

Status of Rockfish Research and Conservation Programs

2022-2024 Biennial Report to the Legislature



Washington
Department of
**FISH &
WILDLIFE**

December 2024



State of Washington
DEPARTMENT OF FISH AND WILDLIFE

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December 11, 2024

The Honorable Kristine Reeves
Chair, House Agriculture &
Natural Resources
132E Legislative Building
Post Office Box 40600
Olympia, WA 98504-0600

The Honorable Sharon Shewmake
Chair, Senate Agriculture,
Water, Natural Resources, & Parks
213 John L. O'Brien
Post Office Box 40442
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Dear Chairs,

I am pleased to submit the Washington Department of Fish and Wildlife's (Department) eighth biennial report to the Legislature on the status of our rockfish research and stock assessment activities in Puget Sound and on the coast.

The Legislature directed the Department to use funds in the Rockfish Research Account (RRA) to develop and implement a research and stock assessment program for rockfish. Since then, the Department, in collaboration with other state, federal, and non-government entities, has realized significant achievements that otherwise could not have been accomplished. Foremost among these are rebuilding the populations of six federally declared overfished rockfish species on the coast and the delisting of an Endangered Species Act (ESA) listed species, Canary Rockfish, in Puget Sound.

The following report describes the projects and activities funded by the RRA in fiscal years 2023 and 2024, and how they are contributing to the establishment of much needed long-term monitoring and assessment programs for coastal and Puget Sound rockfish populations. Some research activities highlighted from this reporting period are:

- Nearshore surveys for coastal rockfish were conducted and information gained was used in the [2023 Black Rockfish Stock Assessment](#),
- The effectiveness of outreach and education on rockfish identification was evaluated, and
- Biological information on ESA listed species was collected to help inform management decisions.

The Department will continue efforts to monitor population health and to recover the remaining overfished species on the coast and ESA listed species in Puget Sound.

Thank you for your continued interest in rockfish management in Washington. If you have any questions about this report or the Department's rockfish research and assessment activities, please contact our new Legislative Director, Melena Thompson, at 564-791-2755.

Sincerely,

A handwritten signature in blue ink, appearing to read "Kelly Sussewind". The signature is fluid and cursive, with a large loop at the end.

Kelly Sussewind
Director

Status of Rockfish Research and Conservation Programs

Biennial Report to the Legislature

Cover photo by WDFW.

Request this information in an alternative format or language at wdfw.wa.gov/accessibility/requests-accommodation, 833-885-1012, TTY (711), or CivilRightsTeam@dfw.wa.gov.

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Introduction

In 2007, the Washington State Legislature created a Rockfish Research Account (RRA) to fund increased monitoring of rockfish abundance and distribution as a result of the significant decline in the past half century of many rockfish species residing in Washington marine waters. Progressively from 1999, seven rockfish species were federally designated as “overfished” on the West Coast, followed in 2010 by the listing of three species in Puget Sound and the southern Strait of Georgia under the federal Endangered Species Act (ESA).

Funded by surcharges on commercial and recreational fishing licenses, revenues from the RRA have helped the Washington Department of Fish and Wildlife (Department, WDFW) to greatly expand its understanding of these vulnerable marine fish and their habitats. The Department in collaboration with state, federal, and non-government entities, has realized significant achievements that otherwise could not have been accomplished. These achievements include the rebuilding of six federally declared overfished rockfish species on the coast, and delisting an ESA listed species, Canary Rockfish, in the Puget Sound.

Since 2008, WDFW has reported to the Legislature every other year on the status of rockfish stock assessment research and fishery management efforts. This report is the latest in that series, providing an update on the current status of rockfish stock assessment capabilities, research projects conducted in fiscal years (FY) 2023 and 2024, and future plans for research by the Department.

Recent Research Highlights

Surveying Coastal Rockfish with Rod-and-Reel

A standardized rod-and-reel abundance survey serves as the long-term monitoring tool for stock abundance of multiple rockfish species and allows for the collection of necessary biological data to support stock assessments for Washington’s coastal rockfish. This survey was reviewed in September 2023 by the Scientific and Statistical Committee (SSC) of the Pacific Fisheries Management Council (PFMC) and was endorsed for supporting PFMC management. The survey was conducted in the fall of 2022, spring and fall of 2023, and the spring of 2024 continuing the time series.

Yelloweye Rockfish Recreational Fishery Biological Sampling Project

Yelloweye Rockfish biological information is limited due to regulations prohibiting the retention of this species in Washington’s fisheries. The goal of this project is to better inform the biological characterization of discarded Yelloweye Rockfish by allowing selected recreational anglers to retain Yelloweye Rockfish caught incidentally during open recreational fisheries. Fish are delivered whole to WDFW for biological sampling. Data collected from this project will be used to inform the coastal Yelloweye Rockfish stock assessment.

Deep-Water Rod-and-Reel Expansion Study

Current WDFW rod-and-reel survey efforts have focused on Washington coastal waters less than 40 fathoms deep where nearshore priority species are mostly distributed. However, some of the groundfish consistently encountered in nearshore surveys have distributions that extend into deeper waters off the Washington coast. One survey day in fall of 2023 and two survey days in the spring of 2024 focused efforts in deep areas near the Juan de Fuca Canyon and Grays Canyon. This effort will help to improve abundance estimates for species with a deeper distribution. Additionally, this work has become extremely valuable due to the potential loss of the International Pacific Halibut Commission (IPHC) survey data from these areas in the future.

