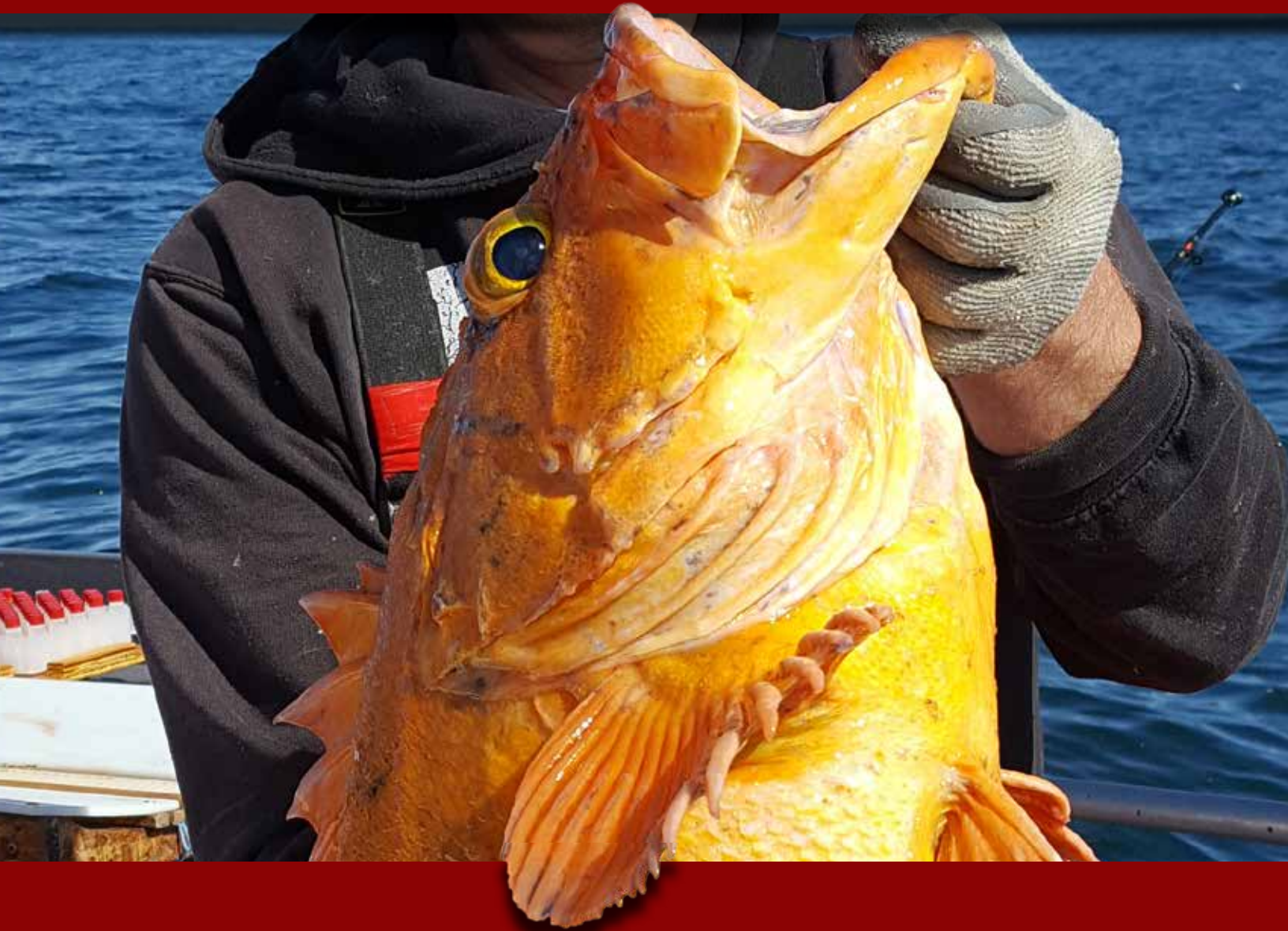


# 2018-2020 Report to the Legislature

**Status of Rockfish Research and Conservation Programs:  
July 2018 through June 2020**

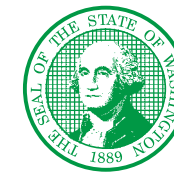


**Washington Department of Fish and Wildlife  
November 2020**



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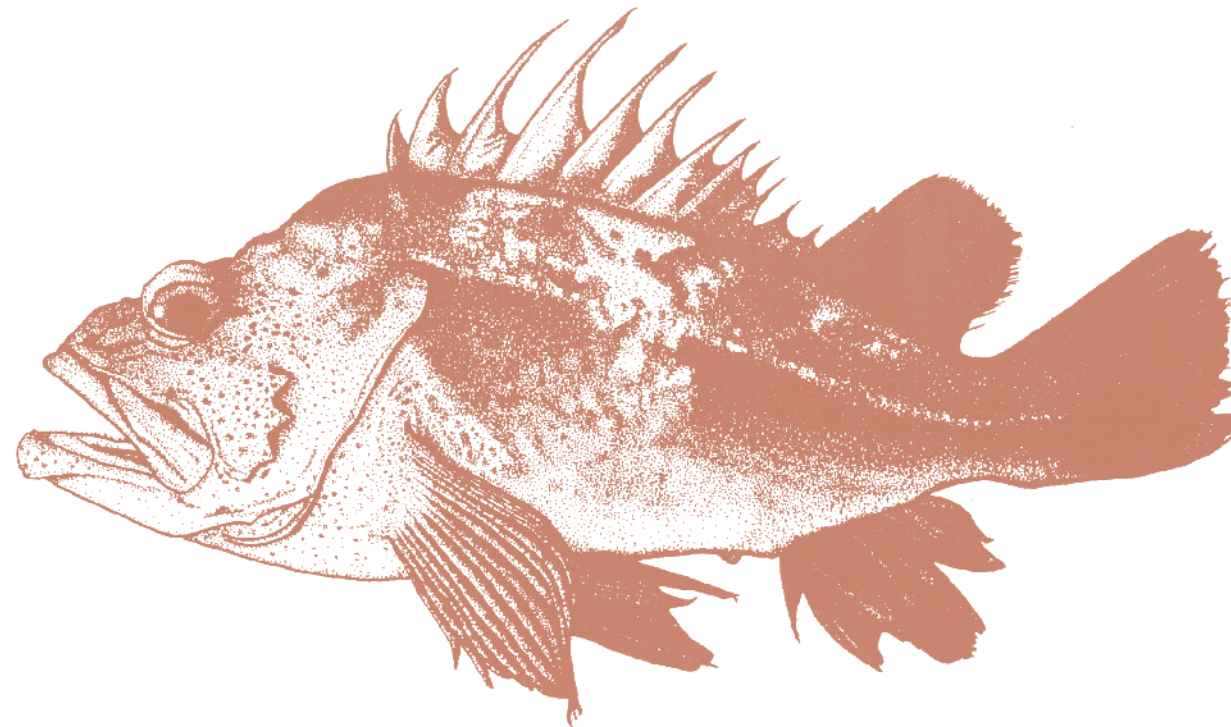


State of Washington

## Department of Fish and Wildlife

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The Honorable Kevin Van De Wege  
Washington State Senator  
212 John A. Cherberg Building  
Post Office Box 40424  
Olympia, WA 98504

The Honorable Brian Blake  
Washington State  
Representative  
314 John L. O'Brien Building  
Post Office Box 40600  
Olympia, WA 98504

Dear Senator Van De Wege and Representative Blake:

I am pleased to submit the Washington Department of Fish & Wildlife's sixth biennial report to the Legislature on the status of its rockfish research and stock assessment activities in Puget Sound and the coast, as required by RCW 77.12.702.

The Legislature directed the Department to use funds in the rockfish research account 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 the rebuilding of six federally declared overfished rockfish species on the coast and delisting of an ESA listed species, Canary Rockfish, in Puget Sound.

The enclosed report describes the projects/activities funded by the account in FY2019 and FY2020, and how they are contributing to the establishment of much needed long-term monitoring and assessment programs for coastal and Puget Sound rockfish populations. During this reporting period, a long-term monitoring program for coastal rockfish was designed and implemented; critical habitats for Rockfish in Puget Sound were defined and some areas surveyed and mapped. Due to the coronavirus pandemic, the FY2020 projects were either cut short or cancelled. The Department will continue efforts to recover the remaining overfished species on the coast and ESA listed species in Puget Sound.

