Agenda Item F.2
Attachment 2
April 2021

Endangered Species Act (ESA) Section 7(a)(2) Biological and Conference Opinion

Continuing Operation of the Pacific Coast Groundfish Fishery (Reinitiation of consultation #NWR-2012-876) – Humpback whale (*Megaptera novaeangliae*)

NMFS Consultation Number: WCRO-2018-01378
ARN 151422WCR2018PR00213

Action Agency: The National Marine Fisheries Service (NMFS)

Affected Species and NMFS' Determinations:

ESA-Listed Species	**Status**	**Is Action Likely to Adversely Affect Species?**	**Is Action Likely To Jeopardize the Species?**	**Is Action Likely to Adversely Affect Critical Habitat?**	**Is Action Likely To Destroy or Adversely Modify Critical Habitat?**
Humpback whale (*Megaptera novaeangliae*) – Central America DPS	Endangered	Yes	No	No	No
Humpback whale – Mexico DPS	Threatened	Yes	No	No	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued]
For
Regional Administrator

Date: October 26, 2020

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LIST OF ACRONYMS

ACL – Annual Catch Limit

AI/Bering – Aleutian Islands/Bering

AK – Alaska

BC – British Columbia

BIA - Biologically Important Area

BRA – Bycatch Reduction Area

CCA – Cowcod Conservation Areas

CCE – California Current Ecosystem

CHRT – Critical Habitat Review Team

CI – Confidence Interval

CPS – Coastal Palegic Species

CPUE – Catch Per Unit Effort

CS – Catch Shares

DPS - Distinct Population Segment

DQA – Data Quality Act

DTL – Daily Trip Limit

EEZ – Exclusive Economic Zone

EFH – Essential Fish Habitat

EFHCA – Essential Fish Habitat Conservation Area

EFP – Exempted Fishing Permit

EM – Electronic Monitoring

ESA – Endangered Species Act

fm – fathom

ft – feet

FMP – Fishery Management Plan

GCA – Groundfish Conservation Area

GEMM – Groundfish Expanded Mortality Multi-year

GOA – Gulf of Alaska

IFQ – Individual Fishing Quota

IPHC – International Pacific Halibut Commission

ITS – Incidental Take Statement

LE – Limited Entry

LEFG – Limited Entry Fixed Gear

MMPA – Marine Mammal Protection Act

MSA – Magnuson-Stevens Act

M/SI – Mortality and serious injury

mtDNA – mitochondrial DNA

NCS – Non-catch share

NLAA – Not Likely to Adversely Affect

NMFS – National Marine Fisheries Service

nmi^2 – square nautical miles

NOAA – National Oceanic and Atmospheric Administration

NPGO – North Pacific Gyre Oscillation

NWFSC – Northwest Fisheries Science Center

NWR – North West Region

OA – Open Access

PBF – Physical or Biological Feature

PCE – Primary Constituent Element

PCGF – Pacific Coast Groundfish Fishery

PFMC – Pacific Fisheries Management Council

PRD – Protected Resources Division

PSMFC – Pacific States Marine Fisheries Commission

RCA – Rockfish Conservation Area

RecFIN – Recreational Fisheries Information Network

RPA – Reasonable and Prudent Alternative

RPM – Reasonable and Prudent Measures

SAR – Stock Assessment Report

SBC – Southern British Columbia

SE/NBC – Southeast Alaska/Northern British Columbia

SEAK – Southeast Alaska

SFD – Sustainable Fisheries Division

SPLASH - Structure of Populations, Levels of Abundance and Status of Humpbacks

SWFSC – Southwest Fisheries Science Center

TAC – Total Allowable Catch

U&A – Usual and Accustomed

U.S. – United States

VMS – Vessel Monitoring System

WCGOP – West Coast Groundfish Observer Program

WCR – West Coast Region

YRCA – Yelloweye Rockfish Conservation Area

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological and conference opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended. The conference opinion concerning proposed critical habitat for humpback whales does not take the place of a biological opinion under section 7(a)(2) of the ESA unless and until the conference opinion is adopted as a biological opinion when the proposed critical habitat designation becomes final. Adoption may occur if no significant changes to the action are made and no new information comes to light that would alter the contents, analyses, or conclusions of this Opinion.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Protected Resources Division (PRD) in Portland, OR.

1.2. Consultation History

In NMFS's 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 (PCGF), (2012 Opinion; NMFS 2012), we determined that the PCGF was likely to have an adverse effect on humpback whales (*Megaptera novaeangliae*), along with four other ESA-listed species:

- Eulachon (*Thaleichthys pacificus*) – southern distinct population segment (DPS)
- Green sturgeon (*Acipenser medirostris*) and their critical habitat – southern DPS
- Leatherback sea turtles (*Dermochelys coriacea*) and their critical habitat
- Steller sea lions (*Eumetopias jubatus*) – eastern DPS (delisted) [1]

On April 5, 2016, NMFS' Sustainable Fisheries Division (SFD) requested a reinitiation for the southern DPS of eulachon portion of the 2012 Opinion due to take exceedance. On October 12, 2018, this reinitiation of the 2012 Opinion was completed with new Terms and Conditions, Reasonable and Prudent Measures, and Conservation Measures for the southern DPS of eulachon (NMFS 2018). For all the other ESA-listed species covered by the 2012 Opinion, all Terms and Conditions, Reasonable and Prudent Measures, and Conservation Measures remained in effect.

[1] The eastern DPS of Steller sea lions was delisted on November 4, 2013 (78 FR 66140).

On October 30, 2018, PRD received a request from SFD to reinitiate consultation on the Pacific Coast Groundfish Fishery (PCGF) due to the revision and subsequent delisting, downlisting, and uplisting of the global humpback whale species into 14 DPSs. On November 29, 2018, PRD requested additional materials be provided by SFD in order to initiate a formal consultation. On October 17, 2019, SFD provided the requested information along with a second trigger for reinitiation – exceeding the amount or extent of humpback whale incidental take from the incidental take statement included with the 2012 Opinion (see below).

This opinion is a reinitiation of the 2012 Opinion for humpback whale (NMFS 2012) for the following two reasons:

First, bycatch estimates generated by Hanson et al. (2019) from review of West Coast Groundfish Observer Program (WCGOP) data indicate that the incidental extent of take was exceeded. Under Section 2.10 of the 2012 Opinion, if "the amount or extent of incidental take is exceeded," then a "reinitiation of formal consultation is required" (50 CFR 402.16). The 2012 Opinion authorized the incidental take of no more than one whale on average over any consecutive five-year period. In an analysis of the fishery, Hanson et al. (2019) estimated that the five-year average for the PCGF has been greater than one humpback whale injury and/or mortality every year since the completion of the 2012 Opinion. This estimate was based on two observed humpback whale entanglements with sablefish pot gear in the PCGF fishery, including the first documented humpback whale entanglement in the Open Access (OA) pot fishery, during that time period.

Second, on October 11, 2016, the humpback whale was delineated into 14 DPSs from a single globally listed (endangered) species. Three DPSs are found within the range of this fishery – Central America (ESA listed as Endangered), Hawaii (not ESA-listed), and Mexico (ESA-listed as Threatened). Under Section 2.10 of the 2012 Opinion, if "a new species is listed or critical habitat designated that may be affected may the action," then a "reinitiation of formal consultation is required" (50 CFR 402.16).

Further, with critical habitat being proposed for humpback whales on October 9, 2019 (84 FR 54354), this opinion will analyze the impact of the groundfish fishery upon the proposed humpback whale critical habitat.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). The action proposed here is the continuing implementation of the Pacific Coast Groundfish Fishery Management Plan (PFMC 2019b). The Fishery Management Plan (FMP) regulates fishing in the Exclusive Economic Zone (EEZ) with respect to species listed in Section 3.1 of the FMP.

1.3.1 Overview of the Components and Operation of the Pacific Coast Groundfish Fishery

Prior to implementation of the PCGF FMP, management of domestic groundfish fisheries was under the jurisdiction of the states of Washington, Oregon, and California with each state acting independently in both management and enforcement. In 1977, the Fishery Conservation and Management Act [later amended and renamed the Magnuson-Stevens Fishery Conservation and Management Act or Magnuson-Stevens Act (MSA)] established eight regional fishery management Councils, including the Pacific Council, and extended U.S. jurisdiction to 200 nautical miles from shore [the full extent of the U.S. Exclusive Economic Zone (EEZ)]. Between 1977 and the 1982 implementation of the PCGF FMP, state agencies worked with the Council to address conservation issues. The PCGF FMP was approved by the U.S. Secretary of Commerce (Secretary) on January 4, 1982; implemented on October 5, 1982; and has been amended 32 times in response to changes in the fishery, reauthorizations of the MSA, and litigation that invalidated provisions incorporated by earlier amendments.

The PCGF is a year-round, multi-species federally-managed fishery that occurs off the coasts of Washington, Oregon, and California. Groundfish fisheries managed under the PCGF FMP occur in the United States' Exclusive Economic Zone (EEZ). The PCGF includes commercial and recreational harvest of more than 90 species including Pacific whiting (*Merluccius productus*), sablefish (*Anoplopoma fimbria*), lingcod (*Ophiodon elongatus*), and various species of rockfish and flatfish. For Pacific whiting, an annual international catch limit is set under the Pacific Hake/Whiting Treaty between the U.S. and Canada. For other species, annual catch limits (ACLs) are set and allocated to sectors[2] of the fishery through a biennial process. A few target groundfish species or stocks[3] are typically caught nearly up to their ACLs, but many species in the fishery are caught at levels significantly below their ACLs. The PCGF includes vessels that use a variety of gear types to harvest groundfish directly or to land groundfish incidentally caught while targeting non-groundfish species.

Based on WCGOP data, from 2009-2018, over 450 marine species were caught in the PCGF. Of those species, 216 species were in excess of one metric ton. Two of those species are humpback whale prey (Pacific sardine and Pacific herring) and, as such, are included as a physical or biological feature (PBF) in the proposed designation critical habitat for the Mexico and Central America DPS (84 FR 54354).

There are multiple ways in which someone may participate in the PCGF based upon whether one commercially holds a Federal permit or not [Limited Entry (has Federal permit) or Open Access (no Federal permit)], has treaty rights (Tribal fishery), or fishes recreationally (Recreational). Based on fishery, gear, and target strategy, the PCGF can be further broken down into the following components (Table 1).

1. The Limited Entry (LE) fishery encompasses all commercial fishermen who hold a Federal LE permit. The program was established in 1994, and the total number of LE permits available is restricted. LE permits are issued with one or more of the following gear endorsements: trawl, longline, and trap (or pot) gear. Vessels with an

[2] A sector is defined as a group of three (or more) distinct persons holding limited access vessel permits who have voluntarily entered into a contract and agreed to certain fishing restrictions for a specified period of time, and which has been granted a quota in order to achieve objectives consistent with the applicable fishery management plan goals and objectives.
[3] All species of rockfish, flatfish, roundfish, and elasmobranchs listed in Table 3-1 of the Pacific Coast Groundfish Fishery Management Plan.

LE permit often have access to a larger portion of the total allowable catch for commercially desirable species than do vessels without an LE permit.

2. The Open Access (OA) fishery encompasses commercial fishermen who do not hold a Federal LE permit. The OA fishery participants may use, but are not limited to longline, vertical hook-and-line, pot, set-net, trammel net, and non-groundfish trawl gear. The OA fishery includes both vessels targeting groundfish and vessels that target other species but incidentally catch and retain groundfish.
3. The Tribal fishery includes Pacific Coast Treaty commercial fishermen in Washington State that have treaty rights to fish groundfish. Participants in the tribal fishery use gear similar to that used in the non-tribal fisheries.
4. The Recreational fishery includes recreational anglers who target or incidentally catch groundfish species.

Table 1. Summary of gear and components by fishery managed under the PCGF FMP.

Fishery	Gear	Components
LE vessels registered to Federal LE groundfish permits (non-tribal)	Trawl—At-sea Pacific whiting cooperatives	Catcher-processor cooperative Mothership sector cooperative
	Trawl—Shorebased Individual Fishing Quota (IFQ) program	Pacific whiting midwater trawl Non-Pacific whiting midwater trawl Bottom trawl Fixed gear (gear switching)
	Fixed gear (longline & pots/traps)	Sablefish tier limit fishery LE fixed gear (LEFG) daily trip limit (DTL) fishery
Open access	See text above for description.	Directed OA Incidental OA
Tribal	Gear similar to LE fishery	Pacific whiting midwater trawl Non-Pacific whiting midwater trawl Bottom trawl Fixed gear
Recreational	Hook-and-line Spear	Commercial passenger vessels and private party vessels

1.3.2 Overview of Trawl Fisheries

In 2011, NOAA Fisheries implemented a catch share program, also referred to as the trawl rationalization program, for the West Coast Groundfish Trawl Fishery. The trawl fishery is managed as an IFQ program. IFQ's are a type of "catch share" program that constrains both the number of vessels participating in the fishery and the amount of fish they may catch. Catch shares (CSs) are used for the shorebased trawl fleet and harvester cooperatives for the at-sea mothership and catcher-processor fleets. The CS system divides the portion of the ACL allocated to the trawl fishery into shares controlled by individual fishermen or groups of fishermen (co-ops). The shares can be harvested largely at the fishermen's discretion. Catch of IFQ species (e.g.

Pacific whiting, sablefish) is deducted from the fisherman's individual quota or the pooled quota (cooperatives). The CS includes trip limits for non-IFQ species, size limits, and area restrictions.

The trawl fishery is divided into a number of sectors for management purposes. A portion of the fishery targets Pacific whiting, a midwater species. This portion of the fishery is divided into vessels that deliver to onshore processors (shoreside) and vessels that process at sea or deliver to vessels that process at sea (at-sea). Another portion of the fishery target bottom-dwelling groundfish species (bottom trawl). Finally, there is a developing fishery for non-Pacific whiting midwater groundfish species. This latter fishery is expected to expand in the future as restrictions put in place to allow formerly overfished species to rebuild are lifted.

It is assumed the Pacific whiting fishery will operate in the same geographical footprint as it has in recent years. The U.S. portion of the annual Pacific whiting total allowable catch (TAC) could go up to 600,000 metric tons, as the TAC has been trending higher in recent years.

For the non-Pacific whiting fishery, it is assumed the geographic distribution of the fleet and harvest levels will be similar to patterns seen in recent years, with the exception of additional effort in the trawl Rockfish Conservation Areas (RCA) off of Oregon and California which were opened beginning in 2020 as a result of Amendment 28 to the Pacific Coast Groundfish FMP. As overfished species are rebuilt, fishing is expected to resemble those historical patterns more closely than recent patterns, which reflect restrictions on fishing necessary for rebuilding the species.

1.3.3 Limited Entry - At-sea Pacific Whiting Cooperatives

For the at-sea trawl fishery, the Pacific whiting primary season runs from May 15 to December 31, or until the sector allocations are taken. Allocations remaining on December 31 are not carried into the new fishing year. Because many of the vessels are also used in the Alaska groundfish fishery and participate in the pollock B-season (June to October), much of the participation in the Pacific whiting fishery occurs in two separate timeframes, a spring season before the Alaska pollock fishery and a fall season. Most of the catcher-processor activity occurs from mid-May to early June and late September to late November. Most of the mothership activity occurs from mid-May to early June and mid-September to mid-November. Generally, there is little or no fishing activity in the Pacific whiting at-sea fishery during July and August.

1.3.4 Limited Entry - Shorebased IFQ Program

The Shorebased IFQ program allows LE trawl permit holders to switch from trawl to fixed gears (longline and pot gear) to fish their individual quota (referred to as Catch Share or CS fixed gear sector throughout the rest of this biological opinion). From 2011-2018, 39 LE trawl vessels used fixed gear to fish for sablefish in the area north of 36° north latitude to the U.S.-Canada border. Fixed gears targeting sablefish are more selective than trawl gear. Sablefish are caught in deeper water, unlike nearshore groundfish species. Sablefish is the target of gear switching due to its high price per pound.

The shorebased IFQ fishery season for Pacific whiting is set using a framework for the area north of 40°30 N. Under the framework, the fishery opens on May 15 north of 42° N; April 1 between 42°and 40°30' N; and April 15 south of 40°30' N. The fishery harvests most of its Pacific whiting from mid-June through September, with smaller amounts being taken after September. The Pacific whiting shorebased IFQ fishery start date is aligned with the at-sea sector start date to allow access to non-Pacific whiting species one month earlier and equal access between the sectors to other midwater species such as widow rockfish.

The bottom trawl fishery is a year-round fishery in which vessels fish in a wide range of depths and deliver catch to shore-side processors. The peak of non-Pacific whiting groundfish catch (all gears) occurs in the spring, in either March or April; with a secondary, lower peak happening in October. Two important and valuable species in this fishery are sablefish and petrale sole. Sablefish catch peaks in September and October, and petrale sole catch peaks in December and January. Since 2011, Petrale sole catch in January has been rising each year.

The non-Pacific whiting midwater trawl fishery currently has the same season start date as the Pacific whiting shorebased IFQ fishery (May 15th). To date, the non-Pacific whiting midwater trawl fishery has not yet established a clear seasonality.

1.3.5 Limited Entry - Fixed Gear

Limited entry fixed gear (LEFG) vessels primarily target high-value sablefish with most landings historically occurring in Oregon and Washington. However, landings of sablefish vary depending on environmental conditions, and they have recently shown a southerly trend. California ports have had the greatest amount of LE, daily-trip-limit landings of sablefish in recent years, while Oregon had the most primary fishery landings.

The LEFG groundfish fishery consists of vessels fishing in the sablefish-endorsed tier fishery and the trip-limit (DTL) fishery targeting nearshore species and non-nearshore species, including the DTL fishery for sablefish. In the sablefish tier fishery, the permit holder of a sablefish-endorsed permit receives an annual share of the sablefish catch or "tier limits." Regulations allow for up to three sablefish-endorsed permits to be stacked on a single vessel. Vessels that are sablefish-endorsed generally fish deeper than 80 fathoms, and they land catch composed mostly of sablefish, with groundfish bycatch consisting primarily of spiny dogfish shark, Pacific halibut, rockfish species, and skates.

In 2019, there were 229 LEFG permits. Those permits included 164 sablefish-endorsed and 61 non-sablefish endorsed permits. In addition, all LE fixed gear permits have gear endorsements (longline, pot/trap, or both). Of the sablefish endorsed permits, 132 were associated with longline gear only, 28 were associated with pot/trap gear only, and 4 were associated with both longline and pot/trap gear. The remaining 61 non-sablefish-endorsed permits were associated with longline gear.[4]

Vessels fishing under trip limits generally target sablefish, thornyheads, and other groundfish species. These vessels primarily fish out of California ports. Fixed gear vessels more frequently catch yelloweye rockfish, a rebuilding species, than trawl vessels, and, therefore, they have greater fishing restrictions on the continental shelf. LEFG vessels may also participate in OA

[4] NMFS West Coast Region Pacific Coast Fisheries Permit System, queried June 6, 2019.

fisheries or the LE trawl fishery. LEFG vessels deliver their catch to ports along the Washington, Oregon, and California coasts.

1.3.6 Open Access Fishery

The Open Access (OA) sector consists of vessels that do not hold a Federal groundfish LE permit. They target groundfish (OA directed fisheries) or catch them incidentally (OA incidental fisheries) using a variety of gears. Vessels in this sector may hold Federal (e.g. Highly Migratory Species) or state permits for non-groundfish fisheries (e.g. spot prawn or Dungeness crab). OA vessels must comply with cumulative trip limits established for the OA sector, and they are subject to the other operational restrictions imposed in the regulations, including general compliance with RCA restrictions.

OA fishermen use longline, trap or pot, setnet, stationary hook-and-line, vertical hook-and-line, and troll gear to target particular groundfish species or species groups. Longline and hook-and-line gear are the most common OA gear types used by vessels directly targeting groundfish and are generally used to target sablefish, rockfish, and lingcod. Pot gear is used for targeting sablefish, thornyheads, and rockfish.

For vessels targeting non-groundfish species, the groundfish catch is incidental to the target species. Only the groundfish catch is regulated under the PCGF FMP. Incidental catch occurs in the following state-managed, non-groundfish trawl fisheries: California halibut, pink shrimp, ridgeback prawn, sea cucumber, and spot prawn. The fixed gear fisheries that take incidental amounts of groundfish include the following fisheries managed by the states (not part of the proposed action) or under other Federal FMPs: California halibut, coastal pelagic species, crab pot, fish pot, highly migratory species, Pacific halibut, salmon, sea urchin, and setnet fisheries. In summary, the incidental retention of groundfish is part of the OA fishery and is therefore included in the proposed action. The target fisheries listed above are not themselves part of the proposed action.

The OA sector is made up of many different gear types involved in directed and incidental catch, which makes it difficult to discern the location of effort. However, based on the diversity of this sector, it is reasonable to assume that effort is widespread across the West Coast. OA groundfish landings vary according to which non-groundfish fisheries are landing groundfish as bycatch. The number of OA vessels that land groundfish also varies with the changes in the non-groundfish fisheries and participation varies between years. For the directed OA fisheries, participation from 2008 to 2012 in the nearshore fixed gear fishery had approximately 597 unique vessels (216 from Oregon and 282 from California), and the non-fixed gears had approximately 150 unique vessels (18 from Washington, 44 from Oregon, and 88 from California) (PFMC 2014). For the incidental OA fisheries, there were approximately 604 unique vessels from 2008 to 2012 (46 from Washington, 200 from Oregon, and 367 from California) (PFMC 2014). There is limited information on the distribution of effort by OA vessels beyond state-level data.

