text.

Overall, when the FPAs for each of the eight issues are considered in conjunction with all the other pressures placed on fisheries by past, present, and reasonably foreseeable future actions, the incremental effect of the FPA would not result in significant impacts, either positive or negative. Therefore, based on

the information and analyses presented in this document, and summarized below by affected resource, there would be no significant cumulative effects associated with any of the analyzed alternatives and sub-options

5.5.1 Physical Environment

Trawl fishermen could access the trawl RCA if it were opened under Amendment 28. It is the footrope, and not chafing gear or double-wall codend, that discourages fishing over high-relief areas due to the potential for costly damage or loss of gear. The codend typically floats above the bottom, due to the taper in the net and floats attached to the codend. Therefore, if fishermen moved into high-relief areas within the RCA, they would do so regardless of the relaxed chafing gear and double-wall codend requirements proposed in this action. Soft substrate makes up the majority (94.2 percent) of the habitat within the RCA boundaries. Soft substrates are the most resilient and the fastest to recover, with full recovery possible in as little as one year after bottom trawling. While hard substrate (including high rocky relief areas) is more vulnerable to the negative impacts associated with trawl gear fishing, only a small portion (2.7 percent) of the RCA area consists of hard substrate.

Most bottom trawl fisherman are expected to target flatfish with small footropes within the former RCA. If fishermen target pelagic rockfish inside of the RCA, they would probably use the modified midwater trawl prior to May 15, as shown by actions of fishermen during the 2017 EFP shoreward of the trawl RCA. Matson and Erickson (2017) described how the distribution of fishing effort may change for bottom trawl in the near future (e.g., new bottom trawl effort within what is currently the boundaries of the trawl RCA). Fishermen may opt to use SFFT while targeting flatfish whether within or shoreward of the RCA to avoid salmon, Pacific whiting, or other unwanted semi-pelagic species. Fishermen who may target pelagic or semi-pelagic rockfish within the RCA or shoreward of the RCA may choose to do so with high-rise, hooded nets, but they may also opt to install salmon excluder devices (e.g., Lomeli and Wakefield 2012) or to select areas and times where Chinook salmon bycatch may be low.

The trawl RCA was not implemented as a habitat protection measure. It was implemented to reduce catch of overfished rockfish species. Fishing historically took place in the trawl RCA as vessels targeted rockfish in these areas. The habitat type within the trawl RCA is mostly soft substrate, with some mixed and hard substrate. EFHRCAs would remain in place, and they would provide protection for hard-bottom habitat areas. Amendment 28 would likely result in a net gain in protection of high relief habitat, even after RCAs were opened.

While the impact analysis in this action is focused on direct and indirect impacts on the physical environment, numerous non-fishing impacts must be considered when assessing cumulative impacts.

Many of these activities are concentrated near-shore and likely work either additively or synergistically to decrease habitat quality. Other non-fishing factors such as climate change may also play a role in habitat degradation.

The no action alternative, considering only the past, present, and reasonably foreseeable future actions (Section 5.4.1), results in low positive cumulative effects on the physical environment. When combined with the FPA's low negative impacts (Table 4-5), the incremental effect of the proposed action would not result in significant cumulative impacts on the physical environment. Therefore, there would be no significant cumulative effects associated with any other combination of alternatives or sub-options.

5.5.2 Biological Environment

The no action alternative, considering only the past, present, and reasonably foreseeable future actions (Section 5.4.2), results in medium positive cumulative effects on the biological environment. When combined with the FPA's low negative impacts, the incremental effect of the proposed action would not result in significant cumulative impacts on the biological environment. Therefore, there would be no significant cumulative effects associated with any other combination of alternatives or sub-options.

5.5.2.1 Groundfish

The proposed action would change how trawl gear is configured and used in the West Coast groundfish fishery. The proposed action would not change the amount of target species that could be harvested. The target groundfish species harvest amounts would likely increase through the 2019-2020 harvest specifications.

Amendment 28 would protect groundfish habitat. Amendment 28 may shift the distribution of fishing effort through removal of the trawl RCA and changes to the EFHRCA areas. When combined with the expected increase in catch limits under the 2019-2020 harvest, the proposed action would further serve to increase flexibility and efficiency, so fishermen may increase catch of healthy groundfish species and attain more of the trawl allocation. The proposed action would not change the amount of target species that could be harvested. These amounts would be set consistent with the Pacific Coast Groundfish FMP, based on the best available science, and would be intended to prevent overfishing while achieving optimum yield as required by the MSA. There would continue to be 100 percent monitoring and accountability for groundfish IFQ species caught.

The proposed action may have an impact on stock productivity if changing the trawl mesh size would cause smaller fish to be harvested. However, there would be no incentive to target smaller fish or reduce the net size to catch more small fish, nor would Amendment 28 or 2019-2020 harvest specifications

change this incentive. Small fish are not marketable, and catch would be covered by IFQ. Therefore, the harvesters would likely reduce their mesh size just enough to address concerns with gilled fish (fish stuck in the net). This, along with improved use of and experimentation with selective devices, may also change size or species selectivity slightly. If, at any time, conservation concerns arise, such as exceedance of an ACL in the 2019-20 harvest specifications, the Regional Administrator for NMFS' West Coast Region (WCR) could restrict fishing through spatial closures, close a sector, or close a fishery. These actions could be taken during routine inseason management or through automatic action authority. Amendment 28 would establish another management tool in BAC boundaries that could be closed to reduce harvest of target or non-target stocks.

5.5.2.2 Non-target, Non-groundfish

It is unlikely that fishing strategies would change significantly throughout the EEZ as a result of the proposed action and reasonably foreseeable future actions. Any changes in distribution of effort and gear type could be strategic (i.e., to improve efficiency and maintain or reduce bycatch; NMFS and Council 2017; Agenda Item G.8 Attachment, March 2016; Matson and Erickson 2017). The trawl industry has an additional incentive for reducing bycatch of all species to remain certified by the MSC (NMFS and Council 2017). The MSC certified the West Coast LE groundfish trawl fishery as sustainable in 2014 (MSC.org). Total catch of non-target, non-groundfish species such as coastal pelagic, forage fish, highly migratory species, shrimp, and halibut may increase or decrease with changes in trawl gear configuration and use, but would likely remain within acceptable harvest levels.

When considered in the context of the fishery management system, the effects of this action on salmon and other protected species would not be significant. The 2017 ITS for salmon (NMFS 2017a) requires the Council to develop mechanisms to close the fishery upon reaching certain take thresholds. The Council proposed such mechanisms in the 2019-2020 harvest specifications. The mechanisms would close a sector (whiting or non-whiting) once a certain amount of salmon has been taken. Additional measures in the 2019-2020 harvest specifications, such as prohibiting all midwater trawling and all bottom trawling except selective flatfish trawl inside the Klamath River Salmon Conservation Zone and Columbia River Salmon Conservation Zone, would provide additional protection in areas where salmon (and green sturgeon) are known to occur.

Under the proposed action, the ability to fish with high-rise trawls shoreward of the RCA may increase salmon catch compared to SFFT if both were towed through the same school of salmon and if fishermen did not use salmon excluders or other trawl modifications. Elimination of SFFT requirements may cause a shift of effort shoreward of the RCA only when midwater trawling is not allowed (January 1 through May

15). After that, most beach draggers that target summer flatfish would likely still use SFFT to avoid bycatch, while those interested in widow and yellowtail rockfish would switch to midwater trawl. During January through March, Chinook salmon bycatch for bottom trawl in deeper waters (seaward of the trawl RCA) is higher than in shallow waters (shoreward of the trawl RCA) (Figure 3-2). Generally, the magnitude of Chinook salmon bycatch is highest during winter months (November to April) and lowest during summer months (May to October) (Figure 3-3). However, bycatch during summer is higher in shallow waters than deeper waters. So, if SFFT requirements were eliminated, fishermen that would shift effort from deeper to shallower waters during January through March might expect a lower bycatch rate.

Overall salmon catch would likely be below the 2017 salmon biological opinion estimates (for example, 5,500 Chinook salmon for non-whiting trawl). The trawl fishery has 100 percent monitoring, and salmon bycatch reports are available approximately 24 hours after the trip. NMFS and the Council can monitor salmon bycatch by species, area, and sector for the trawl fisheries on a weekly basis. Since most historical salmon bycatch has been from the trawl fisheries, the timely reporting of salmon bycatch in the trawl fishery should help ensure that inseason monitoring includes most salmon bycatch.

NMFS and the Council have area management tools in place to address salmon bycatch concerns. BRAs can be used to close depths shallower than a specified depth contour to vessels using midwater gear to minimize impacts on groundfish or any prohibited or protected species such as salmon. Currently in regulation, BRAs are available to close areas shoreward of the 75-fm, 100-fm, and 150-fm depth contours, and can be implemented for a specific sector (i.e., catcher/processor, mothership, shoreside whiting, and shoreside non-whiting midwater) at any latitudinal break (50 CFR 660.11). The Ocean Salmon Conservation Zone (OSCZ) consists of all waters shoreward of a boundary line approximating the 100-fm (183-m) depth contour. When triggered, the OSCZ is closed to the non-tribal whiting fleet. This closure would be implemented coastwide through automatic action when NMFS projects that the Pacific whiting fishery (tribal and non-tribal) may exceed 11,000 Chinook salmon within a calendar year (50 CFR 660.131(c)(3)).

NMFS and the Council can currently modify RCAs inseason through routine action to ease salmon bycatch by the bottom trawl sector and this available at least until Amendment 28 takes effect. BACs in Amendment 28 could prohibit fishing by vessels using groundfish bottom trawl gear at certain depths and latitudes. The waters off the West Coast, seaward of state waters to the 700-fm contour line, are proposed to be divided into separate BACs using existing depth contours and latitudes in regulation. Regardless of any regulations or procedures proposed in reasonably foreseeable future actions, the Regional Administrator of NMFS can close certain areas to fishing or, in the most extreme cases, can close the

entire fishery if a conservation concern were to arise. The 2017 salmon biological opinion requires NMFS to manage to the salmon guidelines.

The fishing industry is also equipped to react quickly, and more directly, to high bycatch events of salmon compared to broad Council or NMFS actions. In recent years, some industry subsectors have shown the ability to be proactive in minimizing salmon bycatch. As an example, the at-sea sectors have instituted self-regulated hotspot closures and move-along rules. The industry has economic and social incentives to minimize salmon bycatch. Voluntary use of salmon and halibut excluder devices would be expected. The trawl industry has the incentive to reduce bycatch of all species to remain certified by the MSC (NMFS and Council 2017). The MSC certified the West Coast LE groundfish trawl fishery as sustainable in 2014 (MSC.org). The Pacific whiting mid-water trawl fishery first achieved MSC certification as a sustainable and well-managed fishery in 2009, and it was recertified in 2017 (MSC.org). It is unlikely that fishing strategies would change significantly throughout the EEZ, due to the reasons described above, and any changes in distribution of effort and gear type could be strategic (i.e., to improve efficiency and maintain or reduce bycatch; NMFS and Council 2017; Agenda Item G.8 Attachment, March 2016; Matson and Erickson 2017). The availability of these measures and the increased incentives to avoid bycatch, combined with advancements in management, monitoring, and technology, would likely result in Chinook salmon bycatch rates remaining similar to those of recent years. Additional areas being closed or opened in combination with one another under Amendment 28 would not change observation rates under the WCGOP (100 percent monitoring with EM or human observers) or change the observed number of interactions beyond what has been observed under baseline conditions.

The proposed action is would likely have no change in impact to low positive impact for very small species, such as eulachon. Three proposed new management measures applicable to the trawl fishery are included in the 2019-2020 harvest specifications (see Section 5.3.1). None of these measures would directly affect eulachon bycatch, but they may have a modest effect on the operation of trawl fisheries, which could indirectly affect bycatch. If the trawl RCA were removed under Amendment 28, large footrope gear might be used seaward of the 100-fm line (currently it is required seaward of the 150-fm line or 200-fm line, depending on latitude). This area restriction would be replaced with a small footrope requirement shoreward of the trawl RCA and north of 42° N. latitude, equivalent to the requirement south of 40°10′ N. latitude. The use of these different gear types in various depth bins could impact eulachon or green sturgeon, but we are uncertain to what extent. Given the relatively small amount of eulachon caught the groundfish trawl fishery and the level of monitoring and tools with which NMFS can respond, cumulative effects to eulachon will not be significant.

5.5.3 Socioeconomic Environment

The proposed action and Amendment 28 would both increase operational flexibility; they are expected to result in positive socioeconomic impacts. Increases in harvest specifications amounts for 2019-2020, particularly for yelloweye rockfish, could result in increased commercial and recreational fishing opportunities on the continental shelf and increased revenues compared to the 2017-2018 harvest specification levels. New management measures would be expected to have mixed socioeconomic impacts, but, overall, the 2019-2020 harvest specification would be expected to have a positive socioeconomic impact. When considered in the context of the fishery management system, the effects of this action on the socioeconomic environment would not be significant. Increased flexibility and efficiency may increase the catch of healthy groundfish species and allow fishermen to attain more of the ACL. However, catch limits would continue be set consistent with the Pacific Coast Groundfish FMP and be based on the best available science, with the goal of preventing overfishing while achieving optimum yield, as required by the MSA.

The no action alternative, considering only the past, present, and reasonably foreseeable future actions (Section 5.4.3), results in medium positive cumulative effects on the socioeconomic environment. When combined with the FPA's medium positive impacts (Table 4-5), the incremental effect of the proposed action would not result in significant cumulative impacts on the socioeconomic environment. Therefore, there would be no significant cumulative effects associated with combination of alternatives or sub-options.

6 REGULATORY IMPACT REVIEW AND INITIAL REGULATORY FLEXIBILITY ANALYSIS

As applicable, rulemakings must comply with EO 12866 and the Regulatory Flexibility Act (RFA). To satisfy the requirements of EO 12866, NMFS undertakes a regulatory impact review (RIR). To satisfy the requirements of the RFA, NMFS prepares an initial regulatory flexibility analysis (IRFA) and final regulatory flexibility analysis (FRFA), or a certification.

> The NMFS Economic Guidelines that describe the RFA and EO 12866 can be found at the following website: http://www.nmfs.noaa.gov/op/pds/documents/01/111/01-111-05.pdf
>
> The RFA, 5 U.S.C. 601 *et seq.*, can be found at the following website: http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/rfa_revised_through_2010_jobs_act.pdf
>
> Executive Order 12866 can be found at the following website: http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/eo12866.pdf

6.1 Regulatory Impact Review

The President of the United States signed EO 12866, "Regulatory Planning and Review," on September 30, 1993. This order established guidelines for promulgating new regulations and reviewing existing regulations. The EO covers a variety of regulatory policy considerations, and it establishes procedural requirements for analysis of the benefits and costs of regulatory actions. The EO stresses that agencies should assess all costs and benefits of available regulatory alternatives when deciding whether and how to regulate proposed actions. Based on this analysis, they should choose those approaches that maximize net benefits to the nation, unless a statute requires another regulatory approach.

NMFS satisfies the requirements of EO 12866 through preparation of an RIR. The RIR provides a review of the potential economic effects of a proposed regulatory action to gauge the net benefits to the nation associated with the proposed action. The analysis also provides a review of the problem and policy objectives prompting the regulatory proposal and an evaluation of the available alternatives that could be used to solve the problem.

The RIR provides an assessment that can be used by the Office of Management and Budget to determine whether the proposed action could be considered a significant regulatory action under EO 12866. EO 12866 defines what qualifies as a "significant regulatory action" and requires agencies to provide analyses of the costs and benefits of such action and of potentially effective and reasonably feasible alternatives. An action may be considered significant if it is expected to achieve the following:

1. Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities
2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency

3. Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof
4. Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the EO

Statement of the Problem
A statement of the problem is available above in Section 1.2.2 of the EA.

Description of the fishery and other affected entities
A detailed description of the fishery and affected entities is covered in Section 3.3 of the EA.

Description of the management goals and objectives
A description of the management goals and objectives is covered in Section 1.2.1 of the EA.

Description of the Alternatives
The Council adopted alternatives for analysis are described in Section 2 of the EA.

An Economic Analysis of the Expected Effects of Each Selected Alternative Relative to the No Action Alternative
A detailed analysis of the expected socioeconomic effects of each selected alternative relative to the No-action Alternative is in Section 4.2.3 (mesh size, measuring mesh size, codends, chafing gear impacts), Section 4.3.4 (selective flatfish trawl impacts) and Section 4.4.3 (multiple gears onboard, fishing in multiple management areas, and fishing before catch is stowed).

RIR-Determination of Significant Impact
As noted above, under EO 12866, a regulation is a "significant regulatory action" if it is likely to do the following:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities
(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency
(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof
(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this EO

Pursuant to the procedures established to implement section 6 of EO 12866, the Office of Management and Budget has determined that this action is not significant.

6.2 Regulatory Flexibility Analysis Certification

For any rule subject to notice and comment rulemaking, the RFA requires Federal agencies to prepare, and make available for public comment, both an initial and final regulatory flexibility analysis, unless the agency can certify that the proposed and/or final rule would not have a "significant economic impact on a substantial number of small entities." This determination can be made at either the proposed or final rule

stage. If the agency can certify a rule, it need not prepare an IRFA, a FRFA, a "Small Entity Compliance Guide," or undertake a subsequent periodic review of the rule under Section 610 of the RFA. The NMFS Regional Administrator/Office Director, using analyses and rationale provided by the Council or NMFS, prepares a memorandum from the Chief Counsel for Regulation (CC/Regs) of the DOC to the Chief Counsel for Advocacy certifying and setting forth the factual basis for the certification. The CC/Regs will sign and transmit the certification to the Small Business Administration (SBA) at the time the notice of proposed rulemaking or final rulemaking is published in the FR, along with a statement providing the factual basis for such certification.

Request for comment on proposed rules
In addition to comments on the analysis below, the agency requests comments on the decision to certify this rule based on the conclusion that, while a significant number of entities in the trawl sector would potentially benefit from the flexibility offered under this largely deregulatory rule, there would not be significant adverse impacts on these entities.

Statement of the objectives of, and legal basis for, the proposed rule
The reasons why agency action is being considered and the legal basis for the proposed rule are explained in the "Purpose and Need for the Action" (Section 1.2) in the EA.

A description and, here feasible, estimate of the number of small entities to which the proposed rule will apply, and a description and estimate of economic effects on entities by entity size and industry
This rule would not directly impose any costs, nor would it include any reporting or recordkeeping requirements or other types of administrative costs for any (small or large) of the directly regulated entities discussed in greater detail below. Part 121 of Title 13, CFR, sets forth, by North American Industry Classification System (NAICS) categories, the maximum number of employees or average annual gross receipts a business may have to be considered a small entity for RFAA purposes. See 13 CFR 121.201. Under this provision, the U.S. SBA established criteria for businesses in the fishery sector to qualify as small entities. Standards are expressed either in number of employees, or annual receipts in millions of dollars. The number of employees or annual receipts indicates the maximum allowed for a concern and its affiliates to be considered small (13 CFR 121.201). A business primarily engaged in Seafood Product Preparation and Packaging (NAICS 311710) is a small business if it employs 750 or fewer persons on a full time, part time, temporary, or other basis (13 CFR 121.106), at all its affiliated operations.[19]

Two small processing entities each own one groundfish permit, required on both catcher vessels and catcher-processors, which would be regulated by the proposed rule. Thirty groundfish vessel permits are owned by seven entities that are considered large, both estimated independently using the definition above, as well as through ownership affiliation to self-reported size standards on groundfish permit and first receiver site license permits (self-reported using the definition above).

Provision is made under SBA's regulations for an agency to develop its own industry-specific size standards after consultation with Advocacy and an opportunity for public comment (13 CFR 121.903(c)). NMFS has established a small business size standard for businesses, including their affiliates, whose

[19] For purposes of rulemaking, NMFS West Coast Region is applying the seafood processor standard to catcher-processors and mothership processor ships, which earn most of their revenue from selling processed Pacific whiting seafood product.

primary industry is commercial fishing (80 FR 81194, December 29, 2015). This standard is only for use by NMFS and only to analyze economic effects in fulfillment of the agency's obligations under the RFA.

NMFS' small business size standard for businesses, including their affiliates, whose primary industry is commercial fishing is $11 million in annual gross receipts. This standard applies to all businesses classified under NAICS code 11411 for commercial fishing, including all businesses classified as commercial finfish fishing (NAICS 114111), commercial shellfish fishing (NAICS 114112), and other commercial marine fishing (NAICS 114119) businesses. (50 CFR 200.2; 13 CFR. 121.201).

LE groundfish vessels must self-report size across all affiliated entities; of the businesses that earn most of their revenue from commercial fishing, one self-reported as large. This entity owns four groundfish permits. The remaining 117 entities primarily involved in seafood harvest self-identified as small, and they own 139 permits.

Not all permit owners choose to fish vessels each season, and active vessels are most likely to be directly impacted by regulations. One hundred thirteen vessels harvested groundfish in the catch share program and would potentially benefit from some or all of the flexibility offered in the proposed rule. Vessels currently use different gear types throughout the year: in 2017 55 vessels used midwater trawl, 20 used fixed gear, and 62 used bottom trawl gear.

In addition to small businesses, the RFA recognizes other kinds of small entities, including small organizations, defined as any not-for-profit enterprise that is independently owned and operated and not dominant in its field. There is no available guidance beyond this statutory language regarding how to determine if non-profit organizations are "small" for RFA purposes. The SBA does have provisions for determining whether a business is small for RFA purposes and whether it is "dominant in its field," and those provisions can inform how NMFS classifies non-profit organizations for the purposes of RFA analyses in rulemaking. After consultation with the SBA, NMFS has decided to use SBA's size standards for non-profit organizations to determine whether a non-profit organization is small and, in turn, whether it is dominant in its field, to apply the statutory definition of a small organization in practice:

A nonprofit organization is determined to be "not dominant in its field" if it is considered "small" under SBA size standards, which for environmental, conservation, or professional organizations (NAICS 813312, 813920) is combined annual receipts of $15 million or less.

The one not-for-profit organization owns four LE trawl permits which, if actively fished, would be impacted by the rule. This entity self-reported fiscal year 2017 receipts of $1.1 billion and would, thus, be considered large by the criteria outlined above.

An explanation of the criteria used to evaluate whether the rule would impose "significant" economic effects

NMFS considers two criteria in determining the significance of adverse regulatory effects: disproportionality and profitability.

Disproportionality: Disproportionality compares the effect of the regulatory action between small and large entities. These regulations are anticipated to benefit all entities, and they are not expected to place any of the small entities described above at a significant competitive disadvantage to large entities.

Profitability: As discussed above, there are no compliance costs for entities associated with this rule anticipated for the 2019-2020 biennium. It is assumed, based on available analyses in the supporting EA document and its appendices, that there will not be any explicit costs associated with this rule. Total/variable/operating costs are not available for most sectors; however, analyses summarized in the EA

above indicate either neutral or positive changes in expected total gross revenue. These increases in total revenue would overstate the likely impacts on profits, as they do not consider variable operating costs. With increased flexibility may come increased opportunity, and annual variable costs may rise for harvesters increasing their days at sea or experimenting with new gear types. They are not, however, predicted to increase as a proportion of revenue. It is rational to assume that entities will only take additional trips or invest in new gear if doing so increases their profits; thus, with no compliance costs, the rule would likely be either neutral or positive for profitability.

An explanation of the criteria used to evaluate whether the rule would impose effects on a substantial number of small entities

This rule provides flexibility for gear configurations and use to the entire catch share portion of the groundfish fishery, with 189 permits and 113 vessels actively harvesting in 2017. Most of the components of the rule focused on the trawl gear portion of the sector. The rule would, thus, likely provide some level of benefit, through this flexibility, to a substantial number of small entities. Because modifying gear within the new regulatory regime to better fit targeting strategies is optional, and up to the discretion of the operator, some vessels may choose not to modify gear operations and, thus, would not be affected by this rule. For vessels such as those participating in current exempted fishing permits testing new gear configurations and that do anticipate changing their gear use under the new regulations effects would likely be positive. Many, if not all, vessels that wish to change their gear have invested in modifications to participate under the exempted fishing permit, which reduces the costs of electing to change gear on the vessels after the proposed rule is implemented.

A description of, and an explanation of the basis for, assumptions used

Data used to inform this analysis come primarily from PacFIN, which includes data provided by the states of Oregon, California, and Washington on commercial fishing trips and landings; in addition to the WCR permit database. The number of entities predicted to be impacted is generally based on the level of participation in the previous year (2017). However, it is possible that changes in environmental or management conditions in other fisheries would impact levels of participation in the groundfish fishery beyond what is predicted here.

Certification statement by the head of the agency

The agency finds per 5 U.S.C. 605 (the RFA) that “the proposed rule, if promulgated, will not have a significant economic impact on a substantial number of small entities.”

Reviewed by West Coast Regional Economist Abigail Harley

7 FINDING OF NO SIGNIFICANT IMPACTS (FONSI)

7.1 Background

Proposed Action:

The proposed action is to revise and remove trawl gear regulations for the Pacific coast groundfish fishery's trawl catch share program, including trawl gear configuration and gear use, as described in this Environmental Assessment (EA).

Alternatives Evaluated in the Environmental Assessment:

Section 2 of the EA describes the alternatives evaluated in the EA. Modifications are proposed for eight components of the current trawl-gear regulations. A summary of these eight "issues" and associated alternatives follow.

(A) Minimum Mesh Size (Section 2.1)

- A1 (No Action) – 4.5-inch minimum for bottom trawl and 3.0-inch minimum for midwater trawl
- A2 – 4.0-inch minimum mesh for groundfish bottom trawl
- A3 – No minimum mesh size for groundfish bottom or midwater trawl (Council preferred)

(B) Measuring Mesh Size (Section 2.2)

- B1 (No Action) – Mesh measurements taken diagonally between knots
- B2 – Mesh measurements taken diagonally between knots (knotted webbing) or corners (knotless webbing) (Council preferred)

(C) Codend Regulations (Section 2.3)

- C1 (No Action) – Only single wall codends may be used
- C2 – Double-wall codends allowed (Council preferred)

(D) Selective Flatfish Trawl (SFFT) (Section 2.4)

- D1 (No Action) – Two-seamed SFFT required shoreward of the trawl RCA north of 40°10' N. lat.
- D2 – Two- or four-seamed SFFT required shoreward of the trawl RCA north of 40°10' N. lat.
- D3 – SFFT may be two- or four-seamed net, but not required north of 40°10' N. lat. (Council preferred)
- D3, NMFS Sub-option 1 – SFFT may be two- or four-seamed net, but not required north of 42° N. lat.

(E) Chafing Gear (Section 2.5)

- E1 (No Action) – For groundfish bottom trawl, chafing gear may encircle no more than 50 percent of the codend circumference and may only cover the last 50 meshes; for midwater trawl, chafing gear may encircle the bottom and sides of the codend but is not permitted on the top panel
- E2 – Bottom trawl chafing gear regulations would be revised to align with midwater trawl
- E3 – Chafing gear regulations eliminated for groundfish bottom trawl and midwater trawl (Council preferred)

(F) Multiple Trawl Gears on Board (Section 2.6)

- F1 (No Action) – Groundfish bottom trawl and midwater trawl not allowed on board simultaneously
- F2 – Groundfish bottom trawl and midwater trawl allowed onboard shoreside IFQ trawl vessels simultaneously; only one gear type may be fished during a trip

- F3 – Groundfish bottom trawl and midwater trawl allowed on board shoreside IFQ trawl vessels and both may be fished during a single fishing trip (Council preferred)

(G) Fishing in Multiple IFQ Management Areas (Section 2.7)

- G1 (No Action) – Shoreside IFQ trawl vessels prohibited from fishing in multiple IFQ management areas on the same trip
- G2 – Shoreside IFQ trawl vessels allowed to fish in multiple IFQ management areas on the same trip, but not during the same tow
- G3 – Shoreside IFQ trawl vessels allowed to fish in multiple IFQ management areas on the same trip and the same tow (Council preferred)

(H) Bringing a New Haul on Board before Previous Catch is Stowed

- H1 (No Action) – Shoreside IFQ trawl vessels are prohibited from bringing a new haul on board until all catch from the previous haul has been stowed
- H2 – Shoreside IFQ trawl vessels allowed to bring a new haul on board before all catch from the previous haul has been stowed, but catch from separate hauls would not be mixed on deck until after the observer sampling has been completed (Council preferred)

Selected Alternatives:

NMFS selected the following Council-preferred alternatives: A3, B2, C2, E3, F3, G3, and H2. NMFS has selected Alternative D3 Sub-option 1, instead of the Council-preferred Alternative D3, because of the uncertainties associated with bottom trawl bycatch of Chinook salmon between 40°10' N. latitude and 42° N. latitude (see page 2-123 of the 2017 salmon biological opinion [NMFS 2017a]). Together, these eight components constitute the proposed action discussed in this FONSI, and are hereafter referred to as the "selected package".

Measures to Reduce Impacts:

Mitigation measures built into the trawl catch share program and Terms and Conditions of biological opinions ensure that impacts of the selected package to the human environment would not be significant. These mitigation measures, which are described in Section 4.1.4, are built into the catch share program and are independent of the proposed action. They include increased flexibility for fishermen, catch controls (various quotas, caps, and thresholds for target and non-target species), 100 percent monitoring and reporting of fishing locations and discarded catch, area management, footrope requirements, closed areas to protect sensitive bottom habitat, and reduced trawling effort relative to the pre-catch share period. Terms and conditions provided by biological opinions also ensure that catch of protected species would likely remain below the prescribed Incidental Take Statement (e.g., see NMFS 2017a) (Section 3.2.3). The selected package does not introduce any new measures to reduce impacts.

Related Consultations:

Section 3.2.3 of the EA describes the Endangered Species Act consultations related to the selected package.

7.2 Significance Review

The Council on Environmental Quality (CEQ) Regulations state that the determination of significance using an analysis of effects requires examination of both context and intensity, and lists ten criteria for intensity (40 C.F.R. § 1508.27). In addition, the Companion Manual for National Oceanic and Atmospheric Administration Administrative Order 216-6A provides sixteen criteria, the same ten as the CEQ Regulations and six additional, for determining whether the impacts of a proposed action are significant. Each criterion is discussed below with respect to the proposed action and considered individually as well as in combination with the others.

1. Can the proposed action reasonably be expected to cause both beneficial and adverse impacts that overall may result in a significant effect, even if the effect will be beneficial?

No. The selected package is not reasonably expected to cause beneficial or adverse impacts that result in a significant effect overall. The impacts of the selected package on the biological, physical, and human components of the environment are described in Section 4 of the EA. The Council's preferred alternatives that NMFS has selected may result in some negligible to low negative impacts to the physical and biological environment as well as negligible to low positive benefits to the socioeconomic environment.

NMFS expects medium-positive impacts to the socioeconomic environment from Alternative D3, NMFS Sub-option 1 (see Table 4-5 in the EA), but these impacts would be restricted to the area shoreward of the trawl RCA off the coast of Oregon and Washington for groundfish bottom trawl. Other gear types (e.g., midwater trawl) and fishing areas (e.g., all groundfish bottom trawling areas seaward of the trawl RCA north of the Oregon-California border and all areas outside of trawl RCAs off the California coast) would experience negligible impacts under Alternative D3, NMFS Sub-option 1.

2. Can the proposed action reasonably be expected to significantly affect public health or safety?

No. Although alternatives F3 and H2 are expected to result in low positive impacts (including safety) for some shoreside IFQ harvesters (Section 4.4.3.2; Section 4.4.3.4), these alternatives would likely affect only a small subset of harvesters and a small subset of trips and tows. As a result, the selected package is not expected to significantly affect public health or safety.

3. Can the proposed action reasonably be expected to result in significant impacts to unique characteristics of the geographic area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?

