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BOEM 2024-054

Socioeconomic Characterization of West Coast Fisheries in Relation to Offshore Wind Energy Development

U.S. Department of the Interior
Bureau of Ocean Energy Management
Pacific Regional Office, Camarillo, CA

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DISCLAIMER

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ABOUT THE COVER

Jack mackerel schooling around Ship Rock, Catalina Island, California. Source: NOAA Fisheries West Coast 2015 Photo Contest: Habitat. Photo credit: Adam Obaza, NOAA Fisheries West Coast Region, Protected Resources Division. Used under Creative Commons license, CC BY-NC-ND 2.0, https://creativecommons.org/licenses/by-nc-nd/2.0/. https://toolkit.climate.gov/image/1659.

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List of Abbreviations and Acronyms

BOEM	Bureau of Ocean Energy Management
CCE	California Current Ecosystem
CCFEP	California Current Fishery Ecosystem Plan
CDFW	California Department of Fish and Wildlife
CPS	Coastal Pelagic Species
CRITFC	Columbia River Inter-Tribal Fish Commission
DTL	Daily-trip-limit
DTS	Dover sole-thornyhead-sablefish complex
EFH	Essential Fish Habitat
ESA	Endangered Species Act
EEZ	Exclusive Economic Zone
FIS	Fishery Impact Statement
FMP	Fishery Management Plan
HMS	Highly Migratory Species
IFQ	Individual Fishing Quota
IOPAC	Input-output model for Pacific Coast fisheries
IPHC	International Pacific Halibut Commission
MSA	Magnuson-Stevens Act Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWFSC	NMFS Northwest Fisheries Science Center
NWIFC	Northwest Indian Fisheries Commission
OCS	Outer continental shelf
ODFW	Oregon Department of Fish and Wildlife
OWE	Offshore wind energy
PacFIN	Pacific Fisheries Information Network
PSC	Pacific Salmon Commission
PFMC	Pacific Fishery Management Council
PSMFC	Pacific States Marine Fisheries Commission
RecFIN	Recreational Fisheries Information Network
RFA	Regulatory Flexibility Act
RFAA	Regulatory Flexibility Act Analysis
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SIA	Social impact assessment
SWFSC	NMFS Southwest Fisheries Science Center
WDFW	Washington Department of Fish and Wildlife

1 Introduction

The Bureau of Ocean Energy Management (BOEM) is charged with planning, siting, and authorizing offshore wind energy (OWE) development on the outer continental shelf (OCS).[1] [2] The BOEM Pacific Region (BOEM Pacific) carries out this process offshore of the continental U.S. West Coast, i.e., off the coasts of California, Oregon, and Washington.[3] Along the West Coast, ocean areas that have been selected for and/or are under consideration for OWE development have or are likely to overlap with areas long used by commercial, tribal, and recreational fisheries. Therefore, West Coast fisheries and fishing communities may be impacted by OWE development activities, including site characterization surveys, construction, operation, and decommissioning of OWE facilities. This report aims to provide a general overview of West Coast fisheries and fisheries information relevant to consider in assessing such impacts drawn from experiences and methods used in federal fisheries management.

1.1 Considering Fisheries in the OWE Development Process

BOEM's process for planning, siting, and authorizing OWE development involves a variety of required analyses to inform its decision-making and comply with applicable laws. Throughout this process BOEM engages with other federal agencies, states, tribes, local governments, and stakeholders.

BOEM Pacific has engaged with West Coast fisheries participants and fishing communities in this process to invite their feedback and comments on BOEM's proposed actions, such as draft Wind Energy Areas (WEAs) and draft analyses conducted under the National Environmental Policy Act (NEPA). Through this engagement, West Coast fishing communities have expressed concerns about the fisheries information (e.g., sectors included, data, and methods) used by BOEM in their analyses to assess OWE impacts to fisheries.

1.2 Report Goals

This report, provided to BOEM by the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS or NOAA Fisheries), describes West Coast commercial and recreational fisheries and fisheries information pertinent to consider in the OWE development process. The goals of this report are to:

- provide an overview of West Coast[4] fisheries and fishing communities, including supportive industries (primary and secondary/ancillary markets), fishing-related infrastructure, fishing sector interconnections, and potential connections between fishing sectors and OWE development,
- overview relevant sources of fisheries socioeconomic information available for West Coast fisheries,
- provide relevant examples of fisheries socioeconomic methods routinely used by NMFS in analyzing potential impacts to fisheries participants and communities of proposed fisheries management actions as well as to assess impacts from other drivers, such as changes in fish stock abundance, market forces, and climate variability, etc.

[1] The Outer Continental Shelf Lands Act defines the OCS as all submerged lands lying seaward of state coastal waters (3 miles offshore) which are under U.S. jurisdiction.

[2] https://www.boem.gov/renewable-energy/renewable-energy-program-overview

[3] BOEM Pacific also oversees OWE off the coast of Hawaii. https://www.boem.gov/regions/pacific-ocs-region

[4] This report is focused on West Coast fisheries (i.e., off the coasts of CA, OR, and WA) and does not include fisheries off Hawaii. BOEM is conducting separate studies focusing on Hawaii's fishing community.

BOEM may consider the resources and examples provided in this report in its engagement with fisheries participants and in preparing its various analyses of OWE impacts on West Coast fisheries.

This report is focused primarily on commercial and recreational fisheries in federal waters where the turbine infrastructure for OWE development is expected. A brief overview of tribal fisheries focused primarily on the legal and general management context is included; however, individual tribes should be engaged directly about their tribal fisheries and potential impacts from OWE. BOEM has provided funding for some tribal nations to develop tribal cultural landscape assessments (as defined by tribes) near West Coast offshore wind energy planning areas, including the coast and offshore.[5]

The report is organized into three main sections structured according to the report goals:

- Section 2 - Overview of West Coast Fisheries
- Section 3 - Fisheries Socioeconomic Data
- Section 4 - Fisheries Socioeconomic Impact Assessment and Methods

1.3 About NMFS

NMFS, also known as NOAA Fisheries, is responsible for the stewardship of the nation's living marine resources and their habitat. NMFS is charged with managing sustainable fisheries, recovery and conservation of protected resources (such as marine mammals and sea turtles), and healthy ecosystems using sound science and an ecosystem-based approach to management.

NMFS has unique knowledge and expertise about the nation's fisheries and fisheries socioeconomic impact assessment due to its mission and statutory mandates. NMFS is the lead agency for federal commercial and recreational fisheries management in the U.S. Exclusive Economic Zone (EEZ)[6] under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act or MSA). NMFS manages fisheries in partnership with eight regional fishery management councils established under the MSA, consistent with the United States' international obligations under various international treaties and agreements, and consistent with the Federal government's trust responsibilities and treaty obligations to American Indian and Alaska Native tribes and villages.

Fisheries provide an important source of food and recreation for the nation, thousands of jobs, and a traditional way of life and essential nutrients for many tribal nations and coastal communities. Socioeconomic impact analyses are an essential part of fisheries management under the MSA and other applicable laws to ensure fisheries continue to provide these benefits to the nation and that decisions are based on the best available scientific information. NMFS has long-standing fisheries economics and social science research programs; collects fisheries data; integrates and disseminates federal and state fisheries data; and develops and uses models to determine impacts on fisheries sectors and communities. Analyses evaluating the impacts on fisheries sectors and communities of opening or closing areas to fishing, for instance, may provide relevant examples for impact analyses expected in the OWE development process.

[5] See https://espis.boem.gov/study%20profiles/BOEM-ESP-PC-21-01.pdf.

[6] The EEZ extends from the seaward boundary of each of the coastal States, generally 3 nautical miles (nm) from shore to 200 nm from shore, except for Texas, western Florida, and Puerto Rico, which claim a 9 nm belt. https://oceanservice.noaa.gov/facts/eez.html

2 West Coast Fisheries Management

There is a long history of fishing for salmon, groundfish, coastal pelagic species (e.g., anchovy, sardine), highly migratory species (e.g., billfish, sharks, tunas), Dungeness crab, pink shrimp, and halibut off the coasts of California, Oregon, and Washington (Figure 1). A brief history of West Coast fisheries and fisheries management is provided in the California Current Fishery Ecosystem Plan (CCFEP) (PFMC 2022)[7]. The marine and nearshore ecosystems of the California Current Ecosystem (CCE) along the West Coast have been exploited at industrial levels for well over two centuries, and had supported populous Native American communities for millennia. As global fish stocks generally experienced periods of overharvest as well as declines from habitat impacts starting in the early 1900s, fisheries science and management evolved with the roots of contemporary management starting in the mid-twentieth century and an ecosystem-based management period emerging from the mid-1990s to the present.

In 2007, NMFS published profiles of 125 place-based communities along the West Coast, the majority of which participate in fisheries in waters adjacent to the southern U.S. West Coast, in the North Pacific, and in Alaska (Norman et al. 2007) (Figure 2). The profiles provide recent historical baseline information about West Coast fishing communities and fisheries participation.

[7] See https://www.pcouncil.org/documents/2022/04/pacific-coast-fishery-ecosystem-plan-march-2022.pdf/.

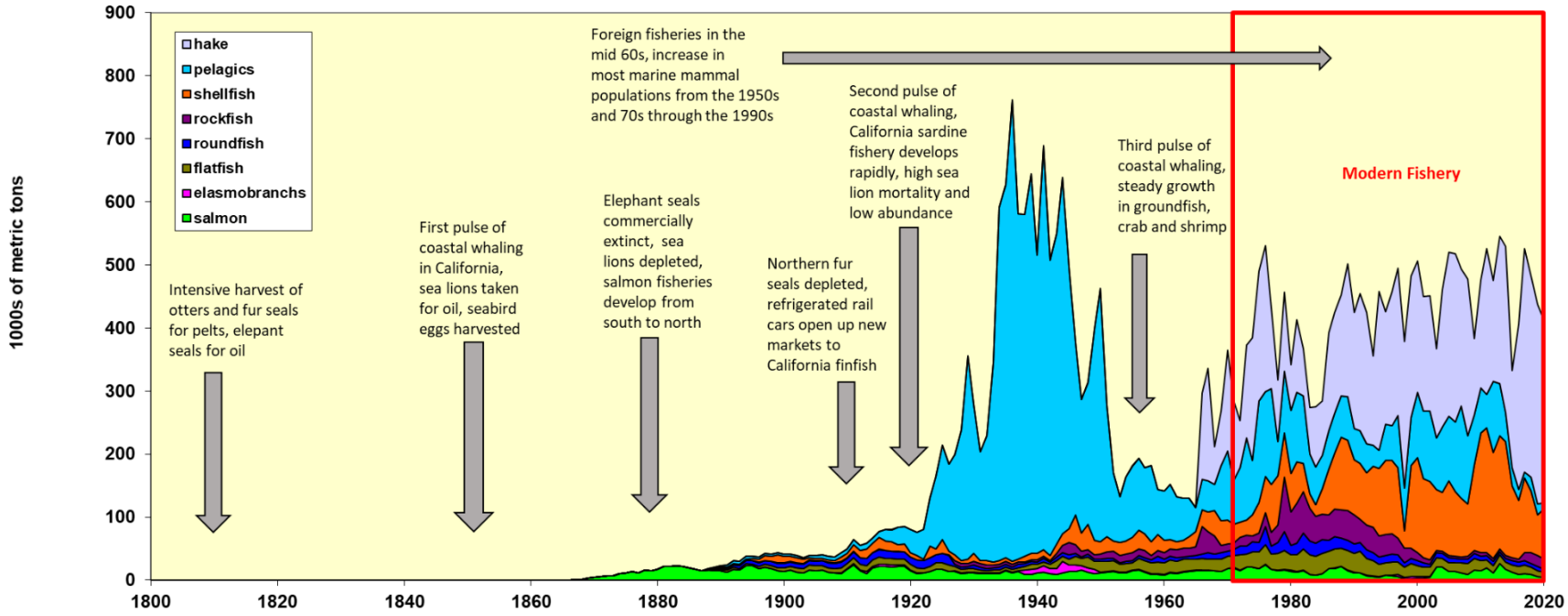


Figure 1. Major fisheries removals and developments within the U.S. portion of the California Current Ecosystem over the past two centuries

An accounting of the history of the most substantial marine resource removals over the past two centuries, illustrating both the magnitude of removals as well as the sequential nature of the development of the major fisheries in the region.

Source: Reprinted from PFMC 2022, Figure 3-7.

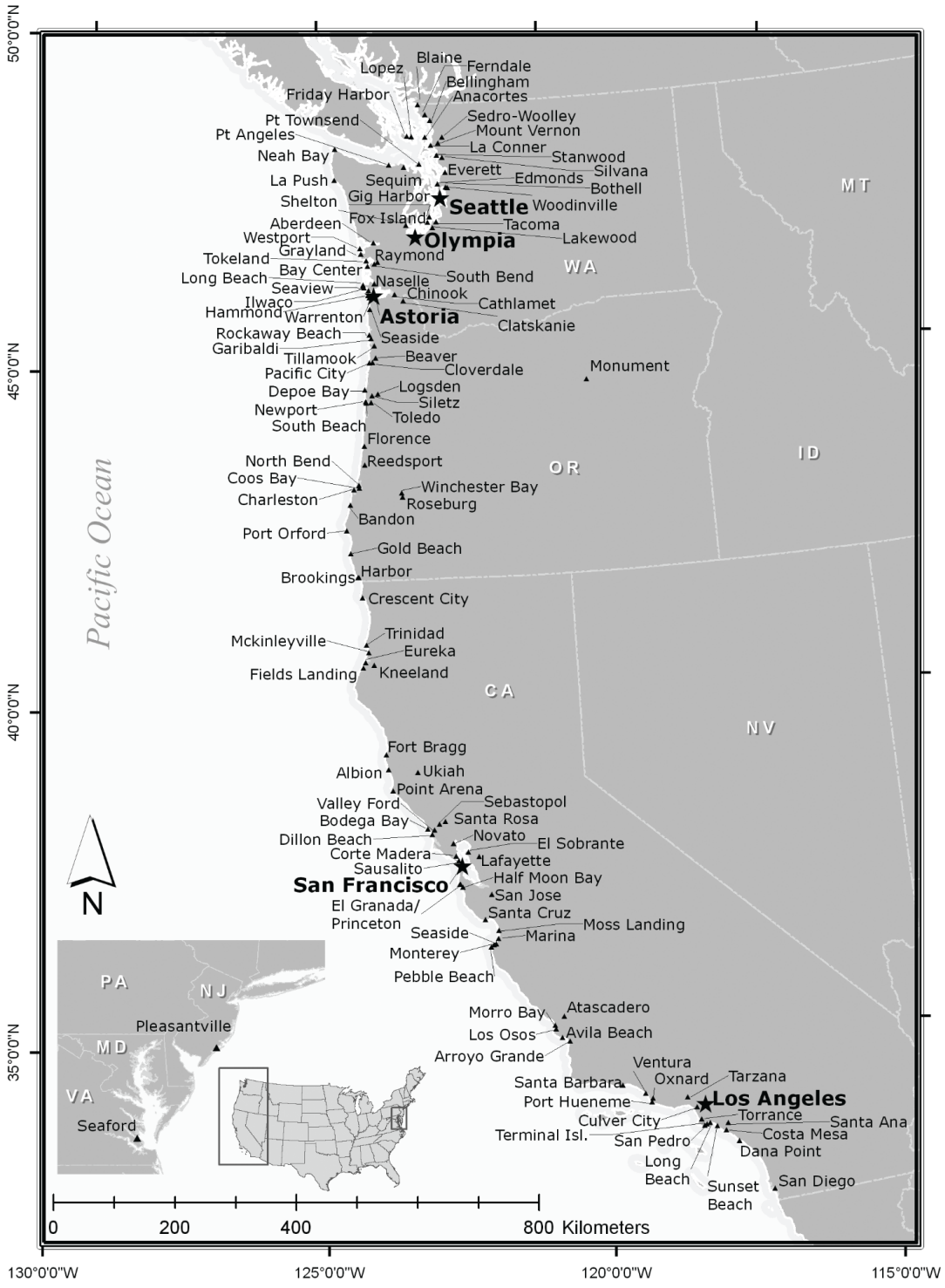


Figure 2. West Coast communities profiled by NMFS
Place-based communities along the West Coast that were profiled by NMFS, the majority of which participate in fisheries in waters adjacent to the southern U.S. West Coast, in the North Pacific, and in Alaska.
Source: Reprinted from Norman et al. 2007.

2.1 Federal Fisheries Management on the West Coast

Under the Magnuson-Stevens Act (MSA), the primary law governing marine fisheries management in U.S. federal waters (i.e., in the EEZ, 3-300 nautical miles (nm) offshore), NMFS works closely with regional fishery management councils.[8] The Councils develop and recommend management actions for review, approval, and implementation by NMFS.[9] The process is participatory and transparent, involving voting and non-voting council members representing participants in fisheries in addition to environmental, academic, and government interests.

On the West Coast, NMFS works with the Pacific Fishery Management Council (PFMC) and state and tribal co-managers (states of CA, OR, WA, and ID; and West Coast tribes (Figure 3)). Federal fisheries managers also work with the states to ensure that management of shared fish stocks is consistent. The states and tribes participate in the PFMC process and also have separate management processes linked to and informing the PFMC's work (PFMC 2022, p. 71).

The PFMC has 14 voting members and 5 non-voting members:

- Voting members
  - 1 principal representative from each state (CA, OR, WA, and ID) with fisheries management authority
  - 1 representative for NMFS West Coast Regional Office
  - 1 representative for West Coast tribes
  - 1 Obligatory Appointment from each state (CA, OR, WA, and ID)
  - At-Large Appointments
- Non-voting members
  - Pacific States Marine Fisheries Commission (PSMFC)
  - U.S. Fish and Wildlife Service
  - U.S. Coast Guard
  - State of Alaska Department of Fish and Game
  - U.S. Department of State

There are four Federal fishery management plans (FMPs) and one fishery ecosystem plan (FEP) on the West Coast[10] that have been developed and adopted by the PFMC and are implemented by NMFS:

- Pacific Groundfish
- Coastal Pelagic Species (CPS)
- Highly Migratory Species (HMS)
- Pacific Salmon
- California Current Fishery Ecosystem Plan (CCFEP)

The Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and the California Department of Fish and Wildlife (CDFW) manage fisheries in state waters (0 to 3 nm offshore).[11] State-managed fisheries include Dungeness crab, pink shrimp, shellfish (e.g.,

[8] https://www.fisheries.noaa.gov/topic/partners

[9] Under the MSA, NMFS may approve, disapprove, or partially approve a proposed Fishery Management Plan (FMP) or FMP amendment recommended by the Council.

[10] See https://www.pcouncil.org/fishery-management-plans/ and https://www.fisheries.noaa.gov/region/west-coast#fisheries.

[11] See Departments of Fish and Wildlife for Washington: https://wdfw.wa.gov/fishing/commercial, Oregon: https://dfw.state.or.us/MRP/regulations/commercial_fishing/index.asp, and California: https://wildlife.ca.gov/Fishing/Commercial.

oysters, clams), and other nearshore fisheries. In 1997 a Congressional decision gave authority to Washington, Oregon, and California to manage the Dungeness crab fishery in state and federal waters. Under the Pacific States Marine Fisheries Commission (PSMFC), the three states have developed an agreement called the Dungeness Crab Tri-State Process to consult on managing the commercial fishery.[12]

Some target fish stocks migrate outside of U.S. waters and the United States manages these shared stocks with other countries bilaterally and through various multilateral international fisheries organizations. On the West Coast, NMFS is responsible for maintaining the United States' international obligations under the following treaties and agreements, and as parties to the following commissions for salmon, tuna, halibut, and whiting (also known as hake):

- Pacific Salmon Treaty, including providing representation to the U.S. Section of the Pacific Salmon Commission (PSC);
- Inter-American Tropical Tuna Commission (IATTC), including support to the U.S. representative to the IATTC and implementation of the Tunas Conventions Act, Agreement on the International Dolphin Conservation Program (AIDCP), and the U.S.-Canada Albacore Treaty, as well as coordination with U.S. Delegations to other Pacific regional fishery management organizations and related working groups and committees (e.g., Western and Central Pacific Fisheries Commission (WCPFC) and Joint WCPFC-IATTC Working Group on Pacific Bluefin Tuna);
- Halibut Convention and Northern Pacific Halibut Act, including supporting the U.S. representative on the International Pacific Halibut Commission (IPHC); and
- Pacific Whiting Agreement, including implementing the Pacific Whiting Act and supporting the U.S. representatives on the Joint Management Committee.

Fishery -- an activity leading to harvesting of fish; typically a unit defined in terms of people involved, species or type of fish, area, fishing method, gear, class of boats, and/or purpose (NOAA 2005).

Commercial fishing refers to the whole process of catching and marketing fish and shellfish for sale (NOAA 2005).

Recreational fisheries refers to non-commercial activities of fishermen who fish for sport or pleasure, as set out in the MSA definition of recreational fishing, whether retaining (e.g., consuming, sharing) or releasing their catches, as well as the businesses and industries (e.g., the for-hire fleets, bait and tackle businesses, tournaments) which support them (NOAA 2015).

Subsistence fishing – A fishery where the fish caught are shared and consumed directly by the families and kin of the fishers rather than being sold at the next larger market (NOAA 2005).

[12] https://www.psmfc.org/program/tri-state-dungeness-crab-tsdc

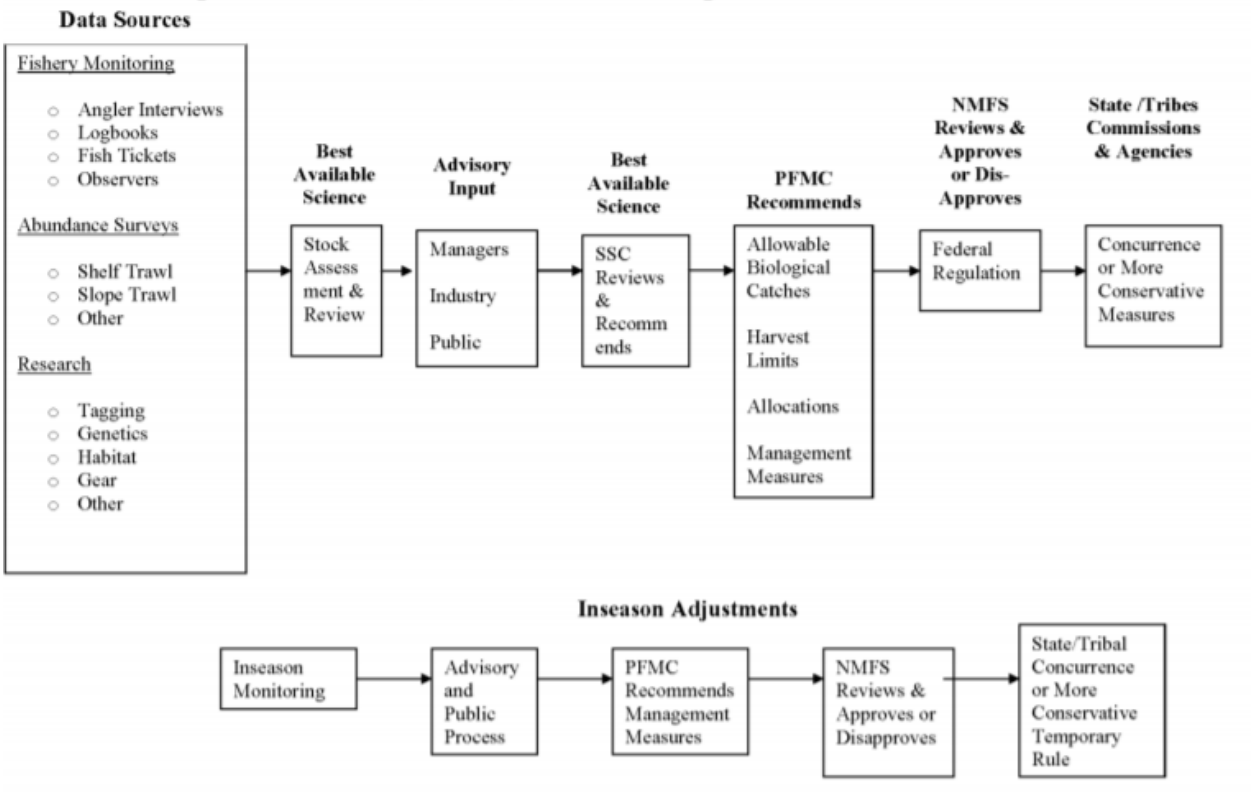


Figure 3: State/Tribal/Federal management process overview
How the states, tribal, and Federal government together collect data, organize, and implement fishery monitoring, surveys, and research.
Source: Reprinted from PFMC 2022, Figure 3-24, p. 71.

2.2 Tribal Fisheries

The United States has a unique, legally affirmed Nation-to-Nation relationship with American Indian and Alaska Native Tribal Nations, which is recognized under the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions. The United States recognizes the right of Tribal governments to self-govern and supports Tribal sovereignty and self-determination. The United States also has a unique trust relationship with and responsibility to protect and support Tribal Nations.

– Presidential Memorandum on Uniform Standards for Tribal Consultation, Nov. 30, 2022

West Coast tribes retain strong spiritual and cultural ties to marine and other aquatic species based on thousands of years of use for tribal religious/cultural ceremonies, subsistence, and commerce. Important tribal fisheries species include but are not limited to salmon, sablefish and other groundfish, halibut, whiting (hake), Dungeness crab, and lamprey.[13]

Some West Coast tribes who participate in the PFMC process have expressed concerns about OWE development, such as concerns about impacts to the exercise of tribal treaty rights and resources and the

[13] Information about tribal fisheries resources may be shared by individual tribes as they determine through consultation and engagement with federal agencies (e.g., BOEM's tribal cultural landscapes https://espis.boem.gov/study%20profiles/BOEM-ESP-PC-21-01.pdf).

ecosystem processes upon which they depend, about potential for non-tribal fishermen displaced by OWE to move into areas important to the tribes, and about the information used in decision-making. To learn about potential impacts to West Coast tribes from OWE development, engagement and consultation[14] with individual tribes is essential as only individual tribes can determine those impacts.

A number of West Coast tribes have fishing rights to ocean species established through treaties or other federal legal mechanisms. The Magnuson-Stevens Act requires that federal fishery management actions taken under that statute are consistent with "other applicable laws," which include tribal fishing rights. As mentioned above, there is a voting tribal seat on the PFMC. The United States government has a government to government relationship with federally recognized Indian tribes. Central to this unique relationship is the trust responsibility of the U.S. government, which includes an obligation on the part of the United States to consider the rights and interests of American Indian tribes while carrying out the mandates of federal law. E.O. 13175 requires each federal agency to establish procedures for meaningful consultation and coordination with tribal officials in the development of federal policies that have tribal implications.

There are four northwest tribes that have Usual & Accustomed Fishing Areas (U&As)[15] within the EEZ off the coast of Washington in which they exercise their treaty fishing rights: the Makah Tribe, the Quileute Tribe, the Quinault Indian Nation, and the Hoh Tribe. The Pacific Coast treaty Indian tribes' U&A fishing areas are mostly described in court orders, with the exception of the U&A for the Hoh Tribe. NMFS' current regulations at 50 CFR 660.4 describe the U&As as stated in court orders, and describe a fishing area for the Hoh Tribe. The Hoh Tribe and the state of Washington are currently working on an agreement for the Hoh U&A boundaries, which upon approval by the court would govern. Other tribes along the West Coast have fishing rights via treaty or executive order (PFMC 2022a):

> In the Columbia River Basin, the sharing structure for salmon between the tribes and states of Washington and Oregon is detailed in the U.S. v. Oregon Management Agreement. Tribes with treaty-reserved fishing rights include the Yakama, Warm Springs, Umatilla, and Nez Perce.
>
> In California, the Yurok and Hoopa Valley tribes have a federally reserved right to harvest up to half of the harvestable surplus of Klamath River fish.
>
> In western Washington, tribes with treaty-reserved fishing rights include the Lummi, Nooksack, Swinomish, Upper Skagit, Sauk-Suiattle, Stillaguamish, Tulalip, Muckleshoot, Puyallup, Nisqually, Squaxin Island, Skokomish, Suquamish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, Makah, Quileute, Quinault, and Hoh.

Federal courts have determined that the treaty tribes are entitled to up to half of the harvestable surplus of fish stocks that reside in or pass through their U&A areas.

[14] In addition to federal directives and guidance on tribal engagement and consultation, the West Coast Ocean Alliance's Tribal Caucus created "Guidance and Responsibilities for Effective Tribal Consultation, Communication, and Engagement: A Guide for Agencies Working with West Coast Tribes on Ocean & Coastal Issues" found at https://westcoastoceanalliance.org/tribal-engagement.

[15] Treaties with many of the Pacific Northwest tribes reserved the right to fish at "usual and accustomed" fishing grounds. These areas have been described by the courts for many of the tribes.

The CCFEP includes a robust description of tribal fisheries on the West Coast. Excerpts are provided below.

3.4.2.3 Tribal Fisheries
The marine ecosystems of the California Current Ecosystem (CCE) support a wide variety of plant and animal species that tribes have depended on, and been stewards of, since time immemorial for food, medicine, tools, culture, ceremony, and commercial endeavors. Tribal fishers do not differentiate between recreational and commercial fisheries; instead, fisheries are a keystone of their cultural and spiritual identities. Shellfish (both mollusks and crustaceans) and various species of marine fishes are important for cultural purposes, social interactions, and health. [...] many West Coast tribes entered treaties with the Federal government, ceding much of their land [while reserving] the continued rights to gather, hunt, and fish in their usual and accustomed (U&A) fishing areas. These treaties have been upheld by the U.S. Supreme Court, and many West Coast tribes are now co-managers of the marine resources of the (CCE).

3.5.4.1 Northwest Tribes' Fisheries Management
The Treaty Tribes of Oregon and Washington (Tribes) have both exclusive and shared authority to manage a wide variety of fisheries and natural resources affected by both current and future actions of the Council and by biophysical conditions within the CCE. The Tribes manage and harvest marine species covered by the [Pacific Fishery Management] Council's FMPs as well as other species governed by the Tribes' own exclusive authorities or by co-management agreements with the states of Oregon and Washington. The Tribes also retain property interests in species they do not currently manage or harvest but may choose to do so at a future time.

Tribal fisheries have ancient roots and their harvests are used for commercial, personal use, and cultural purposes. Authorities to plan, conduct and regulate fisheries; manage natural resources; and enter into cooperative relationships with state and Federal entities are held independently by each of the Tribes based on their own codes of law, policies, and regulations. The independent sovereign authorities of each Tribe were Federally recognized initially in a series of treaties negotiated and signed during 1854-1855: (Treaty with the Tribes of Middle Oregon (1855); Treaty with the Walla Walla, Cayuse, and Umatilla Tribes (1855); Treaty with the Yakama (1855); Treaty with the Nez Perce (1855); Treaty of Medicine Creek (1854); Treaty of Neah Bay (1855); Treaty of Olympia (1855); Treaty of Point Elliot (1855); and Treaty of Point No Point (1855). These treaties have been reaffirmed by judicial review, e.g., U.S. v. Oregon (SoHappy v. Smith) 302 Supp.899 (D. Oregon, 1969) and U.S. v. Washington 384 F. Supp. 312 (W. Dist. Wash., 1974), and administrative policies (e.g., Executive Order 13175 and Secretarial Order 3206).

Each Treaty Tribe exercises its management authorities within specific areas commonly referred to as U&A fishing locations. These areas have been adjudicated within the Federal court system or confirmed by Federal administrative procedures. The restriction of treaty-right fisheries to specific geographic boundaries creates place-based reliance on local resource abundance and limits the Tribes' latitude for response to variations in ecosystem processes, species distributions, or fisheries management effects.

Each Tribe has established sets of laws and policies to achieve sustainable fisheries production through traditional and science-based management. Regulations to control the conduct of each fishery (time, place, gear, etc.) are set through governmental procedures, and performance is monitored to ensure objectives are met. The Tribes participate as full partners with Federal and state entities to ensure their criteria for resource conservation and sustainable fisheries are compatible. [...]

The Tribes' combined regions of management interest and authority include areas outside the EEZ and the physical boundaries of the California Current. [...]

The four coastal Treaty Tribes (Coastal Tribes) of Washington (Makah Nation, Quileute Indian Tribe, Hoh Indian Tribe, and Quinault Indian Nation) have broad interests in the CCE and more complex relationships with Council processes and decisions. The U&As of the Coastal Tribes overlap with the EEZ and they have active ocean fisheries operating under the Council's current FMPs ([CCFEP] Table 3-8).

Harvests in the Coastal Tribes commercial fisheries ([CCFEP] Table 3-8) provide important employment and entrepreneurial opportunities for their remote communities, and make significant contributions to the coastal economy of Washington.

[CCFEP] Table 3-8. Coastal Treaty Tribes commercial fisheries.

Fishery	Species	FMP	Tribes
Longline	Blackcod, Pacific halibut	Groundfish	Makah, Quileute, Hoh, Quinault
Bottom trawl	Groundfish	Groundfish	Makah
Midwater trawl	Whiting, yellowtail rockfish	Groundfish	Makah, Quileute
Troll	Salmon	Salmon	Makah, Quileute, Hoh, Quinault
Purse seine	Sardine	CPS	Quinault
Pot	Dungeness crab		Makah, Quileute, Hoh, Quinault
Manual intertidal	Razor clam		Quinault

3.5.4.2 California Tribes in the Council Process

Fisheries have been important to California tribes since time immemorial for cultural purposes, subsistence, and commerce-related activities. The primary stock co-managed by the Council, California, and the Hoopa Valley and Yurok Tribes is fall Chinook of the Klamath and Trinity River basins, which is an indicator stock for the Southern Oregon and Northern California complex of the Salmon FMP. Klamath Basin spring Chinook are considered a component of the Southern Oregon and Northern California complex; however, co-managers have not yet identified conservation objectives or coordinated regional management for this stock.

The Yurok Tribal fishery occurs within the lower 44 miles of the Klamath River and within a portion of the Trinity River below the boundary of the Hoopa Valley Reservation. The Hoopa Tribal fishery occurs in the Trinity River from approximately one mile above the confluence with the Klamath River to the upstream boundary of the Hoopa Valley Indian Reservation, approximately 12 river miles. The primary gear type used is gillnets; however, a small portion of the Chinook harvest is taken by dip nets and hook- and-line. Fall Chinook are typically harvested from early August through mid-December, with peak harvest in the Klamath River estuary occurring during late-August through mid-September, and in the Trinity River during late-September to early-October.

In 1993, the Interior Department Solicitor issued a legal opinion that concluded that the Yurok and Hoopa Valley Tribes of the Klamath Basin have a federally-protected reserved right to 50 percent of the available harvest of Klamath Basin salmon. Under the Council's annual salmon management process, half of the annual allowable catch of Klamath River fall Chinook has been reserved for these tribal fisheries since 1994. Federal courts affirmed this decision in Parravano v. Masten, 70 F. 3d 539 (9th Cir. 1995), cert. denied, 116 S. Ct. 2546 (1996). Tribal fisheries with recognized Federal fishing rights occur on the Yurok and Hoopa Valley Indian reservations located on the Lower Klamath and Trinity Rivers, respectively. These fisheries are regulated by their respective governments.