1.3.7 Tribal Groundfish Fisheries

Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) possess treaty rights to harvest Federally managed groundfish in their usual and accustomed fishing areas (U&As) within the

EEZ, as described in decisions in *United States v. Washington* and associated cases. The U&As for Pacific Coast treaty Indian tribes are defined at 50 CFR 660.4. Under treaty arrangements, each tribe manages the fisheries carried out by its members. The PCGF FMP and its implementing regulations provide for allocations or set-asides of specific amounts of some species for the tribal fisheries to ensure implementation of treaty fishing rights. Those allocations and set-asides are developed annually or biennially (depending on the species) in consultation with the tribes.

The individual tribes manage their fisheries, coordinating with NMFS and the Council. Treaty tribes participating in the groundfish fishery off Washington have formal allocations for sablefish, black rockfish, and Pacific whiting established through the Council. For other groundfish species without formal allocations, the tribes propose trip limits to the Council. The Council tries to accommodate the requested trip limits by setting aside a portion of the catch limit for specific species, while ensuring that catch limits for all groundfish species are not exceeded.

All four coastal treaty tribes have longline vessels in their fleets; only the Makah Tribe has trawl vessels. The Makah trawl vessels use both midwater and bottom trawl gear to target groundfish. The Makah Tribe also has the most longline vessels, followed by the Quinault, Quileute, and Hoh Tribes. Since 1996, a portion of the U.S. Pacific whiting TAC has been allocated to the West Coast treaty tribes fishing in the groundfish fishery. Tribal allocations have been based on discussions with the tribes regarding their intent for a specific fishing year. From 2007 to 2016, the tribal allocation has ranged from 13 to 37 percent of the U.S. Pacific whiting TAC.

The tribal Pacific whiting annual allocations are interim allocations not intended to set precedent for future allocations. Although the Quinault, Quileute, and Makah Tribes have expressed interest in the Pacific whiting fishery, to date, only the Makah Tribe has participated in the Pacific whiting fishery.

In addition to its participation in the Pacific whiting fishery, the Makah Tribe has a midwater trawl fishery that primarily targets yellowtail rockfish and a bottom trawl fishery that targets petrale sole. In developing its trawl fisheries, the Makah Tribe has implemented management practices that include test fishing to show tribal managers that the fishery can be conducted with gear and in areas without harming tribal fisheries. In the Makah bottom trawl fishery, the Tribe adopted small footrope gear restrictions to reduce rockfish bycatch and avoid areas where higher numbers of rockfish occur. In addition, the bottom trawl fishery is limited by overall footrope length to conduct a more controlled fishery. Harvest is restricted by time and area to focus on harvestable species while avoiding bycatch of other species. If bycatch of rockfish is above a set amount, the fishery is modified to stay within the bycatch limit. The midwater trawl fishery has similar control measures. A trawl area must first be tested to determine the incidence of overfished rockfish species before opening the area to harvest. Vessels receive guidelines for fishing techniques and operation of their net. Under the WCGOP, NMFS contracted observers monitor fishing effort, and changes or restrictions are implemented, as needed, to stay within the bycatch limits.

Approximately one-third of the tribal sablefish allocation is taken during an open competition fishery, where vessels from all four tribes have access to the overall tribal sablefish allocation.

The open competition portion of the fishery tends to be taken in March and April. The remaining two-thirds of the tribal sablefish allocation is split between the tribes according to a mutually agreed-upon allocation scheme. The individual tribes manage specific sablefish allocations. Participants in the sablefish fishery tend to use hook and line gear.

1.3.8 Recreational Fisheries

The states manage recreational fisheries in partnership with NMFS, with a distinction made between charter vessels (commercial passenger fishing vessels) and private party recreational vessels (individuals fishing from their own or rented boats). Federal and state management measures have been designed to limit catch of overfished species and provide fishing opportunity for anglers targeting nearshore groundfish species. The primary management tools have been seasons, bag limits, and closed areas. Gears used in the recreational fisheries include dip nets, throw nets, hook-and-line, dive/spears, and pots. In Oregon, starting in 2018, a longleader gear opportunity became available. Longleader gear has a minimum of 30 feet between the weight and the lowest hook. The gear is designed to target midwater rockfish species such as yellowtail and widow rockfish to move fishing pressure off nearshore rockfish species and to provide increased recreational fishing opportunities.

Recreational fisheries in Washington and California have shifted from year-round fisheries to seasonal fisheries with different open periods, depending on the target species. Recreational fishing in Oregon is open year-round, except when inseason closures are needed. Coastwide, the number of marine angler trips peak in the July-to-August period, but seasonal concentrations are more pronounced in Oregon and Washington where weather is more variable.

1.3.9 Catch Monitoring

Vessel monitoring systems (VMS) that automatically transmit position reports to NMFS are the primary management tool used to monitor commercial vessel compliance with time and area restrictions. All non-tribal commercial vessels are required to have an operational vessel monitoring system to fish in the groundfish fishery. In addition, each vessel operator is required to submit declaration reports to NOAA's Office for Law Enforcement that allows the vessel's position data to be linked to the type(s) of fishing gear and in some cases a target strategy. Table summarizes the type and level of monitoring by fishery sector.

Table 2. Type and level of monitoring by fishery sector

<table>
<tr><th rowspan="2">Fishing Sector</th><th>Time Area Monitoring</th><th colspan="2">Catch and Discard Monitoring</th></tr>
<tr><th>VMS Coverage</th><th>Observer Coverage (2017)</th><th>Other Coverage</th></tr>
<tr><td>Trawl IFQ</td><td rowspan="2">Vessel registered to LE permits must operate VMS 24 hours a day throughout the fishing year</td><td>1 observer per harvesting vessel, 1 catch monitor at first receivers.</td><td>Optional electronic monitoring in lieu of human observers.</td></tr>
<tr><td>Trawl at-sea Pacific whiting</td><td>2 observers per processor 125 ft and over, 1 per processor under 125 ft. 1 observe per mothership harvesting vessel</td><td>Mothership harvesting vessels - optional electronic monitoring in lieu of human observers under an exempted fishing permit (EFP).</td></tr>
</table>

Fishing Sector	Time Area Monitoring	Catch and Discard Monitoring	
	VMS Coverage	Observer Coverage (2017)	Other Coverage
LEFG sablefish tier limit fishery		Observer coverage of all groundfish landings was 37% of the longline and 31% of pot gear landings	
LEFG daily trip limit fishery		Observer coverage coastwide was 3% of all groundfish.	
OA directed	Any vessel that takes, and retains, or possess groundfish in the EEZ must operate VMS 24 hours a day throughout the fishing year	Observer coverage coastwide was: 7% of all groundfish landings in non-nearshore 9% for all nearshore landings	
OA incidental	Any vessel that takes, and retains, or possess groundfish in the EEZ and any vessel that uses non-groundfish trawl gear to fish in the EEZ must operate VMS 24 hours a day throughout the fishing year		
Tribal	Not required, unless vessel is registered to non-tribal groundfish permit	Observer coverage and shore-based sampling of groundfish directed fishing.	
Recreational			State surveys - may include, catch data and estimates from private, rental and charter vessels, beach and private access effort, and effort based on license data. Coverage varies
Trawl Gear EFPs	Same requirement as that for all LE vessels	Vessels may use electronic monitoring (EM) or observers. Observers will take samples by haul on observed vessels and then all prohibited species must be discarded.	EM vessels are exempt from the prohibition on retaining prohibited species and are required to retain all salmon by haul for shoreside sampling.

The monitoring of fishing mortality varies between sectors based on effort and prevalence of bycatch. The greatest amount of monitoring occurs in the trawl fisheries and the least in the incidental OA and recreational fisheries.

1.3.9.1 At-Sea Pacific Whiting Sector

In the at-sea Pacific whiting sectors, catch composition is closely monitored through the WCGOP's on-board observer program on processing vessels and electronic monitoring (video) or on mothership sector catcher vessels.[5] Each processing vessel 125 feet and longer must carry two observers that subsample close to 100 percent of all hauls in order to estimate catch composition. Processing vessels under 125 feet must carry one observer. Currently, there are no processing vessels under 125 feet. Each vessel in the mothership sector has one observer to

[5] Preliminary investigations on the use of electronic monitoring have been conducted under exempted fishing permits. Regulations are expected to be available in regulation in 2021 to monitor mothership catcher vessels and Pacific whiting Shorebased IFQ vessels in lieu of the 100 percent observer coverage requirement.

account for discards or uses electronic video monitoring to verify full retention of catch. Prior to 2011, vessels in the mothership sector were not monitored. In addition, the observers collect biological data from groundfish, protected species, and prohibited species. Catch data by species are generally available within 24 hours during the season and will continue to be available into the future for use in management decisions.

1.3.9.2 Shorebased IFQ Sector

Implementation of the Shorebased IFQ program included an increase in observer coverage for all participating vessels. This was an increase in coverage from approximately 25 percent pre-IFQ to nearly 100 percent of all groundfish landings with IFQ. Nearly 100 percent of the hauls are sampled with discards being accounted for at the haul level. The exception is the Pacific whiting Shorebased IFQ fishery where most vessels retain nearly all their catch and do not sort and discard at sea. In the Pacific whiting shorebased IFQ fishery, observers primarily monitor the retention of catch. Catch composition data are gathered on shore by catch monitors. Pacific whiting vessels may voluntarily use electronic monitoring to monitor catch retention. Observers collect valuable fisheries data, including fishing effort and location, estimates of retained and discarded catch, species composition, biological data, and protected species interactions. Stock specific information on Chinook salmon bycatch is not available until the following year. The data informs fisheries managers and stock assessment scientists, as well as other fisheries researchers. WCGOP catch data informs the vessel accounting system used for quota management.

Shorebased IFQ vessels are required to land catch at IFQ first receivers where the landed catch is sorted and weighed. 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. Prohibited species catch data for the IFQ fishery is available inseason to fishery participants. However, the full dataset at the haul level for all species is not available until the summer of the following year. Total catch data for groundfish species are available approximately 11-12 months following the end of the fishing year.

1.3.9.3 Fixed Gear Sector

The WCGOP provides observer coverage for the LE fixed gear fisheries. Observers collect discard data at sea as well as biological data from groundfish, protected, and prohibited species. Groundfish total catch data are available approximately 11-12 months following the end of the fishing year after sample data are extrapolated and combined with landings data. From 2012 to 2017, 20 to 47 percent of the LE sablefish-endorsed groundfish landings and 4 to 8 percent of the non-sablefish endorsed groundfish landings (Table 3) were monitored by observers (Somers et al 2018b).

The WCGOP also provides observer coverage for the OA fishery. From 2012 to 2017, four to seven percent of the OA fixed gear fishery groundfish landings were monitored by observers (Table 4) (Somers et al 2018b). Groundfish total catch data are available approximately 11-12 months following the end of the fishing year after sample data are extrapolated and combined with landings data.

Table 3. Limited Entry Fixed Gear Observer Coverage Rates, 2002-2017 (Somers et al. 2018b). Coverage rates are computed as the observed proportion of total groundfish landings, summarized from fish ticket landing receipts.

Year	LEFG Sablefish Tier Limit			LEFG non-sablefish DTL
	All gear	Pot gear	Longline gear	All gear
2002	23%	23%	20%	1%
2003	25%	25%	20%	9%
2004	14%	14%	13%	5%
2005	45%	45%	34%	3%
2006	35%	35%	20%	7%
2007	21%	21%	27%	12%
2008	56%	56%	28%	9%
2009	14%	14%	7%	6%
2010	28%	28%	26%	10%
2011	37%	37%	21%	10%
2012	35%	35%	22%	5%
2013	14%	14%	21%	7%
2014	31%	31%	28%	5%
2015	62%	62%	41%	7%
2016	71%	71%	32%	4%
2017	31%	31%	37%	3%

Table 4. Open Access Fixed Gear Observer Coverage Rates, 2003-2017 (Somers et al 2018b). Coverage rates are computed as the observed proportion of total groundfish landings, summarized from fish ticket landing receipts.

Year	All gear	Pot gear	Longline gear
2003	5%	2%	3%
2004	2%	9%	3%
2005	1%	3%	2%
2006	4%	2%	1%
2007	4%	3%	4%
2008	3%	4%	4%
2009	3%	2%	3%
2010	6%	3%	3%
2011	5%	7%	5%
2012	4%	7%	4%
2013	6%	9%	2%
2014	5%	8%	5%
2015	6%	6%	5%
2016	7%	7%	5%
2017	3%	12%	4%

1.3.9.4 Tribal Sector

Tribal-directed groundfish fisheries are subject to full rockfish retention. Tribes also use shorebased sampling and observers to monitor their fisheries. Information on current coverage levels and protocols were not available.

1.3.9.5 Recreational Sector

Recreational catch is generally monitored by the states as it is landed in port. However, there may also be on-the-water effort estimates as well. The Pacific States Marine Fisheries Commission (PSMFC) compiles these data in the Recreational Fisheries Information Network (RecFIN) database. The types of data compiled in RecFIN include sampled biological data, estimates of landed catch plus discards, and economic data. Data are generally available within 3 months. Descriptions of the RecFIN program, state recreational fishery sampling programs and the most recent data available to managers, assessment scientists, and the public can be found on the PSMFC website at http://www.psmfc.org/program/prog-3

2. ENDANGERED SPECIES ACT: BIOLOGICAL AND CONFERENCE OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This opinion includes both a jeopardy analysis and a not likely to adversely affect determination (NLAA) for proposed critical habitat. The analytical approach for the NLAA analysis is presented in Section 2.12. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species:

- Evaluate the rangewide status of the species.
- Evaluate the environmental baseline of the species.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of proposed critical habitat throughout the designated area, evaluates the conservation value of the coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

2.2.1 Climate Change

One factor affecting the rangewide status of ESA-listed species and aquatic habitat at large is climate change. Generally, it is accepted that cetaceans are unlikely to directly suffer problems because of changes in water temperature (IWC 1997). Global warming is more likely to affect changes in habitats that in turn potentially affect the abundance and distribution of prey in these areas. Factors such as ocean currents and water temperature may render currently used habitat areas unsuitable and influence selection of migration, feeding, and breeding locations for humpback and other whales. Changes in climate and oceanographic processes may also lead to decreased productivity of, or lead to different patterns in, prey distribution and availability. Such changes could affect whales that are dependent on this prey. While these regional or ocean basin-scale changes may occur, we do not know the actual magnitude and resulting impacts.

Climate change has received considerable attention in recent years, with growing concerns about global warming and the recognition of natural climatic oscillations on varying time scales, such as long-term shifts like the Pacific Decadal Oscillation or short-term shifts, like El Niño or La Niña. Evidence suggests that the productivity in the North Pacific (Mackas et al. 1998; Quinn and Niebauer 1995) and other oceans could be affected by changes in the environment. Important ecological functions such as migration, feeding, and breeding locations may be influenced by factors such as ocean currents and water temperature. Any changes in these factors could render currently used habitat areas unsuitable and new use of previously unutilized or previously not existing habitats may be a necessity for displaced individuals. Changes to climate and oceanographic processes may also lead to decreased productivity in different patterns of prey distribution and availability. Such changes could affect individuals that are dependent on those affected prey.

Multiple studies have detected changes in the abundance, quality, and distribution of humpback whale prey species in association with climate shifts, particularly with ocean warming. The nature and extent of impacts have varied across study areas and species; however, in many cases, ocean warming has led to negative impacts on humpback whale prey species. For instance, in the California Current Ecosystem (CCE), during the anomalous warming of the upper ocean and weak upwelling from 2013–2016, often referred to as the "blob" or the "warm blob," sharp decreases in euphausiid biomass were observed, as evidenced by declines in both abundance and body length (Harvey et al. 2017, Peterson et al. 2017). Comparisons of samples collected in the Northern California Current region during years of cool (2011, 2012), warm (2000, 2002), and intermediate (2015, 2016) conditions, also indicated that body condition of northern anchovy, Pacific herring, and Pacific sardine were better in cool years compared to warm years, and significantly so for anchovy and herring (Brodeur et al. 2018). During the anomalous warm blob event, sardine spawned earlier and appeared farther north within the Northern California Current than in previous years (Auth et al. 2018). Shifts in prey abundance and distributions may lead to corresponding shifts in marine mammal distributions (King et al. 2011). In Monterey Bay, California, such a response was reported for blue, fin, and humpback whales, the densities of which all declined with El Niño-associated declines in euphausiids (Benson et al. 2002). More recently, Santora et al. (2020) outlined how the 2014-2016 marine heat wave in the northeast Pacific Ocean changed humpback whale prey distribution and abundance resulting in a habitat compression for the species with a coastward shift in distribution. By shifting closer to the coast, humpback whales were more likely to encounter coastal fisheries, which have resulted in an increase in humpback whale entanglements in recent years. In another example, there is some evidence from Pacific equatorial waters that sperm whale feeding success and, in turn, calf production rates are negatively affected by increases in sea surface temperature (Smith and Whitehead 1993; Whitehead 1997). Any changes in these factors could render currently used habitat areas unsuitable. Changes to climate and oceanographic processes may also lead to decreased prey productivity and different patterns of prey distribution and availability. Different species of marine mammals will likely react to these changes differently. For example, range size, location, and whether or not specific range areas are used for different life history activities (e.g. feeding, breeding) are likely to affect how each species responds to climate change (Learmouth et al. 2006).

2.2.2 Status of the Species

In this section, we describe the species, including the specific DPSs that are the subject of this consultation, as well as the species' population structure, abundance, and distribution, which inform their associated extinction risk.

Physical Description

Humpback whales (*Megaptera novaeangliae*; Borowski, 1781) are large baleen whales with long pectoral flippers, distinct ventral fluke patterning, dark dorsal coloration, a highly varied acoustic call (termed 'song') and a diverse repertoire of surface behaviors. Their body coloration is primarily dark grey, but individuals have a variable amount of white on their pectoral fins, flukes, and belly. This variation is so distinctive that the pigmentation pattern on the undersides of their flukes is used to identify individual whales. Coloring of the ventral surface varies from white to marbled to fully black. Dorsal surfaces of humpback whale pectoral flippers are typically white in the North Atlantic and black in the North Pacific (Perrin et al. 2002), and are one-third of the total body length. Similar to all baleen whales, body lengths differ between the sexes, with adult females being approximately 1-1.5m longer than males. Humpback whales reach a maximum of 16-17 m, although lengths of 14-15 m are more typical. Adult body weights in excess of 40 tons make them one of the largest mammals on earth (Ohsumi 1966).

Conservation Status and Population Structure

In June 1970, humpback whales were listed globally as endangered under the Endangered Species Conservation Act (35 FR 18319) and remained on the list of threatened and endangered species after the passage of the ESA in 1973 (35 FR 8491). In November 1991, NMFS released a recovery plan for humpback whales (NMFS 1991). On September 8, 2016, NMFS published a final rule dividing the globally listed endangered humpback whale into 14 DPSs and categorizing four DPSs as endangered and one as threatened (81 FR 62259). NMFS identified three humpback whale DPSs that may be found off the coasts of Washington, Oregon, California, and southern British Columbia (SBC) and within the range of the PCGF - the Hawaii DPS (not ESA-listed), the Mexico DPS (ESA-listed as threatened), and the Central America DPS (ESA-listed as endangered). DPS abundance and geographic distribution are described below.

The 2015 status review relied in large part on the results from field efforts conducted on all known winter breeding regions (2004-2006) and all known summer feeding areas (2004, 2005) for humpback whales in the North Pacific (Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH)). This study, representing one of the largest international collaborative studies of any whale population ever conducted, was designed to determine the abundance, trends, movements, and population structure of North Pacific humpback whales as well as to examine human impacts on the population (Calambokidis et al. 2008). As described in more detail below, results from the SPLASH study continue to be relied upon for abundance estimates as well as movement proportions between wintering (breeding) and summer (foraging) grounds (Bettridge et al. 2015; Wade et al. 2016; Wade 2017), even though the field efforts took place nearly fifteen years ago.

Under the Marine Mammal Protection Act (MMPA), marine mammals are conserved and managed as population stocks, hereafter referred to as stocks, which are groups of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature. NMFS manages humpback whales that occur in waters under the jurisdiction of the U.S. as five separate stocks under the MMPA. Along the West Coast of the U.S., all humpback whales are considered part of the California-Oregon-Washington (CA/OR/WA) stock. The CA/OR/WA stock spends the winter (breeding season) primarily in coastal waters of Mexico and Central America, and the summer (foraging season) along the West Coast from California to British Columbia. The most recent draft Stock Assessment Report (SAR) for the CA/OR/WA stock (Carretta et al. 2020) has not modified the MMPA definition of humpback whale stocks in response to the new ESA listings. For this opinion, we will analyze impacts at the ESA-listed DPS level but we will rely heavily upon information from the near annual SARs for the CA/OR/WA stock of the humpback whale, as well as the most recent scientific information available regarding the abundance of humpback whales along the U.S. West Coast.