Evaluating Rockfish Outreach and Education Efforts

Since 2012, the Department has spent considerable time and money designing and distributing fish identification guides, building a webpage for marine fish identification, and posting rockfish conservation and species identification signs at prominent fishing locations. An online survey was developed to determine how proficient anglers are at identifying rockfish, understanding rockfish biology and their habitat requirements, and related fishing regulations. The survey was advertised and distributed to licensed saltwater anglers in FY 2023 in a limited-duration online format, the results of which are being analyzed in conjunction with NOAA Fisheries and University of Washington research faculty to evaluate the effectiveness of WDFW outreach efforts in promoting recovery of ESA listed rockfish in Puget Sound within the recreational angling community. General background information about rockfish resources, a management overview, and ongoing research projects supported by the RRA can be found in the appendix of this document. New initiatives supported by the RRA and research activities proposed for July 2024 to June 2026 are outlined in the following sections.



Tiger rockfish caught during survey. Photo by WDFW.

Initiatives Supported

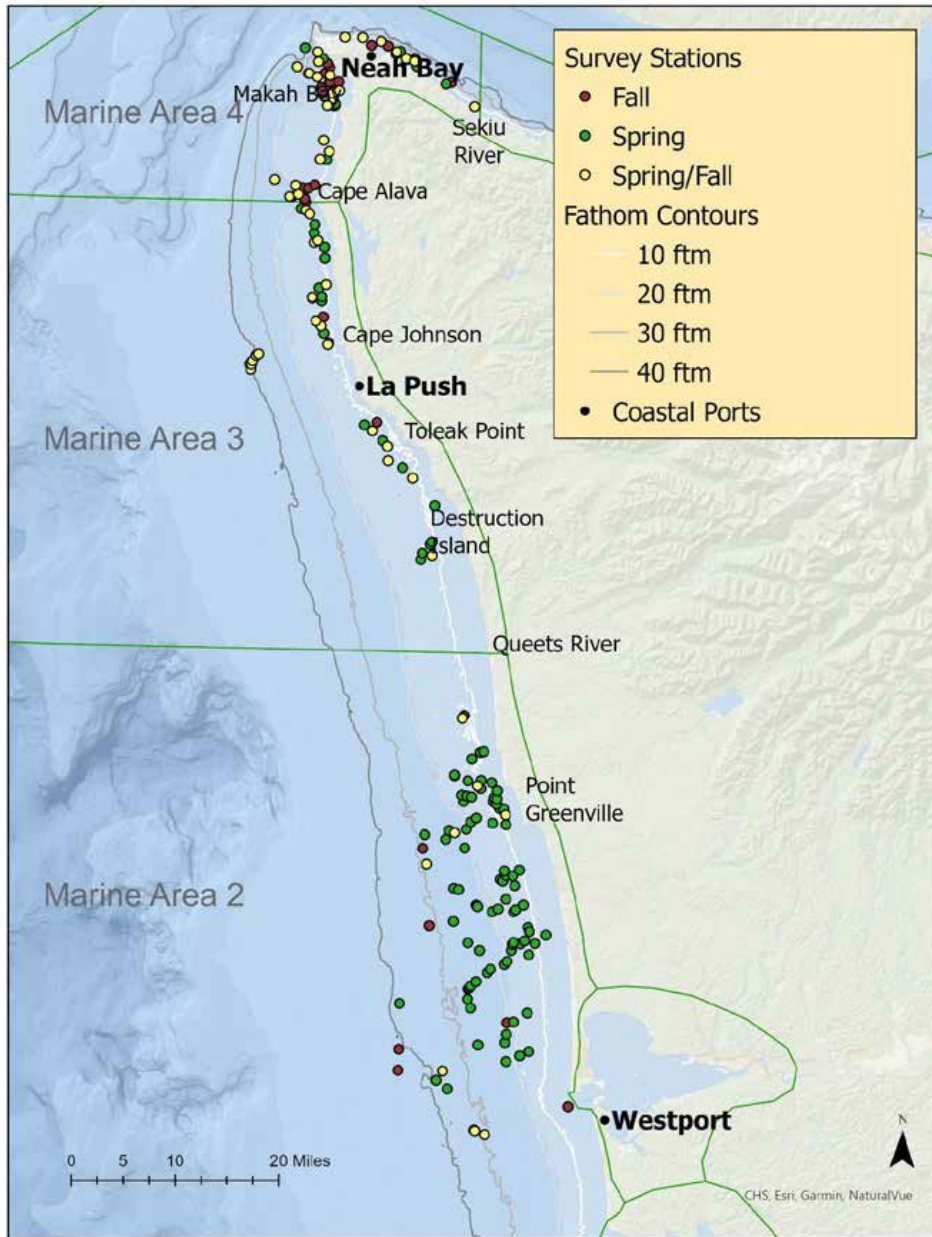
In establishing the RRA, the Legislature found that “improved survey information is essential for assessing abundance and to monitor progress toward rebuilding efforts on the coast and in Puget Sound.” It also recognized that both “new and existing technology” have important roles to play in this effort. The following are initiatives that were supported by the RRA during FYs 2023 and 2024.

Coastal Rockfish Rod-and-Reel Abundance Survey

A suite of monitoring programs, both fisheries-dependent and -independent, are essential for informing rockfish species management in Washington waters. Traditionally, managers have relied on the use of fishery catch-per-unit-effort (CPUE) data to inform the decision-making processes, but this type of data alone may be insufficient for assessing rockfish species. Fisheries-independent surveys, such as multispecies nearshore rockfish surveys, are vital.