The Yurok Tribal Council regulates the fall and spring Chinook fishery via annual Harvest Management Plans, which are based upon the tribal allocation and subsequent regulations regarding sub-area quotas, conservation measures, and potential commercial fisheries. When the Tribal Council allows a portion of the allocation to go to commercial fishing, then most harvest is taken in the estuary where commercial fisheries are held. Subsistence fisheries are spread throughout the reservation.

The Hoopa Tribal Fishery is conducted in accordance with the Hoopa Valley Tribe's Fishing Ordinance. Fishing by tribal members occurs within the exterior boundaries of the Hoopa Valley Indian Reservation. The Hoopa Valley Tribal Council is the sole authority responsible for the conduct of the tribe's fishery, enforces the fishing ordinance, and ensures collection of harvest statistics through its Fisheries Department. The tribal fisheries normally set aside a small (unquantified) number of fish for ceremonial purposes. Subsistence needs are the next highest priority use of Klamath River fall Chinook by the Tribes. [...]

[...] Detailed Klamath Basin tribal fishery data can be found in the Council's annual SAFE Document (PFMC 2023).

Several tribes with treaty-reserved fishing rights have created fish commissions to coordinate fisheries management among member tribes. These include the Northwest Indian Fisheries Commission (NWIFC), Columbia River Inter-Tribal Fish Commission (CRITFC), and Klamath River Intertribal Fish and Water Commission.

There are tribal allocations for three groundfish species (NMFS 2022e; PFMC 2022a):

- Pacific halibut
- Pacific whiting
- sablefish

Annual tribal quotas for Pacific whiting[16] are established by NMFS (NWIFC 2016a). The International Pacific Halibut Commission, through acceptance by the Secretary of State and Secretary of Commerce, provides a harvest allocation for the Pacific Coast treaty tribes consistent with the PFMC's Halibut Catch Sharing Plan (NWIFC 2016a; 50 CFR 300.64). Biennial tribal allocations for sablefish are set according to an allocation scheme codified in the Pacific Coast Groundfish Fishery Management Plan. Allocations for other groundfish species (e.g., rockfish and flatfish) are requested by the tribes and set by Council action during a (biennial) harvest specification process (PFMC 2022a). Plans for the coastal (and in-river) salmon fisheries are negotiated annually by tribal and state fishery managers in coordination with the PFMC's development of ocean fishery management measures. Tribal ocean salmon fisheries are addressed in the PFMC's management measures, which NMFS implements through regulation (NWIFC 2016b; PFMC 2022a). Tribal allocations of coastal pelagic species are sometimes set (50 CFR 660.518).

2.3 Fisheries Overview

Potential impacts to current West Coast fisheries from OWE development are likely complicated. Potential impacts will vary by location and by sector (e.g., fishery or gear type). Potential impacts could be direct, such as space use conflicts, or indirect, such as changes to their port. Potential impacts could reach beyond the people landing catches at a location and could affect the regional processors, port,

[16] https://www.fisheries.noaa.gov/species/pacific-whiting#subsistence-fishing

infrastructure, or general community. Table 1 provides a high-level overview of fisheries that are likely to overlap with areas considered for OWE development, and Figure 4 provides illustrations of general fisheries gear types commonly used in these fisheries.

Section 3 of the report provides detailed information about each of the fisheries managed under the West Coast FMPs, including relevant statistics, and describes the fisheries data collected and used to inform management decisions. It includes a description of the seafood product distribution chain (see Figure 13), i.e., various sectors and businesses involved that are important to consider in fisheries impact analyses.

Section 4 of the report provides an overview of how fisheries data is used in analyzing proposed fisheries management actions using examples that may be most relevant to the types of questions that will be raised in analyses for OWE development.

Table 1. Overview of federal fishery management plans (FMPs) and other important West Coast fisheries

Federal FMPs	Species Included	Gear Types	Gear Operation in Water Column	States Where Landed
Pacific Groundfish	-Over 65 rockfish species; -Flatfish, such as petrale sole and Dover sole; -Roundfish, such as sablefish and Pacific whiting (hake) -Some sharks and skates	Primarily trawl, longline, hook and line, pots	Pelagic and Benthic	WA, OR, CA, At-sea
Highly Migratory Species (HMS)	Tunas, some shark, billfish	Troll (hook-and-line), drift gillnet, deep-set buoy, coastal purse seine, large purse seine, harpoon, pelagic longline	Pelagic	CA; WA, OR (tuna only)
Coastal Pelagic Species (CPS)	Northern anchovy, market squid, Pacific sardine, Pacific mackerel, and jack mackerel	Purse seine, and other types of net gear (drum seines, lampara nets, and dip nets)	Pelagic	WA, OR, CA
Pacific Salmon	Chinook and coho	Troll (hook-and-line)	Pelagic	WA, OR, CA
Other Fisheries (a)	**Species Included**	**Gear Types**	**Gear Operation in Water Column**	**States Where Landed**
Pacific Halibut	Pacific halibut	Primarily longline (setlines), and in recent years pot gear	Benthic	WA, OR, CA
Dungeness Crab	Dungeness crab	Pot/trap	Benthic	WA, OR, CA
Pink Shrimp	Pink shrimp	Trawl	Benthic	WA, OR, CA

Notes: See each FMP for the full list of species managed, including which stocks are target and nontarget. FMPs and fisheries fact sheets found at https://www.pcouncil.org/fishery-management-plans/ and https://www.fisheries.noaa.gov/region/west-coast#fisheries. Information on gear operation in the water column from Table 3-3 of CCFEP (PFMC 2022). Pacific halibut is managed by the International Pacific Halibut Commission https://www.iphc.int/. NMFS and the PFMC allocate allowable catch among harvesters in the U.S. fisheries.
(a) While there are numerous other state-managed fisheries, Dungeness crab and Pink shrimp are the largest.

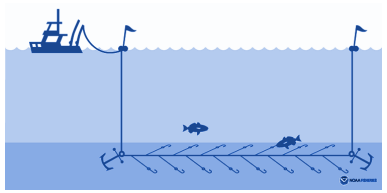
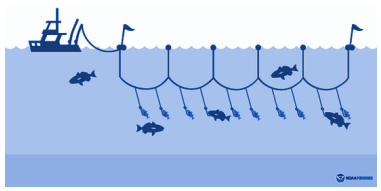
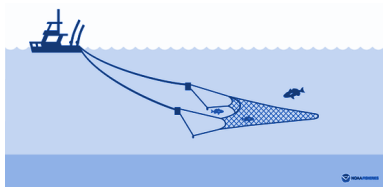
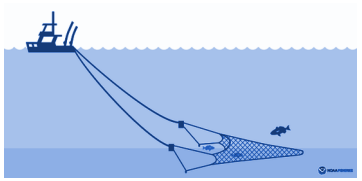
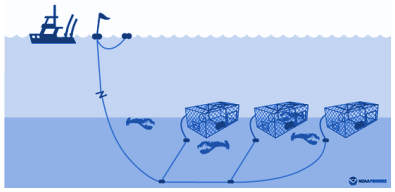
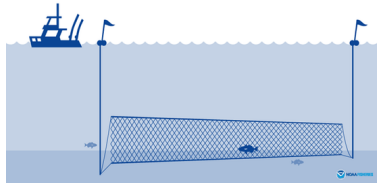
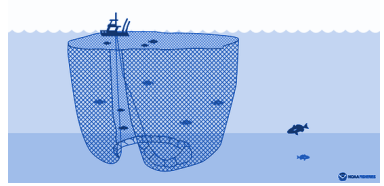
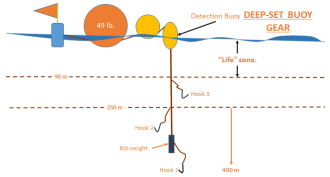
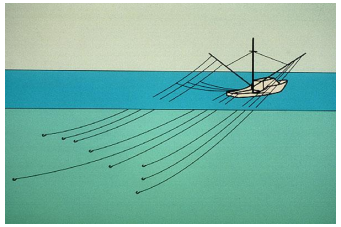
			
a) Bottom longline. Mainline, weighted to the seafloor, and leaders with baited hooks attached. Soak time: hours to days.	**b) Pelagic longline.** Can be suspended at any depth within the water column, depending on target species. Soak time: hours. Used by local small-scale operations to large-scale mechanized fleets.	**c) Midwater trawl.** Vary in length, mesh size, material, and tow speed depending on target species, but most are constructed of four mesh panels sewn together.	**d) Bottom trawl.** Floats are attached to the headrope. Weights on the footrope keep the net open as it moves across the ocean floor. Constructed and rigged for various target species over different bottom surfaces.
			
e) Pots and traps. Submerged wire or wood devices that permit organisms to enter the enclosure but make escape difficult or impossible. Traps can be set individually or in a long continuous series at depths up to 2,400 feet (730 meters). Size and configuration vary based on target species.	**f) Gillnet.** A wall of netting that hangs in the water column. Mesh sizes allow fish to get only their head through the netting but not their body. Design is based on regulations, area fished, and target species. Set gillnets are attached to fixed poles or an anchor system. Drift gillnets use weights and buoys.	**g) Purse seine.** A large wall of netting deployed around an entire area or school of fish. Once a school of fish is located, a skiff encircles the school with the net, the lead line is pulled in and the net closes on the bottom. Vary in size according to vessel, mesh size, and target species.	**h) Deep-set buoy gear.** A type of hook-and-line gear. A surface buoy array allows for strike detection. Vessels remain near the fishing gear to actively tend it.
			
i) Troll. Trolling is hook and line fishing. Several lures or baited hooks are towed from the vessel. The speed of the vessel varies based on target species.			

Figure 4. Illustrations of fishing gear types commonly used on the West Coast
General fisheries gear types commonly used in West Coast fisheries that may overlap with areas considered for offshore wind energy development, including cable routing corridors and coastal infrastructure.
Sources: NMFS 2022, NMFS 2021, FAO 2023.

3 Overview of West Coast Fisheries

3.1 Overview -- Data and Data Sources

In establishing the MSA, Congress found that collection of reliable data is essential to the effective conservation, management, and scientific understanding of the fishery resources of the United States (NMFS 2007). The MSA requires that fisheries conservation and management measures be based on the best scientific information available and requires a peer review process for scientific information used to advise the regional fishery management councils on the conservation and management of fisheries.[17] NMFS and state agencies collect large amounts of data from fishing participants to meet both federal and state goals for sustainable fisheries management under the MSA and other applicable state and federal laws.

The Pacific States Marine Fisheries Commission (PSMFC)[18] is an interstate compact agency that was established in 1947 by Congress to help state and federal agencies and the fishing industry sustainably manage Pacific Ocean fisheries in California, Oregon, Washington, Idaho, and Alaska. Following the establishment of the regional fishery management councils, PSMFC worked with state and federal agencies to establish the Pacific Fisheries Information Network (PacFIN)[19] to provide essential data needed for managing fisheries. PacFIN is funded by NMFS and is one of four regional commercial Fishery Information Networks in the United States. The PacFIN database incorporates data collected by both state and federal agencies, improving the data quality and timeliness for use in fisheries management. Data is stored, processed and disseminated by PacFIN staff. Similarly, in 1992 the Pacific Coast Recreational Fisheries Information Network (RecFIN)[20] was created through the PSMFC to integrate state and federal marine recreational fisheries sampling efforts into a single database to provide important biological, social, and economic data for Pacific coast recreational fishery biologists, managers and anglers. Data collected under the PacFIN and RecFIN programs are essential for NMFS, the PFMC, state fishery agencies, PSMFC, Treaty Indian Tribes, and others responsible for the conservation and management of marine fisheries on the West Coast.

The longest-standing source of fisheries data is the fish ticket system, which is administered by the states. State agencies supply fish tickets to PacFIN, which contain data on the amount of fish landed at authorized dealers, information on the trip, and the seafood the dealer purchased. The states use port sampling programs to gather additional information. State agencies also supply data on vessel registrations and more specific data on the activities of trawlers through a trawl logbook program. Federal agencies and the PFMC are generally data users, but also supply some data such as at-sea catches and discards and fishing permits. Data from these other sources are combined to create value-added data products.

Data sent to PacFIN undergoes error checking and standardization and then are supplied to users via direct access to the PacFIN database (for managers) and through publicly available reports.[21] States maintain data for state-managed fisheries and NMFS maintains some sources of federally managed data without submitting to PacFIN.

Fisheries data is confidential under the MSA (402(b), 16 U.S.C. 1881a(b)). The use of confidential fisheries data is limited to fishery management activities or fisheries related research. Users must be

[17] https://www.fisheries.noaa.gov/national/laws-and-policies/national-standard-2-related-resources
[18] https://www.psmfc.org/psmfc-info/overview
[19] https://www.psmfc.org/program/pacific-fisheries-information-network-pacfin and https://pacfin.psmfc.org/
[20] https://www.psmfc.org/program/prog-3?pid=17 and https://www.recfin.org/about/
[21] https://reports.psmfc.org/pacfin/f?p=501:1000

approved by PSMFC and authorized by the appropriate agency data partner(s) (CDFW, ODFW, WDFW, NMFS (WCR, NWFSC, or SWFSC)) to access confidential-level data. Aggregated, non-confidential data summaries can be requested from PSMFC and/or state and federal agency data partners if pertinent summaries are not available via public reports. For example, port-level summaries, provided they meet confidentiality requirements, could be requested.

3.2 Characteristics of West Coast Fisheries

3.2.1 Commercial Fisheries

Landings in West Coast commercial fisheries in 2021 were 434,600 metric tons,[22] with revenue totaling $677.4 (PacFIN 2022a) (Table 2). Coastal landings accounted for two-thirds of total landed weight (68%) and 95% of total revenues (Figures 5 and 6), while deliveries to at-sea processors and motherships accounted for the balance.[23] Deliveries to at-sea processors and motherships are not counted as "landings", and are thus not attributed to particular states. Fish delivered to at-sea processors and motherships is processed at sea. All at-sea deliveries occur in the federally managed Pacific whiting sector of the Pacific Coast Groundfish Fishery Management Plan. Data are from "fish tickets" – a record of fish delivery – collected by state fisheries agencies and from federal at-sea observers (for catches delivered to at-sea processors and motherships). Fish tickets are classified by gear type and port (Stenberg and Ames 2022) and contain details regarding the delivering vessel, the species or group sold, and the date of the transaction. Fish tickets also specify port of landing and catch location (self-reported by the vessel operator); catch location is not mandatory in all states and the extent of blocks or statistical areas varies by state (California uses California Department of Fish and Wildlife commercial fishing blocks[24], Oregon uses zones[25], and Washington uses Washington Department of Fish and Wildlife statistical areas (Stenberg and Ames 2022).

Table 2. West coast commercial fishery landings and revenues, by state and at-sea, 2021

State	Landed Weight (thousand mt)	Percent of Total	Revenue (millions)	Percent of Total
Washington	82.7	19.0%	$235.1	34.7%
Oregon	144.1	33.2%	$205.4	30.3%
California	67.5	15.5%	$202.5	29.9%
Subtotal	294.3	67.7%	$643.0	94.9%
At-Sea	140.3	32.3%	$34.4	5.1%
Total	434.6	100.0%	$677.4	100.0%

Source: PacFIN 2022a.
Notes: State fishery agency fish ticket data and at-sea observer data (landings by Pacific at-sea processors). A metric ton (mt) is equivalent to 2204.6 pounds. **At-sea* means catches by at-sea processors, and catches by vessels that deliver to motherships. Both at-sea processors and motherships process catch on board, while at sea.

[22] A metric ton (mt) is equivalent to 2,204.6 pounds.
[23] Ex-vessel value estimates for retained catch of Pacific whiting in the at-sea sectors are calculated from shoreside landings, see https://pacfin.psmfc.org/wp-content/uploads/2015/09/Comprehensive_npac.pdf.
[24] See Selected Fishery Regulations Information from California Department of Fish and Wildlife at https://wildlife.ca.gov/Fishing/Commercial#310591030-selected-fishery-regulation-information.
[25] See https://www.dfw.state.or.us/fish/commercial/forms_library/Dealer%20-%20Wholesale%20Fish%20Dealer%20Instructions.pdf.

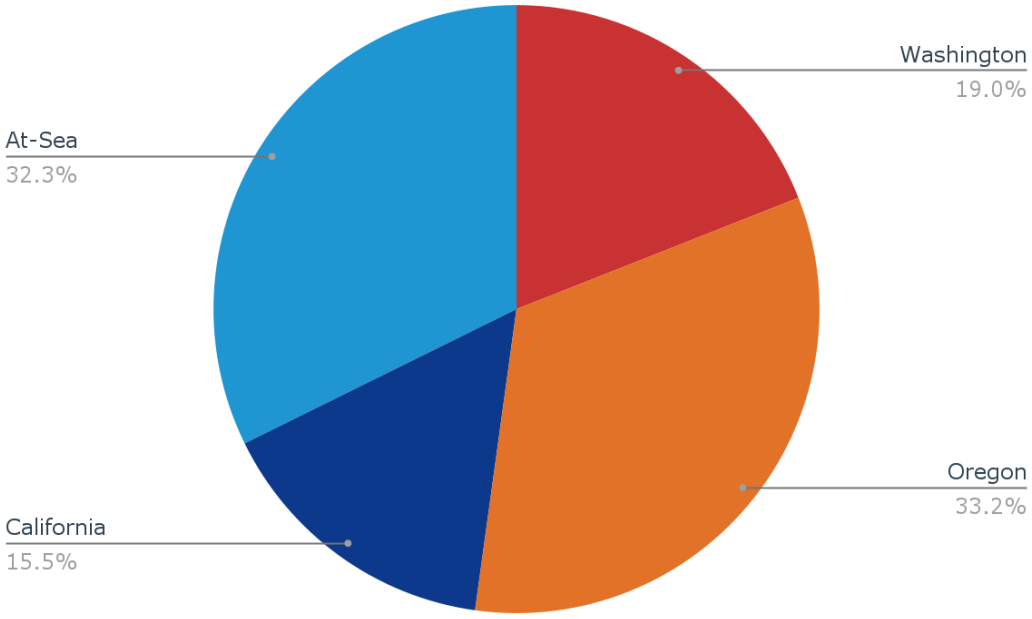


Figure 5. West coast commercial fishery landings, by state and at-sea, 2021
Coastal landings accounted for two-thirds of total landed weight (68%), and deliveries to at-sea processors and motherships (that also process at-sea) accounted for the balance.
Source: PacFIN 2022a.

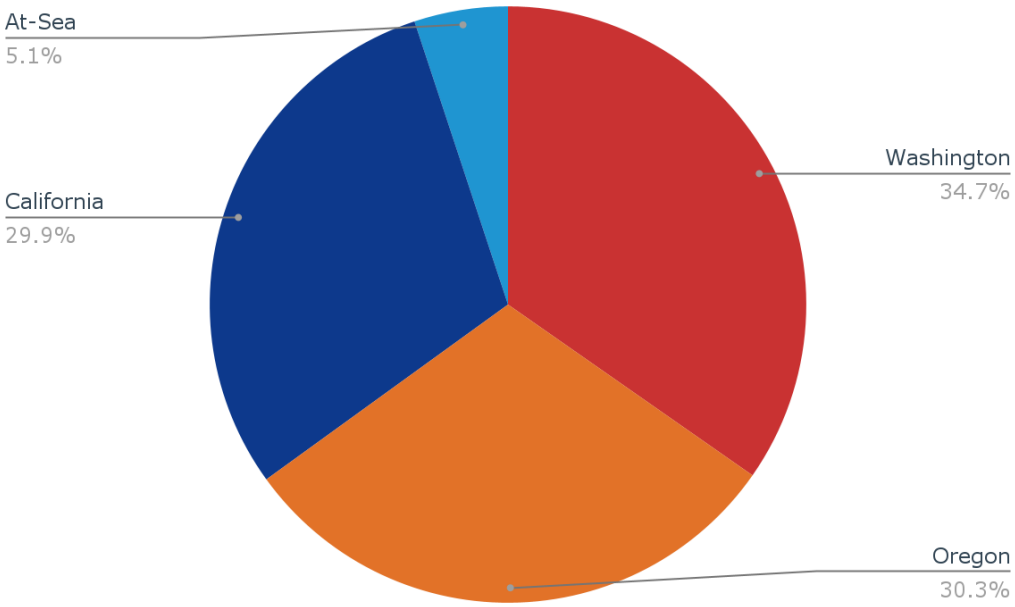


Figure 6. West Coast commercial fishery revenue, by state and at-sea, 2021
Coastal landings accounted for two-thirds of 95% of total revenues, and deliveries to at-sea processors and motherships accounted for the balance.
Source: PacFIN 2022a.

The top three ports–in terms of both commercial landed weight and revenue in 2021–on the West Coast were Westport in Washington, and Astoria and Newport in Oregon (NMFS 2022b).

Commercial landings at Washington's coastal ports and Columbia River (Oregon) area ports represented about half the West Coast landed weight and a fifth (22%) of total revenue in 2021 (PacFIN 2022b) (Table 3). Oregon's Newport area also contributed a large part of total landed weight (18%) and revenue (12%). In California, Monterey and Santa Barbara area ports provided 14% of total landed weight and 12% of total revenue.

Federally managed fish species represented 87% of total commercial landings in 2021, and just over half of total revenues (Table 4). Dungeness crab and Pacific pink shrimp are the primary state-managed species on the West Coast. Dungeness crab landings accounted for 27,300 metric tons with revenues of $294.2 million in 2021.

Table 3. West Coast commercial fisheries, by management entity, 2021

Management Entity	Landed Weight (thousand mt)	Percent of Total	Revenue (millions)	Percent of Total
Federal	376.3	86.6%	$349.3	51.6%
State	58.3	13.4%	$328.1	48.4%
Federal & State	434.6	100.0%	$677.4	100.0%

Source: PacFIN 2022b.
Note: State fishery agency fish ticket data and at-sea observer data (landings by Pacific at-sea processors).

Table 4. West Coast commercial fishery landings and revenue, by state and port area, 2021

State and Port Areas	Landed Weight Metric Tons	Landed Weight Percent of Total	Revenue Dollars (millions)	Revenue Percent of Total
Washington				
N. Puget Sound	4,706	2%	$52.6	8%
S. Puget Sound	3,313	1%	$41.5	6%
Coastal	68,716	23%	$80.5	13%
Columbia River	3,097	1%	$25.6	4%
Unknown	2,913	1%	$34.9	5%
Subtotal	82,745	28%	$235.0	37%
Oregon				
Columbia River	75,210	26%	$57.5	9%
Tillamook	1,351	0%	$11.4	2%
Newport	51,948	18%	$74.6	12%
Coos Bay	10,073	3%	$43.2	7%
Brookings	5,472	2%	$18.7	3%
Subtotal	144,055	49%	$205.4	32%
California				

State and Port Areas	Landed Weight Metric Tons	Landed Weight Percent of Total	Revenue Dollars (millions)	Revenue Percent of Total
Crescent City	1,939	1%	$20.1	3%
Eureka	4,071	1%	$16.5	3%
Fort Bragg	2,303	1%	$9.1	1%
Bodega Bay	984	0.3%	$11.0	2%
San Francisco	4,991	2%	$25.6	4%
Monterey	22,255	8%	$32.5	5%
Morro Bay	506	0.2%	$3.4	1%
Santa Barbara	18,047	6%	$43.2	7%
Los Angeles	10,220	3%	$22.3	3%
San Diego	1,890	1%	$18.6	3%
Unknown	264	0.1%	$0.03	0.004%
Subtotal	67,471	23%	$202.3	31%
Total	294,271	100%	$642.8	100%

Source: PacFIN 2022b.
Note: Data are available disaggregated by port area, management group, and species in PacFIN 2022b, Report ALL005.

3.2.1.1 Commercial Fisheries by Management Group

West Coast landings are classified into 7 management groups: coastal pelagic species, groundfish, highly migratory species, and salmon, as well as crab, shellfish, and shrimp (crab, shellfish, and shrimp are state-managed).26 Management actions by the PFMC include the preparation of Fishery Management Plans (FMPs) and Stock Assessment and Fishery Evaluation (SAFE) documents for federally managed species. FMPs contain measures for conserving and managing specific fisheries and fish stocks; SAFEs provide information on the (past, present, and possible future) biological condition of the species (PFMC 2021b).

Groundfish, including Pacific whiting, represented over half (58%) of total landed weight in 2021, primarily at-sea and in Oregon (Table 5, Figure 7). Nearly half of commercial fishing revenue (44%) was from the harvest of crab in Washington and Oregon (Table 6). Groundfish, primarily in Oregon and at-sea, accounted for an additional 14% of the total West Coast revenue.

[26] The tables include an "other" category, which includes species not managed within an FMP that are not Dungeness crab or Pink shrimp. Species in the "other" are state-managed and include, for example, California Spiny lobster, Red sea urchin, California halibut, and Pacific hagfish.

Confidential Data

"Landing data is considered confidential when 2 or fewer vessels have landed that combination of fish, gear, area, date range, and/or 2 or fewer dealers purchased those fish. Strata can often be combined, or rolled up to limit the impact of confidential species. Public reports have been set up to maintain confidentiality by state and time period for the strata of the report." (PacFIN 2020).

Table 5. Commercial landings of West Coast species, by management group, by state and at-sea, 2021 (thousand metric tons)

Management Group	Washington	Oregon	California	At-Sea	Total
Coastal Pelagic *	0.1	4.5	50.7	1.0	56.3
Crab	11.6	11.0	5.3	0	27.9
Groundfish *	52.3	104.0	6.0	139.2	301.5
Highly Migratory *	1.9	1.5	1.0	**	4.4
Salmon *	3.8	0.8	1.0	**	5.6
Shellfish	1.8	0.3	0		2.1
Shrimp	10.1	21.2	0.6		31.9
Other	1.1	0.6	2.9	0.1	4.7
Total	82.7	144.1	67.5	140.3	434.6

Source: PacFIN 2022a. Fish tickets classified by management group.
Notes: A metric ton is equivalent to 2204.6 pounds.
* indicates federally managed species.
** indicates data is suppressed for confidentiality.

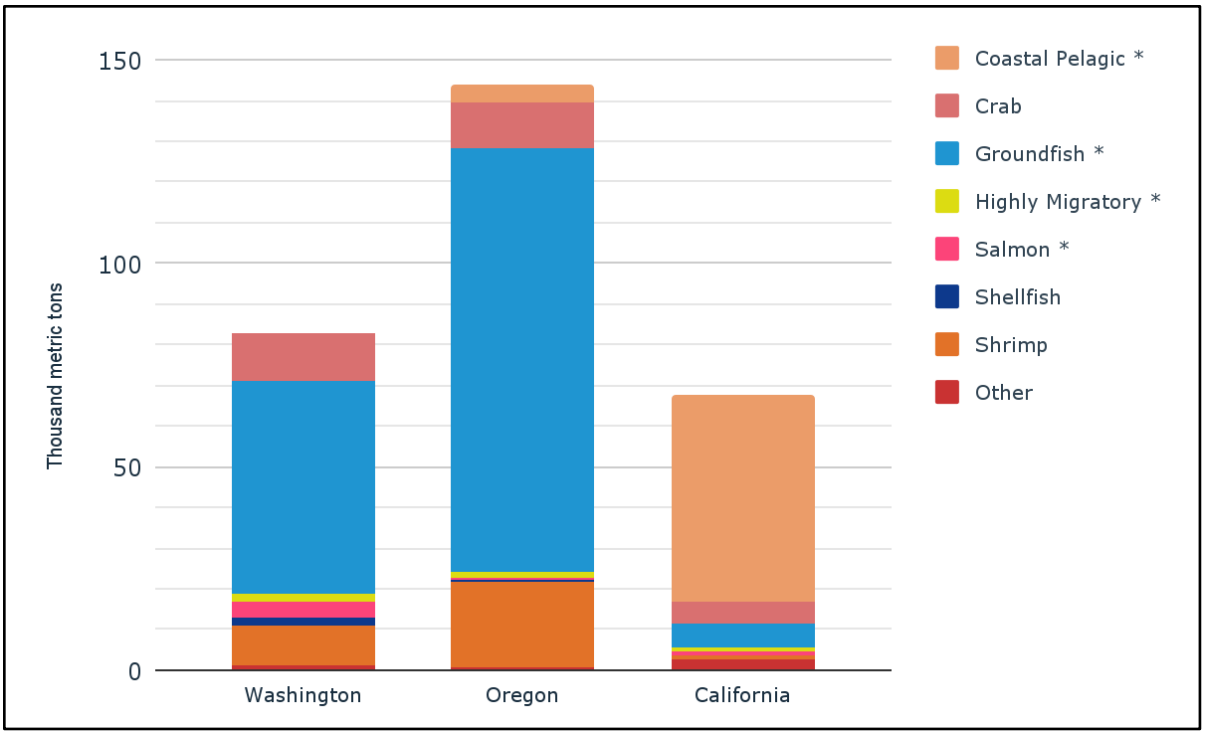


Figure 7. Commercial landings of West Coast species, by management group and state, 2021
Coastal pelagic species represented the majority (75%) of total landed weight in California, and groundfish the majority in Oregon (72%) and Washington (63%).
Source: PacFIN 2022a.
Notes: In addition, at-sea landings totaled 140.3 thousand metric tons, primarily (99%) groundfish.
* indicates federally managed species.

Table 6. Revenue from commercial West Coast species, by management group, by state and at-sea, 2021 (million dollars)

Management Group	Washington	Oregon	California	At-Sea	Total
Coastal Pelagic *	$0.1	$4.6	$71.3	$0	$76.0
Crab	$121.2	$120.0	$55.8	$0	$297.0
Groundfish *	$17.8	$40.0	$14.4	$34.4	$106.6
Highly Migratory *	$8.5	$6.6	$7.5	**	$22.6
Salmon *	$15.5	$6.5	$17.5	**	$39.5
Shellfish	$48.7	$0.9	$0.0	$0	$49.6
Shrimp	$16.4	$23.4	$5.8	$0	$45.6
Other	$7.0	$2.6	$30.1	$0	$39.7
Total	$235.1	$205.4	$202.5	$34.4	$677.4

Source: PacFIN 2022a. Fish tickets classified by management group.
Note: * indicates federally managed species.

Annual landings and revenue can vary considerably over time (Figure 8). Historical data beginning in 1980 are available for many species on the West Coast. Current statistics should be considered within the context of long-term trends. Annual landings and revenue vary for many reasons, including annual catch limits, climate, oceanographic conditions, stock size, management, fishing effort, and ex-vessel prices.

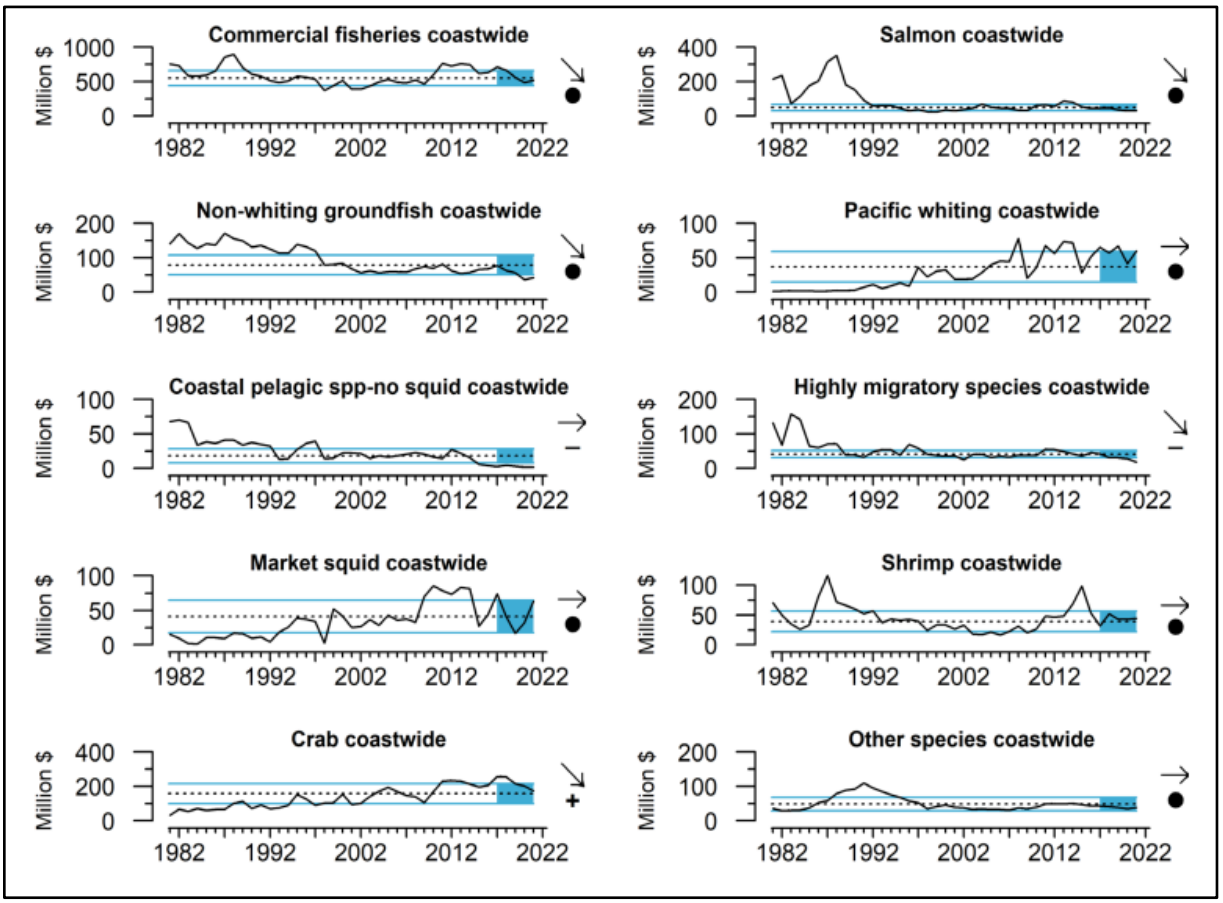


Figure 8. Annual ex-vessel value of West Coast commercial fisheries, 1982-2021 ($2021)
Annual landings and revenue can vary considerably over time. Total revenue across West Coast commercial fisheries had a declining trend from 2017 to 2021, but was 6% higher in 2021 than in 2020, based on data currently available.
Source: Reprinted from NMFS 2022c, Figure O.2.1. Created using PacFIN, which provides data from 1980 to current year, by state and species, accessible using a query tool https://pacfin.psmfc.org/home/.
Note: The blue shaded area is the most recent 5 years of data. Arrows indicate if the recent 5-year trend is positive (↗), neutral (→), or negative (↘). Symbols indicate if the recent 5-year mean is above the upper blue line (+), within the blue lines (●), or below the lower blue line (−).

3.2.1.1.1 Coastal Pelagic Species

Pelagic fish get their name from the pelagic zone, the area of the water they inhabit. Coastal pelagic species (CPS) are found near the surface and in waters up to about 655 feet deep, usually above the continental shelf (NMFS 2023a; PFMC 2021c). Adult fish are generally small, ranging from about 4 inches to 24 inches (PFMC 2021c).

The PFMC's CPS FMP[27] includes Pacific sardine, Pacific mackerel, jack mackerel, northern anchovy, and market squid (PFMC 2019). Management measures for Pacific sardine and Pacific mackerel are

[27] See https://www.pcouncil.org/documents/2019/06/cps-fmp-as-amended-through-amendment-17.pdf/.

adopted annually while management of the other species is assessed periodically. All have annual harvest specifications. The FMP includes monitoring of the status and landings of Pacific herring and jacksmelt.