Thank you for your interest in rockfish management in Washington. If you have any questions or concerns about the report or the Department's rockfish research and stock assessment activities, please feel free to contact Tom McBride, WDFW's Legislative Director, at (360)480-1472.

Sincerely,

Kelly Susewind  
Director

Published by the Washington Department of Fish and Wildlife, November 2020

PO Box 43200, Olympia, WA 98504-3200.

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Kelly Susewind, Director, Washington Department of Fish and Wildlife.

Larry Carpenter, Chair, Washington Fish and Wildlife Commission.

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## Introduction

In 2007, the Washington State Legislature approved House Bill 1476, creating a Rockfish Research Account (RRA) to fund increased monitoring of rockfish abundance and distribution in state waters. This bill was needed 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 Rockfish Research account have helped the Washington Department of Fish and Wildlife (WDFW) to greatly expand its understanding of these vulnerable marine fish.

The Department, in collaboration with other state, federal, and non-government entities, has realized significant achievements that otherwise could not have been accomplished. These achievements include rebuilding of six federally declared overfished rockfish species on the coast, and delisting of an ESA listed species, Canary Rockfish, in 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 FYs 2019 and 2020, and future plans for research by the Department.

**Recent research highlights supported, in full or in part, by revenues from the Rockfish Research Account (RRA) include:**

 *Surveying Coastal Rockfish with Rod and Reel: A standardized rod and reel index survey was conducted in 2019 and 2020. The results of this survey will serve as a long-term index for monitoring stock abundance trends and will allow for the collection of necessary biological data to support stock assessments for Washington's coastal rockfish species.*

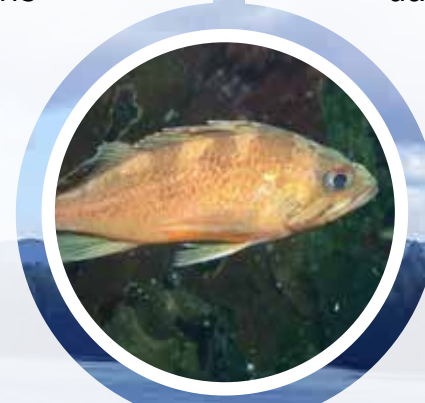



 *Sampling High-relief and Rocky Habitats in Puget Sound with an ROV: A small remotely operated vehicle (ROV) searched prioritized habitats for rockfish, Lingcod and Kelp Greenling throughout the southern Salish Sea. Recent advancements in modeling have facilitated the ability to focus specifically on preferred high-relief and rocky habitats. These areas are critical habitat for federally designated ESA-listed Yelloweye Rockfish and Bocaccio.*



ROV

 *San Juan Islands Yelloweye ROV Survey: In collaboration with the Department of Fisheries and Oceans, Canada (DFO) and NOAA Fisheries, WDFW surveyed predicted Yelloweye Rockfish habitat in the Canadian Gulf Islands and the U.S. San Juan Islands with a small ROV using a survey design based on a maximum entropy (Maxent) species distribution model. Comparisons between the two areas will inform recovery planning for Yelloweye Rockfish stocks, which span the international border, and strengthen interagency connections.*



 *Impact of the coronavirus pandemic on WDFW Surveys: Surveys supported from the RRA that were cancelled, reduced or postponed between March 2020 and June 2020 due to the coronavirus pandemic include the spring coastal rod and reel index survey, the Puget Sound trawl survey, the Puget Sound ROV survey, and juvenile rockfish biological data collection. A workshop on unavoidable survey effort reduction (WKUSER) conducted in February 2020 recommended best practices in four main areas when surveys are reduced. These recommendations are timely and will be helpful in advising management in their decision-making processes for surveys reduced or lost because of the coronavirus pandemic.*

**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 2020 to June 2022 are outlined in the sections below.**

## New Initiatives During FYs 2019 and 2020 Supported by the Rockfish Research Fund

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.

### Scientific Surveys

#### Yelloweye Rockfish Habitat Exploration (full RRA support):

Yelloweye are among the longest-lived species of rockfish, are late to mature, grow slowly, and have small home ranges. Historically, both recreational and commercial fisheries have prized Yelloweye Rockfish. Over the past century, landings increased gradually with large removals beginning in the early 1980s. Recognizing a need to reduce harvest, managers imposed trip limits on rockfish landings beginning in 1983. Despite regulatory actions to reduce fishing pressure, the coastal population of Yelloweye Rockfish was declared overfished by NOAA Fisheries in 2002, and currently,

Yelloweye Rockfish are caught only incidentally in commercial and recreational fisheries targeting other fish that occupy similar habitats.