From 2014 through 2018, the Department initiated a series of experimental rod-and-reel fishing surveys designed to gain knowledge of nearshore rockfish distribution, seasonality, and their reactions to fishing gear. Based on the results, we concluded that two separate surveys are needed: one targeting pelagic schooling rockfish in spring and the other targeting demersal (bottom-dwelling) species in fall.

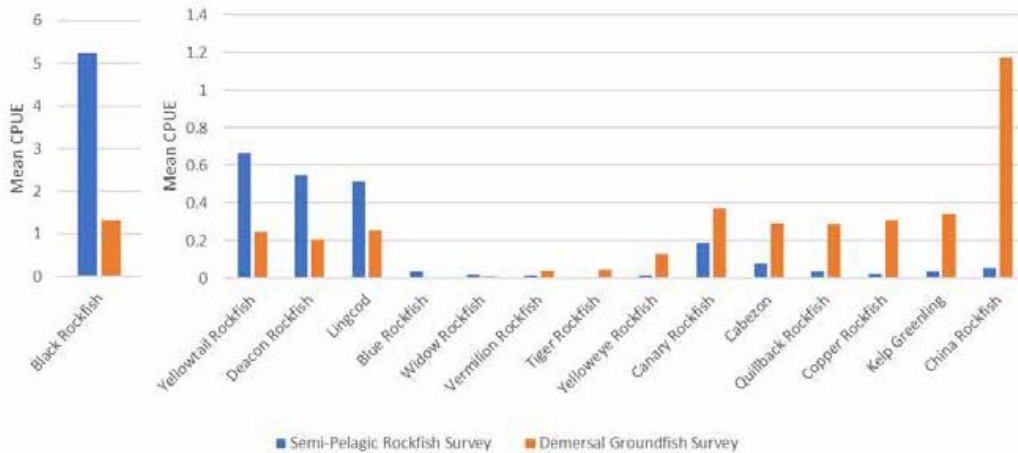
Figure 1. Rod-and-reel survey stations on the Washington coast. Stations are indicated by spring (pelagic) and fall (demersal) surveys with some stations included in both surveys.



The designs of the spring and fall surveys were standardized and sampling began in 2019. After an SSC review in 2023, methods of the surveys were adjusted allowing for an increase of sampling stations in both the spring and fall surveys. As of 2023, a total of 162 index stations are sampled in the spring survey and 84 index stations are sampled in the fall survey (Figure 1). The catch composition of the spring surveys in 2023 and 2024 were dominated by pelagic schooling rockfish, such as Black, Deacon, and Yellowtail rockfish. Coastwide catch rates of Black Rockfish increased from the 2022 survey to the 2023 and 2024 surveys. Catch rates for Canary Rockfish declined in spring survey of 2024 to a historic low, while rates for both Deacon and Yellowtail rockfish increased. China and Black rockfish were the

predominant species caught in the 2022 and 2023 fall demersal surveys. The composition of the fall survey catch was more diversified and included higher percentage of demersal rockfish, like China, Copper, Quillback, and Yelloweye rockfish, compared to the spring survey catches (Figure 2).

Figure 2. Average catch per unit effort (CPUE) – the number of individuals per rod hour, of stations fished in the spring (pelagic) and fall (demersal) surveys in fall 2022, spring 2023, fall 2023, and spring 2024.



The coastal rod-and-reel survey is an effective, fisheries-independent, standardized survey for rockfish populations which, over time, managers use to compare annual results to evaluate changes in nearshore rockfish relative abundance and distribution. Biological data collected during these surveys also inform age and mortality estimates for use in modeling coastal populations of rockfish. Abundance and biological data from this survey was used in 2023 to inform the Black Rockfish stock assessment.

Enhanced Yelloweye Rockfish Recreational Fishery Biological Sampling Project

The goal of the enhanced Yelloweye Rockfish recreational fishery biological sampling project is to better inform the biological characterization of Yelloweye Rockfish encountered in the recreational fisheries, which is lacking due to regulations prohibiting the retention of this species in Washington’s recreational fisheries.

A total of 12 recreational vessels participated in the project in 2021 and five continued with the project in 2022 following the terms and conditions detailed under a federal exempted fishing permit. These vessels were allowed to retain Yelloweye Rockfish incidentally caught in Washington’s coastal recreational fisheries for delivery to WDFW in port. Vessels were subject to all seasonal, gear, bag limit, or other regulations that applied to the recreational fishery.

Of the participating recreational vessels, four charter vessels and two private vessels encountered and retained Yelloweye Rockfish over multiple trips in Washington’s 2021 and 2022 recreational fisheries. Biological data was collected from the 179 Yelloweye Rockfish captured and delivered to WDFW at port. Landings were dispersed along the Washington coast, including catches from all Washington coastal

marine areas. Length, weight, sex, and age structures were collected on all delivered fish and 175 individual rockfish were assessed macroscopically for maturity in the field and 30 ovary samples were collected for histological maturity analysis to be conducted by the Northwest Fisheries Science Center. Genetic fin clip samples were collected and archived from 176 individual rockfish. Additionally, 177 Yelloweye Rockfish were scanned for internal passive integrated transponder tags to facilitate WDFW tag and release research studies, however no tags were recovered.