The SAFE provides a summary of the CPS FMP and describes the fishery's history and current management (PFMC 2022d[28]). Descriptions of landings, estimates of the status of stocks, and acceptable biological catches (ABCs) are included. The PFMC considers ABCs, as well as social and economic factors, when determining annual harvest guidelines and other measures for Pacific sardine and Pacific mackerel.

The federal CPS finfish fishery is managed as a Limited Entry fleet, with the most recent capacity goal and permit transferability provisions implemented in 2003 (PFMC 2022d). In 2021 the fleet consisted of 65 permits and 55 vessels operating under a federal permit program. The capacity goal and transferability provisions (established under Amendment 10) are based on calculated gross tonnage[29] (GT) of individual vessels. The GT calculated for each vessel serves as a proxy for its physical capacity and is used to track total fleet capacity. GT values for the current fleet range from 26.4 GT to 182.5 GT, with an average of 84.3 GT (PFMC 2022e).

CPS are directly fished ("targeted") with nets designed to surround fish such as purse seines, drum seines, lampara nets, and dip nets (PFMC 2021c). They are also caught as bycatch in other fisheries with trawls, nets, trolls, pots, hook-and line, jigs, and beach seines. West Coast buyers of CPS are primarily located in southern and central California; Grays Harbor, Washington; and near Columbia River ports (PFMC 2021c).

A live bait fishery for CPS provides live bait to anglers and commercial vessels in California, Oregon, and Washington. Pacific sardine and Northern anchovy are primarily targeted for use in recreational fisheries, mostly in southern California, and are an extremely important component of the West Coast's recreational fishing community. Northern anchovy live bait also contributes to some commercial fishery sectors such as the albacore tuna fishery.

3.2.1.1.2 Groundfish

The Pacific Coast Groundfish FMP (PFMC 2022f) covers over 100 species that live on or near the bottom of the ocean: all West Coast rockfish, flatfish (12 species), roundfish (6 species), and some sharks and skates. Management measures include harvest guidelines, quotas, trip and landing limits, area restrictions, seasonal closures, and gear restrictions (PFMC 2021d).

Some species within the groundfish fishery experienced steep declines in the 1990s. Several stocks were declared overfished (Warlick et al. 2018). Rebuilding plans were put in place with measures including closed areas and reduced catch limits. The PFMC began developing a rationalization plan for the groundfish fishery in the 1990s.[30] In 2003 Congress financed a capacity reducing buyback program, permanently removing 91 vessels from the bottom trawl fishery. In 2004, the PFMC developed a catch share program for the limited entry trawl fishery, which was implemented in 2011. Also in 2011, the at-sea whiting sector, which strictly targets Pacific whiting, began a harvest cooperative management plan with allocations for select species which, as of 2020, are managed with yield set-asides.

[28] See https://www.pcouncil.org/documents/2022/10/2021-cps-safe-september-2022.pdf/ and https://www.pcouncil.org/documents/2022/10/appendix-a-2021-safe-tables-september-2022.pdf/.
[29] Gross tonnage = 0.67(length x breadth x depth)/100
[30] See https://media.fisheries.noaa.gov/dam-migration/feis-groundfish-am28-7-19.pdf#page=91 for more on bottom trawl groundfish landings, nominal revenue, and number of vessels 1994-2016.

All of the stocks declared overfished have been rebuilt, except one (yelloweye rockfish) which is rebuilding and no longer overfished.[31] Many fisheries participants and communities endured hardships throughout that rebuilding period, the fishery has become an example of responsible and sustainable fisheries management. As a result, in 2018 NMFS liberalized trawl gear restrictions, and in 2019 reopened about 2,000 square miles of a large Rockfish Conservation Area off California and Oregon that had been off-limits to groundfish bottom trawling since 2002.[32]

Understanding the recent history of the Groundfish fishery and what participants and communities experienced is essential to understanding the fishery today.

Devastating Collapse of Groundfish Fishery Forces a More Sustainable Future
October 08, 2019
https://www.fisheries.noaa.gov/feature-story/devastating-collapse-groundfish-fishery-forces-more-sustainable-future

West Coast Fisheries "Comeback of the Century"
October 07, 2019
https://www.fisheries.noaa.gov/feature-story/west-coast-fisheries-comeback-century

Reeling to Rebuilding: Success for West Coast Groundfish Fisheries
October 10, 2019
https://www.fisheries.noaa.gov/video/reeling-rebuilding-success-west-coast-groundfish-fisheries

[31] https://www.fisheries.noaa.gov/species/west-coast-groundfish#overview

[32] https://www.fisheries.noaa.gov/feature-story/rebound-groundfish-leads-new-flexibility-fishermen-protection-deep-sea-corals

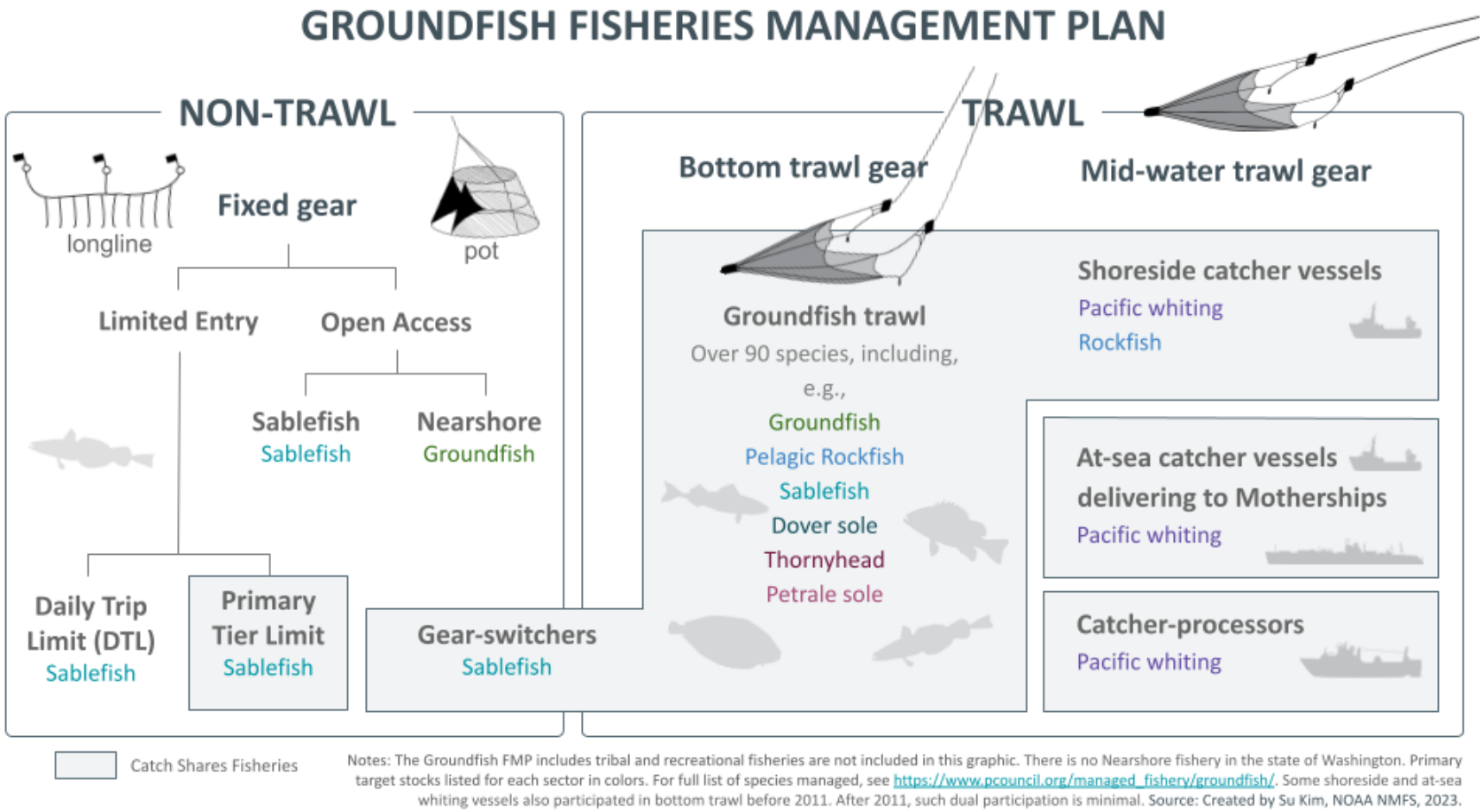


Figure 9. Sectors within the Groundfish Fishery Management Plan
The Groundfish Fishery Management Plan has a complicated “sector-based” structure that is based on gear, targeted species, type of vessel, and/or permit type. Source: Su Kim, NWFSC/NOAA 2023.

The Groundfish FMP has a complicated "sector-based" structure that is based on gear, targeted species, type of vessel, and/or permit type (PFMC 2022g). These management sectors are represented in Figure 9.[33] There is a trawl sector and a non-trawl/fixed gear sector. Within the trawl sector, there are: 1) shorebased Individual Fishing Quota (IFQ) sector consisting of midwater trawl including shoreside whiting, gear switchers who target sablefish, and bottom trawl; and 2) at-sea whiting, consisting of catcher processors and the catcher vessels that deliver to motherships. Within the non-trawl sector there is a limited-entry fixed gear fishery and an open access fishery. Limited entry is either with or without a sablefish endorsement, and with a longline or traps/fishpots endorsement. Open access vessels may be targeting certain groundfish stocks or may catch groundfish while targeting other non groundfish species.

3.2.1.1.2.1 Trawl Sector

Shorebased IFQ

In 2011 the PFMC implemented a catch share program. This program allocates IFQs for groundfish, including whiting trawlers delivering to shoreside plants (called "shoreside whiting"). At-sea whiting is managed separately (see below), although there is some sector cross-participation. Under the catch share management program, annual species quota pounds are allocated to quota share owners. These owners then transfer the quota pounds to vessel accounts, thus allowing these pounds to be landed. Quota can be transferred from vessel to vessel throughout the season, allowing for flexibility of catch. Allocations are based on formulas in the FMP, or determined during the biennial management process. Harvest levels of the Pacific whiting (or hake, a roundfish) are determined each year under the terms of the U.S.-Canada Pacific Whiting Treaty (PFMC 2022g).

The shorebased IFQ program consists of shoreside whiting, midwater rockfish, bottom trawl, and "gear switchers." ("Gear switchers" are vessels that have a permit in the bottom trawl fishery but are allowed to use fixed gear to fish sablefish against the sablefish trawl quota[34]). Whiting and midwater rockfish are targeted with midwater trawl nets. In 2019 there were 27 vessels participating in shoreside whiting. The midwater rockfish fishery was closed in 2002 due to overfishing, and was reopened in 2016, with Widow rockfish the primary target, followed by Yellowtail rockfish. Bottom trawlers typically target multiple species, such as dover sole, petrale sole, and sablefish. These three species are responsible for 75% of this sector's revenue from 2011-2019. In 2011, 71 vessels participated in the bottom trawl fishery, and declined to 58 in 2018. From 2011-2018, gear switchers landed approximately 30% of total available sablefish pounds north of 36° N. There were 24 gear switching vessels in 2011, down to about 16 in 2019.

At-Sea Whiting

The at-sea whiting sector consists of catcher processors and motherships, along with the catcher vessels that deliver to the motherships (PFMC 2022g). This sector has been managed with cooperatives since 2011. At-sea whiting strictly targets whiting, with yield set-asides for co-occurring groundfish species. Catcher processors have been operating under the Pacific Whiting Conservation Cooperative since 2011, and is capped at 10 vessels. There have been at least 9 catcher processors annually since 2011. Motherships are large processing vessels under the Whiting Mothership Cooperative, formed by the 37 catcher vessels endorsed for the mothership sector. The cooperative receives its own quota allocation. In

[33] See https://www.pcouncil.org/documents/2022/09/status-of-the-pacific-coast-groundfish-fishery-stock-assessment-and-fishery-evaluation-july-2022.pdf/, page 10.

[34] According to the 2022 Groundfish SAFE, "Gear switching was envisaged as a strategy to harvest species not otherwise accessible in a mixed stock trawl fishery with some conservation benefits due to less bottom habitat disturbance." (PFMC 2022g).

2011 there were 18 catcher vessels delivering to 5 motherships, and in 2019 there were 19 vessels delivering to 6 motherships.

3.2.1.1.2.2 Non-Trawl Sector

The non-trawl sector uses fixed gear, and is separated by permit type (limited entry and open access) and location (nearshore and non-nearshore). The nearshore non-trawl sector operates in state waters in California and Oregon (Washington closed state waters to commercial fisheries in 1995), while the non-nearshore non-trawl sector operates farther offshore and primarily targets sablefish. Nearshore and non-nearshore are both subject to trip limits (PFMC 2022g).

Limited Entry Fixed Gear

Limited entry fixed gear vessels fish with or without a sablefish endorsement and with their gear endorsement (longline or pots/traps). A sablefish endorsement means a vessel can fish in the "primary" sablefish fishery north of the 36ºN line, which is open from April 1 to December 31. Those without an endorsement target northern sablefish in the daily-trip-limit fishery (DTL). Sablefish endorsed vessels can fish in the DTL fishery before and after the primary season. The primary fishery has three tiers of cumulative landing limits for participants fishing sablefish north 36ºN. About 85% of sablefish is allocated to the vessels with a sablefish endorsement, with the remaining 15% to the DTL fishery (PFMC 2022g). All other species are managed with trip limits that are typically higher than those in the open access fishery.

Open Access

There are no permit requirements in the open access fishery but vessels typically have lower landing limits (PFMC 2022g). Some open access vessels target groundfish while the others catch groundfish while targeting other species. Open access vessels in the nearshore groundfish fishery are subject to state regulations, and are not permitted to fish in federal waters unless they have a limited entry permit and a Vessel Monitoring System (VMS).[35]

3.2.1.1.2.3 Fishing Effort and Trends

Every two years the NMFS Northwest Fisheries Science Center publishes a technical report on trends in fishing effort in the West Coast groundfish fishery. The following section summarizes groundfish fishing effort and trends, as indicated by the latest report in this series, *Fishing Effort in the 2002–19 U.S. Pacific Coast Groundfish Fisheries* (Somers et al. 2022). This report breaks out the groundfish fishery by gear, area, and management plan, and reports on the status of the fishery. Table 7 summarizes the information in this report and provides the average length of vessels and the number of vessels participating.

[35] See https://www.pcouncil.org/documents/2022/09/status-of-the-pacific-coast-groundfish-fishery-stock-assessment-and-fishery-evaluation-july-2022.pdf/.

Table 7. Trends in fishing effort and vessel characteristics

Sector	Average Length of Haul	Main Geographic Area	Depth	Average Length of Vessel (2020)	Number of Vessels (2020)	Total Number of Trips (2020)
Trawl- Bottom trawl	~3 hours	Astoria, OR Hotspots near Newport, OR and Fort Bragg, CA	0-100 fathoms	70’	50	693
Trawl- Mid-water trawl, rockfish	~1.2-1.8 hours	Central WA to Central OR, concentrated on OR-WA border	75% 50-100 fathoms	87’	28	191
Trawl- Mid-water trawl, shoreside whiting	~2-2.5 hours	Concentrated near Newport, OR and Astoria, OR	50-250 fathoms	93’	28	1243
Trawl, Mid-water trawl, At-sea whiting- Catcher-processors	~2.5-3.3 hours	lat 48–47°N, lat 43°N	>90% 100-250 fathoms	303’	10	**
Trawl, Mid-water trawl, At-sea whiting- Mothership	~2-2.5 hours	lat 47°N and lat 43°N	>90% 100-250 fathoms	107’	15	330
Fixed gear, Pot, Open Access, Non Catch Share	~15-40 pots per set	Majority between Astoria, OR and Fort Bragg, CA	100-300 fathoms	35’	87	**
Fixed gear, Hook-and-line, Open Access, Non Catch Share	~2,500 hooks per set	lat 48–32°N, dispersed evenly along the coast, proportion of landings occurring in the 48°N, 39°N, and 34°N latitudinal bins increased slightly.	0-750 fathoms, majority 150-200 fathoms	27’	528	**
Fixed gear, Pot, Limited Entry, Catch Share	~15-40 pots per set	Washington and Oregon,with two areas of concentration off Fort Bragg and San Francisco, CA	100-600 fathoms	59’	36	119 *
Fixed gear, Hook-and-line, Limited Entry, Catch Share	~3,200 hooks per set	>50% occurred in the 48°N latitudinal bin in both 2017 and 2019; increased landings in the 46°N latitudinal bin from 2017 to 2019; no landings south of lat 43°N after 2016.	0-750 fathoms, majority in 200-250 fathoms	47’	33	

Sources: Somers et al. 2022; FishEYE Web application (https://connect.fisheries.noaa.gov/fisheye/fisheyelandingpage.html)
* Fixed gear limited entry catch share pot and hook-and-line trips are combined in the total.
** Number of trips for non-catch share groundfish fisheries may be available via data request from the West Coast Groundfish Trawl Catch Share Observer Program (https://www.fisheries.noaa.gov/west-coast/fisheries-observers/west-coast-groundfish-trawl-catch-share-observer-program). Number of trips for catcher processors may be available via data request from the North Pacific Observer Program (https://www.fisheries.noaa.gov/alaska/fisheries-observers/north-pacific-observer-program).

The highest revenue groundfish species in California are sablefish and thornyheads, and the gear most used to land these species are longline and setline. In Oregon, Pacific whiting is the highest revenue species, ahead of rockfish. In Washington, whiting is also the most landed species, ahead of sablefish. Midwater trawl lands the most whiting, and longline or setline lands the sablefish. According to *Fishing Effort in the 2002-2019 U.S. Pacific Coast Groundfish Fisheries* (Somers et al. 2022), most groundfish bottom trawl effort takes place near Astoria, Oregon, with hotspots near Newport, Oregon, and Fort Bragg, California.

3.2.1.1.3 Highly Migratory Species

Highly migratory species (HMS) range throughout the open ocean, and may spend part of their lifecycle in nearshore waters (PFMC 2021a). Tunas, sharks, billfish, and dorado (also known as dolphinfish or mahi-mahi) are managed under the PFMC's HMS FMP[36] (PFMC 2022h). The PFMC's HMS Management Team prepares a SAFE[37] annually which provides info on the status of HMS stocks and fisheries (PFMC 2022i).

HMS are harvested by U.S. commercial and recreational anglers and by foreign fishing fleets; a small portion of most Council-managed HMS are caught in U.S. waters. The Inter-American Tropical Tuna Commission (IATTC) and Western and Central Pacific Fisheries Commission (WCPFC), of which the U.S. are a member, are responsible for the conservation and management of fisheries in the Pacific Ocean (PFMC 2021a). Approximately 400 commercial vessels along the West Coast have participated in the HMS fishery in recent years; drift gillnet, harpoon, and long-line are among the gear used (Table 8).

Current Council management issues include reducing bycatch in fisheries targeting swordfish off the West Coast, measures to end overfishing (in coordination with international management organizations), and protecting sharks, susceptible to overfishing (PFMC 2021a).

[36] See https://www.pcouncil.org/documents/2022/07/fishery-management-plan-for-west-coast-fisheries-for-highly-migratory-species-through-amendment-5.pdf/.
[37] See https://www.pcouncil.org/safe-documents-2/.

Table 8. Gear, location, and number of vessels in HMS fisheries

Fishery	Principal Gears	Location/Ports	Number of Vessels 2012-2021
Albacore	Surface-hook-and line: Troll and bait boat (live bait). Incidentally caught by purse seine, longline, and large mesh drift gillnet gears.	Recent landings concentrated in Newport and Astoria ports, Oregon, and Westport and Ilwaco ports, Washington (a)	Varied from 293 in 2021 to 815 in 2012
Swordfish (c) (predominantly) and shark	Drift gillnet	South of Monterey, California, in southern California Bight (b)	Varied from 6 in 2021 to 21 in several previous years
Swordfish	Harpoon	Southern California Bight	Varied between 10 in 2012 to 21 in 2017
Swordfish and Tuna	High seas long line	Pelagic longline vessels fishing outside the West Coast EEZ land swordfish and tuna in West Coast ports, mainly San Francisco, Los Angeles, and San Diego. (d)	Varied between 8 and 23
Yellowfin, skipjack, and bluefin tunas	Coastal purse seine	Southern California Bight	Varied between 1 in 2012 and 14 in 2018
Swordfish	Deep-set buoy	Southern California Bight	50 (2021)

Source: PFMC 2022i.
Notes: (a) A treaty between the governments of the U.S. and Canada allows vessels from each country to fish in the other country's EEZ outside of 12 miles. Vessels also have port privileges and Canadian vessels may land albacore in designated ports.
(b) Pacific Ocean from Point Conception to just past San Diego (border with Mexico).
(c) Federal legislation has been proposed to phase out fishery.
(d) The HMS FMP prohibits targeting swordfish with pelagic longline gear. However, vessels possessing a Hawaii longline limited access permit may land swordfish at West Coast ports.

3.2.1.1.4 Salmon

The PFMC manages commercial and recreational Chinook (king) salmon and coho (silver) salmon, in coastal federal waters in accordance with the Pacific salmon FMP and in coordination with treaty tribes and states (PFMC 2022j). Small numbers of pink salmon may be harvested in odd-numbered years (PFMC 2023[38]). Other Pacific salmon species (sockeye and chum salmon and steelhead trout) are rarely caught in Council-managed areas (PFMC 2021e; PFMC 2023). Conservation objectives and allocation provisions are the two main parts of the FMP. Management tools (e.g., season length, quotas, bag limits) vary depending on how many salmon are estimated to be present (PFMC 2023).

The challenges of managing commercial and recreational West Coast salmon fisheries include coordinating with international, regional, and other agencies and groups, assessing the effects of regional fisheries on stocks, recovery under the Endangered Species Act (ESA) (for endangered salmon species that co-mingle with MSA-managed target stocks), fair division of harvest, and restoring freshwater habitat (PFMC 2021e).

[38] See https://www.pcouncil.org/documents/2023/02/review-of-2022-ocean-salmon-fisheries.pdf/.

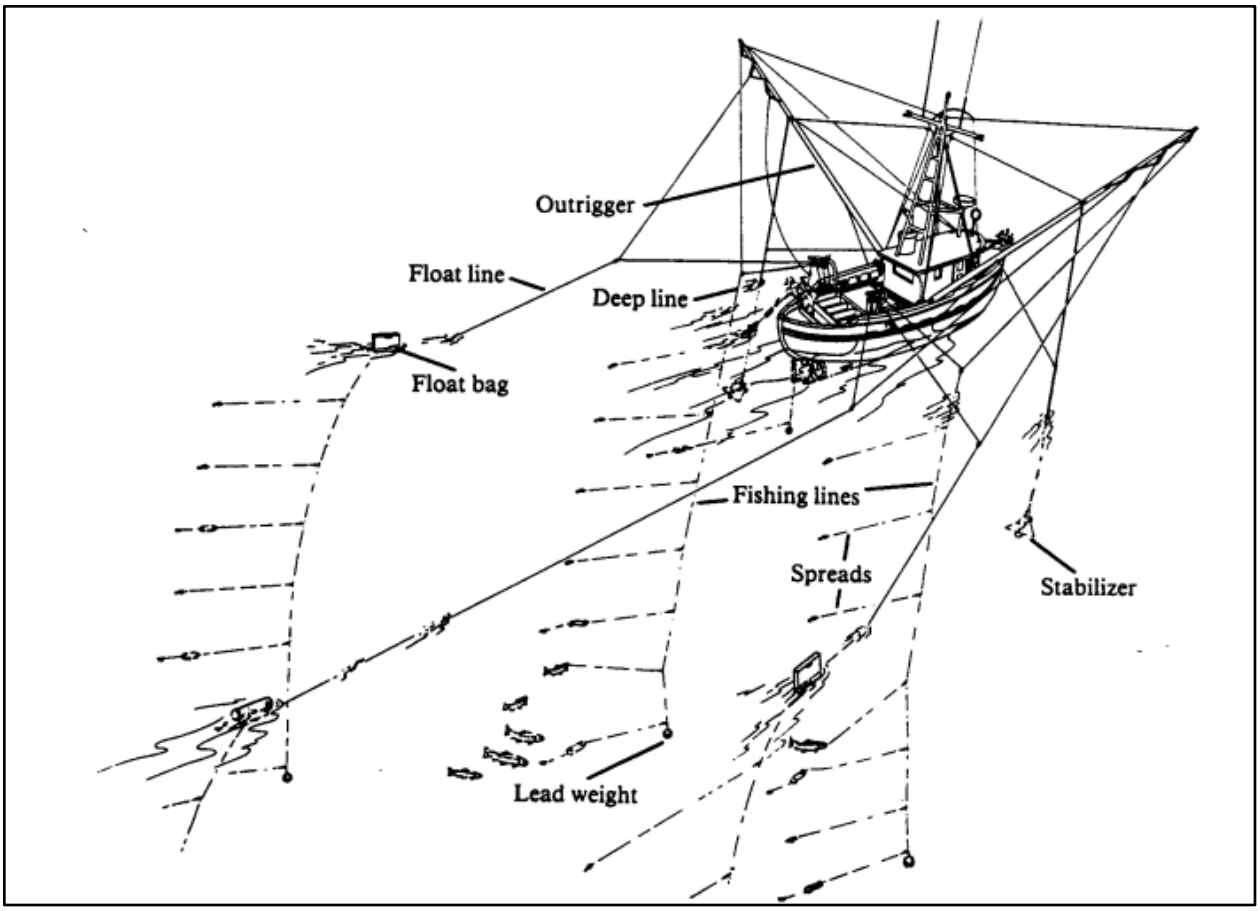


Figure 10. Salmon troll gear set
Source: PSFMC 2000, Figure 3.

Salmon are anadromous, meaning they hatch in freshwater rivers and streams, migrate to the ocean to grow to adults, and return to their natal waters to spawn (PFMC 2021e). Chinook salmon are found throughout the Pacific Ocean as far south as the U.S. border with Mexico, while coho are primarily in coastal waters between central Oregon and southeast Alaska.

A total of 2,062 West Coast vessels had commercial fishing permits in 2021, and about a third landed salmon (Table 9) (PFMC 2023). The dominant vessel length varies by state, with 54 (71%) of the 76 Washington vessels participating in the West Coast commercial salmon troll (see Figure 10) fishery greater than 36 feet in length; over half (105) of the Oregon-permitted vessels were between 20 and 29 feet long, and over half (272) of California vessels were 21 to 35 feet long (PFMC 2023, Tables D-7 to D-9). Salmon trollers generally operate close to shore, from the breakwater to about 300 meters water depth, although some may go to deeper waters.

Table 9. Number of vessels registered and number with commercial Chinook and coho troll salmon landings

State	Vessels with Permits	Vessels Landing Salmon	Percent of Permitted Vessels Landing Salmon
Washington	153	76	50%
Oregon	883	187	21%
California	1,026	486	47%
Total	2,062	749	36%

Source: PFMC 2023, Tables D-4 to D-6.
Note: Annual data for prior years are available.

3.2.1.2 Commercial Fisheries by Gear Type

Commercial fishers on the West Coast use trawl, long line, and hook and line gear to catch most groundfish, while net gear are primarily used for coastal pelagic species such as mackerel (PFMC 2021c; PFMC 2021d). Fish trawls accounted for nearly 70% of commercially landed weight on the West Coast and 12% of revenue in 2021 (Table 10). Nearly half of the fish caught in trawls were landed at-sea (PacFIN 2022c). Net gear landings were the second largest in terms of weight. Revenue from use of pots and traps represented nearly half total total West Coast commercial landings in 2021. Gear types and general locations for commercial fisheries in Washington, Oregon and northern California are provided in Tables 11 and 12 (Industrial Economics 2012).

Table 10. Commercial landings and revenue of West Coast species by gear type, 2021

Gear	Landed Weight Metric Tons	Landed Weight Percent of Total	Revenue Dollars (millions)	Revenue Percent of Total
Dredge	1,798	0.4%	$48.3	7%
Hook & Line	4,123	1%	$28.3	4%
Net	59,824	14%	$98.6	15%
Pot & Trap	31,600	7%	$331.0	49%
Troll	4,659	1%	$37.1	5%
Trawl	299,285	69%	$84.4	12%
Shrimp Trawl	30,456	7%	$33.6	5%
Other Gear	2,829	1%	$15.9	2%
Total	434,573	100%	$677.1	100%

Source: PacFIN 2022c.
Note: The total includes (fish trawl) landings by Pacific at-sea processors: 140,303 metric tons, with revenue totaling $34.4 million.

Table 11. Washington and Oregon commercial fisheries, gear types, and locations

Fishery	Gear Type	Washington	Oregon
Tuna	Mobile (troll/pole, hook and line)	Generally near surface, 30-40 nm or more from shore	Generally near surface, 30 nm or more from shore at 50-100 up to 500-2,000 fathoms
Salmon	Mobile (troll, hook and line)	10-180 fathoms from Canada to Oregon border	Breakers to 200 fathoms; sometimes up to 650 fathoms
Crab	Fixed (pot)	0-10 fathoms up to 90-100 fathoms; mostly sandy or mud bottom; Important tribal issues here - only southernmost 38 miles open to all	Breakers to 130 fathoms and up to 700 in some years; around tops of canyons, high spots
Shrimp	Mobile (trawl)	30-150 fathoms; muddy, flat, soft bottom	30-150 fathoms; 90 percent in 60-140 fathoms; muddy, soft, flat bottom
Groundfish	Mobile (bottom and midwater trawl, hook and line)	Surface to 700 fathoms; midwater trawl generally at 1,000 fathoms, but nets are not this deep	Breakers to 400-700 fathoms; 1,200 fathoms for midwater, but nets are not this deep
Black Cod (Sablefish)	Mobile (trawl); fixed (pots, long line)	100-500 fathoms; depends on time of year	100-500/650 fathoms
Halibut	Fixed (long line)	90-100 fathoms	22 nm at 100-125 fathoms
Spot Prawns	Fixed (pot)	85-120/130 fathoms; primarily hard bottom at around 100 fathoms	85-120/130 fathoms; primarily hard bottom at around 100 fathoms

Source: Modified (reformatted for accessibility) from Industrial Economics, Inc. 2012, Table 6-5.
Notes: A fathom is equivalent to 6 feet; nm = nautical mile, 1 nautical mile is equivalent to ~2,025 yards or 1.5 statute (land) miles.
Bottom trawling is not currently allowed outside of 700 fathoms in the entire West Coast EEZ. This relatively new regulation is intended to protect essential fish habitat.

Table 12. Northern California commercial fisheries, gear types, and locations

Fishery	Gear Type	Locations (a)
Albacore (tuna)	Mobile (troll, hook-and-line)	Pelagic/surface. Distribution varies by water temperature and feed. BRG: ≤ 25 nm, 500 fathoms and beyond. ERK: >= 30-40 nm and beyond the EEZ; range: Pt. Arena - Canadian border
Black Cod	Mobile (trawl); fixed (pot, longline)	Transitional hard, mud and some sand bottom BRG longline: edges of canyons, outside RCA (150 fathoms), ~200 fathoms, ~14 nm NW; range: Pt. Arena - Shelter Cove BRG trap: 8 nm west ERK: longline and groundfish trawl occur ~ same area
Crab	Fixed (pot)	Sand or mud bottom, shelf Most of N. coast in winter BRG: ≤ 60 fathoms (federal waters) for smaller boats; 40°10' line 100 fathoms for larger boats; avoid canyons; most in state waters; a few OCS spots ERK: most boats ≤ 60 fathoms, 5-100 fathoms, ≤ 15 miles
Groundfish	Mobile (bottom and midwater trawl, hook-and line)	Fish move in and out over season; different species distributed differently ERK: "beach" fishing (<100 fathoms, some 3-4 nm; most 45-80 fathoms, 5-10 nm); offshore fishing (outside RCA), some out to ~28 nm, 40°10' N BRG longline: < 20 fathoms and >150 fathoms (5-6 nm) BRG trawl: soft bottom, sand mud; ~4.5nm - 20 nm; 600-700 fathoms, 40°10' line - below Cordell Banks; inside RCA to Pt. Arena
Hagfish	Fixed (pot lines)	Mud bottom, similar to crab ≥ 35 fathoms
Pacific Halibut	Fixed (longline)	
Salmon	Mobile (troll, hook-and-line)	Pelagic, distribution varies by feed and time of season BRG: inside and outside the RCA, often 3nm good ERK: KMZ closures have sharply limited ERK-CRS fishery since 1985; ≤ 25 miles, some follow 100 fathom curve, canyon fingers
Shrimp	Mobile (trawl)	Mud/soft bottom BRG: ERK: 3 nm -- 110 fathoms; 40-100 fathoms, range from Westport, California, to Coos Bay, Oregon
Spot Prawn	Fixed (pot)	85-120/130 fathoms, Washington to California; primarily hard bottom at around 100 fathoms

Source: Based on Industrial Economics, Inc. 2012, Table 7-5.
Notes: A fathom is equivalent to 6 feet; nm= nautical mile, 1 nautical mile is equivalent to ~2,025 yards or 1.5 statute (land) miles.
BRG = Fort Bragg area/fleet; ERK = Eureka area/fleet; RCA = Rockfish Conservation Area
Since space and use information for fisheries off Crescent City is limited, this table focuses on the Eureka area and Fort Bragg.
For most commercial fisheries, most productive area is 3-20 nm, although much crabbing occurs in state waters, and some fisheries (e.g., albacore tuna) range > 20 nm. Bottom trawling is prohibited in state waters (<3 nm), and since 2006 has been prohibited outside 700 fathoms throughout most of the U.S. West Coast eeZ under federal Essential Fish Habitat regulations. The Rockfish Conservation Areas (RCAs), which vary by gear type and change periodically, also constrain space use.

3.2.1.3 Commercial Fisheries Engagement

Approximately 4,700 people were engaged in commercial fishing on the West Coast in 2019 (U.S. Bureau of Labor Statistics 2022; U.S. Census Bureau 2022a) (Table 13). This is likely an underestimate because the average annual number of employees is unavailable for 10 of the 26 counties (data do not meet the U.S. Bureau of Labor Statistics (BLS) or State agency disclosure standards) (U.S. Bureau of Labor Statistics 2022). In the 16 counties for which average annual employee data are available, an average of 80% of all fishers were in "nonemployer establishments[39]"-- businesses with no paid employees. Most nonemployers are self-employed individuals operating sole-proprietorships (U.S. Census Bureau 2022a). The portion of all fishers that were self-employed ranged from 48% to 95% in the 16 coastal counties, with sales/revenue of $297.4 million in 2019 (2021 dollars; Table 14). The spatial distribution of commercial fishing engagement is shown in Figures 11 and 12. Engagement is measured by the number of permits, pounds and value of landings, and number of dealers for commercial fishing (Jepson and Colburn 2013).