CA/OR/WA Stock status

The growth rate of the CA/OR/WA stock of the North Pacific humpback whales, which consists of Hawaii, Mexico, and Central America DPS whales, has been estimated as increasing about 6-7 percent annually (Carretta et al. 2020). The most recent stock assessment report, published in August 2020, used a best fit model based on mark-recapture estimates from 2011 through 2014 to produce an abundance estimate (including a minimum abundance estimate) for humpback whales in the CA/OR/WA stock. Calambokidis and Barlow (2020) presented updated estimates of humpback whale abundances along the U.S. West Coast using photo-identification data collected through 2018. The report contained multiple abundance estimates based both on regions, capture-recapture models, years and datasets. That analysis suggests that there currently are 4,973 humpback whales found off the U.S. West Coast, based on the Chao Mth model, which used rolling 4-year periods and accounting for heterogeneity of capture probability (Table 3 *in* Calambokidis and Barlow 2020). With a standard error of 239, the lower (minimum estimate) 20th percentile value is 4,776 whales foraging off the U.S. West Coast. Therefore, the minimum abundance estimate of 4,776 whales in the CA/OR/WA stock is conservative and is based on the most recent available data (2014-2018), which represents the most accurate estimate to be used for this Opinion, as it will likely be included in a future SAR. Researchers are refining the latitudinal distribution of humpbacks along the U.S. West Coast, which, in the future, will likely elucidate the proportion of humpbacks foraging off the coast of Washington.

Distribution and Migratory Patterns

Humpback whales are found in all oceans of the world and migrate from high latitude feeding grounds to low latitude calving areas. Humpback whales primarily occur near the edge of the continental slope and deep submarine canyons, where upwelling concentrates zooplankton near the surface for feeding. In general, humpback whales feed on euphausiids (krill) and various schooling fishes, including sardines, anchovies, herring, capelin, sand lance, and mackerel (Clapham 2009).

Humpback whales in the North Pacific migrate seasonally from northern latitude feeding areas in summer to low-latitude breeding areas in winter. Feeding areas are dispersed across the Pacific Rim from California, USA to Hokkaido, Japan. Within these regions, humpback whales have been observed to spend the majority of their time feeding in coastal waters. Breeding areas in the North Pacific are more geographically separated than the feeding areas and include regions offshore of mainland Central America; mainland, Baja Peninsula and the Revillagigedos Islands, Mexico; Hawaii; and Asia including Ogasawara and Okinawa Islands and the Philippines. About half of the humpback whales in the North Pacific Ocean breed and calve in the U.S. waters off Hawaii; more than half of North Pacific Ocean humpback whales feed in U.S. waters (Bettridge et al. 2015).

Humpback whales in the North Pacific generally exhibit strong site fidelity and movement between feeding and breeding regions,but movements between feeding and breeding areas are complex and varied (Calambokidis et al. 2008; Barlow et al. 2011). An overall pattern of migration has recently emerged. Asia and Mexico/Central America are the dominant breeding areas for humpback whales that migrate to feeding areas in lower latitudes and more coastal areas on each side of the Pacific Ocean, such as California and Russia. The Revillagigedo Archipelago and Hawaiian Islands are the primary winter migratory destinations for humpback whales that feed in the more central and higher latitude areas (Calambokidis et al. 2008). However, there are exceptions to this pattern and it seems that complex population structure and strong site fidelity coexist with lesser known, but potentially high, levels of plasticity in the movements of humpback whales (Salden et al. 1999; Bettridge et al. 2015).

Feeding

Humpback whales have a diverse diet that slightly varies across feeding aggregation areas. The species is known to feed on both small schooling fish and on euphausiids (krill). Known prey organisms include species representing Clupea (herring), Scomber (mackerel), Ammodytes (sand lance), Sardinops (sardine), Engraulis (anchovy), Mallotus (capelin), and krills such as Euphausia, Thysanoessa, and Meganyctiphanes (Baker 1985; Geraci et al. 1989; Clapham et al. 1997). Humpback whales also exhibit flexible feeding strategies, sometimes foraging alone and sometimes cooperatively (Clapham 1993). During the winter, humpback whales subsist on stored fat and likely feed little or not at all (Bettridge et al. 2015).

In the Northern Hemisphere, feeding behavior is varied and frequently features novel capture methods involving the creation of bubble structures to trap and corral fish; bubble nets, clouds, and curtains can be observed when humpback whales are feeding on schooling fish (Hain et al. 1982). Lobtailing and repeated underwater 'looping' movements (referred to as kick feeding) have also been observed during surface feeding events and it may be that certain feeding behaviors are spread through the population by cultural transmission (Weinrich et al. 1992; Friedlaender et al. 2006). On Stellwagen Bank, in the Gulf of Maine, repeated side rolls have been recorded when whales were near the bottom, which likely serves to startle prey out of the substrate for better foraging access (Friedlaender et al. 2009). In many locations, feeding in the water column can vary with time of day, with whales bottom feeding at night and surface feeding near dawn (Friedlaender et al. 2009; Bettridge et al. 2015).

Humpback whales are 'gulp' or 'lunge' feeders, capturing large mouthfuls of prey during feeding rather than continuously filtering food, as may be observed in some other large baleen whales (Ingebrigtsen 1929). In the Southern Hemisphere, only one style of foraging ('lunge' feeding) has been reported. When lunge feeding, whales advance on prey with their mouths wide open, then close their mouths around the prey and trap them by forcing engulfed water out past the baleen plates. Southern Hemisphere humpback whales forage in the Antarctic circumpolar current, feeding almost exclusively on Antarctic krill (*Euphausia superba*) (Matthews 1937; Mackintosh 1965; Kawamura 1994). Stomach content analysis from hunted whales taken in subtropical waters and on migratory routes indicated that stomachs were nearly always empty (Chittleborough 1965). Infrequent sightings of feeding activity and stomach content data suggest that some individuals may feed opportunistically during the southward migration toward Antarctic waters (Matthews 1932; Dawbin 1956; Kawamura 1980; Bettridge et al. 2015).

Reproduction

The mating system of humpback whales is generally thought to be male-dominance polygyny, also described as a 'floating lek' (Clapham 1996). In this system, multiple males compete for individual females and exhibit competitive behavior. The humpback whale song is a long, complex vocalization (Payne and McVay 1971) produced by males on the winter breeding grounds, and also less commonly during migration (Clapham and Mattila 1990; Cato 1991) and on feeding grounds (Clark and Clapham 2004). The exact function has not been determined, but behavioral studies suggest that song is used to advertise for females, and/or to establish dominance among males (Tyack 1981; Darling and Bérubé 2001; Darling et al. 2006). It is widely believed that, while occasional mating may occur on feeding grounds or on migration, the great majority of mating and conceptions take place in winter breeding areas (Clapham 1996; Clark and Clapham 2004). Breeding in the Northern and Southern Hemisphere populations is out of phase by approximately six months, corresponding to their respective winter periods (Bettridge et al. 2015).

Sexual maturity of humpback whales in the Northern Hemisphere occurs at approximately 5-11 years of age, and appears to vary both within and among populations (Clapham 1992; Gabriele et al. 2007; Robbins 2007). Average age of sexual maturity in the Southern Hemisphere is estimated to be 9-11 years. In the Northern Hemisphere, calving intervals are between one and five years, though 2-3 years appears to be most common (Wiley and Clapham 1993; Steiger and Calambokidis 2000). Estimated mean calving rates are between 0.38 and 0.50 calves per mature female per year (Clapham and Mayo 1990; Straley et al. 1994; Steiger and Calambokidis 2000) and reproduction is annually variable (Robbins 2007). In the Southern Hemisphere, most information on humpback whale population characteristics and life history was obtained during the whaling period. Post-partum ovulation is reasonably common (Chittleborough 1965) and interbirth intervals of a single year have occasionally been recorded. This may be a consequence of early calf mortality; the associated survival rates for annually born calves are unknown in the Southern Hemisphere (Bettridge et al. 2015).

Humpback whale gestation is 11-12 months and calves are born in tropical waters (Matthews 1937). Lactation lasts from 10.5-11 months (Chittleborough 1965), and weaning begins to occur at about age six months and calves attain maternal independence around the end of their first year (Clapham and Mayo 1990). Humpback whales exhibit maternally directed fidelity to specific feeding regions (Martin et al. 1984; Baker et al. 1990; Bettridge et al. 2015).

The average generation time for humpback whales (the average age of all reproductively active females at carrying capacity) is estimated at 21.5 years (Taylor et al. 2007). Empirically estimated annual rates of population increase range from a low of 0 to 4 percent to a maximum of 12.5 percent for different times and areas throughout the range (Baker et al. 1992; Barlow and Clapham 1997; Steiger and Calambokidis 2000; Clapham et al. 2003a); however, Zerbini et al. (2010) recently concluded that any rate above 11.8 percent per year is biologically implausible for this species (Bettridge et al. 2015).

Natural Mortality

Annual adult mortality rates have been estimated to be 0.040 (SE = 0.008) (Barlow and Clapham 1997) in the Gulf of Maine, and 0.037 (95 percent CI 0.022-0.056) (Mizroch et al. 2004) in the North Pacific Hawaiian Islands populations. In the Southern Hemisphere, estimates of annual adult survival rates have been made using photo-identification studies in Hervey Bay, east Australia (1987-2006) and range between 0.87 and 1.00 (Chaloupka et al. 1999; Bettridge et al. 2015).

Robbins (2007) estimated calf (0-1 year old) survival for humpback whales in the Gulf of Maine at 0.664 (95 percent CI: 0.517-0.784) which is low compared to other areas and annually variable. Barlow and Clapham (1997) estimated a theoretical calf mortality rate of 0.125 on the Gulf of Maine feeding ground. Using associations of calves with identified mothers on North Pacific breeding and feeding grounds, Gabriele (2001) estimated mortality of juveniles at 6 months of age to be 0.182 (95 percent CI: 0.023-0.518). Survival of calves (6-12 months) and juveniles (1-5 years) has not been described in detail for the Southern Hemisphere.

2.2.2.1 Mexico DPS

The Mexico DPS consists of whales that breed along the Pacific coast of mainland Mexico, the Baja California Peninsula and the Revillagigedos Islands. The Mexico DPS feeds across a broad geographic range from California to the Aleutian Islands, with concentrations in California-Oregon, northern Washington – southern British Columbia, northern and western Gulf of Alaska and Bering Sea feeding grounds. This DPS was determined to be discrete based on significant genetic differentiation as well as evidence for low rates of movements among breeding areas in the North Pacific based on sighting data. The Mexico DPS was determined to be significant due to the gap in breeding grounds that would occur if this DPS were to go extinct and the marked degree of genetic divergence to other populations. This DPS also differs from some other North Pacific populations in the ecological characteristics of its feeding areas (Bettridge et al. 2015).

Population Status and Trends

The Mexico DPS of humpback whales forages along the West Coast of North America as far north as the Aleutian Island and Bering Sea, AK. Recently, Wade (2017) estimated the abundance of the Mexico DPS to be 2,806 whales based on a revised analysis of the SPLASH data. Because these estimates are >8 years old, and humpback whales in the Pacific have recently experienced positive growth rates, they are not considered a reliable estimate of current abundance (NOAA 2016; Carretta et al. 2020). Although no specific estimate of the current growth rate of this DPS is available, it is likely that the positive growth rates of humpback whales along the U.S. West Coast and in the North Pacific at large that have been documented are at least somewhat reflecting growth of this DPS, given its relative population size. In Section 2.2.1.3 below, we consider how to reconcile the DPS specific information from Wade (2017) with the most recent stock specific information on humpback whale abundance from Calambokidis and Barlow (2020). Because the Mexico DPS forages widely in the North Pacific, including areas off British Colombia and Alaska, it is difficult to estimate the abundance of this DPS based on the recent minimum abundance estimate of the CA/OR/WA stock of humpbacks. Therefore, if we assume that the population estimated by Wade (2017) based on information from 2004-2006 (2,806 animals) has increased by 6 percent annually in the last 15 years, the current abundance estimate of the Mexico DPS would be 6,724 animals.

2.2.2.2 Central America DPS

The Central America DPS is composed of whales that breed along the Pacific coast of Costa Rica, Panama, Guatemala, El Salvador, Honduras and Nicaragua. Whales from this breeding ground feed almost exclusively offshore of California and Oregon in the eastern Pacific, with only a few individuals identified at the northern Washington–southern British Columbia feeding grounds. This DPS was determined to be discrete based on re-sight data as well as findings of significant genetic differentiation between it and other populations in the North Pacific. The genetic composition of the DPS is also unique in that it shares mitochondrial DNA (mtDNA) haplotypes with some Southern Hemisphere DPSs, suggesting it may serve as a conduit for gene flow between the North Pacific and Southern Hemisphere. The breeding ground of this DPS occupies a unique ecological setting, and its primary feeding ground is in a different marine ecosystem from most other populations. Loss of this population would also result in a significant gap in the range of the species (Bettridge et al. 2015).

Population Status and Trends

The Central America DPS of humpback whales occurs along the U.S. West Coast, although individuals are more likely to be found off the coast of California and Oregon. Most recently, Wade (2017) estimated the abundance of the Central America DPS to be 783 whales based on a revised analysis of the SPLASH data. Because these estimates are >8 years old, and humpback whales in the Pacific have recently experienced positive growth, they are not considered a reliable estimate of current abundance (NOAA 2016; Carretta et al. 2020). The population trend for the Central America DPS is unknown (Bettridge et al. 2015), although it is likely that the positive growth rates of humpback whales along the U.S. West Coast and in the North Pacific at large that have been documented are at least somewhat reflecting growth of this DPS, given its relative population size. It is also possible that some other factors are limiting or inhibiting population growth of this DPS given its relative small population size. Because there are three DPSs foraging off the West Coast, it is difficult to determine the abundance of the Central American DPS from the recent minimum abundance estimate of the CA/OR/WA stock of humpbacks. Therefore, if we assume that the population estimated by Wade (2017) based on information from 2004-2006 (783 animals) has increased by 6 percent annually in the last 15 years, the current abundance estimate of the Mexico DPS would be 1,876 animals.

2.2.2.3 Current Assessment of Abundance and Distribution of ESA-listed Humpback Whale DPSs

In this section, we consider how to reconcile the DPS specific information from Wade (2017) with the most recent stock specific information on humpback whale abundance from Calambokidis and Barlow (2020). Wade et al. (2016) summarized the distribution and relative abundance of humpback whale breeding populations, including the two ESA-listed DPSs that forage off the U.S. west coast, including CA/OR/WA. Subsequent review of the models used to generate those estimates from the SPLASH data produced new estimates of the abundance and distribution of humpback whale DPSs in both summer feeding areas and winter mating and calving areas (Wade 2017). The models described in Wade et al. (2016) reflect the strong fidelity individual whales show to specific winter and summer areas. Wade et al. (2016) and Wade (2017) describe estimated movement probabilities (also referred to as migration rates) of the Mexico DPS and the Central America DPS between wintering grounds and summer feeding areas and categorize the summer feeding areas into regional strata. The action area for this Opinion falls within the Oregon and California (OR/CA) and Southern British Columbia and Washington (SBC/WA) regional strata.

According to Wade (2017), the Mexico breeding population (Mexico DPS) primarily migrates to foraging areas off the Gulf of Alaska and the Aleutian Islands/Bering Sea (approximately 66 percent), with approximately 32 percent foraging off OR/CA and WA/SBC (Table 3a in Wade 2017). Within the OR/CA strata, the probability of a Mexico DPS humpback whale feeding in the summer months moving back to its winter breeding area off Mexico is 32.7 percent. For the SBC/WA strata, the probability would be 27.9 percent (Table 5).

According to Wade (2017), the majority (approximately 93 percent) of the Central America DPS uses the CA/OR strata with approximately 7 percent of the DPS using the SBC/WA (Wade 2017, Table 3a). Withinthe OR/CA strata, the probability of a whale feeding in the summer months moving back to its winter breeding area off Central America (Central America DPS) is 67.2

percent. For the SBC/WA strata, the probability would be 8.7 percent (Table 5.). Thus, the majority of the Central America DPS forages off OR/CA, with a small proportion (probably) foraging off SBC/WA.

Table 5. Movement probabilities for the multi-strata model – Probability of moving from each summer area (on left) to each winter area (as columns) (from Wade 2017, Table 3b).

		Area Moving To			
		Asia	Hawaii	Mexico	Central America
Area Moving From	Kamchatka	1.000	0.000	0.000	0.000
	AI/Bering[a/]	0.021	0.868	0.110	0.000
	GOA[b/]	0.004	0.872	0.120	0.000
	SE/NBC[c/]	0.000	0.961	0.038	0.000
	SBC/WA[d/]	0.000	0.635	0.279	0.087
	OR/CA[e/]	0.000	0.000	0.327	0.672

a/ Aleutian Islands and Bering Sea
b/ Gulf of Alaska
c/ Southeast Alaska and Northern British Columbia
d/ Southern British Columbia and Northern Washington
e/ California and Oregon

Based on the most recent information in the 2019 SAR (Carretta et al. 2020) and in Calambokidis and Barlow (2020), it is clear that there have been changes in the abundance and/or distribution of humpback whale DPSs over the last 10-15 years since the data gathered that was used by Wade (2017). While we do not have an analysis that provides a specific estimate of the current DPS abundances and distributions are, we used the available information to consider several scenarios and generated the most plausible estimate of the current abundance and distribution of the two listed DPSs.. From these estimates, we can weigh potential impact of activities on ESA-listed humpback whales off the West Coast in the face of some uncertainty until definitive information on the current status of ESA-listed DPSs become available.

Because we do not have current movement probabilities for humpbacks originating from Central America and Mexico (the two listed DPSs that forage off the West Coast), we will first consider the revised Wade (2017) proportions. We know that previously published abundance estimates for the Mexico DPS and the Central America DPS based on the SPLASH surveys are outdated. More recent abundance estimates published in the 2019 SAR (Carretta et al. 2020) do not include data collected during subsequent years (through 2018) off the West Coast. Therefore these SAR estimates should be considered *minimum* estimates. We know that humpback whales have increased between 6-7 percent annually over the last 30+ years (Carretta et al 2020; Calambokidis and Barlow 2020), and since the SPLASH studies, although we do not know whether these increases are applicable to all three DPSs that forage off our coast. However even if we conservatively estimate that the endangered Central America DPS has increased 6 percent annually over 15 years, the current abundance estimate would be 1,876 animals found off the

West Coast. Similarly, if we assumed that the threatened Mexico DPS has increased at 6 percent annually, the current estimate for the entire DPS would be around 6,724 animals.

The most recent minimum abundance estimate contained in Calambokidis and Barlow (2020) for CA/OR humpbacks is 4,776 animals. Based on the Wade (2017) calculations of proportions off of CA/OR, 67 percent of these animals (or ~3,200) are from the Central America DPS (which would indicated around a quadrupling of the estimate from 2004-2006) and 33 percent (or 1,576 animals) are from the Mexico DPS (a *decline* of 44 percent from 2004-2006). Because it is not likely that the Central America DPS has grown in abundance by a factor of four, nor that the portion of the Mexico DPS population that migrates to CA, OR, and WA waters has declined to half its previous size, we should assume that the probability rates in summer feeding areas off of CA/OR estimated by Wade (2017) are outdated.

Therefore, to consider what probabilities/proportions of these DPSs would be off of our coast, we considered the combination of the most recent abundance estimates with reasonable assumptions of population growth rates since 2004-2006 to derive proportional estimates for the current populations of humpback whales off the coasts of CA, OR, and WA. Since we know that all of the Central America DPS forages off the U.S. West Coast, we assume that, with a 6 percent annual growth rate, approximately 1,876 (or 39 percent of the 4,776 minimum abundance estimate above) feeding off the West Coast originate from Central America (endangered DPS). Based on available information, almost all of that DPS (93 percent per Wade (2017)) forages off CA/OR (~1,688 animals), so we can assume around 188 Central America DPS humpbacks forage off WA/SBC. Given this logic, and the fact that Mexico DPS humpbacks forage off CA/OR (and no other DPSs forage there), approximately 61 percent of humpbacks foraging off CA/OR (or 2,913 animals of the 4,776 minimum abundance estimate) would originate from Mexico (threatened DPS).

For WA/SBC, we do not have an estimate of the abundance of humpbacks that may be foraging north of CA/OR and only within U.S. waters, only that they represent a small proportion of the minimum abundance estimate for the CA/OR/WA stock, as designated under the MMPA, with most of the humpbacks feeding north of the U.S. border. However, if we use the Wade (2017) movement probabilities of humpbacks feeding off SBC/WA to breeding areas off Central America and Mexico, we can assume that around 28 percent of whales feeding off WA/SBC originate from the Mexico DPS, and approximately 9 percent originate from the Central America DPS (Table 5). The majority of the humpback whales (63 percent) feeding in this area would originate from the non-listed Hawaii DPS.

Although we considered several other scenarios of abundance estimates and movement probabilities for the two listed DPSs foraging off the West Coast, the scenario described above represents the most plausible and represents the best and most current available data.