The 179 individual rockfish collected and sampled over the course of the study significantly increased the available biological information describing Yelloweye Rockfish bycatch from Washington's recreational fisheries. The average size and weight of fish observed in the study was larger than that observed in the individual rockfish retained by the sport fishery from 2003 to 2022, using the data available in WDFW internal database. For the purposes of comparing the "selectivity" of individual rockfish collected by this study with those retained by the sport fishery, we observed that Yelloweye Rockfish were approximately the same range of lengths in this study and the sport fishery (2003-2022). This study was completed in October 2022.

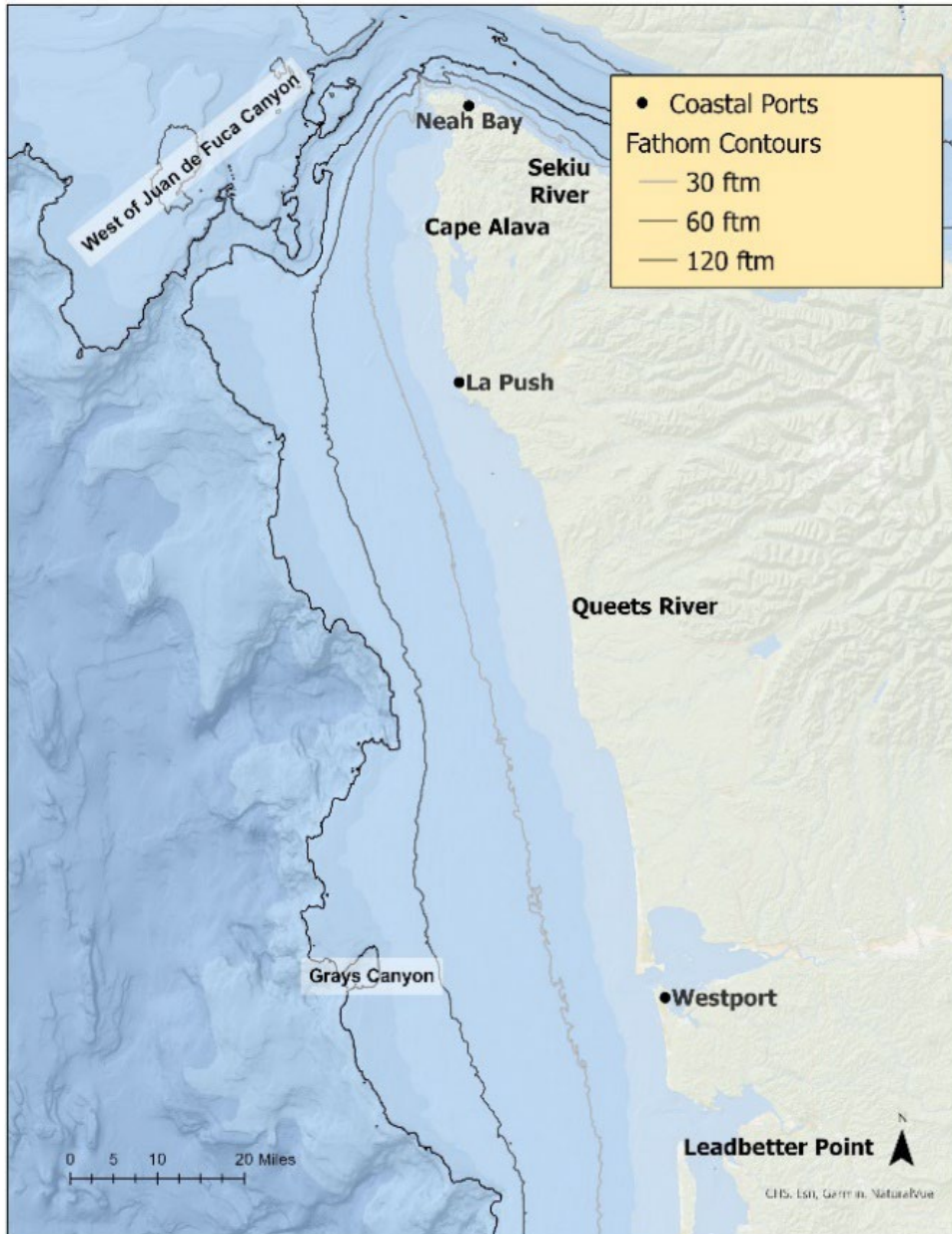
Deep-Water Rod-and-Reel Expansion Study

Current WDFW rod-and-reel survey efforts have been limited to coastal waters less than 40 fathoms deep where nearshore priority species are mostly distributed. However, some of the groundfish consistently encountered in nearshore surveys have distributions that extend into deeper waters. In particular, Yelloweye, Yellowtail, and Canary rockfish are frequently caught in current shallow-water WDFW rod-and-reel surveys but are known to commonly extend down to 110 fathoms off the Washington coast.

Setline surveys, such as the coastal Yelloweye Rockfish longline survey, which is incorporated into the annual IPHC survey, have typically been used to represent coastal rocky habitat species found at these depths. While setline gear effectively samples deep-water rocky reefs in a standardized way, it is cost restrictive. The cost of attaining significant abundance data, particularly of Yelloweye Rockfish that have a patchy distribution on the Washington coast, has restricted the use of this survey type by WDFW. Alternatively, rod-and-reel surveys are more cost effective but functionally challenging in deep water where weather conditions and the complexity of fishing methods tend to compound with depth and distance from shore. In the fall of 2023 and the spring of 2024, WDFW conducted deep water experimentation on the Washington coast to evaluate the use of rod-and-reel gear at depths over 50 fathoms and to identify specific reef locations at these depths for further study.