No. Significant impacts are not expected to occur on any of the above areas. The selected package is located in the marine environment and does not open new areas that were not previously affected by groundfish fishing.

4. Are the proposed action's effects on the quality of the human environment likely to be highly controversial?

No. The impacts of the selected package are not expected to be controversial. When the action was first proposed, there was the perception that the selected package would increase discards and increase catch of juvenile fish. However, because of the analysis shown in Section 4 of this EA, and because of the incentives and the mitigation measures built into the catch share program (Section 4.1.4), NMFS believes that the physical and biological impacts of the selected package will range from negligible to low negative compared to No Action.

5. Are the proposed action's effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

No. The possible effects of the selected package on the human environment are limited in their uncertainty (Section 4.1.3). There may be some uncertainty around how relaxing or removing trawl-gear or trawl-use requirements may impact bycatch, but the fishery already has monitoring and bycatch reduction measures in place to help address that uncertainty and keep catches within their predetermined limits (Section 4.1.4). The effects on the human environment from the selected package are neither unique nor unknown. There were no unique or unknown risks identified during the development of selected package of alternatives, nor did any surface during preparation of the required environmental documentation.

6. Can the proposed action reasonably be expected to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration*?*

No. The selected package will not be setting precedents for future actions with significant effects because future actions, including gear changes and gear use, will be analyzed under NEPA and MSA.

7. Is the proposed action related to other actions that when considered together will have individually insignificant but cumulatively significant impacts?

No. The cumulative effects of the selected package are detailed in Section 5 of the EA. Overall, when the selected package is considered in conjunction with all the other pressures placed on fisheries by past, present, and reasonably foreseeable future actions, the incremental effect of the selected package would not likely result in cumulatively significant impacts, either positive or negative.

8. Can the proposed action reasonably be expected to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?

No. The impacts of the selected package on the human environment are described in Section 4 of the EA. No impacts to districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places are expected to occur. Additionally, no impacts are expected that may cause loss or destruction of significant cultural, scientific, or historical resources.

9. Can the proposed action reasonably be expected to have a significant impact on endangered or threatened species, or their critical habitat as defined under the Endangered Species Act of 1973?

No. The impacts of the selected package on endangered and threatened species and critical habitat are described in Section 4 of the EA. The selected package is not expected to have a significant impact on endangered or threatened species, or their critical habitats.

10. Can the proposed action reasonably be expected to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection?

No. The selected package is not expected to alter fishing methods or activities such that they would threaten any federal, state, or local laws or requirement for the protection of the environment.

11. Can the proposed action reasonably be expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act?

No. The selected package is not expected to adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act (MMPA). The West Coast groundfish trawl fishery is considered Category III fisheries under MMPA, indicating a remote likelihood of or no known incidental mortality and serious injury of marine mammals (83 FR 5349, February 7, 2018).

12. Can the proposed action reasonably be expected to adversely affect managed fish species?

No. Groundfish species harvest amounts are set consistent with the Pacific Coast Groundfish FMP, are based on the best available science, and are intended to prevent overfishing while achieving optimum yield as required by the MSA. Mitigation measures that are built into the catch share program (e.g., 100 percent monitoring, individual accountability, quotas, trip/possession limits, size limits, and time/area closures) are expected to continue maintaining target and non-target groundfish harvest below overfishing levels. The selected package will not change the amount of target and non-target groundfish species that can be harvested, nor any of these mitigation measures, harvest levels, or overfishing levels.

The selected package may have an impact on stock productivity if changing the trawl mesh size (or effective mesh size) causes smaller fish to be harvested. However, there is no incentive for harvesters to target smaller fish or reduce the mesh size of the net so as to catch more small fish. These undersized fish are not marketable and harvesters would have to use their IFQ to cover the catch. In addition, reducing mesh size (or effective mesh size) of the trawl may reduce flow, increase drag, and reduce fishing efficiency.

It is expected that a limited number of harvesters using bottom trawl may reduce codend mesh size to 3.0 or 3.5 inches to address concerns about gilled fish (fish stuck in the net) when targeting widow rockfish, yellowtail rockfish, and canary rockfish (schooling pelagic or semi-pelagic species). Bycatch of non-target species is low when harvesters target these semi-pelagic and pelagic rockfishes. In addition, mesh size has little effect on size selectivity for these semi-pelagic and pelagic rockfishes.

Total catch of other non-target species by groundfish trawl may be negligible (i.e., rarely encountered), taken into account by other FMPs (e.g., CPS and HMS), or managed with harvest caps. For example, Pacific halibut regulations are in place under the Pacific Coast Groundfish FMP and the Halibut Act and Area 2A Catch Sharing Plan to limit incidental harvest.

13. Can the proposed action reasonably be expected to adversely affect essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act?

No. The selected package is not expected to adversely affect essential fish habitat. The selected package does not change any areas that are currently closed to fishing, such as Essential Fish Habitat Conservation Areas (EFHCAs) designed to protect sensitive habitat from bottom contact gear. Additionally, increased targeting of widow rockfish, canary rockfish, and yellowtail rockfish shoreward of the trawl RCA with non-SFFT gear (north of 42° N. latitude) would likely occur using groundfish bottom trawl over soft-bottom habitat or using pelagic trawls fished off the ocean floor and in the water column away from any high relief structures that could harm their nets. Finally, the selected package does not change small footrope requirements for bottom trawl shoreward of the RCA; this small footrope requirement provides a strong disincentive for harvesters to fish with bottom trawl over high-relief habitat.

14. Can the proposed action reasonably be expected to adversely affect vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystems?

No. The selected package is not expected to adversely impact vulnerable and sensitive marine or coastal ecosystems compared to No Action. The selected package does not open any new vulnerable or sensitive areas to fishing that are currently closed, such as EFHCAs designed to protect sensitive habitat from bottom contact gear. Additionally, increased targeting of widow rockfish, canary rockfish, and yellowtail rockfish shoreward of the trawl RCA with non-SFFT gear (north of 42^{o} N. latitude) would likely occur using groundfish bottom trawl over soft-bottom habitat or using pelagic trawls fished off the ocean floor and in the water column away from any high relief structures that could harm their nets. The small footrope requirement will provide a strong disincentive for harvesters to fish with bottom trawl over high-relief habitat shoreward of the trawl RCA.

15. Can the proposed action reasonably be expected to adversely affect biodiversity or ecosystem functioning (e.g., benthic productivity, predator-prey relationships, etc.)?

No. Adverse impacts to biodiversity and ecosystem function are not anticipated under the selected package. The Pacific Coast Fishery Ecosystem Plan (FEP) (Council 2013) provides information on groundfish and ecosystem interactions, including predator-prey relationships. The various life stages of groundfish play a role in ecosystem function. As referenced in the FEP, the Atlantis model of the California Current Ecosystem (CCE) may provide some information on large scale fishery impacts on the CCE. The selected package could increase the catch of smaller fish through changes to mesh size (or effective mesh size), and removing smaller fish may negatively affect biodiversity or ecosystem function. However, the effect is not expected to be significant because the incentive to take small fish does not exist as they are not marketable. It is likely that groundfish trawlers would strategically only use smaller mesh or double-wall codends to improve the function of selective devices (such as escape panels) rather than to retain smaller fish. Finally, harvest is expected to remain within allowable harvest levels due to mitigation measures that are built into the catch share program (Section 4.1.4). Harvest would be 100 percent monitored with timely reporting, and if a conservation concern arises, then different mitigation tools are available to the Council and to the Regional Administrator to reduce harvest, if necessary.

16. Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

No. Activities under the selected package will not involve the transport of non-indigenous species. Participating vessels would not increase the risk of introduction through ballast water or hull fouling because they are vessels that have been and continue to be based on the west coast of the United States. Disposition of the catch does not include any translocation of living marine resources, nor use of any nonindigenous species as bait.

7.3 Determination

In view of the information presented in this document and the analysis contained in the supporting environmental assessment prepared for an action to revise and eliminate restrictions on groundfish bottom and midwater trawl gear used in the Pacific Coast Groundfish Fishery, it is hereby determined that this action will not significantly impact the quality of the human environment as described above and in the supporting environmental assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an environmental impact statement for this action is not necessary.

Barry A. Thom
Regional Administrator
West Coast Region
National Marine Fisheries Service

11/09/2018
Date

8 CONSISTENCY WITH MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (MSA) AND OTHER APPLICABLE LAWS

8.1 Magnuson-Stevens Fishery Conservation and Management Act

Below are the 10 National Standards as contained in the MSA, 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.

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.

MSA section 303(a)(3) requires that each FMP include an estimate of MSY and OY for the fishery. OY is the amount of fish that will provide the greatest overall benefit to the United States, particularly with respect to food production and recreational opportunities, while taking into account the protection of marine ecosystems. OY is prescribed as such on the basis of the MSY from the fishery as reduced by any relevant economic, social, or ecological factor; and in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery.

The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing (50 CFR 600.310(b)). In establishing OYs, the interim step of calculating OFLs, ABC, and ACLs is taken (PCGFMP Section 4.1). OFL is the MSY harvest levels associated with the current stock abundance. Over the long term, if OFLs are fully harvested, the average of the OFLs would be MSY. ABC is a threshold below the OFL, which accounts for scientific uncertainty in the estimate of OFL. ACL is a harvest specification set at or below ABC, and it is intended to prevent overfishing. The ACLs are established to achieve OY. The OY for a stock or stock complex is the long-term average of the stock or stock complex ACLs.

Since 2005, fishing with groundfish bottom trawl gear other than SFFT shoreward of the trawl RCA north of 40°10′ N. latitude has been prohibited in order to rebuild overfished rockfish stocks. However, these previously overfished stocks, including canary, widow, and yellowtail rockfish, have since been rebuilt, and the SFFT requirement shoreward of the trawl RCA is limiting the fleet’s capacity to achieve their trawl allocations following the recently expanded ACLs for many groundfish stocks. As such, this action’s Alternative D3 (remove SFFT requirements) will enable the trawl sector to more reasonably achieve their trawl allocation, which in turn will better enable the groundfish fishery to attain OYs..

Prior to the implementation of the catch share program, a number of gear-use and area restrictions were in place to track catch of specific stocks by gear type and area (e.g., needed for enforcement and stock assessments) because less than 20 percent of the hauls were observed at sea. Given the implementation of the catch share program and 100 percent observer coverage, these restrictions are no longer necessary and limit the flexibility of vessels, preventing them from achieving the trawl allocation. Alternatives F3 (fish multiple gears) and G3 (fish multiple IFQ management areas) in this action will afford vessels the flexibility necessary to optimize their operations and increase yield, improving the likelihood of attaining the trawl allocation and therefore the OY for the groundfish fishery.

Finally, a number of trawl gear restrictions implemented prior the catch share program, intended to mitigate catch of undersized or unwanted species in the absence of 100 percent observer coverage and/or mitigate impacts to the seabed by trawl gear, also hinder the attainment of the groundfish trawl allocations. Alternative A3 (eliminate mesh size restrictions), Alternative C2 (eliminate codend restrictions), and

Alternative E3 (eliminate chafing gear restrictions) are no longer necessary due to provisions built into the catch share program (e.g., individual quotas and 100 percent observer coverage), EFHCA protections, and continued small footrope requirements. Eliminating these requirements will provide trawl fishermen the flexibility to experiment with and modify their trawl gear to increase catch of marketable fish while reducing the catch of unmarketable and unwanted species, and therefore enable the groundfish fishery to more reasonably achieve OY.

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

The best available science standard applies to the following areas relative to this proposed action: stock assessments, rebuilding analyses, and methods for determining management reference points (OFL, ABC, ACL, etc.); these areas form the basis for determining necessary gear restrictions and the evaluation of socioeconomic impacts. The removal of trawl gear restrictions reflects the application of the best scientific information available to current harvest management policies.

The impacts of this action were considered using analysis for and of 2017 and 2018 trawl-gear EFPs, designed to evaluate potential impacts of some action alternatives on small scale (e.g., eliminate minimum mesh size and SFFT requirements). The impacts of this action on fisheries stocks have been based on most recent stock assessments for groundfish. Recent catch, landing, and economic data were obtained from PSMFC (PacFIN), WCGOP, EDCP reports, and information provided by the West Coast groundfish trawl catch-share program five-year review. Most recent biological opinions and endangered species workshop reports informed potential impacts to protected species. Finally, results of peer-reviewed research articles and government/university reports were included in the analysis of this action.

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.

The Council develops and designates management units for groundfish, which include stocks, stock complexes, or geographic subdivisions thereof. Groundfish ACLs are set for these management units. The Groundfish SAFE document details the process by which ACLs for each management unit are developed.

In general, stocks, stock complexes, and geographic subdivisions are managed through the methods in the following discussion. Stocks with their own ACLs are managed throughout the range of that stock (as opposed to the species), although issues do arise in the case of stocks straddling international borders. For this reason, allocation of the harvestable surplus of Pacific whiting between the United States and Canada is subject to international agreement.

Stock complexes group co-occurring species (e.g., Other Flatfish), many of which have not been formally assessed. The 2018 Groundfish SAFE document describes how ACLs for stock complexes are developed, based on ABC and ACL estimates of component stocks. Stocks within these complexes are not managed individually for a variety of reasons including the lack of assessments, lack of reliable catch data at the species level, or the fact that they constitute a small portion of catches. If a stock within a complex is individually assessed, it may be managed under a separate harvest limit, when practicable.

Separate ACLs may be set for geographic subcomponents of a stock for management purposes. However, the development of subcomponent ACLs is based on managing these stocks throughout their range within United States waters.

This action does not alter the previous stock categorizations in the West Coast groundfish fishery but supports their management as determined in the PCGFMP.

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.

The PCGFMP describes allocation decisions made during this biennial harvest specification process. The proposed measures will not discriminate between residents of different states. Decision-making on allocations occurs through the Council process, which facilitates substantial participation by state representatives and the public. Generally, state proposals are brought forward when alternatives are crafted and integrated to the degree practicable. Emphasis is placed on equitable division while achieving conservation goals. Allocation decisions are also made as part of the Council's biennial harvest specifications process for those stocks that do not, at present, have established formal allocations under the PCGFMP.

This action is intended to improve flexibility and efficiency for all groundfish harvesters using trawl and groundfish processors/first receivers across the states of Washington, Oregon, and California.

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.

Currently, trawl gear restrictions implemented during the trip-limit era (a period with less than 20 percent observer coverage) are layered on top of a catch-share program that includes 100 percent observer coverage. This regulatory environment limits flexibility and prevents the groundfish trawl fishery from efficiently harvesting fish stocks.

Alternative A3 of this action allows for vessels to purchase mesh sizes and experiment with selective devices to optimize their operations. Alternative C2 allows for greater flexibility of codend configuration, providing improved use of excluders that could increase the proportion of marketable fish in a haul. Alternative C2 additionally allows for more strategic physical strengthening and protection of codends, which can lengthen the life of fishing gear and lower the costs of the fishery. Alternative D3 will allow vessels to diversify their catch shoreward of the trawl RCA north of 40°10′ N. latitude, which will increase income for those who utilize it. Alternative E3 will allow vessels to better protect their nets without inhibiting escapement of undersized fish, thereby lowering net maintenance and replacement costs. Alternative F3 allows vessels to more dynamically choose what gear to use, improving their ability to adapt to conditions, change fish locations and target species, and respond to market demands without the need and expense of transiting back to port to change gear types. Alternative G3 allows vessels to have more flexibility in regions where fishing ranges are bisected by IFQ management lines and similarly eliminates costs of transiting back to port to declare fishing in a new IFQ management area.

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

Management measures reflect differences in catch, and, in particular, bycatch, of overfished species, among different fisheries. Such measures include spatial closures, catch control, and input controls. For example, different RCA configurations are established for different gear types (trawl versus fixed gear). Catch control tools can be specific to a fishery. For example, at-sea whiting fisheries are managed by co-ops, the shorebased groundfish trawl fishery by IFQs, and LE fixed gear fishery for sablefish by vessel-level allocations (permit stacking). Within these fisheries, and in the OA sector, cumulative trip limits are used

for particular management units and/or during certain times of the year. Input control can be used as a recreational fishery management tool, for example, area closures and bag limits can be proposed by the states and are appropriate to the catches and characteristics of each state's recreational fishery.

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

Generally, by coordinating management, monitoring, and enforcement activities between the three West Coast states, duplication and, thus, cost are minimized. Three of the alternatives in this action take particular steps towards minimizing costs of enforcement: Alternatives A3, C2, and E3 reduce enforcement costs by eliminating and/or simplifying restrictions that must be enforced.

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.

The alternatives laid out in this action take steps to improve flexibility for groundfish trawl vessels, which will improve their capacity to utilize fishery resources to the benefit of fishing communities. Alternative D3 will allow vessels to diversify their catch shoreward of the trawl RCA north of 40°10′ N. latitude, which will increase income for those who utilize it. Alternative F3 allows vessels to more dynamically choose what gear to use during a trip, improving their ability to adapt to conditions, fish locations, and market demands or market orders, and eliminating the cost of transiting back to port to change gear types. Alternative G3 allows vessels to have more flexibility in regions where fishing ranges are bisected by management lines and similarly eliminates costs of transiting back to port to declare fishing in a new IFQ management area.

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.

Minimizing bycatch is an important component of the alternatives. Through the use of RCAs, fishing effort is reduced in areas where overfished species are (or were) most abundant, thereby reducing potential bycatch of overfished species. Catch share management, particularly in the shorebased IFQ fishery, has reduced bycatch by eliminating most regulatory discards (some non-target species are managed with cumulative trip limits, which may induce some level of regulatory discards). The catch share program has also resulted in the voluntary reduction in catch of overfished groundfish, undersized groundfish, and other unwanted species due to individual accountability, 100 percent observer coverage, and MSC certification. Alternatives A3 and C2 will allow vessels more flexibility in the configuration of their nets, opening up leeway to experiment with excluders or other size/species selectivity devices that could further decrease bycatch. Alternative F3 will allow vessels to switch gear types during a trip within a specified area to most effectively catch target species while reducing bycatch. This alternative provides fishermen with the flexibility to change gear type/target species in the event that one haul reveals that a particular gear type in that area at that time has a high proportion of bycatch.

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

Although the action alternatives are intended to improve the flexibility and efficiency for trawl harvesters to increase attainment of the trawl allocations and increase profitability, many of the alternatives of this action also promote the safety of human life at sea. Alternative H2 (bring haul onboard before the previous catch is stowed) will provide trawl vessels with the flexibility to haul back and dump catch on deck earlier than planned in the event of rapidly worsening weather and sea-state. Alternatives F3 and G2 will reduce the number of days at sea and the number of bar crossings required to attain IFQ, and thereby reduce exposure to dangerous conditions.

8.2 Paperwork Reduction Act

The Paperwork Reduction Act requires that agency information collections minimize duplication and burden on the public, have practical utility, and support the proper performance of the agency's mission.

The increased flexibility afforded by the proposed action to participants in the catch share program may require the collection of additional information during a single trip. In particular, Alternative F3 (carrying and using multiple gears on a single trip) and Alternative G3 (fishing in multiple IFQ areas during a trip or during a tow) may require collecting this additional information each trip compared to the No-action Alternative.

Under the No-action Alternative F1, a trawl vessel in the shoreside IFQ program is allowed to carry and use only one gear type during a trip (bottom trawl or midwater trawl). The vessel is required to submit a declaration report to NMFS Office of Law Enforcement (OLE) by telephone prior to leaving port that identifies the specific gear type that would be used during the trip. The vessel would not be allowed to change activities, including fishing with any gear other than the declared gear type, until the vessel returns to port, offloads all fish, and a new declaration is submitted to revise the old declaration.

Under the proposed action (Alternative F3), trawl vessels will continue to declare one type of trawl gear at a time. However, because the alternative would allow vessels in the shoreside IFQ program to carry and fish multiple types of groundfish trawl gear on the same trip (groundfish bottom trawl and midwater trawl), these vessels would be required to make a new declaration when switching gear while at sea, without having to return to port to do so. Vessels would still need to make a declaration any time they switched to a gear other than the one previously declared, but they would not be required to return to port to make the new declaration. Because vessels would be afforded flexibility to switch gear during a trip, the number of trips is expected to decrease under Alternative F3 compared to No Action. However, it is not expected that the number of declarations would change under the proposed rule, and Alternative F3 would not add burden to the harvesters.

Under the No-action Alternative G1, a trawl vessel in the shoreside IFQ program is allowed to fish in only one IFQ management area during a single trip, whereas under the proposed action (Alternative G3), these vessels would be allowed to fish in multiple IFQ management areas during a single trip or a single tow. This proposed action would not increase burden on the public, because harvesters would continue to record their tow locations in logbooks, similar to No Action. In addition, first receivers would be required to record the IFQ management areas fished by trawlers during the trip on fish tickets under Alternative G3; which is not expected to increase the burden to the public relative to No Action.

Changes in the way information is collected under the proposed action are necessary to support the performance of the agency’s mission. Without this information, IFQ tracking and validity of stock assessments may be compromised. It is not expected that the proposed action will result in significant duplication or burden on the public. Hence, this proposed action, as implemented by the alternatives described above or any of the alternatives considered in this action, does not require collection of information subject to the Paperwork Reduction Act.

9 LIST OF PREPARERS AND PERSONS/AGENCIES CONSULTED

This action is a Council-recommended action that includes all interested and potential cooperating agencies, such as the United States Fish and Wildlife Service, tribal government representatives, and state representatives for Washington, Oregon, and California.

The following people were responsible for the preparation of this document (authors):

Daniel Erickson, Contractor with Ocean Associates Inc., Catch Shares Policy Support & Analyst
Becky Renko, NMFS West Coast Region, Fishery Management Specialist
Brian Hooper, NMFS West Coast Region, Fishery Management Specialist
Colin Sayer, Contractor with Ocean Associates Inc., Catch Shares Program Follow-on Actions
Abigail Harley, NMFS, West Coast Region, West Coast Regional Economist
Jamie Goen, Alaska Bering Sea Crabbers, Executive Director (formerly NMFS, West Coast Region)
Spencer Showalter, NMFS, West Coast Region, Pathways Intern

The following people were consulted and reviewed/edited this document:

Aja Szumylo, NMFS, West Coast Region, Groundfish and Coastal Pelagic Species Branch Chief
Galeeb Kachra, Contractor with Lynker Technologies, LLC, NEPA Coordinator
Karen Palmigiano, NMFS, West Coast Region, Fishery Management Specialist
Laurie Beale, NOAA General Counsel, Attorney
Sheila Lynch, NOAA General Counsel, Attorney
Maggie Smith, NOAA General Counsel, Attorney-Advisor
Karen Cantillon, Contractor with Lynker Technologies, LLC, Technical Writer / Editor
Dr. Jim Seger, Pacific Fishery Management Council, Staff Officer

The following people were consulted for information, data, and/or general guidance:

Andrew Bornstein, Bornstein Seafoods, Inc.
Susan Chambers, West Coast Seafood Processors Association
John DeVore, Pacific Fishery Management Council
Jessi Doerpinghaus, Washington Department of Fish and Wildlife
Mark Freeman, Oregon Department of Fish and Wildlife
Todd Hay, NMFS, Northwest Fisheries Science Center
Beth Horness, NMFS, Northwest Fisheries Science Center
Travis Hunter, F/V *Fishwish*
Lori Jessi, Pacific States Marine Fisheries Commission
Aimee Keller, NMFS, Northwest Fisheries Science Center
Paul Kujala, F/V *Cape Windy*
Mark Lomeli, Pacific States Marine Fisheries Commission
Heather Mann, Midwater Trawlers Cooperative
Sean Matson, NMFS, West Coast Region
Jon McVeigh, NMFS, Northwest Fisheries Science Center
Patrick Mirick, Oregon Department of Fish and Wildlife
Mike Okoniewski, Pacific Seafood
Brad Pettinger, Oregon Trawl Commission; F/V *Alex*
Victor Simon, NMFS, Northwest Fisheries Science Center
Sara Skamsar, Foulweather Trawl
Aileen Smith, Pacific States Marine Fisheries Commission
Dave Smith, F/V *Lisa Melinda*
Kayleigh Somers, NMFS, Northwest Fisheries Science Center
John Stadler, NMFS, West Coast Region

Brad Stenberg, Pacific States Marine Fisheries Commission
Waldo Wakefield, NMFS Northwest Fisheries Science Center
John Wallace, NMFS, Northwest Fisheries Science Center

10 BIBLIOGRAPHY

Allen, M. J., and G. B. Smith. 1988. Atlas and zoogeography of common fishes in the Bering Sea and northeastern Pacific. U.S. Department of Commerce, NOAA Technical Report NMFS 66. 151 pages. Available at http://aquaticcommons.org/2755. Web site accessed August 30, 2018.

Alton, M. S. 1986. Fish and crab populations of Gulf of Alaska seamounts. Pages 45 to 51 *in* R. N. Uchida, S. Hayasi, and G. W. Boehlert, editors. 1986. Environment and resources of seamounts in the North Pacific. U.S. Department of Commerce. NOAA Technical Report NMFS 43. Available at https://pdfs.semanticscholar.org/7382/e58ff40fd373ea171d340ab398aaefb7d289.pdf. Web site accessed October 20, 2017.

Bechtol, W. R. 2000. Rockfish assessment in Prince William Sound, Alaska. Regional Information Report No. 2A99-34. Alaska Department of Fish and Game, Anchorage, AK. 37 pages. Available at http://www.adfg.alaska.gov/FedAidpdfs/RIR.2A.1999.34.pdf. Web site accessed February 8, 2018.

Bellman, M.A. 2004. Evaluation of a US west coast groundfish habitat conservation regulation via analysis of spatial and temporal patterns of trawl fishing effort. Master's thesis, Oregon State University, Department of Fish and Wildlife, Corvallis, OR. Available at http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/32142/BellmanMarleneA2004.pdf?sequence=3. Web site accessed October 20, 2017.

Bellman, M. A., S. A. Heppell, and C. Goldfinger. 2005. Evaluation of a US west coast groundfish habitat conservation regulation via analysis of spatial and temporal patterns of trawl fishing effort. Canadian Journal of Fisheries and Aquatic Sciences. Volume 62, pages 2886 to 2900.

Bellman, M.A, A. W. Al-Humaidhi, J. Jannot, and J. Majewski. 2011. Estimated discard and catch of groundfish species in the 2010 U.S. west coast fisheries. West Coast Groundfish Observer Program. National Marine Fisheries Service, NWFSC, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/total_mortality_2010.pdf. Web site accessed October 20, 2017.

Bellman, M. A., A. W. Al-Humaidhi, J. Jannot, and J. Majewski. 2012. Estimated discard and catch of groundfish species in the 2011 U.S. west coast fisheries. West Coast Groundfish Observer Program. National Marine Fisheries Service, NWFSC, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/GroundfishMortality2011_Final_101112.pdf. Web site accessed October 20, 2017.

Bellman, M. A., J. Jannot, M. Mandrup, and J. McVeigh. 2013. Estimated discard and catch of groundfish species in the 2012 U.S. west coast fisheries. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/GroundfishMortality2012.pdf Web site accessed October 20, 2017.

Beltestad, A. K. 1977. Selectivity experiments with topside chafers and round straps. International Council for the Exploration of the Sea (ICES), Gear and Behaviour Committee C.M. 1977/B:38. 17 pages. Available at https://brage.bibsys.no/xmlui/bitstream/handle/11250/101931/CM_1977_B_38.pdf?sequence=1. Web site accessed February 22, 2018.

Berger, A. M., C. J. Grandin, I. G. Taylor, A. M. Edwards, and S. Cox. 2017. Status of the Pacific Hake (whiting) stock in U.S. and Canadian waters in 2017. Prepared by the Joint Technical Committee of the U.S. and Canada Pacific Hake/Whiting Agreement, National Marine Fisheries Service and Canada Department of Fisheries and Oceans. Available at http://www.pcouncil.org/wp-content/uploads/2017/02/hake-assessment-2017-final.pdf. Web site accessed October 18, 2017.

Berkeley, S. A. 2006. Pacific rockfish management: are we circling the wagons around the wrong paradigm? Bulletin of Marine Science. Volume 78(3), pages 655 to 677.

Berkeley, S. A., M. A. Hixon, R. J. Larson, and M. S. Love. 2011. Fisheries sustainability via protection of age structure and spatial distribution of fish populations. Fisheries. Volume 29(8), pages 23 to 32. Available at http://www.tandfonline.com/doi/pdf/10.1577/1548-8446(2004)29%5B23%3AFSVPOA%5D2.0.CO%3B2. Web site accessed January 17, 2018.

BOEM (Bureau of Ocean Energy Management). 2018. 2019-2024 National Outer Continental Shelf Oil and Gas Leasing – Draft Proposed Program. Available online at: https://www.boem.gov/National-OCS-Program

Briggs, R. P. Preliminary observations of the effect of a cod-end cover or lifter bag on catch composition in the Northern Ireland Nephrops fishery. 1981. International Council for the Exploration of the Sea, Fish Capture Committee, C.M. 1981/B:11. Available at http://www.ices.dk/sites/pub/CM%20Doccuments/1981/B/1981_B11.pdf. Web site accessed on February 21, 2018.

Broadhurst, M. K., P. Suuronen, and A. Hulme. 2006. Estimating collateral mortality from towed fishing gear. Fish and Fisheries. Volume 7, pages 180 to 218.

California Department of Fish and Game (CDFG). 2003. Marine Life Protection Act: species likely to benefit from the establishment of marine protected areas in California. Internet accessible database (http://www.dfg.ca.gov/marine/mpa/species.asp). Database accessed October 20, 2017.

Chopin, F. S. and T. Arimoto. 1995. The condition of fish escaping from fishing gears–a review. Fisheries Research. Volume 21, pages 315 to 327.

Chopin, F., Y. Inoue, and T. Arimoto. 1996. Development of a catch mortality model. Fisheries Research. Volume 25, pages 377 to 382.

Clark, J. R. 1958. Underwater television observations of the effect of chafing gear on escapement of haddock. International Commission for the Northwest Atlantic Fisheries (ICNAF). Annual Proceedings. Volume 8, pages 101 to 103. Available at https://www.nafo.int/Portals/0/PDFs/icnaf/ICNAF-AnnualProceedings/ann-proc-v08.PDF?ver=2016-11-03-151907-613. Website accessed on February 22, 2018.

Cope, J. M., J. DeVore, E. J. Dick, K. Ames, J. Budrick, D. L. Erickson, J. Grebel, G. Hanshew, R. Jones, L. Mattes, C. Niles, and S. Williams. 2011. An approach to defining stock complexes for U.S. west coast groundfishes using vulnerabilities and ecological distributions. North American Journal of Fisheries Management. Volume 31(4), pages 589 to 604.

Cope, J. M. J. Dick, A. MacCall, M. Monk, B. Soper, and C. Wetzel. 2015. Data-moderate stock assessments for brown, China, copper, sharpchin, stripetail, and yellowtail rockfishes and English and rex soles in 2013. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/Data-Moderate_Assessments_2013_FINAL_160116.pdf. Web site accessed October 26, 2017.

Cope, J. M. and M. A. Haltuch. 2012. Temporal and spatial summer groundfish assemblages in trawlable habitat off the west coast of the USA, 1977 to 2009. Marine Ecology Progress Series. Volume 451, pages 187 to 200.

Dark, T. A., M. E. Wilkins, and K. Edwards. 1983. Bottom trawl survey of canary rockfish (*Sebastes pinninger*), yellowtail rockfish (*S. flavidus*), bocaccio (*S. paucispinis*), and chilipepper (*S. goodie*) off Washington–California, 1980. NOAA Technical Memorandum NMFS F/NWC-48. 40 pages. Available at https://repository.library.noaa.gov/view/noaa/5518. Web site accessed on March 15, 2018.