Therefore, we will refer in part to the status of the populations that are found in the action area using the most recent SAR (2019; Carretta et al. 2020) and the most recent technical report (Caalambokidis and Barlow 2020). As a result, both the endangered Central America DPS and the threatened Mexico DPS both at times travel and feed off the U.S. West Coast and may be exposed to the sablefish pot fishery.

This opinion evaluates impacts on both the Central America and Mexico DPSs of humpback whales as both are expected to occur in the action area in the relative proportions described above. To the extent that impacts are evaluated at an individual animal level, these proportions would be used as the likelihood that the affected animal is from either DPS.

2.2.3 Status of the Species' Proposed Critical Habitat

Critical habitat for the endangered Central America DPS and the threatened Mexico DPS of humpback whales was proposed for specific marine areas located off the coasts of California, Oregon, Washington, and Alaska on October 9, 2019 (84 FR 54354). Following a response to public comment, we anticipate that the critical habitat designation will be finalized in early 2021. There is only one PBF determined to be essential to the conservation of ESA-listed humpback whales: prey.

Humpback whales from both DPSs travel to U.S. coastal waters to access energy-rich feeding areas, and a high degree of fidelity to specific locations indicates the importance of these feeding areas. Although humpback whales are generalist predators and prey availability can very seasonally and spatially, substantial data indicate that the humpback whales' diet within the California Current marine ecosystem, which extends from British Columbia to southern Baja California Mexico, includes: Pacific sardine (*Sardinops sagax*); northern anchovy (*Engraulis mordax*); Pacific herring (*Clupea pallasii*); euphausiids (specifically *Euphausia*, *Thysanoessa*, *Nyctiphanes*, and *Nematoscelis*) and occasionally juvenile rockfish (*Sebastes*) (Appendix A of NMFS 2019). Humpback whales are also known to switch between target prey depending on what is most abundant or of the highest quality in the system – thus, their diet composition may vary spatially and temporarily. Because humpback whales only rarely feed on breeding grounds and during migrations, humpback whales must have access to adequate prey resources within their feeding areas to build up their fat stores and meet the nutritional and energy demands associated with individual survival, growth, reproduction, lactation, seasonal migrations, and other life functions. Essentially, while on feeding grounds, the whales must finance the energetic costs associated with migration to breeding areas, reproductive activities, as well as the energetic costs associated with their return migration to high-latitude feeding areas (NMFS 2019).

Physical and Biological Features Essential to the Conservation of the Species

The Critical Habitat Review Team (CHRT) identified a prey biological feature that is essential to the conservation of the two humpback whale DPSs, defined as follows: "prey species, primarily euphausiids and small pelagic schooling fishes of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth."

Special Management Considerations or Protections (Condition of PBFs)

A specific area within the geographic area occupied by a species may only be designated as critical habitat if the areas contain one or more essential physical or biological feature that "may require special management considerations or protection." Four broad categories of actions, or threats, were identified by the CHRT as having the potential to negatively affect the essential prey feature and the ability of feeding areas to support the conservation of listed humpback whales in the North Pacific: climate change, direct harvest of the prey by fisheries, marine pollution, and underwater noise.

Within the areas under consideration for designation, a few fisheries directly target prey species that form a major part of the humpback whale diet (e.g., Pacific herring, Pacific sardine, northern anchovy), and other fisheries can incidentally capture important prey species. This creates the potential for direct competition between humpback whales and certain fisheries (Trites et al. 1997). Humpback whales target large, dense schools of prey, and the best available data support the conclusion that, though not yet quantifiable, there is a density threshold below which humpback whales will not feed or cannot feed effectively due to trade-offs with the energetic demands of feeding. Consequences of prey depletion as a result of fishing activities are also likely to be exacerbated in years when alternative humpback whale prey species are naturally low in abundance due to climate or environmental factors. Sufficient depletion of prey on the feeding grounds can lead to nutritional stress, which in turn can lead to decreases in body condition, size, reproductive output, and survival.

Pacific sardine and northern anchovy are targeted off the U.S. West Coast in commercial fisheries managed by the Pacific Fisheries Management Council under the Coastal Pelagic Species (CPS) FMP. Under the CPS FMP, the Pacific sardine fishery has been closed since the 2015 fishing season (allowable catch set to zero) due to predicted low biomass estimates; however, there are allowances for incidental catch of CPS species in CPS and non-CPS fisheries, and directed harvest is allowed for live bait, recreational, and tribal fisheries (Hill et al. 2017). Fluctuations in biomass are common for Pacific sardine (Chavez et al. 2003), and the fishery will likely re-open with sufficient population increases. The anchovy fishery remains active; however, this species is landed in relatively low numbers and is managed by monitoring trends in landings and making qualitative comparisons to available abundance data (no formal stock assessment) (PFMC 2018).

Climate change may alter the spatial and temporal distributions of humpback whale prey species. Multiple studies have detected changes in humpback whale prey abundance, quality, and distribution in association with climate shifts, particularly with ocean warming. The nature and extent of impacts have varied across study areas and species; however, in many cases, ocean warming has led to negative impacts on humpback whale prey species. For instance, in the California Current extension, during the anomalous warming of the upper ocean and weak upwelling in 2013 - 2016, often referred to as the “blob” or the “warm blob,” sharp decreases in euphausiid biomass, as evidenced by declines in both abundance and body length, were observed (Harvey et al. 2017, Peterson et al. 2017). During the “warm blob” event, sardines spawned earlier and appeared farther north within the Northern California Current than in previous years (Auth et al. 2018).

In comparisons of samples collected in the Northern California Current region during years of cool (2011, 2012), warm (2000, 2002), and intermediate (2015, 2016) conditions, body condition of northern anchovy, Pacific herring, and Pacific sardine were better in cool years compared to warm years, and significantly so for anchovy and herring (Brodeur et al. 2018). However, within the eastern Pacific, sardines have been shown to have improved reproductive success in warm years, and Agostini et al. (2007) concluded that one of the key drivers of this pattern was decreased predation on larval sardines in warm years. Therefore, shifts in prey abundance and distributions may lead to corresponding shifts in marine mammal distributions (King et al. 2011). Such a responses was reported for blue, fin, and humpback whales in Monterey Bay, California, the densities of which all declined with El Niño -associated declines in euphausiids (Benson et al. 2002).

Although pollution was not identified as a significant threat to any of the North Pacific DPSs of humpback whales in the recent status review (Bettridge *et al.* 2015), humpback whales can accumulate contaminants in their blubber through ingestion of contaminated prey. Consumption of contaminated or low quality prey may negatively affect the health, population growth, and ultimately the recovery of listed humpback whales. Although they do not consume prey species from higher trophic levels, humpback whales are still susceptible to bioaccumulation of lipophilic contaminants because they have long lifespans and large fat deposits in their tissues. Some contaminants may also be passed to young whales during gestation and lactation (as in fin whales, Aguilar and Borrell 1994). In comparisons of samples collected from Northern Hemisphere feeding grounds, Elfes *et al*. (2010) reported that concentrations of contaminants within humpback whale blubber were high in southern California and in the Northern Gulf of Maine.

Organic pollutants, including petroleum products, organochlorine pesticides (OCPs), and polychlorinated biphenyls (PCBs), have the potential to directly impact the prey essential feature as defined above. Exposure to petroleum could kill the prey organisms, reduce their fitness through sub-lethal effects, and potentially disrupt the structure and function of marine communities and ecosystems. The biological effects of oil pollution include both acute effects (e.g., direct mortality of both adult and juvenile and larval life stages due to acute exposure) as well as sub-lethal effects to both adult and juvenile life stages due to acute and chronic exposure and indirect impacts to other organisms composing the pelagic ecosystem such as phytoplankton community structure, thereby impacting the forage base of fish species that serve as prey for humpback whales.

Other pollution-related concerns that may affect prey availability and quality include oil spills and algal blooms. Pollution from untreated industrial and domestic wastewater may be contributing to the occurrences of algal blooms. During algal blooms, toxins can become increasingly concentrated as they move up the food chain. Although much of the humpback whales' prey are lower trophic level species, four unusual mortality events have been documented in the Atlantic Ocean. During one event where 16 humpback whale carcasses were found, a portion of the humpback whales had saxitoxin poisoning and/or contained domoic acid; other whales were not sampled (Gulland 2006). In another event, 14 whales died after eating Atlantic mackerel that contained saxitoxin (Geraci *et al.* 1989).

Lastly, effects of noise on fish and zooplankton species, which is a topic of increasing research attention, may range from health and fitness consequences to mortality and reductions in abundance (Popper and Hastings 2009, Kight and Swaddle 2011, Radford *et al*. 2014). For example, there is evidence that marine seismic surveys can result in behavioral effects as well as significant injury and mortality of fishes and zooplankton (McCauley *et al.* 2017, Carroll *et al*. 2017); but, such impacts may be relatively short in duration and spatially limited (to within the survey footprint and extending out ~15 km) and may be minimized by ocean circulation (Richardson *et al*. 2017). Available research also suggests that other noise in the marine environment, such as impact pile driving, underwater explosives, and cargo ships, may have negative consequences on certain fish and invertebrate species by causing trauma or tissue damage, mortality (of various life stages), stress, avoidance, disruptions of schooling, or reduced foraging success (reviewed in Popper and Hastings 2009 and Weilgart 2017). Whether and how specific humpback whale prey are currently being impacted by various noise sources and levels is not yet clear, but the available information is sufficient to indicate that underwater noise is posing a management concern for many fish and invertebrate species (Hawkins and Popper 2017). Finally, as mentioned earlier in this report, noise may negatively affect the prey such that the whales' ability to access and capture prey or carry out normal feeding behaviors is impacted, thus posing additional management concerns.

2.2.3.1 Mexico DPS

Specific occupied areas proposed for designation as critical habitat for the Mexico DPS of humpback whales contain approximately 175,812 nmi^2 of marine habitat within the North Pacific Ocean, specifically within portions of Bristol Bay, the Bering Sea, the Gulf of Alaska, and California Current Ecosystem off the coasts of Washington, Oregon, and California. In general, off Washington and Oregon, the nearshore boundaries are defined by the 50-m isobaths and the offshore boundaries are defined by the 1,200-m isobaths to 2,000-m isobaths (southern Oregon). Critical habitat also includes waters within the U.S. portion of the Strait of Juan de Fuca to Angeles Point. Off California, the nearshore boundary is defined from 15-50-m isobaths and the offshore boundary is defined by between 2,000-m to 3,700-m isobath, depending on the latitude (84 FR 54354). This proposed critical habitat overlaps with the PCGF, particularly the trawl fisheries (e.g., CS bottom trawl, midwater rockfish and hake trawl, and tribal shoreside) that may take the prey identified as essential for the conservation for the Mexico DPS (i.e., Pacific sardines, northern anchovies and herring).

2.2.3.2 Central America DPS

Specific occupied areas proposed for designation as critical habitat for the Central America DPS of humpback whales contain approximately 48,459 nmi^2 of marine habitat within the North Pacific Ocean, specifically within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California. In general, off Washington and Oregon, the nearshore boundaries are defined by the 50-m isobaths and the offshore boundaries are defined by the 1,200-m isobaths to 2,000-m isobaths (southern Oregon). Critical habitat also includes waters within the U.S. portion of the Strait of Juan de Fuca to Angeles Point. Off California, the nearshore boundary is defined from 15-50-m isobaths and the offshore boundary is defined by between 2,000-m to 3,700-m isobath, depending on the latitude (84 FR 54354). This proposed critical habitat overlaps with the PCGF, particularly the trawl fisheries (e.g., CS bottom trawl, midwater rockfish and hake trawl, and tribal shoreside) that may take the prey (i.e., Pacific sardines, northern anchovies, and herring) identified as essential for the conservation for the Central America DPS.

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For the PCGF, the action area includes the EEZ and state waters of the Pacific Ocean from the Canada/U.S. border to the Mexico/U.S. border. Although the state-managed groundfish fisheries in state waters are not part of the proposed action, vessels participating in Federally-managed fisheries transit through state waters and land fish within the states. Thus, some effects of the Federally-managed groundfish fishery occur in state waters. Figure 1 shows the area where fishing has occurred, and where the direct effects to the ESA-listed species are most likely to occur. It is reasonable to expect that future fishing would occur in the same areas.

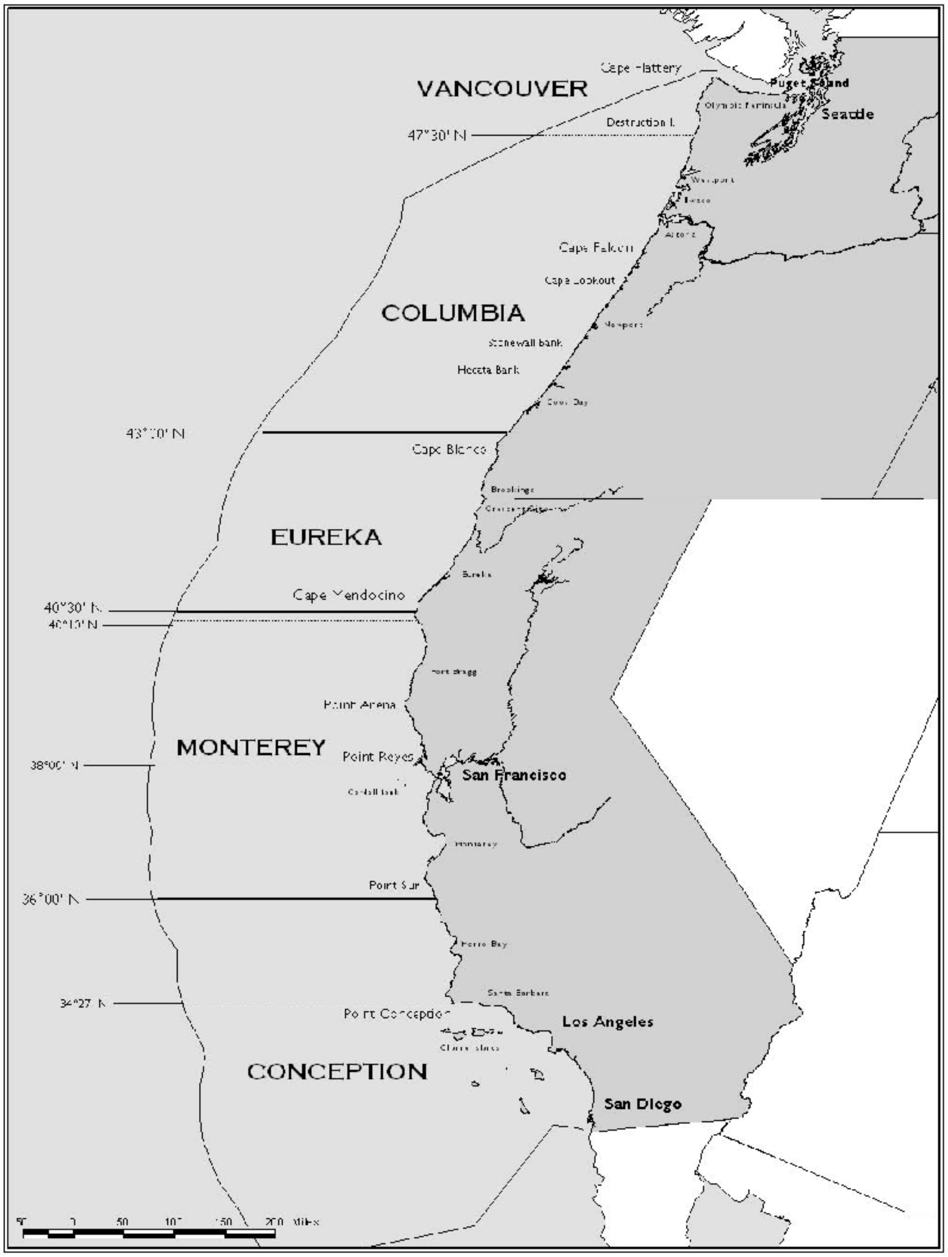

Figure 1. The fishery management area, showing major communities and groundfish management areas within the EEZ (PFMC 2019b).

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

A comprehensive list of general threats to humpback whales and their habitat is detailed in the Recovery Plan (NMFS 1991) and the most recent Status Review (Bettridge et al. 2015). Similar to other large whales, humpback whales and their habitat are potentially affected by climate change, entanglement/entrapment in fishing gear, vessel collisions, coastal development, contaminants (e.g., heavy metals, persistent organic pollutants, effluent, airborne contaminants, plastics and other marine debris and pollution), energy exploration and development, harmful algal blooms, whale-watching, scientific research, habitat degradation, loss of prey (for a variety of reasons including competition for resources with humans and/or climate variability), and anthropogenic underwater noise (Bettridge et al. 2015).

2.4.1. Climate Change and Other Habitat Impacts

Marine species generally may respond in one of three ways to major changes in climate: redistribution, adaptation, or extinction (IPCC 2007). Based on what is known to date, humpback whales are more likely to redistribute as a result of climate change. Because this proposed action is likely to continue into the future (10 years or more), we consider the environmental baseline and the effects of climate change to continue, similar to the effects of climate change summarized in Sections 2.2.1 and 2.2.3. Most large whales, including humpbacks, undertake extensive movements, both during their feeding season (when they are found within the action area) and during migration. These broad ranges (which routinely encompass much of the Pacific Ocean), together with the humpback's ability to withstand prolonged periods of fasting through utilization of fat reserves in their blubber, potentially provide the whales with the means to adapt their range in response to major climate-related spatial shifts in biological productivity, primarily by seeking new habitats with sufficient prey resources. As summarized in Bettridge et al. (2015), although the extent of the threat of climate change to Northern Hemisphere humpback whales was very uncertain, it was unlikely that climate change was a major extinction risk factor. Notably, melting and receding ice sheets may open up more feeding habitat for humpback whales in the Northern Hemisphere, although humpbacks generally do not feed primarily in Arctic waters.

As mentioned in the *Status of the Species' Proposed Critical Habitat* (Section 2.2.3), prey availability may be reduced through ecosystem shifts driven by climate change. In particular, within the action area (the California Current), during the anomalous warming of the upper ocean and weak upwelling during 2013-2016, there were sharp decreases in euphausiid biomass, although there were varying responses observed between euphausiid species off California. For example, some species have experienced severe declines during El Nino years, and in the Gulf of Alaska, the effects of warming have been mixed across euphausiid species, which may be attributed to differences in the timing of spawning. Fish species targeted by humpback whales and included as a primary biological feature in the proposed critical habitat designation may also be negatively impacted by warming ocean conditions. For example, samples collected in the Northern California Current region during years of cool (2011-2012), warm (2000, 2002) and intermediate (2015-2016) conditions, showed that the body condition of northern anchovy, Pacific herring, and Pacific sardine were better in cool years compared to warm years, and significantly so for anchovy and herring (Brodeur et al. 2018).

Climate change may also effect the species' proposed critical habitat by altering the spatial and temporal distributions of humpback prey species. During the "warm blob" event, sardines spawned earlier and showed up further north in the Northern California Current than in previous years (Auth et al. 2018). Shifts in prey distribution and abundance may lead to corresponding shifts in humpback whale distribution. Therefore, with shifting climate change-induced warmer oceans within the action area, humpback whales may shift their distribution to access prey and may therefore increase the risk to the PCGF.

In addition to climate change, and as noted in the *Status of the Species' Proposed Critical Habitat* (Section 2.2.3), fisheries, pollution, and noise are additional anthropogenic factors effecting the species habitat. Fisheries along the West Coast harvest prey species that are an important part of the humpback whale diet (e.g., Pacific herring, Pacific sardine, northern anchovy). Depletion of prey on the feeding grounds can lead to nutritional stress, which in turn can lead to decreases in body condition, size, reproductive output, and survival of humpback whales. Pollution also has the potential to effect the health of individual humpback whales. The consumption of contaminated prey can lead to bioaccumulation of those contaminants in the blubber of humpback whales. Pollution may also directly impact the availability of prey. Exposure to petroleum could kill the prey organisms, reduce their fitness through sub-lethal effects, and potentially disrupt the structure and function of marine communities and ecosystems. Lastly, noise from a variety of anthropogenic sources such as underwater construction and ship traffic has the potential to both directly and indirectly effect humpback whales. Whether and how specific humpback whale prey are currently being impacted by various noise sources and levels is not yet clear, but the available information is sufficient to indicate that underwater noise is posing a management concern for many fish and invertebrate species (Hawkins and Popper 2017). Noise may also negatively affect the prey such that the whales' ability to access and capture prey or carry out normal feeding behaviors is impacted.

2.4.2. Human-caused Mortality and Injury of Humpback Whales

Off the U.S. West Coast, human-caused mortality and injuries are recorded though stranding reports, observer records, and at-sea sightings. The most recent SAR indicated that the CA/OR/WA stock of humpback whales was impacted by anthropogenic activities, including pot/trap and gillnet fisheries, unidentified fishery interactions, vessel strikes and marine moorings. In addition to interactions with humpback whales, there were entanglements involving "unidentified whales," particularly in the last 5 years reported (2013-2017) (Carretta et al. 2020). Like most large whales, humpback whales are threatened by increasing levels of anthropogenic sound in the ocean, such as those produced from shipping traffic, Navy sonar exercises, explosive, etc. Since all of these activities may occur along the U.S. West Coast and may interfere with communication, foraging, as well as disturbance or threat to hearing threshold levels, increasing levels of anthropogenic sound pose a threat to the CA/OR/WA humpback whale stock (Carretta et al. 2020).