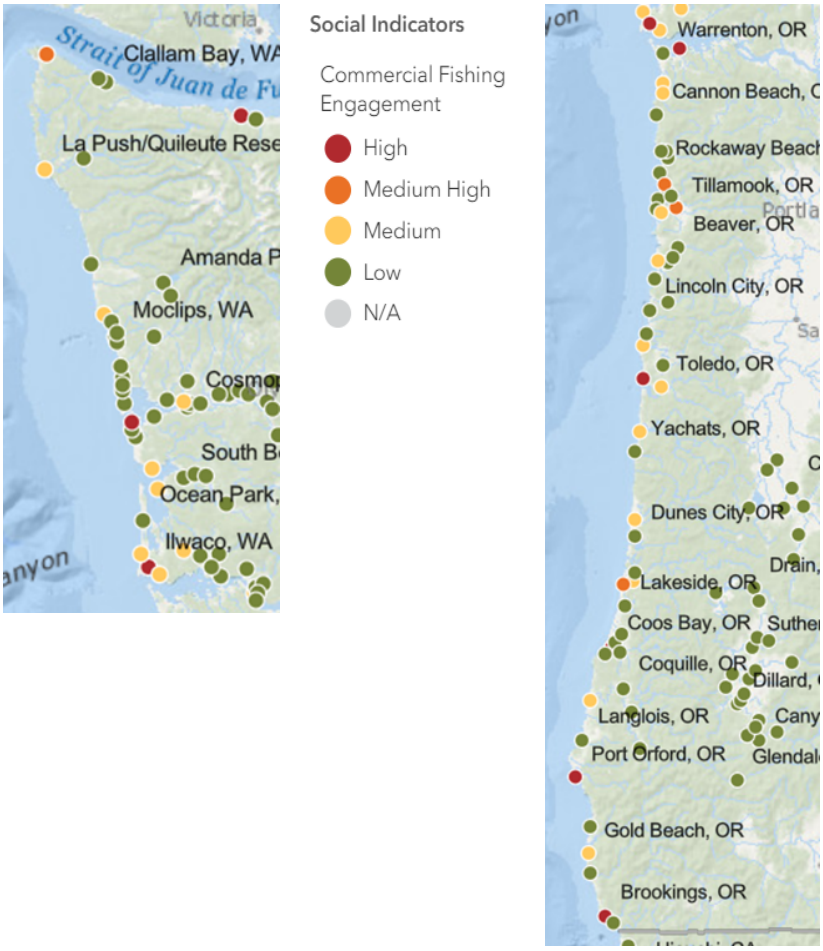


Figure 11. Commercial fishing engagement, Washington and Oregon, 2019
Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. (A high rank indicates more engagement.)
Note: See section 5.1.2.1, Fishing Engagement and Reliance.
Source: NMFS Social Indicators Tool (https://www.st.nmfs.noaa.gov/data-and-tools/social-indicators/).

[39] An establishment is a single physical location at which business is conducted or services or industrial operations are performed. (A company may consist of one establishment or more) (U.S. Census Bureau 2022b).

Employees in commercial fishing establishments earned at least $39 million in 2019 (U.S. Bureau of Labor Statistics 2022) (Table 14). (Employee wages are not available for 9 of 25 counties because data do not meet BLS or State agency disclosure standards.)

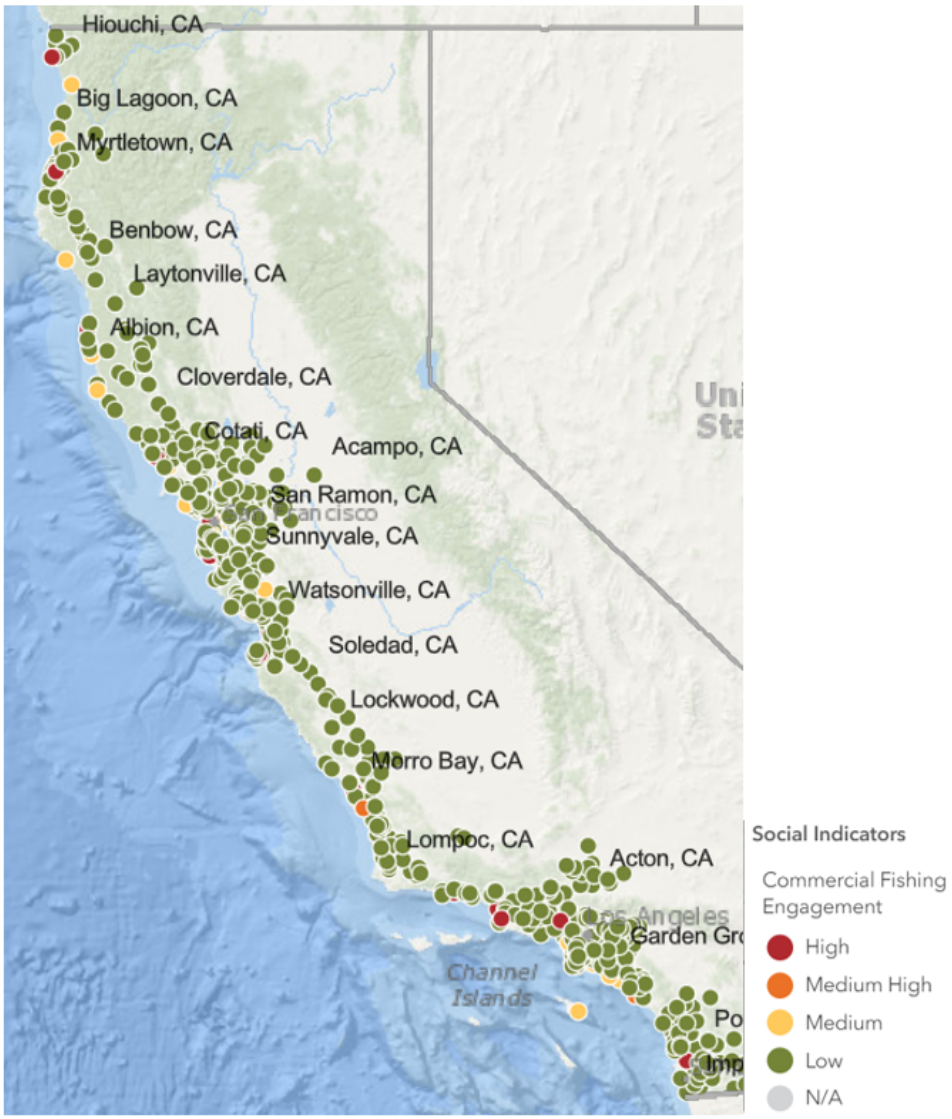


Figure 12. Commercial fishing engagement, California, 2019
Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. (A high rank indicates more engagement.)
Note: See section 5.1.2.1, Fishing Engagement and Reliance.
Source: NMFS Social Indicators Tool (https://www.st.nmfs.noaa.gov/data-and-tools/social-indicators/).

Table 13. Number of West Coast fishing establishments and employees, and nonemployer establishments, by state, 2019[40]

State	Establishments with Employees Annual Establishments	Establishments with Employees Average Annual Employees (a)	Number of Nonemployer Establishments	Total Fishers (b)
Washington	61	368	689	1,057
Oregon	102	209	1,112	1,321
California	190	239	2,052	2,291
Total	353	816	3,853	4,669

Sources: U.S. Bureau of Labor Statistics 2022; U.S. Census Bureau 2022a. Data for North American Industrial Classification System code 11411 (Fishing). (Does not include fish hatcheries and aquaculture.) Data for coastal counties: Clallam, Jefferson, Grays Harbor, and Pacific County, Washington; Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry County, Oregon; and Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Francisco, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego County, California.
Notes: Nonemployer establishments are businesses with no paid employees. Most nonemployers are self-employed individuals (sole proprietors).
(a) Average annual employees are not available for 9 of 25 counties because data do not meet BLS or State agency disclosure standards. Values for 2 counties are estimated based on the first 3 quarters (data unavailable for the 4th quarter).
(b) Average annual employees plus number of nonemployer establishments.

Table 14. Total wages of West Coast fishing establishment employees and nonemployer revenue, by state, 2019 (thousands of 2021 dollars)

State	Employee Wages (a)	Nonemployer Revenue (b)
Washington	$14,828	$57,394
Oregon	$13,361	$104,163
California	$13,744	$135,888
Total	$41,933	$297,444

Sources: U.S. Bureau of Labor Statistics 2022; U.S. Census Bureau 2022a.
Data for North American Industrial Classification System code 11411 (Fishing).
Notes: Nonemployer establishments are businesses with no paid employees. Most nonemployers are self-employed individuals (sole proprietors).
(a) Employee wages are not available for 9 of 25 counties because data do not meet BLS or State agency disclosure standards. Values for 2 counties are estimated based on the first 3 quarters (data unavailable for the 4th quarter).
(b) Nonemployer revenue is comparable to employee wages.

3.2.1.4 Industries Supporting Commercial Fisheries

For commercially caught fish, the path from commercial vessels to consumers can be complex (Figure 13). Some harvested seafood is sold directly to consumers, while some is processed, brokered, distributed, or exported, and retailed by separate firms (PSMFC 2000). Fish processing involves a variety of functions. For some species, processing entails icing fish and selling directly to consumers or shipping it to be canned. For example, most albacore tuna is frozen and exported to be canned while non-whiting

[40] 2019 is the most recent year for which nonemployer data is available (U.S. Census Bureau 2022a).

groundfish are generally fileted. Other types of processing involve large amounts of labor, such as shelling shrimp, or large amounts of capital, such as the production of surimi (Krigbaum et al. 2019).

NMFS collects processor data only for the catch shares sectors of the West Coast groundfish fishery.[41] In 2020, there were 10 shore-based processors in Washington and Oregon and 3 in California. The Washington and Oregon facilities processed a total of 22 species [average 11 each]. Seafood sales revenue (the value of fish products) totaled $145.9 million in Washington and Oregon, and the 1,238 employees were paid $36.3 million (wages, bonuses, benefits, payroll taxes and unemployment insurance; 2020 dollars).

Data regarding the number of seafood buyers, species purchased, and cost of purchases is available from fish tickets. The buyers referenced on fish tickets may be processors, buyers that do simple processing such as gutting and freezing, buying stations, or offloading stations that truck purchased fish to coastal or in-shore processing facilities.

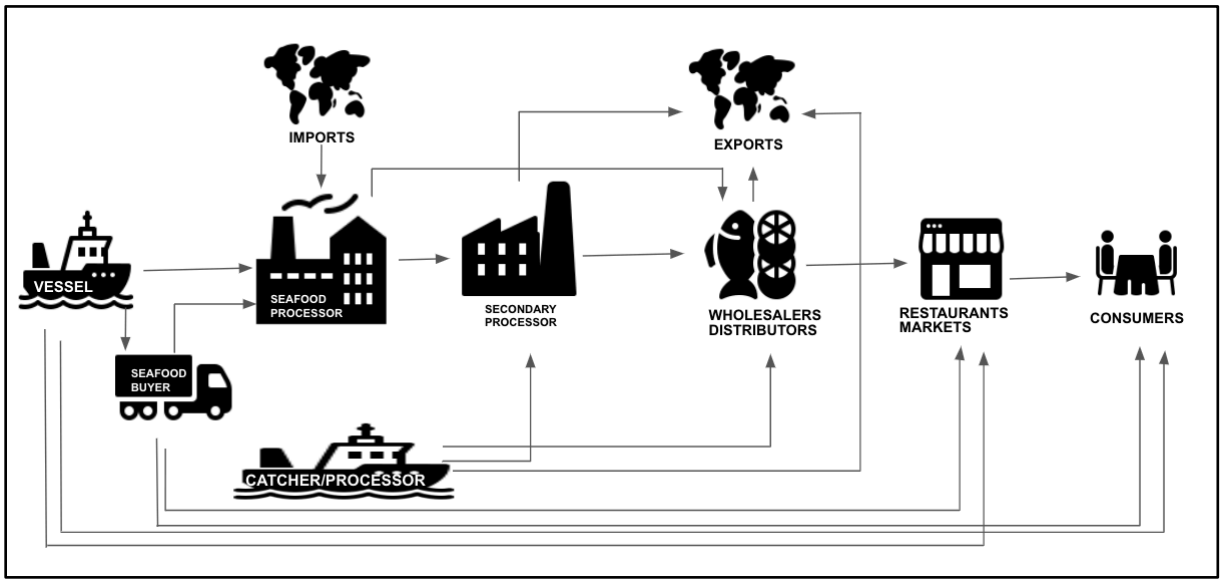


Figure 13. Seafood product distribution chain
The path from commercial vessels to consumers can be complex for commercially caught fish.
Source: Figure developed based on Figure 3 in "Description of the U.S. West Coast Commercial Fishing Fleet and Seafood Processors" (PSMFC 2000).

Industries that directly support commercial fishing include seafood wholesalers, processors, and retail seafood markets.[42] There were 623 establishments in these supporting industry sectors in West Coast counties in 2019; over half were seafood wholesalers (U.S. Bureau of Labor Statistics 2022) (Table 15). Other industry sectors support fishing, as well as other port users, such as warehousing, ship and boat building and repair, and marine transportation services.[43] In 2019 there were 756 such establishments in coastal counties.

[41] See https://connect.fisheries.noaa.gov/WestCoastCatchShares/.
[42] A national survey of harvesters and businesses that participate in a state or federal commercial fishery was conducted March through July 2023 by the University of Maine, with results expected to be released thereafter (University of Maine 2023 Mar 1).
[43] The number of establishments providing other goods, e.g., fishing gear, bait, ice, and boat fuel, are included within other industry sectors and the portion supporting commercial fishing and other port users cannot be identified separately.

Table 15. Number of West Coast establishments supporting commercial fishing, by industry and state, 2019

Industry	Washington	Oregon	California	Total
Seafood-related:				
Seafood wholesalers	4	9	343	356
Seafood processing	18	27	37	82
Seafood markets	8	17	160	185
Subtotal	30	53	540	623
Port-related:				
Refrigerated warehousing (a)	1	1	115	117
Ship and boat building and repair	19	16	101	136
Heavy construction (b)	6	22	186	214
Search and navigation equipment	0	0	147	147
Marine transportation services (c)	6	11	125	142
Subtotal	32	50	674	756
Total	62	156	1,754	1,972

Source: U.S. Bureau of Labor Statistics 2022. Data for North American Industrial Classification System codes 42446, 31171, 44522, 49312, 3366, 23799, 334511, and 4883. State totals represent the sum of West Coast county data; county-level data may be withheld if it does not meet BLS or State agency disclosure standards. Port-level data not available.
Notes: (a) Does not include farm product warehousing and storage (NAICS code 49313).
(b) Includes dredging and development of marine facilities.
(c) Includes port and harbor operations, marine cargo handling, navigational services to shipping, and other support activities for water transportation.

Port infrastructure needed for the processing and distribution of the commercial catch includes docks and unloading facilities, cold storage, utilities, ice, and water. Summaries of infrastructure by port are provided in *West Coast Groundfish Trawl Catch Share Program: Five-year review* (PFMC and NMFS Northwest Fisheries Science Center 2017) (Table 16). The information was obtained primarily from interviews with enforcement personnel, port samplers, port managers, and members of the industry. Profiles are available for ports in Washington, Oregon, and California. The type and extent of infrastructure at these ports could indicate the degree to which other activities at the ports may conflict with commercial fishing activities.

Table 16. Example of information available about port infrastructure

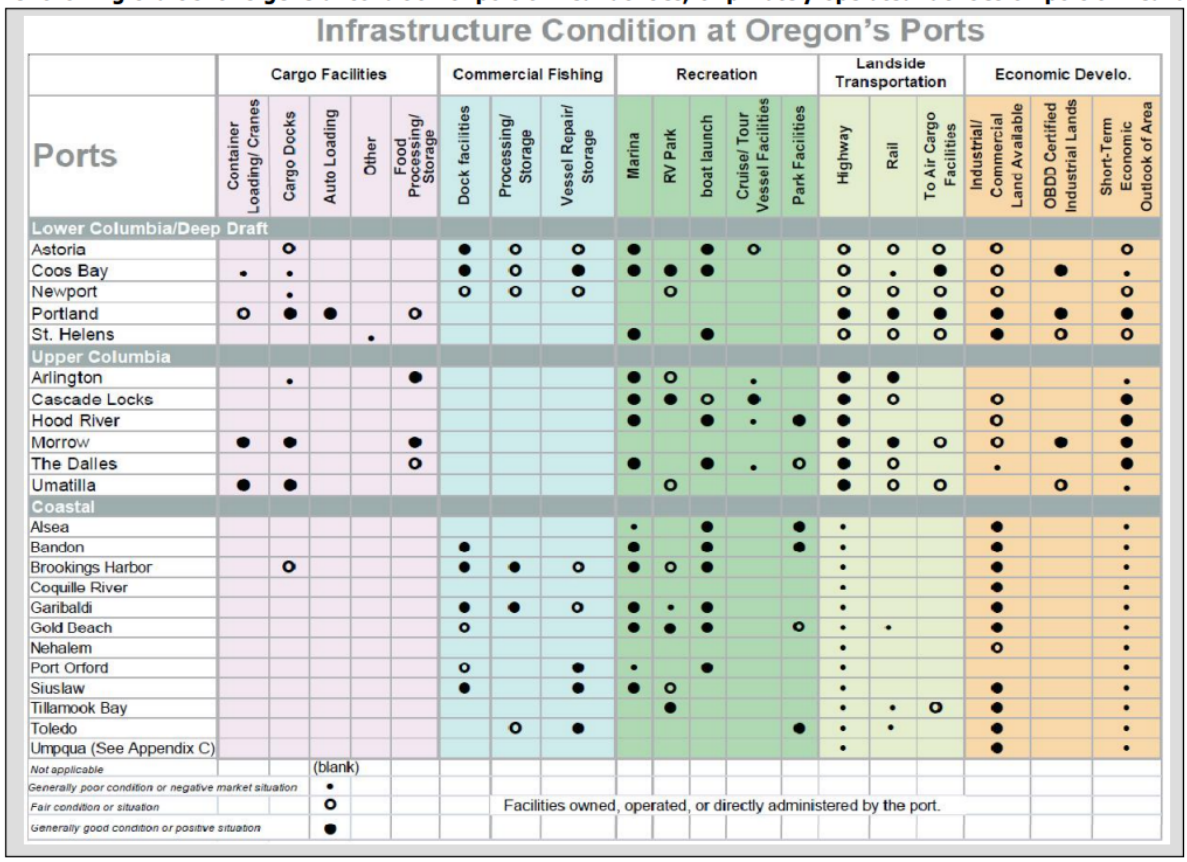
Ilwaco Harbor, Baker Bay on Columbia River	Fuel Dock	Ice Plant/ Sales Cold Storage/Refrig.	Processors	Fishery-related Berths and Moorage (excludes shipping and government, e.g., USCG)	Gear storage/ gear yard	Boat Hoists, Lifts, and Cranes Shipyard/Boatyards/Dry Dock	Marine/Vessel Supply Stores	Dredging	USCG
Pre-catch shares.[23]	Two.	Ice available. Cold storage for bait (processor has cold storage for own use).	One.	54 commercial fishing vessels and 610 pleasure craft (June 2005) 800-slip marina.	No.	Two small boat hoists (recreational) and a 50 ton travel lift for fairly large commercial vessels). Dry boat storage Full service work yard.	Yes.	Periodic entrance dredging by the ACOE. Port maintains the marina area.[24]	USCG Station Cape Disappointment (largest search and rescue station on the Northwest Coast) is co-located with the USCG National Motor Lifeboat School.
Catch shares (2011 to 2016).[25]	One.	No change.	No change.	Upgrading commercial docks.	No.	No change to hoists. Now three enclosed bays for inside work and an enclosed shop (there has been one for a long time, and two more were added)	No change.	Recent COE commitment to several years of dredging.	No change.[26]

[23] Data from NMFS (2007) port profiles, unless otherwise noted.
[24] Whittaker, Luke. "Dredging Underway at Port of Chinook." Chinook Observer. January 31, 2017. http://www.chinookobserver.com/co/local-news/20170131/dredging-underway-at-port-of-chinook.
[25] Personal communication, Dan Chadwick, February 10, 2017, unless otherwise noted.
[26] Personal communication, Brian Corrigan, February 1, 2017: USCG reports no shifts in cutter homeport shifts, air station relocations, or boat station relocations relative to the start of the trawl catch share program.

Source: Modified (reformatted for accessibility) from PFMC and NMFS Northwest Fisheries Science Center 2017, Appendix D, Table D5a. Ilwaco Washington, commercial-fishery-related infrastructure.
https://www.pcouncil.org/documents/2017/01/trawl-catch-share-review-appendices.pdf/

There have been recent regional efforts to assess port infrastructure, such as Monterey, California's, *Fishing Community Sustainability Plan* (Lisa Wise Consulting, Inc. 2013). The plan includes an evaluation of the municipal wharf and facilities associated with commercial fishing infrastructure and recommendations for improvement. Infrastructure needs for San Diego's Seaport Village have also been documented for the California Coastal Commission (email from S. Scheiblauer March 15, 2023). And infrastructure at Oregon's ports were summarized in the state's 2010 Strategic Business Plan (Figure 14) (Parsons Brinckerhoff 2010).[44] Infrastructure at many ports serves recreational fisheries as well as commercial.

The following chart shows general condition of port-owned facilities, or privately-operated facilities on port-owned land.



Infrastructure Condition at Oregon's Ports

Ports	Cargo Facilities					Commercial Fishing			Recreation					Landside Transportation			Economic Develo.		
	Container Loading/ Cranes	Cargo Docks	Auto Loading	Other	Food Processing/ Storage	Dock facilities	Processing/ Storage	Vessel Repair/ Storage	Marina	RV Park	boat launch	Cruise/ Tour Vessel Facilities	Park Facilities	Highway	Rail	To Air Cargo Facilities	Industrial/ Commercial Land Available	OBDD Certified Industrial Lands	Short-Term Economic Outlook of Area
Lower Columbia/Deep Draft																			
Astoria		o				●	o	o	●		●	o		o	o	o	o		o
Coos Bay	•	•				●	o	●	●	●	●			o	•	●	o	●	•
Newport		•				o	o	o		o				o	o	o	o		o
Portland	o	●	●		o									●	●	●	●	●	●
St. Helens				•					●		●			o	o	o	●	o	o
Upper Columbia																			
Arlington		•			●				●	o		•		●	●				•
Cascade Locks									●	●	o	●		●	o		o		●
Hood River									●		●	•	●	●			o		●
Morrow	●	●			●									●	●	o	o	●	●
The Dalles					o				●		●	•	o	●	o		•		●
Umatilla	●	●								o				●	o	o		o	•
Coastal																			
Alsea									•		●		●	•			●		•
Bandon						●			●		●		●	•			●		•
Brookings Harbor		o				●	●	o	●	o	●			•			●		•
Coquille River														•			●		•
Garibaldi						●	●	o	●	•	●			•			●		•
Gold Beach						o			●	●	●		o	•	•		●		•
Nehalem														•			o		•
Port Orford						o		●	•		●			•					•
Siuslaw						●		●	●	o				•			●		•
Tillamook Bay										●				•	•	o	●		•
Toledo							o	●					●	•	•		●		•
Umpqua (See Appendix C)														•			●		•

Not applicable (blank)
Generally poor condition or negative market situation •
Fair condition or situation o
Generally good condition or positive situation ●

Facilities owned, operated, or directly administered by the port.

Figure 14. Infrastructure condition at Oregon's ports
Facilities at many coastal ports serve recreational fisheries as well as commercial.
Source: Reprinted from Parsons Brinckerhoff 2010.
Note: Table excerpt showing coastal ports from https://www.oregon.gov/biz/Publications/Ports/2010PortPlan.pdf.

3.2.2 Recreational Fisheries

Recreational fishing refers to fishing for pleasure, rather than for fish to sell or subsistence (NOAA 2005). There were an estimated 1.2 million marine recreational anglers on the West Coast in 2018 (the most recent year for which data are available), and nearly two-thirds (71%) were coastal residents (NMFS 2023b) (Figures 15 and 16). Marine recreational anglers on the West Coast took 1.2 million trips in 2021 and caught over 9 million fish, the majority off California (RecFIN 2023b; PFMC 2023; PFMC 2022i). Data provided in this section are primarily from the Pacific States Marine Fisheries Commission's Pacific

[44] See also http://www.worldportsource.com/states.php#C.

Coast Recreational Information Network (RecFIN) which integrates data from state and federal marine recreational fishery sampling efforts into a single database. Additional data was obtained from PFMC. Similar to commercial groundfish fisheries, groundfish bag limit and time and area restrictions were implemented in the past couple of decades to facilitate rebuilding of some groundfish stocks. As these stocks have been rebuilt, these restrictions have been lifted and an increase in groundfish trips have occurred over time. Future liberalization and/or restrictions of the time and area open to recreational fishing depends on the recurring evaluation of stock status through the stock assessment process.

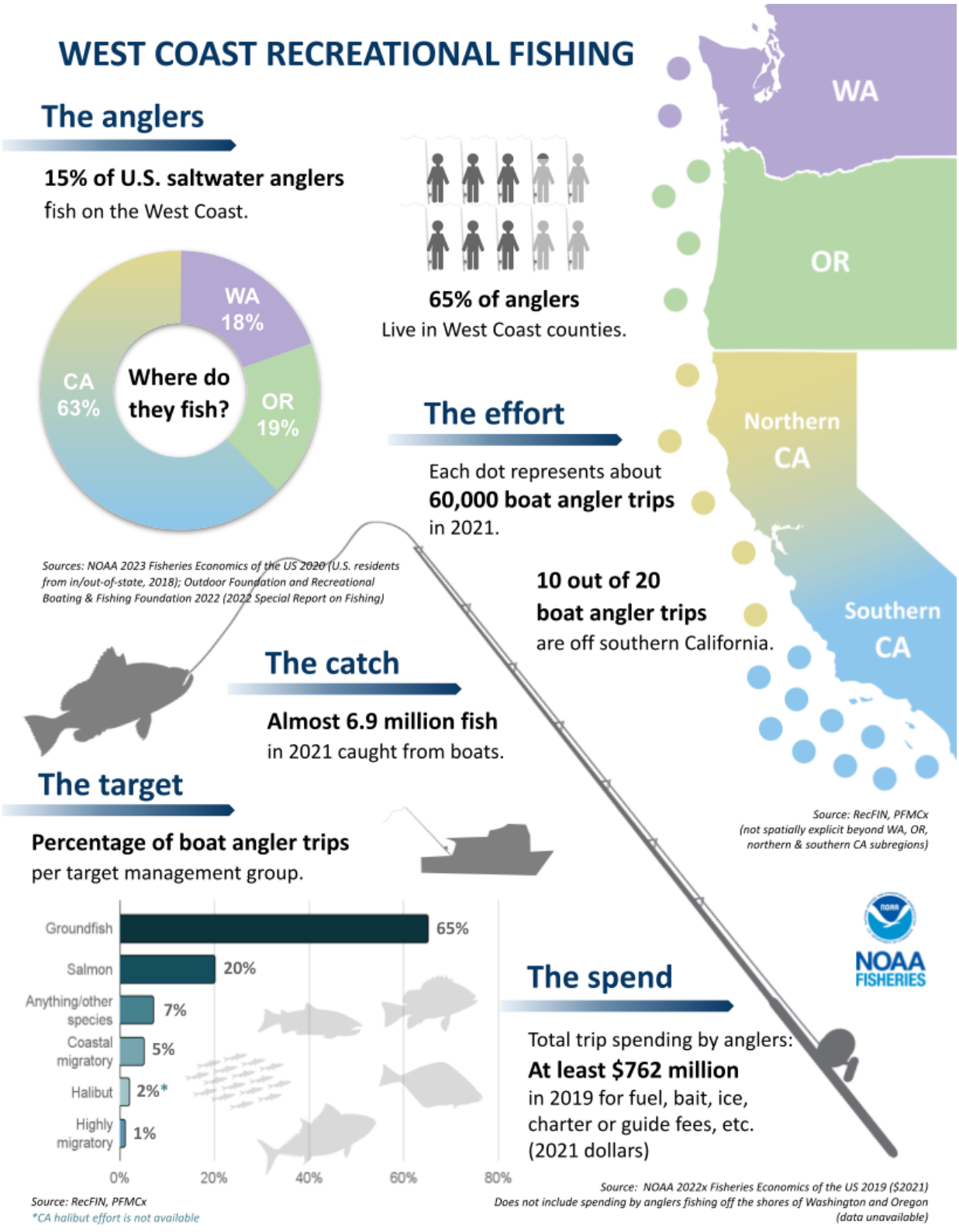


Figure 15. West Coast recreational fishing
Recreational anglers, fishing effort, catch, target species, and trip spending.
Source: Su Kim, NWFSC/NOAA 2023.

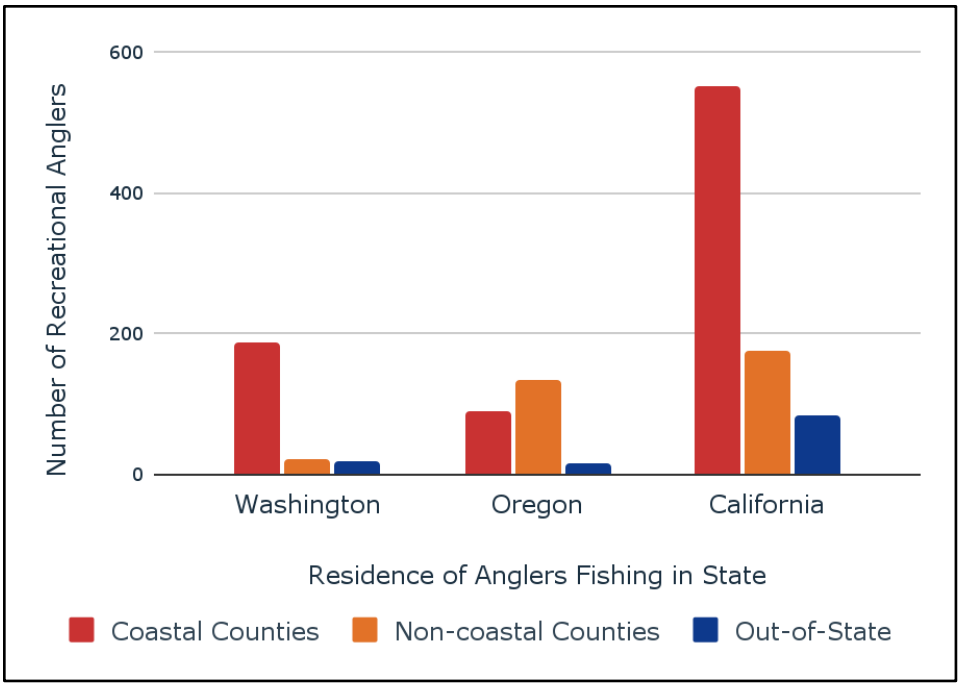


Figure 16. State recreational anglers by residence, 2018
Nearly two-thirds of West Coast recreational anglers were coastal residents.
Source: NMFS 2023b.

Total recreational landings coast-wide, measured in terms of weight, has declined over the last 5 years (Figure 17). This has been driven by a downward trend in California; the trend has been level in Washington and Oregon (NMFS 2022c). In 2021, over 9.7 million fish were caught (retained plus released) (Figure 18) (RecFIN 2023a; does not include salmon, Pacific halibut and California highly migratory species).

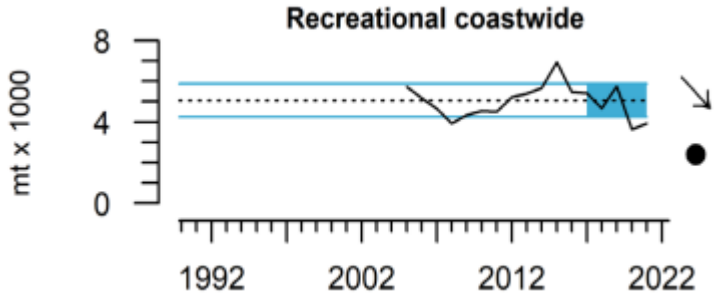


Figure 17. Recreational landings along the West Coast, 2005-2021
Coastwide recreational landings have declined over the last 5 years (excludes Pacific halibut, salmon, and California HMS).
Source: NMFS 2022c, Figure 4.1.2.
Note: The blue shaded area is the most recent 5 years of data. Arrows indicate if the recent 5-year trend is positive (↗), neutral (→), or negative (↘). Symbols indicate if the recent 5-year mean is above the upper blue line (+), within the blue lines (●), or below the lower blue line (−).

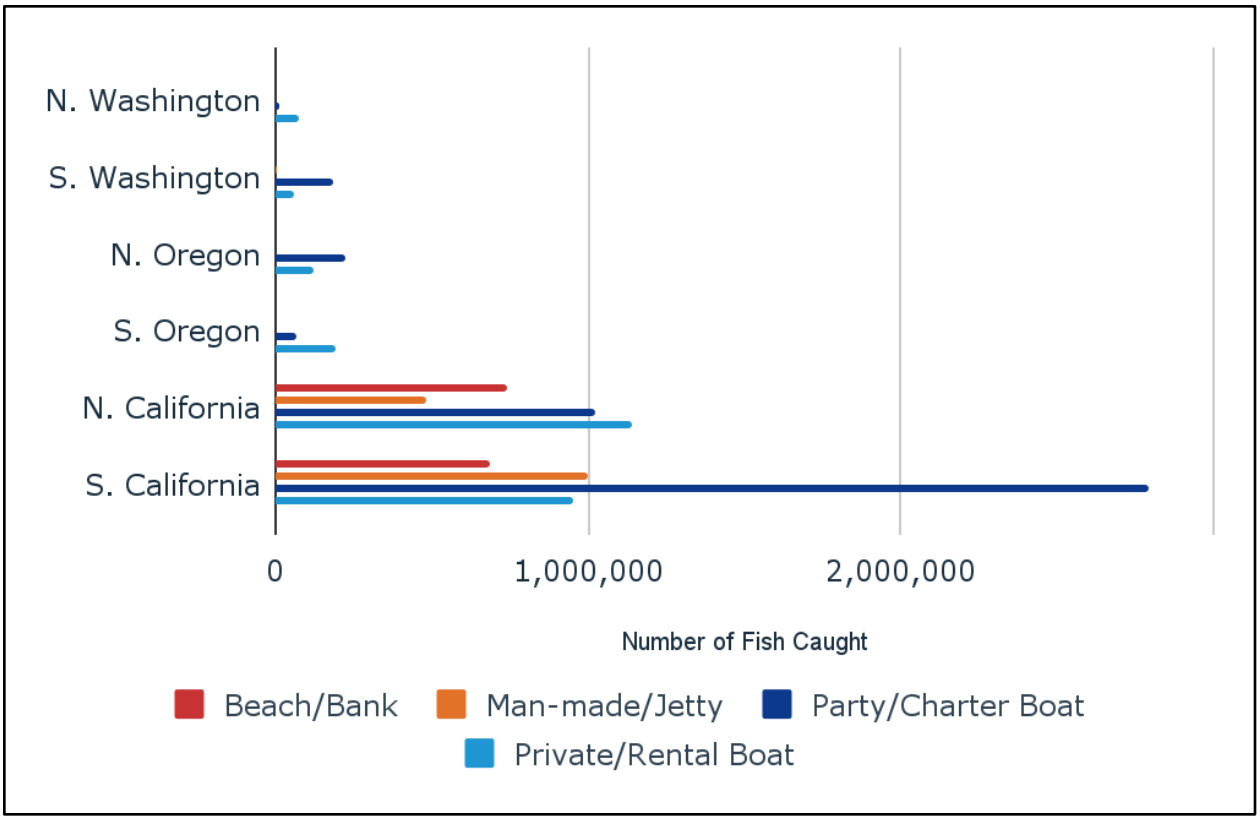


Figure 18. Ocean recreational fishing catch, by state subregion and fishing mode, 2021
Over 9.7 million fish were caught (not including Pacific halibut, salmon, and California highly migratory species). Source: RecFIN 2023a.
Notes: The Washington Department of Fish and Wildlife surveyed recreational boating anglers at ports and land-based anglers at 1 jetty, while the Oregon Department of Fish and Wildlife surveyed only boat anglers. RecFIN does not include catch estimates for Pacific halibut, salmon, or California highly migratory species. Salmon and California highly migratory species catch estimates (in pounds, not number) are available from PFMC for boat trips (PFMC 2022h; PFMC 2023). Pounds of Pacific halibut landed by State are available from PFMC September 2021 Agenda Item G.1.a NMFS Report 1.