Ebert, D. A. 2003. Sharks, rays, and chimaeras of California. University of California Press, Berkeley, California, 284 pp.

Erickson, D. L. and E. K. Pikitch. 1994. Incidental catch of Chinook salmon in commercial bottom trawls off the U.S. west coast. North American Journal of Fisheries Management. Volume 14, pages 550 to 563.

Erickson, D. L., J. A. Perez-Comas, E. K. Pikitch, and J. R. Wallace. 1996. Effects of catch size and codend type on the escapement of walleye pollock (*Theragra chalcogramma*) from pelagic trawls. Fisheries Research. Volume 28, pages 179 to 196.

Erickson, D. L. and J. E. Hightower. 2007. Oceanic distribution and behavior of green sturgeon. American Fisheries Society Symposium. Volume 56, pages 197 to 211.

Eschmeyer, W. N., E. S. Herald, and H. Hammon. 1983. A field guide to Pacific Coast fishes of North America. Houghton Mifflin, Boston, Massachusetts. 336 p

Ferro, R. S. T. and R. J. Kynoch. 2006. A square mesh panel in a species separating trawl to improve the selectivity of cod: EU 'recovery" project status report no. 2. Fisheries Research Services Collaborative Report no. 14/06. Fisheries Research Services, Marine Laboratory, Aberdeen, Scotland. Available at http://www.gov.scot/Uploads/Documents/Coll1406.pdf. Web site accessed October 20, 2017.

Fisher, R. B. 1972. An effective combination trawl for west coast draggers: Atlantic-Western Trawls. OSU Sea Grant, Station Bulletin 613, Agricultural Experiment Station, Oregon State University, Corvallis, OR. July 1972. Available at https://ir.library.oregonstate.edu/downloads/rn301174j. Web site accessed May 16 2018.

Fraidenburg, M. E. 1980. Biological statistic of yellowtail rockfish (*Sebastes flavidus, Ayres*) in the northeast Pacific. Washington Department of Fish and Wildlife Technical Report No. 55. 64 pages.

Frandsen, R. P., N. Madsen, and L. A. Krag. 2010. Selectivity and escapement behavior of five commercial fishery species in standard square- and diamond-mesh codends. ICES Journal of Marine Science. Volume 67, pages 1721 to 1731.

Gillis, D. M., R. M. Peterman, and E. K. Pikitch. 1995. Implications of trip limit regulations for high-grading; a model of the behavior of fishermen. Canadian Journal of Fisheries and Aquatic Sciences. Volume 52(2), pages 402 to 415.

Graham, K. J., M. K. Broadhurst, and R. Millar. 2009. Effects of codend circumference and twine diameter on selection in south-eastern Australian fish trawls. Fisheries Research. Volume 95 (2009), pages 341 to 349.

Graham, N. 2010. Technical measures to reduce bycatch and discards in trawl fisheries. Pages 249 to 264 *in* P. He, editor. 2010. Behavior of marine fishes: capture process and conservation challenges. Blackwell Publishing, Ltd., Ames, Iowa.

Graham, N., R. J. Kynoch, and R. J. Fryer. 2003. Square mesh panels in demersal trawls: further data relating to haddock and whiting selectivity to panel position. Fisheries Research. Volume 62, pages 361 to 375.

Guldin, M. E. Steiner, A. Warlick, and J. Leonard. 2017. Economic data collection program first receiver and shoreside processor report (2009-2015). National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA. 195 pages. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/documents/EDC_First_Receiver_Sharebased_Processor_Report_June_2017.pdf. Accessed October 31, 2017.

Gustafson, R. G., L. Weitkamp, Y.-W. Lee, K. Somers, V. Tuttle, and J. Jannot. 2016. Status review update of eulachon (*Thaleichthys pacificus*) listed under the Endangered Species Act: southern distinct population segment. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA. Available at http://www.westcoast.fisheries.noaa.gov/publications/status_reviews/other_species/eulachon/eulachon_2016_status_review_update.pdf. Web site accessed March 16, 2018.

Gustafson, R., Y.-W. Lee, E. Ward, K. Somers, V. Tuttle, J. Jannot and J. McVeigh. 2017. Observed and estimated bycatch of eulachon in 2002–2015 US west coast groundfish fisheries. National Marine Fisheries Service, Northwest Fisheries Science Center, Fishery Observation Science, Seattle, WA. Available at http://www.pcouncil.org/wp-content/uploads/2017/03/F5a_NMFS_Rpt4_ElectricOnly_Eulachon_bycatch_rpt_2017_Apr2017BB.pdf. Web site accessed October 19, 2017.

Hagerman, F.B. 1952. The biology of Dover sole, *Microstomus pacificus* (Lockington). State of California Department of Fish and Game Bureau of Marine Fisheries Fish Bulletin No. 85. Available at http://www.oac.cdlib.org/view?docId=kt587003w7&brand=oac4&doc.view=entire_text. Web site accessed October 20, 2017.

Hall, S. J. 1994. Physical disturbance and marine benthic communities: life in unconsolidated sediments. Oceanography and Marine Biology: An Annual Review. Volume 32, pages 179-239.

Hannah, R. W. and M. Freeman. 2000. A preliminary assessment of the impacts of the "small footrope" regulation on the spatial distribution of Oregon bottom trawl effort in 2000. Oregon Department of Fish and Wildlife, Marine Resources Program, Newport, OR. Available at http://www.dfw.state.or.us/MRP/publications/docs/comm_finfishing.pdf. Web site accessed October 19, 2017.

Hannah, R. W. 2003. Spatial changes in trawl fishing effort in response to footrope diameter restrictions in the U.S. West coast trawl fishery. North American Journal of Fisheries Management. Volume 23(3), pages 693-702.

Hannah, R. W., S. J. Parker, and T. V. Buell. 2005. Evaluation of a selective flatfish trawl and diel variation in rockfish catchability as bycatch reduction tools in the deepwater complex fishery off the U.S. west coast. North American Journal of Fisheries Management. Volume 25(2), pages 581 to 593.

Hansen, J. U. and P. Tørring. 2012. Best available technology makes drastic cuts in fuel expenses in trawl fisheries. Second International Symposium on Fishing Vessel Energy Efficiency, E-Fishing, Vigo, Spain. Available at http://catch-fish.net/doc/BAT-fuel%20costs.pdf. Website accessed on August 30, 2018

Hart, J. L. 1988. Pacific Fishes of Canada. Bulletin of the Fisheries Research Board of Canada. Volume 180, pages 1 to 740.

Hay, D. E. and P. B. McCarter. 2000. Status of the eulachon *Thaleichthys pacificus* in Canada. Department of Fisheries and Oceans Canada, Canadian Stock Assessment Secretariat, Research Document 2000-145. Ottawa, Ontario. Available at http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ResDocs-DocRech/2000/2000_145-eng.htm. Web site accessed October 18, 2017.

He, P. 1993. Swimming speeds of marine fish in relation to fishing gears. ICES Journal of Marine Science Symposium. Volume 196, pages 183 to 189.

He, P., M. Pol and P. Suuronen. 2016. Selective fishing and balanced harvest: means, methods, and implications. Fisheries Research. Volume 184, page 1.

He, X. and J. C. Field. 2017. Stock assessment update: status of bocaccio, *Sebastes paucispinis*, in the Conception, Monterey, and Eureka INPFC areas for 2017. Pacific Fisheries Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2017/05/F4_Att3__2017_Bocaccio_Assessment_DraftFull_Version_Electronic_Only_Jun2017BB.pdf. Web site accessed on December 20, 2017.

He, X., D. E. Pearson, E. J. Dick, S. Ralston, and A. D. MacCall. 2011. Status of the widow rockfish resource in 2011. Pacific Fishery Management Council, Portland OR. Available at http://www.pcouncil.org/wp-content/uploads/Widow_2011_Assessment.pdf. Web site accessed October 18, 2017.

Hicks, A. C. and C. R. Wetzel. 2015. The Status of widow rockfish (*Sebastes entomelas*) along the U.S. west coast in 2015. Pacific Fishery Management Council, Portland, OR. Available at https://www.pcouncil.org//wp-content/uploads/2016/04/WidowAssessment2015.pdf. Web site accessed October 18, 2017

Hylen, A. 1966. Selectivity experiments with a large-meshed topside chafer. 1966. International Council for the Exploration of the Sea. Comparative Fish Committee, C.M. 1966/F:13. 5 pages. Available at http://www.ices.dk/sites/pub/CM%20Doccuments/1966/F/1966_F13.pdf. Web site accessed February 22, 2018.

Jacobson, L. D., J. Brodziak, and J. Rogers. 2001. Depth distributions and time-varying bottom trawl selectivities for Dover sole (*Microstomus pacificus*) sablefish (*Anoplopoma fimbria*), and thornyheads (*Sebastolobus alascanus* and *S. altivelis*) in a commercial fishery. Fishery Bulletin, Volume 99, pages 309 to 327.

Jacobson, L. D. and J. R. Hunter. 1993. Bathymetric demography and management of Dover sole. North American Journal of Fisheries Management, Volume 13, pages 405 to 420.

Jacobson, L. D. and R. D. Vetter. 1996. Bathymetric demography and niche separation of thornyhead rockfish: *Sebastolobus alascanus* and *Sebastolobus altivelis*. Canadian Journal of Fisheries and Aquatic Sciences, Volume 53, pages 600 to 609.

Jannot, J. E., K. Somers, N. B. Riley, V. Tuttle, and J. McVeigh. 2016a. Pacific halibut bycatch in the U.S. west coast groundfish fisheries (2002-2015). NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at https://www.nwfsc.noaa.gov//research/divisions/fram/observation/pdf/Pacific_halibut_Bycatch_Report_2002_2015_100516.pdf. Web site accessed October 18, 2017.

Jennings, S., M. Kaiser, and J. D. Reynolds. 2001. Marine Fisheries Ecology. Blackwell Science Ltd., publisher, Malden, MA. 432 pages.

Johnson K. F., M. B. Rudd, M. Pons, C. A. Akselrud, Q. Lee, F. Hurtado-Ferro, M. A. Haltuch and O. S. Hamel. 2016. Status of the U.S. sablefish resource in 2015. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2016/04/Sablefish_2015_Final.pdf. Web site accessed October 18, 2017.

Kaiser, M. J., J. S. Collie, S. J. Hall, S. Jennings, and I. R. Poiner. 2001. Impacts of fishing gear on marine benthic habitats. Available at ftp://ftp.fao.org/fi/document/reykjavik/pdf/12kaiser.PDF. Web site accessed on October 18, 2017.

Kaplan, I. C. and T. E. Helser. 2007. Stock assessment of the arrowtooth flounder (*Atheresthes stomias*) population off the west coast of the United States in 2007. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/ArrowtoothAssess_Aug22.pdf. Accessed on October 26, 2017.

King, S. E., R. W. Hannah, S. J. Parker, K. M. Matteson, and S. A. Berkeley. 2004. Protecting rockfish through gear design: development of a selective flatfish trawl for the U.S. west coast bottom trawl fishery. Canadian Journal of Fisheries and Aquatic Sciences. Volume 61, pages 487 to 496.

Kramer, D. E., W. H. Barss, B. C. Paust, and B. E. Bracken. 1995. Guide to northeast Pacific flatfishes: families *Bothidae*, *Cynoglossidae*, and *Pleuronectidae*. Alaska Sea Grant College Program, Fairbanks, AK and Alaska Fisheries Development Foundation, Anchorage, AK. Marine Advisory Bulletin No. 47, 104 pages.

Laroche, W. A., and S. L. Richardson. 1981. Development of larvae and juveniles of the rockfishes *Sebastes entomelas* and *S. zacentrus* (Family *Scorpaenidae*) and occurrence off Oregon, with notes on head spines of *S. mystinus*, *S. flavidus*, and *S. melanops*. Fishery Bulletin. Volume 79, pages 231 to 256.

Lauth, R. R. 1999. The 1997 Pacific Coast upper continental slope trawl survey of groundfish resources off Washington, Oregon, and California: estimates of distribution, abundance, and length composition. NOAA Technical. Memorandum NMFS-AFSC-98, 284 pages. Available at https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-98/Text%20from%20NOAA-TM-AFSC-98.pdf. Web site accessed October 18, 2017.

Lindley, S. T., M. L. Moser, D. L. Erickson, M. Belchik, and D. W. Welch. 2008. Marine migration of North American green sturgeon. Transactions of the American Fisheries Society. Volume 137, pages 182 to 194.

Lindley, S. T., D. L. Erickson, M. L. Moser, G. Williams, O. P. Langness, B. McCovey Jr., D. Vogel, W. Pinnix, J. T. Kelly, J. C. Heublein, and A. P. Klimley. 2011. Electronic tagging of green sturgeon reveals population structure and movement among estuaries. Transactions of the American Fisheries Society. Volume 140, pages 108 to 122.

Lee, Y.-W., R. Gustafson , J. Jannot , J. McVeigh, N. Riley, K. Somers, V. Tuttle, S. Wang, and E. Ward. 2017. Observed and estimated bycatch of green sturgeon in 2002–2015 US West Coast groundfish fisheries. West Coast Groundfish Observer Program, National Marine Fisheries Service, NWFSC, Seattle, WA. Available at http://www.pcouncil.org/wp-content/uploads/2017/03/F5a_NMFS_Rpt5_ElectricOnly_Green_Sturgeon_Bycatch_rpt_2017_Apr2017BB.pdf. Web site accessed October 19, 2017.

Lomeli, M. J., W. S. Hamel, W. W. Wakefield, and D. L. Erickson. 2017. Improving catch utilization in the U.S. west coast groundfish bottom trawl fishery: an evaluation of T-90 mesh and diamond-mesh codends. Marine and Coastal Fisheries. Volume 9(1), pages 149 to 160.

Lomeli, M. J. M. and W. W. Wakefield. 2012. Efforts to reduce Chinook salmon (*Onchorhynchus tshawytscha*) and rockfish (Sebastes spp.) bycatch in the U.S. west coast Pacific hake (*Merluccius productus*) fishery. Fisheries Research. Volume 119 to 120, pages 128 to 132.

Lomeli, M. J. M. and W. W. Wakefield. 2015. Testing of Pacific halibut bycatch reduction devices in two US West Coast bottom trawl fisheries. Pages 1 to 23 *in* G. H. Kruse, H. C. An, J. DiCosimo, C. A. Eischens, G. S. Gislason, D. N. McBride, C. S. Rose, and C. E. Siddon, editors. 2015. Fisheries Bycatch: Global Issues and Creative Solutions. Alaska Sea Grant, University of Alaska, Fairbanks. Available at: https://seagrant.uaf.edu/bookstore/pubs/item.php?id=12269. Web site accessed on September 5, 2018.

Love, M. S. 1996. Probably more than you want to know about the fishes of the Pacific coast. Really Big Press, Santa Barbara, CA. 215 pages.

Love, M. S., M. Yoklavich, and L. Thorsteinson. 2002. The rockfishes of the northeast Pacific. University of California Press, Los Angeles, CA. 405 pages.

Madsen, N. and R. Holst. 2002. Assessment of the cover effect in trawl codend selectivity experiments. Fisheries Research. Volume 56, pages 289 to 301.

Madsen, N. and D. Valentinsson. 2010. Use of selective devices in trawls to support recovery of the Kattergat cod stock: a review of experiments and experience. ICES Journal of Marine Science, Volume 67, pages 2042 to 2050.

Mason, J. C., R. Beamish, and G. A. McFarlane. 1983. Sexual maturity, fecundity, spawning, and early life history of sablefish (*Anoplopoma fimbria*) off the Pacific coast of Canada. Canadian Journal of Fisheries and Aquatic Science. Volume 40, pages 2126 to 2134.

Matson, S. 2012. West Coast Groundfish IFQ fishery catch summary for 2011: first look. National Marine Fisheries Service, Northwest Region, Sustainable Fisheries Division. Available at http://www.pcouncil.org/wp-content/uploads/F6b_SUP_NMFS_RPT_MAR2012BB.pdf. Web site accessed October 20, 2017.

Matson, S. and D. L. Erickson. 2017. Analysis of the west coast groundfish fisheries for the 2017 salmon ESA Biological Opinion. National Marine Fisheries Service, West Coast Region, Seattle, WA. October 2017. Unpublished Document. 81 pages. Available at https://www.pcouncil.org/wp-content/uploads/2018/03/H5a_Sup_NMFS_Rpt1_Salmon_AnalyticalDoc_withRevisedCover_Mar2018BB.pdf. Web site accessed on June 13, 2018.

Matsushita, Y., Y. Inoue, and A. I. Shevchenko. 1996: The mesh selectivity experiments of single and double codends in the Pacific Coast of Kuril Islands. Nippon Suisan Gakkaishi. Volume 62(1), pages 78 to 82. Available at https://www.jstage.jst.go.jp/article/suisan1932/62/1/62_1_78/_article. Web site accessed on November 28, 2017.

Methot, R. D., R. Lauth, F. Shaw, and M. Wilkins. 1994. Assessment of the west coast sablefish stock in 1994. Status of the Pacific coast groundfish fishery through 1994 and recommended acceptable biological catches for 1995: Stock assessment and fishery evaluation. Pacific Fishery Management Council, Portland, Oregon. Available at http://www.pcouncil.org/wp-content/uploads/Sablefish_1994_Assessment.pdf. Web site accessed October 19, 2017.

Moderhak, W. 1993. Some problems of water flow through trawl codend. International Council for the Exploration of the Sea, Fish Capture Committee, C.M. 1993/B:11. Available at http://ices.dk/sites/pub/CM%20Doccuments/1993/B/1993_B11.pdf. Web site accessed February 21, 2018.

Moser, M. L., J. A. Israel, M. Neuman, S. T. Lindley, D. L. Erickson, B. W. McCovey Jr., and A. P. Klimley. 2016. Biology and life history of green sturgeon (*Acipenser medirostris* Ayers, 1854): state of the science. Journal of Applied Ichthyology. Volume 32, Issue S1, pages 67 to 86.

Muir, J. F. 2015. Fuel and energy use in the fisheries sector - approaches, inventories and strategic implications. FAO Fisheries and Aquaculture Circular No. 1080. Rome, Italy. Available at http://www.fao.org/3/a-i5092e.pdf. Accessed on October 18, 2017.

Murie, D. J., D. C. Parkyn, B. G. Clapp, and G. G. Krause. 1994. Observations on the distribution and activities of rockfish, *Sebastes* spp., in Saanich Inlet, British Columbia, from the Pisces IV submersible. Fishery Bulletin. Volume 92, pages 313 to 323.

Nakamoto, R. J., T. T. Kisanuki, and G. H. Goldsmith. 1995. Age and growth of Klamath River green sturgeon (*Acipenser medirostris*). U.S. Fish and Wildlife Service Project 93-FP-13, Yreka, CA. 20 pages. Available at http://www.krisweb.com/biblio/klamath_usfws_nakamotoetal_1995_sturgeon.pdf. Accessed on October 19, 2017.

National Marine Fisheries Service (NMFS). 1999 Endangered Species Act - Reinitiated Section 7 Consultation Biological Opinion Fishing Conducted under the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery Agency: National Marine Fisheries Service, Northwest and Southwest Regional Sustainable Fisheries Divisions Consultation Conducted by National Marine Fisheries Service Protected Resources Division. December 15, 1999.

NMFS. 2005a. Final groundfish essential fish habitat (EFH) environmental impact statement. National Marine Fisheries Service, Northwest Region, Seattle WA, Available at http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/final_groundfish_efh_eis.html. Accessed on October 18, 2017.

NMFS. 2006. Endangered Species Act (ESA) Section 7 Consultation - Supplemental biological opinion on the Pacific Coast groundfish fishery management plan (consultation #2006/00754). NMFS Northwest Region, Sustainable Fisheries Division, Seattle, WA. Available at http://www.pcouncil.org/wp-content/uploads/2015/05/D3a_NMFS_Rpt2_GFreiinitiate2006_JUN2015BB.pdf. Web site accessed October 18, 2017.

NMFS. 2012. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Section 7(a)(2) “Not Likely to Adversely Affect” determination; continuing operation of the Pacific coast groundfish Fishery. National Marine Fisheries Service Northwest Region, Seattle, December 7, 2012, PCTS Number: NWR-2012-876. Available at http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/final_groundfish_biop_12-7-12.pdf. Web site accessed October 18, 2017.

NMFS. 2013. Groundfish essential fish habitat synthesis; a report to the Council. National Marine Fisheries Service, West Coast Region, Seattle, WA, April 2013. Available at http://www.pcouncil.org/wp-content/uploads/D6b_NMFS_SYNTH_ELECTRIC_ONLY_APR2013BB.pdf. Web site accessed December 6, 2017,

NMFS. 2016a. Amendment 27 to the Pacific coast groundfish fishery management plan and 2017-2018 harvest specifications and management measures final environmental assessment. National Marine Fisheries Service, West Coast Region, Seattle, WA, December 2016. Available at http://www.pcouncil.org/wp-content/uploads/2017/05/17-18-spex-final-ea-03062017.pdf. Web site accessed October 18, 2017.

NMFS. 2016b. Salmon bycatch in the Pacific coast groundfish fisheries. National Marine Fisheries Service, Sustainable Fisheries Division, West Coast Region, Seattle, WA. October 2016. Available at http://www.pcouncil.org/wp-content/uploads/2017/02/I1a_NMFS_Rpt2_Bycatch_Summary_FinalPublicVersion_2016Updated_Mar2017BB.pdf. Web site accessed on December 20, 2017.

NMFS. 2017a. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion. Reinitiation of Section 7 consultation regarding Pacific Fisheries Management Council's Groundfish Fishery Management Plan. NMFS Consultation Number: F/WCR-2017-7552. National Marine Fisheries Service, West Coast Region, Seattle, WA. December 2017. Available at https://www.pcouncil.org/wp-content/uploads/2018/02/H5_Att1_FullVersionElectricOnly_S7-Groundfish-_biop_121117_MAR2018BB.pdf. Web site accessed on March 7, 2018.

NMFS. 2017b. Exempted fishing permit program for an experimental midwater rockfish fishery. An Environmental Assessment. National Marine Fisheries Service, West Coast Region, Seattle, WA, February 2017.

NMFS. 2017c. Issuance of an exempted fishing permit for limited entry groundfish bottom trawl and non-whiting midwater trawl vessels in the shoreside individual quota program: trawl gear EFP. An Environmental Assessment. National Marine Fisheries Service, West Coast Region, Seattle, WA. Available at http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/misc_ea/2018-trawl-gear-efp.pdf. Web site accessed on April 24, 2018.

NMFS. 2018a. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion: Continuing Operation of the Pacific Coast Groundfish Fishery (Reinitiation 2018). NMFS Consultation Number WCR-2018-8635. National Marine Fisheries Service, West Coast Region, Seattle, WA. October 12, 2018.

NMFS. 2018b. Pacific Coast groundfish fishery 2019-20 harvest specifications, yelloweye rebuilding plan revisions, and management measures. Draft Environmental Assessment/MSA analysis/Regulatory Impact Review/Regulatory Flexibility Analysis. National Marine Fisheries Service, West Coast Region, Seattle, WA. August 2018. Available at https://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/misc_ea/2019-20_gfspexea_nmfs_august_2018.pdf. Web site accessed on November 1, 2018.

National Marine Fisheries Service (NMFS) and Pacific Fishery Management Council (Council). 2017. West coast groundfish trawl catch share program five-year review – Draft. National Marine Fisheries Service, Seattle WA and Pacific Fishery Management Council, Portland OR. August 2017. Available at https://www.pcouncil.org/groundfish/fishery-management-plan/trailing-actions/public-review-draft-of-the-groundfish-trawl-catch-share-program-five-year-review/. Web site accessed June 13, 2018.

NMFS and Council. 2018. Changes to groundfish essential fish habitat conservation areas and boundaries of the trawl gear rockfish conservation areas. Includes description of areas closed to groundfish bottom trawl fishing off the Pacific Coast and Amendment 28 to the Pacific Coast Groundfish Fishery Management Plan to refine and expand habitat conservation areas and change the trawl rockfish conservation area. Draft Environmental Impact Statement and Magnuson-Stevens Act Analysis. National Marine Fisheries Service, Seattle WA and Pacific Fishery Management Council, Portland OR. March, 2018. Available at https://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/am28-deis-9-2018.pdf. Web site accessed on November 1, 2018.

National Oceanic and Atmospheric Administration (NOAA). 1990. West coast of North America coastal and ocean zones strategic assessment: Data Atlas. U.S. Department of Commerce, NOAA. OMA/NOS, Ocean Assessments Division, Strategic Assessment Branch. Invertebrate and Fish Volume.

National Research Council (NRC). 2002. Effects of trawling and dredging on seafloor habitat. U.S. Department of Commerce. NOAA. OMA/NOS, Ocean Assessments Division, Strategic Assessment Branch. Invertebrate and Fish Volume.

Northwest Fisheries Science Center (NWFSC). 2012. Risk assessment of U.S. West Coast groundfish fisheries to threatened and endangered marine species. Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, WA. Available at http://www.pcouncil.org/wp-content/uploads/F3b_ATT2_RISK_ASSMT_MAR2012BB.pdf. Web site accessed October 18, 2017.

NWFSC. 2017. Observed and estimated total bycatch of salmon in the 2002-2015 U.S. west coast fisheries. Report Tables. National Marine Fisheries Service, Northwest Fisheries Science Center, Fishery Observation Science, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/xls/SalmonBycatch_Expanded_2002-2015.xlsx. Web site accessed October 19, 2017.

NWFSC. 2018. Observed and estimated total bycatch of salmon in the 2002-2016 U.S. west coast fisheries, July 2018. Report Tables. National Marine Fisheries Service, Northwest Fisheries Science Center, Fishery Observation Science, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/xls/Salmon%20Bycatch%2002-16%202018-07-26.xlsx. Web site accessed August 2, 2017.

O'Neill, F. G. and K. Mutch. 2017. Selectivity in trawl fishing gears. Scottish Marine and Freshwater Science. Volume 8(1). 85 pages. Available at http://www.discardless.eu/media/publications/00513830.pdf. Web site accessed January 13, 2018.

Orr, J. W., M. A. Brown and D. C. Baker. 2000. Guide to rockfishes (Scorpaenidae) of the genera *Sebastes, Sebastolobus*, and *Adelosebastes* of the northeast Pacific Ocean. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC_117. Available at https://www.afsc.noaa.gov/race/media/publications/archives/pubs2000/techmemo117.pdf. Web site accessed October 19, 2017.

Özbilgin H and Z. Tosunoğlu. 2003. Comparison of the selectivities of double and single codends. Fisheries Research. Volume 63, pages 143 to 147.

Pacific Fishery Management Council (Council). 1994. Environmental assessment/regulatory impact review regarding proposed regulations to define pelagic trawl, establish the minimum mesh size of trawls, revise other trawl definitions and modify marking requirements for vertical (Portuguese) longlines. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/02_1994_Trawl_Defs_Portuguese.pdf. Web site accessed October 19, 2017.

Council. 1996. Status of the Pacific coast groundfish fishery through 1996 and recommended acceptable biological catches for 1997. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/SAFE_September_1996.pdf. Web site accessed October 19, 2017.

Council. 1998. Amendment 8 (to the northern anchovy fishery management plan) incorporating a name change to the Coastal Pelagic Species Fishery Management Plan – Appendix A. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/cpsa8_apdx_a.pdf. Web site accessed October 19, 2017.

Council. 1999. Annual specifications for 2000. Supplemental GMT Report G.4.(1)., September 1999. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/bb/1999/0999/G4.1_Supp_GMT_Rpt_Sept99BB.pdf. Web site accessed October 19, 2017.

Council. 2002. Status of the Pacific coast groundfish fishery through 2001 and recommended acceptable biological catches for 2002. Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/SAFE_July_2002.pdf. Web site accessed October 19, 2017.

Council. 2003. Appendix F to the U.S. west coast Highly Migratory Species Fishery Management Plan: life history accounts and essential fish habitat descriptions. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/HMS_AppF.pdf. Web site accessed October 19, 2017.

Council. 2004. Acceptable biological catch and optimum yield specification and management measures for the 2005-2006 Pacific coast groundfish fishery. Final environmental impact statement and regulatory analyses. Pacific Fishery Management Council, Portland, OR. October 2004. Available at https://www.pcouncil.org/groundfish/current-season-management/past-management-cycles/2005-2006-final-environmental-impact-statement/. Web site accessed October 19, 2017.

Council. 2005a. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery, Appendix B, Part 2. Groundfish life history descriptions. Pacific Fishery Management Council, Portland, OR. November 2005. Available at http://www.pcouncil.org/wp-content/uploads/GF_FMP_App_B2.pdf. Web site accessed October 19, 2017.

Council. 2005b. Amendment 18 (bycatch mitigation program) Amendment 19 (essential fish habitat) to the Pacific coast groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, OR. November 2005. Available at https://www.pcouncil.org/wp-content/uploads/A18-19Final.pdf. Website accessed on November 15, 2017.

Council. 2012. Pacific Coast groundfish 5-year review of essential fish habitat report to the Pacific Fishery Management Council. Phase 1: new information. Groundfish Essential Fish Habitat Review Committee. Agenda Item H.6.b, EFHRC Report, 1 September 2012. Pacific Fishery Management Council, Portland, OR. Available at https://www.pcouncil.org/wp-content/uploads/H6b_EFHRC_RPT_1_SEP2012BB.pdf. Web site accessed October 19, 2017.

Council. 2013. Pacific Fishery Ecosystem Plan for the U.S. portion of the California Current Large Marine Ecosystem. Pacific Fishery Management Council, Portland, OR. July 2013. Available at http://www.pcouncil.org/ecosystem-based-management/fep/. Web site accessed October 19, 2017.

Council. 2015. Informational Report 4: National Marine Fisheries Service report on analysis of seafloor contact in midwater trawls engaged in the US West coast Pacific hake fishery. Pacific Fishery Management Council, Portland, OR. April 2015. Available at http://www.pcouncil.org/wp-content/uploads/2015/03/IR4_Groundfish_EFH_midwater_trawl_bottom_contact_Rpt_APR2015BB.pdf. Web site accessed December 4, 2017.

Council. 2016a. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2017/03/GF_FMP_FinalThruA27-Aug2016.pdf. Web site accessed August 2, 2018.

Council. 2016b. Comprehensive ecosystem-based Amendment 1: protecting unfished and unmanaged forage fish species of the U.S. portion of the California Current Ecosystem. Environmental Assessment for Amendment 15 to the Coastal Pelagic Species Fishery Management Plan, Amendment 25 to the Pacific Coast Groundfish Fishery Management Plan, Amendment 3 to the Highly Migratory Species Fishery Management Plan, and Amendment 19 to the Pacific Coast Salmon Fishery Management Plan. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2016/05/ceba1_ea_final_march2016.pdf. Web site accessed October 19, 2017.

Council 2016c. Modifications to: Pacific Coast groundfish essential fish habitat and trawl rockfish conservation areas (Amendment 28 to the Pacific Coast Groundfish Fishery Management Plan) - description and analysis of alternatives for Council decision-making. Pacific Fishery Management Council, Portland, OR. November 2016. Available at http://www.pcouncil.org/wp-content/uploads/2016/11/F4a_Project_Team_Report_EFHRCA_Modifications_Analytical_Doc_NOV2016BB.pdf. Web site accessed October 19, 2017.

Council. 2016d. Status of the Pacific Coast groundfish fishery – stock assessment and fishery evaluation: description of the fishery. Pacific Fishery Management Council, Portland Oregon. Available at http://www.pcouncil.org/groundfish/safe-documents/. Web site accessed October 26, 2017.