Four locations near Grays Canyon and 10 locations near the Juan De Fuca Canyon were studied over three deep-water days (Figure 3). Depths fished over the study ranged from 370 to 600 feet. Extended drop and retrieval times of fishing gear at these depths limited the effectiveness of the current WDFW nearshore rod-and-reel survey protocols. Method adjustments have been developed to increase efficiency and will be incorporated into any future deepwater study. 70% of the fishing locations that were thoroughly documented near the Juan De Fuca Canyon produced Yelloweye Rockfish.

Figure 3. Deep-water expansion study general locations in Juan de Fuca Canyon and Grays Canyon, Washington.



Evaluating Rockfish Education and Outreach Efforts

A 2012 research project conducted by the University of Washington clearly demonstrated that most marine fish anglers in Puget Sound struggle to properly identify bottomfish to species group, let alone individual species. In many cases, even ESA listed rockfish could not be confidently identified. Since 2012, WDFW has spent considerable time and money designing and distributing fish identification guides, building a webpage for marine fish identification, and posting rockfish conservation and species identification signs at prominent fishing locations.

Creation of a survey capable of evaluating education and outreach effort effects was proposed for 2020, but actions were postponed due to COVID-19. In the spring of 2022, the Department developed an online survey to evaluate the efficacy of outreach efforts to improve angler rockfish and other marine fish species identification skills. The survey data are currently undergoing analysis in cooperation with University of Washington faculty and NOAA staff with two publications in preparation. Results will be used to refine and reevaluate the current outreach and education approaches moving forward.

Puget Sound Bocaccio Rockfish Sampling

In 2022, WDFW conducted rod-and-reel sampling targeting ESA listed (Endangered) Bocaccio Rockfish in the Puget Sound using support from a NOAA grant and partial RRA funding. Bocaccio Rockfish has largely eluded previous surveys and sampling efforts, due to their rarity in the area. The project goal was to collect genetic samples from Puget Sound fish to help refine the current understanding of Bocaccio Rockfish population genetic structure, and specifically to resolve the connectivity question between coastal and Puget Sound populations. This project completed 30 field days from September 2022 through October 2023. WDFW anglers made 63 trips to 36 sites throughout Puget Sound and the San Juan Islands for a total of 369 angler hours fished. Over the course of the sampling trips, 268 fish were caught across 14 species including Quillback, Redstripe, Yellowtail, Yelloweye, and Canary rockfish. No Bocaccio Rockfish were caught during the sampling events despite targeting locations where this species has previously been caught and/or observed during ROV surveys.



Canary Rockfish caught during research in Puget Sound. Photo by WDFW.

Proposed Research for Ongoing Activities: July 2024 to June 2026

From July of 2022 through June of 2024, WDFW used revenues from the RRA to support new research projects designed to improve the state’s research capabilities and management of important, but vulnerable, rockfish species. The RRA also partially supported additional surveys used to inform rockfish assessment and harvest models. In coming years, the Department plans to expand on survey efforts and address other pressing needs for data that resource managers can use to make informed decisions. Ongoing and new projects under consideration for the next two-year period are included in this section of the report.

Coastal Yelloweye Rockfish Longline Surveys

The coastal Yelloweye Rockfish longline survey was conducted in the summer of 2023 at WDFW-funded rockfish index sites that accompany the annual IPHC longline survey. While the IPHC survey is primarily focused on Pacific halibut, WDFW rockfish stations are intended to target and characterize Yelloweye Rockfish. Incorporating WDFW rockfish index sites into the IPHC survey allows for the collection of vital fishery-independent information about Yelloweye Rockfish and other rockfish species that inhabit offshore rocky terrain in a cost-effective way. The IPHC adjusted the design of their 2024 survey, removing all study locations on the Washington coast. Consequently, the WDFW rockfish index sites were not surveyed in 2024.



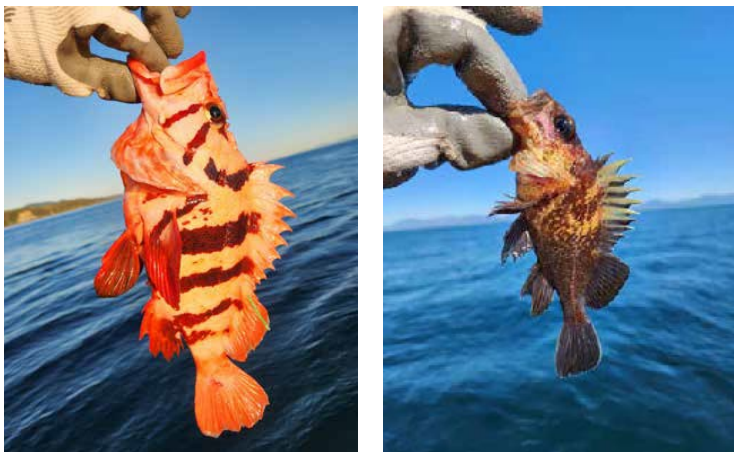
Research vessel used for longline surveys of coastal Yelloweye Rockfish. Photo by WDFW.

Coastal Rockfish Rod-and-Reel Surveys

The coastal rockfish rod-and-reel surveys will continue through 2026. The semi-pelagic survey, focused on Black Rockfish and other schooling rockfish species is planned for the spring of 2025 and 2026, and the demersal bottomfish survey is scheduled in the fall of 2024 and 2025 with no changes to methodology. During these surveys, researchers will collect biological samples from rockfish and lingcod and continue the documentation of habitat types along the coast. Survey data will be used to calculate relative abundance estimates for nearshore rockfish species and to inform the Black Rockfish stock assessment in the next assessment cycle.