Port names: Northern Washington - Sekiu, Neah Bay, and LaPush; Southern Washington - Westport, Ocean Shores, Ilwaco, Columbia River North Jetty, and Chinook; Northern Oregon - Pacific City, Newport, Garibaldi, Depoe Bay, and Astoria; Southern Oregon - Winchester Bay, Port Orford, Gold Beach, Florence, Charleston, Brookings, and Bandon; Northern California - Redwood (Del Norte and Humboldt Counties, except Shelter Cove Area); Wine (Shelter Cover Area in Humboldt and Mendocino); Bay Area (Sonoma, Marin, Solano, Napa, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco); Central (Santa Cruz, Monterey, and San Luis Obispo); Southern California - Channel (Santa Barbara and Ventura) and South (Los Angeles, Orange, and San Diego) (email from Jason Edwards, PSMFC, March 23, 2023).

Slightly more than half of the 1.2 million boating fishing trips coast-wide in 2021 occurred from party or charter boats, with trips on private or rental boats accounting for the remaining trips (RecFIN 2023b) (Figures 19 and 20). The Washington Department of Fish and Wildlife surveys recreational anglers who fish from boats at ports and land-based anglers at only one jetty, while the Oregon Department of Fish and Wildlife surveys only boat anglers[45] (Washington State Department of Fish and Wildlife 2017; Schindler et al. 2021). California surveys both boat and land-based anglers (Figure 20). Key West Coast recreational species include mackerels, rockfish, salmon, and lingcod (NMFS 2023b). Nearly two-thirds

[45] Oregon's *Shore and Estuary Boat Survey* was last conducted in 2005; it was "suspended due to budget constraints and reprioritization of sampling resources" (RecFIN 2020).

of West Coast boat angler trips targeted groundfish (Table 17, Figure 21). Washington, Oregon, and northern California recreational fisheries locations are summarized in Tables 18 and 19.

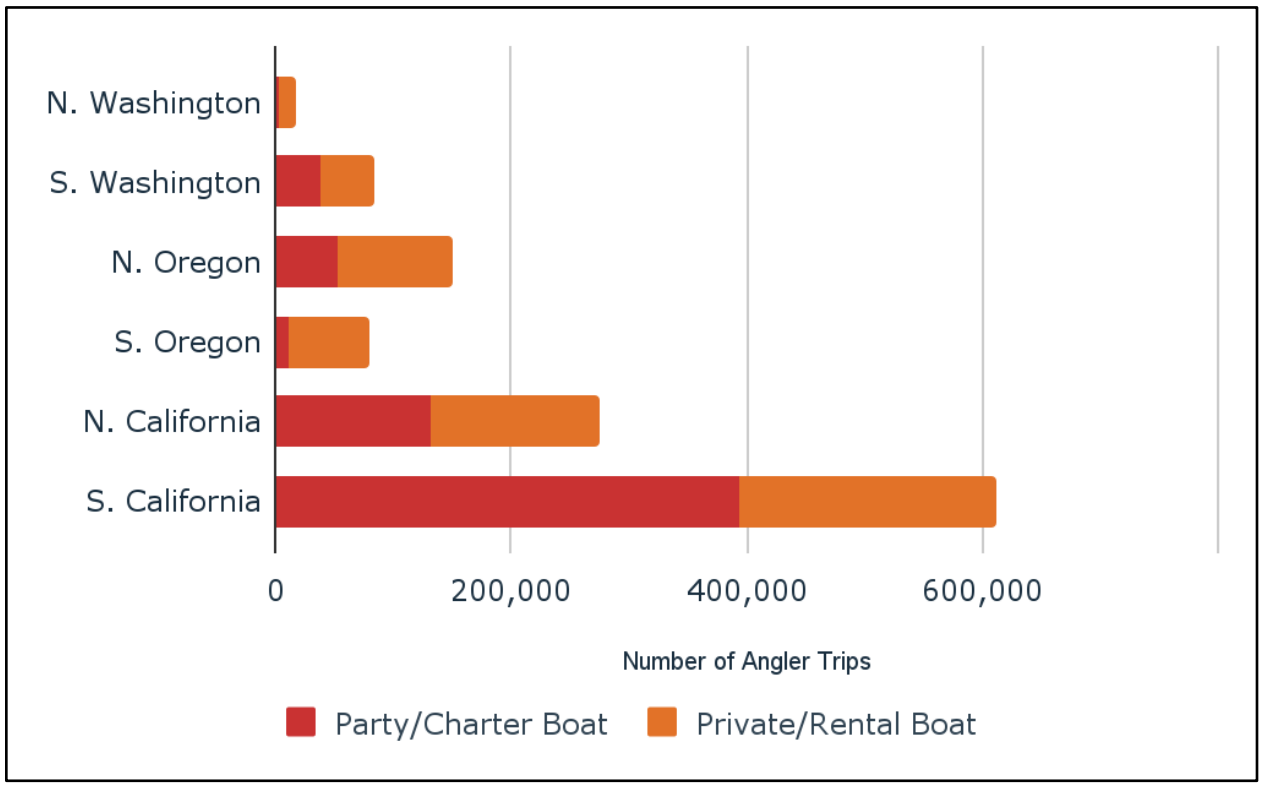


Figure 19. Ocean recreational boat fishing effort, by state subregion and fishing mode, 2021
Slightly more than half of the 1.2 million boating fishing trips coast-wide in 2021 occurred from party or charter boats, with private or rental boats accounting for the remaining trips.
Sources: RecFIN 2023b; PFMC 2022i; PFMC 2023
Notes: Washington surveys boat anglers at ports and anglers at 1 jetty, Oregon surveys only boat anglers (Washington State Department of Fish and Wildlife 2017; Schindler et al. 2021).
RecFIN does not include California salmon or highly migratory species fishing effort, available from the PFMC and included in figure above. Salmon fishing effort in northern California was 56,671 boat trips and in southern California 31,882 boat trips in 2021 (PFMC 2023). Fishing effort for other highly migratory species is available from CDFW Marine Logbook System and California Recreational Fishing Survey estimates (PFMC 2022i).

Port names: Northern Washington - Sekiu, Neah Bay, and LaPush; Southern Washington - Westport, Ocean Shores, Ilwaco, Columbia River North Jetty, and Chinook; Northern Oregon - Pacific City, Newport, Garibaldi, Depoe Bay, and Astoria; Southern Oregon - Winchester Bay, Port Orford, Gold Beach, Florence, Charleston, Brookings, and Bandon; Northern California - Redwood (Del Norte and Humboldt Counties, except Shelter Cove Area); Wine (Shelter Cover Area in Humboldt and Mendocino); Bay Area (Sonoma, Marin, Solano, Napa, Contra Costa, Alameda, Santa Clara, San Mateo, and San Francisco); Central (Santa Cruz, Monterey, and San Luis Obispo); Southern California - Channel (Santa Barbara and Ventura) and South (Los Angeles, Orange, and San Diego) (email from Jason Edwards, PSMFC, March 23, 2023).

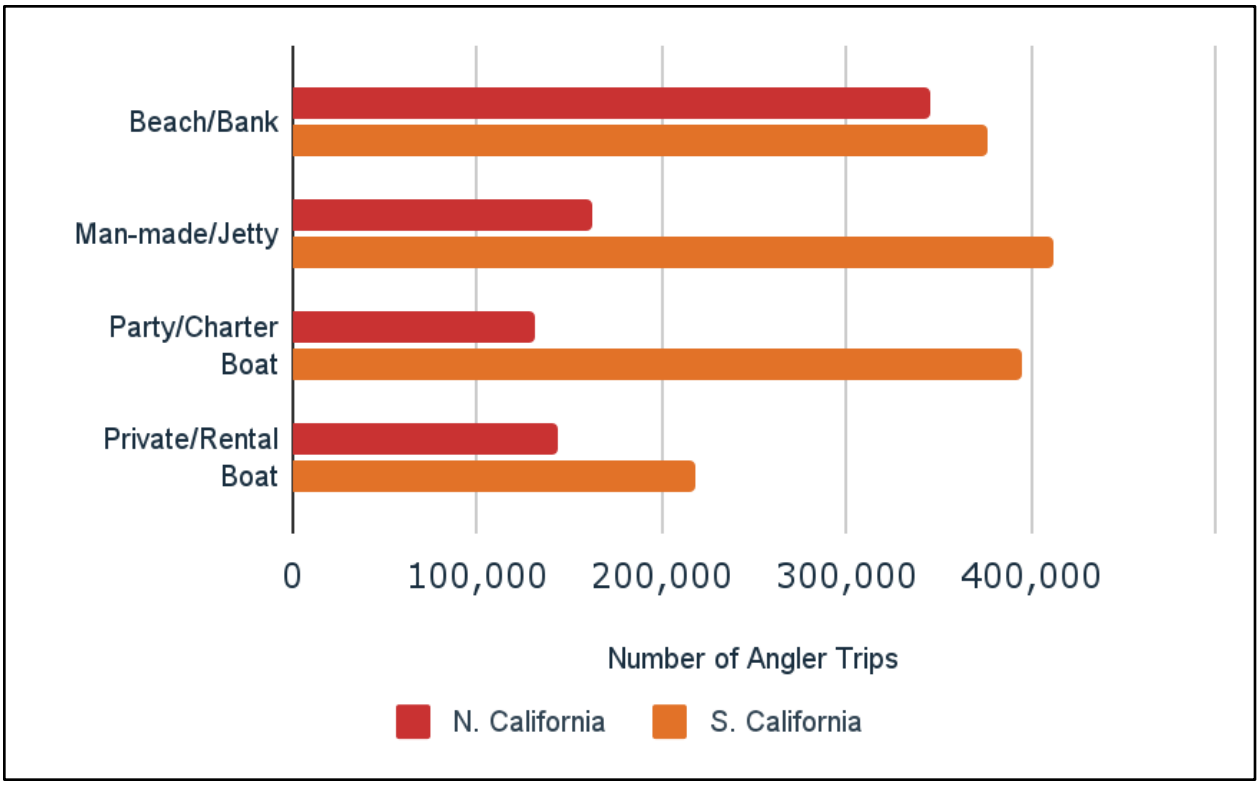


Figure 20. Ocean recreational fishing effort, California, by fishing mode, 2021
Boat trips represented about 40% of California recreational fishing effort.
Sources: RecFIN 2023b; PFMC 2022i; PFMC 2023
Notes: Land-based fishing effort depicted in this figure is not available for Washington (except for 1 jetty) or Oregon (Washington State Department of Fish and Wildlife 2017; Schindler et al. 2021)
RecFIN does not include California salmon or highly migratory species fishing effort, available from PFMC and included in figure above. Salmon fishing effort in northern California was 56,671 boat trips and in southern California 31,882 boat trips in 2021 (PFMC 2023). Fishing effort for other highly migratory species is available from CDFW Marine Logbook System and California Recreational Fishing Survey estimates (PFMC 2022i).

Table 17. Number of recreational boat angler fishing trips, by trip type (target species management group) and state subregion, 2021

Target Species	N. Washington	S. Washington	N. Oregon	S. Oregon	N. California	S. California	Total	Percent of Total
Groundfish	5,952	24,158	59,003	40,507	212,467	445,263	787,350	64.7%
Coastal migratory					1,366	68,029	69395	5.7%
Highly migratory: Tuna	49	4,498	1,748	4,067	NA	NA	10,417	0.9%
Halibut	5,088	7,359	9,214	3,637	NA	NA	25,298	2.1%
Salmon	6,218	48,003	71,220	27,441	56,600	31,900	241,382	19.8%
Anything/other species	0	16	8,158	3,648	4,691	67,303	83,816	6.9%
Total	17,307	84,034	149,343	79,300	275,179	612,495	1,217,658	100%

Sources: PFMC 2022i; PFMC 2023; RecFIN 2023b
Notes: Pacific halibut and highly migratory species tuna trip data not available for California.
California HMS data available for charter boats, not private boats.

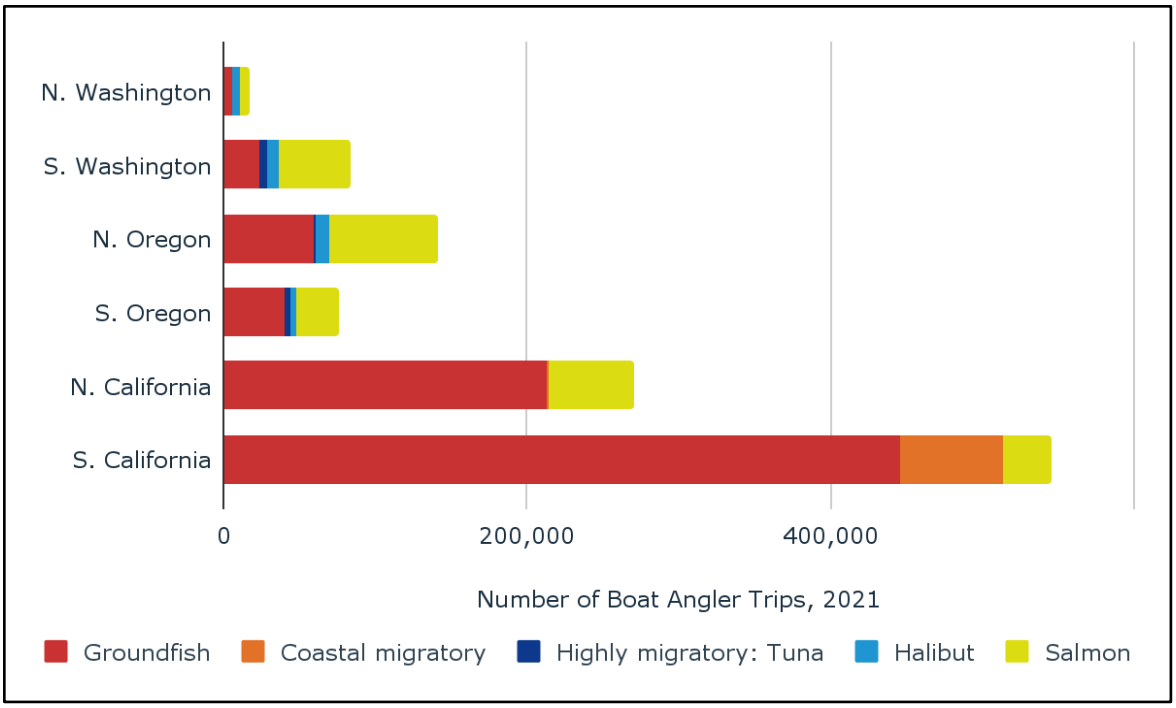


Figure 21. Recreational boat angler fishing trips, by trip type (target species management group) and state subregion, 2021
Nearly two-thirds of West Coast boat angler trips targeted groundfish.
Sources: PFMC 2022i; PFMC 2023; RecFIN 2023b
Note: Pacific halibut target trip data not available for California.

Table 18. Washington and Oregon recreational fisheries and locations

Fishery	Location: Private/Rental Boat	Charter Boat
Tuna	Typically 30-50 nm (within a 70-80 mile radius of port)	Out to 20-50 nm (within a 70-80 mile radius of port)
Salmon	Breakers to 50 fathoms; usually stay within 20 nm	Breakers up to 50 fathoms; 20 +/- nm to high spots
Crab	In Washington, 80-90 percent in bays and estuaries; in Oregon and Washington ocean, typically out to about 20 fathoms	Often inside of bays and estuaries; in the ocean out to 20-70 fathoms
Groundfish	Within 5 nm or 40 fathoms (further if closures were lifted; typically within 30 mile radius of port); mostly in pockets of high relief habitat	Bottom fishing very important; within 5 nm or 40 fathoms (within 30 mile radius of port); look for reefs and high spots
Black cod (Sablefish)	Typically bycatch when fishing for halibut	Same as groundfish
Halibut	Within 40-100 fathoms; focus on sand or gravel habitat	Very valuable fishery; within 40-100 fathoms; focus on sand or gravel habitat

Source: Based on Industrial Economics, Inc. 2012, Tables 6-5 and 6-6.
Note: nm = nautical mile, equivalent to ~ 2,025 yards or 1.5 statute (land) miles.

Table 19. Northern California recreational fisheries and locations

Fishery	Location: Private/Rental Boat	Charter Boat
Albacore (tuna)	BRG: 15-40 nm, some closer (e.g., 10 nm off Albion), at canyon edges with strong currents ERK: 10-60 nm (some further)	BRG: 10-60 nm ERK: 10-60 nm (some further)
Crab	ERK: Humboldt Bay, river mouths (e.g., Eel River), within 1 nm of harbor entrance; 23-30 F, some go out <= 5 nm	BRG: state waters, ≥ 20 feet ERK: state waters
Groundfish	Rocky bottom BRG: < 20 F (due to RCA) and ≤ 3 nm ERK: < 20 F (due to RCA), most ≤ 3nm; when allowed few travel ~16 miles west of port for deeper rockfish	BRG: rockfish inside 20 fathoms (due to RCA), experimental chilipepper permit outside 150 fathoms ERK: < 20 fathoms (due to RCA); rockfish on rocky bottom 16 miles off ERK for deepwater species when permitted; otherwise travel to False Cape and Trinidad
Pacific Halibut	BRG: Flat, muddy bottom, gravely bottom; canyon mouths, ≥ 150 feet (some in state waters) ERK: Punta Gorda to Mad River, ≥ 30 ft, ≤ 10 nm	BRG: ≥ 3 nm ERK: Punta Gorda to Mad River, ≥ 30 feet, ≤ 10 nm at canyons at Cape Mendocino and Gorda
Salmon	BRG: ~ 3 nm, 300-350 feet (~50 fathoms) EFK: ≤ 10 nm for most	BRG: Edge of nearby canyons, ~8-12 nm ERK: ≤ 10 nm

Source: Based on Industrial Economics, Inc. 2012, Tables 7-5 and 7-6.
Notes: A fathom is equivalent to 6 feet; nm = nautical mile, equivalent to ~2,025 yards or 1.5 statute (land) miles.
BRG = Fort Bragg area/fleet; ERK = Eureka area/fleet; RCA = Rockfish Conservation Area
Since space and use information for fisheries off Crescent City is limited, this table focuses on the Eureka area and Fort Bragg.
Except for albacore and some salmon (especially off ERK), most recreational fishing occurs well within 10 nm because of vessel range, safety and time considerations. Rockfish anglers out of ERK tend to head south of port to fish because more areas to the north are used by the Trinidad sport fleet, although some prefer to head north because northwesterly winds come up later in the day, making it difficult and dangerous to return from the south. Previously, the recreational RCA precluded fishing for rockfish outside of 20 fathoms. Changes in groundfish location for private/rental and charter may have occurred beginning in 2023 with the opening of all-depth groundfish opportunities for a portion of the year.

Average expenditures per angler day ranged from $96 for shore trips to $592 for party/head and charter boat trips in 2017 (in $2021) (Table 20) (Lovell et al. 2020). Trip expenditures include fuel, bait, ice, and charter or guide fees, as well as trip related expenses on food, lodging, and transportation.

Table 20. West Coast recreational average expenditure per angler day, 2017 ($2021)

Fishing Mode	Washington	Oregon	California
Party/Head and Charter Boat	$592.10	$485.22	$417.66
Private/Rental Boat	$270.11	$193.52	$207.01
Shore	$107.62	$115.62	$95.94

Source: Lovell et al. 2020. Also provides average trip expenditure per angler day by expense category (e.g., boat fuel, lodging, guide fees) by state and fishing mode.

Recreational fishing trip expenditures totaled at least $761.9 million in 2019 ($2021), with party/head and charter boat ("for-hire") trip expenditures accounting for the largest share (45%) in California, the only state for which effort estimates for all fishing modes are available (Table 21).

Table 21. West Coast recreational angler trip expenditures, 2019 (millions of $2021)

Fishing Mode	Washington	Oregon	California	Total
Party/Head and Charter Boat	$37.9	$26.0	$235.6	$299.5
Private Boat	$146.9	$31.4	$100.8	$279.1
Shore	NA	NA	$183.4	$183.4
Total	$184.8	$57.4	$519.8	$761.9

Source: NOAA 2022d.
NA = Not available

The level of recreational fishing activity varies along the coast (Figures 22 and 23). One indicator, Recreational Fishing Engagement, measures the presence of recreational fishing through fishing activity estimates, with a high rank indicating more engagement.[46] (See section 3.2.1 Fishing Engagement and Reliance).

[46] Data from the Washington State Recreational and Conservation Office, Oregon State Marine Board, California State Parks Division of Boating and Waterways, Southwest Fisheries Science Center, Pacific States Marine Fisheries Commission, and ESRI were used to create the West Coast recreational indices (Social Indicator Supporting Information 2021).

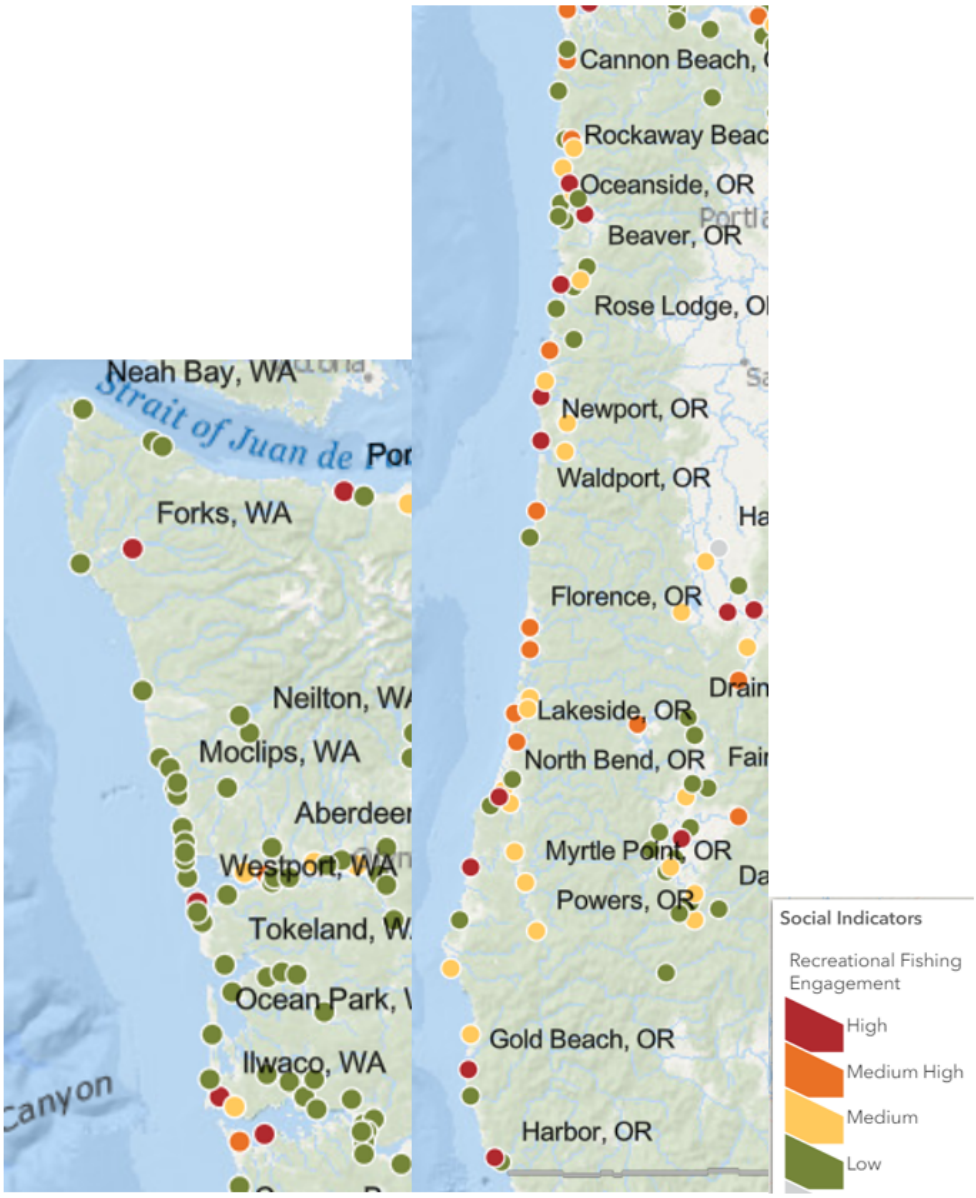


Figure 22. Recreational fishing engagement in communities in Washington and Oregon, 2016
Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. (A high rank indicates more engagement.)
Source: Reprinted from NMFS Social Indicators Tool (https://www.st.nmfs.noaa.gov/data-and-tools/social-indicators/).
Note: 2016 is the most recent year for which data are available. Recreational engagement is measured by the estimated number of fishing trips (Jepson and Colburn 2013).

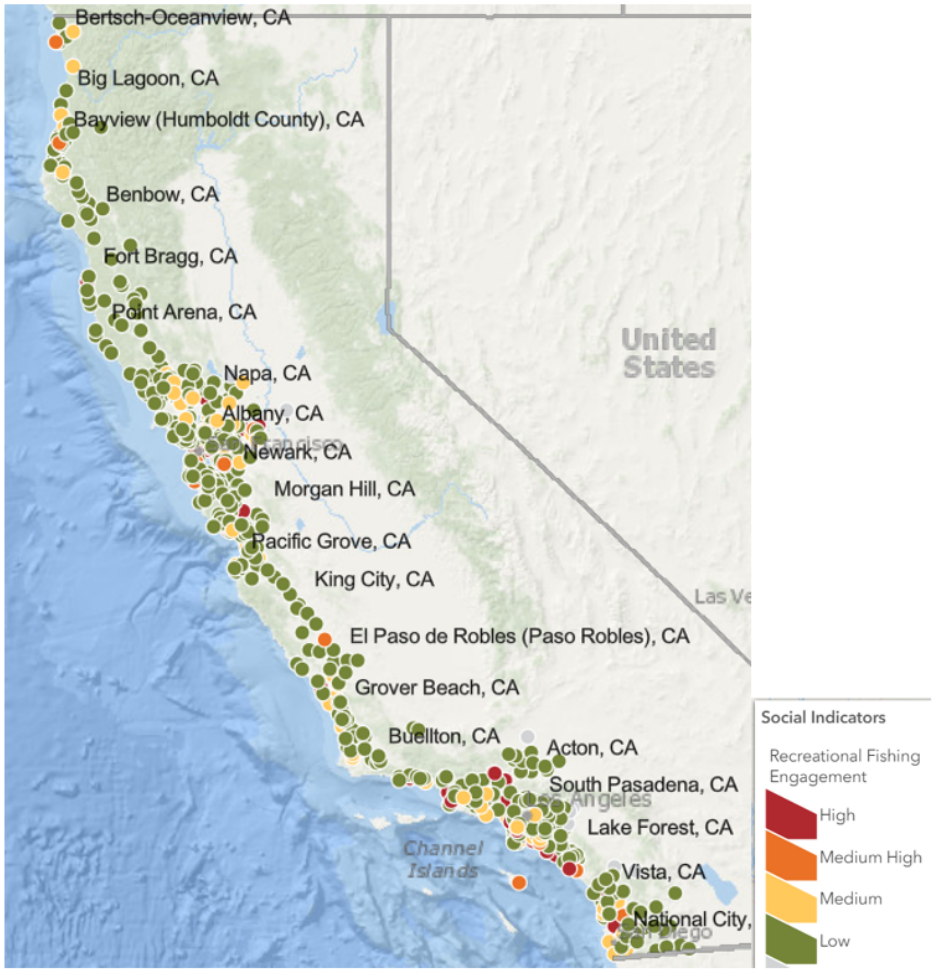


Figure 23. Recreational fishing engagement in communities in California, 2016
Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. (A high rank indicates more engagement.)
Source: Reprinted from NMFS Social Indicators Tool (https://www.st.nmfs.noaa.gov/data-and-tools/social-indicators/).
Note: 2016 is the most recent year for which data are available. Recreational engagement is measured by the estimated number of fishing trips (Jepson and Colburn 2013).

3.2.2.1 Industries Supporting Recreational Fisheries

Many businesses provide goods and services to anglers and others while recreating on the West Coast. These include restaurants, hotels, boat rental and repair shops, bait and tackle stores, and fishing guides.[47] In 2019 there were over 50,000 food and lodging establishments in western coastal counties, with restaurants and other eating establishments representing the majority (Table 22) (U.S. Bureau of Labor Statistics 2022). Boat dealers and other water-related establishments totaled 475, and there were approximately an additional 1,600 recreation-related industries (not water-specific) in coastal counties.

[47] Marine tourism and recreation industry sectors were obtained from NOAA 2017.

Table 22. Recreation-related establishments in coastal counties, 2019

Industry	Washington	Oregon	California	Total
Food and lodging				
Restaurants	430	1,625	44,798	46,853
Hotels, motels, and B&Bs	147	380	3,770	4,297
RV parks and campgrounds	34	69	129	232
Subtotal food and lodging	611	2,074	48,697	51,382
Water-related				
Marinas	2	9	92	103
Boat dealers	4	11	138	153
Scenic and sightseeing water transportation (a)	11	16	192	219
Subtotal water-related	17	36	422	475
Not water-specific				
Recreational goods rental	4	7	182	193
Sporting and athletic goods manufacturing	3	8	234	245
All other recreation industries (b)	19	78	1,134	1,231
Subtotal not water-specific	26	93	1,550	1,669

Source: U.S. Bureau of Labor Statistics 2022: NAICS 72251, restaurants and other eating places; 7211, traveler accommodation; 721211, RV parks and campgrounds; 713930, marinas, 441222, boat dealers; 487210, scenic and sightseeing water transportation; 532284, recreational goods rental; 339920, sporting and athletic goods manufacturing; 713990, all other amusement and recreation industries. Data for Clallam, Grays Harbor, Jefferson, and Pacific County, Washington; Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry County, Oregon; and Del Norte, Humboldt, Marin, Mendocino, Monterey, San Francisco, San Luis Obispo, San Mateo, Santa Barbara, Santa Cruz, Sonoma, Ventura, Los Angeles, Orange, and San Diego County, California.
Notes: (a) Includes party/head and charter boats.
(b) Includes fishing guide services and recreational fishing clubs.

4 Other Coastal Activities

Commercial, recreational, and tribal fishing operations in some locations along the West Coast may be affected by offshore wind energy development. There are other activities occurring on the coast and ocean that could also be affected, such as the shipping of domestic and international freight and recreation in addition to fishing (e.g., boating, swimming, wildlife-watching).

4.1 Ports

Western ports are economically important for the nation's domestic and international trade, with a total of 351 million short tons shipped and received in 2020 (Table 23) (Department of the Army Corps of Engineers 2022). The ports of Seattle, Tacoma, Oakland, Long Beach, and Los Angeles were among the top 25 U.S.-International trade freight gateways, in terms of the value of shipments, in 2020 (U.S. Department of Transportation).

Major coastal ports include Grays Harbor, Washington; Coos Bay, Oregon; and Oxnard Harbor District (Port Hueneme), Long Beach, Los Angeles, and San Diego, California (Department of the Army Corps of Engineers 2022). Tonnage at these ports represented 41% of total Pacific states' waterborne trade in 2020.

Three ports accounted for over three-fourths of the 1.1 million short tons of fish and shellfish received at or shipped from the West Coast: Seattle, Washington, Port of Los Angeles, and Port of Long Beach, California (U.S. Army Corps of Engineers).

Table 23. Western states waterborne commerce, 2020 (thousand short tons)

State	Total	Shipping Domestic	Shipping Foreign	Receiving Domestic	Receiving Foreign	Receiving Intrastate
Washington	109,703	10,778	60,774	10,413	19,318	8,419
Oregon	26,564	2,408	13,915	4,051	2,838	3,352
California	214,920	3,171	52,943	18,546	131,300	8,960
Total	351,187	16,357	127,632	33,010	153,456	20,731

Source: Department of the Army Corps of Engineers 2022.
Note: A short ton is equivalent to 2,000 pounds.

4.2 Non-consumptive Coastal Recreation

In addition to fishing, people participate in other recreational activities on the Pacific coast, with over 141 million trips annually by coastal state residents alone (LaFranchi and Daugherty 2011; Point 97 and Surfrider Foundation 2015; Colgan et al. 2021) (Figures 24, 25, and 26). Surveys of Washington (in 2014) and Oregon (2010) state residents found that the top activities they participated in on their last trip to the coast were beach going, sightseeing or scenic enjoyment, wildlife viewing, and/or photography[48] (LaFranchi and Daugherty 2011; Point 97 and Surfrider Foundation 2015). Beach going, swimming, boating, scenic drives, and photography were among the most popular activities of California residents visiting the state's coast (Colgan et al. 2021); data are available for northern and southern California coastal counties).

Washington residents took an estimated 4.1 million coastal trips per year, spending a total of $551 million ($2021) for hotels, shopping, dining, etc. ($481 million $2014 or $134.13 per trip ($2021; $117.14/trip $2014) (Point 97 and Surfrider Foundation 2015). During the estimated 27.6 million trips to the coast annually by Oregon residents, expenditures totaled $3.0 billion a year ($2021; $2.4 billion a year $2010), or $109.04 per trip ($2021; $87.72 per trip $2010) (LaFranchi and Daugherty 2011). California residents account for an estimated 109.8 million coastal trips annually in 2019 (Colgan et al. 2021).

[48] The surveys measured non-consumptive activities, defined as "activities enjoyed on the coast without taking anything out of the ocean or from the beach" (LaFranchi and Daugherty 2011).