Council (Pacific Fishery Management Council) and NMFS (National Marine Fisheries Service). 2009. Proposed acceptable biological catch and optimum yield specifications and management measures for the 2009-2010 groundfish fishery: final Environmental Impact Statement including regulatory impact review and initial regulatory flexibility analysis. Pacific Fishery Management Council, Portland, OR. January, 2009. Available at http://www.pcouncil.org/wp-content/uploads/0910GF_SpexFEIS.pdf. Web site accessed October 19, 2017.

Council and NMFS. 2010a. Rationalization of the Pacific coast groundfish limited entry trawl fishery; final Environmental Impact Statement including regulatory impact review and initial regulatory flexibility analysis. Pacific Fishery Management Council, Portland, OR. June 2010. Available at http://www.pcouncil.org/wp-content/uploads/1_Pacific-Coast-Grounddfish-Limited-Entry-Trawl-Fishery-FEIS.pdf. Web site accessed October 19, 2017.

Council and NMFS. 2010b. Allocation of harvest opportunity between sectors of the Pacific coast groundfish fishery: final Environmental Impact Statement including regulatory impact review and initial regulatory flexibility analysis. Pacific Fishery Management Council, Portland, OR. June, 2010. Available at http://www.pcouncil.org/wp-content/uploads/ISA_FEIS_June_2010_Final.pdf. Web site accessed October 19, 2017.

Council and NMFS. 2014. Trawl rationalization trailing actions: chafing gear. Environmental Assessment. Pacific Fishery Management Council, Portland, OR and National Marine Fisheries Service, Seattle, WA. Available at http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/misc_ea/chafing-ea-final.pdf. Accessed October 31, 2017.

Council and NMFS. 2015. Harvest specifications and management measures for 2015-2016 and biennial periods thereafter - includes the reorganization of groundfish stock complexes, designation of ecosystem component species and Amendment 23 to the Pacific Coast Groundfish Fishery Management Plan to establish a process for determining default harvest specifications. Final Environmental Impact Statement. Pacific Fishery Management Council, Portland, OR and National Marine Fisheries Service, Seattle, WA. January 2015. Available at http://www.pcouncil.org/wp-content/uploads/GF15_16_SpexFEISJanuary2015.pdf. Web site accessed October 19, 2017.

Parker, S. J., M. R. Saelens, S. A. Kupillas and R. W. Hannah. 2004. Using an exempted fishing permit for a large-scale test of a selective flatfish trawl in the continental shelf flatfish fishery. Oregon Department of Fish and Wildlife Information Report Series No. 2004-01. 22 pages. Available at http://odfw.forestry.oregonstate.edu/inforeports/2004-01.pdf. Web site accessed October 19, 2017.

Payne, J., D. L. Erickson, M. Donnellan, M., and S. T. Lindley, S. T. 2015. Migration and habitat use of green sturgeon (*Acipenser medirostris*) near the Umpqua River estuary: project to assess potential impacts of the Reedsport Ocean Power Technologies wave energy generation facility. Available at: http://www.oregonwave.org/oceanic/wp-content/uploads/2015/04/Green-Sturgeon-Study_-Website_FINAL.pdf. Accessed October 28, 2017.

Pearcy, W. G., D. L. Stein, M. A. Hixon, E. K. Pikitch, W. H. Barss, and R. M. Starr. 1989. Submersible observations of deep-reef fishes of Heceta Bank, Oregon. Fishery Bulletin. Volume 87, pages 955 to 965.

Perez-Comas, J. A., D. L. Erickson, and E. K. Pikitch. 1998. Cod-end mesh size selection for rockfish and flatfish of the US west coast. Fisheries Research. Volume 34, pages 247 to 268.

Pikitch, E. K., D. L. Erickson, and J. R. Wallace. 1988. An evaluation of the effectiveness of trip limits as a management tool. NWAFC Processed Report 88-27. National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Seattle, WA. 33 pages. Available at https://www.afsc.noaa.gov/Publications/ProcRpt/PR1988-27.pdf. Web site accessed October 19, 2017.

Pikitch, E. K., M. O. Bergh, D. L. Erickson, J. R. Wallace, and J.R. Skalski. 1990. Final report on the results of the 1988 West Coast groundfish mesh size study. Saltonstall-Kennedy Grant NA88-ABH-00017. Fisheries Research Institute Report FRI-UW-9019. University of Washington, Fisheries Research Institute, Seattle WA. Available at https://digital.lib.washington.edu/researchworks/bitstream/handle/1773/4141/9019.pdf?sequence=1&isAllowed=y. Web site accessed January 24, 2018.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada. Bulletin 191, pages 1 to 382.

Rose, C. S. 1996. Behavior of North Pacific groundfish encountering trawls: Applications to reduce bycatch. Pages 235 to 241 *in* Solving Bycatch - Considerations for Today and Tomorrow. University of Alaska, Sea Grant College Program, Report No. 96-03. Available at http://nsgl.gso.uri.edu/aku/akut81001/akut81001/akuw95001/akuw95001_part9.pdf. Web site accessed August 24, 2018.

Rose, C., A. Carr, D. Ferro, R. Fonteyne, and P. MacMullen. 2000. Using gear technology to understand and reduce unintended effects of fishing on the seabed and associated communities: background and potential directions. Pages 106 to 122 *in* Report of the Working Group on Fishing Technology and Fish Behaviour, Fisheries Technology Committee, International Council for the Exploration of the Seas (ICES) CM 2000/B:03. Available at http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/ftc/2000/wgftfb00.pdf. Web site accessed October 20, 2017.

Ryer, C. H. 2008. A review of flatfish behavior relative to trawls. Fisheries Research. Volume 90 (2008), pages 138 to 146.

Russell, S. M., M. Van Oostenburg, A. Vizek, and B. T. G. Carter. 2017. PCGFSS abbreviated community summaries- draft in support of the 5-year review of the West Coast groundfish trawl catch share program. Pacific Fishery Management Council, Portland, OR. 106 pages. Available at http://www.pcouncil.org/wp-content/uploads/2017/08/E7_Att3_E-Only_CommunitiesDoc_Updated_Table_8.18.2017_SEPT2017BB.pdf. Web site accessed October 20, 2017.

Sainsbury, John C. 1996. Commercial fishing methods, an introduction to vessels and gears (fishing news books). Wiley, Cambridge, MA.

Sampson, D. B., O. S. Hamel, K. Bosley, J. Budrick, L. Cronin-Fine, L. K. Hillier, K. E. Hinton, M. J. Krigbaum, S. Miller, K. M. Privitera-Johnson, K. Ramey, B.T. Rodomsky, L. K. Solinger, and A. D. Whitman. 2017. 2017 assessment update for the US West Coast stock of arrowtooth. Pacific Fishery Management Council, Portland, OR. Available at https://www.pcouncil.org/groundfish/stock-assessments/by-species/arrowtooth-flounder/. Web site accessed October 20, 2017.

Skamser, S. 2002. Fowlweather Trawl: Trawl Training Class April 9th and 10th, 2002. Newport, OR. Pages 3-76 to 3-86 *in* NMFS. 2005. Final groundfish essential fish habitat (EFH) environmental impact statement. National Marine Fisheries Service, Northwest Region, Seattle WA, Available at http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/final_groundfish_efh_eis.html. Accessed on October 20, 2017.

Skamser, S. 2003. Personal Communication, Foulweather Trawl, Newport, OR. Pages 3-76 to 3-86 *in* NMFS. 2005. Final groundfish essential fish habitat (EFH) environmental impact statement. National Marine Fisheries Service, Northwest Region, Seattle WA, Available at http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/final_groundfish_efh_eis.html. Accessed on October 20, 2017.

Somers, K. A., M. Bellman, J. Jannot, N. Riley, and J. McVeigh. 2014. Estimated discard and catch of groundfish species in the 2013 U.S. west coast fisheries. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/Groundfish_Mortality_Report_2013.pdf. Web site accessed October 20, 2017.

Somers, K. A., J. Jannot, Y.-W. Lee, N. B. Riley, V. Tuttle, and J. McVeigh. 2015. Estimated discard and catch of groundfish species in the 2014 U.S. west coast fisheries. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/Groundfish_Mortality_2014.pdf . Website accessed October 20, 2017.

Somers, K.A., Y.-W. Lee, J.E. Jannot, & J. McVeigh. 2016a. FOS coverage rates, 2002-2016. Last updated: May 2017. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at http://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/sector_products.cfm#ob. Web site accessed October 20, 2017.

Somers, K. A., Y.-W. Lee, J. Jannot, V. Tuttle, N. B. Riley, and J. McVeigh. 2016b. Estimated discard and catch of groundfish species in the 2015 U.S. west coast fisheries. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/Groundfish_Mortality_2015_2017.02.10.pdf. Web site accessed October 20, 2017.

Somers, K. A., J. Jannot, V. Tuttle, N. B. Riley, and J. McVeigh. 2017a. Estimated discard and catch of groundfish species in the US west coast fisheries. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at http://www.pcouncil.org/wp-content/uploads/2017/08/E1b_NMFS_NWFSC_Rpt_2_E-Only_Groundfish_Mortality_2016_SEPT2017BB.pdf. Web site accessed October 24, 2017.

Somers, K. A. Y.-W. Lee, J. E. Jannot, C. E. Whitmire, V. J. Tuttle, and J. T. McVeigh. 2017b. Fishing effort in the 2002-2015 U.S. Pacific coast groundfish fisheries. West Coast Groundfish Observer Program. National Marine Fisheries Service, NWFSC, Seattle, WA. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/protected_species.cfm. Web site accessed November 15, 2017.

Somers, K. A., J. Jannot, K. Richerson, V. Tuttle, N. B. Riley, and J. T. McVeigh. 2018. Estimated discard and catch of groundfish species in the 2017 US west coast fisheries. NOAA Fisheries, NWFSC Observer Program, Seattle, WA. Available at https://www.pcouncil.org/wp-content/uploads/2018/08/I1b_NMFS_NWFSC_Rpt1_E-Only_Est_Discard_Mortality_Groundfish_2017_SEPT2018BB.pdf. Web site accessed September 5, 2018.

Stanley, R. D., B. M. Leaman, L. Haldorson, and V. M. O’Connell. 1994. Movements of tagged adult yellowtail rockfish, *Sebastes flavidus*, off the west coast of North America. Fishery Bulletin. Volume 92, pages 655 to 663.

Stauffer, G. 2003. NOAA protocols for groundfish bottom trawl surveys of the nation’s fishery resources. NOAA Technical Memorandum NMFS-SPO-64, October 2004. 211 pages. Available at https://repository.library.noaa.gov/view/noaa/12855. Web site accessed March 15, 2018.

Stawitz, C. C., F. Hurtado-Ferro, P. Kuriyama, J. T. Trochta, K. F. Johnson, M. A. Haltuch, and O. S. Hamel. 2016. Stock assessment update: status of the U.S. petrale sole resource in 2014. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2016/04/Petrale2015Update_1Apr16.pdf. Web site accessed October 20, 2017.

Steiner, E., M. Guldin, A. Warlick, and L. Pfeiffer. 2017a. Economic data collection program catcher vessel report (2009-2015). National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA. 184 pages. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/documents/EDC_Catcher_Vessel_Report_June_2017.pdf. Web site accessed October 20, 2017.

Steiner, E., A. Warlick, M. Guldin, and L. Pfeiffer. 2017b. Economic data collection program mothership report (2009-2015). National Marine Fisheries Service. Northwest Fisheries Science Center, Seattle, WA. 55 pages. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/documents/EDC_Mothership_Report_June_2017.pdf. Web site accessed October 20, 2017.

Stephens, A. and I. G. Taylor. 2014. Stock assessment and status of longspine thornyhead (*Sebastolobus altivelis*) off California, Oregon, and Washington in 2013. Pacific Fishery Management Council, Portland, OR. Available at https://www.pcouncil.org//wp-content/uploads/Longspine_Assessment_2013.pdf. Web site accessed October 20, 2017.

Stewart, P. A. M. and J. H. B. Robertson. 1985. Attachments to codends. Scottish Fisheries Research Marine Laboratory, Report 33. Aberdeen, Scotland. Available at http://www.gov.scot/Uploads/Documents/No%2033.pdf. Web site accessed January 14, 2018.

Suuronen, P. and D. L. Erickson. 2010. Mortality of animals that escape fishing gears or are discarded after capture: approaches to reduce mortality. Pages 265 to 294 *in* P. He, editor. 2010. Behavior of marine fishes: capture process and conservation challenges. Blackwell Publishing, Ltd., Ames, Iowa.

Suuronen, P., D. Erickson and E. Pikitch. 1997a. Mesh-size management in pelagic trawl fisheries—potential solutions. Pages 563-567 *in* D. A. Hancock, D. C. Smith, A. Grant and J. P. Beumer, editors. 1997. Developing and sustaining world fisheries resources: The state of science and management. Proceedings of the Second World Fisheries Congress. CSIRO Publishing, Collingwood, VIC Australia.

Suuronen, P., E. Lehtonen, and J. Wallace. 1997b. Avoidance and escape behavior by herring encountering midwater trawls. Fisheries Research. Volume 29(1), pages 13 to 24.

Suuronen, P., F. Chopin, C. Glass, S. Løkkeborg, Y. Matsushita, D. Queirolo, and D. Rihan. 2012. Low impact and fuel efficient fishing – Looking beyond the horizon. Fisheries Research. Volume 119-120 (2012), pages 135 to 146.

Swain, D. P., A.F. Sinclair, and J. M. Hanson. 2007. Evolutionary response to size-selective mortality in an exploited fish population. Proceedings of the Royal Society B. Volume 274, pages 1015 to 1022. Available at http://rspb.royalsocietypublishing.org/content/274/1613/1015. Web site accessed January 16, 2018.

Tagart, J. V. 1987. Description of the Washington state fishery for widow rockfish. Pages 11 to 12 *in* W. H. Lenarz and D. R. Gunderson, editors. 1987. Widow rockfish proceedings of a workshop, December 11 to 12, 1980, Tiburon, CA. U.S. Department of Commerce NOAA Technical Report NMFS 48. 57 pages. Available at https://spo.nmfs.noaa.gov/tr48.pdf. Web site accessed August 30, 2018.

Tagart, J. V. and D. K. Kimura. 1982. Review of Washington's coastal trawl rockfish fisheries. Washington Department of Fisheries Technical Report No. 68, 66 pages.

Taylor, I. G. and A. Stephens. 2014. Stock assessment of shortspine thornyhead in 2013. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/Shortspine_2013_Assessment.pdf. Web site accessed on October 20, 2017.

Thorson, J. T. and C. Wetzel. 2016. The status of canary rockfish (*Sebastes pinniger*) in the California current in 2015. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2016/05/Canary_2016_Final.pdf. Web site accessed February 16, 2018.

Tissot, B. N., M. A. Hixon, and D. L. Stein. 2007. Habitat-based submersible assessment of macro-invertebrate and groundfish assemblages at Heceta Bank, Oregon, from 1988 to 1990. Journal of Experimental Marine Biology and Ecology. Volume 352, pages 50 to 64.

Vasilakopoulos, P., F. G. O'Neill, and C. T. Marshall. 2011. Misspent youth: does catching immature fish affect fisheries sustainability? ICES Journal of Marine Science. Volume 68(7), pages 1525 to 1534.

Videler, J. J. and P. He. 2010. Swimming in marine fish. Pages 5 to 23 *in* P. He, editor. 2010. Behavior of marine fishes: capture process and conservation challenges. Blackwell Publishing, Ltd., Ames, Iowa.

Wakefield, W. W. 1990. Patterns in the distribution of demersal fishes on the upper continental slope off central California with studies on the role of ontogenetic vertical migration in particle flus. Ph.D. dissertation, University of California, San Diego, CA.

Wakefield, W. and M. McClure. 2014. Power Point presentation from ad-hoc mid-water gear bottom contact information session, Northwest Fisheries Science Center, Seattle, WA, December 12 to 17 2014. *In* Appendix D of Informational Report 4: National Marine Fisheries Service report on analysis of seafloor contact in midwater trawls engaged in the US West coast Pacific hake fishery. Pacific Fishery Management Council, Portland, OR. April 2015. Available at http://www.pcouncil.org/wp-content/uploads/2015/03/IR4_Groundfish_EFH_midwater_trawl_bottom_contact_Rpt_APR2015BB.pdf. Web site accessed December 4, 2017.

Wallace, J. R. Unpublished. Applying information from the U.S. West Coast's first major trawl bycatch and mesh size studies to fishery data using post-hoc fishing strategies and geographical area. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA.

Wallace, J. R. and V. Gertseva. 2017. Status of the darkblotched rockfish resource off the continental U.S. Pacific coast in 2017 (update of the 2015 assessment model). Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2017/05/F4_Att4_DBRK_2017_Assessment_Update_ExecSummary_Jun2017BB.pdf. Web site accessed on December 20, 2017.

Wallace, J. R., E. K. Pikitch, and D. L. Erickson. 1996. Can changing cod end mesh size and mesh shape affect the nearshore trawl fishery off the west coast of the United States? North American Journal of Fisheries Management. Volume 16, pages 530 to 539.

Wardle, C. S. 1975. Limit of fish swimming speed. Nature. Volume 225, pages 725 to 727.

Warlick, A., E. Steiner, L. Pfeiffer, M. Guldin. 2017. Economic data collection program catcher-processor Report (2009-2015). National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA. 54 pages. Available at https://www.nwfsc.noaa.gov/research/divisions/fram/documents/EDC_Catcher_Processor_Report_June_2017.pdf. Web site accessed October 20, 2017.

Wathne, F. 1977. Performance of trawls used in resource assessment. Marine Fisheries Review. No 1253. Pages 16 to 23. June 1977. Available at https://spo.nmfs.noaa.gov/mfr396/mfr3963.pdf

Weinberg, K. L. and D. A. Somerton. 2006. Variation in trawl geometry due to unequal warp length. Fishery Bulletin. Volume 104, pages 21 to 34.

West Coast Trawlers' Network. 2016. Gear Modification Workshop Summary. Groundfish Trawl Gear Modification Workshop; July 26 to 28, 2016, Newport, OR. Available at http://westcoasttrawlers.net/wp-content/uploads/2016/08/Gear-Mod-Workshop-Summary.pdf. Web site accessed October 20, 2017.

Westrheim, S. J., W. H. Barss, E. K. Pikitch, and L. F. Quirollo. 1992. Stock delineation of Dover sole in the California-British Columbia region, based on tagging studies conducted during 1948-1979. North American Journal of Fisheries Management. Volume 12, pages 172 to 181.

Wetzel, C. R., L. Cronin-Fine, K. F. Johnson. 2017. Status of Pacific ocean perch (*Sebastes alutus*) along the US west coast in 2017. Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/wp-content/uploads/2017/08/E8_Att3_POP_FullDoc_E-Only_SEPT2017BB.pdf. Web site accessed October 20, 2017.

Williams, E. H., A. D. MacCall, S. Ralston, and D. E. Pearson. 2000. Status of the widow rockfish resource in Y2K. Appendix to Status of the Pacific coast groundfish fishery through 2000 and recommended acceptable biological catches for 2001 (Stock Assessment and Fishery Evaluation). Pacific Fishery Management Council, Portland, OR. Available at http://www.pcouncil.org/groundfish/stock-assessments/by-species/widow-rockfish/. Web site accessed October 26, 2017.

Winger, D., S. Eayrs, and C. W. Glass. 2010. Fish Behavior near fishing gears during capture processes. Pages 67 to 103 *in* P. He, editor. 2010. Behavior of marine fishes: capture process and conservation challenges. Blackwell Publishing, Ltd., Ames, Iowa.

Zhou, S., A. D. M. Smith, A. E. Punt, A. J. Richardson, M. Gibbs, E. A. Fulton, S. Pacoe, C. Bulman, P. Bayliss, and K. Sainsbury. 2010. Ecosystem–based fisheries management requires a change to the selective fishing philosophy. Proceedings of the National Academy of Sciences, Volume 107 (No. 21), pages 9485 to 9489. Available at http://www.pnas.org/content/107/21/9485.full.pdf. Web site accessed on January 14, 2018.

Zimmermann, M. and P. Goddard. 1996. Biology and distribution of arrowtooth, *Atheresthes stomias*, and Kamchatka, *A. evermanni*, flounders in Alaskan waters. Fishery Bulletin. Volume 94, pages 358 to 370.

Appendix A
Public Comment Received from the Notice of Intent (NOI)

The Council received ten responses to a NOI that provided notice for the March 2016 Council meeting (81 FR 11189), where a preliminary draft EIS was presented (Agenda Item G.8 Attachment (Full Version), Electronic Only, March 2016). The response letters are shown below.

Commercial Fishermen of Santa Barbara

Commercial Fishermen of Santa Barbara, Inc. 6 Harbor Way, #155 Santa Barbara, CA 93109 www.cfsb.info

Mr. William Stelle April 1, 2016
NMFS Regional Administrator
7600 Sand Point Way NE
Seattle, WA 98115-0070
Attn: Jamie Goen

Re: Review of Trawl Rationalization Program

Mr. Stelle:

I am writing on behalf of the Commercial Fishermen of Santa Barbara and the small boat, limited entry, longliners fishing the waters of the Pt Conception Management Area (south of 34 27). I am a participant in this limited entry longline fishery. Our main catch is black cod and shortspined thorneyheads.

The purpose of this letter is to inform NMFS and the Pacific Fisheries Management Council about the huge negative impacts the Trawl Rationalization Program has had on our small boat limited entry fleet. Here are some of the ways the Trawl Catch Share Program has impacted our fishery:

The program has created a new fishery in our area. South of the 34 27, there was never a groundfish trawl fishery for black cod. The majority of the black cod fishery habitat was untrawlable due to its extremely rocky nature. One could say there was also a de facto closure outside the 600f line as this area was not fishable for the longliners because of the excessive grenadier catch. By allowing gear switching to traps and as a result of the program's ITQ consolidation, a huge impact has occurred in our area south of PT Conception as this area has become the main area where the bulk of the trawl quota catch is now coming from.

The trawlers were allowed to fish on a bi-monthly basis as we are doing now. The ITQ trap boats come down and fish 24/7 for a short period of time with unlimited gear and can negatively impact an area with such intensive fishing. This impact can take years to rebound if it rebounds at all. This super concentrated fishing style is a damaging and extremely poor fishery management technique.

Specifically, these over 50' boats typically set 6 strings of gear. Each string consists of 30 – 50 traps and is approximately 2 miles long. The gear footprint can easily be 20 linear miles. Most of these boats are capable of carrying only 2 strings of gear so each time they go in to unload they can get another 2 sets of gear. Along with the significant impact on the resource this huge footprint totally excludes us from fishing the same area. We have attempted several times to establish a communication line to mediate where their gear is but have not succeeded. This gear conflict is unacceptable.

Before the trawl program existed, the trawl boats had many options for fishing and could do so as the market and resource dictated. When the ITQ program was introduced the different trawl species were separated out and dealt with individually. Much of the quota was sold at premium prices making for a significant investment by the ITQ boats. Even if the resource or market suggested that it would be better to concentrate on another species, the ITQ boats don't have that option because of their huge financial commitments. As the resource fluctuated this ability to switch to another species was a safety valve that doesn't exist now.

Additionally, with the implementation of this trawl ITQ program came fees and conditions to pay for the program, including the buy-back and incorporation of ground truthing (observers). While these fees and conditions make it more difficult for the quota consolidators, they make it absolutely uneconomical and totally prohibitive for our small boat (<38') fleet to be successful participants in the program. The size of our boats limits the amount of gear and fish we can hold. We cannot re-bait on the grounds, so after traveling 60 miles we get one set and have to return home. We don't have room for an observer. Basically we are completely prohibited from participation in any aspect of this ITQ program because of these economic constraints.

The Catch Share Program was based on the concept of "The Tragedy of the Commons" where a set area was no longer used for common use and separated into areas where people could, through ownership, take care of their plot and not over harvest it. By allowing these out of state, non-owner operated, huge ITQ boats to consolidate quota and take over an area, the exact "tragedy" that catch shares was meant to avoid is present. We are asking for an immediate solution and need the NMFS to take responsibility and do something about this unforeseen tragic outcome.

RECOMMENDATIONS:

From our small boat point of view the obvious solution would be to do away with the trawl program and put it back the way it was. Politically that probably isn't a possibility.

- The bulk of the quota in this program came from above the 34 27 line. (North of Pt Conception). Find a way to mitigate this for the fishermen south of that line (Pt Conception Management Zone) as the bulk of the trawl quota catch has now been coming from this southern area.

- Require the trap boats to take all their gear in when they unload.

- Put a trap limit (one boatload worth) on all trap boats.
- Level the playing field between the ITQ boats' unlimited access and the limited entry longline boats' weekly and bi-monthly access.
- Work with the small boats to find a way to give them affordable access to the program.
- Please note that the concept of having a modeler determine the TAC and then caring only that the TAC is met and not caring how the TAC is extracted is a biologically and socially irresponsible management technique.
- Realize that this program is absolutely ruining our local groundfish community. The status quo is not acceptable.

CONCLUSION

This outcome of this program is not in the spirit of the Magnuson-Stevens Act. There have been many unforeseen consequences of this Groundfish Trawl Catch Share Program. The purpose of this review is to quantify those consequences and do something about them. Please do that. Also do not hesitate to contact me regarding any of the issues discussed above.

Sincerely,

John Colgate
Vice President CFSB

Groundfish GearEIS - NOAA Service Account <groundfish.geareis@noaa.gov>

Comments on Trawl ITQ Gear Switching

1 message

roger cullen <dorado032002@yahoo.com> Sat, Apr 2, 2016 at 7:21 PM
Reply-To: roger cullen <dorado032002@yahoo.com>
To: "groundfish.gearEIS@noaa.gov" <groundfish.gearEIS@noaa.gov>

Dear William W Stelle Jr.

My name is Roger Cullen. I am a long time fisherman working out of Morro Bay for over 30 years now. I have invested in a "A" long line permit for some time

now, and fish Sable as well as Short Spine on a weekly basis. I, am very concerned about the large IFQ fixed gear vessels fishing in the waters south of 36

degrees targeting Sable fish with what appears to be an uncontrolled quantity of trap gear. These boats are now piling Sable quota up to a vessel cap limit of

over 200,000 lbs. , carrying and trucking hundreds of large traps to our town. It took six hours for two of our dock workers just to unload one boats gear from

truck to dock last year! They are not here long...three or four weeks, but saturate our traditional long line areas, extracting hundreds of thousands of pounds of

Sable in a very short time...not good for the resource or sustainable. We have noticed declining CPUE and very poor fishing after they leave the areas they

have occupied and recovery appears to take months. These results have now been documented by PSMAC. Our once stable traditional Fixed Gear Sector is

now threatened with this injection of 170 new potential IFQ participants into a Fixed Gear Sector. For all intent and purposes our fishing grounds for Sable here

are from 36 degrees to just a bit below 34.27 degrees...not a lot of area when you think about it...in my opinion our fishing grounds will not survive this new

pressure. Small town boats...so important to our small fishing communities are under threat along with our continually developing domestic markets.

How can this happen? Is there not something in fishing law that prohibits a new sector from affecting another in such a way? We are hearing this situation is

now effecting even some of the IFQ trawl boats, not being able to fish to their potential due to the rising cost of IFQ Sablefish....a result of the new directed IFQ .

fixed gear program. We need some control mechanism here...Trap limitations south of 36 degrees...Bringing in gear before landings...reducing the IFQ vessel

cap for southern Sable....or even preferably for many of us eliminate the IFQ fixed gear program altogether south of 36 degree line.

Respectively,

Roger Cullen
F/VDorado
805-909-1025

04/02/2016 To William W. Stelle, Jr., Regional Administrator, West Coast Region, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115-0070; Attn: Jamie Goen.

Dear Sir,

I would like to bring a couple of points to your attention regarding the Trawl Catch Shares (Rationalization) program. I am not naïve enough to think that there is any possibility of the whole scheme being thrown out, as it should be, but there is a change that could be instituted to remedy some of its more damaging aspects.

The whole gear switching option has proved to be a disaster for the traditional fixed gear fleet operating under "A" Limited Entry Permits. There was once an orderly fishery that provided fish to local markets at a measured rate with many people depending on these fish through out the supply chain.

In times past, when trawlers were actually trawling, they took a broad variety of species. Their catches were managed quite well, through a "bi-monthly" limit system. There never was a trawl fishery, in this area, that targeted strictly Sablefish. The fishery was even referred to in the log books as the "DTS" target species , Dover sole, Thornyhead and Sablefish. What we have now is a directed "Sablefish only" fishery with three or four large boats coming to the "south of 36 degrees" area with hundreds of traps and removing huge amounts of fish in a short amount of time.

The trawl fishery primarily took fish in the 3/5# and 5/7# categories while operating in this area. Now, we have these trap boats targeting large fish which are more fecund, (http://calcofi.org/publications/calcofireports/v30/Vol_30_Hunter_etal.pdf.) through the use of escape rings. Time will tell what the long term effect of the removal of vast numbers of these large fish will have on the population. One of the other environmental issues is that these trap boats present is their propensity of setting on rocky bottom areas where the large females and their attracted males tend to congregate. These areas support vast communities of benthic organisms that are doubtlessly being adversely affected by the traps tearing up the bottom as they are retrieved.

With the current system, these large trap boats come into previously virgin areas and lay out hundreds of heavy steel and web traps on sensitive rocky bottom areas. They then leave this gear on the grounds when they return to port for off-loading or when they are forced to leave the grounds due to weather. Traps left for more than a day always have a certain level of "dead loss". Fish that die as a result of being trapped in a confined area coupled with predation from slime eels and sand fleas. There is no way to quantify this amount of fish waste as there is frequently nothing left of the dead fish other than some bones and skin remnants. The grounds where all of the boats fish, are heavily traveled by ships and tow boats with barges enroute between west coast ports and Asia. It is inevitable that as time goes by, long strings of trap gear that are left unattended are going to be cut off by the ships and tow boats. These lost gear strings, in addition to "ghost fishing" for a time, are going to make areas unfishable by the longline boats due to snagging.

Gear switching is a bad idea. If the council is unwilling to roll that bad idea back, then please require that the traps be removed from the water when the vessel returns to port for off loading or when weather prevents the gear from being hauled on at least an 18hour basis. Another idea that would also help, would be the elimination of escape rings so that the quotas would be taken with a more broad spectrum of the fish population size, rather than targeting the larger, more fecund fish. The old system was not as bad as the ENGO's led the council to believe, the bi- monthly limits produced more of an orderly fishery and less of a "derby" with large amounts of fish being extracted and dumped on the market in short time periods, which the Catch Shares gear switching has brought now.

Thank You for your consideration. William Diller GF0632.

Groundfish GearEIS - NOAA Service Account <groundfish.geareis@noaa.gov>

ITQ gear shifting comments

1 message

Chris Hoeflinger <makaharvest@gmail.com> Fri, Apr 1, 2016 at 4:20 PM
To: groundfish.gearEIS@noaa.gov

April 1 , 2016

Comments for trawl ITQ gear switching.

Dear William W Stelle Jr.

Thank you for the opportunity to comment on this important topic.

First let me state that I hold a west coast fixed gear ground fish A permit with Longline endorsement.

I would also like to state that I support responsible trawl fishing and believe that it is the most effective , and sometime the only viable method to catch certain species of ground fish.

Converting trawl boats to trap boats requires more thought and precaution. It is not the silver bullet our environmental friends would have us believe.

I am very concerned about the adverses impact that the Trawl ITQ gear switching has had on the fixed gear longline and pot fishery south of point Conception where I live and fish.