Deep-Water Rod-and-Reel Expansion Study

The area in and around the Juan De Fuca Canyon has the highest abundance of Yelloweye Rockfish known on the Washington coast and numerous unsurveyed fishing locations there have been indicated as potential rockfish habitat. Further exploration in this area is planned as it would be highly beneficial to any future deep-water study design. Additional deep-water experimentation will refine terminal tackle gear types and evaluate specific fishing locations for future survey development. This work has become essential due to the loss of the IPHC survey data from these deep-water areas.



Tiger Rockfish (left) and Quillback Rockfish (right) caught during surveys. Photos by WDFW.

Puget Sound Remote Operated Vehicle (ROV) Survey of Rockfish Habitat

Since 2004, the Department has been using a small ROV to estimate the abundance of rocky habitat-associated species within the interior marine waters of Washington, with the most recent survey completed in September 2021. Staff have completed data collection from the survey's recorded video transects and will be working to produce the final report in 2025.

In the fall of 2021, a new ROV was purchased to replace the outdated 2007 system. Research activities in FY 2023 focused on operationalizing and testing the new, high-definition capable ROV system and newly acquired tracking software, and refining ROV survey design and population estimation methods.

This process entailed field trials to both test the new systems and calibrate all components. High-resolution bathymetry and environmental data were acquired in FY 2023, and these data have since been incorporated into a new species distribution model that will be used as the basis for the Puget Sound wide ROV survey scheduled to begin in September of 2024.

Research activities for FYs 2025 and 2026 will primarily focus on conducting an ROV survey within Puget Sound across complex habitats. Survey results will be used to estimate biomass of ESA listed Yelloweye Rockfish and other rockfish species to track population trends. Survey activity will occur throughout FY 2025, and FY 2026 will focus on video review, data collection, and analysis. Final reports from previous surveys will be completed in FY 2025.



WDFW staff member checking the ROV system used in a survey. Photo by WDFW.

Enhanced Shore-side Sampling of Coastal Recreational Fisheries

The Department's marine fish shore-side sampling program collects biological information on all rockfish species recreationally landed at the ports of Westport, La Push, and Neah Bay. Enhanced sampling at these ports is proposed to continue annually from April to September. This program provides valuable biological data such as fish age, length, and weight, which is crucial for rockfish stock assessments.

Evaluating Rockfish Education and Outreach Efforts

Evaluation of education and outreach efforts in relation to rockfish is being conducted in a collaborative project with the University of Washington (UW) and NOAA. The project began in July 2022, when an

online survey, developed originally by WDFW, was sent to licensed anglers aged 18 and older who, according to their license type, were able to fish in Puget Sound (saltwater) during the previous five years. The survey was open until Sept. 30, 2022. During the survey's open period, the Department's Communications and Public Engagement Division promoted the survey via social media, and blog posts, with a reminder being sent to the designated anglers in mid-September. With funding from NOAA, a researcher and students at UW also conducted interviews with special interest groups. The researcher is now in the process of analyzing the data from both the online survey and the interviews to evaluate the present state of angler knowledge with respect to Puget Sound groundfish. Results from this work will be used to evaluate the effectiveness of current outreach and education approaches used by WDFW and will inform future outreach strategies.

Re-analysis of Puget Sound Trawl Survey Data

Funded in part by the Puget Sound Partnership and the RRA, the Department will develop model-based indices of abundance for representative bottomfish species sampled in the Puget Sound bottom trawl survey. Model-based indices will improve model-based estimates of abundance for bottomfish species and represent a large methodological progression over the historical design-based estimates. One of the goals of this project is to provide more reliable abundance information for rockfish and bottomfish species encountered in the trawl survey for fishery managers, decision-makers, and the public.



Rockfish trawl survey nets and catch. Photos by WDFW.

New Initiatives Under Consideration

Juvenile Rockfish Biological Data Collection and Surveys

WDFW has periodically assessed localized areas for juvenile rockfish abundance and habitat use via SCUBA surveys. With two species of ESA listed rockfish in Puget Sound, it is important to understand nearshore use, assess juvenile rockfish recruitment events, evaluate juvenile rockfish abundance, and quantify the presence of juvenile rockfish habitat.

In collaboration with NOAA Fisheries, the Seattle Aquarium, the Point Defiance Zoo and Aquarium, the University of Washington, and other partners, WDFW is evaluating the feasibility of engaging in shallow-water juvenile rockfish surveys. In coming years, the Department intends to identify the most cost effective and efficient method of monitoring young of year abundance for rockfish species in Puget Sound, leveraging these key partnerships to achieve shared goals.

Conductivity, Temperature, and Depth Instrument (CTD) Data Analysis

During coastal rod-and-reel surveys, researchers used an electronic CTD that measures dissolved oxygen, conductivity (salinity), temperature, and depth. The CTD is deployed at select rod-and-reel stations and measurements are recorded throughout the water column. The information recorded by the CTD can help scientists better understand the chemical and physical parameters of the area they are studying which can lead to a better understanding of species distribution and abundance by area. Currently, this survey data has not been analyzed and WDFW management is evaluating the cost associated with this analysis.