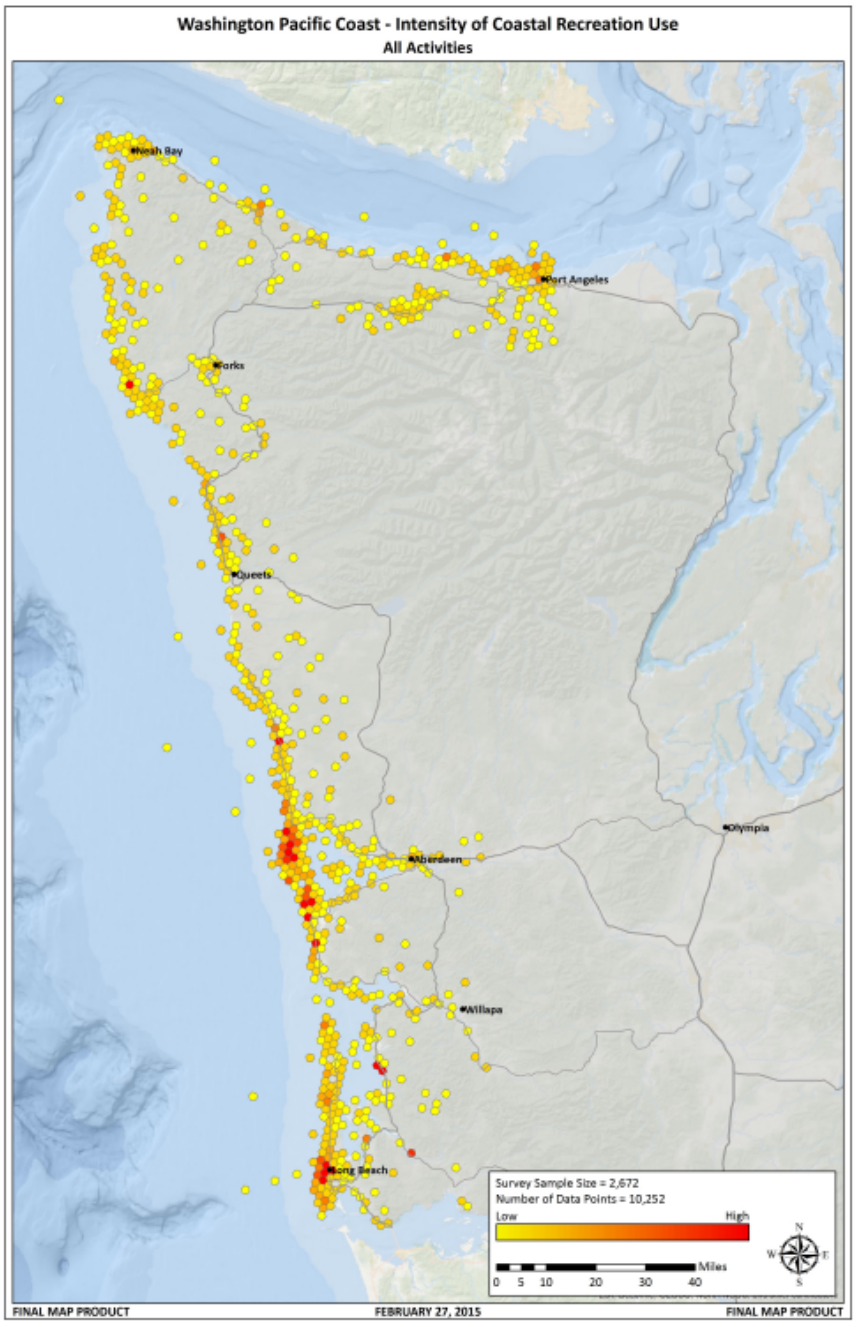


Figure 24. Intensity of Washington coastal non-consumptive recreation use (person-trips) - all activities
Recreational use of Washington's coast, in addition to fishing
Source: Reprinted from Point 97 and Surfrider Foundation 2015.
Notes: Non-consumptive activities are defined as "activities enjoyed on the coast without taking anything out of the ocean or from the beach" (LaFranchi and Daugherty 2011).
Maps are also available for coastal visitors participating in diving, shore-based activities, surface water activities, and wildlife viewing and sightseeing. See also Washington Marine Spatial Planning http://mapview.msp.wa.gov/default.aspx#.

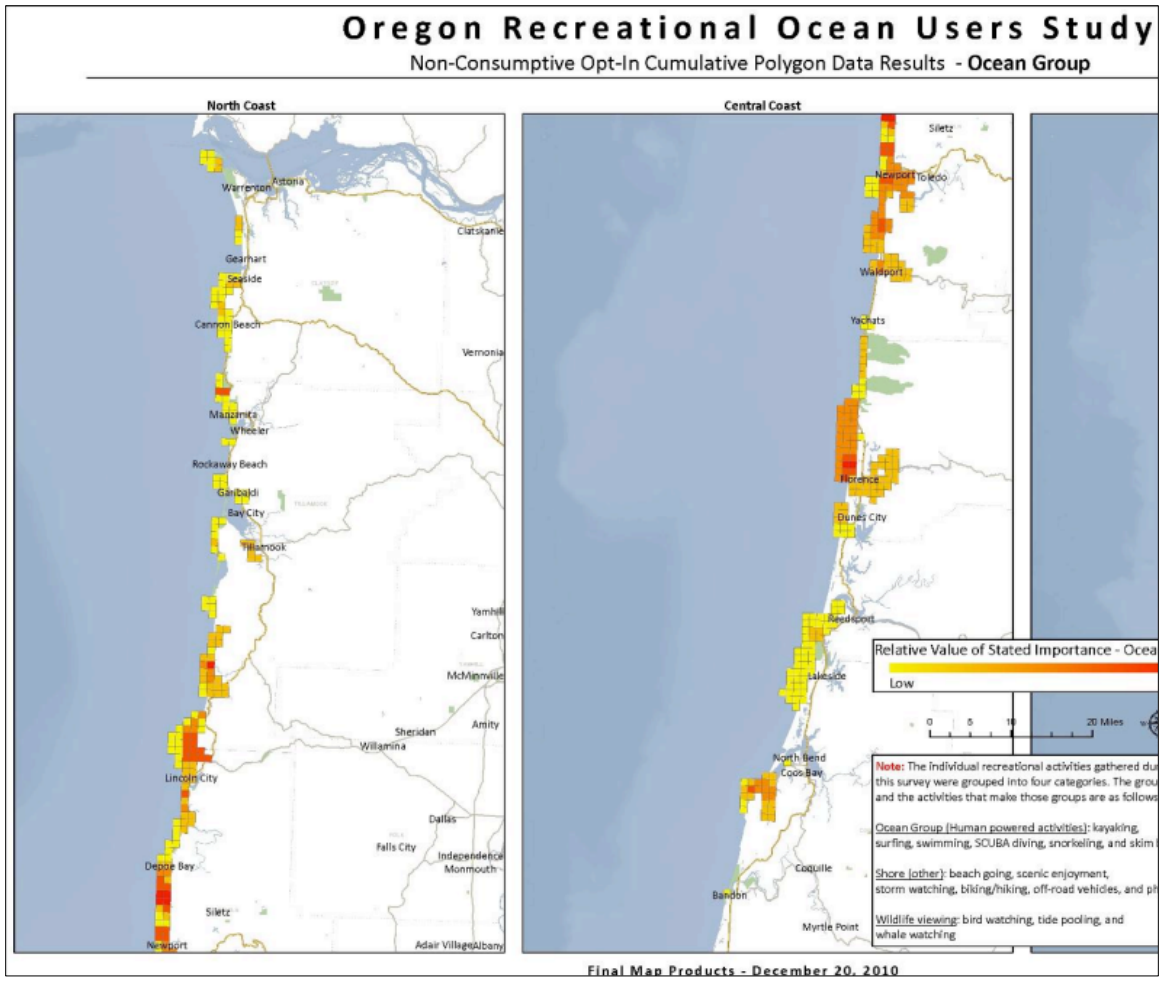


Figure 25. Coastal Oregon recreation use: non-consumptive ocean-based activities
Recreational use of Oregon's coast, in addition to fishing.
Source: Reprinted from LaFranchi and Daugherty 2011.
Notes: Non-consumptive activities are defined as "activities enjoyed on the coast without taking anything out of the ocean or from the beach".
Separate maps are also available for coastal visitors participating in wildlife watching, shore-based activities, and boating.

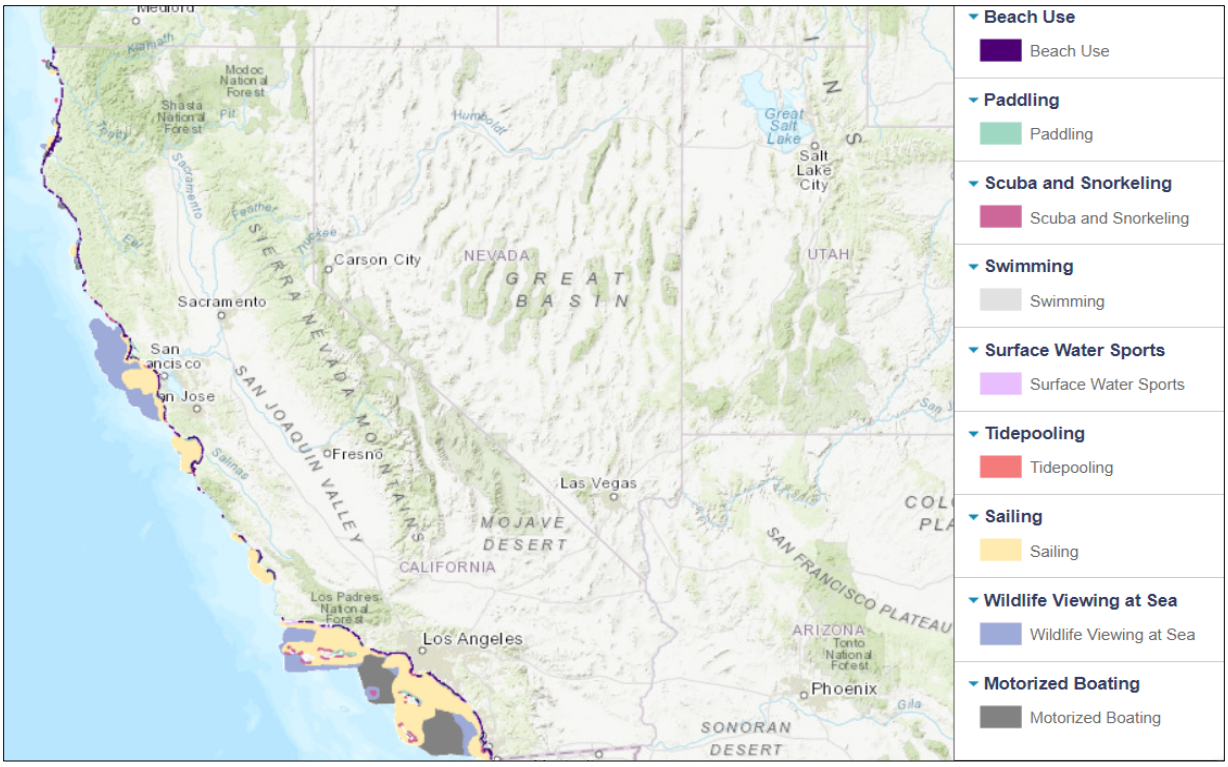


Figure 26. California non-consumptive ocean uses
Recreational uses of California's coast, in addition to fishing.
Source: Reprinted from Conservation Biology Institute 2023.
Also available: California coastal marinas, boat launch sites, lodging, and dive sites https://caoffshorewind.databasin.org/galleries/fb8d806956134431b495a0aa93fb6d97/#.

5 Fisheries Socioeconomic Impact Assessment and Methods

NMFS has unique knowledge of West Coast fisheries as well as long-standing research programs and expertise in the areas of fisheries socioeconomics, including approaches and models to determine impacts on fisheries sectors and communities, and social indicators for assessing fishing communities' vulnerability (also relevant to environmental justice considerations). NMFS also does cutting edge research in the areas of fisheries socioeconomics. NMFS regularly applies this scientific information to its impact analyses under NEPA and other applicable laws to assess socioeconomic impacts of NMFS' management decisions, including evaluating proposed closed areas on fishing sectors and communities. In this section the regulations and principles that guide NMFS's socioeconomics research and policy programs are described, as well as the data, indices, and analyses commonly used to evaluate fisheries management actions. Two examples of recent fisheries management actions, and a description of the socioeconomic evaluations that were undertaken as part of the actions, are provided in section 5.2.

5.1 Data, Indices, and Analyses Commonly Used to Evaluate Fisheries Management Actions

For almost every regulatory action, the NMFS prepares a Regulatory Impact Review (RIR), which includes an analysis of the economic effects of the preferred and alternative actions. One of the purposes of the RIR is to comply with the requirements of E.O. 12866. The RIR is intended to assist the regional management Councils and NMFS in selecting the regulatory approach that maximizes net benefits

(including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach. A Regulatory Flexibility Act Analysis (RFAA) is necessary to satisfy the requirements of the Regulatory Flexibility Act (RFA). The RFAA should assess the impacts of the proposed/final rule on small entities and describe steps the agency has taken to minimize any significant economic impact on small entities while still achieving regulatory goals. The general intent of the RIR and RFAA analytical and process requirements is to make the decision process open and transparent so that all can understand the what, where, and why of regulatory decision-making and can agree that the required steps of the process were followed. The economic analyses provide decision-makers and the public with the agency's best estimates of the impacts of proposed actions and of their alternatives. NMFS' policy that these analyses are undertaken by staff with economic expertise.[49] Economic analyses are also required to varying degrees under the MSA, NEPA, the Endangered Species Act (ESA), and other applicable laws. For example, section 303(a)(9) of the Magnuson-Stevens Act requires a Fishery Impact Statement (FIS). This includes an analysis of the effects of a proposed action on participants in the fishery and on fishing communities. NMFS has developed agency guidance for meeting the procedural and analytical requirements of E.O. 12866 and the RFA for regulatory actions promulgated by NMFS available at https://media.fisheries.noaa.gov/dam-migration/01-111-05.pdf.

Social impact assessment (SIA) is also an essential part of the fishery management process and improves fishery conservation and management decision-making.[50] SIA is predicated on the idea that decision-makers should understand the social consequences of their policies and regulations and that the affected parties should have the opportunity to participate in designing their future. The social environment differs from the natural environment in that it reacts in anticipation of change and can adapt in reasoned ways to changing circumstances in the planning process. In addition, persons in different social settings interpret change in different ways, and react in different ways. If a well-prepared SIA contemplates these human social complexities and is integrated into the decision-making process, better decisions will result. Without an SIA, a fishery management plan or amendment or other regulatory actions are not considered complete.[51]

The MSA's ten National Standards are principles to ensure sustainable and responsible fishery management. Many of these involve socioeconomic factors. Proposed fishery management plans, plan amendments, and regulations, are reviewed for consistency with these principles and the National Standard guidelines[52] developed by NMFS. Although MSA does not apply to OWE development, these approaches and methods used in fisheries management may be useful to explore for analyses aimed at understanding OWE impacts to fisheries.

[49] https://media.fisheries.noaa.gov/dam-migration/01-111.pdf
[50] https://media.fisheries.noaa.gov/dam-migration/01-111-02.pdf
[51] https://media.fisheries.noaa.gov/dam-migration/01-111-04.pdf
[52] These can be found at https://www.ecfr.gov/current/title-50/chapter-VI/part-600/subpart-D/section-600.305.

The Magnuson-Stevens Act's 10 National Standards

1. Optimum yield - Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
2. Scientific information - Conservation and management measures shall be based upon the best scientific information available.
3. Management units - To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.
4. Allocations - Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (a) fair and equitable to all such fishermen; (b) reasonably calculated to promote conservation; and (c) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privilege.
5. Efficiency - Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.
6. Variations and contingencies - Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
7. Costs and benefits - Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.
8. Communities - Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirement of paragraph (2) [i.e., National Standard 2], in order to (a) provide for the sustained participation of such communities, and (b) to the extent practicable, minimize adverse economic impacts on such communities.
9. Bycatch - Conservation and management measures shall, to the extent practicable, (a) minimize bycatch and (b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
10. Safety of life at sea - Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

Source: https://www.fisheries.noaa.gov/national/laws-and-policies/national-standard-guidelines

The first step in the evaluation of proposed fisheries management actions is to identify and describe the entities/user groups likely to be directly and indirectly affected by the proposed fishery management actions (e.g., commercial fisheries, processors, recreational anglers). Relevant information is available on the PFMC website (e.g., SAFE documents), from NMFS (e.g., Community Social Vulnerability Indicators), and from data sources and analyses described below.

For federal rulemaking, NMFS is generally required to respond to requirements under E.O. 12866 (Regulatory Planning and Review[53]), which can be similar to analysis conducted under NEPA, and under

[53] See https://www.archives.gov/files/federal-register/executive-orders/pdf/12866.pdf and https://www.reginfo.gov/public/jsp/Utilities/circular-a-4_regulatory-impact-analysis-a-primer.pdf.

the Regulatory Flexibility Act (RFA) (5 U.S.C. 6 § 601 et seq.), which is unique and centers around impacts of federal regulations on small businesses/entities as defined by the Small Business Administration (Table 24). Under NEPA and E.O. 12866, NMFS must analyze and compare alternatives to a proposed action, including no action, and uses quantitative and qualitative data and analyses, distributive impacts, and assesses cumulative impacts. Potential socioeconomic impacts on fisheries and fishing communities across states and jurisdictions must be considered. In these analyses it is important to accurately describe impacts on fishing communities, small businesses, and/or other affected group(s), and balance the magnitude of impacts and benefits. While separate documents may be prepared to meet these requirements, they may all be addressed in one document (see, for example NMFS 2019).

Table 24. Comparison of NEPA, Regulatory Review, and Regulatory Flexibility Act requirements

NEPA	E.O. 12866 (Regulatory Impact Review)	Regulatory Flexibility Analysis
Purpose and Need Introduction/ Affected Environment Methods Description of Alternatives Effects of the Alternatives Alternatives Considered but not Analyzed Further/ Rejected	Statement of the Problem Description of the management goals and objectives Description of Fisheries and Other Affected Entities Methods Used for Impact Analysis Description of the Alternatives An Economic Analysis of the Expected Effects of Each Selected Alternative Relative to the No Action Alternative Summation of the Alternatives with Respect to Net Benefit to the Nation/Determination of Significant Impact	Description of why action by the agency is being considered Statement of the objectives of, and legal basis for, the proposed rule For directly regulated entities only: A description and, where feasible, estimate of the number of small entities to which the proposed rule will apply An explanation of the criteria used to evaluate whether the rule would impose “significant” economic effects; An explanation of the criteria used to evaluate whether the rule would impose effects on “a substantial number” of small entities; A description of, and an explanation of the basis for, assumptions used Description and estimate of economic effects on entities, by entity size and industry. Reporting and recordkeeping requirements; Relevant federal rules that may duplicate, overlap or conflict with the proposed rule A description of any significant alternatives to the proposed rule that accomplish the stated objectives of applicable statutes and that minimize any significant economic impact of the proposed rule on small entities

Source: Modified (reformatted for accessibility) from Harley 2023.

5.1.1 Data

Data for federally managed West Coast commercial and recreational fisheries are available from many sources presented below, including NMFS. State fisheries agencies maintain data for state-managed fisheries.

5.1.1.1 Commercial Fisheries

Commercial fisheries data sources include fish tickets, permits, logbooks, observers, Vessel Monitoring System (VMS), cost-earnings surveys, and social surveys (Table 25). Fish tickets are inclusive of state-regulated fisheries, but most other sources are not, and/or have state-run data collections (such as logbooks).

Data owners, administrators, and coverage varies (Table 25). Types of data are collected for specific purposes; e.g., the purpose of fish ticket data is to record landings (species, weight). Not all entities collect data at the same level of detail. There are data sharing agreements required or confidentiality limitations under MSA for sharing federal fisheries data and by states for use of state fisheries data. Some data is available to the public in aggregated formats to protect confidentiality.

Aggregated, publicly available data can be obtained from the PacFIN, NOAA's California Current Integrated Ecosystem Assessment (CCIEA), FMPs, Stock Assessment and Fishery Evaluation (SAFE) reports produced under the MSA for each fishery, and NMFS fisheries reports (Tables 27 and 28, with links). PacFIN also stores and processes confidential-level data for use by fisheries managers. Oregon and Washington have undertaken marine spatial planning efforts that include publicly available maps of fishery-use areas, but the data are not currently up-to-date.[54]

[54] Washington's Marine Spatial Plan: http://mapview.msp.wa.gov/default.aspx# and Oregon's Territorial Sea Plan: https://www.oregonocean.info/index.php/resource-inventory-maps.

Table 25. Data owners, administrators, and coverage by data type

Data type	Purpose	Administrator	PacFIN holds the data?	Coverage depends on fishery?	Major advantages	Major issues	Fisheries
Fish tickets (landings records)	Landings records	State DFWs and PacFIN	yes	no	Record for all landings; also be used to identify shore-based buyers; records revenue	Multiple tickets/trip Multiple trips/ticket Target or fishery not specified Fishing area ID only for CA If no landings there is no record	All landings
Logbooks	Trip records	State DFWs NMFS PacFIN	some	yes	Contemporaneous information; usually spatial information	Some are on paper; compliance varies; Information varies; QA/QC varies;	Variable
Permits	Permitting participation	State DFWs NMFS Regional office	some	yes	Record for all permitted vessels	Some open access fisheries do not require permits	All fisheries that require permits
Observer records	Bycatch and catch records	NMFS Regional office/Northwest Fisheries Science Center/Alaska Fisheries Science Center	no	yes	Contemporaneous, spatial and temporal information; full QA/QC	Full coverage only for specific fleets	Full coverage on for Groundfish IFQ, At-sea whiting, HMS; partial coverage for variety of other fisheries detailed in https://doi.org/10.25923/ky3a-q655
Electronic monitoring data	Bycatch and catch records without human observer	NMFS Regional office	yes	yes	Contemporaneous, spatial and temporal information; full QA/QC	Video data used for compliance monitoring	Select vessels in at-sea whiting, groundfish IFQ, as detailed in https://www.fisheries.noaa.gov/west-coast/resources-fishing/electronic-monitoring-west-coast

Data type	Purpose	Administrator	PacFIN holds the data?	Coverage depends on fishery?	Major advantages	Major issues	Fisheries
Vessel Monitoring System (VMS)	Area and time-based enforcement	NOAA Office of Law Enforcement	no, but acquired for research	yes	Very frequent spatial information	Target or fishery not specified reliably; gaps in data	Coverage of fisheries is incidental, other than groundfish, non-groundfish trawl, and drift-gillnet vessels, as detailed in https://www.fisheries.noaa.gov/national/enforcement/regional-vessel-monitoring-information#west-coast.
Economic Data Collections (EDC)	Economic analysis	NMFS Northwest Fisheries Science Center Economics and Social Science Program	no	yes	Complete annual economic information; Full QA/QC; economic information on land-based and at-sea processors that purchase groundfish	Required of all vessels and processors annually but 3 year lag	Groundfish catch share program participants only https://dataexplorer.northwestscience.fisheries.noaa.gov/fisheye/About.html
Cost-earnings surveys	Economic analysis	NMFS Northwest and Southwest Fisheries Science Centers	no	yes	Provide basis for cost and earnings profiles of vessels	Voluntary; Every several years (funding dependent)	Limited Entry and Open Access sectors: Groundfish, salmon, crab, shrimp, swordfish, coastal pelagics
Groundfish Social Surveys	Social and cultural analysis	NMFS Northwest Fisheries Science Center	no	yes	Detailed interview and long-form questionnaire	Voluntary; Snowball survey design; every ~5 years (funding dependent)	Groundfish IFQ Program only https://www.fisheries.noaa.gov/west-coast/socioeconomics/west-coast-groundfish-trawl-fishery-social-study
Fishing Participation Social Survey	Social and cultural analysis	NMFS Northwest Fisheries Science Center	no	yes	Detailed questionnaire	Voluntary; Permit-based sample design; conducted twice (funding dependent)	All

Data type	Purpose	Administrator	PacFIN holds the data?	Coverage depends on fishery?	Major advantages	Major issues	Fisheries
Automatic Identification System (AIS)	Location tracking	US Coast Guard	no	yes	Frequent ping rate	Size/format makes it unwieldy; must be matched with other data to determine if fishing vessel; no fishery information	Vessels >65ft starting 3/1/2016; vessels >300GT

Table 26. Relevant information for commercial fishing by data source

	Fish tickets (landings records)	Logbooks	Observer records	Electronic Monitoring data	Vessel Monitoring System	Economic Data Collection (EDC)	Cost-earnings	Social surveys
Days fished	No	Some	Yes	Yes	No	Yes	Yes	No
Target or fishery	Derived	Some	Usually	Yes	NA	NA	Some	NA
Trip dates	No	Some	Yes	Yes	No	No	No	No
Spatial/location information	Some - various resolutions. (block area for CDFW)	Start/end of sets	Start/end of sets	Start/end of sets	Location at pings	No	No	No
Set time/length	No	Some	Yes	Yes	No	No	No	No
Gear	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Earnings	Yes	No	No	No	No	Yes	Yes	Some
Costs	No	No	No	No	No	Yes	Yes	No
Demographics	No	No	No	No	No	No	No	Yes

Table 27. Socioeconomic data sources related to commercial fishing on the West Coast that are publicly available on a recurring basis

Source of Data and Publication	NMFS Fisheries Economics of the United States	NMFS Fisheries of the United States	PSMFC Pacific Fisheries Information Network (PacFIN)	NOAA California Current Integrated Ecosystem Assessment (CCIEA)	NMFS Fisheries Economic Explorer (FishEyE)	NMFS West Coast Fisheries Participation Survey
Geography; Scope	U.S., regions (Pacific region) and states, (WA,OR, CA); marine	U.S., regions (Pacific coast), and states (WA, OR, CA); marine	States (OR, WA, CA); marine	States (OR, WA, CA); marine	West Coast; Participants in the Groundfish Trawl Catch Share Program	West Coast; commercial fishers
Frequency	Annual; most recent February 2023 includes 10 years 2011-2020	Annual; most recent May 2022	Annual, monthly 1980-2022 (commercial) 1990-2022 (RecFIN)	Annual	Annual	2017, 2020
Format	Data tables (time series)	Text, data tables, graphics	Query	Graphs (time series)	Data tables and graphs (time series)	Data tables and graphs
Landings	Total: dollars, pounds; annual Key species (a)/species groups: dollars, pounds, annual	Pounds, metric tons, dollars; 2019 and 2020	Landings, metric tons, dollars, by management group, species, gear, port group, month	Landings; metric tons and revenue (ex-vessel); by species group; 1981-2022 (data from PacFIN)	Landings, metric tons, dollars, by management group, vessel length class, home port	
Port	NA	Landings and value at major U.S. ports: pounds, dollars; 2019-2020			Statistics by West Coast ports	
Average ex-vessel price	Key species (a)/species groups: dollars per pound; annual		Dollars, by management group and species		Available for whiting, revenue/pound available for groundfish trawl	
Economic impacts of the seafood industry	Dollars (sales, income, value added) and jobs; by sector; 2020				Impact estimates of catch share fishery over time	

Source of Data and Publication	NMFS Fisheries Economics of the United States	NMFS Fisheries of the United States	PSMFC Pacific Fisheries Information Network (PacFIN)	NOAA California Current Integrated Ecosystem Assessment (CCIEA)	NMFS Fisheries Economic Explorer (FishEyE)	NMFS West Coast Fisheries Participation Survey
Marine Economy	Seafood sales and processing, transportation support and marine operations, by sector: number of non-employer firms and receipts; number of establishments, employees, and payroll; 2011-2019 and total 2019					
Other		U.S. supply of commercial finfish and shellfish; landings, import, export, total; 2019 and 2020 U.S.: aquaculture production, processed fishery products, foreign trade		Human wellbeing indices: community social vulnerability; fishery revenue diversification, port-level revenue concentration, fisheries participation networks	Profit, costs, labor, and shorebased processors that buy groundfish	Demographic information, social connections, preferences, household characteristics, income from fishing
URL to source document	https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-economics-united-states	https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-united-states https://www.fisheries.noaa.gov/foss/f?p=215:26:5792801929762	https://reports.psmfc.org/recfin/f?p=601:1000:9070461583133	https://www.integratedecosystemassessment.noaa.gov/index.php/regions/california-current/california-current-reports	https://connect.fisheries.noaa.gov/WestCoastCatchShares/	https://www.fisheries.noaa.gov/national/science-data/west-coast-fisheries-participation-survey-results

Source of Data and Publication	NMFS Fisheries Economics of the United States	NMFS Fisheries of the United States	PSMFC Pacific Fisheries Information Network (PacFIN)	NOAA California Current Integrated Ecosystem Assessment (CCIEA)	NMFS Fisheries Economic Explorer (FishEyE)	NMFS West Coast Fisheries Participation Survey
URL to Interactive data-query website	https://www.fisheries.noaa.gov/foss/f?p=215:200 https://www.fisheries.noaa.gov/data-tools/fisheries-economics-united-states-data-and-visualizations			https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-iea-indicators	https://connect.fisheries.noaa.gov/WestCoastCatchShares/	https://www.fisheries.noaa.gov/data-tools/west-coast-fisheries-participation-survey-result-tool-2020

Notes: (a) Key species or species groups were chosen due to their regional importance to commercial fisheries (NMFS 2023b).

5.1.1.2 Recreational Fisheries

Annual recreational fishing data for the number, weight, and species caught; target species; number of anglers; number of trips ("effort"); and expenditures are available by state and fishing mode (e.g., shore, private/rental boat, charter/ head boat). Expenditures for fishing trips and durable goods (e.g., fishing tackle, boat expenses) are available from NMFS surveys. Cost data for businesses engaged in the charter / headboat sector are available from NMFS surveys.[55]

Sources of data include the Recreational Fisheries Information Network (RecFIN) that is managed by PSMFC, the Pacific Fishery Management Council (PFMC), and NMFS reports (Table 28). These recreational data are based on angler surveys and charter boat logbooks.

In addition, NMFS' National Marine Recreational Fishing Expenditure Survey is conducted every 3 to 5 years. For the latest survey, 2019-2020, anglers in coastal states with saltwater fishing licenses were asked about their expenditures on durable goods used for saltwater fishing (such as fishing rods, boats, and vehicles) during the previous 12 months. Data on recreational anglers' ocean catch and effort can be obtained from RecFIN[56] by state and state subregion (north and south) by:

- Mode - beach/bank, made-made/jetty, party/charter boat, private/rental boat, shore (effort only)
- Target species - bottomfish, coastal migratory, halibut, highly migratory, salmon, other anadromous

Catch estimates are reported as the number and metric tons of fish by species and are available for 2001 through the current year. Effort is measured by the number of angler trips and boat trips (except California, which reports only boat trips) for 1990 through the current year. Data also available for 13 "fished areas" along the Washington coast (e.g., Cape Falcon to Leadbetter Point) in the effort estimate report. Estimates for salmon and highly migratory species catch and effort along the California coast are not available in RecFIN, and can be found on the Pacific Fishery Management Council's website.

[55] See, for example, *Marine Recreational Bait & Tackle Economic Survey* (2013) https://www.st.nmfs.noaa.gov/Assets/economics/Bait-and-Tackle/documents/RBTES%20Final%20Results%20Flyer%20v8.pdf.

[56] See Reports CTE001 and CEE001 at https://reports.psmfc.org/recfin/f?p=601:1000:27287377966521.

Table 28. Socioeconomic data related to recreational fishing on the West Coast publicly available on a recurring basis

Source of Data and Publication	NMFS Fisheries Economics of the United States	NMFS Fisheries of the United States	PSMFC Recreational Fishing Information Network (RecFIN)	NOAA California Current Integrated Ecosystem Assessment (CCIEA)	USFWS National Survey of Fishing, Hunting, and Wildlife-Associated Recreation
Geography & Scope	U.S., regions (Pacific region) and states, (WA,OR, CA); marine	U.S., regions (Pacific coast), and states (WA, OR, CA); marine	States (OR, WA, CA); marine	States (OR, WA, CA); marine	U.S., coastal states, WA; saltwater, freshwater
Frequency	Annual; most recent February 2023 includes 10 years 2011-2020	Annual; most recent May 2022	Annual, Monthly 1990-2022 (recreational)	Annual	Every 5 years (most recent 2016, 2023*); Some unpublished 2016 state data available from FWS
Format	Data tables (time series)	Text, data tables, graphics	Query	Graphs (time series)	Data tables
Number of anglers	Number by residence (total, coastal, non-coastal, out-of-state); annual				Number of saltwater anglers by residence (state resident, non-resident)
Fishing effort	Angler trips by fishing mode (b); annual	Trips by state; 2020	Angler trips by fishing mode (b), water area (ocean), subregion (north, south) and target species; monthly		Total angler trips and days; average days; saltwater fishing
Catch	Harvest and release by key species (a); number of fish; annual	Finfish harvest, release, total catch; number by state; 2020	Species caught by fishing mode, water area (ocean), subregion (north, south) and target species; monthly	Total coastwide catch, total coastwide salmon catch; metric tons (data from RecFin)	Number of saltwater anglers and days of fishing by type of fish; state residents and non-residents
Expenditures	Total trip expenditures by fishing mode (b); 2020				Saltwater trip expenditures by type (food and lodging, transportation, equipment, other); total $ amount, # spenders, average dollars/spender, average dollars/angler

Source of Data and Publication	NMFS Fisheries Economics of the United States	NMFS Fisheries of the United States	PSMFC Recreational Fishing Information Network (RecFIN)	NOAA California Current Integrated Ecosystem Assessment (CCIEA)	USFWS National Survey of Fishing, Hunting, and Wildlife-Associated Recreation
Economic impacts	Dollars (sales, income, value added) and jobs; by fishing mode; 2020				
Other				Human wellbeing indices: community social vulnerability	
URL to source document	https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-economics-united-states	https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-united-states https://www.fisheries.noaa.gov/foss/f?p=215%3A26	https://reports.psmfc.org/recfin/f?p=601:1000:9070461583133	https://www.integratedecosystemassessment.noaa.gov/index.php/regions/california-current/california-current-reports	https://www.census.gov/programs-surveys/fhwar.html https://www.fws.gov/program/national-survey-fishing-hunting-and-wildlife-associated-recreation-fhwar
URL to interactive data-query website	https://www.fisheries.noaa.gov/foss/f?p=215:200 https://www.fisheries.noaa.gov/data-tools/fisheries-economics-united-states-data-and-visualizations			https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-iea-indicators	

* To be released summer 2023.
Notes: (a) Key species or species groups were chosen due to their regional importance to recreational fisheries (NMFS 2023b).
(b) Fishing Mode: For-hire (party/charter boat), private boat, or shore.

5.1.2 Coastal Community Social Vulnerability Indicators

MSA's National Standard 8 directs that "Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities" (16 USC § 1851).

The MSA defines term "fishing community" as "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (16 USC § 1802(17)). While most fishing communities may be coastal communities, not all coastal communities are fishing communities.

NMFS' Community Social Vulnerability Indicators characterize and evaluate a community's vulnerability and resilience to disturbances (e.g., regulations, extreme weather, oil spills, sea level rise) (NOAA 2021[57]). There are 14 social, economic, and climate change indicators for over 4,600 coastal communities in 24 states available in an indicator map and graphing tool.[58] Indicators are grouped into 5 categories: Fishing engagement and reliance, environmental justice, climate change, economics, and gentrification.

The commercial and recreational fishing engagement and reliance[59] indices show the importance or level of dependence on fishing to coastal communities[60]:

- Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. (A high rank indicates more engagement; see Figures 11 and 12 for an illustration of the commercial fishing engagement indicator on the West Coast)
- Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity. (A high rank indicates more reliance.)
- Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. (A high rank indicates more engagement; see Figures 21 and 22 for an illustration of the recreational fishing engagement indicator on the West Coast).
- Recreational fishing reliance measures the presence of recreational fishing in relation to the population size of a community. (A high rank indicates increased reliance.)

Three indicators address environmental justice:

- Poverty is expressed as those receiving assistance, families below the poverty line, and individuals older than 65 and younger than 18 in poverty. (A high rank indicates a high rate of poverty and a more vulnerable population.)

[57] See https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities.
[58] See Social Indicators Tool. Social Vulnerability Index Score values for select West Coast communities over time are available from California Current IEA Indicators' Indicator Data Custom Plotting Tool, Human Wellbeing component. https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-iea-indicators
[59] The definitions of these and the subsequent 10 indicators are directly from NOAA 2021.
[60] Norman et al. (2022) explore relationships between community-level fishery measures and individual fishers in https://www.sciencedirect.com/science/article/abs/pii/S0964569122001685.

- Population composition corresponds to the demographic makeup of a community including race, marital status, age, and ability to speak English. (A high rank indicates a more vulnerable population.)
- Personal disruption captures unemployment status, educational attainment, poverty, and marital status. (A high rank indicates less personal capacity to adapt to changes and thus a more vulnerable population.)