Allowing only one fishery sector (trawling) the opportunity to gear switch is unfair to other gear types for the following reasons.
1. no other sector is able or permitted to switch gears to compete on a level playing field. If you allow trawlers to switch to trap gear so they can access a species of fish which they previously did not catch In my area with trawl gear like black cod, you are stealing opportunity away from the fixed gear sector and from me. The original purpose of limited entry in the west coast ground fish fishery, was fair and equitable allocation of a limited resource between gear types. The trawl fishery in my area historically was primarily a flatfish fishery, not a blackcod fishery.
2. ITQ gear switching has concentrated large amounts of new fixed gear pot effort into the conception management area. This is detrimental to the sustainability objectives that the limited entry program was designed to address.
3. How may Limited entry fixed gear permits, endorsed for pots, made significant landings of black cod south of conception prior to the ITQ gear switching program? The answer to this question will highlight the the mistake the NMFS has made in allowing new, unrestrained effort to enter a previously stable and controlled fixed gear fishery South of point Conception. The Pacific coast goundfish fish management plan limited the number of ground fish pot boats for biological and economic reasons. Arbitrarily ignoring those reasons and purpose, could result in grave consequences to not only established fix gear permit holders, but also the sustainability of the ground fish stocks they depend on. ITQ Gear switching has disrupted a once orderly run black cod fishery south of Conception. It has turned it into a derby style race for the fish with long liners unable to compete with pot gear deployed by larger ITQ gear switching trawl boats. These boats have substantially higher overhead costs. They are able to mop up large volumes of fish very rapidly. Is this not what we are trying to avoid? We're not the highly restrictive by-monthly quotas, intended to slow down the rate of harvest? Is it fair to restrain local long liners using less efficient gear with low by-monthly quotas while you reward out of town ITQ gear switchers with the ability and permission to catch an entire years catch on the same fishing grounds in a week or two?
4. If one gear type is good and another bad, are you not punishing the wrong gear type by disenfranchising the users of the good?

Recommendations:

1. End the ITQ gears switching program and return the trawl boats to trawl gear fishing.
2. If you will not end the gear switching program, allow all gear types to switch to any gear they prefer and allow them to catch 6 bi-monthly quotas in one month.
3. If you will not select one of the two options above, constrain the gear switchers to bimonthly quotas equal to 1/6 of their ITQ.

Remember , ITQ stands for individual transferable quota not individual transferable gear switching. If gear switching is good it should be good for all gear types not just trawling.

Your ITQ gear switching program has failed not only long liners and pot endorsed fix gear fishermen it has failed the sustainability objectives of the resource we depend on as well. The gear switching program dilutes the profitability of fixed gear fishermen. It damages a resource we are trying to rebuild. It is unfair.

Respectfully ,
Chris Hoeflinger

Sent from my iPhone

April 4 2016

William Stelle Jr.

Regional Administer

West Coast region, NMFS

Seattle, WA

Mr. Stelle,

My name is Austin Jeffcoat and I am a long line fisherman that works in the Point Conception Management Zone. I am writing this to express my concerns about the trawl/ ITQ program and how it negatively affects me.

How can it be fair to allow one sector to catch an entire year's bi-monthly allocation in a trip or two on the grounds they never fished historically with a gear type they never qualified to use? You're allowing this at my expense. What kind of management is this? A few big trap boats come down and scoop up more fish in a couple of months then the whole fleet of small boats that traditionally fish these grounds do in a year. Never had gear conflicts until trawl/catch shares, now we do.

My recommendation to fix this problem is either eliminate the program entirely by making the trawl boats go back to trawl fishing or allow all gear types to switch to any gear they like and be allowed to catch six bi-monthly trip limits in one month. If gear switching is good, then it should be good for all gear types.

The catch share/ trawl ITQ program has totally failed the small boat fixed gear fleet and reduced our profitability.

Sincerely,

Austin Jeffcoat

NOAA

Groundfish GearEIS - NOAA Service Account <groundfish.geareis@noaa.gov>

Gear Switching is Harmful to Communities

1 message

Owen Hackleman <ohackleman@gmail.com> Sun, Apr 3, 2016 at 7:12 PM
To: groundfish.geareis@noaa.gov

Dear Sir,

I am a longline permit holder and vessel owner who relies on the year round groundfish fishery out of Morro Bay, south of 36 degrees latitude to support my family.

Allowing gear switching for southern sablefish trawl quota to use pots to target sablefish has been a disaster for local small-scale longliners in central and southern California. Unlimited amounts of heavy pot gear can eliminate access to productive fishing grounds within the range of small, local longline boats, making it impossible to safely set and recover longlines. Some pot gear has been lost and in some cases even abandoned in prime fishing areas, forever preventing longline boats from accessing those areas because of costly and dangerous tangles with the massive gear used by the IFQ boats.

The use of pot gear by large IFQ boats to target sablefish south of 36 degrees has been a major hardship for local longline fishermen in Morro Bay and Santa Barbara. These boats from other states are effectively able to cordon off massive fishing areas with unlimited numbers of pots, preventing access to vital grounds by local fishermen for weeks or even months at a time. Unlike longlines, which are brought back to port every trip, pots are left on the fishing grounds while the IFQ boats return to port to land their catch. It is impossible for local boats to fish these areas without high risk of gear loss and damage from entangling with the pots and the miles of heavy rope to which they are connected.

Central and southern California are also subject to a large amount of commercial shipping traffic. This traffic generally travels through the depths where sablefish are most abundant, which inevitably leads to the loss of unattended pot gear left while IFQ boats return to port to unload catch. These vast unrecovered strings of pots are miles long and cause very costly damage or loss to longline gear they come into contact with. Fishermen are forced to avoid grounds that have been vital to our income and more areas are taken from us every time a string of this large scale pot gear is lost due to heavy ship traffic.

Our local longline fleet consists of small, owner operated businesses and every one of these has seen a dwindling bottom line in an already struggling industry due to conflict with large IFQ pot boats. Some common sense solutions must be enacted to prevent further economic losses to our communities. Pot limits of 100 pots per boat or less would prevent local fishermen from being forced from our vital fishing grounds and requiring traps to be retrieved before landing each catch would prevent the loss of gear and allow longliners to access areas after the pot boats.

Thank you for your consideration,

Owen Hackleman

fishing vessel Provision

Longline Permit # GF0633

Point Conception Groundfishermen's Association
Santa Barbara, California

April 3 2016
William W. Stelle, Jr
Regional Administrator
West Coast Region, NMFS
7600 Sand Point Way NE
Seattle, WA 98115
Attn: Jamie Goen

Dear Mr. Stelle,

As a lifelong ground fish fisherman in the Point Conception Management zone, and as a representative of our association, I feel it would be appropriate for me to provide a few thoughts about the Trawl Catch Share Program and some of the collateral or unintended consequences of the program to fishermen and their fishing communities. Some of my fellow fishermen who fish south of Point Conception have already sent in comments about how the program has affected them in a more immediate time frame. I would like to address the impacts of the program on the 'ground fish fishery' in a broader sense and how it has contributed to the systematic hijacking of the Council process by NGO's.

We need to back up several years to the beginning of the "west coast ground fish crisis". First off, an important point, the entire suite of crises were obviously exaggerated. With what authority can I make this claim? Because every stock of supposedly overfished species has rebounded light years ahead of original projections. Many have already been declared rebuilt with two more stocks projected to be rebuilt next year. So, either the original data was complete bunk, or we did not have a ground fish crisis anywhere near the magnitude purported, or the fishery managers failed miserably at their jobs and let politics influence management decisions.

The Trawl Catch Share program was conceived as a result of three events.

1.) A questionable ground fish crisis based on shoddy data.
2.) A NOAA director (Dr. Jane Lubchenco) that was doing the bidding of NGO's
3.) The mistaken belief that IFQ programs would be the savior of our ground fish fisheries.

So, how specifically has the Trawl Catch Share program affected the industry, fishing communities and Council process? Let's take a look at the Pacific Fishery Management Council, the entity that is supposed to oversee and provide the guidance for management of the fishery. Before trawl ITQ, a typical PFMC meeting was two days long, three at most. Management cycles were one year instead of two. Now a typical PFMC meeting is 6 days or longer and there are off the agenda meeting days attached to each meeting to try and hash out all of the issues going on so the Council actually has some chance of getting something done. In the meantime, the ground fish stocks have been rebuilt or increased to such a magnitude that fishermen can't get away from the species of concern. Healthy stocks can't be accessed because of RCA's, MPA's, CCA's, EFH areas, choke species, seasonal and time closures or quota's that are so small it's not cost effective to even bother. The Council who is so inundated with Trawl ITQ/Catch Share program shortcomings and making up regulations on the fly, has lost touch with the reality of what's really going on with West Coast ground fish. The majority of the industry can't get a fair or equitable piece of the ground fish pie even though the stocks are beyond healthy. How can you expect unsubsidized fisherman or fishermen associations to consistently participate with meaningful and thoughtful input to the Council and maintain their fishing business while NGO's with paid representatives, lobbyists and attorneys have overwhelmed the process? The few fishermen associations that do have paid reps are the very ones that trawl/ITQ program benefits, not the rank and file independent fisherman who are the overwhelming majority of the ground fish industry. The playing field in the Council process has not been level since the trawl/ ITQ process started.

For us that have been affected, the benefits to the fishing industry and their communities never have materialized from the trawl/ITQ program. NOAA continues to spin the results of the program like it has been a smashing success while Eileen Sobecks and her predecessors monthly 'rah rah we did it' diatribes in National Fisherman only inflame an industry already on its knees. Too many family fishing operations have gone out of business because they can't make their fishing business profitable any longer. The infrastructure at the ports that support the fishing business have declined to an extent that ice houses are gone, wharfs with hoists and truck access points have disappeared, ships chandlery businesses have closed up shop. The bottom line is that robust fisheries equate to robust fishing communities. Unfortunately, that will never be realized because NOAA and the Council while trying to save face, have become polarized trying to make a failed program work at the rest of the industries expense.

Respectfully,

Tim Athens

PCGA

April 4, 2016

William W. Stelle, Jr
Regional Administrator
West Coast Region, NMFS
7600 Sand Point Way NE
Seattle, WA 98115
Attn: Jamie Goen

Re: Review of Trawl Rationalization Program

Mr. Stelle:

I am a limited entry fixed gear fisherman in the Conception management area and I am writing to express my view and share my experience of the trawl rationalization program. Since the program was implemented in 2012 there has been a drastic decline in the abundance of sable-fish, an overall smaller grade of fish being caught, lowered market prices, and the immergence of safety hazards on the fishing grounds.

The catch share program has depleted the Sablefish resource in our area. Because the Trawl Rationalization program eliminated trawl boats bi-monthly quota constraint, the owners of the ITQs have the freedom to take their entire annual quota at one time. This has created consolida-tion of quota and the use of huge boats to extract the maximum amount of fish possible in the shortest amount of time, gaining the economy of scale and maximum financial gain. The ITQ boats come down to our area in late summer or fall to harvest sablefish when they are grouped up and spawning. Once the quota is filled, these large ITQ boats leave the area to participate in other west coast fisheries. The traps that they use have escape rings located in the mesh ensur-ing that the small fish escape and only the large, more valuable breeding stock are caught. In addition to the obvious decline that I have seen with my own eyes, this practice is sure to cause a more long lasting damage to the biomass. As regulated by the NMFS, we are required to har-vest fish slowly throughout the year and use non-discriminate hooks. Question: Why does the NMFS allow these guys to come here and break all the rules that they themselves have put in place for us and for the protection of the resource?

The Sablefish of the Conception management area were never targeted by the trawl sector before the trawl program's gear switch. The "supposed" historic landings that the transferable quotas are based on did not come out of our Conception Management area. It is only now that they are allowed to use pots that they have traveled into our area to catch Sablefish. Groundfish in the south have never seen this kind of extreme derby fishing before. We do have a healthy groundfish stock in our area, just not the species targeted by the trawl program.

The ITQ program has damaged the value of the resource and harmed the local community economy. ITQ fish are generally j-cut, frozen, and sold in quantity for cheaper prices, the exces-sive amount of lower quality Sablefish on the market has caused the market price to drop drasti-cally. The fishermen of our LE fleet take pride in bringing a high quality, sustainably managed product to the community and we deserve to sell our fish at prices that reflect the value of our product and our work.

The trawl program has created hazardous working conditions for the limited entry fleet of our area. The ITQ boats come into our fishing area with much more gear than they can carry on their boat at one time and so the gear is left on the fishing grounds for long periods of time while the boats have left the area. They leave miles of hazardous snags in the water that endanger any other boats attempting to fish the area. It is crucial for NMFS to address this issue if nothing else due to the threat of injury and loss that has been imposed by this practice of gear storage.

Additionally, the NMFS should note that fish traps left unattended for long periods of time continue to catch. It is well known that fish that are caught and left in traps often die from predation, this unknown and unaccounted for quantity of fish is further reducing the resource.

The Catch Share program was introduced as a way to make the fishing industry safer, more lucrative, and more sustainable but my personal experience and that of everyone I know is that the Trawl Program with the use of ITQ has done the exact opposite. The simple solution to this horrendous situation is to figure out a way to end the ITQ program. I understand that this is a difficult task but if the NMFS has the integrity to fulfill its duty in upholding the Magnusun-Stevens Act, whose purpose is to “prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry”, then it will find a way. The ITQ program is not fulfilling its purported purpose and is not in accordance with the Magnusson Stevenson Act- the NMFS is therefore duty bound to correct or eliminate the program.

I have limited faith in the willingness of the NMFS to eliminate the program but I know that changes and improvements can be made and ask the council to dedicate yourselves to this important task. It is crucial that changes be made to the ITQ program rules to align them with the management area regulations currently in place to conserve the west coast fisheries. In our area, this means that you must re-distribute the trawl quota evenly throughout year and end the rapid-extraction and large fish depletion. Re-instate the by-monthly catch periods. This is the only way to restore the balance of the west coast ground fish fleet.

Thank you for taking the time to read this letter and for your work.

Sincerely,

Jason Michael Robinson

FV Miss Conception
Limited Entry Ground fleet
Santa Barbara, California
sbjay@ymail.com
(805) 680-7559

4/25/2016 National Oceanic and Atmospheric Administration Mail - Impact of trawl catch shares.

Groundfish GearEIS - NOAA Service Account <groundfish.geareis@noaa.gov>

Impact of trawl catch shares.

1 message

Steve Hackleman <stevenwh1@yahoo.com> Mon, Apr 4, 2016 at 11:34 AM
To: groundfish.gearEIS@noaa.gov

Dear Sir,

I am an owner/operator that fishes an "A" fixed gear permit out of Morro Bay, California, my concerns about the "catch share program" are listed below.

1. Limits new entrants to the fishery as share ownership is being aggregated by wealthy corporations/individuals. Program costs also limit smaller owner operator participation as smaller boats(artisanal operations) simply don't catch the volume of fish necessary to make their one or two day trips trips profitable. Under the new program it is a high volume low margin fishery that precludes the participation of locally based individual small boat artisanal operations.

2. Trawl boats using fixed gear are now fishing in areas that have been traditionally fished by the fixed gear fleet and they are having a significant impact. They are typically larger boats that fish traps and they leave all their gear in the water for the weeks/months it takes to catch their quota. This leaves the grounds unavailable to our local traditional fixed gear fleet. There is also the growing problem of lost gear that complicates fishing with hook and line such as most of the small boats use. The traditional fixed gear fleet generally removes all gear at the end of each trip. There should be a limit on the number of traps and they should be removed at the end of the trip.

3. The fishing of this quota by mostly out of area boats/crews does not enhance the local waterfront economies as it once did when it was fished by local boats/crews. Many local businesses have been affected negatively by this change.

4. They primarily target only only one or two species(Thornyhead/Sablefish) in the new areas they fish and in the case of sablefish are generally taking a larger more fecund grade of fish than was traditionally caught by the trawl fleet, they also generally harvest a very large volume of fish in a relatively short period of time compared to the local fleets that are fishing small volumes year round. This is most definitely having a negative impact on the fishing stocks in the traditional fixed gear fishing areas out of the Morro Bay/Santa Barbara ports.

These are my primary concerns with the program and how I see it affecting the fishery.

Sincerely,

Steve Hackleman
FV Ruth Anne II, GF0309

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WEST COAST SEAFOOD PROCESSORS ASSOCIATION
650 NE Holladay Street, Suite 1600
Portland, OR 97232
503-227-5076
March 30, 2016

William W. Stelle, Jr.
Regional Administrator, NMFS West Coast Region
7600 Sand Point Way NE.
Seattle, WA 98115-0070

Attn: Jamie Goen

RE: Comments on Trawl Gear Change NOI

Dear Mr. Stelle:

The following comments are submitted by the West Coast Seafood Processors Association (WCSPA) regarding the Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for gear changes proposed in the Pacific Coast groundfish fishery trawl catch share program, published in the *Federal Register* on March 3, 2016. WCSPA represents shoreside processing companies located in CA, OR, and WA. Our members process more than 80 percent of groundfish landed on the Pacific Coast, and many of them have been greatly affected by the groundfish trawl catch share program.

WCSPA strongly supports moving forward with this management action as expeditiously as possible so the groundfish trawl fleet can begin to experience the benefits assured to them when the trawl catch share program was developed. The measures proposed in the gear change NOI are critical to increase flexibility and fishing opportunities for the trawl fleet, which in turn will provide benefits to shoreside processors and other fishing-related businesses in communities along the Pacific Coast.

Proposed Management Measures (Section 2)

The NOI and Draft EIS address eight proposed gear changes, identified in the documents as Issues A-H. WCSPA supports the March 2016 recommendations of the Groundfish Advisory Subpanel (GAP) for the final management measures, many of which were included in the Pacific Council's *final preferred alternative* (FPA). With respect to the Issues F and G, WCSPA offers the following comments:

- **Issue F (Multiple Gears)** – We support the GAP recommendations regarding this issue. Alternative F3 (multiple gears on board), Gear Sub-option A (use any trawl gear), and Sorting Sub-option B (catch by gear type can be comingled), with allowance for more than one gear fished on a trip would be most helpful in providing flexibility to the trawl fleet. It would reduce fuel costs and create more efficient fishing operations. The Pacific Coast groundfish trawl fishery is one of the most heavily-monitored, highly-documented fisheries in the world; vessels participating in this fishery use vessel monitoring systems (VMS), pay for 100% monitoring (at-sea and dockside), and fill out logbooks and electronic fish tickets. Given the small number of vessels/trips that may take advantage of the flexibility afforded under this option, it is very difficult to understand how there could be uncertainty about the gear used to harvest the fish on a particular trip, and how that uncertainty could ultimately compromise future stock assessments. Surely, haul-specific observer logs could be cross-checked with vessel logs and fish tickets to determine the operational details of the fishing trips that use multiple gears.

- **Issue G (Fishing in Multiple IFQ Management Areas)** – For similar reasons as those discussed under Issue F above, we support further consideration of options to allow vessels to fish in multiple IFQ management areas. We urge the Council to select this FPA at the June 2016 Council meeting.

Draft Impact Analysis (Section 4)

Overall, we believe the positive impacts of the proposed management measures are understated throughout Section 4 of the Draft EIS. Additionally, some of the potential negative impacts are overstated, speculative, and based on outcomes that are highly unlikely and, in many cases, unrealistic. Under a catch share system, fishermen are not going to make decisions that are uneconomical. Fishermen will not take advantage of the proposed gear changes to modify their gear in order to target and land smaller groundfish, which are less marketable. Targeting smaller fish will not increase economic returns. Moreover, WCSPA processors do not want to buy small groundfish.

Having flexibility to develop gear innovations and tailor fishing operations to individual vessel needs will help improve economic returns in the groundfish fishery. The proposed gear changes encourage conservation engineering and gear specialization within the trawl fleet. These measures help achieve the outcomes desired by the catch share program, i.e., providing 100 percent accountability and allowing fishermen to maximize their economic returns from the limited amount of fish they are allowed to catch. The *purpose and need* of this management action (Section 1.3 of the Draft EIS) touches on these impacts, but the discussion of the purpose and need section should be expanded so the positive impacts on harvesters, processors and fishing communities (discussed in Section 4) can more clearly link to the purpose and need.

Specific to the Draft EIS, WCSPA offers the following additional comments:

- When addressing impacts of the gear changes on non-target species and protected species, conclusions regarding the negative impacts are largely speculative; additionally, the positive impacts of bycatch reduction through conservation engineering and gear innovation are not acknowledged under several of the proposed measures. For example, Section 4.1.2.2.3 and 4.1.2.3.3 conclude that Mesh Alternative A3 (part of the Council's FPA) would likely have a *medium negative* and a *high negative* impact on non-target species and protected species respectively, as it may affect their stock productivity over time because more and smaller non-target species/protected species might be caught. However, Mesh Alternative A3 and the other proposed gear changes may result in a reduction of interactions with non-target species and protected species as more selective fishing gear is developed, thereby producing *positive* impacts. The biological benefits of providing fishermen with flexibility to experiment with gear should be acknowledged throughout this section.
- Similarly, the economic benefits of increasing efficiency as well as reducing bycatch should be more explicitly acknowledged throughout the impact analyses in the Draft EIS. As previously noted, it is not economically desirable for the industry to target small fish, nor is it consistent with fishing behavior that is expected under a catch share system. Catch shares are specifically intended to increase economic efficiency in the fishery. Section 1.3.1 of the Draft EIS states the purpose for this action is to foster innovation and allow for more optimal harvest operations and that the benefits of this action may include increased efficiency through reduced costs and increased revenues. Therefore, the analyses throughout Section 4 should more directly relate the impacts of the proposed gear changes to the language in the purpose and need and should acknowledge the economic benefits of reducing bycatch through gear innovation.
- The analyses provided in Section 4 should also consider the positive impacts associated with improving yield from the groundfish fishery. Aggregate attainment in the non-whiting groundfish trawl fishery in 2015 was 20 percent and has averaged 28 percent over the last five years since the

catch share program was implemented. The current groundfish management system is clearly not meeting the requirements of National Standard 1 – to prevent overfishing *while achieving, on a continuing basis,* the optimum yield from each fishery. While the groundfish fishery may never see 100 percent utilization, the management system certainly should be designed to allow the fleet to maximize utilization of optimum yield given the right market, fishery, and weather conditions. This is the intent of the MSA, and bringing the Pacific Coast Groundfish FMP one step closer to compliance with National Standard 1 should be explicitly acknowledged in the document as one important benefit expected to result from the proposed management action.

- The Draft EIS should include a discussion of the overall impacts of the entire suite of measures included in the Council's FPA for this management action. Many of the positive impacts that can be expected from the proposed action will likely be even *more positive* when Issues A-H are evaluated "as a package." Similarly, concerns about non-target species or protected species interactions that may occur under one option may be lessened when that option is "packaged" with other options that, in combination, more directly encourage bycatch reduction through gear innovation. A discussion of the collective impacts of the Council's FPA would also provide another good opportunity to relate the benefits of the proposed action to the purpose and need.
- Section 4.9 of the Draft EIS provides a cumulative effects analysis (CEA) that adequately considers the effects of past, present and reasonably foreseeable future actions in combination with the proposed management action. Two future actions of particular attention are identified and addressed to the extent possible in the CEA: (1) further implementation of electronic monitoring (EM) in the trawl fishery; and (2) potential changes to the groundfish EFH/RCA areas. Further consideration/implementation of EM in the trawl fishery requires substantial additional discussion and analyses and the interaction of the proposed gear changes with additional EM requirements for the bottom trawl fleet cannot be predicted with any certainty at this time. Options for modifying the EFH/RCA areas are not yet fully developed and analyzed, also making cumulative effects difficult to predict at this time. However, moving forward expeditiously with this proposed action will better inform the analyses that will be necessary for the EFH and EM actions in the future. When the Council is closer to selecting a FPA for those management actions, it will be appropriate to consider the cumulative impacts of the trawl gear changes at that time.

In sum, WCSPA supports the Council's FPA (with the addition of GAP recommendations for Issues F and G) and urges NMFS to move forward with the approval and implementation of this action as quickly as possible. The groundfish trawl rationalization program has yet to achieve its intended objectives of increasing net economic benefits, creating individual economic stability, and providing full utilization of the trawl sector allocation. The implementation of the proposed gear changes will bring the program one step closer to achieving these objectives.

Sincerely,

Lori L. Steele

Lori Steele
Executive Director

Appendix B
Public Comment and GAP Reports from March and June, 2016 Council Meetings

The sections below detail public comments received during council meetings. They also present information from GAP reports to the Council.

March, 2016 Council Meeting

Oral public comments and a GAP report were provided under Agenda Item G.8 at the March 2016 Council meeting (Changes to Trawl catch share program Gear Regulations – Final Action). There was no written public comment related to this action. Following are excerpts taken from this input at the March Council meeting.

GAP Report: The Council and NMFS took the GAP statement into account for scoping purposes. The GAP provided general input relative to purpose and need, identified preferred options (along with the rationale), and recommended removal of specific options (Agenda Item G.8.a, Supplemental GAP Report, March 2016). The GAP made the following general points:

- The GAP has consistently advocated for eliminating archaic regulations from pre-catch shares management to achieve greater economic viability and efficiency.
- The trawl sector has become more inefficient because new regulations were overlaid on out-of-date regulations.
- The trawl fleet is bearing all the burden of being fully rationalized without the majority of the benefits of a rationalized fishery.
- The industry would like to return to the best, most efficient and conservative gear that has been used in the past; industry would also like to have the opportunity to freely design and experiment with new gears that could be even more efficient and selective. The catch share program was designed to encourage innovative approaches.

Responding to Council questions on the GAP report, Kevin Dunn (trawl vessel owner and operator) provided the following information:

- No one wants to encircle the codend with chafing gear. I would want to attach the chafing gear to the top riblines and extend the chafing gear beyond 50 codend meshes.
- The goal is not to catch smaller fish.
- There are no changes in the alternatives that would increase bottom impacts.
- There is no longer any reason to use double-wall codends.

Oral Public Testimony: The Council and NMFS took public testimony into account for scoping purposes (***ftp://ftp.pcouncil.org/pub/R1603_March_2016_Recordings/***). Some points made during this public comment period follow.

Lori Steele, Executive Director, West Coast Seafood Processors Association:

- Many of the shoreside processors have been greatly impacted by the catch share program.
- The importance to the industry is understated in the preliminary draft EIS.
- The trawl fleet has been working under all of the requirements of catch shares, but has not reaped any benefits.
- Aggregate attainment in non-whiting groundfish catch share last year was 20 percent, and averaged 28 percent over the last five years.
- This program is not meeting the requirement of National Standard 1, a primary Council mandate, to prevent overfishing while achieving optimum yield. It says "while achieving optimum yield." We are not even close.
- This is a step in the right direction to meet the requirements of Magnuson.
- Much of the preliminary draft EIS is unrealistic. Fishermen will not do something that does not benefit them economically.
- Fishermen will not take advantage of regulations to land small, unmarketable groundfish.
- The WCSPA support inclusion of any action that provides more flexibility to fishermen and provide more fish at the dock.

Jeff Lackey, trawl owner/operator:

- Regarding sorting options under multiple gears and multiple areas – the concern is not sorting itself, but this will require extra effort, such as more offload protocol.
    - How will this play out at the dock? It will be necessary to identify which bin gets offloaded. The process might be inefficient.
    - Communication will have to be good between the boat and the dock.
- Different boats have different bin configurations. Sorting requirements will impact some boats more than others.
- Sorting options will require more deck-sorting time and more offload time.

Paul Kujala, trawl owner/operator:

- Risks are overstated in the preliminary draft EIS; the potential benefits are understated.
- My income is half of what it was four years ago, but the program costs more.
- What will I do different (if trawl modifications go into effect)?
    - Reduced mesh size provides freedom to experiment with excluders.
    - Reduced mesh size will allow use of a midwater codend (3-inch mesh) when fishing rockfish with a beach net. This will avoid gillers.
    - When fishing for flatfish shoreward of the RCA, I will use a small hooded trawl to retain more rockfish. This will provide more yellowtail rockfish throughout the year and will help offset a lot of the extra costs of this program.
    - I will bring chafing gear to the top riblines, because hanging it on the web damages the web.
    - I currently use 8-inch and 16-inch chafing gear, which is larger than required.
    - Regarding hauling aboard a tow before the previous catch is stowed - this is necessary during an emergency (e.g., tear, hang up, or generator problem), or on occasion for other reasons.
    - Regarding fishing in rockier areas - size of footrope, not chafing gear, determines where I fish.

Brad Pettinger, trawl owner and Director of the Oregon Trawl Commission:

- Most people use 5-inch mesh today.
- This fishery is based on profit. We do things that make it more efficient and cost effective.
- The first thing a captain will think about is his crew. They will push back if a lot of small fish are caught.
- Double-wall codends were used because of mesh size restrictions. People closed the gap to catch longspine thornyhead. Double-wall codends will be unnecessary if mesh restrictions are gone.

Peter Leipzig, Executive Director, Fishermen's Marketing Association:

- Regarding fishing in multiple areas, or fishing with multiple gear types - concerns about data and data quality have to do with the magnitude of the application of those options, if they were to occur. The magnitude will be minor.

- The GAP recommended removing fixed gear from the option of using multiple gears on a single trip. This simplifies things. If fixed gear and trawl gear were used during the same trip, selectivity for sablefish would be much different between gear types, so I understand how this could jeopardize data quality.
- The original intent of fishing in multiple areas was to allow fishing across lines, not fishing in one area then moving to fish in another area. This was permissible historically, when catch was apportioned to the port of landing.

Steve Bodnar, Executive Director, Coos Bay Trawlers Association:

- There is concern that small fish will be landed if minimum mesh size is no longer regulated. There is also productivity concern. However, the fleet only wants to land big fish.
- The fleet wants to use small mesh for excluders. Excluders are not currently regulated except for mesh size.
- How can we innovate and invent if we must use regulated materials to fish?
- The trawl fleet has demonstrated cooperation, and want to continue to be participants.

June, 2016 Council Meeting

There was one written public comment under Agenda Item G.9 at the June 2016 Council meeting (Final Action on Trawl Catch Share Program Gear Use Regulations for Fishing in Multiple Management Areas). There were also two oral public comments and a GAP Report that the Council and NMFS considered at this meeting for scoping.

GAP Report: The Council and NMFS took the GAP statement (Agenda Item G.9.a, Supplemental GAP Report, June 2016) into account for scoping purposes. The GAP provided specific comments regarding three alternatives for fishing in multiple management areas (see Agenda Item G.9.a, NMFS Report, June 2016). In addition, the GAP provided comment on housekeeping changes to language in the Groundfish Fishery Management Plan (see Agenda Item G.9, Attachment 1, June 2016). The GAP made the following points:

- The GAP supports Multiple Areas Alternative G3, the GAP alternative, but proposes modifying it to include only trawl gear and only between the United States/Canada border and 36° N. latitude. The GAP also supports the no sorting requirement and attributing the catch to the port of landing for catch accounting.

- The goal of this suggestion is so trawl fishermen could tow across the 40˚10′ N. latitude line, as they did prior to implementation of the catch share program.
- Due to concerns about sablefish and other species, the GAP is not interested in pursuing alternatives that would allow fishing across the 36˚ N. latitude or the 34˚27′ N. latitude lines.
- Enforcement issues would decrease if allowed to fish in multiple areas.
- Crediting catch to the port of landing was routine prior to the catch share program.
- The landed amounts of fish from these trips would be low enough to have a negligible effect on stock assessments.

- The GAP concurs with the proposed housekeeping language for FMP amendment (see Agenda Item G.9, Attachment 1, June 2016).

Written Public Comment: One supplemental comment was submitted to the briefing book and is summarized below (*Agenda Item G.9.b, Supplemental Public Comment, June 2016*):

ftp://ftp.pcouncil.org/pub/R1603_March_2016_Recordings/Rod Moore, West Coast Seafood Processors Association:

- Specific comment regarding Table 4-11 in Agenda Item G.9, Attachment 2, Preliminary Draft EIS;
  - Text regarding "Socioeconomic Impacts" for Alternative G-2, the impact on processors is listed as "neutral" and is contradicted by text found on page 12 where it is listed as "low negative."
- Regarding Issue G (fishing in multiple areas): "…the Council and NMFS should at least get the language right in the draft EIS and stop trying to pretend that every aspect of the ITQ program is good for processors. Simply admit this has a low negative impact, will impose an increased paperwork burden, but that overall the change is good for the fishery."