Appendix I: General Background Information

Rockfish Resources

Rockfish is the general term for marine fish species in the family Sebastidae. These fish are typically long-lived, with some species living over 100 years, and occupy a diverse range of depths and habitats. Many species do not reach sexual maturity until well into their teens or twenties. Along the Washington coast, they play a key role in marine ecology. Juvenile rockfish are prey to a variety of species including larger rockfish, salmon, lingcod, birds, and marine mammals. As they grow, rockfish become generalist predators preying on a diversity of animals from shrimp, to crabs, to fish. On average, rockfish range in size from 1.5 pounds to five pounds, but may reach 30 pounds depending on species and are a vital link in the marine food web.

Historically, rockfish have been a key component of commercial and recreational fisheries in Washington. In more recent years, rockfish harvest on the coast and in Puget Sound has been restricted to preserve and recover depleted populations. Because of their long lifecycle and relatively late sexual maturity, rockfish are vulnerable to—and slow to recover from—depletion via overfishing. The situation is exacerbated by contamination from human activities, shifts in global climate regimes, and other stressors that may limit individual survival and/or reproductive output.



Bocaccio Rockfish in kelp. Photo by WDFW.

Management Overview

The PFMC is the regional council that recommends management measures for the U.S. West Coast to NOAA Fisheries, has jurisdiction over the economic zone off Washington, Oregon, and California, and

manages fisheries for about 119 fish species, including rockfish. Between 1999 and 2007, seven species of rockfish on the U.S. West Coast were progressively designated as overfished by NOAA Fisheries. As of 2020, only one rockfish species, Yelloweye Rockfish, remains federally designated as overfished off the Washington coast. The others have been declared rebuilt. The overfished designation for Yelloweye Rockfish has resulted in management action.

On the Washington coast, WDFW management has taken action to:

1. Establish large closed Rockfish Conservation Areas;
2. Prohibit recreational retention of Yelloweye Rockfish;
3. Require descending devices on vessels targeting all species of bottomfish; and
4. Limit incidental catch of rockfish by commercial fleets.

Although these restrictions are designed to protect vulnerable rockfish stocks, they also provide positive benefits for other coastal species, including lingcod, Pacific halibut, and other bottomfish.

Rockfish harvest restrictions in the Puget Sound currently include area closures and a bottomfish fishing depth restriction of 120 ft. This depth restriction reduces the incidental fishing mortality of rockfish, and in particular ESA listed Yelloweye Rockfish, when anglers are targeting other bottomfish species. For most rockfish, mortality rates are high even when they are released after capture because rockfish have a gas-filled swim bladder that can overexpand, and even burst, when the fish are brought to the surface, a condition known as barotrauma. While barotrauma also occurs in other fish species, deep-dwelling species, such as many rockfishes, are especially prone to the more dramatic, physically damaging effects (e.g., pop eye, stomach eversion). Extensive public outreach and education initiatives by WDFW and angling groups have promoted a greater understanding of this issue. Research has shown that releasing rockfish using a descending device allows for recompression of expanded organs and increases survival. In 2017, WDFW adopted a new regulation requiring descending devices on all vessels targeting bottomfish in all Puget Sound marine areas, and in 2018 extended this requirement to all coastal areas.

In April 2010, the Puget Sound/Georgia Basin populations of Bocaccio, Canary and Yelloweye Rockfish were listed under the ESA. Since the ruling, collaborative research between WDFW, NOAA Fisheries, and several local fishing organizations has enabled the removal of the Puget Sound/Georgia Basin Distinct Population Segment (DPS) of Canary Rockfish from the Federal List of Threatened and Endangered Species. Bocaccio continue to be listed as endangered; the only fish species in Puget Sound with this designation, and Yelloweye Rockfish remain listed as threatened.

Within Puget Sound, WDFW management has taken action to:

1. Prohibit recreational retention of all rockfish (except in the western Strait of Juan de Fuca, which lies outside of the DPS);
2. Restrict fishing depths to shallower than 120 ft. when targeting bottomfish species;
3. Require descending devices on vessels targeting all species of bottomfish;
4. Eliminate commercial fisheries that target rockfishes; and
5. Limit incidental catch of rockfish by other commercial gears, in part, by eliminating fisheries.

Ongoing Research Supporting Fish Conservation and Management

Scientific research is one of the key components in the effective management of fish species in both state and federal waters. Information drawn from population surveys, catch monitoring programs, and tag recapture studies provide the basis for developing informed stock assessments. Stock assessments are the foundation for both managing fisheries and restoring depleted stocks. The following section describes the long-established research methods, their limitations, and the opportunities for improvement made possible by funding from the RRA.

Fish-receiving Tickets, Logbooks, and Port Sampling

WDFW has separate systems for monitoring commercial and recreational fisheries. For commercial activities, WDFW collects fish-receiving tickets filed by fish processors and trawl logbooks maintained by vessel operators. Submitting the information is a legal requirement. For recreational fisheries, WDFW conducts angler interviews at dockside or by phone. At ports and ramps, staff collect tag recapture data, biological data, and species composition information at the time of delivery from commercial vessels and from recreational anglers when they conclude fishing. The purpose of these activities is to monitor the catch, encounter rates, and associated mortality of fish—where, when, how, who, and how much.

This information provides the basis for fishery regulations and long-term assessments of harvest trends, although changes in economic and regulatory conditions can limit its value in assessing stock abundance and distribution. This problem is especially apparent in Puget Sound, where directed rockfish fisheries were closed in 2010 to protect depleted rockfish populations and on the coast for species with prohibited retention. Since then, fishery-dependent data in Puget Sound has been limited to reports of rockfish caught incidentally and released in other fisheries, primarily recreational fisheries. This loss of fishery-independent data puts increased reliance on the use of other scientific surveys, and the development of new tools and methods, for assessing rockfish populations.