The impact of fisheries (commercial and recreational) on the CA/OR/WA humpback whale stock is likely underestimated, since the mortality or serious injury of large whales due to entanglement in gear may go unobserved because whales swim away with a portion of the net, line, buoys, or pots or the entanglement may occur in a remote area of the coast or far offshore and may not be observed or reported. Humpback whales, especially calves and juveniles, are highly vulnerable to ship strikes (Stevick 1999) and other interactions with non-fishing vessels. Off the U.S. West Coast, humpback whale distribution overlaps significantly with the transit routes of large commercial vessels, including cruise ships, large tug and barge transport vessels, and oil tankers in the proposed action area. Whale watching boats and research activities directed toward whales may have direct or indirect impacts on humpback whales as harassment may occur, preferred habitats may be abandoned, and fitness and survivability may be compromised if disturbance levels are too high.

Along the U.S. West Coast, the estimated annual mortality and serious injury of the CA/OR/WA stock of humpback whales from 2013-2017 due to commercial fishery entanglements (17.3/yr), non-fishery (e.g., marine mooring buoy) entanglements (0.2/yr), recreational Dungeness crab pot fisheries (0.35/yr), tribal fisheries (0.2/yr), serious injuries assigned to unidentified whale entanglements (2.1/yr), plus observed ship strikes (2.2/yr), equals 22.35 animals, which exceeds the potential biological removal[6] (PBR) of 16.7 animals (Carretta et al. 2020). Most data on human-caused mortality and serious injury for this population is based on opportunistic stranding and at-sea sighting data and represents a minimum count of total impacts. There is currently no estimate of the fraction of anthropogenic injuries and deaths to humpback whales that are undocumented on the U.S. West Coast. Based on strandings and at sea observations, annual humpback whale mortality and serious injury in commercial fisheries (17.3/yr) is greater than 10 percent of the PBR; therefore, total fishery mortality and serious injury is not approaching zero mortality and serious injury rate (Carretta et al. 2020). In 2018 (34 entanglements) and 2019 (17 entanglements), humpback whales were confirmed entangled at high levels that will receive additional evaluation in upcoming SARs (NMFS 2019a, NMFS 2020a). This information will be further described and assessed in the *Effects of the Action* (Section 2.5) of this opinion.

We acknowledge that these threats to humpback whales within the action area are based on information collected through the present time, as available and analyzed through a rigorous review by NMFS' Science Centers. While we continue to improve our outreach and reporting mechanisms to account for the threats to humpback whales, research fishing gear modifications that may reduce threats of fishing activity, and work with partner agencies such as the states of

[6] As defined by the MMPA, the term "potential biological removal" level means the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

California, Oregon, and Washington to reduce fisheries interactions, we anticipate that these threats will continue into the future. As summarized below, we attempt to characterize the threat of fisheries entanglement and ship strikes to each listed DPS found within the action area. We anticipate that these threats may continue to occur in the future, if mitigation to reduce the threat is not successful, particularly with an increasing humpback whale population off the U.S. west coast.

2.4.2.1 Mexico DPS

Considering the most recent SARs and our assessment of the proportion of listed DPSs that may be found off California, Oregon, Washington, we can generate a relative proportional estimate of human impacts (mortality/serious injury) on the Mexico DPS of humpback whales. Here, we assumed the worst case scenario (i.e., that most of the impacts to humpback whales occur off California and Oregon and therefore may have impacted the Mexico DPS) that of all documented mortalities and serious injuries to humpback whales off the West Coast, 61 percent would have been representative of the Mexico DPS (Table 6).

Table 6. Human-caused estimated interactions (mortality/serious injury) of the CA/OR/WA stock of humpback whales and their potential proportional effects upon the Mexico DPS of humpback whale within the waters off the U.S. West Coast (2013-2017) (Carretta et al. 2020).

Impact type	Events per year – CA/OR/WA	CA/OR/WA Proportion from Mexico DPS	Total annual mortalities / serious injuries
Commercial Fishery entanglement	17.3	0.61	10.55
Non-fishery entanglement	0.2	0.61	0.12
Recreational Crab pot fishery	0.35	0.61	0.21
Tribal Fishery	0.2	0.61	0.12
Unidentified whale entanglements	2.1	0.61	1.28
Observed ship strikes	2.2	0.61	1.34
Total impact to DPS	**22.35**	**0.61**	**13.63**

2.4.2.2 Central America DPS

Considering the most recent SARs and our assessment of the proportion of the listed DPSs that may be found off the West Coast we can generate a relative proportional estimate of human impacts (mortality/serious injury) on the Central America DPS of humpback whales. Here, we assumed the worst case scenario (i.e., that most of the impacts to humpback whales occur off California and Oregon and therefore may have impacted the Central America (and Mexico)

DPS) that of all documented mortalities and serious injuries to humpback whales off the West Coast, 39 percent would have been representative of the Central DPS (Table 7).

Table 7. Human-caused estimated interactions (mortality/serious injury) of the CA/OR/WA stock of humpback whales and their potential proportional effects upon the Central America DPS of humpback whale within the waters off the U.S. West Coast (2013-2017) (Carretta et al. 2020).

Impact type	Events per year	Proportion from Central America DPS	Total mortalities / serious injuries annually
Commercial Fishery entanglement	17.3	0.39	6.75
Non-fishery entanglement	0.2	0.39	0.08
Recreational Crab pot fishery	0.35	0.39	0.14
Tribal Fishery	0.2	0.39	0.08
Unidentified whale entanglements	2.1	0.39	0.82
Observed ship strikes	2.2	0.39	0.86
Total impact to DPS	**22.35**	**0.39**	**8.72**

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The effects of the action on proposed Critical Habitat are detailed in the *"Not Likely to Adversely Affect" Determinations* section 2.12. below.

2.5.1 Humpback Whale Effects Analysis

For the *Effects of the Action* analysis, we have identified the impact of incidental capture or entanglement in groundfish fishing gear as the primary adverse effect of the PCGF on ESA-listed humpback whales. Specifically, we have identified that fixed pot fishing gear associated with targeting sablefish occasionally results in the injury or death (bycatch) of humpback whales due to their entanglement in the fishing gear.

As described in the *Proposed Action* (Section 1.3), the PCGF includes vessels that use a variety of gear types portioned into different sectors to directly or incidentally harvest groundfish. Due to the geographic overlap of the PCGF and humpback whales, humpback whales would encounter PCGF fishing gear with varying results. Entanglements with fixed fishing gear, especially sablefish pots, occur when whales and other marine species encounter lines and other parts of the gear that may be suspended in the water, laying on the seafloor bottom, and/or floating on the surface. Many times these encounters do not lead to entanglements; but sometimes a portion of the line/gear, or a loop in the line, may catch on a body part of an animal. If that happens, then the gear may begin to wrap around the body (including the head/mouth area, pectoral and dorsal fins, and the tail/fluke region) as the animal moves through the water. Reacting to the contact of the gear, or the drag created by the gear, the animal may perform quick and powerful changes in directions or body movements attempting to shake the gear free. The specific dynamics of gear encounters that may be more likely to lead to an entanglement are not well documented, as very few entanglements have been witnessed in the initial stages. However, forensics review of entanglement cases suggests that knots/splices/leads and other potential sources of snags, along with loose or slack lines, are likely contributors to numerous entanglements. Other possible contributors include animal behavior (whether they encounter the gear while foraging or migrating) and ocean conditions (e.g. current, tide, wind) as well as the condition and/or life stage of the animal.

In this effects analysis, the terms bycatch and entanglement are used interchangeably, as the primary mode of bycatch for ESA-listed humpback whales in the PCGF is entanglement in the lines that are associated with setting and retrieving pot gear used to catch sablefish. There are other potential impacts that could occur as a result of the PCGF including bycatch with other gear used in the PCGF such as trawl nets, or from direct or incidental capture of prey species important for humpback whales, that our analysis will also consider.

Other possible impacts from the PCGF include collisions with fishing vessels, or exposure to any pollution or marine debris generated by this action. At this time, the available information does not suggest that any of these additional factors are affecting ESA-listed humpback whales as a result of the continued operation of the PCGF. For example, collisions with ships are observable by fishers and observer programs; and there are no reported collisions of humpback whales with boats of the proposed fishery. Thus, we do not consider fishing boats of the proposed fishery to be a collision risk for humpbacks. Organic pollutants, including petroleum products (or oil spills) that may be utilized by fishing vessels in the PCGF during their operations, may have the potential to directly impact humpback whales or the prey they rely on, killing or reduce the fitness of humpback whales or their prey through sub-lethal effects. Given the continual and dispersed movement of vessels within the action area, we do not anticipate that effects to humpback whales or their prey by the release of petroleum into the marine environment to cause acute or chronic exposure to them, particularly since humpback whales and their the prey are mobile. Without evidence to support analyses of how these factors may affect ESA-listed species as a result of the proposed action, NMFS assumes these factors are insignificant and discountable.

Exposure and Response – Bycatch in the PCGF Fishery

In order to determine the exposure and response of ESA-listed humpback whales to the PCGF, NMFS relies on several sets of data and information that are available: (1) data on bycatch and fishing effort provided by the WCGOP; (2) data on fishing effort provided through records of groundfish landings; and (3) opportunistic reporting of entangled whales reported to the NMFS WCR Marine Mammal Stranding Program.

Under the WCGOP, NMFS has been deploying observers in the PCGF since 2001. The WCGOP implements an objective sampling scheme that forms the basis of scientifically derived estimates of bycatch in the PCGF. Historically, annual estimates of marine mammal bycatch have been generated by NMFS using ratio estimators (e.g., Jannot et al. 2011). However, more recently, Jannot et al. (2018) and Hanson et al. (2019) have used statistical models better designed to deal with 'rare-event' cases like the observed bycatch of ESA-listed humpback whales in the sablefish fishery. These annual estimates will be further described below.

In addition to the WCGOP documented humpback whale interactions in the sablefish fishery and bycatch estimates produced using that data, we also have records of entangled whales that have been reported opportunistically from a variety of ocean users. Some of these records involve gear that is attributed to the PCGF, including cases that were documented by the WCGOP. In addition, there are numerous entanglement records associated with many other sources, including other fixed gear fisheries from the U.S. West Coast, other types of fishing gear, other non-fishery sources, and unknown sources. Below, we consider this record further as a complementary source of information regarding the risk of humpback whale bycatch in the PCGF.

As discussed in the *Status* and *Environmental Baseline* sections, the distributions of humpback whale DPSs and their relative proportion of the total number of humpback whales that may occur in a given area varies across the U.S. West Coast. Consequently, we recognize that the relative exposure of each DPS to potential bycatch in the PCGF varies accordingly. As a result, we examine the distribution of fishing effort based on WCGOP data and fishery landings data to gauge the relative proportion of effort that occurs in the sablefish fixed gear fishery. We then consider the distribution of humpback whales to identify the anticipated exposure of different humpback whale populations to fixed gear in the PCGF. Also considered are trends in available fishing effort data, including patterns of effort in various sectors, and the relative seasonality of fishing effort during times of the year when humpback whales are most likely to be present in the action area.

In order to determine the response of individual whales to entanglement in groundfish gear, NMFS primarily relies upon the assessments of mortality and serious injury for cases of humpback whale entanglements reported to NMFS and described in the most recent humpback whale SAR (Carretta et al. 2020), as appropriate.

Using all of this information, we translate what has occurred in the PCGF into expectations for what may occur in the future. The exposure analysis below presents a description of anticipated bycatch from two perspectives: (1) what could be expected to occur in any single year, and (2) what could be expected to occur over a 5-year period. Both concepts are useful for monitoring the impact of the PCGF on ESA-listed humpback whales, especially given the prospect of the continued availability of observer data and opportunistic entanglement reports used to develop this Effects Analysis.

2.5.2 Exposure and Response to Interactions with the Sablefish Pot Fishery

2.5.2.1 Bycatch Estimates

Since the deployment of observers in 2002, there have been two documented takings of a humpback whale in the PCGF; one in the LE sablefish pot fishery (2014) and one in the Open Access (OA) fixed gear sablefish pot fishery (2016) (Hanson et al. 2019). The NMFS WCR Marine Mammal Stranding Program also reported both of these takings. Using this data, the NWFSC used Bayesian procedures to estimate mean annual fleet-wide bycatch and a running 5-year fleet-wide average in the LE and OA sablefish pot fisheries (Appendix 2 from Hanson et al. 2019) (Table 8).

Table 8. Bycatch estimates of humpback whales 2002-2017 in: (a) LE Sablefish pot fishery sector, (b) Open Access pot fishery sector, and (c) combined sectors. Asterisks indicate running averages and confidence limits calculated on less than 5 years of data.

Year	Annual Bycatch	Conf. Limit (Lower)	Conf. Limit (Upper)	Running 5-year Mean	5-year Mean CL (Lower)	5-year Mean CL (Upper)
a).						
2002	0.18	0.01	0.55	0.18*	0*	1*
2003	0.29	0.02	0.91	0.24*	0*	1*
2004	0.37	0.02	1.2	0.28*	0*	2*
2005	0.2	0.01	0.64	0.26*	0*	2*
2006	0.24	0.01	0.75	0.26	0	2
2007	0.22	0.01	0.68	0.27	0	2
2008	0.11	0	0.35	0.23	0	1
2009	0.31	0.01	0.94	0.22	0	1
2010	0.23	0.01	0.74	0.22	0	1
2011	0.15	0.01	0.45	0.2	0	1
2012	0.12	0	0.36	0.18	0	1
2013	0.19	0	0.58	0.2	0	1
2014	1.15	1	1.51	0.37	0	2
2015	0.08	0	0.26	0.34	0	2
2016	0.06	0	0.19	0.32	0	2
2017	0.17	0	0.52	0.33	0	2
b).						
2003	1.94	0.1	5.71	1.94*	0*	4*
2004	1.33	0.07	3.93	1.63*	0*	3*
2005	3	0.19	9.48	2.09*	0*	3*
2006	3.73	0.2	11.13	2.50*	0*	4*
2007	2.1	0.12	6.09	2.42	0	5
2008	1.92	0.13	5.69	2.42	0	6

2009	3.05	0.18	8.82	2.76	0	6
2010	2.56	0.13	7.4	2.67	0	6
2011	1.81	0.1	4.96	2.29	0	6
2012	0.98	0.05	2.84	2.06	0	6
2013	0.57	0.03	1.73	1.79	0	5
2014	1.11	0.07	3.26	1.4	0	5
2015	1.75	0.11	5.07	1.24	0	4
2016	2.52	1.11	5.59	1.39	0	4
2017	1.43	0.09	4.26	1.48	0	4
c).						
2003	2.23	0	6	1.21*	0*	4*
2004	1.7	0	5	1.37*	0*	4*
2005	3.21	0	7	1.83*	0*	5*
2006	3.97	1	8	2.26*	0*	6*
2007	2.33	0	6	2.69	0	6
2008	2.03	0	5	2.65	0	6
2009	3.36	0	7	2.98	0	7
2010	2.79	0	6	2.89	0	7
2011	1.96	0	5	2.49	0	6
2012	1.1	0	4	2.24	0	6
2013	0.77	0	3	1.99	0	5
2014	2.26	0	6	1.77	0	5
2015	1.84	0	5	1.58	0	4
2016	2.58	0	6	1.71	0	5
2017	1.6	0	4	1.81	0	5

Based on the estimates for the combined sectors (Table 8.c), the number of annual entanglements ranged from 0.77 to 3.97 humpback whales, with an average over the 15-year period of 2.25. The 5-year running average number of entanglements for the two sectors combined ranged from 1.21 to 2.98 humpback whales.

As described in Section 1.3 *Proposed Action*, a significant change in the sablefish pot fishery occurred following the implementation of the catch share program in 2011 and implementation of the program that has allowed the CS sector to use different gear types (i.e., gear switching) to harvest allowable catch. Since 2011, the amount of sablefish landed in pot gear has increased (Figure 2).

We will focus on sablefish pot fishing effort and bycatch estimates since 2011 as a reflection of the proposed action. The corresponding entanglement estimates for the 2011-2017 period all decrease from those based on the total period of record (2003-2017). The average annual number of humpback whale entanglements is estimated to be 1.73 entanglements (2011-2017) with an annual high estimate of 2.58 entanglements (2016), and a maximum 5-year running average (including only years since 2011) of 1.81 entanglements (Table 8).

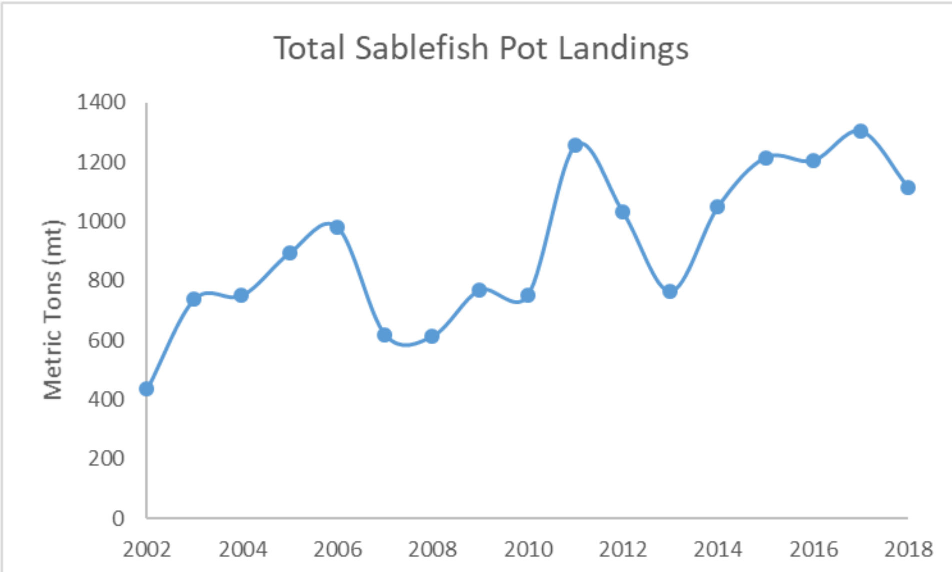

Figure 2. Total landings of sablefish in pot gear, 2002-2018. NWFSC data.

In addition, during this period (2011-2017), there have also been three other humpback whale entanglements reported to NMFS through opportunistic observations from ocean users that have been identified as involving sablefish pot gear; one in 2006, 2016, and 2017. At this time, we do not have enough information to determine which sector or sectors of the sablefish pot fishery are responsible for these humpback whale entanglements. Due to the opportunistic nature of this data, it is difficult to produce a straightforward estimate of the total number of entanglements with sablefish gear that may have occurred. Instead, below we will consider these data further to ground-truth the estimates of bycatch that have been produced and/or any anticipated levels of bycatch that may occur in the future.

As described above, the available bycatch estimates only represent bycatch associated with effort in the LE and OA sablefish pot fishery sectors. This is the result of the analytical effort to generate sector-specific estimates of bycatch, and the methodology that requires at least one observation of a bycatch event (by a fisheries observer) in a sector to generate any estimate (Hanson et al. 2019). To date, there have not been any observations of entangled humpback whales in the CS sablefish fishery sectors, despite substantial observer coverage in the CS sector.

With respect to observer coverage in sablefish pot fishing sectors since 2011, annual coverage rates of fishing activity in the LE sector (tier fishery) have averaged 40 percent, based on the total pounds of fish landed (Hansen et al. 2019). In the OA sector, annual coverage has averaged 8 percent of the landings. In terms of comparison of overall effort between these two sectors, the LE sector has accounted for about twice as much effort in landings compared to the OA sector each year on average since 2011 (LE - 339 metric tons (mt) per year vs OA – 179 mt per year; Table 1 *in* Hanson et al. 2019).

Within the portion of the CS pot fishery that does not use Electronic Monitoring (EM), there is 100 percent observer coverage. This represents approximately 50 percent of all landings in the CS sector. Of which, sablefish accounts for ≥98 percent of the total landings associated with groundfish pot fishing effort (Somers et al. 2019). In the other approximately 50 percent of the CS pot fishery that uses EM (≥98 percent are sablefish landings), there has been approximately 33 percent coverage since 2015 (Somers et al. 2019). It is unclear from the available information what the observer coverage rate has been for the LE DTL pot gear sector as observer coverage rates are provided for both hook and line and pot fishing effort in the LE DTL fishery combined (3-10 percent annually; Somers et al. 2018). However, the available information indicates the LE DTL pot gear sector represents a relatively minimal portion of the overall sablefish fishing effort (Somers et al. 2019). Overall, in terms of relative comparisons between the apparent fishing pot gear fishing effort in the CS fishery compared to the LE, OA, and DTL (commonly referred to all together as Non-Catch Share, or NCS), sablefish pot fishing effort in the CS sector is greater than or equal to the effort in the NCS sectors combined (Table 25 and 26 *in* Somers et al. 2019).