Climate change indices identify environmental conditions that can affect the sustainability of commercial and recreational fishing businesses and infrastructure:

- Sea level rise risk signifies the overall risk of inundation from projected sea level rise between one to six feet over the next ~90 years (Figure 27, for example; indices are also available for other West Coast areas). The indicator represents the possibility of inundation based upon the combined projections at each stage of sea level rise and could vary depending upon future circumstances. (A high rank indicates a community more vulnerable to sea level rise.)
- Storm surge risk refers to the overall risk of flooding from hurricane storm surge categories 1-5. The indicator represents the "worst-case" possibility of inundation based on the combined hurricane storm surge categories and could vary depending on future circumstances. (A high rank indicates a community more vulnerable to a particular hurricane storm surge.)

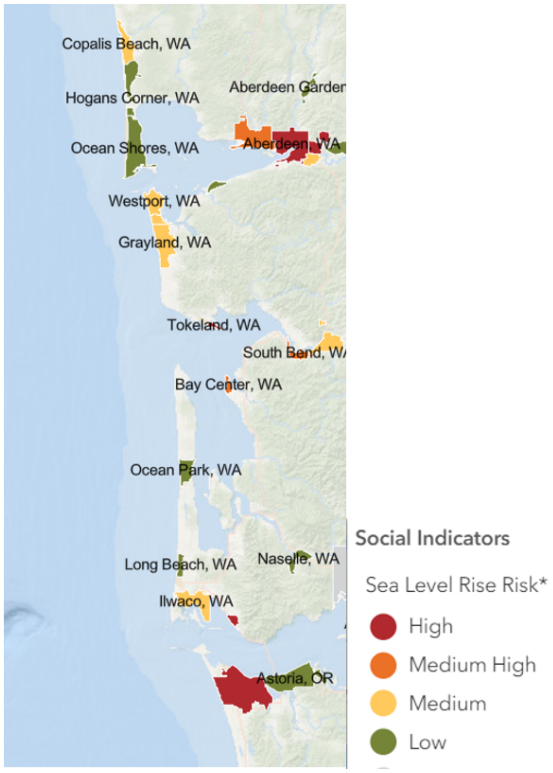


Figure 27. Sea level rise risk, southern Washington, 2019
Signifies the overall risk of inundation from projected sea level rise between one to six feet over the next ~90 years.
Source: Reprinted from NMFS Social Indicators Tool (https://www.st.nmfs.noaa.gov/data-and-tools/social-indicators/).

Economic indicators measure the strength and stability of the workforce and housing:

- Labor force structure characterizes the availability of employment including females employed, population in the labor force, self-employment, and social security recipients. (A high rank indicates fewer employment opportunities and a more vulnerable population.)
- Housing characteristics is a measure of infrastructure vulnerability to coastal hazards including median rent and mortgage, number of rooms, and presence of mobile homes. (A high rank means more vulnerable infrastructure and a more vulnerable population. On the other hand, the opposite interpretation might be that more affordable housing could be less vulnerability [sic] for some populations.)

Finally, gentrification pressure indicators represent factors that, over time, may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure:

- Housing Disruption represents factors that indicate a fluctuating housing market where some displacement may occur due to rising home values and rents including change in mortgage value. (A high rank means more vulnerability for those in need of affordable housing and a population more vulnerable to gentrification.)
- Retiree migration characterizes communities with a higher concentration of retirees and elderly people in the population including households with inhabitants over 65 years, population receiving social security or retirement income, and level of participation in the workforce. (A high rank indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living.)
- Urban sprawl describes areas experiencing gentrification through increasing population density, proximity to urban centers, home values and the cost of living. (A high rank indicates a population more vulnerable to gentrification.)

These NMFS' Community Social Vulnerability Indicators are often used for National Environmental Policy Act (NEPA), Magnuson-Stevens Act (MSA), and environmental justice analyses required by Executive Order 12898 (1994). Indicators from the 5 categories may be used together or separately to explain the vulnerabilities a fishing community faces.

5.1.3 Commercial Fishery Indices

A number of indices or other types of indicators have been developed to measure changes in key phenomena that describe fisheries in a way that is useful to the regulatory review process. These include fishery participation networks, fleet revenue diversification, and revenue concentration. Each of these are tracked in the CCIEA (NOAA 2022c).

5.1.3.1 Fishery Participation Networks

Commercial fishers participate in multiple fisheries, thus earning income from various sources. This diversification of "harvest portfolios" can be illustrated by fisheries participation networks which show the number of vessels and vessel-level revenue (NMFS 2022c) (Figure 27). Fisheries are depicted as nodes, and pairs of nodes are connected by lines that convey information about the number of vessels participating in both fisheries. For example, Figure x (a) shows that in the Coos Bay port group, the salmon, tuna, crab, and pink shrimp fisheries generated the largest share of revenue in 2013 and were connected to multiple other fisheries.

Changes in coastal waters' ecology, management, markets, and other factors affect changes in participation networks over time. For example, comparing participation networks for the Coos Bay port group based on 2013 and 2021 data (see Figure 28) shows participation in all fisheries changed over time

and the number of links in the network increased (approximately 50%, from 19 to 28). There were declines in participation in fisheries for salmon, tuna, and the Dover sole-thornyhead-sablefish complex (DTS), and increased participation in the crab fishery. Fisheries participation networks for Washington, Oregon, and California from November 2020 to November 2021, are available from CCIEA (NOAA 2022c).[61]

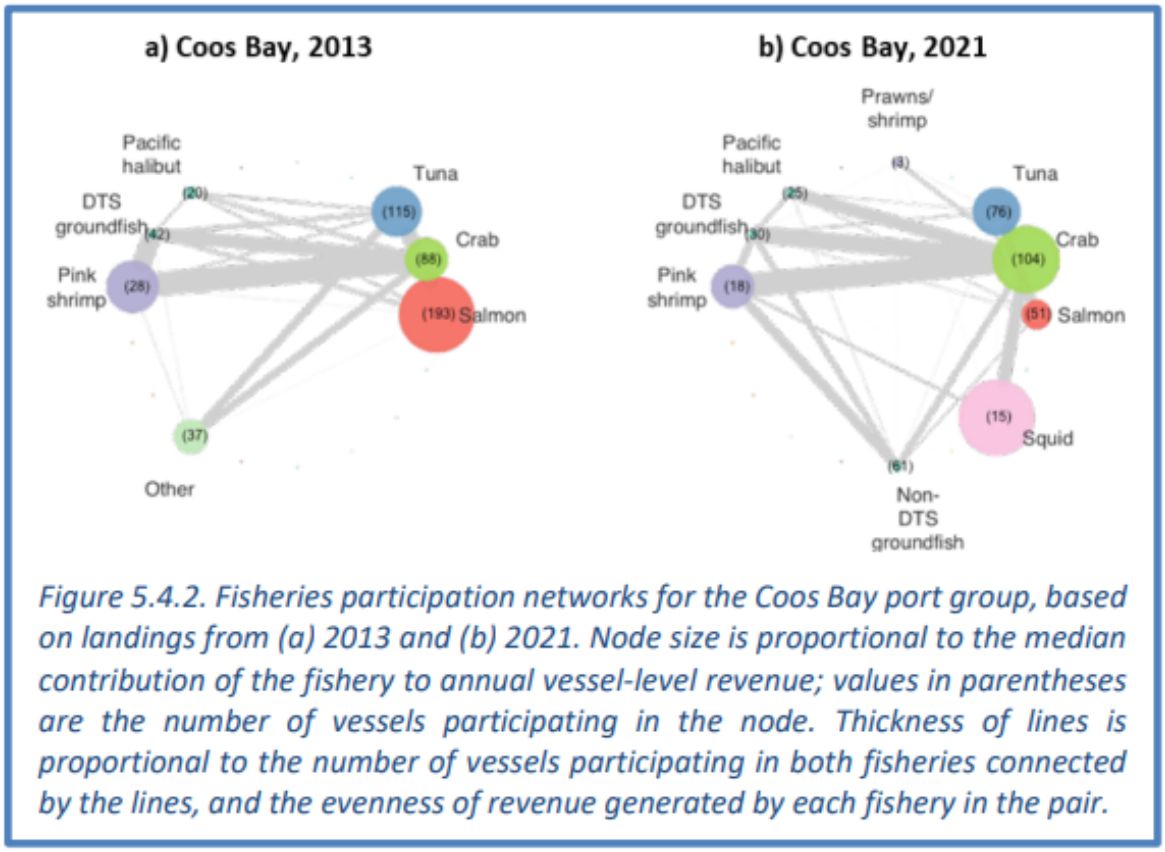


Figure 28. Commercial fisheries participation network, Coos Bay port group
Contribution of fisheries to annual revenue and number of vessels participating in fisheries, 2013 and 2021.
Source: Reprinted from NMFS 2022c.
Note: "DTS" is the Dover sole-thornyhead-sablefish complex.

The timing of participation in fisheries also varies throughout the year. For example, in the groundfish catch share program, the groundfish and DTS (Dover sole-thornyhead-sablefish complex) trawls operate year-round, while Pacific whiting fisheries occur between May and November (Figure 29) (Steiner 2019).

[61] See NOAA 2022c, Appendix T, Figures T.1 - T.4 https://www.pcouncil.org/documents/2022/02/h-2-a-cciea-team-report-1-2021-2022-california-current-ecosystem-status-report-and-appendices.pdf/.

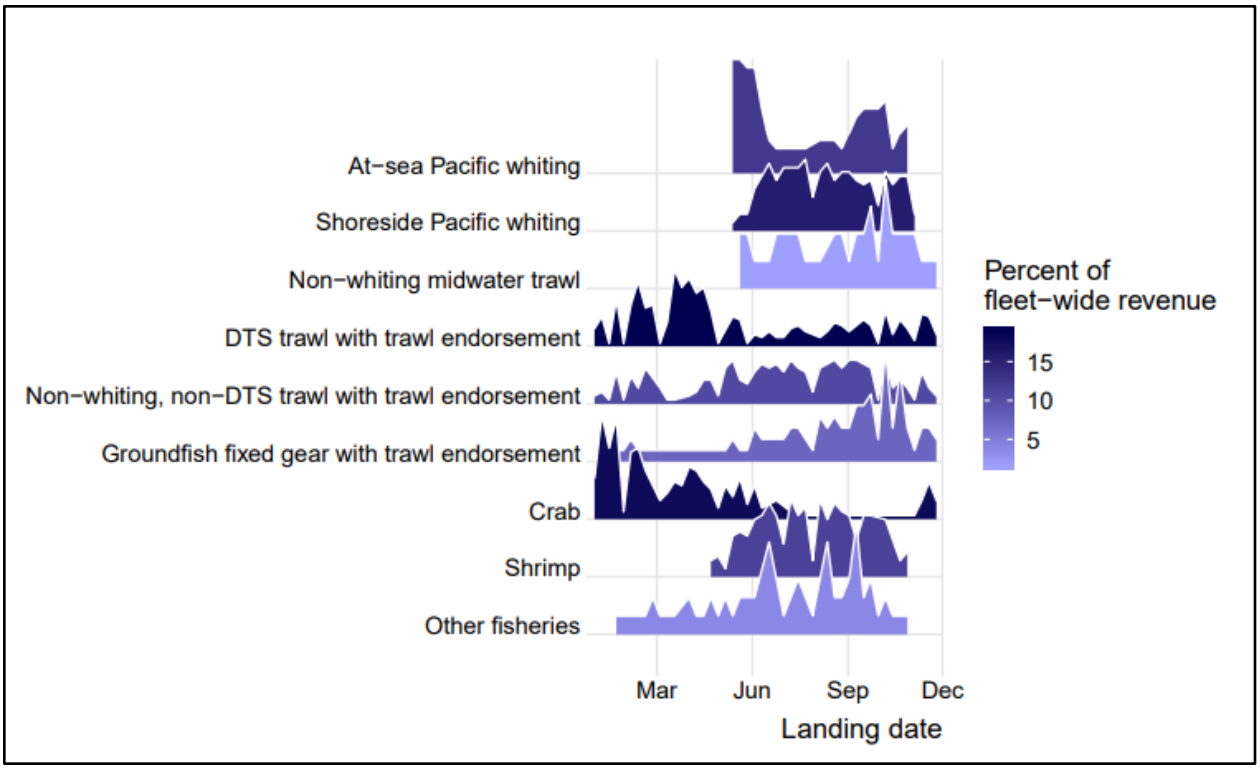


Figure 29. Proportion of trips by week within each fishery that also participates in the groundfish catch share program, 2016
Darker blue indicates a higher proportion of fleet-wide revenue and lighter blue indicates a lower proportion of revenue.
Source: Reprinted from Steiner 2019.

5.1.3.2 Fishery Fleet Revenue Diversification

Fishing revenue varies from year to year because of annual variations in fish landings and ex-vessel prices. Diversifying fishing activities across multiple fish species and/or regions can reduce this variability (NOAA 2022c). A measure of fishery revenue diversification (the Effective Shannon Index) indicates that diversification has declined over the last 40 years for most ports on the West Coast; Bellingham Bay and Westport in Washington are among the few ports that have become more diversified (Figure 30). Diversification scores are highly variable year-to-year for some ports–particularly those in southern Oregon and northern California that depend heavily on the Dungeness crab fishery.

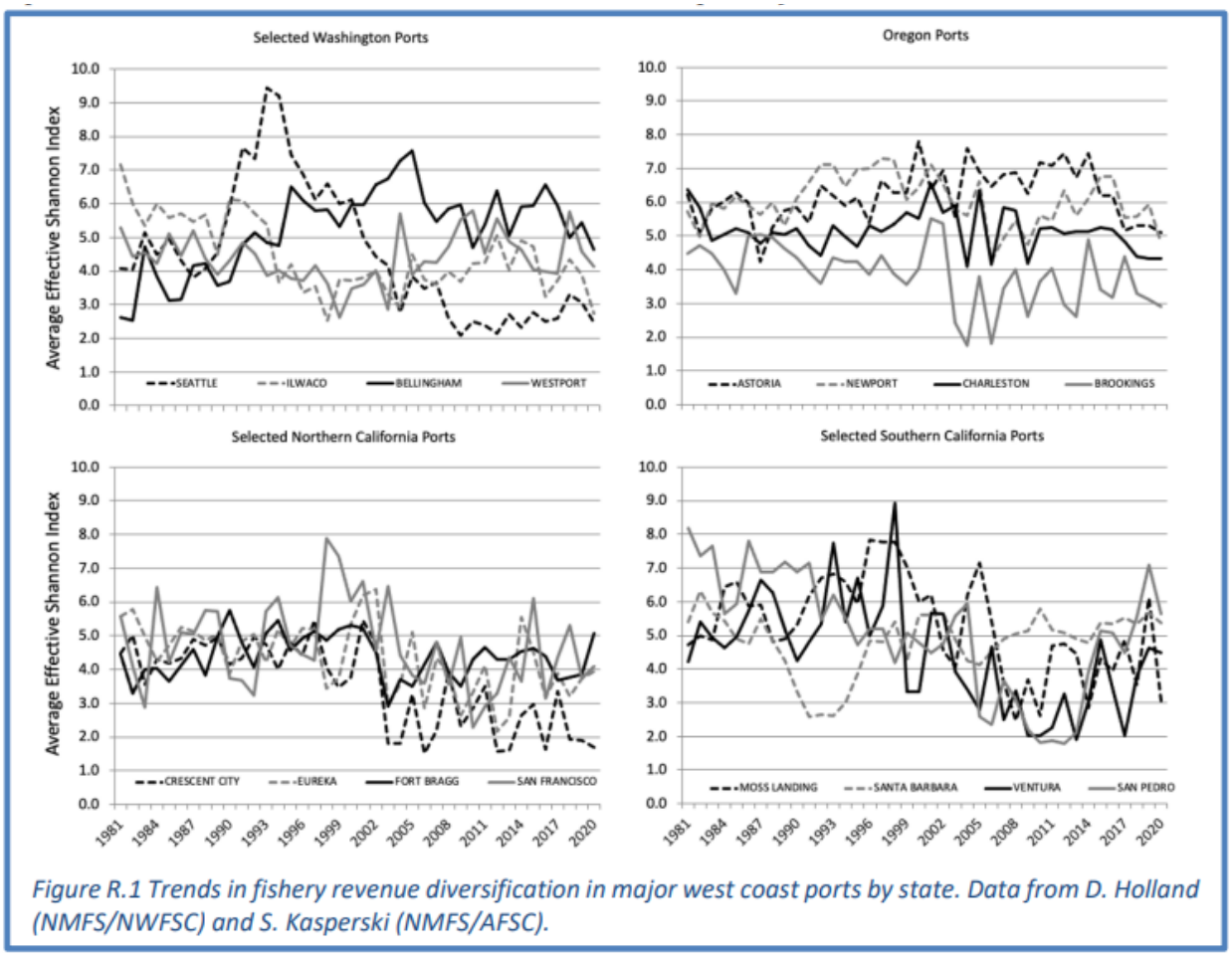


Figure 30. Fishery revenue diversification index, 1981-2021[62]
Diversification has declined over the last 40 years for most ports on the West Coast.
Source: Reprinted from NMFS 2022c.

5.1.3.3 Measures of Revenue Concentration

The geographic concentration of commercial fishery revenues can be measured by the Theil Index, with higher index values indicating greater revenue concentration in a subset of ports[63] (NOAA 2022c). For West Coast port groups, Coastal Pelagic and Highly Migratory Species fisheries have had the highest Theil values since about 2012 (Figure 31). This indicates those groups currently have relatively high concentration of revenue in a smaller number of port groups. The Theil Index for the groundfish fishery has increased since 2010, indicating a growing concentration of revenue in a smaller number of port groups over time.

[62] Annual values for "Fleet Diversity" for the west coast, by state and for select ports, are available from California Current IEA Indicators' Indicator Data Custom Plotting Tool, Human Wellbeing component: https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-iea-indicators.
[63] The index estimates the difference between observed revenue concentrations and what they would be if they were perfectly equally distributed across ports.

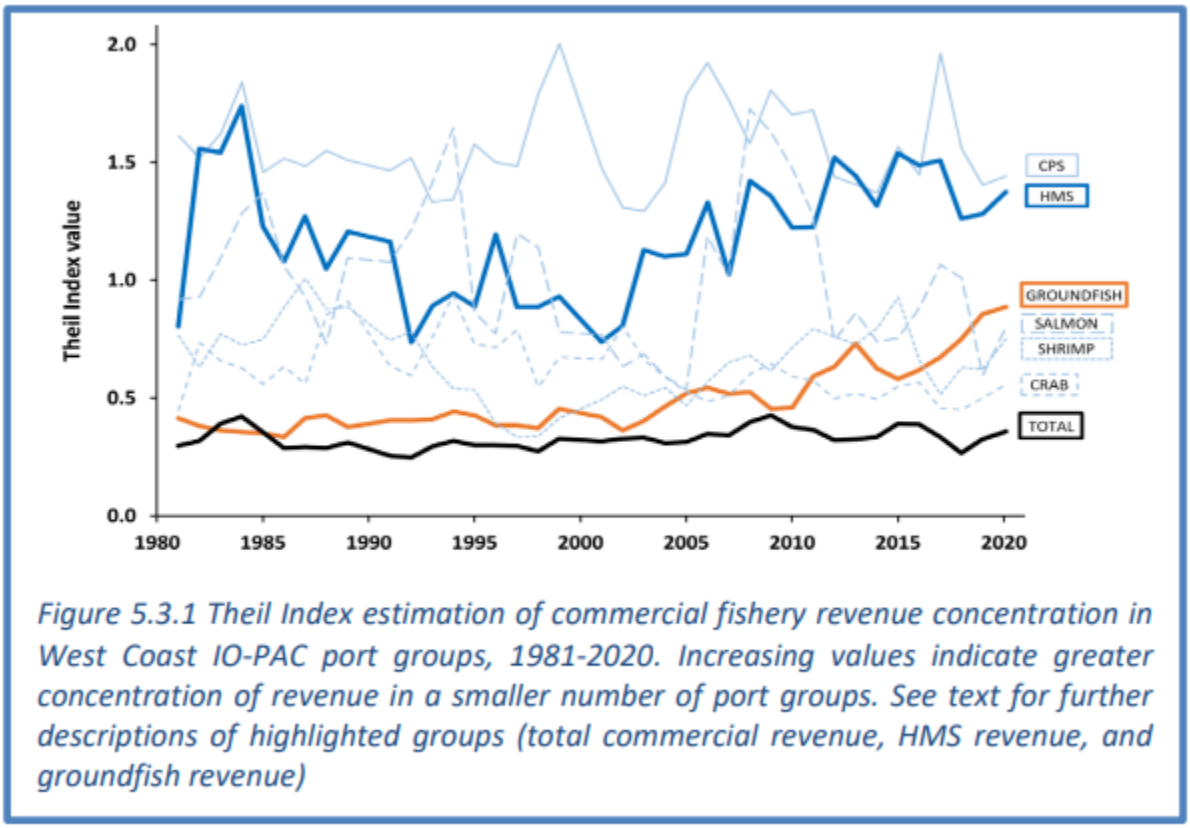


Figure 31. Commercial fishery revenue concentration index, 1981-2021[64]
Coastal Pelagic and Highly Migratory Species fisheries have had the highest revenue concentration since about 2012.
Source: Reprinted from NMFS 2022c.

5.1.4 Economic Impact Modeling

Economic Impact Modeling is a key tool that NMFS uses for summarizing economic activity in the fishing sector as well as for regulatory review. Fisheries Economics of the United States is an annual report that summarizes the economic performance of commercial and recreational fisheries and other marine-related sectors on a state, regional, and national basis (NMFS 2023b). It also describes how U.S. commercial and recreational fishing affects the economy, in terms of employment, sales, and value-added impacts using a national Economic Impact Model. This national model is used in many regions for regulatory review as well. However, the NMFS Northwest Fisheries Science Center (NWFSC) developed their own Economic Impact Model to estimate direct and indirect output, income, and employment contributions from fishing on the U.S. West Coast (Leonard and Watson 2011). This model was co-developed with specific data collections to better parameterize the model for the West Coast, as well as to deal with specific data deficiencies on the West Coast. The model is called the Input-Output Model for Pacific Coast Fisheries (IOPAC) and is used for summarizing economic activity in the fishing sector and for regulatory review purposes.

[64] Annual values for "Commercial fishing revenue concentration" for the West Coast by management group are available from California Current IEA Indicators' Indicator Data Custom Plotting Tool, Human Wellbeing component: https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-iea-indicators.

Economic impact studies are commonly used by regional economists to measure economic activity. It is important to recognize that 'economic impacts' as defined by this framework refer to a very specific and assumption-laden concept. 'Economic impacts without substitution', which are discussed in this section, are sometimes referred to as 'economic contributions' (Watson et al. 2007). They are also distinct from 'economic benefits' which is a measure of social welfare. Economic contribution and impact studies are a narrowly defined type of economic model, and should not be confused with the study of economics in general.

The term 'economic impact (without substitution)' refers to how an economic activity cycles through the region's existing economy. An economic impact is defined as the **gross** changes in a region's existing economy that can be attributed to a given industry, event, or policy. Impact analysis is a descriptive analysis that simply tracks the gross economic activity of the given event, policy, or industry, as the dollars cycle through the region's economy. This type of analysis is the most common analysis that is performed, and is not a measure of social welfare (Watson et al. 2007).

Figure 32 illustrates how economic impacts are measured, and the types of measurements produced through impact analysis. In this figure's example, the industry under consideration is the commercial fishing and processing industry, depicted in the yellow circle. The "direct effect" of this industry is the value of the outputs produced by the fishing and processing industry. The impact analysis would then follow this economic activity through the regional economy. Figure 33 is another conceptual diagram of an economic impact model (Northern Economics 2013). It has the additional detail that only a portion of local labor and materials spending is retained within the model framework, as "direct local impacts" in the figure. Money that leaves the study area is considered a leakage (represented by the upward arrows).

Local spending by individuals that are participating in activities associated with commercial fishing and processing is considered an "indirect effect", shown in green in Figure 32. For example, harvesters and seafood processors purchase supplies, inputs, and services such as bait, ice, fuel, boxes, quota, groceries, insurance, moorage, and shipyard services. Bait and ice providers also buy fuel, groceries, supplies, hire employees, and purchase other inputs. Grocery stores purchase transportation services, and they pay suppliers and manufacturers, wholesalers, financial services, and they also hire employees. Harvesters and seafood processors also purchase labor in the form of crew, processing employees, management, and rents to boat, facility, and/or quota owners, and pay business taxes.

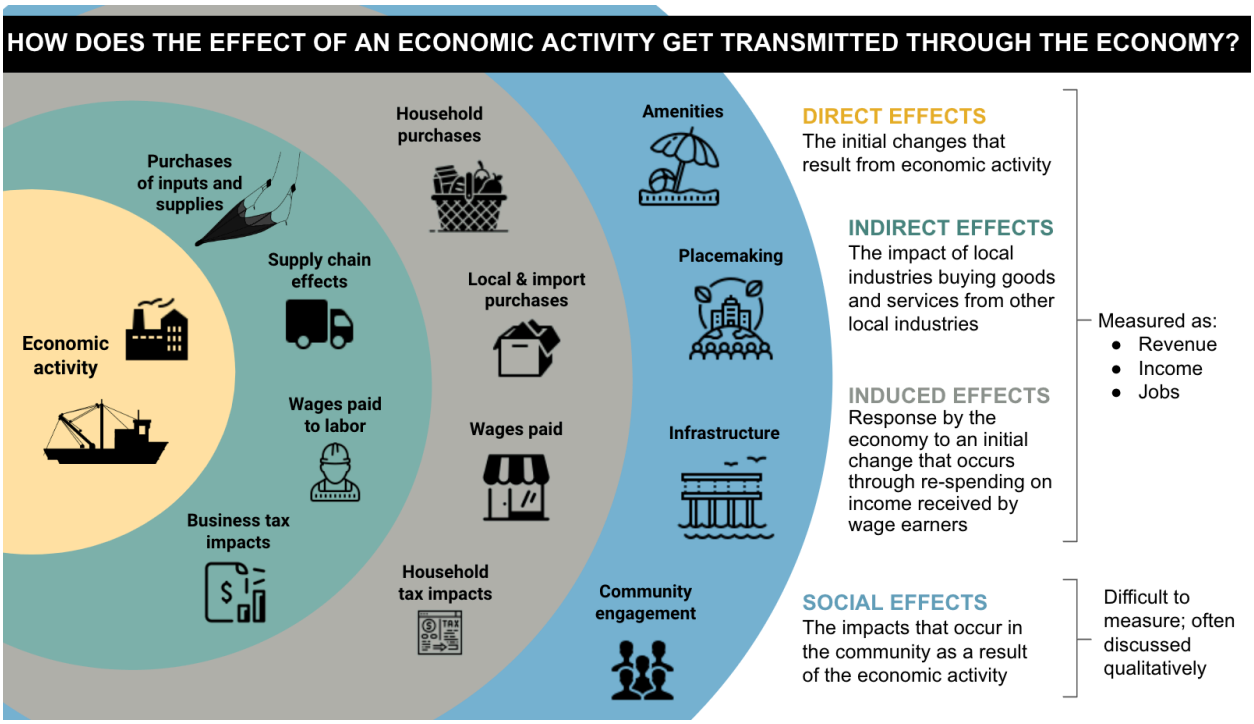


Figure 32. How the effect of an economic activity is transmitted through the economy
Direct, indirect, induced, and social effects resulting from economic activity in a specified sector.
Source: Adapted by the authors from a figure by IMPLAN (https://blog.implan.com/what-is-implan).

Each individual crew, captain, processing employee, and manager also spends money supporting and supplying their household. This re-spending is called an "induced effect" (in gray), consisting of household spending, local purchases, and household tax impacts.

These indirect and induced effects are calculated using a model called an Input/Output Model. An Input/Output Model uses an accounting framework to create a picture of the flow of goods between industries and consumers. It represents the structure and degree of interconnectedness in the regional economy with the output of each sector attributed to expenditures on intermediate inputs or to value-added components such as labor, taxes, and returns to capital.

An Input/Output Model is used to derive "multipliers", which relate an industry's economic activity to gross sales in the other sectors of the regional economy. An industry's single-period gross sales multiplied by the sector's multiplier for that region gives the total economic impact of the industry to the regional economy. Direct, indirect, and induced impacts sum to the total economic impacts of a project or industry. Total impacts are then often reported in measures of output, jobs, and/or labor income generated within the study area. Different multipliers are generated by the model depending on whether the output of interest is output, jobs, or labor income.

The input-output model for Pacific Coast Fisheries (IOPAC) is a regional input/output model developed by the NMFS Northwest Fisheries Science Center (NWFSC) to estimate direct and indirect output, income, and employment contributions from fishing on the U.S. West Coast. NMFS uses these analyses in fish stock rebuilding plans, climate and ecosystem modeling, harvest specifications, and other fishery

management measures. For commercial fishing the study area can be the West Coast, state(s), or port area(s).[65]

The IOPAC model employs financial linkages between industries and households in the study area to estimate the economic impact of a policy change/event (e.g., change in catch) on the region's economy in the short term. These linkages rely on IMPLAN[66] (a commonly used set of economic impact data), and are calibrated to Pacific coastal communities and fisheries using information from PacFIN fish tickets, NMFS cost earnings surveys, and NMFS recreational fishing expenditure surveys. The choice of Input/Output model and its specifications are important. The model defines all of the interconnections in the regional economy. Very specific and/or unique sectors of the economy may not be well-represented in publicly accessible or commonly used economic impact data.

The data underlying the IOPAC model specifically represents the expenditures surveyed from fishers actually operating across the U.S. West Coast. In addition, catch patterns and species-specific expenditure patterns are constructed from historical fish ticket data at the port-, state-, and coast-level. Using more generalized data, for example at a national level, may not capture the true heterogeneity across different types of vessels, fishers, and geographic areas that these fishers operate in. The Economic Impact Model used for Fisheries Economics of the United States are calculated using two separate national IMPLAN models (commercial fishing and seafood industry and recreational fishing sectors) of the Economics and Sociocultural Analysis Division, Office of Science and Technology, NOAA Fisheries (NMFS 2023b).

IOPAC (and all Input/Output Models) include a set of restrictive assumptions. They assume that there are no supply constraints (i.e., that the fishing industry can buy as many inputs as they want), that there is no possible substitution between inputs (i.e., that a fisher could change the type or ratio of inputs they use), that the output per employee ratio is fixed (i.e., that more jobs are created if output increases), and they form a static snapshot (i.e., there is no evolution over time). The models assume that individuals cannot start new lines of work outside of the fishing industry and capital cannot be used for another purpose, and recreational activities cannot be substituted for one another. They assume that prices are fixed. Finally, they say nothing about how spending on one industry may impact spending in another industry. These assumptions limit their usefulness (especially when contemplating a cross-industry analysis) and should be described when presenting the results of economic impact analysis.

Economic activity also generates social effects, depicted in Figure 32 in blue. Community amenities, a sense of place, infrastructure, and social engagement in a community all result from economic activity. These social effects are difficult to measure, and difficult to attribute directly to a specific sector of economic activity. Therefore, these effects are often discussed qualitatively, and are typically not provided as part of estimates of economic impacts. Social indicators such as engagement and dependence on an industry help to quantify social effects, but may be incomplete, difficult to disaggregate, and/or not attributable at the level of certainty needed for a quantitative analysis.

[65] For a list of the ports included in IOPAC port groups see Table 9 in NOAA Technical Memorandum NMFS-NWFSC111, Description of the Input-Output Model for Pacific Coast Fisheries by Jerry Leonard and Phillip Watson (June 2011). https://www.webapps.nwfsc.noaa.gov/assets/25/1620_08012011_142237_InputOutputModelTM111WebFinal.pdf

[66] See https://implan.com/ for more information.

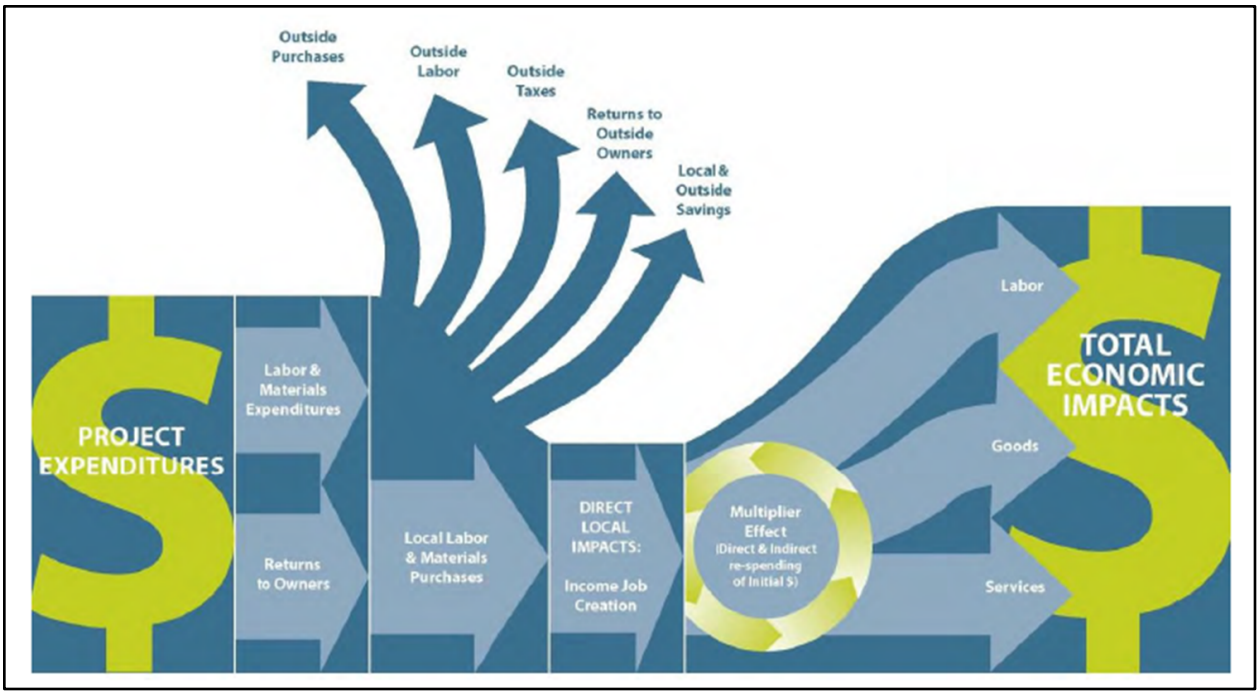


Figure 33. Framework for evaluating the total economic effects or impacts of local spending
Economic Impact models provide a framework for evaluating the way in which expenditures from a specific economic activity or project are transmitted through a local economy. A portion of local labor and materials spending is retained within the model framework ("direct local impacts" in the figure). Money that leaves the study area is considered a leakage (represented by the upward arrows). The direct local impacts are scaled by a "multiplier", which estimates the direct and indirect effects of local re-spending of the initial project or activity expenditures on labor, goods, and services.
Source: Reprinted from Northern Economics 2013.

5.2 Examples of Socioeconomic Analyses for Regulatory Review

The data and models described above are commonly used to assess the potential effects of proposed fisheries management actions. In this section, we discuss two examples of actual proposed fisheries management actions, and the socioeconomic analyses that were completed as part of their evaluation. The analyses presented in this section address tradeoffs between fishery stock levels and fishing community benefits. Two examples are 1) the likely effects of potential re-opening and closures of essential fish habitat to groundfish bottom trawl (2019), and 2) proposed changes to yelloweye rockfish management (2018). The types of analyses completed were determined, in part, by the nature of the proposed action and data availability (Table 29).