Scientific Surveys

Scientific bottom trawl, rod and reel, underwater video, and longline surveys have become the mainstays for collecting detailed information on rockfish and other bottomfish in Washington state. These surveys provide historical and current population biomass estimates and biological data on the length, weight, sex, maturation stage, genetic status, and age of specimens in Puget Sound and off the coast. These data help to assess the status of fish populations over time.

Bottom-trawl Surveys

WDFW has conducted scientific bottom-trawl surveys of bottomfish—including rockfish—in Puget Sound on a periodic basis since 1987 and annually since 2000, except for 2020 due to the Covid-19 pandemic. In 2008, WDFW adopted a fixed station survey design that samples four depth strata in every sub-basin of Puget Sound from late April to early June each year, providing a consistent index of abundance and distribution. The bottom-trawl protocol is focused on low-relief substrates; however, several species of rockfish are frequently encountered, and valuable genetic, age, and length data are

collected. To date, 23 species of rockfish have been encountered in the bottom-trawl survey, and 3,402 genetics samples and 3,129 age samples (otoliths) have been collected. For the past 20+ years, this survey has been one of the primary methods of evaluating stock status and trends for bottomfish in Puget Sound.

In coastal waters, NOAA Fisheries coordinates an annual scientific bottom-trawl survey that samples habitats on the continental slope and shelf from Cape Flattery south to the U.S.-Mexico border. Supported by state fisheries agencies, coastal treaty tribes, and West Coast universities, this survey provides valuable estimates of relative abundance and biological traits of species caught in bottom-trawl gear.

Bottom-trawl surveys are commonly used for assessing bottomfish on low relief substrates and have limitations specific to rockfish species that include:

- Habitat: Most bottom-associated rockfish species live in rocky and/or high-relief habitats, which are difficult—if not impossible—to adequately survey using bottom trawl nets.
- Mortality: Bottom-trawl surveys cause high levels of mortality in sampled fish, including rockfish. When stocks are already depressed, all sources of mortality must be reduced and sampling must be strategic and low impact.



WDFW scientific research staff assessing catch from a bottom-trawl survey. Photo by WDFW.

Coastal Longline Survey

A traditional source of data for coastal rockfish populations has been the annual longline survey conducted by the IPHC along the Pacific coast since the early 1960s. While the survey's primary focus is

halibut, it also produces valuable information about rockfish due to overlaps in species distributions. To enhance this survey, WDFW has funded IPHC survey coverage at additional sites identified as important Yelloweye Rockfish habitat. This supports the collection of vital data about adult Yelloweye Rockfish and other bottomfish species that inhabit offshore rocky terrain along the coast, providing an index of abundance over time.

Conducting surveys for rockfish using longline gear has two major advantages over the use of bottom-trawl gear. The largest advantage is that it can be used in rocky terrain that is inaccessible to trawling, and secondly, mortality rates for fish caught using longline gear are typically much lower than for those caught in bottom-trawl nets. Most Yelloweye Rockfish caught during WDFW longline surveys survive being hooked, and are released using a descending device, which counters the effects of barotrauma and enhances survival by returning fish to their naturally inhabited depth. However, like most survey techniques, longline surveys also have their limitations, including a selectivity towards larger fish, lower encounter rates for abundant species due to hook number limits, and fish loss to predation prior to gear recovery.



China Rockfish caught during coastal longline survey. Photo by WDFW.

Rod and Reel Survey

WDFW began applying rod-and-reel methods scientifically as part of a capture-and-recapture (tagging) program in 1981 to monitor Black Rockfish abundance in Washington's coastal waters. In 2010, the Department expanded the Black Rockfish tagging program to include all nearshore bottomfish species and began a series of experimental rod-and-reel studies designed to assess the diverse groundfish assemblages found in Washington's nearshore coastal waters. The results of these studies led to development of the 2019 coastal index survey methodology which focuses on estimating relative changes in abundance over time. This coastal index survey allows researchers to better monitor the population status of recreationally targeted rockfish and other bottomfish species.

Rod-and-reel survey methodology allows for selective targeting of individual species through the use of specific, preferred terminal tackle. Using these methods for surveying is comparable to recreational angling and provides fishery independent catch-per-unit-effort (CPUE) estimates. In addition to effort and catch data, rod-and-reel survey methods allow for the collection of biological data and individual

tagging. Rod-and-reel surveys incur lower mortality rates when compared to bottom-trawl survey methods, and are more effective in sampling rocky, high relief areas, but are limited by angler capacity of the research vessel, and the number of hooks deployed at each survey location.

Underwater Video Surveys

Since 2007, the Department has employed underwater video technology using a small ROV to conduct abundance and distribution surveys for rockfish and other bottom-dwelling organisms throughout Puget Sound. Given that some species of rockfish show declining trends in abundance and that two species have been ESA listed in Washington waters, an advantage of the ROV survey is that it does not cause mortality and is considered a scientifically valid alternative to conventional bottom trawl and longline surveys. The major drawback to visual surveys is the lack of physical fish samples for biological data collection and analysis. However, the recent addition of a stereo camera system to WDFW's ROV enables the collection of accurate length measurements that can be used for developing size/age-structured population assessments.



Copper Rockfish caught on camera during an underwater video survey. Photo by WDFW.