In addition to looking at landings data, we also looked at other gear metrics that come primarily from observed fishing effort. In particular, we note that the average number of pots per haul from observed hauls for CS and NCS sectors vary each year and these numbers are generally similar, except for the last few years when substantially fewer pots per haul have been observed in the CS sector (Somers et al. 2019). It is unknown if using fewer pots per haul has affected the total number of hauls and/or the total number of vertical lines that may have been deployed in the CS sector, as that data is not readily available. As mentioned above, there are no bycatch estimates that represent effort associated with CS sablefish fishing effort because no bycatch events have been observed. It is important to note that this does not mean that the estimates of what has occurred in these sectors is "zero", but rather only that estimates cannot be produced.

2.5.2.2 Bycatch Risk in the Catch Share (CS) Sector

Based on the available data, it is not possible to estimate how many entanglements might have occurred in the CS sablefish pot fishery sector since 2011. Given that humpback whale entanglements with sablefish pot gear are rare events and that fishery observers monitor a significant portion of the CS fishery, it is possible that no entanglements have occurred. Based on past performance, we conclude it would be very unlikely that more than 2 entanglements would be observed in the CS sector over a similar period if none have been observed to date, despite more than double the amount of observer coverage (67 percent compared to 29 percent) in the roughly the same amount of total fishing effort in terms of landings since 2011. Even if two entanglements were observed in the CS sector over a similar period, if relative observer coverage rates remain roughly identical, it is likely that estimates produced from those results would equate to roughly less than half of what has been calculated from the NCS sectors given the general underlying math that accompanies expansions of observed bycatch rates to unobserved portions. This is evident from a review of the bycatch rates associated with the OA fishery compared to the LE portion even without a detailed review of the statistical models. With the exception of 2014, when a bycatch event was observed in the LE portion, bycatch estimates from the OA portion constitute the large majority of combined estimates, which is directly attributable to increased expansion of observed events through the lower observer coverage rates in the OA fishery.

Based on this combination of quantitative and qualitative information, we have determined that even if a couple of entanglements were observed in the CS sector, we would generally expect those to equate to no more than half of what has been estimated in the NCS sector. As a result, we anticipate that overall estimates for the entire sablefish pot fishery as follows:

- **Annual maximum** = NCS sector entanglements (2.58) + CS sector entanglements (2.58 * 0.5 = 1.29) = no more than 3.87 entanglements
- **Maximum 5-year running average** = NCS sector entanglements (1.81) + CS sector entanglements (1.81 * 0.5 = 0.91) = no more than 2.72 entanglements

2.5.2.3 Opportunistic Entanglement Reports

As described above, there have been a total of five "opportunistic" entanglement reports positively attributed to sablefish pot fishing gear that have been received by the NMFS WCR Marine Mammal Stranding Program since 2006. Two of those entanglements were the same entanglements observed by the WCGOP. Therefore, ocean users have reported three additional entanglements. Due to the difficulty in applying any type of expansion factor to these types of reports, the best use of this data is to use it to ground truth bycatch estimates by looking at the opportunistic entanglement report records as a minimum source of accounting regarding the potential total number of entanglements that may have occurred in the past (and may occur in the future).

The opportunistic reporting of humpback whale entanglement data was described in Section 2.4 *Environmental Baseline.* In general, the quantity and quality of information received from reports has increased over time, as well as has NMFS's ability to evaluate them (Saez et al. 2020). As a result, we generally have more confidence about the entanglement data that has been gathered recently—particularly in the time since the 2012 Opinion on humpback whale entanglements in the PCGF was issued. Herein, we focused on looking at how the sablefish pot fishery has been carried out since 2011 and thereby capture changes in pot fishing effort following the rationalization program. As a result, we will also focus on the opportunistic entanglement data that has been gathered along the U.S. West Coast since 2011. Certainly, the volume of entanglement reports and our ability to identify the origins of gear that are involved in entanglements has evolved significantly since the 2012 Opinion was issued.

From 2011 to 2019, NMFS received and evaluated 194 confirmed humpback whale entanglement reports (separate cases – does not include resighting of an entangled whale multiple times) (Saez et al. 2020; NMFS 2019, 2020). Since 2011, four of these reports have been identified as associated with the sablefish pot fishery, which represents about 2 percent of all confirmed entanglement reports. Of these 194 cases, 119 records are positively identified to some particular source or origin (61.3 percent), and 75 records where the gear could not be identified (38.7 percent). As a result, 3.4 percent of the entanglement records are attributed to the sablefish pot fishery (4 out of 119). With respect to the 75 unattributed cases, if we assume 3.4 percent of those may have also been attributed to sablefish gear, that would equate to approximately 2.5 additional sablefish entanglements that may have been reported since 2011.

It is possible that a thorough evaluation of the 75 unattributed entanglement reports could eliminate the possibility of some reports as being associated with the sablefish fishery. However, because of the relatively small likelihood (3.4 percent) that any individual entanglement report received since 2011 is associated with the sablefish fishery, such an effort is unlikely to dramatically influence the overall conclusion that that there may have been two to three additional entanglements that involved sablefish gear that were not identified.

There have also been 13 additional entanglement reports that have involved unidentified whales, some of which would be expected to involve humpback whales (Carretta et al. 2019a, b). Based on the low likelihood (3.4 percent) that any entanglement report involves sablefish gear, it is unlikely that any of those 13 reports would be humpback whales entangled in sablefish gear (3.4 percent sablefish entanglement reports x 13 reports = 0.4 entanglements, which rounds to 0 entanglements).

It is important to acknowledge we do not have a good understanding how many humpback whale entanglements with all gear types and origins might have occurred and not been reported. Based on what we have described above, four sablefish entanglements of humpback whales have been witnessed and reported since 2011, and it is possible that two or three more cases are attributable to the fishery but the gear was not positively identified. If sablefish gear potentially entangles a small number of humpback whales each year (or at least in some years), it is not surprising that an average of about one sablefish entanglement of a humpback whale per year (~7 entanglements reported in 9 years) may have been witnessed and reported. Overall, we conclude that the opportunistic entanglement reporting record with respect to sablefish pot fishery and humpback whale entanglements are not obviously or necessarily incongruent with each other. While we do not have any specific expectations for how many of the actual entanglements that occur would be expected to be detected and reported through opportunistic reports, the prospect that it is only a fraction of the total is very plausible. The sablefish pot fishery is conducted across a wide range of the U.S. West Coast, including offshore areas that are not necessarily frequented by a high volume of ocean users in more remote areas. On the other hand, detections of these entanglements may be easier than entanglements with some types of gear because whales entangled with heavier strings of pot gear like sablefish gear are often more restricted in their movements and potentially less likely to be free-swimming with an entanglement that might be more cryptic to a casual observer passing by. Ultimately, while we are not able to specifically calibrate opportunistic reporting with estimates of sablefish pot fishery entanglements produced by observer coverage, we find that the opportunistic reporting record does not apparently conflict with the type of estimates and expectations that result from using observer data and other supporting analytical approaches we have used to date.

2.5.2.4 Sablefish Pot Fishery Entanglements by Humpback Whale DPS

Distribution of Sablefish Fishing Effort

As stated above, we recognize that the relative exposure of each humpback whale DPS to potential bycatch in the PCGF varies accordingly. In order to complete the *Effects Analysis* in this opinion, we have to estimate what proportions of the total number of entanglements that are expected to occur in all sablefish pot fisheries would be associated with the two ESA-listed humpback whales affected by the proposed action. In order to do this in a relatively straight forward manner, we will assume that bycatch events would occur along the coast in direct proportion to the relative distribution of the fishery along the U.S. West Coast as it pertains to the significant foraging area boundaries that describe the differing distributions of humpbacks whale DPSs along the coast. As described in the *Status* and *Environmental Baseline* sections, the distribution of humpback whale DPSs varies according to whether whales occur off the coast of California and Oregon, versus whales that may occur off the coast of Washington and southern British Columbia. As a result, we examine the distribution of sablefish pot fishing effort as described by landings data and data gathered by the WCGOP to assess the relative proportions of sablefish pot fishing effort that occur in those two areas. To date, all of the entanglement reports that involve sablefish pot fishing have originated off the coast of Oregon and California. While we do not have confirmed locations of where gear was set in all of these cases, we assume that humpback whales entangled in strings of pot gear are generally limited in their ability to move around and travel away from the location where they were entangled.

In addition, we recognize that there is a seasonality of humpback whale presence off the U.S. West Coast. While humpback whales could be present at any time of the year anywhere along the U.S. West Coast, our general understanding of humpback whale migrations and behavior suggest the presence of humpback whales is likely to be higher during the late spring through the fall as indicated by numerous surveys, sightings, models, and tracking efforts. In particular, we note that the entanglements of humpback whales are most commonly reported on the U.S. West Coast from April through November, which reflect the general migration pattern of heading south to breeding areas by December each year, and subsequently starting to return to feeding areas by April (Saez et al. 2020). In order to make sure we do not overlook the potential for any bias in fishing effort that may occur during the winter and early spring when humpback whales are less likely to be present in sablefish pot fishing grounds, we also look at how sablefish pot gear is distributed specifically within the April to November "whale season." Acknowledging the caveat that we usually do not know the timing of when an entanglement actually occurred prior to its being observed and reported, we note that sablefish pot gear entanglements have been previously reported in April, May, July, August, and October (Saez et al. 2020).

Table 9 summarizes the analysis of landings data from all sablefish pot fishing sectors. Landings were stratified into categories that include landings within Oregon/California and Washington, as well as within/outside the April through November (whale season) timeframe. We acknowledge that the location of landings is not necessarily reflective of the location of fishing effort, but landings data is the only comprehensive data set for the sablefish pot fishery available to analyze in this fashion.

Table 9. Analysis of sablefish pot fishing landings data comparing effort before and after initiation of Catch Share (CS) (NWFSC data).

Sablefish Landings in all Groundfish Sectors			
	Since 2011	Pre-CS	% change
Ave. coastwide landings (mt)	1238.5	798.5	+55.1%
Ave. % landed in OR/CA	91.8%	91.3%	
Min % landed in OR/CA	87.8%	76.6%	
Max % landed OR/CA	98.8%	98.5%	

Sablefish Landings During April - November			
	Since CS	Pre CS	% change
Ave. coastwide landings (mt)	1116.7	728.3	53.3%
Ave. % during whale season	90.5%	91.3%	
Min % during whale season	86.3%	89.3%	
Max % during whale season	95.5%	98.4%	
Ave. % OR/CA	91.3%	91.0%	
Min % OR/CA	87.0%	74.9%	
Max % OR/CA	98.9%	98.4%	
CS Sablefish Landings since 2011 (using 3 years of complete data)[7]			
Ave. CS sablefish landings (mt)	696.8		
Ave. % of all sablefish landings	57.6%		
Ave. % landed in OR/CA	86.6%		
Ave. % during whale season	93.7%		

The results of this analysis indicate that across all sablefish pot fishing sectors, ≥90 percent of sablefish pot landings are made in Oregon or California (OR/CA) each year; with landings proportions approaching 100 percent in some years (although some Washington landings data are missing in some years). In addition, the results indicate that ≥90 percent of sablefish pot fishing landings/effort occurs during whale season (April-November), and that ≥90 percent of sablefish pot landings are made in OR/CA during the whale season. We acknowledge there is some potential for a small bias because in some years some Washington landings data is not available. But the years with complete data look very similar to other years when viewed along these stratification lines and contain low totals for sectors in Washington during those year, indicating that any bias here is likely not significant enough to influence the main results of analysis.

With respect to the CS sablefish pot fishing sector, similar to the results represented in Table 9 and described above, the results indicate the CS sablefish pot represents >50 percent of the total pounds of sablefish landed since 2011. Also, as depicted in Figure 2. Total landings of sablefish in pot gear, 2002-2018. NWFSC data. above, the results indicate that overall landings/effort in sablefish pots increased >50 percent since the CS program began in 2011. Similar to the overall analysis, the results indicate that ~90 percent of CS sablefish pot fishing landings/effort occurs during whale season and ~90 percent of CS landings are made in OR/CA. On average, the results indicate there has been no apparent difference in the distribution of sablefish pot landings/effort relative to OR/CA vs. Washington since implementation of the CS program, although historically there were some years where the proportion of Washington landings was relatively higher.

[7] 2011, 2012, and 2014 were the only years where the data set was complete. In other years, some landings data from WA was unavailable from certain sectors.

Table 10 summarizes the analysis of observed effort data from sablefish pot fishing sectors since 2011. Similar to the landings data analysis above, where possible, efforts have been made to stratify the data into categories that include landings within OR/CA and Washington, as well as within/outside the whale season timeframe and within OR/CA during the whale season. We note that we were unable to compile all effort from all sectors, as complete data were not available for all sectors in each year. Instead, we compiled data for each sector using years where complete data were available for those sectors. Unlike the landings data, observer fishing effort data does represent the actual location of fishing effort. However, the observer data may not necessarily be representative of all fishing effort regarding the stratification that was of interest in this analysis, as these factors were likely not the determining factors of how observers are deployed.

Table 10. Analysis of observed sablefish pot fishing effort data. NWFSC data.

Observed Effort - % of observed hauls since 2011		**Observed Effort - sablefish landings (mt) since 2011**	
CS sector - % observed off OR/CA		CS sector - % obs. off OR/CA	
Average	81.0%	Average	81.0%
Max	97.3%	Max	96.4%
Min	60.6%	Min	61.0%
CS sector - % observed during whale season		CS sector - % observed during whale season	
Average	87.8%	Average	88.1%
Max	94.9%	Max	96.2%
Min	80.0%	Min	74.5%
LE sector - % observed off OR/CA		LE sector - % observed off OR/CA	
Average	75.2%	Average	78.3%
Max	99.7%	Max	99.8%
Min	43.0%	Min	49.4%
OA sector - % observed off OR/CA during whale season		OA sector - % observed off OR/CA during whale season	
Average	87.9%	Average	94.6%
Max	95.9%	Max	99.1%
Min	81.0%	Min	89.4%

The results of this analysis suggest that the distribution of observed effort off OR/CA since 2011 has been closer to 80 percent in terms of number of hauls and total landings of sablefish observed in the CS and LE sectors on average with more annual variation in these results than was evident looking at the landings data. Similar to the landings data, the results suggest that ~90 percent of CS effort occurs during the whale season. The results also indicate that ~90 percent of observed effort in the OA sector during the whale season occurs off OR/CA.

Overall Findings of Sablefish Pot Fishing Effort Distribution

Looking at the combination of fishing effort data from landings and observer data sources, we conservatively conclude and assume the following about future sablefish pot fishing activity based on the recent implementation of the fishery:

- On average – the overall distribution of sablefish pot fishing effort in OR/CA is expected to be ~90 percent of all sablefish pot fishing effort across all sectors combined.
- Distribution of sablefish pot fishing effort during whale season is similar to the distribution year round given that the effort data is overwhelming dominated by effort occurring during the whale season when entanglement risks are highest.
- CS sector sablefish pot fishing effort represents an approximate doubling of sablefish pot effort compared to LE and OA alone. Given the similarity in distribution and timing – it is reasonable to expect that risks are more similar than they are different.
- We do not have a true measure of gear in terms of the number of vertical lines and/or other characteristics of the CS sector vs. other sectors (such as fine-scale specific spatial-temporal patterns) to further evaluate differential risk of different sectors at this time.

Estimates of Humpback Whale bycatch in Sablefish Pot Fishery

Based on the analysis above, we assume that approximately 90 percent of sablefish pot fishing effort, and consequently humpback whale entanglements, would occur in ocean waters off the coast of California and Oregon, and approximately 10 percent of effort and humpback entanglements would occur off the coast of Washington. As described in *Status* Section 2.2.1., Wade (2017) describes the relative distribution of various humpback whale DPSs across various feeding grounds in the Pacific Ocean (Table 5) in terms of relative probability of any individual animal moving between feeding areas (summer) and breeding areas (winter). However, in the *Status* Section 2.2.1, we reviewed the most recent information regarding the estimated abundance of humpback whales off the U.S. West Coast over the last 10 to 15 years since the data gathered that was used by Wade (2017) to estimate the abundance and distributions of humpback whales at that time. While we do not have a more recent estimate of what the abundance and distributions of humpback whale DPSs may be today, it is clear that there must have been changes to these characteristics since that time given a conservative view of how the abundance of humpbacks off the U.S. West Coast has increased since then. According to this most recent information, we can expect that 39% percent of humpback whales that may become entangled in sablefish pot gear off OR/CA may be Central America DPS individuals and 61 percent may be Mexico DPS individuals. As explained in Status Section 2.2.1., we can expect that 9 percent of humpback whales that may become entangled in sablefish gear off SBC/WA may be Central America DPS, 28 percent may be Mexico DPS, and that 64 percent may be from the unlisted Hawaii DPS (Table 5).

In order to calculate the bycatch rates of Mexico DPS and Central America DPS humpback whales, we use the anticipated bycatch rates for all humpback whales in the sablefish pot fishery based on the results of the humpback whale bycatch analysis above (section 2.5.2.2):

Expected Humpback Whale Bycatch in Sablefish Pot Fishery

- Annual maximum = no more than 3.87
- Maximum 5-year running average = no more than 2.72

Next, we applied the data-derived estimate that 90 percent of bycatch occurs off OR/CA and the remaining 10 percent occurs off WA. Then we considered the estimated population abundance and expected proportions of each DPS within each feeding area as described above.

Table 11. Anticipated bycatch of ESA-listed humpback whale DPSs in the sablefish pot fishery.

OR/CA Bycatch		WA Bycatch		Total Bycatch	
MEXICO DPS					
Annual Maximum	2.12	Annual Maximum	0.11	Annual Maximum	2.23
Maximum 5-yr Running Ave	1.49	Maximum 5-yr Running Ave	0.08	Maximum 5-yr Running Ave	1.57
CENTRAL AMERICA DPS					
Annual Maximum	1.36	Annual Maximum	0.03	Annual Maximum	1.39
Maximum 5-yr Running Ave	0.95	Maximum 5-yr Running Ave	0.02	Maximum 5-yr Running Ave	0.98

2.5.3 Risk of Trawl Interactions

Entanglements with fixed pot gear do not represent the only potential risk of interactions between humpback whales (and other ESA-listed species) and the PCGF. As described in the *Proposed Action* (Section 1.3) there is significant effort using other gear types, including trawl nets in particular. Historically, no bycatch interactions between whales and trawl gear have been documented in the PCGF trawl fishery, and we have not previously considered it likely that ESA-listed whales could be caught in PCGF trawl gear. However, during this consultation, two events transpired that warrant updated consideration in this biological opinion.

In July, 2020, EM in the Pacific whiting trawl fishery documented two separate incidents where humpback whales were incidentally captured/entangled in the forward section of midwater trawl nets (i.e., "big meshes") (NMFS EM data). In both situations, the humpback whales were clearly dead at the time the net was hauled in. No information is available that would allow the whales to be identified as belonging to a particular DPS. Consequently, we do not know whether the whales were listed under the ESA or not.

In one situation, the captain reported indications that the whale was clearly in poor condition, suggesting a death prior to being swept up in the trawl. The view of the whale in the EM video is obstructed, which hinders an evaluation of the whale's condition. Multiple NMFS SWFSC and Marine Mammal Stranding Program staff reviewed the EM video and could not determine whether the whale was dead or alive at the time of capture. The EM documentation of this event may not be of sufficient quality/quantity to make a definitive assessment of whether or not the animal was alive when it encountered the trawl, NMFS will continue to evaluate the evidence. As a result, at this time we cannot rule out the possibility the whale was alive when it encountered the Pacific whiting trawl (email from NMFS PRD staff to NMFS SFD staff, September 9, 2020).

In the second situation, the captain also reported indications the whale was dead when it encountered the trawl net. In this case, the view of the whale in the EM video was directly overhead off the stern and unobstructed. There were four small buoys tangled in the net ahead of the whale suggesting that the whale may have been entangled in fixed gear when swept up in the trawl net, although this entanglement could not be confirmed upon review of the EM documentation. Once again, multiple NMFS SWFSC and Marine Mammal Stranding Program staff reviewed the EM video and could not determine whether the whale was dead or alive at the time of capture. However, given what was visible of the condition of the animal, there was some evidence to support the proposition that the whale was dead when captured in the trawl. The apparent presence of additional gear on the whale may also support this. An entangled whale would be more susceptible to bycatch in trawl gear than an unencumbered whale. Although there is some evidence to suggest the whale was dead prior to encountering the trawl, it appears that there may not sufficient documentation to make a definitive assessment either way (email from NMFS PRD staff to NMFS SFD staff, September 9, 2020).

NMFS staff will continue to evaluate both of these events as part of the marine mammal SARs process. However, at this time, we cannot definitively state whether these events involved live whales being caught in the trawl nets, or whether the nets swept up whales that were already dead. Given the information currently available, we cannot rule out the possibility that at least one of these events, if not both, could have been the result of live humpback whales being incidentally caught in Pacific whiting trawl gear. As a result, we must consider the possibility that such an event could happen in the future.