Table 29. Comparison of socioeconomic analyses in two proposed fisheries management actions

	Groundfish Essential Habitat	Yelloweye Rockfish Management
Type of Analyses	Primarily qualitative due to limited data; likely direction and magnitude of effects [4.1.2.1]	Quantitative and qualitative
Fisheries	Commercial, tribal [p. 4-12]	Commercial, recreational, tribal
Metrics	Commercial effort (hours), landings, ex-vessel revenue	Commercial ex-vessel revenue, income and employment impacts (by community*); recreational effort, income and employment impacts (by community group); tribal landings
Data Sources	PacFIN, vessel logbooks	PacFIN, RecFIN, vessel cost earnings surveys, recreational expenditure
Models Used	None	PFMC Groundfish Management Team commercial catch and recreational fishing effort (angler trips) projection models, landings distribution model, IOPAC

Sources: NOAA 2019, 2018
Note: Community groups are based on IOPAC port groups.

5.2.1 Groundfish Essential Fish Habitat

A study by NMFS and the PFMC for Amendment 28 to the Groundfish FMP (2019) assessed the likely effects of potential closures of essential fish habitat to bottom trawl. NMFS' 2019 Environmental Impact Statement analyzed an Amendment to the Pacific Coast Groundfish FMP (Amendment 28) that would change where bottom trawl fishing was allowed off the coasts of Washington, Oregon, and California, as well as the timing and location of bottom trawl closures (NMFS 2019). Various combinations of alternatives to the existing federal bottom trawl closures ("no action") were considered: changes to the essential fish habitat conservation areas, adjustments to the groundfish trawl rockfish conservation area, and use of MSA authorities to prohibit bottom contact fishing activities in waters deeper than 3,500 meters (Table 30) (NMFS 2019).

Table 30. Summary of the alternatives considered in "Changes to Pacific Coast Groundfish Essential Fish Habitat Conservation Areas and Boundaries of the Trawl Gear Rockfish Conservation Area" FEIS

Subject Area	No-action Alternative	Action Alternatives
1. EFHCA changes (re-openings and closures)	No-action Alternative Retains current suite of EFHCAs. Retains Trawl RCA closures. Continues to allow use of bottom contact gear in waters deeper than 3,500 m.	Alternative 1.a, Collaborative Alternative Alternative 1.b, Oceana et al. Alternative [1/] Alternative 1.h, Preferred Alternative
2. Adjustments to Trawl RCA	No-action Alternative Retains current suite of EFHCAs. Retains Trawl RCA closures. Continues to allow use of bottom contact gear in waters deeper than 3,500 m.	Alternative 2.c, Remove trawl RCA and implement area closures (BACs)[2/] Alternative 2.d, Preferred Alternative, Remove trawl RCA and implement BACs (Oregon and California)
3. Use of MSA Sec. 303(b) discretionary authorities	No-action Alternative Retains current suite of EFHCAs. Retains Trawl RCA closures. Continues to allow use of bottom contact gear in waters deeper than 3,500 m.	Alternative 3, Preferred Alternative, Use MSA Sec. 303(b)(2)(A), Sec. 303(b)(2)(B), or Sec. 303(b)(12) to close waters deeper than 3,500 m to bottom contact gear, consistent with September 2015 Agenda Item H.8.a, Supplemental NMFS Report

[1/] Alternative 1.b, Oceana, et al., was modified per November 2016 Agenda item F.4.b CDFW report.
[2/] Alternative 2.c, would remove the trawl RCA coastwide outside the tribal U&A fishing area.
Source: Modified (reformatted for accessibility) from NMFS 2019, Table 2-1.
Notes: EFHCA = Essential fish habitat conservation area
RCA = Rockfish conservation area
BAC = Block area closure

Participants in the non-tribal fisheries, shore-based processors, and fishing-related businesses in coastal communities were among those determined to be affected by these changes, as well as participants in the nontribal fisheries who harvest groundfish using bottom trawl gear. The assessment was primarily qualitative, informed by quantitative information on the recent and past economic importance of fishing grounds (NMFS 2019). For example, the qualitative analysis for socioeconomic effects of closures in Subject Area 1 are shown in Table 31. The quantitative analyses considered the estimated state and coast-wide (by IOPAC port group) effects on landings (pounds), revenues, fishing effort, and dependence on and participation in the fishery (proportion of community revenues) for each proposed alternative; Table 32 provides the results for Subject Area 1 alternative h, the preferred alternative.

Table 31. Qualitative analysis for Subject Area 1 closures: summary of recent contribution of landings in proposed closures under Subject Area 1 alternatives, net square miles proposed to be closed, and expected coastwide net economic impact

	No-action Alternative	Subject Area 1 Proposed Closures (2011 to 2014 data)	Subject Area 1 Proposed Closures (2011 to 2014 data)	Subject Area 1 Proposed Closures (2011 to 2014 data)
	No-action Alternative	Collaborative Alternative (1.a)	Oceana, et al. Alternative (1.b)	Final Preferred Alternative (1.b)
	Relative Contribution[1/] of a Port (2011 to 2014 data)	Relative Contribution[2/] of Areas Proposed for the Following:	Relative Contribution[2/] of Areas Proposed for the Following:	Relative Contribution[2/] of Areas Proposed for the Following:
Port Group	Relative Contribution[1/] of a Port (2011 to 2014 data)	Closure	Closure	Closure
North Washington coast	Low Contribution	No Data	No Data	Negligible Contribution
Puget Sound	Low Contribution	No Data	No Data	Negligible Contribution
South and Central Washington coast	Medium Contribution	Negligible Contribution	Low Contribution	Negligible Contribution
Washington Total	**High Contribution (~13%)**	**Negligible Contribution**	**Negligible Contribution**	**Negligible Contribution**
Astoria	High Contribution	Negligible Contribution	Negligible Contribution	Negligible Contribution
Newport	Medium Contribution	No Data	Low Contribution	Negligible Contribution
Coos Bay	High Contribution	No Data	Negligible Contribution	No Data
Brookings	Medium Contribution	Negligible Contribution	Low Contribution	No Data
Oregon Total	**High Contribution (~62%)**	**Negligible Contribution**	**Low Contribution**	**Negligible Contribution**
Crescent City	Negligible Contribution	Negligible Contribution	Negligible Contribution	Negligible Contribution
Eureka	High Contribution	Negligible Contribution	High Contribution	**Low Contribution**
Fort Bragg	Medium Contribution	Negligible Contribution	**Low Contribution**	Negligible Contribution
San Francisco	Low Contribution	Negligible Contribution	**Low Contribution**	Negligible Contribution
Monterey	Low Contribution	Negligible Contribution	Negligible Contribution	Negligible Contribution
Morro Bay	Low Contribution	Negligible Contribution	**Low Contribution**	Negligible Contribution
California Total	**High Contribution (~26%)**	**Negligible Contribution**	**Medium Contribution**	**Negligible Contribution**
Square Miles	**N/A**	**959 mi^2**	**14,380 mi^2**	**12,455 mi^2**
Summary	Landings accrued by bottom trawl vessels fishing in areas that are not closed to bottom trawling	Loss of areas of negligible contribution offset by gains in ecosystem services and existence values for areas proposed to be closed Some reduction in the opportunity to optimize fishing activity	Loss of areas of low contribution offset by gains in ecosystem services and existence values for closed areas that are greater than in Alternative 1.1 (based on mi^2 proposed to be closed) Some reduction in the opportunity to optimize fishing activity (more reduction than Alternative 1.a)	Loss of areas of negligible contribution offset by gains in ecosystem services and existence values for closed areas that are less than Alternative 1.b and more than Alternative 1.a (based on mi^2 proposed to be closed) Some reduction in the opportunity to optimize fishing activity; likely less than Alternative 1.a and more than Alternative 1.b

1/ Contribution of a port group to all coastwide bottom trawl landings in that period
2/ Contribution to port group of landings in impact areas relative to all bottom trawl landings in port group in that period
No Data
Negligible Contribution 0%-1%
Low Contribution 1%-5%
Medium Contribution 5%-10%
High Contribution >10%
Source: Modified (reformatted for accessibility) from NMFS 2019, Table 4-19.

Table 32. Quantitative analyses for alternative 1.h, the preferred alternative. Closures; aggregated non-whiting trawl groundfish species landings and revenue by port group from catch in areas proposed for closure 2011-2014

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Inflation-adjusted Ex-vessel Revenue [Thousand dollars (2015)]	Percent of Port Group Non-whiting Groundfish Revenue
North Washington coast	-	-	-	-
Puget Sound	-	-	-	-
South and Central Washington coast	1	0.01%	$1	0.01%
Washington Total	**1**	**0.01%**	**$1**	**0.01%**
Astoria	47	0.08%	$27	0.08%
Newport	9	0.09%	$6	0.08%
Coos Bay	-	-	-	-
Brookings	-	-	-	-
Oregon Total	**56**	**0.06%**	**$33**	**0.06%**
Crescent City	2	0.20%	$2	0.25%
Eureka	305	1.67%	$229	1.76%
Fort Bragg	3	0.03%	$3	0.03%
San Francisco	12	0.44%	$17	0.87%
Monterey	4	0.13%	$5	0.19%
Morro Bay	11	0.43%	$5	0.22%
California Total	**338**	**0.85%**	**$260**	**0.89%**
Coastwide Total	**395**	**0.26%**	**$294**	**0.30%**

Source: Modified (reformatted for accessibility) from NMFS 2019, Table 4-17.

The final rule implementing Amendment 28 (effective 1/1/2020) "closes over 12,000 square miles (31,000 square km) of the exclusive economic zone (EEZ) and re-opens over 200 square miles (518 square km) of the EEZ to bottom trawl gear, which adversely affects groundfish EFH. The new closures protect a variety of ocean floor types (substrates) designated as groundfish EFH, and include areas designated as habitat areas of particular concern. In particular, these closed areas protect submarine canyons, seamounts, methane seeps, deep-sea corals as well as stationary three-dimensional invertebrates like sponges and corals. Revisions to existing EFH conservation areas expand closures to protect important habitat features, but reopen habitats with lower sensitivity and faster recovery to disturbance. Impacts to fishing communities are anticipated to be minimal, because very little fishing effort occurred in the closed areas (less than 2 percent of the total groundfish landings and revenues on either a coastwide or port-group level). Overall, this final rule, in combination with existing habitat management measures that remain unchanged, minimizes the adverse effects of fishing on groundfish EFH while mitigating negative socioeconomic effects to fishing communities." (50 CFR Part 660) (84 FR 63966-63992, November 19, 2019)

5.2.2 Yelloweye Rockfish Management

Another example is the proposed changes to yelloweye rockfish management in 2018. Yelloweye rockfish were declared to be overfished in 2002, and in response the PFMC developed a rebuilding plan, including a default harvest control rule.[67] The Council has managed catch limits since then to rebuild the stocks while giving consideration to species biology and the needs of fishing communities. NMFS proposed the adoption of 2019-2020 yelloweye rockfish harvest specifications; revisions to the rebuilding plan; and adjustments to existing, and implementation of new, management measures (NMFS 2018). These actions were proposed to prevent overfishing, rebuild overfished stocks, ensure conservation, and facilitate long term protection of essential fish habitat.

The Council considered two sets of alternatives, in addition to no-action: changes to harvest control rules and yelloweye rockfish rebuilding plan parameters, and harvest specifications; and changes in management measures related to harvest specifications (Table 33). The alternatives were based on the most recent stock assessment and rebuilding analysis.

Table 33. Alternative 2019 and 2020 harvest specifications for select groundfish stocks selected for detailed analysis (metric tons)

Stock	Alternative	2019 OFL	2019 ABC	2019 ACL	2020 OFL	2020 ABC	2020 ACL	Harvest Control Rule
CA Scorpionfish S. of 34°27' N lat.	No Action	337	313	150	331	307	150	150 mt constant catch ACL
CA Scorpionfish S. of 34°27' N lat.	Alt. 1 (Preferred)	337	313	313	331	307	307	ACL = ABC (P* = 0.45)
Lingcod N. of 40°10' N	No Action	5,110	4,872	4,859	4,770	4,549	4,533	ACL = ABC (P* = 0.45 in OR & WA; P* = 0.4 in CA) w/ 40-10 adj. for the CA contribution to the ABC and ACL. Assumes 1,000 mt and 750 mt removals for 2017 and 2018 in the north and south, respectively and full ACL attainment thereafter.
Lingcod S. of 40°10' N	No Action	1,143	1,043	996	983	898	839	ACL = ABC (P* = 0.4) w/ 40-10 adj. Assumes 1,000 mt and 750 mt removals for 2017 and 2018 in the north and south, respectively and full ACL attainment thereafter.
Lingcod N. of 40°10' N	Alt. 1 (Preferred)	5,110	4,885	4,871	4,768	4,558	4,541	ACL = ABC (P* = 0.45) w/ 40-10 adj. for the CA contribution to the ABC and ACL. Assumes 40% and 75% ACL attainment for 2017 and 2018 in the north and south, respectively and full ACL attainment thereafter.
Lingcod S. of 40°10' N	Alt. 1 (Preferred)	1,143	1,093	1,039	977	934	869	ACL = ABC (P* = 0.45) w/ 40-10 adj. Assumes 40% and 75% ACL attainment for 2017 and 2018 in the north and south, respectively and full ACL attainment thereafter.
Yelloweye rockfish	No Action	81	74	29	84	77	30	ABC (P* =0.4), ACL (SPR = 76.0%); median time to rebuild = 2027
Yelloweye rockfish	Alt.1	81	74	39	84	77	40	ABC (P* =0.4), ACL (SPR = 70.0%); median time to rebuild = 2028
Yelloweye rockfish	Alt. 2 (Preferred)	81	74	48	84	77	49	ABC (P* =0.4), ACL (SPR = 65.0%); median time to rebuild = 2029

Source: Modified (reformatted for accessibility) from NMFS 2018, Table 2-2.
Notes: OFL = Overfishing limit
ABC = Acceptable biological catch
ACL = Annual catch limit
P* = Overfishing probability

The potential changes in revenue, income, and employment by community were estimated for commercial and recreational fishing, and changes in landings for tribal fishery. The PFMC's Groundfish Management Team catch and effort projection models and landings distribution model,[68] and NMFS' IOPAC were used for the analyses. For example, Table 34 shows estimated ex-vessel revenues by alternative, and Table 35 the estimated recreational fishery income impacts under Status Quo and the

[67] Default harvest control rule represents the continuation of the existing basis for harvest specifications (NOAA 2018).
[68] The landings distribution model, developed by the PFMC Groundfish Management Team, is used to estimate where landings are likely to occur and the resulting port-level ex-vessel revenue.

alternatives by community group. The preferred harvest guideline alternative for yelloweye rockfish was adopted in the Final Rule for the Pacific Coast groundfish fishery, effective June 18, 2020, "... intended to ensure the long-term sustainability of the Pacific whiting, shortbelly rockfish, and cowcod stocks (85 FR 36803 et seq.[69])."

Table 34. Estimated ex-vessel revenues by groundfish harvest sector under the alternatives (million $2017)

Sectors	Status Quo	No Action 2019	No Action 2020	Alternative 1 2019	Alternative 1 2020	Preferred Alternative (Alternative 2) 2019	Preferred Alternative (Alternative 2) 2020
Shoreside Sectors:							
Whiting	$21.1	$21.1	$21.1	$21.1	$21.1	$21.1	$21.1
Non-whiting Trawl+Non-trawl IFQ	$37.9	$38.6	$38.3	$38.6	$38.3	$38.6	$38.3
Limited Entry Fixed Gear	$18.9	$19.7	$20.0	$19.7	$20.0	$19.7	$20.0
Nearshore Open Access	$4.5	$5.3	$5.3	$5.3	$5.3	$5.3	$5.3
Non-nearshore Open Access	$3.6	$3.8	$3.8	$3.8	$3.8	$3.8	$3.8
Incidental Open Access	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Tribal (inc. whiting)	$11.7	$11.3	$11.4	$11.3	$11.3	$11.3	$11.4
Shoreside sectors' Totals	**$97.9**	**$99.9**	**$100.0**	**$99.9**	**$100.0**	**$99.9**	**$100.0**
At-sea Sectors:							
Non Tribal Whiting	$34.6	$34.6	$34.6	$34.6	$34.6	$34.6	$34.6
Tribal Whiting	$6.9	$6.9	$6.9	$6.9	$6.9	$6.9	$6.9
At-sea sectors' Totals	**$41.5**	**$41.5**	**$41.5**	**$41.5**	**$41.5**	**$41.5**	**$41.5**
TOTAL Groundfish Revenue	**$139.4**	**$141.4**	**$141.5**	**$141.4**	**$141.5**	**$141.4**	**$141.5**

Source: Modified (reformatted for accessibility) from NMFS 2018, Table 4-6.

[69] See https://www.govinfo.gov/content/pkg/FR-2020-06-18/pdf/2020-12959.pdf.

Table 35. Estimated recreational fishery income impacts under Status Quo and the alternatives by community group (million $2017)

Community Groups	Status Quo	No Action	Alternative 1	Preferred Alternative (Alternative 2)
Puget Sound	-	-	-	-
Washington Coast	$6.9	$7.1	$7.1	$7.8
Astoria-Tillamook	$1.8	$1.8	$1.8	$1.8
Newport	$7.9	$7.9	$7.9	$7.9
Coos Bay-Brookings	$3.3	$3.3	$3.3	$3.3
Crescent City-Eureka	$5.4	$5.4	$7.2	$7.2
Fort Bragg – Bodega Bay	$3.4	$3.4	$4.5	$4.5
San Francisco Area	$14.6	$14.6	$18.3	$18.3
SC ─ Mo ─ MB [a/]	$16.7	$16.7	$20.5	$20.5
SB ─ LA ─ SD [a/]	$125.1	$125.1	$168.5	$168.5
Coastwide Total	**$185.0**	**$185.2**	**$239.2**	**$239.9**

a/ SC ─ Mo ─ MB: Santa Cruz ─ Monterey ─ Morro Bay; SB ─ LA ─ SD: Santa Barbara ─ Los Angeles ─ San Diego.
Source: Modified (reformatted for accessibility) from NMFS 2018, Table 4-15.

5.3 Cumulative Effects

The regulations implementing NEPA define cumulative effects as "effects on the environment that result from incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other action." (40 CFR 1508.1 (g)(3)). Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative effects analysis is important "when individual projects have negligible to minor impacts, but moderate to major impacts occur after multiple individual projects are implemented" (Hogan et al. 2023). For NMFS, there is a need to consider the cumulative impacts of multiple management measures on fishing communities as a whole, not just the group(s) that may be the most directly affected. These impacts accumulate over broad temporal and spatial scales (Willsteed et al. 2017). Analyses should have a regional perspective due to the transboundary nature of ocean resources (Hogan et al. 2023).

In the examples from fisheries management, above (section 3.4), cumulative effects were analyzed for the affected resources for defined geographic and temporal boundaries. While the scope was similar for the two analyses, the Groundfish Essential Fish Habitat analysis included non-fishing activities that occur in the proposed action area and may affect the same resources (Table 36). These include agricultural runoff, port maintenance, coastal development, marine transportation, marine mining, beach nourishment, dredging, and disposal of dredged material.

Table 36. Scope and summary of the cumulative effects analyses in two proposed fisheries management actions

	Groundfish Essential Fish Habitat July 2019	Yelloweye Rockfish Management November 2018
Affected Resources	Habitat, fish resources, protected resources, socioeconomic resources (fishing communities). Also considers non-fishing activities that occur in the action area and may affect the same resources. (a)	Groundfish, habitat including Groundfish Essential Fish Habitat, protected species, socioeconomic environment including fishing communities.
Geographic Scope	West Coast EEZ (habitat, fish, and protected resources); U.S. fishing communities directly involved in the harvest or processing of Council-managed resources, particularly those of the states of Washington, Oregon, and California (socioeconomic resources).	West Coast EEZ (Groundfish, habitat, and protected resources); U.S. fishing communities directly involved in the harvest or processing of Council-managed resources, particularly those of the states of Washington, Oregon, and California (socioeconomic environment).
Temporal Scope: Past and Present Actions	Actions that occurred since FMP implementation in 1982.	Actions that occurred after FMP implementation (1982), focusing specifically on actions that have occurred since the implementation of the previous cumulative effects analysis in the 2016 EA.
Temporal Scope: Reasonably Foreseeable Future Actions	Based on the following two criteria: 1. Actions in the West Coast EEZ that affect the same resources impacted by the proposed action. Administrative fishery management actions that have no discernible effect are not included. 2. Actions that are not speculative, in that the action is defined to an extent that it can be analyzed, including actions for which the Council has decided on a Preliminary Proposed Alternative or a Final Preferred Alternative. List reasonably foreseeable future actions and estimated effective dates (6 fishery-related through 2020 and select non-fishing related, ongoing).	Based on the following four criteria: 1. Actions in the West Coast EEZ that affect the same resources affected by the proposed action. Administrative fishery management actions that have no discernible effect are not included. 2. Actions that are not speculative in that the action is defined to an extent that it can be analyzed, including actions for which the Council has decided on a Preliminary Proposed Alternative or a Final Preferred Alternative. 3. Actions that are not identified in the 2016 EA. 4. Actions in which additional information or analysis has been completed since the 2016 EA Takes into account the fact that this tiered action is undertaken every two years and evaluation of this periodic action includes a consideration of cumulative effects. Thus, the same as that for the evaluation of direct indirect effects, through the 2019–20 biennial period. List 3 reasonably foreseeable future actions and estimated effective dates (in 2019).
Summary of the Cumulative Effects Analysis	Overall, when combined with the effects of past, present, and reasonably foreseeable future actions, the incremental effect of the range of alternatives would have between a neutral to medium positive influence on habitat, a neutral to medium positive influence on socioeconomics, a neutral to low positive influence on fish resources, and a neutral influence on protected resources.	Overall, when the proposed action or alternatives are considered in conjunction with all the other pressures placed on fisheries by past, present, and reasonably foreseeable future actions, the incremental effect of the proposed action or alternatives is not expected to result in any significant cumulative impacts, positive or negative, for any affected resource.

Sources: NMFS 2018, 2019

Note: (a) “Human-induced non-fishing activities tend to be localized in the nearshore areas and the marine project areas where they occur. Examples of these activities include, but are not limited to, agricultural runoff, port maintenance, coastal development, marine transportation, marine mining, beach nourishment, dredging, and disposal of dredged material. These non-fishing activities that introduce chemical pollutants, sewage, changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment pose a risk to all of the identified affected resources.” NOAA 2019, p. 6-9.

In the context of offshore wind energy development, the NEPA definition of cumulative effects requires decision-makers to be aware of the effects of existing marine renewable energy infrastructure and the likely effects of planned infrastructure; and to be aware of how those effects are likely to interact with existing effects of other human activities happening in the same environment, such as commercial and recreational fishing (Willsteed et al. 2017). The environmental and economic effects will not be isolated, and fishing communities have suggested the scale of analysis should match that of fisheries and ecosystem management practices (Hogan et al. 2023). Willseed et al. (2017) outline ten key considerations to advance cumulative effects analyses (CEA), both from the perspective of needed research and for regulatory review (Table 37).

Table 37. Ten key considerations to advance Cumulative Effects Analysis (CEA) in defined ecological areas subject to integrated marine management

Define a meaningful area and the ecological receptors that provide insight into the health and functions of the ecosystem therein
Establish a baseline, level of variability and the 'most' important receptors that require assessment and monitoring (a targeted approach may be a necessary starting point if there are many such receptors)
Define appropriate spatial and temporal scales, depending on the ecological patterns, the level/magnitude of activities and developments, cognisant of financial constraints (e.g. monitoring will need to reflect what is financially feasible recognising that frequency may change depending on how the system responds and confidence in effect significance determinations)
Integration at all levels: cross sectoral, cross border and multidisciplinary approaches are a must, whilst attempting to understand cumulative effects. This is perhaps one of the primary weaknesses of current approaches which apply a narrow perspective to what is a complex and multidisciplinary problem
Validation of predicted effects as well as critical assessment of the significance of changes following, for example construction and operation of individual and multiple developments in a given area
Define the significance of changes in ecological and management terms. This will help to define and target an appropriate level of effort for individual development assessments and define the expected benefits of such efforts
Explore and integrate indirect effects into CEAs, for example using ecological modeling. Future research could compare whether assessments focussed on ecological functions or indicators thereof are more informative in support of marine management ambitions than the current approach of assessing isolated species protected by punitive legislation
Accept and acknowledge the level of 'uncertainty of these changes', as there will be areas that require further data collection, dedicated specific tools and distinct approaches (e.g. cross-border collaboration for migratory species, different methodologies for sessile and mobile receptors). Directed research targeted at priority cause-effect relationships at scales relevant to key receptors would enable CEA to advance specific to an activity to advance (e.g. Electromagnetic field (EMF) effects on sensitive species migrating across multiple cables)
Recognize the temporal component of changes (e.g. short term construction effects, long-term operational effects, unknown decommissioning effects) and integration of variable effects into the licensing and management processes. Developing guidance for legislators, regulators and CEA/EIA practitioners to adhere to support ecologically meaningful CEA will be an important next step
Consider implications of environmental change due to development on social receptors and welfare, including the potential for short-term effects as well as long-term changes to have significant impacts on, for example, individual vessel earning capacity

Source: Reprinted from Willsteed et al. 2017.

These ten considerations could help to guide BOEM's assessments of cumulative effects considering existing and future planned infrastructure, as well as interactions with existing human uses in the same regional environment. They can also serve to guide future proposals and funding decisions for research to advance the methods used in cumulative effects assessments.

5.4 Data and Analysis Needs

Section 5 includes data and analysis methods regularly used by NMFS for fisheries management and fisheries regulatory review. Additional data (both quantitative and spatial) could further inform BOEM's evaluation of OWE impacts. As this report was being written, specific data elements that were perceived by the authors as potentially helpful to BOEM Pacific's future analysis needs were noted. However, BOEM Pacific will need to conduct a thorough inventory of data needs, using the tables and figures in this report as references. This report contains publicly available, summarized information, and a description of additional data that is collected. Aggregated, non-confidential data summaries can be requested from PSMFC and/or state and federal agency data partners if pertinent summaries are not available via public reports. For example, port-level summaries, provided they meet confidentiality requirements, could be requested.

Data elements that are likely to be needed by BOEM Pacific but are currently not publicly available in a comprehensive manner. These include:

- number and location (port) of commercial fishing vessels
- commercial fishing vessel lengths
- location of commercial fishing effort (offshore)
- number and location of fish buyers
- revenue of fish buyers

These data could potentially be accessed with a data request to the appropriate agency (see Table 25, 27, 28). However, it is important to understand that a seemingly simple data request may not actually be simple, as data collections are designed for fisheries management and may not be appropriate for other uses.

Data elements that are likely to be needed by BOEM Pacific but new data collections would need to be designed for them:

- number and location (port) of recreational fishing vessels
- location of recreational fishing effort (offshore)
- characteristics of recreational fishing vessels
- number of land-based (shore/jetty) recreational fishing trips in Oregon and Washington
- operational costs for non-groundfish fisheries
- number, location, and characteristics of fish processing facilities

In addition, NMFS' NWFSC is leading the Pacific Fishing Effort Mapping Project (PacFEM) to integrate spatial fisheries data to support fisheries management, marine planning, and inform offshore wind-related analyses for commercial fisheries. NMFS is partnering with the PSMFC and subject matter experts from CDFW, WDFW, and ODFW. The project is funded by NMFS and BOEM Pacific. It is expected to be usable at the end of 2023 and aggregated data will be accessible to the public. Full functionality is expected by the end of 2024. This project will provide more port-level information, as well as more information about the location of fishing effort at sea. The need to incorporate recreational fishing data is known, but is currently unfunded and the suitability of available data would need to be scoped.

BOEM Pacific will need to evaluate the extent to which models and data collections will need to be expanded to meet their needs. Economic impact models designed to evaluate fisheries management actions (such as IOPAC) are unlikely to be sufficient to evaluate the impacts of OWE development. However, they provide an example of how NMFS has developed data collection programs and models designed for the socioeconomic questions NMFS is responsible for analyzing.

6 Conclusion

This report describes West Coast commercial and recreational fisheries pertinent to OWE development. West Coast fishing communities include supportive industries (primary and secondary/ancillary markets), fishing-related infrastructure, fishing sector interconnections, and potential connections between fishing sectors and it is important to consider all these factors when exploring how OWE development may impact fisheries and fishing communities. Many of the sources of socioeconomic information and methods regularly used by the PFMC and NMFS in analyzing the potential impacts of fisheries management decisions may also be applicable as BOEM conducts analyses to examine impacts of OWE on fisheries. They were developed in the fisheries management process with co-managers and stakeholders and designed to meet scientific standards under the MSA and other applicable law, such as NEPA. Although the MSA does not apply to OWE development, approaching fisheries socioeconomic impact analysis informed by the approaches that have evolved in fisheries management can help inform a scientifically sound and robust framework relevant in the OWE context.

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Appendix A: Glossary

Angler - A person catching fish or shellfish with no intent to sell, including people releasing the catch (NOAA 2005).

Angler trip - any part of a single day (24 hours) of marine recreational fishing. Fishing trips are classified as occurring in one of three fishing modes: 1) a shore-based fishing trip; 2) by a private or rental boat; or 3) on a for-hire fishing boat (NOAA 2023b).

Catch - 1. To undertake any activity that results in taking fish out of its environment dead or alive. To bring fish on board a vessel dead or alive; 2. The total number (or weight) of fish caught by fishing operations. Catch should include all fish killed by the act of fishing, not just those landed; 3. The component of fish encounter-ing fishing gear, which is retained by the gear (NOAA 2005).

Catch share program - program where participants in the limited entry shorebased trawl sector (consisting of trawl vessels delivering to shoreside processors) are managed under a system of IFQs and participants in the limited entry at-sea sectors (consisting of large trawl vessels that catch and process whiting at sea) are managed under a system of harvesting cooperatives (PFMC 2022). (see *Individual Fishing Quota*) (PFMC 2022g).

Charter boat - Any vessel-for-hire engaged in recreational fishing and hired for a charter fee by an individual or group of individuals (for the exclusive use of that individual or group of individuals), which results in that vessel being unavailable for hire to any other individual or group of individuals during the period of the charter (NOAA 2005).

Commercial fishery - A term related to the whole process of catching and marketing fish and shellfish for sale. It refers to and includes fisheries resources, fishermen, and related businesses (NOAA 2005).

Cooperative - A group of fishers or stakeholders with collective exclusive access to some aspect of a fishery's resources (Deacon and Ovando 2013).

Establishment - A single physical location at which business is conducted or services or industrial operations are performed. (A company may consist of one establishment or more) (U.S. Census Bureau 2022b).

Ex-vessel - The price received by a captain, at the point of landing, for the catch (NOAA 2005).

Exclusive Economic Zone (EEZ) - The EEZ is the area that extends from the seaward boundaries of the coastal states (3 nautical miles (nm) in most cases, the exceptions are Texas, Puerto Rico and the Gulf coast of Florida at 9 nm) to 200 nm off the U.S. coast. Within this area the United States claims and exercises sovereign rights and exclusive fishery management authority over all fish and all continental shelf fishery resources (NOAA 2005).

Fathom - Depth equivalent to 6 feet.

Fish ticket - A record of fish delivery collected by state fishery agencies and at-sea observers. Fish tickets are classified by gear type and port (Stenberg and Ames 2022).

Fishery Management Council - A regional fisheries management body established by the Magnuson-Stevens Act to manage fishery resources in eight designated regions of the United States (NOAA 2005).

Fishing community - A community that is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs. Includes fishing vessel

owners, fishing families, operators, crew, recreational fishers, fish processors, gear supplies, and others in the community who depend on fishing (NOAA 2005).

For-hire - Fishing mode that refers to trips taken by recreational fishermen (anglers) on a party (also referred to as a head boat) or charter boat (NOAA 2023b).

Harvest - The total number or weight of fish caught and kept from an area over a period of time. Note that landings, catch, and harvest are different (NOAA 2005).

Head boat - A fishing boat that takes recreational (sport) fishermen out for a fee per person. Different from a charter boat in that people on a head boat pay individual fees as opposed to renting the boat (NOAA 2005). (see *Party boat*)

Hook and line - A type of fishing gear consisting of a hook tied to a line. Fish are attracted by natural bait that is placed on the hook, and are impaled by the hook when biting the bait. Artificial bait (lures) with hooks are often used. Hook-and-line units may be used singly or in large numbers (NOAA 2005).

Individual Fishing Quota (IFQ) - A type of limited entry, an allocation to an individual (a person or a legal entity, e.g. a vessel owner or company) of a right [privilege] to harvest a certain amount of fish in a certain period of time. It is also often expressed as an individual share of an aggregate quota, or total allowable catch (TAC) (NOAA 2005).

Landings - 1. The number or poundage of fish unloaded by commercial fishermen or brought to shore by recreational fishermen for personal use. Landings are reported at the locations at which fish are brought to shore. 2. The part of the catch that is selected and kept during the sorting procedures on board vessels and successively discharged at dockside (NOAA 2005).

Management - The art of taking actions that affect a resource and its exploitation with a view to achieve certain objectives, such as maximizing the production of that resource. Management includes, for example, fishery regulations such as catch quotas or closed seasons. Managers are those who practice management (NOAA 2005).

Metric ton - Weight equivalent to 2,204.6 pounds.

Nautical mile (nm) - Distance equivalent to ~2,025 yards or 1.5 statute (land) miles.

Party boat - Any vessel-for-hire engaged in recreational fishing and hired (or leased, in whole or part) per a per-capita fee on a first-come, first-served basis (NOAA 2005). (see *Head boat*)

Pelagic - Inhabiting the water column as opposed to being associated with the sea floor; generally occurring anywhere from the surface to 1,000 meters (NOAA 2005).

Recreational fishery - Harvesting fish for personal use, sport, and challenge (e.g. as opposed to profit or research). Recreational fishing does not include sale, barter, or trade of all or part of the catch (NOAA 2005).

Subsistence fishery - A fishery where the fish caught are shared and consumed directly by the families and kin of the fishers rather than being sold at the next larger market (NOAA 2005).

Target species - Those species primarily sought by the fishermen in a particular fishery. The subject of directed fishing effort in a fishery. There may be primary as well as secondary target species (NOAA 2005).

Trawling - Fishing technique in which a net is dragged behind the vessel and retrieved when full of fish. It includes bottom- and midwater fishing activities (NOAA 2005).

Vessel Monitoring System (VMS) - A satellite communications system used to monitor fishing activities—for example, to ensure that vessels stay out of prohibited areas. The system is based on electronic devices (transceivers), which are installed on board vessels. These devices automatically send data to a shore-based "satellite" monitoring system (NOAA 2005).

Yield set-aside - the amount of yield of an actively managed stock or stock complex that is deducted from an ACL or sector allocation. A set-aside deducted from an ACL is designed to accommodate catch in Tribal fisheries, research fisheries, exempted fishing permit activities, and bycatch in non-groundfish fisheries (PFMC 2022f).

U.S. Department of the Interior (DOI)
DOI protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

Bureau of Ocean Energy Management (BOEM)
BOEM's mission is to manage development of U.S. Outer Continental Shelf energy, mineral, and geological resources in an environmentally and economically responsible way.