In the fall of 2018, the WDFW continued an exploratory study designed to supplement the offshore Yelloweye Rockfish longline survey by characterizing the extent of appropriate habitat in waters off the Washington coast. The initial exploration effort was devoted to shallow water (25-40 fathoms) off Westport and La Push using both longline and rod and reel gear. In 2018, this effort was expanded northward and to deeper waters in and around the Yelloweye Rockfish Conservation Area “C” closure west of Cape Alava (Fig. 1). Two rod and reel survey days were devoted to

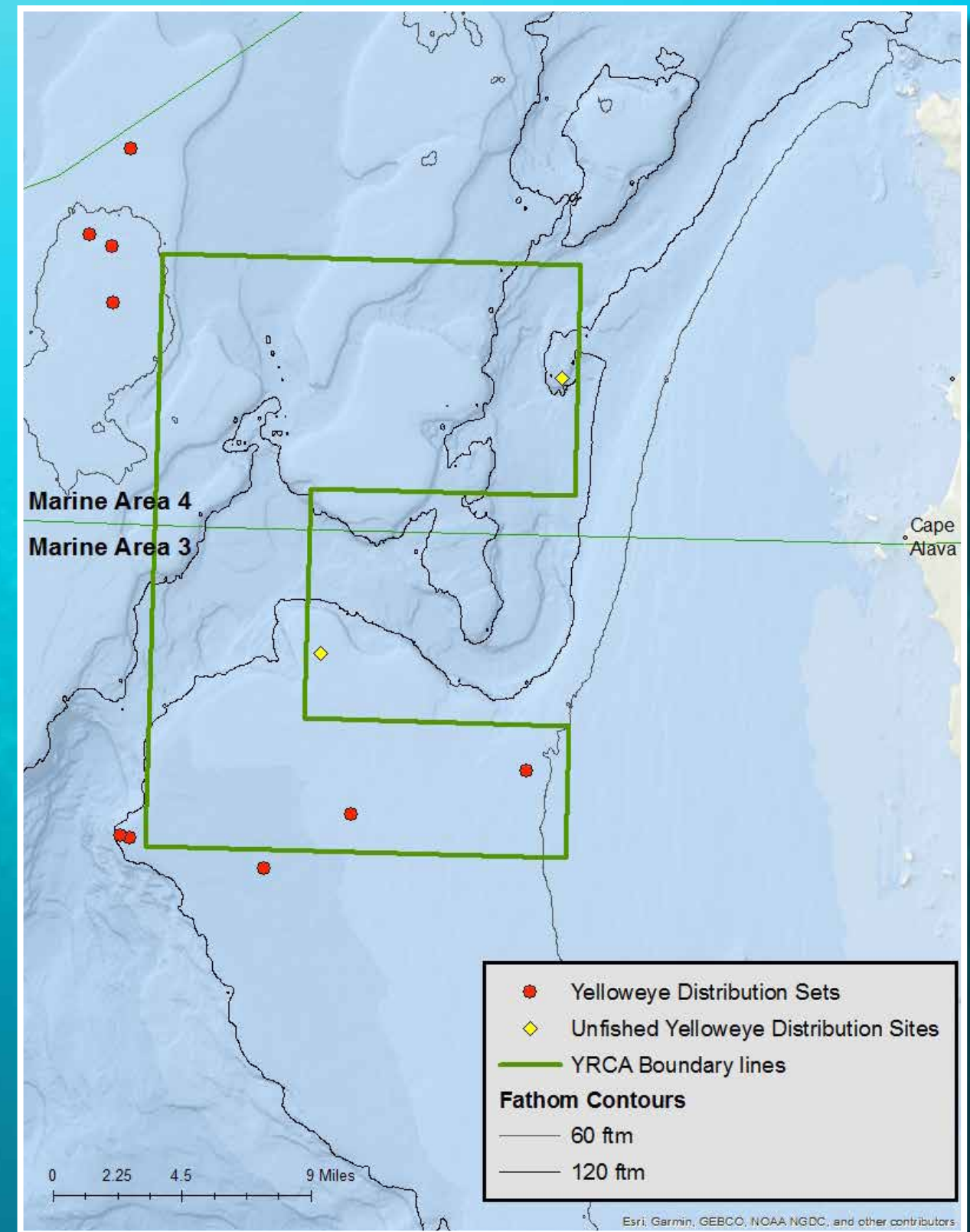


Figure 1. Locations targeted with rod and reel gear in 2018 exploring Yelloweye Rockfish habitat