If such an event did occur, it would represent the first time that any live whale is known to have been incidentally captured in the history of the PCGF trawl fishery, at least since mandatory marine mammal bycatch self-reporting requirements under the MMPA were implemented in the 1990s and observers have been deployed in PCGF fisheries in the last two decades. A review of the WCGOP observer records suggest there has been at least one instance in which a whale came up dead in PCGF bottom trawl. In that case, the condition of the body as documented and reported by the observer was clearly indicative of an already decomposing whale (NMFS observer data). It is possible that other instances of similar events have been documented and reported by groundfish observers, but none were found in the data available for this consultation.

In an effort to evaluate the future prospect of whale bycatch in PCGF trawl fisheries, we consider information from other trawl fisheries in the U.S. about relative frequency of live whales being incidentally captured in trawl gear that may be reflected in the MMPA U.S. List of Fisheries (LOF) (85 FR 21079). The LOF typically tracks marine mammal bycatch over the most recent time periods (5-year) where information is available for the purposes of categorizing U.S. fisheries. The LOF also provides a list of species/stocks incidentally killed or injured associated with fisheries on the LOF. While this list generally reflects updated information from the most recent 5-year time period, this list may also reflect more historical information—especially for fisheries where recent information is not available. Looking at the U.S. List of Fisheries (LOF) under the MMPA (85 FR 21079), we identified three Alaska groundfish fisheries with whales among the species/stocks incidentally killed or injured—including two midwater trawl fisheries that are somewhat similar to PCGF midwater trawls for Pacific whiting. Specifically, humpback whales (from different populations in the North Pacific) were identified in one midwater and one bottom trawl fishery, and fin whales (from the Northeast Pacific) were identified in one midwater trawl fishery. Looking at U.S. East Coast fisheries, we found no instances in which a live whale was recorded as having been incidentally killed or injured in an East Coast midwater trawl fishery (https://www.fisheries.noaa.gov/national/marine-mammal-protection/northeast-mid-water-trawl-fishery-mmpa-list-fisheries).

Looking further into the marine mammal SARs, incidents of whale bycatch in trawl fisheries in the U.S. appear to be extremely rare. The only recent incident of whale bycatch in trawl gear that we could identify was one humpback whale capture in an Alaska groundfish midwater trawl fishery in 2012 (Muto et al. 2019). Reviewing the most recent biological opinion on Alaska groundfish fisheries (NMFS 2010), the only record of a whale being documented as bycatch in trawl fisheries was a fin whale caught in a midwater trawl in 1999.

After reviewing the available information on documented whale interactions with trawl gear fisheries throughout the U.S., we conclude that the bycatch of a live whale in a trawl is a very unlikely event, occurring extremely rarely at the scale of all U.S. trawl fisheries over the last couple of decades. Given the very low probability that any whale (let alone a humpback whale) would be incidentally captured alive in PCGF trawl fishery, the uncertainty surrounding whether such an event happened in 2020, and the uncertainty regarding whether the whales captured in 2020 were from an ESA-listed DPS, we conclude that it is extremely unlikely that there would be any interaction between live ESA-listed humpback whales and PCGF trawl fisheries in the future. Therefore, such interaction with the PCGF are not considered further in this opinion, although the risk that humpback whales may be seriously injured or killed by other fisheries or other human caused sources in the future that may be consistent with events that transpired in 2020 is considered as part of the *Environmental Baseline* of this opinion.

2.5.4 Risk of Prey Removal

According to WCGOP data, important prey species for humpback whales that are periodically incidentally captured in the PCGF include Pacific sardines, Pacific herring, and northern anchovies. As summarized in the Status of the Species' Proposed Critical Habitat section (Section 2.2.3), humpbacks are generalists, targeting a variety of prey while foraging but also switching between prey depending on what is most abundant or of highest quality in the system. In Section 2.12.1 "*Not Likely to Adversely Affect" Determinations*, the extent of incidental capture of these important prey species in the PCGF, and the relative impact of these removals on the proposed critical habitat are described in detail. Ultimately that analysis concludes that the PCGF is not likely to adversely affect the prey feature of the proposed critical habitat designation because: (1) the bycatch of humpback whale prey species by the PCGF is limited in amount compared to the amount of prey required and available for humpback whales on the U.S West Coast; (2) humpbacks can readily switch prey to other schooling fish or euphausiids based on what is available; (3) and the CA/OR/WA stock of humpbacks is increasing approximately 6-7 percent per year under the existing levels of prey removals that occur as a result of the PCGF that are anticipated to continue to occur in the future. As a result of these same factors, we conclude that the impacts of prey removal by the PCGF, as described further in Section 2.12.1 "*Not Likely to Adversely Affect" Determinations*, are not likely to adversely affect ESA-listed humpback whales.

2.5.5 Response to Entanglement

The probability that a marine mammal will initially survive an entanglement in fishing gear depends largely on the species and age or size of marine mammal involved. Documented cases have indicated that entangled marine mammals may travel for extended periods of time and over long distances before either freeing themselves of gear, being disentangled by stranding network personnel, or dying as a direct result of the entanglement (Angliss and DeMaster 1998). In most cases, it is unknown whether an entanglement immediately results in an injury that is serious enough or debilitating enough to lead eventually to death.[8] If the gear is heavy or significantly restricts the ability of an animal to swim, the animal could become exhausted from repeatedly trying to reach the surface to breathe and might eventually drown. Less severe entanglements may also lead the animal to exhaustion (not as quickly as expected with heavier gear), depletion of energy stores, and starvation due to the increased drag (Wallace 1985). If an animal's appendage is wrapped tightly, the injury can debilitate the animal, especially if the gear is constricting, causes lacerations, or impairs swimming or feeding ability (Scordino 1985), which may make the animal more susceptible to disease or predation (Angliss and DeMaster 1998). The lacerations themselves may become a source of infection. A sustained stress response, such as repeated or prolonged entanglement in gear or having gear left on the animal, may make marine mammals less able to heal and fight infection or disease (Angliss and DeMaster 1998). Younger animals are particularly at risk if the entangling gear is tightly wrapped, for as they continue to grow, the gear will likely become more constricting. This is of particular concern, as a large number of large cetaceans that become entangled in fishing gear are juveniles (Angliss and DeMaster 1998). Data from the NMFS WCR Stranding Database do not provide conclusive information on the size or age of most whales that have been reported entangled, although reports of juvenile whale entanglements are certainly part of that record.

Although the specific outcome of any given entanglement event following the last sighting of an entangled or disentangled animal are rarely known, NMFS evaluates the likelihood of mortality and serious injury associated with each entanglement in terms of the probability that each bycatch event results in mortality or serious injury (M/SI). Those expectations are based on the current criteria for such determinations in the SARs (NOAA 2012). Lacking any further specific information regarding survival and mortality of ESA-listed humpback whales resulting from entanglement events with sablefish pot gear being available, we relied upon the M/SI rates from previously documented entanglements to inform our anticipated response of ESA-listed humpback whale in future entanglements.

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[8] The current criteria used for assessing the severity of injury to marine mammals were published in NOAA 2012.

Out of the previous five known humpback whale entanglements with sablefish pot gear, there is a readily available M/SI score for the most recent 4 cases that have occurred since 2013 (Carretta et al. 2019b). For these entanglements, the total assessed M/SI with sablefish pot gear is 2.5; which equates to an M/SI rate (per entanglement case) of 0.63 (M/SI total of 2.5/4 cases) across all the cases. This includes: one case where gear was removed during a disentanglement response leading to non-serious injury that otherwise would have been deemed a serious injury (M/SI score of 1.0); one case where all gear was removed, but the resulting injury was still designated a prorated serious injury (M/SI score of 0.75); one case where a partial disentanglement resulted in a prorated serious injury score; and one case where the whale was observed to be deceased (Carretta et al. 2019b). From these records, it is apparent that the assessed M/SI would have been greater without the intervention of a disentanglement response. Assuming no intervention had occurred, the M/SI rate from the initial description of the entanglement event would have been 94 percent (M/SI total of 3.75/4 cases). This is consistent with our general understanding that strings of multiple traps have the capability of inflicting serious injuries given their heavy weight and tendency to restrict dramatically the movement of entangled whales. However, the expected benefit is that whales that are restricted in movement are easier to respond and potentially disentangle.

Given the relatively low number of humpback whale entanglements in sablefish gear, we looked at entanglement cases with similar configurations of multi-trap strings as they provide additional examples to consider in terms of likely outcomes for entangled whales. Overall, the M/SI rate for all multi-trap gear humpback whale entanglements since 2013 is 0.44, or 44 percent (13 cases with 5.75 total M/SI; Carretta et al. 2019b) including the interventions that occurred with those cases, and 0.92, or 92 percent (13 cases with 12 total M/SI) if intervention had not occurred. While intervention in the future is not guaranteed, our intervention rate has been high for these types of entanglements, when reported, and we generally understand how and why that has occurred (NMFS 2020). However, assuming that intervention rates will remain at previous levels, and that intervention success will continue at the same rate, is uncertain. Conservatively, we will assume that intervention cannot be relied upon in the future, and that the extent of injuries documented prior to human intervention for gear that involves multi-trap strings represent the potential fate of all humpback whales that may get entangled with multi-trap strings in the future, including sablefish pot gear, in the future. As a result, we conclude that assuming a M/SI rate of 0.92, or 92 percent, for future entanglements in the sablefish pot fishery is a conservative (i.e., no intervention to disentangle animals) estimation of what to expect moving forward, especially as NMFS continues to develop and expand response capacities across the U.S. West Coast.

2.5.6 Risk for ESA-listed Humpback Whales

In the *Estimates of Sablefish Bycatch of Humpback Whale DPS* section above, we estimated bycatch for different ESA-listed humpback whale DPSs considering the most recent scientific information available. In this section, we will continue our analysis to consider what the relative population level impacts could be under various scenarios of relative distribution and abundances suggested by the available information.

Using the bycatch estimates from Table 8 and the associated population abundance estimates described in the *Status of the Species* Section 2.2.2, along with the expected M/SI rate of 0.92, we anticipate the levels of M/SI and relative population impacts in terms of percentage of the DPS that may be removed from the population annually are as presented in Table 12.

Table 12. Anticipated M/SI and relative impact on population abundance of ESA-listed humpback whale DPSs.

	Total Bycatch	Total M/SI	DPS Impact
MEXICO DPS (ABUNDANCE – 6,724)			
Annual Maximum	2.23	2.05	0.03%
Maximum 5-yr Running Ave	1.57	1.44	0.02%
CENTRAL AMERICA DPS (ABUNDANCE – 1,876)			
Annual Maximum	1.39	1.28	0.07%
Maximum 5-yr Running Ave	0.98	0.90	0.05%

Overall Findings of Population Risk Analysis

We have considered and analyzed the population risks associated with the occasional incidental bycatch of ESA-listed humpback whales in the sablefish fixed gear fishery given our assumptions about the current abundance and relative distribution of ESA-listed humpback whale DPSs along the U.S. West Coast based on analysis of historical information alongside more recent scientific information. In the intervening time since the data was collected that was analyzed by Wade (2017), there has been a substantial increase in the number of humpback whales that occur off the U.S. West Coast feeding areas, suggesting that substantial increases in the representative ESA-listed (and non-listed) humpback whale DPSs have increased since that time as well. In this scenario, we expect that on average less than one Central America DPS humpback whale would be seriously injured or killed each year and that less than two Mexico DPS humpback whale would be seriously injured or killed each year. Based on the assumed abundances of each DPS in this scenario, we estimate these annual removals would amount to less than 0.1 percent of the total population of each DPS, on average. During any one year, we expect that up to 2 (rounding up from 1.25) Central America DPS and 3 (rounding up from 2.09) Mexico DPS whales may be seriously injured or killed, which still amounts to less than 0.1 percent of the abundance of either DPS. During any 5-year period, we expect a maximum running average of 0.88 Central American DPS and 1.47 Mexico DPS humpback whales may be seriously injured or killed, which amounts to less than 0.1% of either DPS.

Ultimately, based on interpretation of the risk analyses conducted, we conclude that less than 0.1 percent of any ESA-listed DPS would be entangled, seriously injured or killed, and ultimately removed from further contribution to survival, reproduction, and recovery of these ESA-listed populations, even during the highest annual totals and across any series of years that we can expect to occur under the proposed action.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline vs. cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the rangewide status of the species and critical habitat (Section 2.4).

We did not identify additional state or private activities that are reasonably certain to occur within the action area, do not involve Federal activities, and could result in cumulative effects to ESA-listed species within the action area. Activities that may occur in these areas will likely consist of state or Federal government actions related to ocean use policy and management of public resources, such as fishing or energy development projects. Changes in ocean use policies as a result of non-Federal government action are highly uncertain and may be subject to sudden changes as political and financial situations develop. Examples of actions that may occur include development of aquaculture projects; changes to state fisheries that alter fishing patterns or influence the bycatch of ESA-listed marine species; installation of hydrokinetic projects near areas where marine mammals are known to migrate through or congregate; designation or modification of marine protected areas that include habitat or resources that are known to affect marine mammals; and coastal development that alter patterns of shipping or boating traffic. However, none of these potential state, local, or private actions, can be anticipated with any reasonable certainty in the action area at this time, and some of those described as examples would likely involve Federal involvement of some type.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species (Section 2.2), to formulate the agency's opinion as to whether the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution.

In this opinion, we first analyzed the impact to all humpback whales combined along the U.S. West Coast. Since there are multiple DPSs present along the U.S. West Coast, when a take occurs (e.g., entanglement, ship strike) it is unknown from which DPS the whale is from. To assign which DPS a take is from, we are reliant upon overall abundance and DPS proportion based upon location when we look at the general data. However, even using the best available science, the abundance and proportionment to DPS are not well known. The information from

Wade (2017) is reliant upon 15 year old studies while overall humpback abundance appears to have increased 6-7 percent annually (Carretta et al. 2020). Further, the most recent SAR for the U.S. West Coast (Carretta et al. 2020) is not apportioned to DPS and presents overall abundance for the humpback whale species as a whole. Therefore, we used our interpretation of the most recent information from Calambokidis and Barlow (2020) in the *Effects of the Action* section to analyze impact to the DPS level. Next, we present our analysis of impacts to both DPSs based upon the likely abundance and proportions described earlier. As described in the *Environmental Baseline* section, although efforts are underway to address some of the baseline threats to ESA-listed humpback whales including efforts reduce fisheries interactions are underway, we conservatively anticipate that these threats will continue into the future.

2.7.1 Mexico DPS Humpback Whales

In this opinion, we considered possible effects of the proposed action that included estimates for occasional incidental capture and serious injury or mortality of Mexico DPS humpback whales associated with entanglements in PCGF sablefish pot gear occurring each year in the future. We concluded that the bycatch of Mexico DPS humpback whales in PCFG trawl gear in the future was extremely unlikely. We concluded that impacts to Mexico DPS humpback whales from collisions with PCGF fishing vessels or exposure to any pollution or marine debris generated by the PCGF were unlikely to materialize. We also concluded that the impacts of prey removal by the PCGF on Mexico DPS humpback whales in the future would be insignificant.

From the *Environmental Baseline* and the most plausible scenario for population level impacts from the *Effects of the Action* sections, we expect the Mexico DPS to experience an average annual M/SI of 15.68 humpback whales (Table 13). For the Mexico DPS of humpback whales, which we estimate to be approximately 6,724 whales given a 6 percent increase over the last 15 years, we expect the annual impact to the DPS to be no more than 0.23 percent of abundance. We also estimate that the maximum five-year running average for the PCGF would be no more than 1.44 humpback whales from the Mexico DPS.

Although we recognize that the baseline impacts from human activities may be underestimated to some degree, the level of population impacts from the PCGF fishery represent a small fraction (~10%) of the M/SI of Mexico DPS humpback whales that are estimated to occur (Table 13). In actuality, the PCGF likely will account for an even smaller fraction of the true total amount of human caused mortality of the Mexico DPS population that will occur in the future. Given the current trajectory of Mexico DPS humpback whales, it does not appear that current levels of impact from the PCGF fishery, in addition to the current levels of other impacts that are anticipated to continue to occur, is likely to prohibit continued population growth toward recovery by the Mexico DPS of humpback whales.

While we recognize the threat of climate change for Mexico DPS humpback whales is uncertain and likely not a major risk factor, we also recognize that shifts in prey distribution and abundance resulting from climate change and other variable environmental conditions may lead to corresponding shifts in humpback whale distribution. As a result, humpback whales may shift their distribution to access prey and may therefore increase the risk to the PCGF, as well as other threats described in the *Environmental Baseline* section. While we are not explicitly able to estimate the magnitude of changes that may occur and how that will translate into future threats faced by Mexico DPS humpback whales throughout their range, we can generally assume that significant changes in the level of impacts from bycatch in the PCFG and other baseline threats overall would be necessary to appreciably reduce the likelihood of survival and recovery of the Mexico DPS based on the available information and assessment of what is occurring now.

Table 13. Estimated Annual M/SI for the Mexico DPS of humpback whales from current human-caused impacts (Environmental Baseline) plus the PCGF impacts analyzed in this opinion (Table 12).

Source of take	M/SI
Environmental Baseline average annual impact (Section 2.4.1)	13.63
PCGF – One-year maximum (Section 2.5.5)	2.05
PCGF – Maximum five-year running average (Section 2.5.5)	1.44
Total Annual Impact to DPS (one-year maximum plus the baseline)	**15.68**

2.7.2 Central America DPS Humpback Whales

In this opinion, we considered possible effects of the proposed action that included estimates for occasional incidental capture and serious injury or mortality of Central America DPS humpback whales associated with entanglements in PCGF sablefish pot gear occurring each year in the future. We concluded that the bycatch of Central America DPS humpback whales in PCFG trawl gear in the future was extremely unlikely. We concluded that impacts to Central America DPS humpback whales from collisions with PCGF fishing vessels or exposure to any pollution or marine debris generated by the PCGF were unlikely to materialize. We also concluded that the impacts of prey removal by the PCGF on Central America DPS humpback whales in the future would be insignificant.

From the *Environmental Baseline* and the most plausible scenario for population level impacts from the *Effects of the Action* sections, we expect the Central America DPS to experience an average M/SI of 10 humpback whales (Table 14). For Central America DPS of humpback whales, which we estimate to be approximately 1,876 whales given a 6 percent increase over the last 15 years, we expect there to be a maximum impact to the DPS of 0.53 percent of abundance. We also estimate that the maximum five-year running average for the PCGF would be no more than 0.90 humpback whales from the Central America DPS.

Although we recognize that the baseline impacts from human activities may be underestimated to some degree, the level of population impacts from the PCGF fishery represent a small fraction (~10%) of the M/SI of Central America DPS humpback whales that are estimated to occur (Table 14). In actuality, the PCGF likely will account for an even smaller fraction of the true total amount of human caused mortality of the Central America DPS population that will occur in the future. Given the current trajectory of Central America DPS humpback whales, it does not appear that current levels of impact from the PCGF fishery, in addition to the current levels of other impacts that are anticipated to continue to occur, is likely to prohibit continued population growth toward recovery by the Central America DPS of humpback whales.

While we recognize the threat of climate change for Central America DPS humpback whales is uncertain and likely not a major risk factor, we also recognize that shifts in prey distribution and abundance resulting from climate change and other variable environmental conditions may lead to corresponding shifts in humpback whale distribution. As a result, humpback whales may shift their distribution to access prey and may therefore increase the risk to the PCGF, as well as other threats described in the *Environmental Baseline* section. While we are not explicitly able to estimate the magnitude of changes that may occur and how that will translate into future threats faced by Central America DPS humpback whales throughout their range, we can generally assume that significant changes in the level of impacts from bycatch in the PCFG and other baseline threats overall would be necessary to appreciably reduce the likelihood of survival and recovery of the Central America DPS based on the available information and assessment of what is occurring now.

Table 14. Annual M/SI for the Central America DPS of humpback whales from current human-caused impacts (Environmental Baseline) plus the PCGF impacts analyzed in this opinion (Table 12).

Source of take	Total Annual M/SI
Environmental Baseline average annual impact (Section 2.4.2)	8.72
PCGF – One-year maximum (Section 2.5.5)	1.28
PCGF – Maximum five-year running average (Section 2.5.5)	0.90
Total Annual Impact to DPS (one-year maximum plus the baseline)	**10.00**

In summation the effects of the action (Section 2.5) when added to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species (Section 2.2), would have a small effect on the abundance for both DPSs (and therefore a similar effect on reproduction/productivity), but little to no effect on spatial structure or diversity.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of either the Mexico DPS or the Central America DPS of humpback whale.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). “Incidental take” is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

The incidental take authorization and the RPMs and Terms and Conditions in the ITS are not in effect for any component of the non-tribal sablefish pot fishery at this time because the incidental take of humpback whales has not been authorized under section 101(a)(5)(E) of the Marine Mammal Protection Act (MMPA) (see 16 U.S.C. 1536(b)(4)(C)). Following issuance of such authorization, the incidental take authorization and the RPMs and Terms and Conditions in the ITS take effect and become fully operative. NMFS is actively pursuing an authorization under section 101(a)(5)(E) and anticipates a proposed authorization may be available in late 2020 or early 2021. Once in effect, the ITS is subject to the continued authorization of the incidental take under MMPA Section 101(a)(5)(E). NMFS may revise the ITS based on future MMPA incidental take authorizations.