Oral Comments: The Council and NMFS took public comment into account for scoping purposes (***ftp://ftp.pcouncil.org/pub/R1603_March_2016_Recordings/***). Oral comments included the following points:

Travis Hunter, trawl owner/operator:

- The 40º10′ N. latitude management line became a fence or wall that hindered my fishing abilities. This line bisected an area that has been historically trawled. I support Alternative G3

to allow fishing on both sides of management line but have no preference on how catch accounting is done.

Brad Pettinger, trawl owner/operator and Director of the Oregon Trawl Commission:

- The management line at 40º10´ N. latitude concerns most Oregon trawlers. Keeping the option simple is best to minimize workload.
- Keep this option for trawlers (not fixed gear) to maintain simplicity.
- If fishing in two areas, the vessel should declare that they fished in two areas, and catch should be apportioned in both areas (Option 2), because Option 3 (port of landing) creates spatial issues.

Appendix C
Public Comment and GAP Reports before March 2016

Council briefing books were reviewed from March 2011 through November 2015 to identify public input that may be relevant to this EIS. Following are excerpts taken from public comment (oral and written) and GAP reports provided during this period.

GAP Report – March 2011 (Agenda Item H.5.b, Supplemental GAP Report, March 2011)

- "Over the past 20-plus years, the Council, NMFS and the states have built up a body of regulations based on the way we used to operate. These include restrictions on how trawls are constructed and used, where they are used, and even when they are used. All of these regulations were for a good cause: to properly conserve and manage groundfish stocks. But now we are operating under a rationalized system that forces us to be creative in order to be successful and we can't be creative under the new system if we are stuck operating under the regulations developed for the traditional system."
- "Allow gear modifications that increase efficiency and selectivity….For example, allowing the use of a four-seam net as opposed to a two-seam net could make it easier to use certain types of halibut excluders."

Public Comment – March 9, 2011 (ftp://ftp.pcouncil.org/pub/R1103_March_2011_Recordings/)

Paul Kujala, trawl owner/operator:

- We need flexibility sooner rather than later.
- Flexibility is needed to exclude halibut and rockfish.
- We need to be able to make modifications to the selective flatfish trawl to reduce bycatch, such as allowing a four-seam trawl on the shelf.

GAP Report – April 2011 (Agenda Item I.7.b, Supplemental GAP Report, April, 2011)

- The GAP believes the highest priority for the TRREC should be to focus on regulatory artifacts of the old management system that have the potential to limit the success of the trawl rationalization program.

Supplemental Public Comment – April 2011 (Agenda Item I.7.c, Supplemental Public Comment Power Point, April, 2011)

John Gauvin, Science Projects Director, Alaska Seafood Cooperative:

- Four-seam flatfish trawls are designed to achieve good flow in the back end of the net. Most fishermen (in Alaska) use four-seam nets with flexible grate excluders.

- Two-seam flatfish trawls sometimes have low flow rates in the intermediate section.
    - Better water flow in four-seam trawls catches fish better and improves the performance of flexible grate excluders.

GAP Report – September 2011 (Agenda Item G.8.g, Supplemental GAP Report, September 2011)

- "The GAP notes that all of its priorities under this agenda item fit within National Marine Fisheries Service (NMFS) priorities; primarily 'measures to make the existing trawl rationalization program more enforceable or more efficient' and 'cost reduction discussions and projects.'"
    - "The GAP notes that the TRREC's scope as a first priority should include all groundfish gear regulations which may have been made obsolete and unnecessary by the adoption of the ITQ program and the individual accountability that goes along with it."

Public Comment – September 18, 2011
(ftp://ftp.pcouncil.org/pub/R1109_September_2011_Recordings/)

Rod Moore, Executive Director, West Coast Seafood Processors Association:

- Seventeen percent of the non-whiting groundfish have been harvested so far through September 15. We have upcoming costs, continuing costs, fuel costs, and reductions in sablefish in 2013. The market for fish is unstable.
    - It is unlikely that prices will get high enough to offset the costs that people are facing. The only way to make it up is volume. The major impediment to increase this volume is the lack of flexibility due to the old regulations that were defined for a trip limit system but are inappropriate for an IFQ system.
- It is unfortunate we did not start this process sooner. For many in the industry, 2014 may be too late.

TRREC Report – November 2011 (Agenda Item E.7.b, Supplemental TRREC Report, November, 2011)

- The TRREC provided rationale for its recommendations. Selected recommendations along with rationale follow:
    - *Allow possession and use of multiple gears*: Current regulations "were important when vessels were managed based on cumulative trip limits and fleet-wide impacts

were modeled. Under trawl rationalization, individuals are accountable for their total fishery impacts and those impacts are observed on every trip and on every vessel. Thus, such specific gear type prohibitions no longer appear to be needed…"

   - *Eliminate codend, chafing gear, mesh size and selective flatfish trawl gear requirements and restrictions*: "While these regulations were important when vessels were managed based on cumulative trip limits, under trawl rationalization individuals are accountable for their total fishery impacts and such specific gear regulations are no longer needed and may hinder experimentation to develop more biologically and ecologically sound gear configurations."

- The TRREC identified other regulations made obsolete by the implementation of trawl rationalization in 2011, and included the following recommendation.
   - Allow fishing in two or more management areas on the same trip.

GAP Report – November 2011 (Agenda Item G.8.b, Supplemental GAP Report, November 2011)

- Trawl gear modifications that increase efficiency and selectivity – The GAP identified this as a priority item "where urgent action is needed."
   - Rationale: Current trawl gear regulations may impair innovations that would provide the fleet with better means to avoid overfished and constraining stocks. For example, emerging data suggest that a four-seam net provides much better water flow, enhancing rigidity and, thereby, selectivity of excluder devices.
- Multiple gears on board – The GAP identified this as an issue that has implications for a large segment of the fleet.
   - Rationale: "It will provide more flexibility for fishermen and poses no threat to the resource, since all trips will be observed and quota is required to cover all catch."
- Fishing in multiple management areas in a single trip – The GAP identified this as issue that has implications for a large segment of the fleet.
   - Rationale: "…important for the long-term success of the program, especially now that multiple area stock management seems to be proliferating."

Public Comment – November 5, 2011

ftp://ftp.pcouncil.org/pub/R1111_November_2011_Recordings/

Rod Moore, Executive Director, West Coast Seafood Processors Association:

- If someone were foolish enough to go to a small mesh and catch small rockfish, they would not have a market for them, so they would have to discard. They would be fully observed, and the discard would be counted against their individual quota.
- If given the flexibility, fishermen will design and use their gear to get efficiency and maximize their quota pounds, which is what trawl IFQ intended.
- Observer costs will increase. We are not catching all of the fish that are allocated. You can either reduce costs or promote efficiency to catch more fish. You are not going to adjust prices because prices are based on a world market.
- There is plenty of incentive to avoid salmon…since salmon are listed under ESA.
- Shrinkage is a reason for having no minimum mesh size.

Ralph Brown, trawl owner; Pete Leipzig, Executive Director of Fishermen's Marketing Association, and Brad Pettinger, Director of Oregon Trawl Commission:

- Provided support and justification for fishing across management lines.

Gear Workshop Report (Agenda Item I.5.a, Attachment 4 – Gear Workshop Report, November 2012)

- The purpose of the workshop was to review gear restrictions (including area of use) that apply under the Trawl Rationalization Program and discuss the need for such restrictions in the context of the program. Selected recommendations and rationale follow.
    - Allow expanded use of multiple trawl gear types and midwater trawl on the same trip.
        - "However, trips on which bottom trawl and midwater trawl was used on the same trip, catches by the two gear classes would need to be kept separate in the vessel hold and at time of offloading so separate landing receipts could be made for the respective gear classes."
        - "New declarations would be required for the following: possessing bottom trawl and midwater gear on board on the same trip."
        - Justification: The current "restrictions were important when vessels targeting non-whiting species were managed based on landings and fleet-wide impacts were modeled. Under trawl rationalization, individuals are accountable for

their total catch of groundfish and the catches observed on every trip and on every vessel. Thus, such specific on board gear type prohibitions, generally, no longer appear to be needed."

- Reduce minimum mesh size for bottom trawl ½ inch to 4 inches.
  - "The recommendation is not to remove all minimum mesh size provisions, as recommended by the TRREC, but rather to lower it for bottom trawl nets by ½ inch."
    - Justification: "The reason for the change is to accommodate the inconsistency, reported in the workshop, of available netting in meeting the minimum mesh size requirement of 4.5 inches in all net sections." The justification was meant to help prevent minimum mesh size violations.
    - Potential Negative Impacts: "Use of the smaller mesh size could also result in increased catch of non-marketable size fish that individuals would be held accountable for in their total catch of groundfish."
- Eliminate the selective flatfish trawl requirement.
  - Justification: "The main reason for the proposed change stems from the specificity of the regulation: it does not provide for the effective placement of flexible grates to exclude non-target fish species nor does it allow for experimentation with new net designs or net configurations."
  - Potential Negative Impacts: "This proposal has potential negative biological impacts if catch of canary rockfish, an overfished species, should increase. Ultimately canary rockfish catch is limited by the available QP, however, there could be negative impacts for the fleet as a whole if the gear change resulted in disaster tows (tows with amounts of canary equal to a significant portion of the total shoreside fishery canary allocation)."
- Fishing Across Management Lines.
  - Justification: "Some vessel owners report that the regulation is expensive to their operations, particularly those that fish out of ports in close proximity to a management line."

Open Public Comment – March, 2013

Jeff Lackey, trawl owner/operator (Agenda Item B.1.b, Supplemental Open Public Comment, March 2013):

- "This is a system that the majority of the industry, including myself, fully supports; but the issue at hand is the old constraints of the old management system are added on top of the new constraints to create inefficiencies for fishermen and underutilization of the resource."
- "The best way to help communities is to increase non-whiting utilization, because that is the only way to grow the industry, which directly leads to benefits of increased employment."
- "…the next few years will bring increased observer costs and cost recovery fees that makes the urgency of reviewing archaic constraints more apparent. Increasing fishery resource utilization will not only achieve MSA specified purposes, but will increase overall value of catch shares fisheries, thereby increasing buyback loan payments and cost recovery payments."

Heather Mann, Executive Director, Midwater Trawlers Association (Agenda Item B.1.b, Supplemental Open Comment 2, March 2013):

- "The unimplemented actions as well as the delay in consideration of other trailing actions/activities are causing additional burden to an industry that seems to be facing only increased costs."
- "If we cannot figure out a way to reduce the burgeoning costs associated with monitoring and cost recovery in addition to the other fees (state landings taxes and the Buyback loan payments) and at the same time extract more value out of this fishery by eliminating redundant or irrelevant regulations, we are on a collision course with failure."
- "Other examples of regulations preventing a greater amount of the TAC from being harvested include gear and area restrictions that no longer seem necessary now that each individual fisherman is 100% accountable for his catch."

GAP Report – April 2013 (Agenda Item D.2.c, Supplemental GAP Report, April 2013)

- "The GAP would like to take this opportunity to note that the attainment of many non-whiting ACLs such as Dover remains low and that the cumulative attainment for all non-whiting species combined is less than 30 percent."
- "The GAP believes that artifacts from previous management regime regulations are preventing higher attainment of some of the ACLs."

GAP Report – September 2013 (Agenda Item G.9.c, Supplemental GAP Report, September 2013)

- "As an overarching comment, members of the GAP are increasingly frustrated with delays in implementing trailing actions already approved by the Council, while at the same time, NMFS continues to bring forward proposals for new work that will further delay critical improvements."
- "Many pre-individual trawl quota (ITQ) regulations were based on the need to minimize rockfish catch under the trip limit management regime. With 100 percent monitoring and individual accountability, there are now more direct means to control rockfish catch. At the same time, many of the pre-ITQ regulations limit efficiency and some even hamper the ability to fish more cleanly (e.g., two-seam net requirement as part of selective flatfish trawl definition shoreward of the RCA)."
- "The GAP strongly supports the proposed T-flex process to remove regulatory inefficiencies through a comprehensive assessment of pre-ITQ regulations that may no longer be necessary. As you'll note implicitly in all of the GAP priorities, the fishery is now dramatically different than it was pre-rationalization. One hundred percent observer coverage and individual accountability for all mortality have changed the game. We believe that NMFS proposed T-flex concepts recognizes this change and we would like to see it move forward expeditiously."

GAP Report – September 2014 (Agenda Item J.1.c, Supplemental GAP Report, September 2014)

- "Some GAP members argued that moving items forward that would benefit the ITQ program would also benefit other commercial sectors. Making the ITQ program actually work would maintain a volume of fish coming across the dock on a year-round basis that will support processing infrastructure and other secondary and tertiary supply businesses."
- "This is essentially the same infrastructure that receives deliveries from fixed gear and open access vessels. At the same time, maintaining strong processing and related marine business infrastructure is key to keeping coastal communities thriving."
- "A number of GAP and audience members pointed out that from a conservation standpoint, the ITQ program is working great, but from an economic standpoint, the program is a failure. There is still much work to do to make it sustainable from an economic perspective."
- "Promises of flexibility and the elimination of archaic regulations, meant to govern a non-rationalized fishery, have not happened and are stuck in a regulatory purgatory. The ITQ fishery is not realizing the full benefits of rationalization. For example, command and control

regulations still constrain the ability of the fishery to fish where it wants, how it wants, when it wants.**”**

- “Expenses have increased dramatically but incomes have not. Fishermen reported actually losing money under ITQ while also losing access to fishing grounds – the polar opposite of what was promised.”
- “Cumulative attainment of non-whiting groundfish species has been consistently below one-third of what is available. If this trend continues, it threatens the viability of the traditional groundfish fleet, which was anticipated to receive significant benefits from the rationalization program.”
- “The trawl fleet as a whole (whiting and non-whiting) face all the burden and costs of being fully rationalized without realizing all the benefits. The fleet still cannot fish where they want, when they want, and how they want, and this has resulted in the poor economic performance of the non-whiting sector.”
- “Existing regulations are preventing gear development and experimentation.”
- “Prohibitions on use of particular gear in certain areas or times are preventing higher revenues from being achieved.”
- “The attainment rate for yellowtail rockfish was 32 percent in 2012 – leaving more than 4.5 million pounds of yellowtail rockfish in the water. At an average price of $0.55 a pound, this equates to more than $2.5 million in forgone revenue. Clearly there are opportunities to increase the harvest for this stock and this will provide immediate benefit to the fleet.”

Public Comment – (Agenda Item J.1.d, Public Comment, September 2014)

Ana Kujundzic and Mike Okoniewski, Pacific Seafood Group:

- “Mid-way through the fourth year since implementation of the IFQ program, it has become more than apparent that the non-whiting groundfish portion of the program is performing poorly from an economic sense. Non-whiting revenues are stagnant and cumulative attainment of target species remains at less than one-third of the allowable catch. At the same time costs for participating in the program continue to rise. It is our opinion that the program, as currently structured, is not economically viable over the long-term.”
- “Markets can handle seasonality but not inconsistency. Starvation followed by intense gluts is not well received. We believe that there is enormous opportunity if we can get the fish out of

the water and strategically work together to sell the West Coast groundfish on a year round basis."

- "Can we achieve the value out of this fishery that is necessary in order to sustain the escalating costs of participation? In our estimation this is only achievable if we view the harvest, processing and marketing as a symbiotic relationship.
- "The market is the fuel that drives the engine."
- "Celebrating only biological gains while ignoring the failure to attain economic objectives will not sustain this program."

Appendix D
Trawl Gear Exempted Fishing Permits conducted during 2017 and 2018

Exempted fishing permits (EFPs) were issued in 2017 and 2018. They allowed use of any small footrope trawl shoreward of the RCA north of 42° N. latitude (see Appendix B in Matson and Erickson, 2017). The EFP participants were exempt from SFFT requirements in this northern area. Bottom trawl EFP participants were also exempt from minimum mesh size regulations during the 2017 and 2018 EFPs. Some additional provisions included only in the 2018 EFP were as follows:

- Implement an exemption of the minimum mesh size for midwater trawl.
- Implement an exemption to use midwater groundfish trawl gear to target non-whiting species both north and south of 40°10' N. latitude in all open areas (including inside the boundaries of the trawl RCA both north and south of 40°10' N. latitude) for effective dates of the EFP. These vessels would no longer be constrained by the Primary whiting season for the IFQ fishery.
- Implement an exemption from the prohibition to have both groundfish bottom trawl gear and midwater trawl gear onboard simultaneously north and south of 40°10' N. latitude. Both gear types could be fished during the same trip subject to specific declaration requirements and sorting requirements.

The 2017 groundfish trawl EFP application was submitted at the November 2016 Council meeting (Agenda Item F.5, Attachment 1, November 2016). Fishing under this EFP was allowed beginning February 24, 2017 (Agenda Item F.8, Supplemental Attachment 2, June 2017). All final terms and conditions of the 2017 EFP are available at the following website: http://www.westcoast.fisheries.noaa.gov/publications/fishery_management/groundfish/public_notices/nmfs-sea-17-03.pdf.

The 2018 groundfish trawl EFP application was submitted at the June 2017 Council meeting (Agenda Item F.8, Attachment 1, June 2017) and was subsequently modified and submitted as a supplemental document at the September 2017 Council meeting (Agenda Item E.4.a, Supplemental EFP Application 1, September 2017). The Council made most final recommendations for the 2018 EFP requirements at the September 2017 Council meeting (Council Decisions, September 2017). However, the Council decided not to extend the 2018 groundfish SFFT exemption south of 42° N. latitude during March 2018 (Council Decisions, March 2018). Fishing was allowed under this EFP beginning January 1, 2018 (Agenda Item F.6.a, Supplemental NMFS Report 1, April 2018). All final terms and conditions of the 2018 EFP are available at the following website: http://www.westcoast.fisheries.noaa.gov/publications/fishery_management/groundfish/public_notices/nmfs-sea-17-19.pdf).

Some inferences can be drawn from results of the 2017 and 2018 EFPs regarding catch of prohibited species, catch of target species (e.g., widow and yellowtail rockfish), and choice of trawl type by EFP participants. However, there are some limitations concerning the EFP data. Gear specification information was not collected during the 2017 EFP, so specifications such as mesh size, footrope type, mouth opening, etc., are unknown or uncertain. During the 2017 EFP, some fishermen may have used true bottom trawls (e.g., four-seam Aberdeen high-rise combination trawl designed with a vertical opening of approximately 15 feet; Hannah et al. 2005), whereas others may have used modified midwater trawls that were fished off-bottom. In the latter case, small (less than 8-inch-diameter) rollers or bobbins could be attached to the bare footrope of a midwater trawl, creating a legal bottom trawl by definition. The general definition of bottom trawl (50 CFR 660.11) is described as follows: "Any trawl not meeting the requirements for a midwater trawl in 50 CFR 660.130(b), subpart D is a bottom trawl." As such, most results collected during 2017 are likely associated with pelagic or semi-pelagic trawls (i.e., fished off-bottom), but they are defined as bottom trawl, whereas a few trips may have been conducted using true bottom trawl gear (i.e., one that fishes on bottom). It is uncertain whether catches described for the 2017 EFP were by bottom-tending trawls or pelagic trawls (see below for more detail).

Fishing with midwater trawl (year-around coastwide) and small footrope bottom trawl (north of 42° N. latitude shoreward of the RCA) was allowed for 2018 EFP participants. Even though gear specification information was collected for most 2018 EFP trips, haul-level data analysis is necessary to evaluate the impacts of the SFFT exemption, because multiple gear types could be fished during a single trip. Haul-level information is needed not only to discern between midwater trawl hauls and bottom trawl hauls during a single trip, but also to discern between bottom trawl hauls set seaward of the RCA (i.e., where no EFP exemption would be required) versus bottom trawl hauls set shoreward of the RCA (i.e., using EFP-exempted bottom trawl gear). An example of the potential uncertainty using only trip-level data is illustrated in the summary of EFP trawl catches for 2018 (Agenda Item F.6.a, Supplemental NMFS Report 1, April 2018). In this case, 25 EFP bottom trawl trips are shown, but some of these trips may have used midwater trawl gear for some hauls (exempted under the EFP) and bottom trawl gear seaward of the RCA for other hauls (i.e., no EFP exemption required). In addition, some of these EFP trips may have carried midwater trawl gear and bottom trawl gear, but only fished bottom trawl gear seaward of the RCA (i.e., no exempted gears used during a single trip).

Results of the 2017 and 2018 EFPs and Potential Increase in Fishing Effort

During the 2017 EFP, when SFFT requirements were exempted north of 42° N. latitude, the number of trips per month by EFP participants increased rapidly until midwater trawls were allowed (i.e., May 15th). Once midwater fishing was allowed, the rate of bottom trawl trips conducted by EFP participants per month decreased (Figure D-1).

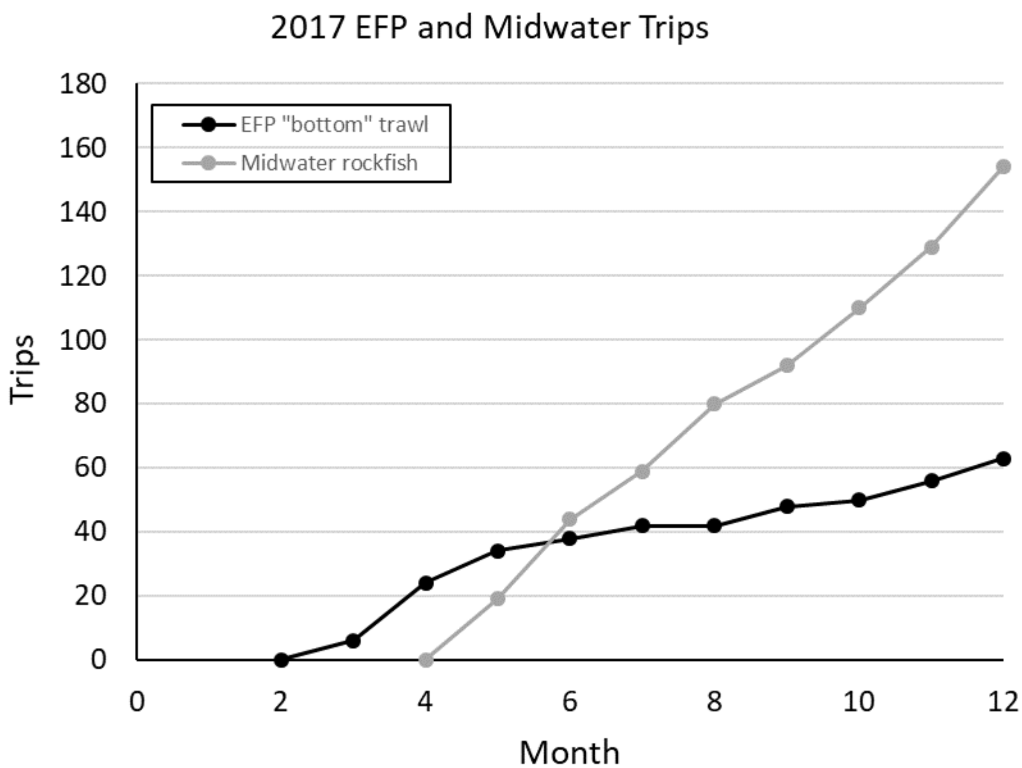


Figure D-1. Number of midwater rockfish trips and EFP bottom trawl trips during 2017. EFP participants were exempt from selective flatfish trawl and mesh size requirements. Seven EFP permits were issued February 24, 2017. Midwater trawling (non-EFP) was allowed beginning May 15, 2017. Seven EFP permits were active when midwater trawling was initiated. An additional four vessels signed up for the EFP between May 15 and November 27. Source: PSMFC

The 2017 EFP showed large landings of groundfish (e.g., Agenda Item F.8, Supplemental Attachment 2, June 2017), most of which consisted of widow rockfish, yellowtail rockfish, and canary rockfish during March (when the EFP began), April, and May (Figure D-2). Once midwater trawling was allowed, landings by 2017 EFP participants showed small amounts of pelagic and semi-pelagic rockfishes. Most individuals that declared EFP trips after May 15th likely made sets seaward of the RCA (e.g., targeting DTS species) rather than shoreward of the RCA targeting rockfishes. The location of fishing cannot be determined until logbook data become available. It was expected that some

fishermen would declare into the EFP to use small footrope trawls with overhanging or hooded headropes and higher vertical openings than SFFT (e.g., 400 Eastern trawl with 6-foot vertical opening; Wathne 1977; Szalay 2003) to continue targeting shallow-water flatfish shoreward of the RCA but with the intention of adding value and variety to the catch by increasing rockfish composition (Appendix B and Appendix C). Some of these individuals opted out of the EFP and continued using the SFFT shoreward of the RCA to avoid bycatch of whiting and a large year class of undersized sablefish (P. Kujala, pers. comm., F/V *Cape Windy*).

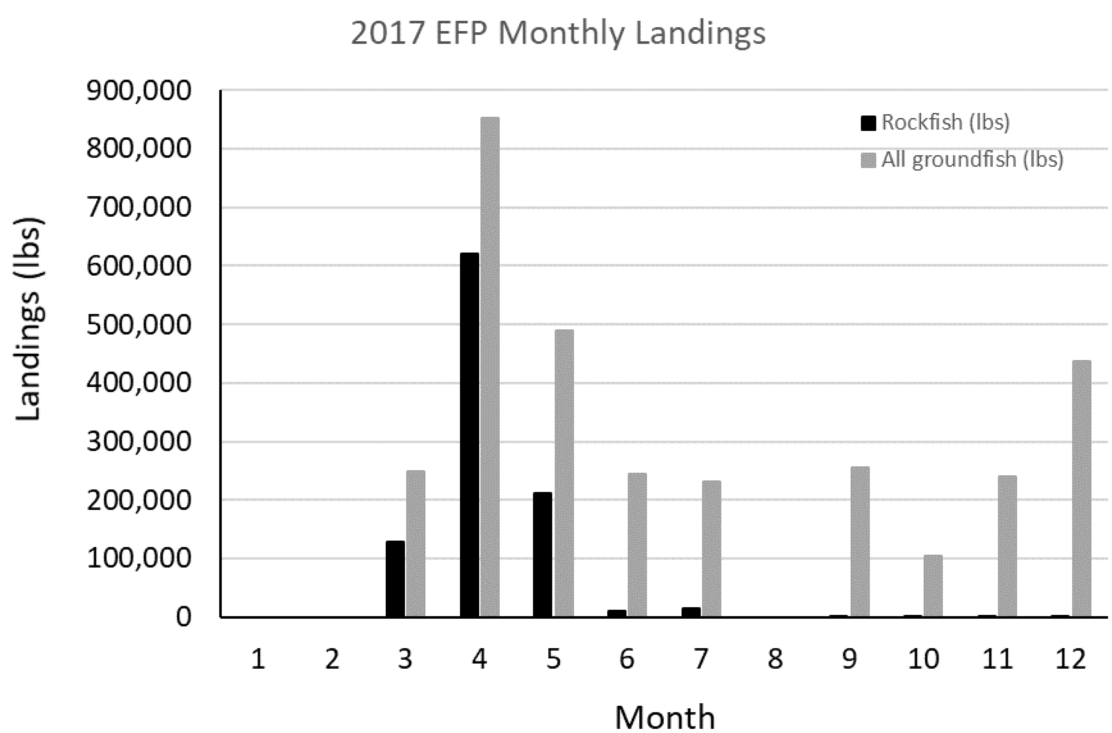


Figure D-2. Monthly landings (pounds) by 2017 EFP participants for pelagic and semi-pelagic rockfishes (widow, canary, and yellowtail rockfish) (black bar) and for all groundfish combined (gray bar). The EFP participants were exempt from SFFT requirements shoreward of the RCA north of 42° N. latitude. Source: PSMFC

The 2018 EFP exempts SFFT requirements, and it allows participants to fish bottom and midwater trawls during the same trip (i.e., carry and fish with multiple gears) (see above). A summary of catches by the 2018 EFP was provided for the June Council meeting (Agenda Item I.8.a, Supplemental NMFS Report 1, September 2018). As of August 13, 2018, midwater trawl vessels landed 9.9 million pounds of groundfish, whereas bottom trawl participants declared in the EFP that fished north of 42° N. latitude landed 1.9 million pounds of groundfish. Most, if not all, bottom trawl sets made by 2018 EFP participants were likely seaward of the RCA. For example, logbook data from EM trips that

participated in the 2018 EFP showed all bottom trawl sets (through April 5, 2018) were seaward of the RCA (PSMFC, unpublished data). Landings data (e.g., species composition) for these 2018 bottom trawl EFP trips also suggest that most bottom trawl sets were seaward of the RCA (PacFIN data). Logbook data are not available for observed trips that participated in the 2018 EFP (i.e., non-EM trips); fishing locations cannot be verified for these trips until logbook data become available.

NMFS anticipated that some EFP participants would use bottom trawls with high vertical openings to target pelagic or semi-pelagic rockfishes, such as polyethylene Nor'Eastern trawls (vertical opening approximately 20 to 26 feet; Wathne 1977) or Atlantic-Western combination trawls (vertical opening 12 to 20 feet; Fisher 1976). Results suggest that EFP participants opted for midwater trawl gear instead of high-rise or combination bottom trawls to target widow and yellowtail rockfish during 2018. Similar to the 2017 EFP, NMFS also anticipated that EFP participants targeting shallow-water flatfish might use hooded trawls with vertical openings higher than SFFTs (average 4.5 feet; Hannah et al. 2005) but lower than the vertical opening of combination trawls (12 to 20 feet; Fisher 1972). For example, a 400 Eastern trawl with a 6-foot vertical opening (Wathne 1977; Weinberg and Somerton 2006) may improve fishing efficiency for targeted flatfish, while adding variety and value to the catch with increased incidental rockfish catch (Appendix B and Appendix C). Although this may have been the intention of some fishermen targeting shallow-water flatfish, some opted out of the EFP and continued using the SFFT shoreward of the RCA to minimize bycatch of whiting and a large year class of undersized sablefish (P. Kujala, pers. comm., F/V *Cape Windy*).

Appendix E
Fish Behavior in and around Trawls - Capture and Escapement Process

The following is a brief description of the capture and escapement process for fish in and around trawls.

<u>The Capture and Escape Process</u>

Biological interactions with trawl gear may vary among zones (or areas) of the trawl; catch, probability of escapement, damage to fish, and escape mortality may vary by trawl zone (Chopin and Arimoto 1995; Chopin et al. 1996; Broadhurst et al. 2006). Winger et al. (2010) described three zones for the trawl and provided examples of fish response within each zone:

- Zone 1 is described as the pre-trawl zone, and represents the area in front of trawl doors. The fish capture (or escape) process begins here, where fish may detect and respond to low-frequency sound of the vessel, cables (or sweeps), doors, and the trawl. Fish response may vary in direction (e.g., horizontal and vertical movement patterns) and swimming speed to avoid the perceived threat (Winger et al. 2010), both within and between species.
- Zone 2 is described as the area between the trawl doors and the net mouth. Once in this zone, fish will either be in the direct path of the net or within the sweep zone. The sweep zone is defined as the area between the wings of the net and the trawl doors. Fish within the sweep zone may be herded (or guided) into the net path after direct or near direct contact with doors, sand clouds, and sweeps (Winger et al. 2010).
- Zone 3 is described as the area between the trawl mouth (i.e., wing tips) and the terminal end of the codend. Fish behavior, avoidance reactions, susceptibility to injury, and endurance varies within this zone as fish move from the mouth of the trawl, through the body, into the intermediate, and finally into the codend portion of the trawl.