surveying locations in this general area where Yelloweye Rockfish are anecdotally known to reside. Due to poor fishing conditions, catch was low at these areas; two scheduled sites were not surveyed, and no Yelloweye Rockfish were encountered.

The locations of all sites visited were documented for future survey work as they are anecdotally known and likely to include Yelloweye Rockfish habitat. This study, which focused on documenting both adult and juvenile Yelloweye Rockfish occurrences, produced information about areas of suitable habitat along a section of coast that was previously undocumented. This information is invaluable as managers seek ways to optimize species recovery efforts.



### **Coastal Rockfish Rod and Reel Index Survey (partial RRA support):**

Since Black Rockfish make up the majority of recreational bottomfish catch each year along the Washington coast, a suite of monitoring programs, both fishery dependent and independent, are essential for informing management of this important and highly utilized resource. Traditionally, managers have relied on the use of fishery dependent CPUE data to inform the decision-making processes, but this type of data alone is inadequate for assessing rockfish species that face high rates of exploitation. Fishery independent surveys, including multispecies nearshore rockfish surveys, are vital.



Beginning in 2014, the WDFW initiated a series of experimental rod and reel fishing surveys designed to assess nearshore rockfish distribution, biological parameters, and fishing gear selectivity. Researchers determined that because of species-specific behavior and terminal tackle selectivity, Washington's coastal nearshore rockfish populations are best assessed using two independent survey designs: one targeting pelagic schooling rockfish and the other targeting demersal (bottom-dwelling) species.

Accordingly, a standardized pelagic rod and reel survey was initiated in the spring of 2018 focused on Black Rockfish and other schooling rockfish species, and an analogous demersal survey was conducted in the fall of 2018 focused on sea floor associated rockfish and other

rocky habitat associated bottomfish species. The 2018 surveys were conducted over 28 sea days and included 70 survey stations along the Washington coast in the spring and 32 stations in the fall. Each survey captured their respective species groups well with pelagic schooling Black, Yellowtail, and Canary Rockfish making up over 90% of the spring catch, and demersal species including China, Quillback, and Yelloweye Rockfish, Cabezon, and Kelp Greenling all significantly represented in the much more diverse fall catch. However, despite the diversity in the fall catch, Black Rockfish were still the most abundant species captured.



The designs of the spring and fall surveys were adjusted in 2019 to further standardize survey fishing effort over time. To accomplish this, survey station size and survey effort at each station was reduced. This reduction in the size of the survey stations allowed for more stations to be fished per day. Over 22 survey days, 126 stations, spanning the entire Washington coast, were surveyed in the spring (Fig. 2). Catch composition of the 2019 spring survey was highly dominated by pelagic schooling rockfish species, such as Black and Yellowtail Rockfish, similar to the 2018 survey although total catch was somewhat lower because of decreased fishing effort required for survey standardization. The 2019 fall demersal rod and reel survey was conducted over 11 charter days and included 64 stations. Total rockfish catch was also lower than in the 2018 fall survey, mostly due to a reduction of schooling species catch pushing the catch composition closer to demersal species dominance. With the adjustments to survey design implemented in 2019, managers determined these surveys were robust enough to use as a relative abundance index for multiple pelagic schooling rockfish and demersal groundfish species.