2.9.1. Amount or Extent of Take

In the opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

We anticipate that take of humpback whales would occur through entanglement with fishing gear as a result of the proposed continued operation of the PCGF, specifically with sablefish pot fishing gear. The expected bycatch of humpback whales in the PCGF that we anticipate is described as:

Mexico DPS

- Annual upper estimated amount = no more than 3
- 5-year running average limit = no more than 1.44

Central America DPS

- Annual upper estimated amount = no more than 2
- 5-year running average limit = no more than 0.90

In the *Effects of the Action* section (Section 2.5), we estimated that the number of entanglements that may occur within any one year could be as high as 2.23 humpback whales from the Mexico DPS and 1.39 humpback whales from the Central America DPS. We also anticipate a maximum 5-year running average of 1.57 Mexico DPS and 0.98 Central America DPS humpback whales.

In the *Effects of the Action* (Section 2.5) we also concluded that there is a 92% probability of mortality and serious injury associated with each entanglement event. If we apply the mortality and serious injury rate of 92% to the estimated number of entanglements described above, we would expect that the number of individuals killed or seriously injured as a result of entanglement with sablefish pot gear within any one year could be as high as 3 (2.05 rounded up) Mexico DPS and 2 (1.28 rounded up) Central America DPS humpback whales. We also anticipate that the maximum 5-year running average of the number of the individuals killed or seriously injured could be 1.44 Mexico DPS and 0.90 Central America DPS humpback whales.

Our expectation is that information on the amount and extent of humpback whales incidentally taken in the PCGF will come primarily from the bycatch estimates produced by the NWFSC and Endangered Species Workgroup. Secondarily, opportunistic reports of humpback whale entanglements reported to the NMFS WCR Marine Mammal Stranding Program will be available to help ground truth these estimates, especially as a potential indicator of obvious discordance between estimated and known actual incidents of bycatch. From either source, information on the respective humpback whale DPS that may be associated with any or all humpback whale bycatch in the PCGF may not be available. As a result, we expect to rely primarily upon the number of all humpback whales that are reported entangled (estimated or observed) and subsequently killed or seriously injured as a result to represent a surrogate for the numbers of humpback whales that may be associated with each respective ESA-listed DPS. Using this information, if more than 5 humpback whales are observed or estimated to have been incidentally captured in the PCGF in any one year, or if the 5-year running average of humpback whale bycatch exceeds 2.34 per year, then we would conclude that the incidental take of ESA-listed Mexico DPS and/or Central America DPS humpback whales would have been exceeded.

2.9.2. Effect of the Take

In the opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The reasonable and prudent measures (RPMs) included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of listed cetacean species resulting from the proposed action.

The RPMs, and their associated terms and conditions, set forth in the incidental take statement of the 2012 Opinion (NMFS 2012) remain appropriate and in effect, with the exception of those written for humpback whales. The RPM specific to humpback whales and the associated terms and conditions are no longer in effect and are superceded by the RPM and associated terms and conditions set forth in this opinion.

(1) NMFS shall monitor the PCGF to ensure compliance with the regulatory and conservation measures included in the proposed action and the identified amount or

extent of incidental take, including collection and evaluation of data on the capture, injury, and mortality of humpback whales.

2.9.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and the National Marine Fisheries Service must comply with them in order to implement the RPMs (50 CFR 402.14). The National Marine Fisheries Service has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

The following terms and conditions implement reasonable and prudent measure 1:

(1) NMFS SFD, in cooperation with the PFMC and NMFS PRD as necessary, shall investigate the methods and feasibility associated with implementing additional pot gear marking regulations for the PCGF. The feasibility study shall consider whether additional gear marking would increase NMFS' ability to attribute humpback whale entanglements to specific fisheries and assist in identifying potential modifications to the pot gear regulations that could reduce incidental take of humpback whales. The feasibility study shall be completed by March 2023 and the findings given consideration by the PFMC for potential changes to the pot gear marking regulations by March 2024. Completion dates may be revised by mutual agreement by NMFS SFD, PFMC, and NMFS PRD. The following methods shall be evaluated, as well as any other potential methods identified by NMFS SFD, the PFMC, or NMFS PRD as part of the investigation process:

   a. Line marking - as an example, proposed Washington Department of Fish and Wildlife Dungeness crab regulations (October 2, 2019).[9]

   b. Additional markings on buoys/surface gear – as an example, California Department of Fish and Wildlife Commercial Trap Gear marking regulations.[10]

(2) NMFS SFD, in cooperation with the PFMC and NMFS PRD, shall review the Terms of Reference for the Groundfish Endangered Species Workgroup. NMFS SFD, PRD, and the PFMC will review the priority of needs associated with incidental humpback whale bycatch in the PCGF and provide any recommendations to the Workgroup. The review shall be completed by March 2021, or some other mutually agreeable date.

(3) NMFS SFD, in coordination with the NWFSC WCGOP, shall ensure observer coverage in the PCGF's fixed gear fishery maintains the capability to provide scientifically defensible humpback whale bycatch estimates across all sectors to confirm that the take exemption for the proposed action is not exceeded. When feasible, NMFS SFD should consider observer deployment options to reduce uncertainty in humpback whale bycatch estimates and increase the understanding of the fishery dynamics in the fixed gear fishery.

(4) NMFS SFD, in cooperation with the PFMC and NMFS PRD as necessary, shall review and consider measures for maximizing the utility and benefit of EM with respect to

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[9] https://www.psmfc.org/crab/2019%20-2020%20files/letter%20to%20license%20holders_Oct%202%202019%20FINAL.pdf
[10] https://wildlife.ca.gov/Notices/Regulations/Marking

gathering information from any future bycatch events of humpback whales. NMFS SFD shall complete this review and make a report of the findings available to PFMC and NMFS PRD by March 2023. Completion dates may be revised by mutual agreement by NMFS SFD, PFMC, and NMFS PRD. Factors that could be considered include, but are not limited to, the following:

a. Placement of EM technology.

b. Review protocols, including the amount of review and extent of analysis to be provided.

c. Options for supplemental documentation and data collection.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or regarding the development of information (50 CFR 402.02).

Conservation recommendations included in the 2012 Opinion (NMFS 2012) and 2018 eulachon reinitiation biological opinion (NMFS 2018) remain in effect for all species, with the exception of humpback whales. The following conservation recommendations replace those for humpback whales in the 2012 Opinion. Implementing these updated recommendations would provide information for future considerations of how to reduce the effects of the PCGF on Central America DPS and Mexico DPS humpback whales.

(1) Scientific tools and frameworks: To reduce real-time geographic overlap of whales and the PCGF pot fishery, which increases the entanglement risk of Central America DPS and Mexico DPS of humpback whales, NMFS should encourage the exploration and implementation of new and existing scientific tools and frameworks in coordination with the PFMC, including consideration of using:

a. Near-real time environmental data streams to predict whale concentrations (e.g., Forney et al. in prep, Abrahms et al. 2019) and forage conditions (e.g., Santora et al. 2020).

b. Environmental data to predict patterns of fishing effort.

c. Observational/survey data and other tools to identify spatial/temporal areas of concern to avoid in a dynamic management approach.

(2) Gear modifications: To reduce the severity and frequency of Central America DPS and Mexico DPS humpback whale entanglements with groundfish pot gear, NMFS should encourage the development and testing of gear modifications in coordination with the PFMC as necessary, including but not limited to:

a. Weak links – as an example, see NOAA Fisheries Atlantic Large Whale Take Reduction Plan – Supplement B: Weak Links & Anchoring Techniques.[11]

b. Reduction of the maximum breaking strength of ropes used in the sablefish pot fishery – similar to a recent study conducted on the U.S. East Coast (Knowlton et al. 2016).[12]

c. Pop-up/on demand gear retrieval innovation.

(3) Logbook requirements: To improve bycatch estimates for Central America DPS and Mexico DPS humpback whales and better understand the distribution of fishing effort, NMFS should complete ongoing efforts to implement a coast-wide Federal fixed gear logbook requirement for all fixed gear sectors, including pot gear. As part of this effort, NMFS should consider implementation of automated/electronic logbook reporting system that can provide comprehensive fishery effort information at fine spatial scales that could readily feed into other available data streams on whale distributions and forage conditions allowing for more rapid assessment of fishing dynamics and potential entanglement risks of the PGGF fixed gear fisheries than current approaches allow.

(4) To better understand fishery gear configurations and how they might contribute to the likelihood of Central America DPS and Mexico DPS humpback whale entanglements and the severity of those encounters (likelihood of mortality), NMFS should consider any needs to collect information on gear configuration and characteristics in the sablefish fishery as part of their ongoing effort to catalog and understand the characteristics of all West Coast fixed gear fisheries relative to entanglement risk and/or reported entanglements. Based on this review, NMFS should track gear configuration characteristics through the logbook and/or WCGOP. This information could result in the development of innovative gear that reduces the frequency and severity of WCGF encounters with humpback whales.

(5) NMFS, in concert with the PFMC, should further investigate the potential for interactions between whales and trawl gear, including review of the underlying circumstances associated with the recent events documented in the Pacific whiting trawl fishery documented in this biological opinion. In addition to assessment of the risks of interactions, measures and/or data collection protocols should be developed by NMFS to help increase the capabilities to make determinations regarding the underlying circumstances of any future events where dead whales are encountered in trawl nets in the PCGF.

2.11. Reinitiation of Consultation

This concludes formal consultation for the *Continuing Operation of the Pacific Coast Groundfish Fishery (Reinitiation 2020) – Humpback whale (Megaptera novaeangliae)*.

[11] https://www.fisheries.noaa.gov/webdam/download/94698533
[12] June 2019 Groundfish Endangered Species Workgroup recommendation

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12. "Not Likely to Adversely Affect" Determinations

The opinion also examines the condition of proposed critical habitat throughout the designated area, evaluates the conservation value of the coastal and marine environments that make up the designated area, and discusses the function of the physical and biological features (PBFs) that are essential for the conservation of the species.

Section 2.2.3 above describes the critical habitat proposed for the endangered Central America DPS and threatened Mexico DPS of humpback whales (84 FR 54354; October 9, 2019), as well as the status of that habitat. As previously stated, there is only one PBF essential to the conservation of ESA-listed humpback whales: prey.

Section 2.4.1 above describes the existing environmental baseline of proposed critical habitat for the endangered Central America DPS and threatened Mexico DPS of humpback whales (84 FR 54354; October 9, 2019). There is also a discussion of the baseline below.

Furthermore, Section 2.5 above describes what constitute the "effects of the action" under the ESA. In this section, we will evaluate all the consequences to the proposed critical habitat caused by the proposed action, including the consequences of other activities caused by the proposed action. As a reminder, in our analysis we consider 50 CFR 402.17(a) and (b). When evaluating whether the proposed action is not likely to adversely affect proposed critical habitat, NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Effects are considered discountable if they are extremely unlikely to occur.

2.12.1 Effects of the Proposed Action on the Proposed Critical Habitat for Humpback Whales

From 2009-2018, over 450 marine species have been caught in the PCGF according to WCGOP data. Of those species, 216 species were caught in excess of one metric ton during that period. Other than euphausiids, a primary prey species for humpbacks, Pacific sardines and Pacific herring are targeted by humpback whales and have been documented as bycatch in the Pacific groundfish fisheries. Northern anchovies were caught in amounts totaling less than one metric ton), which are not considered substantial levels; herein.

As summarized in the Status of the Species' Proposed Critical Habitat section (Section 2.2.3), humpbacks are generalists, targeting a variety of prey while foraging but also switching between prey depending on what is most abundant or of highest quality in the system. Unlike most baleen whales, which forage primarily on euphausiids (krill), humpbacks will shift trophic levels, depending on the oceanographic conditions. These shifts are between krill and small schooling fish (primarily anchovies and sardines).

Scientists estimate that large baleen whales consume around 3-4 percent of their body weight per day. Since a large humpback whale may weigh 40 tons, during a normal day in the summer feeding season, one whale may consume between 1-1.5 tons (0.9-1.4 metric tons) of food per day (Clapham and Baxter 2013). Given that humpback whales generally feed off the U.S. West Coast from April through November (~8 months), one humpback whale can eat up to 240 tons (218 metric tons) of food (including euphausiids and small schooling fish) during the foraging season.

Along the U.S. West Coast, Calambokidis et al. (2015) identified seven Biologically Important Areas (BIAs) for humpback whales, among other marine mammal species. The BIAs for humpback whales were based on high concentration areas of feeding animals observed from small boat surveys, ship surveys, and opportunistic sources. These BIAs compare favorably to broader habitat-based density models. While the BIAs represent only 3 percent of waters within the U.S. EEZ, they encompass nearly 90 percent of the sightings. Six of the BIAs are located off Oregon and Washington, including: (1) Stonewall and Heceta Bank (May-November); (2) Point St. George (July-November); (3) Fort Bragg to Point Arena (July-November); (4) Gulf of the Farallones-Monterey Bay (July-November); (5) Morro Bay to Point Sal (April-November); and (6) Santa Barbara Channel-San Miguel Island (March-September). The majority of the humpback whale BIAs are located in waters shallower than 400 meters, which still encompasses the action area, particularly the pot/trap fisheries.

Within the action area, which includes the California Current Extension, humpbacks have been documented feeding on both fish and euphausiids, with information dating back to whaling ship logbooks from the 1920s (the majority of humpback whale stomachs contained primarily sardines and "shrimp" (presumed to be euphausiids) (Clapham et al. 1997). In the late 1950s and early 1960s, an examination of nearly 150 humpback whale stomachs found that over 60 percent of the stomachs contained anchovies and 36 percent contained euphausiids (Rice 1963). Data from this study showed a distinct shift in small schooling fish targeted by humpbacks when one of the fish species biomass was very low (e.g., sardines in the 1950s and 1960s).

During 1993-2012, Fleming et al. (2016) collected 259 skin samples from whales throughout the California Current Extension (between 34°N and 42°N latitude) and used stable isotope analysis to evaluate the relative contribution of euphausiids versus fish to the diet. Shifts in stable isotope signatures over the 20-year period corresponded to shifts in relative prey abundance (krill versus anchovy and sardine) and changing oceanographic conditions within the California Current Extension. Fleming *et al.* (2016) demonstrated that krill dominated humpback whale diet during positive phases of the North Pacific Gyre Oscillation (NPGO), with cool sea surface temperature, strong upwelling, and high krill biomass. Conversely, schooling fish dominated humpback whale diet during years characterized by negative NPGO shifts, delayed seasonal upwelling, and warmer temperatures. These results suggest that the dominant prey in humpback whale diet switched from krill to fish, and back to krill during the 20-year period, depending on the relative abundance of each prey. Based on previously published isotope values, the authors found that anchovy and sardine values were similar to isotope signatures in humpback whale samples in fish-dominant years and carbon values were correlated with anchovy abundance, suggesting whales were consuming these fish species.

The WCGOP has not documented any bycatch of euphausiids in the PCGF, which might inform if humpbacks are targeting this prey species during particular oceanographic conditions or shifts in Pacific Decadal Oscillations that favor euphausiids. In March 2006, the CPS FMP was amended to prohibit harvest of all species of krill in the U.S. EEZ. While not specific to humpback whales, that amendment was passed to prevent the development of a commercial fishery that could deplete krill stocks and thereby impact many other predators in the ecosystem. Similarly, commercial fisheries are prohibited from developing new fisheries other currently unfished and non-managed forage fish off the U.S. West Coast, including sand lance and smelt). Therefore, during years favorable to small schooling fish, the PCGF (primarily trawl) may take prey species targeted by humpbacks as bycatch.

In order to analyze the effects of the proposed action on proposed critical habitat adequately, we reviewed the Groundfish Expanded Mortality Multi-year (GEMM) data product, which includes expanded estimations by fishery sector of all observed species, except protected fish, marine mammals, sea birds, and sea turtles. This included a review of any bycatch of sardines, northern anchovies, and Pacific herring, since they are the primary target species of humpback whales, particularly when their other primary forage, euphausiids, are not available in sufficient quantity during particular years.

Based on information from the GEMM database from 2002-2018, several sectors in the PCGF caught sardines as bycatch: Tribal shoreside fishery, limited-entry trawl, CS bottom trawl, mid-water rockfish trawl, mid-water hake trawl, at-sea hake catcher-processor, and shoreside hake. Most sectors caught 1 to 9 metric tons of sardines per year with a maximum total of 1 to 2 metric tons per year. However, the tribal shoreside fishery caught the majority of sardines. Between 2012 and 2016, the tribal shoreside fishery caught as bycatch between 85 (2016) and 1,128 (2012) metric tons of sardines with an average of approximately 500 metric tons per year. As mentioned in the description of the proposed action, the Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) possess treaty rights to harvest Federally-managed groundfish in their U&As. In addition, the Quinault Range, owned and operated by the Department of Defense, is proposed to be excluded from critical habitat for both the Central America DPS and Mexico DPS, which overlaps with the northern Washington BIA (May-November) identified in Calambokidis et al. (2015, Figure 4.5). As mentioned in the status section, a small proportion of humpbacks are estimated to feed off the coast of Washington and southern BC, with the majority of animals migrating to forage off SBC (Calambokidis and Barlow 2020). Furthermore, the number of humpback whales foraging off the U.S. West Coast are increasing 6-7 percent per year (Carretta et al. 2020). Assuming each whale is consuming between 1 and 1.5 tons (0.9 and 1.4 metric tons) of fish per day, a typical whale would need at least 210 tons (190 metric tons) of food during the season and assuming it is feeding daily during the 7 months off the coast of Washington (May-November).

Based on information from the GEMM database from 2002-2018, most PCGF sectors caught northern anchovy as bycatch in very low numbers (0.01 to 0.1 metric tons per year). In 2016, the tribal shoreside fishery caught 112 metric tons of northern anchovy, while in other years, northern anchovies comprised zero of the discarded fish. Overall, the PCGF has very low, if any, bycatch of northern anchovies.

Based on information from the GEMM database from 2002-2018, most PCGF sectors caught Pacific herring as bycatch in low numbers (1-70 metric tons per year). The most Pacific herring caught in a fishery in one year was 69 metric tons in the midwater hake fishery. However, on average, Pacific herring bycatch was around 20 metric tons per year. As described above, when feeding on small schooling fish off the U.S. West Coast, humpbacks primarily target sardines and anchovies and favor feeding on Pacific herring in Alaskan waters, where this fish species are more plentiful. In addition, the CA/OR/WA stock of humpback whales are increasing at a rate of approximately 6-7 percent per year, indicating that they are not compromised by a lack of prey availability.

As summarized in Section 2.2.3, organic pollutants, including petroleum products (or oil spills) that may be utilized by fishing vessels in the PCGF during their operations, may have the potential to directly impact the prey that humpbacks rely on, killing organisms, reduce their fitness through sub-lethal effects, and potentially disrupt the structure and function of marine communities and ecosystems. Given the continual and dispersed movement of vessels within the action area, we do not anticipate that effects to prey life stages by the release of petroleum into the marine environment to cause acute or chronic exposure to these organisms comprising the pelagic ecosystem, particularly since the prey are mobile.

In summary, (1) the bycatch of humpback whale prey species by the PCGF is limited in amount, (2) humpbacks can switch to other schooling fish or euphausiids (when available) and feed in areas other than the U&As, (3) and the CA/OR/WA stock of humpbacks is increasing approximately 6-7 percent per year. Consequently, we expect that the removal of humpback prey by the PCGF, considered in the context of the existing baseline, would be insignificant. As summarized in Section 2.6, we do not anticipate that the effects of pollution through use of petroleum or minor oil spills to adversely affect the prey resources targeted by humpback whales and proposed as a physical and biological feature for critical habitat within the action area. Based on this analysis, NMFS finds that the proposed action is not likely to adversely affect critical habitat proposed for the Central America DPS and Mexico DPS of humpback whales

3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

3.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the National Marine Fisheries Service. Other interested users could include others interested in the conservation of the affected ESUs/DPS. Individual copies of this opinion were provided to the National Marine Fisheries Service. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

3.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

3.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

4. REFERENCES

4.1 Federal Register Notices

June 2, 1970 (35 FR 8491). Final Rule: Conservation of Endangered Species and Other Fish and Wildlife.

December 2, 1970 (35 FR 18319). Final Rule: Conservation of Endangered Species and Other Fish and Wildlife – List of Endangered Foreign Fish and Wildlife.

May 11, 2006 (72 FR 27408). Final Rule: Magnuson-Stevens Act Provisions; Fisheries off West Coast States; Pacific Coast Groundfish Fishery.

September 8, 2016 (81 FR 62259). Final Rule: Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (Megaptera novaeangliae) and Revision of Species-Wide Listing.

December 3, 2018 (83 FR 62269). Final Rule: Magnuson-Stevens Act Provisions; Fisheries Off West Coast States; Pacific Coast Groundfish Fishery; Groundfish Bottom Trawl and Midwater Trawl Gear in the Trawl Rationalization Program.

November 19, 2019 (84 FR 63966). Final Rule: Magnuson-Stevens Act Provisions; Fisheries Off West Coast States; Pacific Coast Groundfish Fishery; Pacific Fishery Management Plan; Amendment 28

August 27, 2019 (84 FR 44977). Final Rule: Endangered and Threatened Wildlife and Plants; Regulations for Interagency Cooperation.

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4.2 Literature Cited

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