The diversity of fish behavior is high in the transition area between Zone 2 and Zone 3, i.e., at the trawl mouth (Winger et al. 2010). Depending on light levels and species, fish may either orient in the direction of the tow and maintain position within or near the trawl (i.e., under adequate light) or appear at various angles to the approaching trawl and demonstrate little reaction (i.e., at low-light levels). Reactions and endurance may be dependent on other factors such as water temperature and trawling speed (Broadhurst et al. 2006). Hence, in this area of the trawl, fish escapement over the headrope, under the footrope, around the wings, or through the webbing is variable between and within species. Fish that are unable to escape this portion of the trawl either become exhausted and fall back into the trawl (Main and Sangster 1983 in Winger et al. 2010) or turn and swim directly toward the codend (Winger et al. 2010). Fish that escape this portion of the trawl may be less injured or damaged than fish that escape later in the capture process (Chopin and Arimoto 1995; Broadhurst et al. 2006).

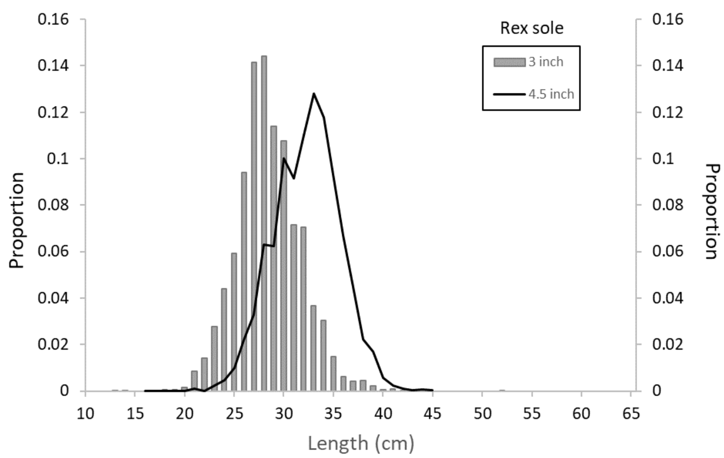
Fish behavior and escapement in the intermediate portion of the trawl: Fish crowding and exhaustion increases as the net narrows and fish enter the intermediate or extension portion of the net. Swimming behavior and direction may range from somewhat random, active bursts toward side- and top-panel meshes or swimming parallel to and in the same direction as the trawl. At this point and depending on species, fish may rise and fall back towards the codend or swim in towards the codend. Some individuals may become entrained on the side or bottom panel of meshes until dislodged by debris or other fish (e.g. flatfish on bottom panels). Escapement through meshes may actively occur in this portion of the trawl (Erickson et al. 1996). It is here that square-mesh panels or escape windows may be installed to successfully enhance escapement of undersized fish (Erickson et al. 1996; Graham et al. 2003; Winger et al. 2010). Skin damage and other injuries due to exhaustion, collisions with other fish and debris, and scraping against net walls may increase within the intermediate.

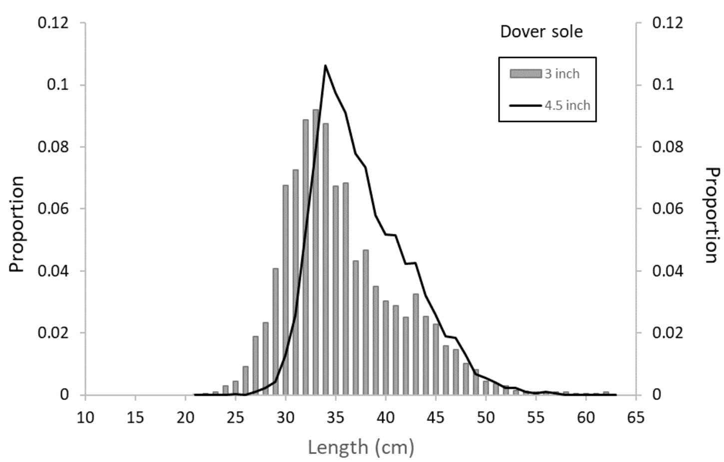
Fish behavior and escapement in the codend portion of the trawl: Most fish entering the codend are likely exhausted (Suuronen and Erickson 2010; Winger et al. 2010). Here, fish either become part of the accumulated catch (= catch bulge) or may continue swimming ahead of the catch bulge while oriented forward (Suuronen et al. 1997a). Small fish may passively escape open meshes whereas stronger swimming fish may actively detect, orient, and swim through open meshes (Winger et al. 2010). Depending on species and availability of open meshes, escapement may take place far ahead of the catch bulge (Erickson et al. 1996) or only immediately in front of the catch bulge (Stewart and Robertson 1986; Suuronen et al. 1997a).

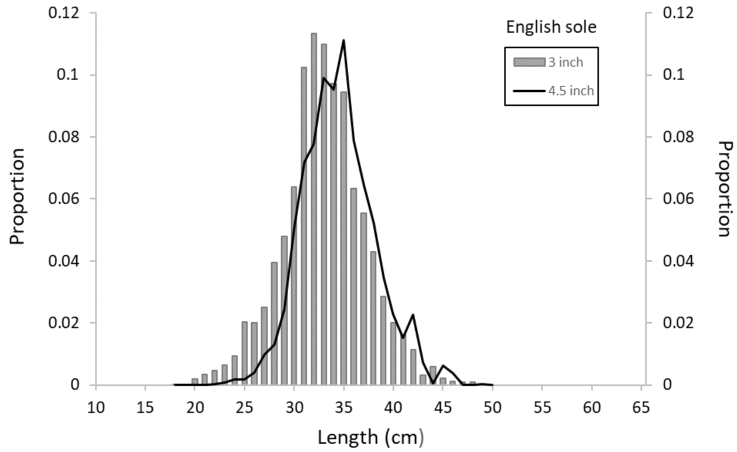
Escapement from the codend is dependent on species, fish size, mesh size, and mesh shape. Pikitch et al. (1990), Wallace et al. (1996), and Perez-Comas et al. (1998) showed increased escapement of West Coast groundfish as mesh size increased from 3 inches to 5.5 inches. They also showed that larger roundfishes (such as sablefish) more readily escaped through square meshes than through similar-size diamond meshes, whereas flatfishes escaped diamond meshes more readily than similar-size square meshes. Lomeli et al. (2017) also showed increased escapement for numerous groundfish species as codend mesh size was increased from 4.5 inches to 5.5 inches. In addition, Lomeli et al. (2017) showed species-specific differences in escapement probability between mesh shapes. Given the same mesh size (i.e. 4.5 inches), larger sablefish may escape T-90 meshes relative to similar sized conventionally hung diamond meshes, whereas larger Dover sole may escape diamond meshes with more ease than T-90 mesh (Lomeli et al. 2017). T-90 mesh is conventional diamond mesh turned 90 degrees in orientation so that the meshes stay more open (due to physical resistance to close) and resemble square mesh.

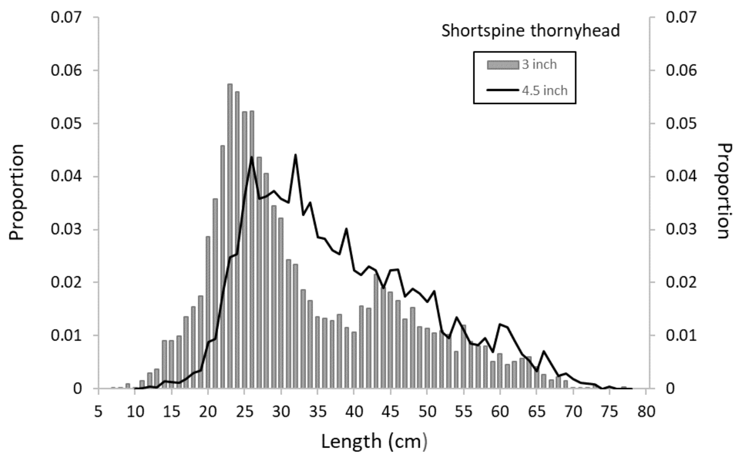
Appendix F
Groundfish Length Frequency Distributions
(sexes pooled)

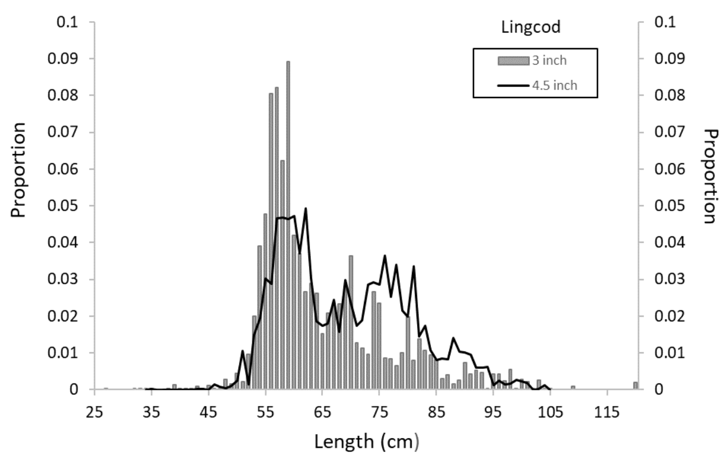
Weighted length frequency distributions of groundfish caught by bottom trawl while using 3-inch mesh codends (bar) and 4.5-inch mesh codends (line) during 1988 to 1990. An alternate haul method was used; only balanced blocks were included (i.e., those blocks that included hauls with both 3-inch and 4.5-inch mesh codends). Data used to generate length frequency distributions were described in Pikitch et al. (1990), Perez-Comas et al. (1998), and Wallace (unpublished).

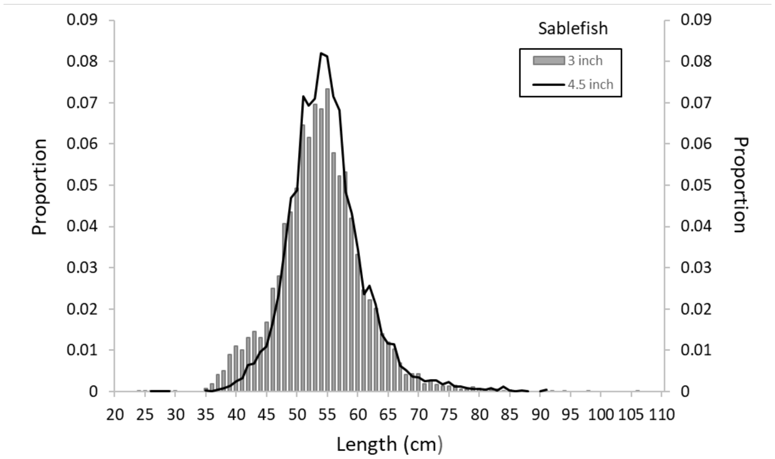


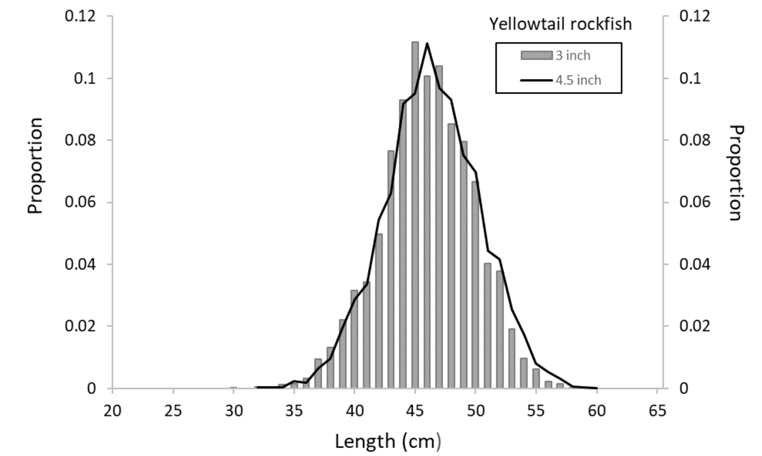


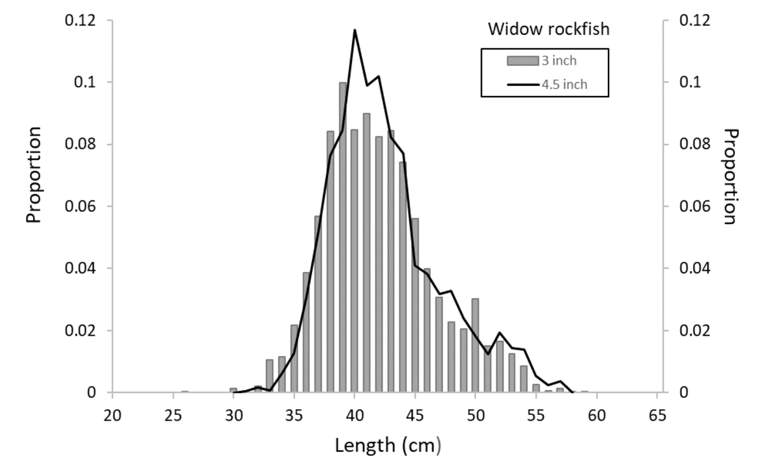

English sole
3 inch
4.5 inch
Proportion
Length (cm)

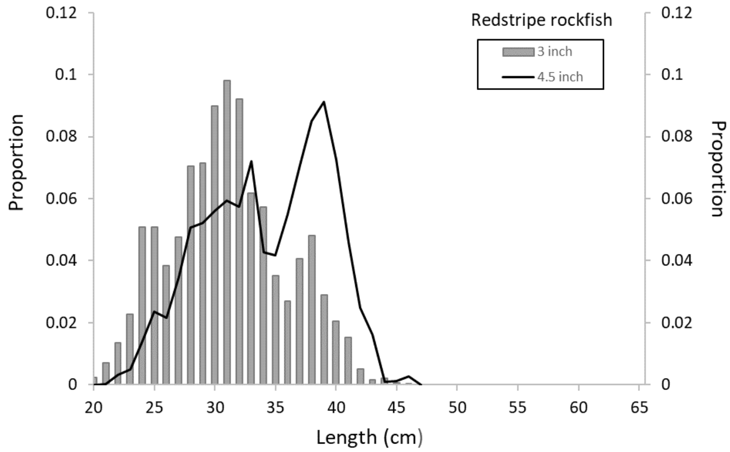

Shortspine thornyhead
3 inch
4.5 inch
Proportion
Length (cm)


Lingcod
3 inch
4.5 inch
Proportion
Length (cm)


Sablefish
3 inch
4.5 inch
Proportion
Length (cm)
Proportion

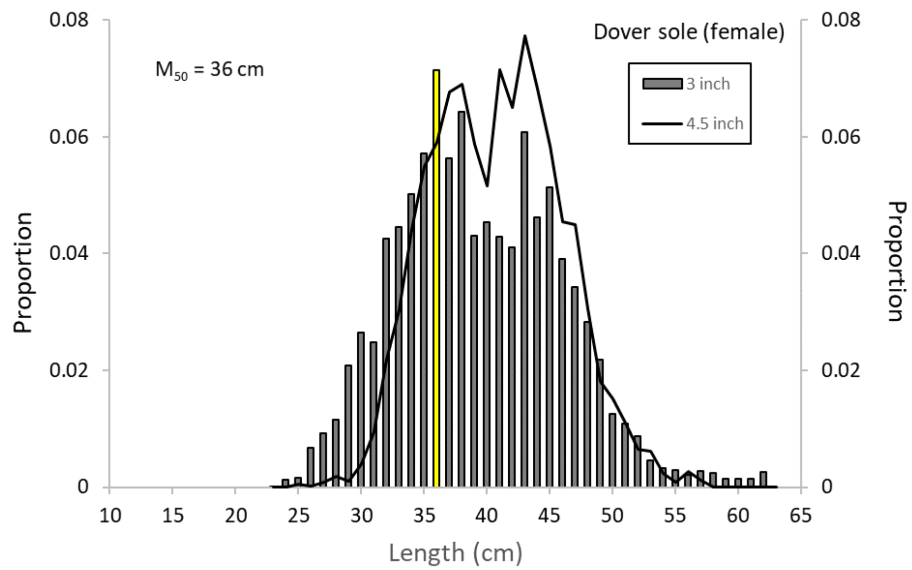

Yellowtail rockfish
3 inch
4.5 inch
Proportion
Length (cm)
Proportion

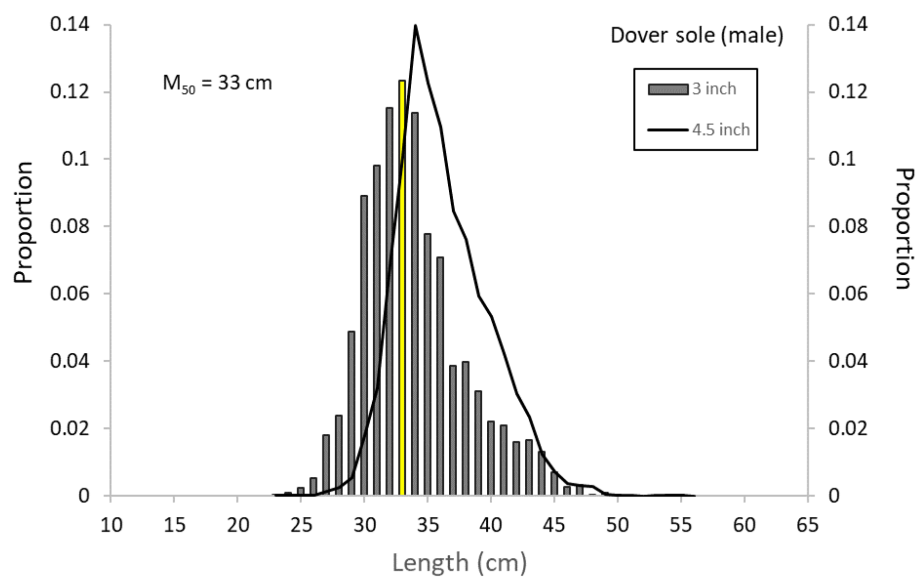

Widow rockfish
3 inch
4.5 inch
Proportion
Length (cm)
Proportion

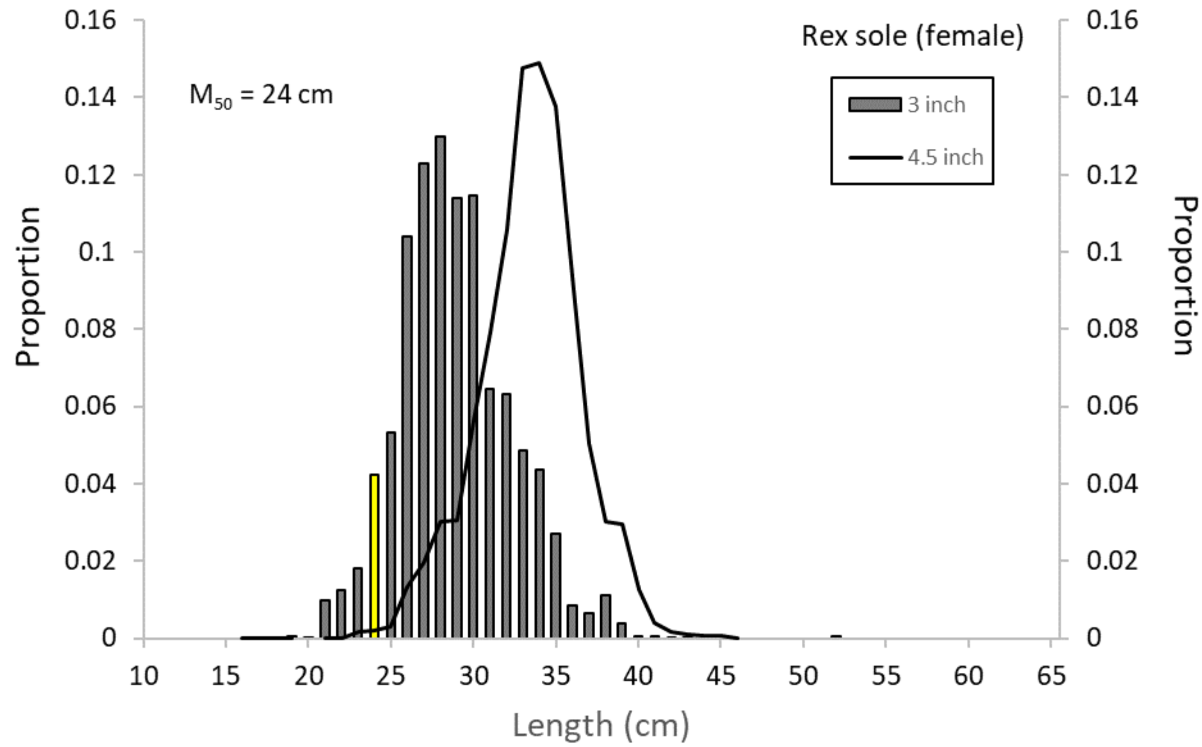

Redstripe rockfish
3 inch
4.5 inch
Proportion
Proportion
Length (cm)
0.12
0.1
0.08
0.06
0.04
0.02
0
20
25
30
35
40
45
50
55
60
65

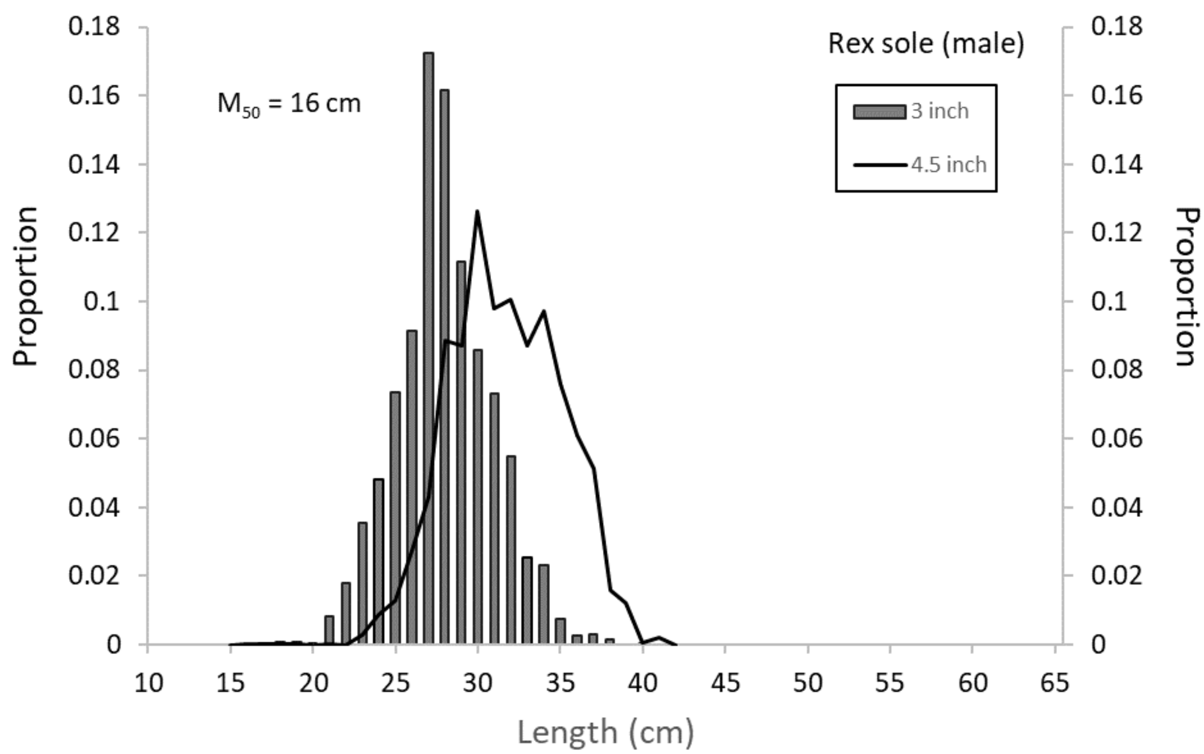
Appendix G
Groundfish Length Frequency Distributions
(by sex)

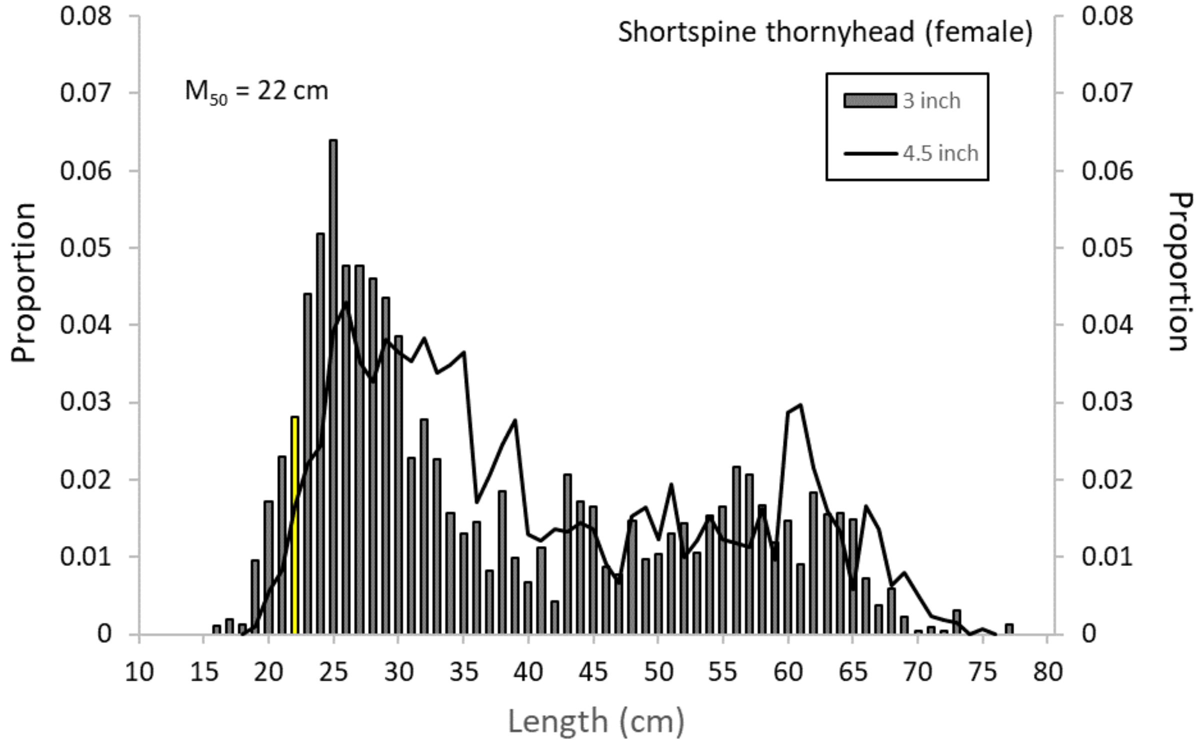
Weighted length frequency distributions of female and male groundfish caught by bottom trawl while using 3-inch mesh codends (bar) and 4.5-inch mesh codends (line) during 1988 to 1990. An alternate haul method was used; only balanced blocks were included (i.e., those blocks that included hauls with both 3-inch and 4.5-inch mesh codends). Light-colored bar represents the length at 50 percent maturity (M_{50}). Sources for maturity estimates are shown Perez-Comas et al. (1998). Data used to generate length frequency distributions were described in Pikitch et al. (1990), Perez-Comas et al. (1998), and Wallace (unpublished).