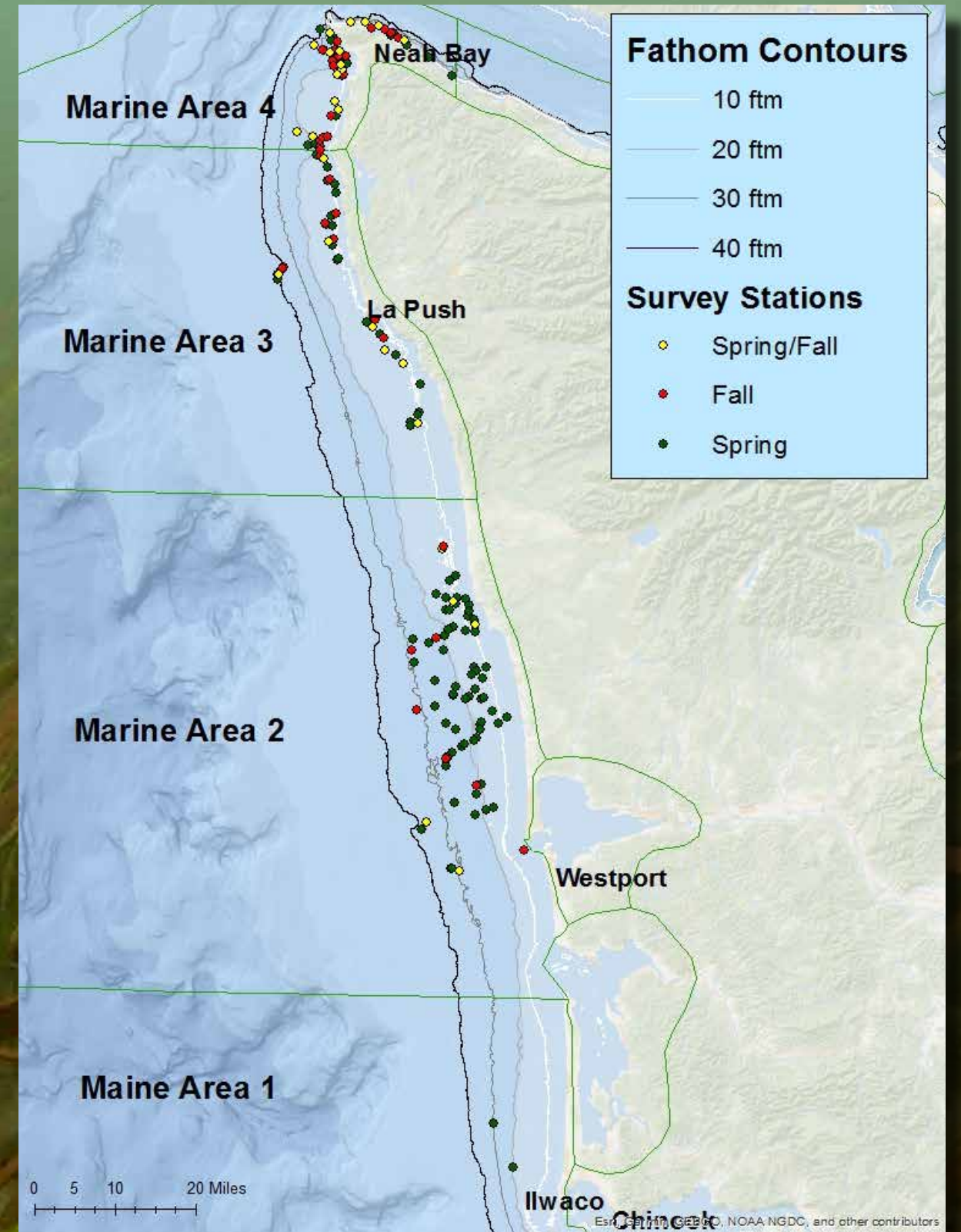
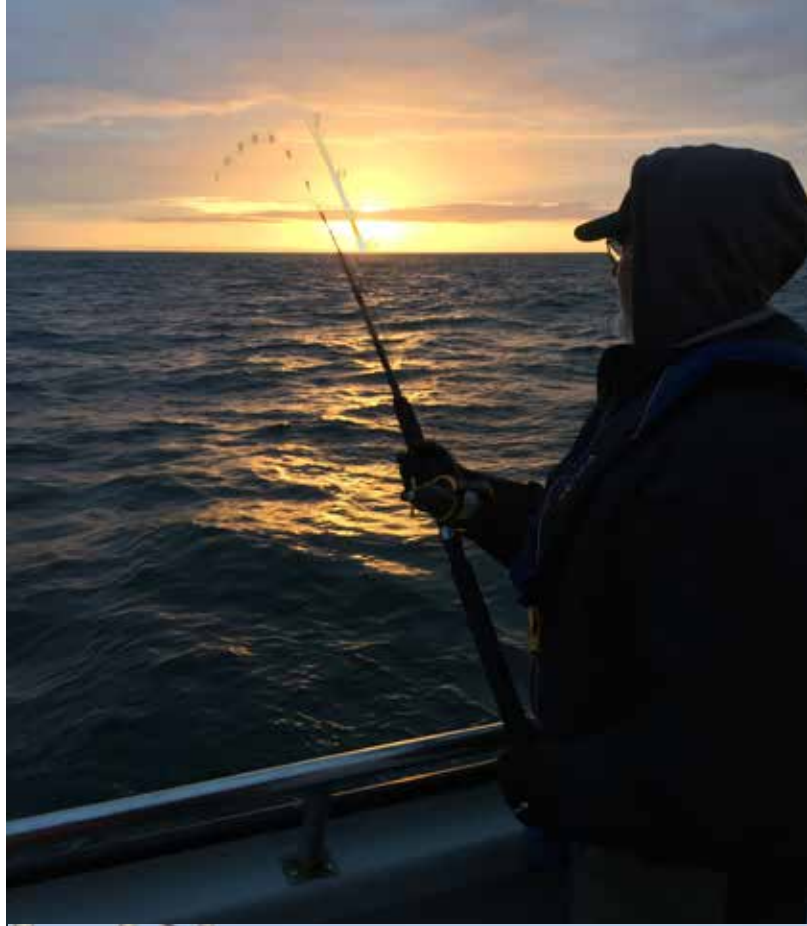