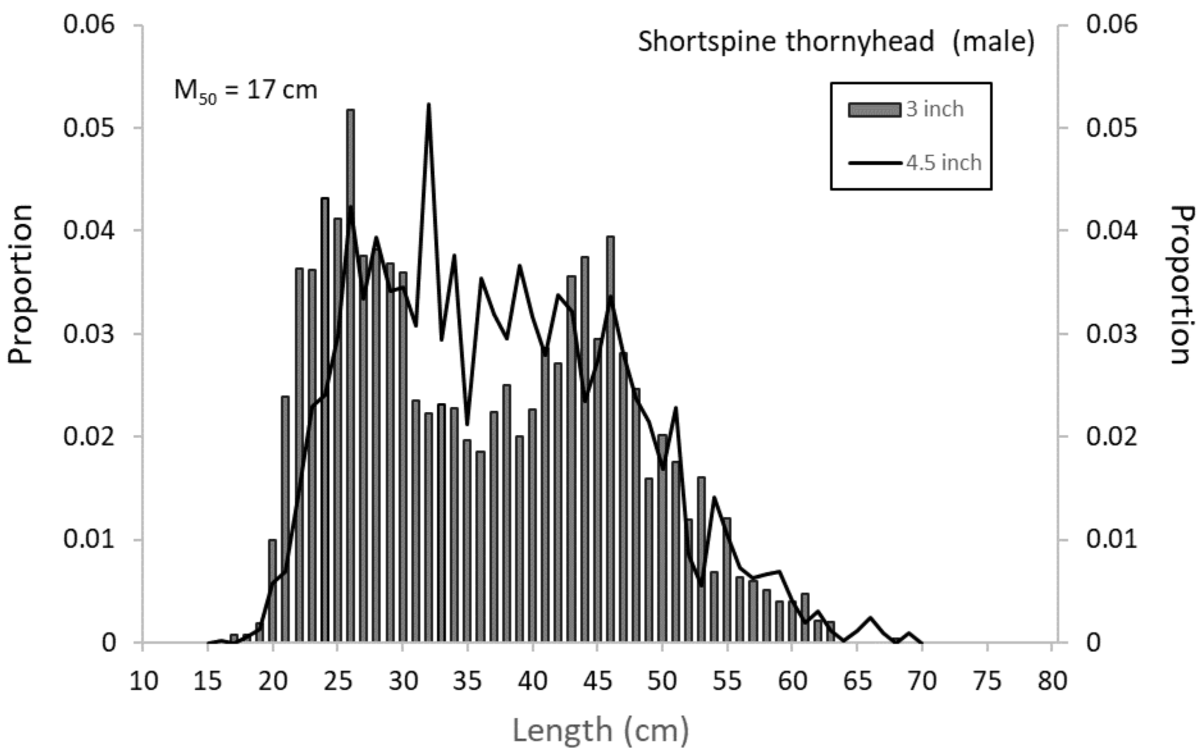



Rex sole (female)
M50 = 24 cm
3 inch
4.5 inch
Proportion
Length (cm)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
10
15
20
25
30
35
40
45
50
55
60
65

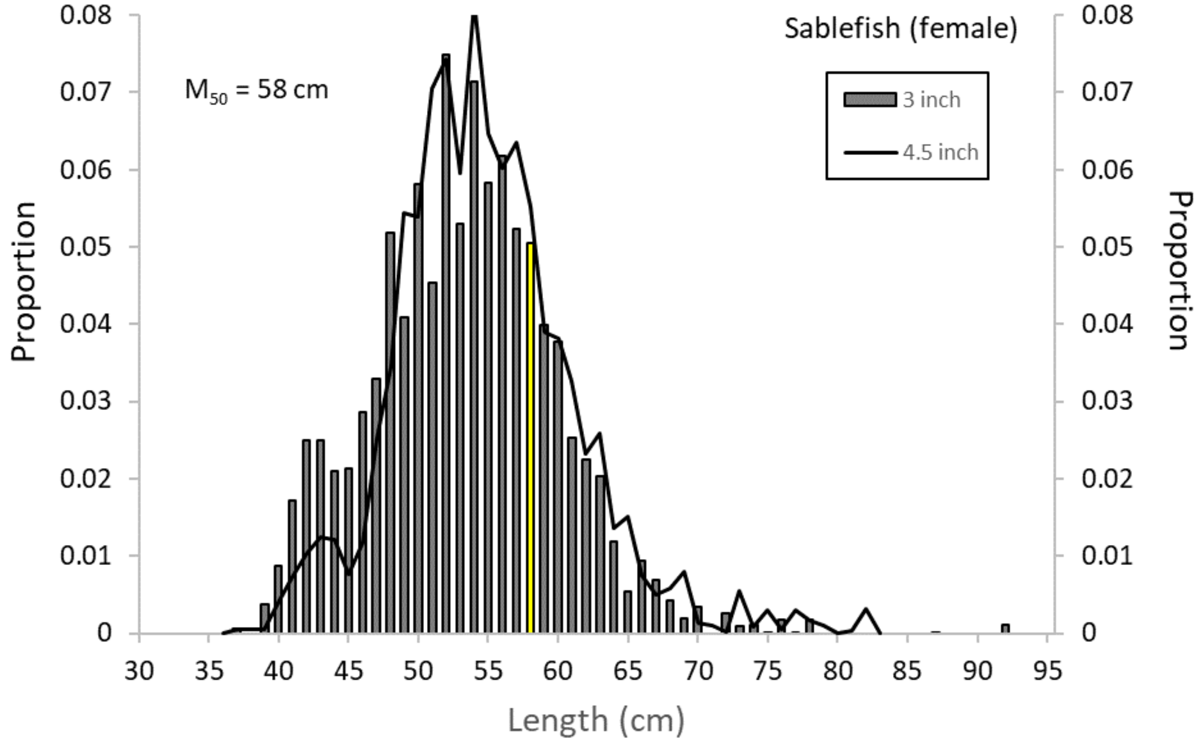

Rex sole (male)
M50 = 16 cm
3 inch
4.5 inch
Proportion
Length (cm)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
10
15
20
25
30
35
40
45
50
55
60
65

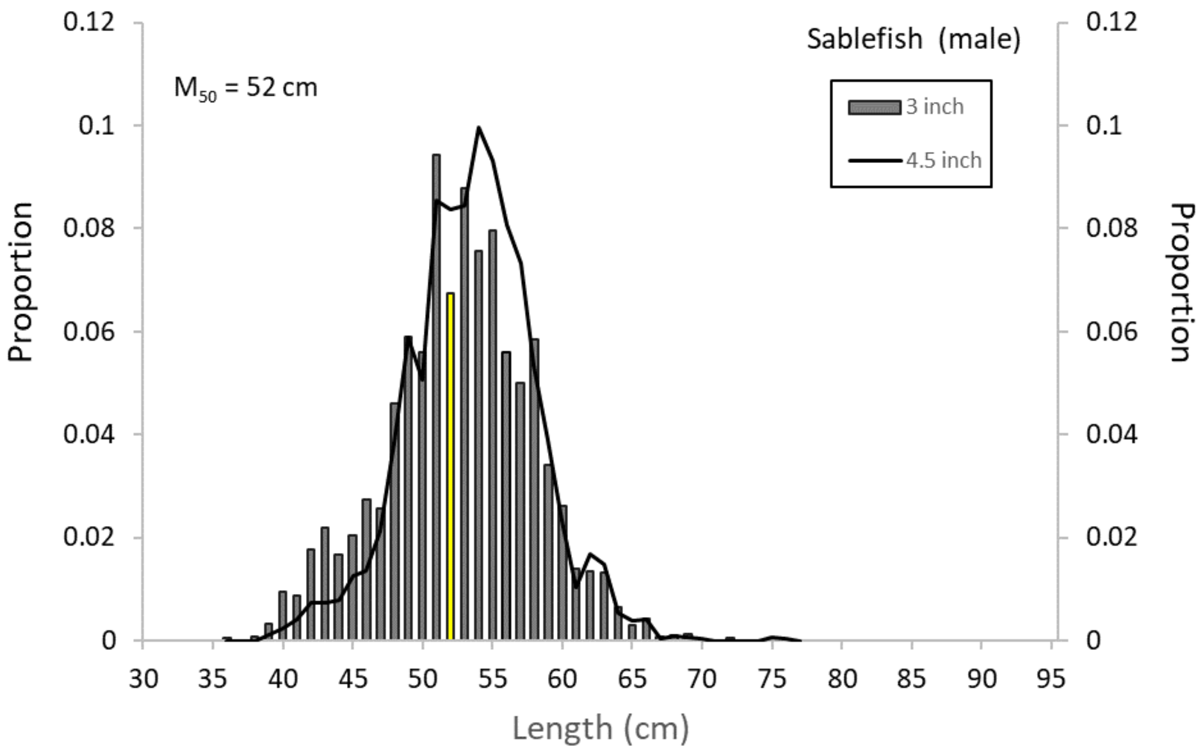


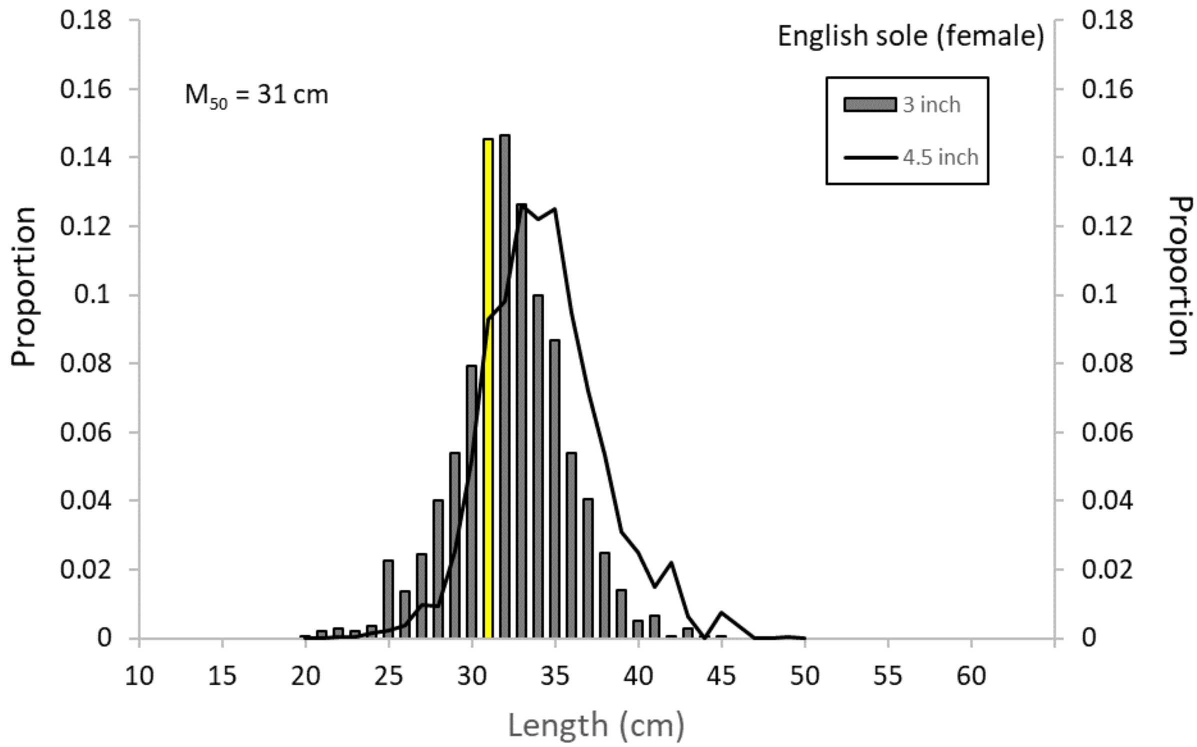
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Proportion
Shortspine thornyhead (female)
M_{50} = 22 cm
3 inch
4.5 inch
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Length (cm)

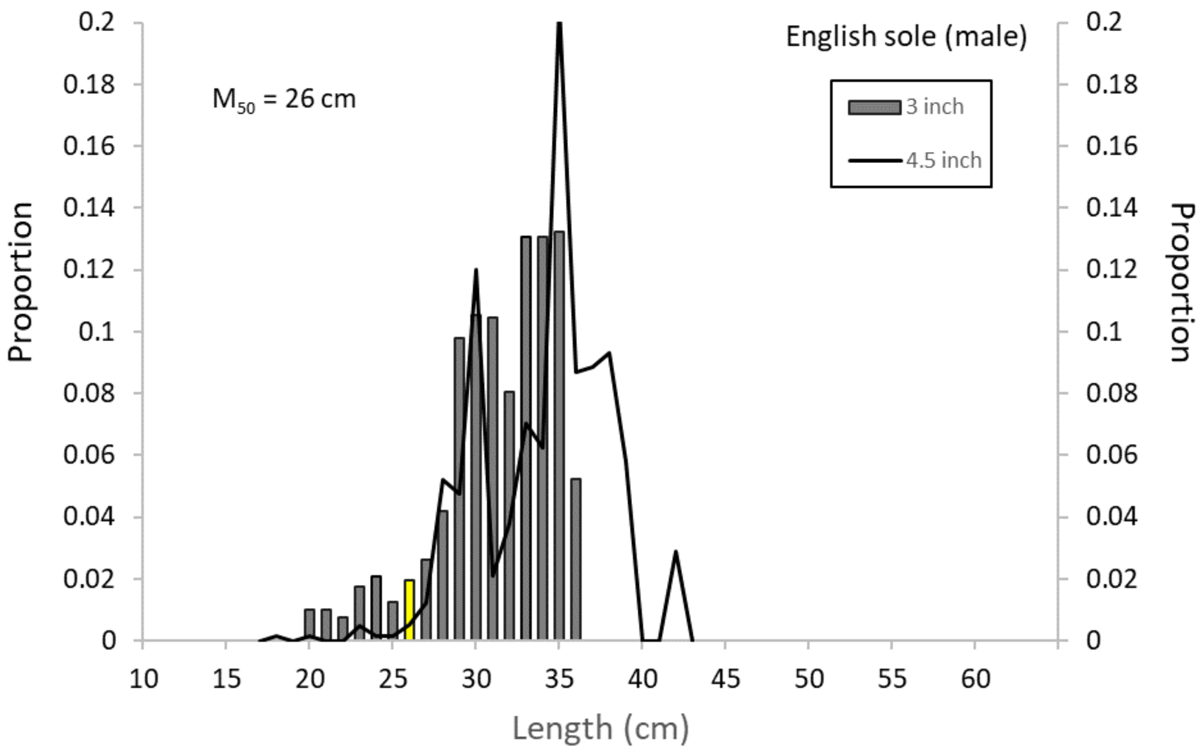


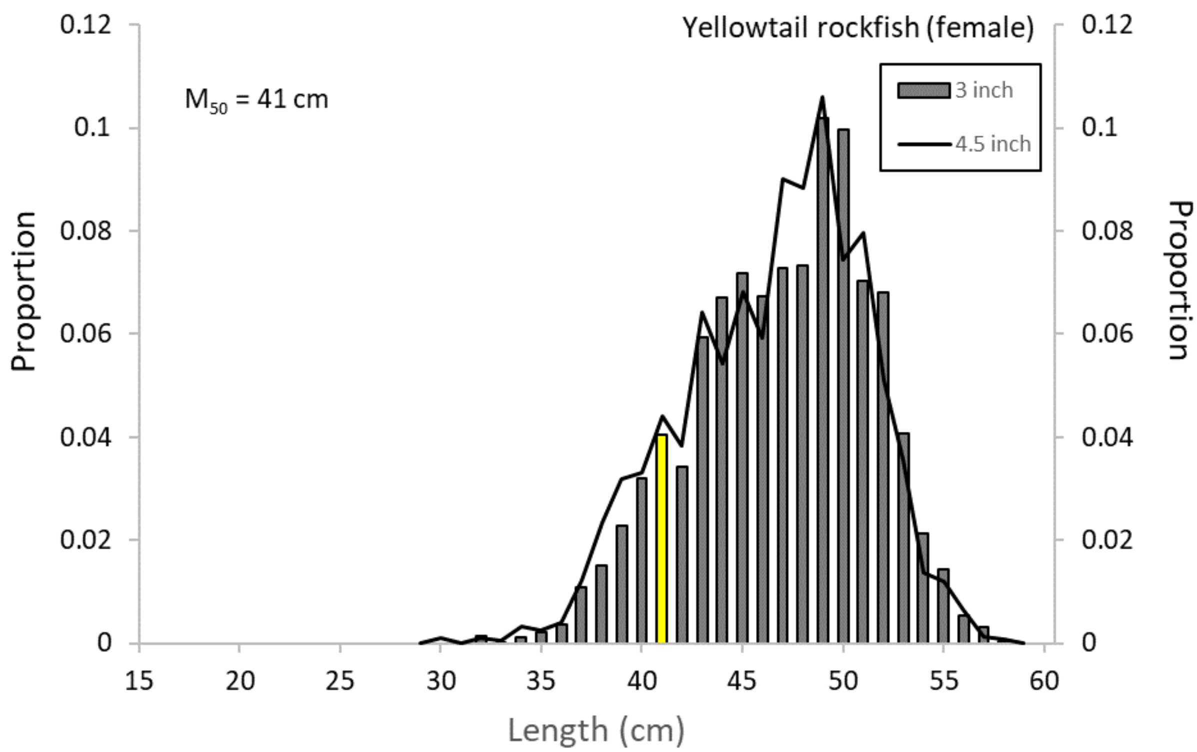
0.06
0.05
0.04
0.03
0.02
0.01
0
Proportion
Shortspine thornyhead (male)
M_{50} = 17 cm
3 inch
4.5 inch
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Length (cm)

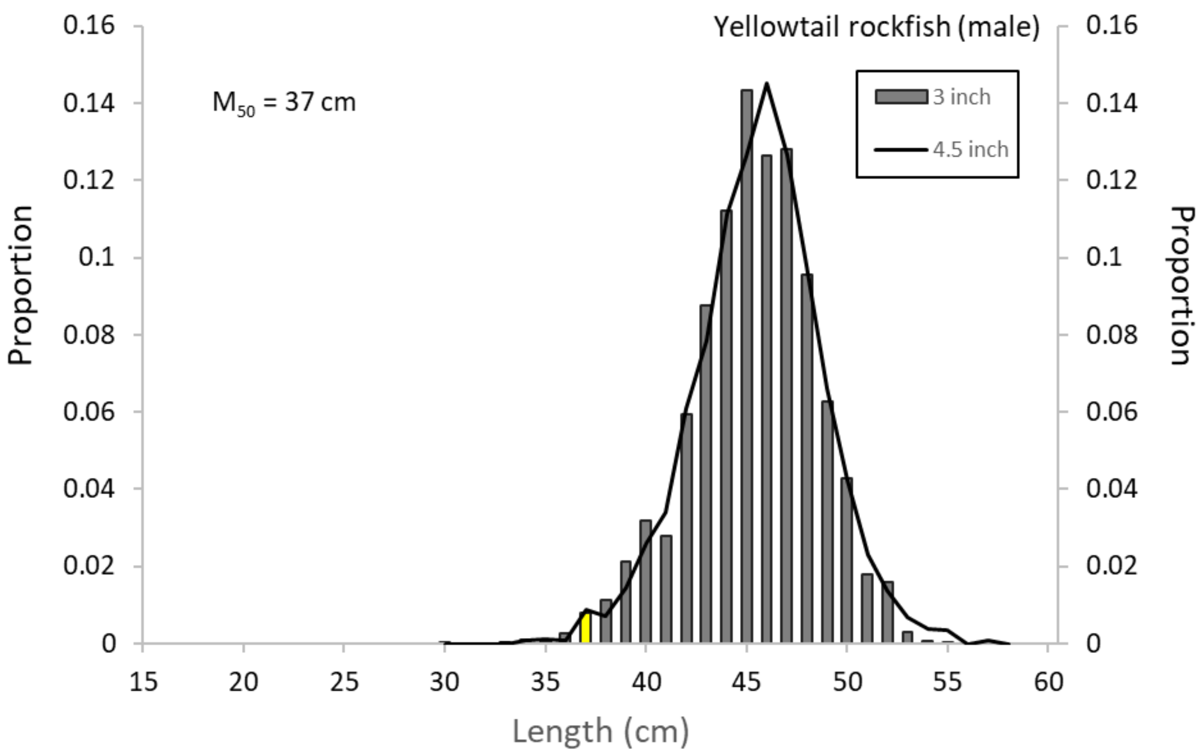

Sablefish (female)
M_{50} = 58 cm
3 inch
4.5 inch
Proportion
Length (cm)

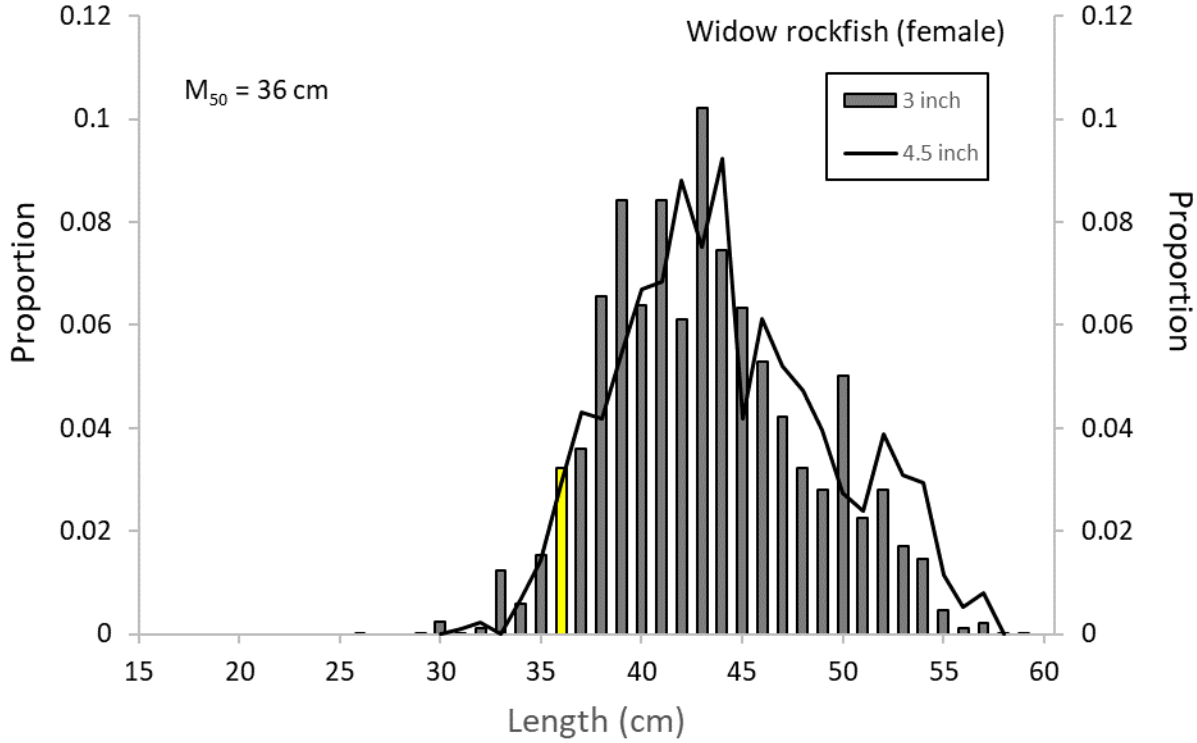

Sablefish (male)
M_{50} = 52 cm
3 inch
4.5 inch
Proportion
Length (cm)

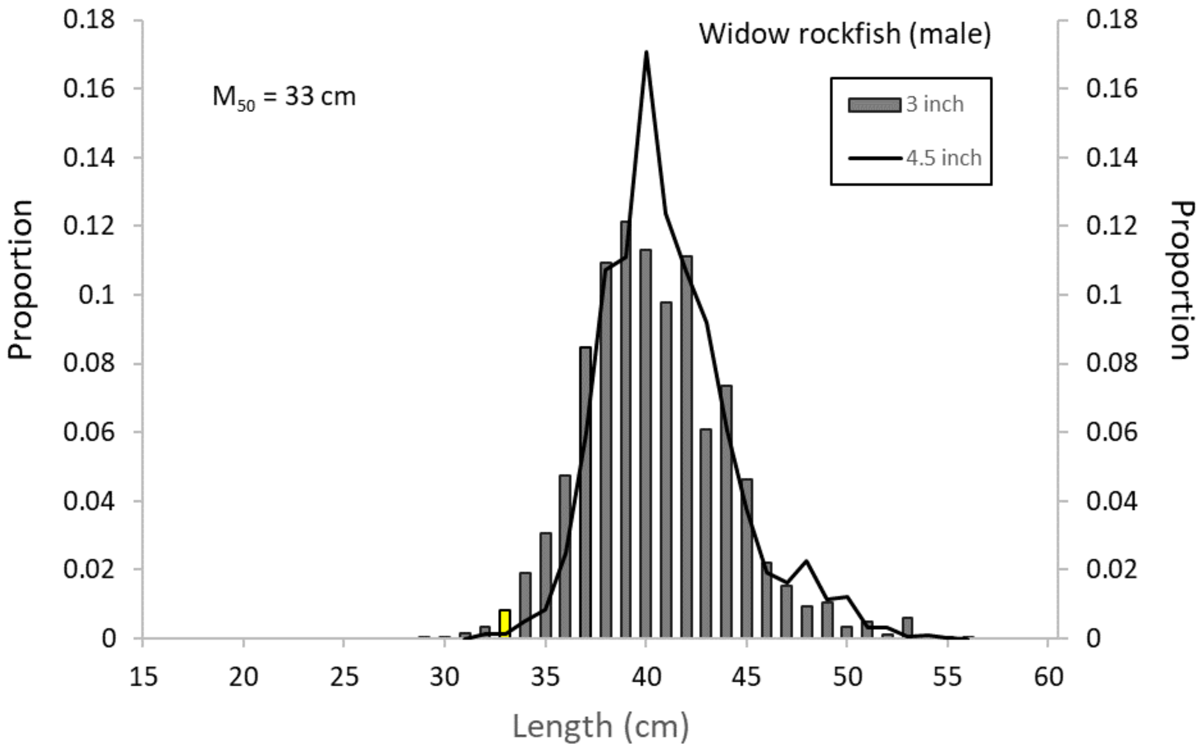

English sole (female)
M_{50} = 31 cm
3 inch
4.5 inch
Proportion
Length (cm)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
10 15 20 25 30 35 40 45 50 55 60

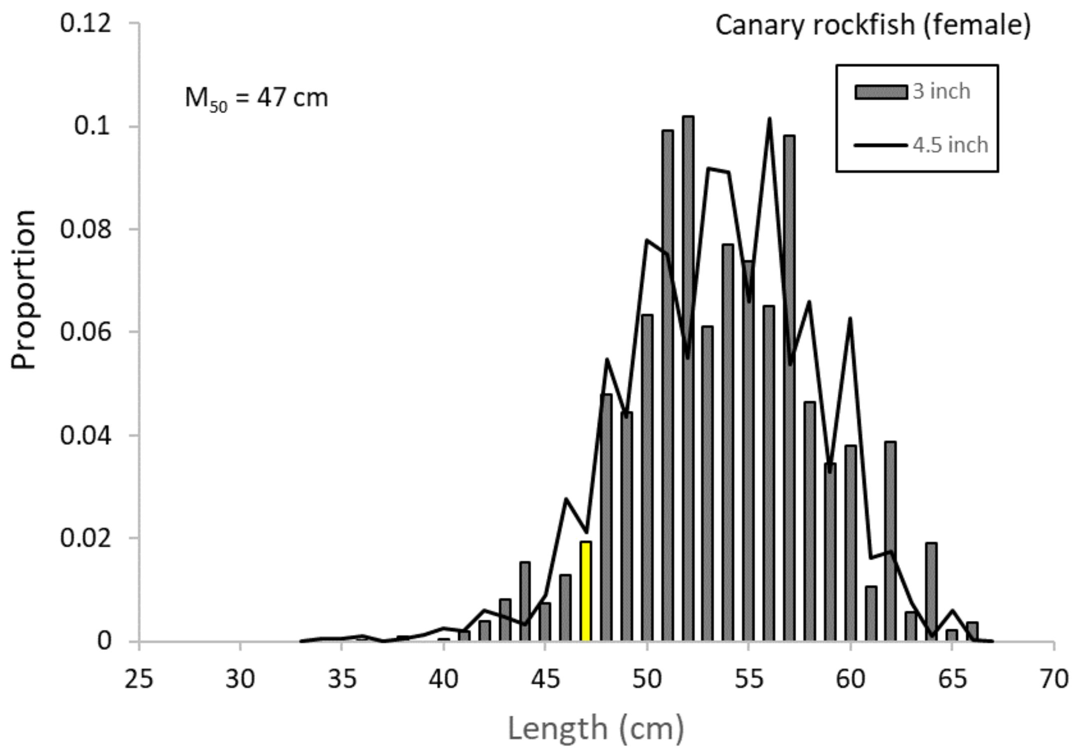

English sole (male)
M_{50} = 26 cm
3 inch
4.5 inch
Proportion
Length (cm)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
10 15 20 25 30 35 40 45 50 55 60

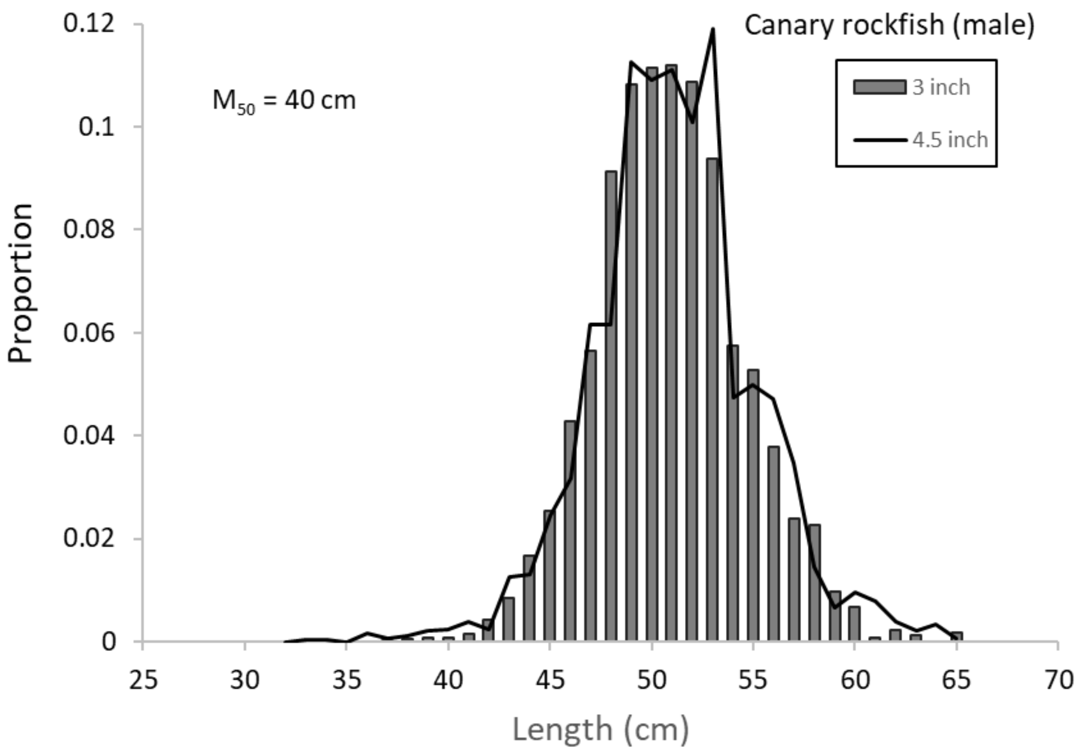

Yellowtail rockfish (female)
M_{50} = 41 cm
3 inch
4.5 inch
Proportion
Length (cm)
0.12
0.1
0.08
0.06
0.04
0.02
0
15 20 25 30 35 40 45 50 55 60

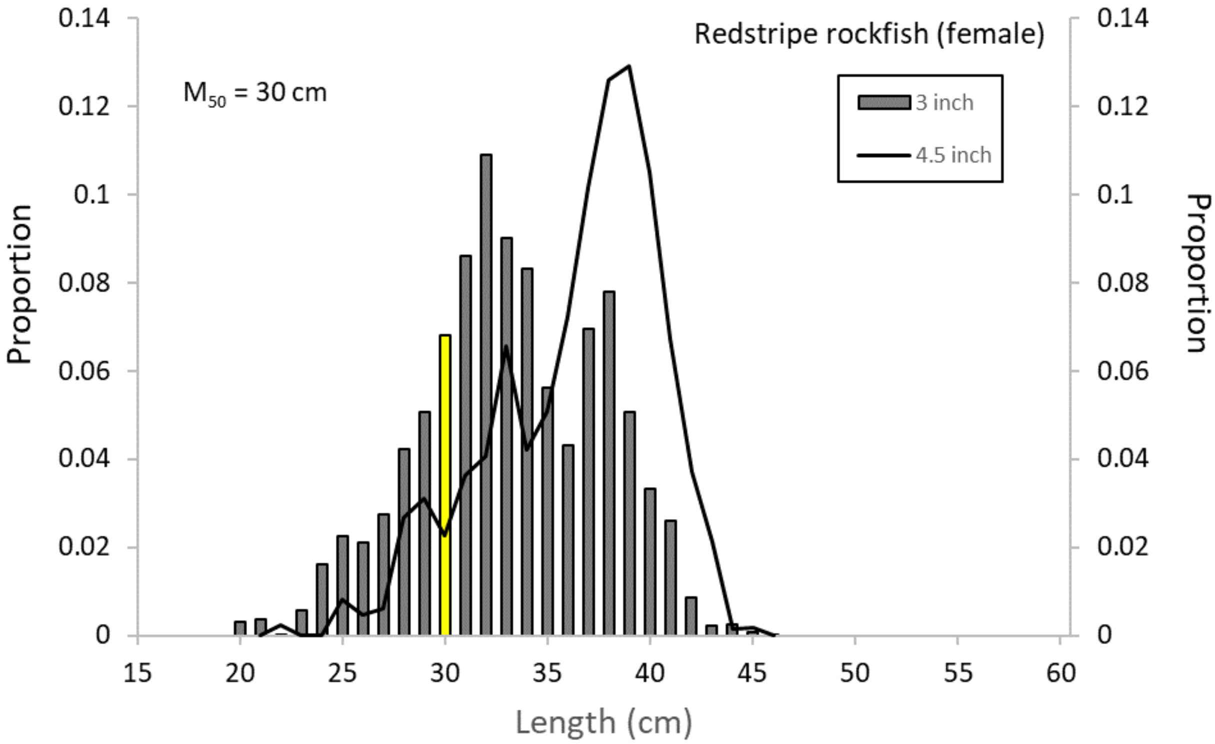

Yellowtail rockfish (male)
M_{50} = 37 cm
3 inch
4.5 inch
Proportion
Length (cm)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
15 20 25 30 35 40 45 50 55 60


Widow rockfish (female)
M_{50} = 36 cm
3 inch
4.5 inch
Proportion
Proportion
Length (cm)
0.12
0.1
0.08
0.06
0.04
0.02
0
15
20
25
30
35
40
45
50
55
60


Widow rockfish (male)
M_{50} = 33 cm
3 inch
4.5 inch
Proportion
Proportion
Length (cm)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
15
20
25
30
35
40
45
50
55
60


Canary rockfish (female)
M_{50} = 47 cm
3 inch
4.5 inch
Proportion
0.12
0.1
0.08
0.06
0.04
0.02
0
25
30
35
40
45
50
55
60
65
70
Length (cm)


Canary rockfish (male)
M_{50} = 40 cm
3 inch
4.5 inch
Proportion
0.12
0.1
0.08
0.06
0.04
0.02
0
25
30
35
40
45
50
55
60
65
70
Length (cm)


Redstripe rockfish (female)
M_{50} = 30 cm
3 inch
4.5 inch
Proportion
Proportion
Length (cm)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
15
20
25
30
35
40
45
50
55
60