Figure 2. Rod and reel survey stations on the Washington coast selected in 2019 for use as Coastal Index Survey Stations. Stations are indicated by Spring (pelagic) and Fall (demersal) surveys with some stations included in both surveys.



The spring 2020 rod and reel survey was scheduled with no changes to methodology from the 2019 surveys, but was cut short due to the the coronavirus pandemic. Eight of the 22 scheduled survey days were completed before operations were canceled. The fall rod and reel survey in 2020 was also cancelled because of the pandemic.

The coastal rod and reel index survey is an effective, fishery-independent, standardized survey for rockfish populations which, over time, managers can use to compare annual results to evaluate changes in nearshore rockfish relative abundance. Biological data collected during these rod and reel surveys also informs age extrapolation and mortality estimates for use in modeling coastal populations of rockfish.



### ROV Survey for Improved Abundance Estimates (partial RRA support)

An ROV survey designed to broadly sample predicted habitat for bottom associated rockfish, Lingcod, and Kelp Greenling began on August 6, 2019. The design of this survey was based on a maximum entropy species distribution model (Maxent) that incorporates multiple environmental and physical factors to predict the geographic distribution of a species or suite of species based on documented locations. Using a Maxent model for benthic rockfish, Lingcod and Kelp Greenling, Marine Fish Science (MFS) staff completed 98 of 450 planned stations from August to late September 2019 (Fig. 3). In September, an equipment failure on the support vessel suspended the survey. At this time, MFS staff were already working to secure the purchase of a replacement vessel and it was decided to suspend the survey until the new vessel had been acquired and outfitted. The R/V Salish Rover, a retired 17m Canadian Coast Guard vessel, was acquired in December 2019 and was undergoing final outfitting when the coronavirus pandemic struck. MFS staff had just initiated the process to acquire hull painting and shaft maintenance, but the

Governor's Stay-at-Home order delayed that process until May 2020. Yardwork was completed on the Salish Rover on June 30, 2020 and final outfitting was completed by mid-August 2020. Several days of sea trials have been conducted to test the ROV and equipment and MFS staff recently received approval to resume the survey. To date, none of the video imagery collected for this survey has been annotated.

Due to the loss of survey time resulting from the Governor and WDFW's pandemic restrictions, MFS management decided to drop 96 stations in the western Strait of Juan de Fuca to concentrate efforts

on the Washington portion of the Distinct Population Segments (DPS) for the two ESA-listed rockfish species, Bocaccio and Yelloweye. The DPSs are defined as the marine waters east of a line between Port Angeles, WA and Victoria, British Columbia. Restricting the survey to this geographic area will provide a comparable dataset to those acquired during the 2015-16 ROV survey of Puget Sound and the 2018 ROV survey of the San Juan Islands and still facilitate assessment of ESA-listed rockfish recovery trajectories by providing data to NOAA for their 5-year review of these species.

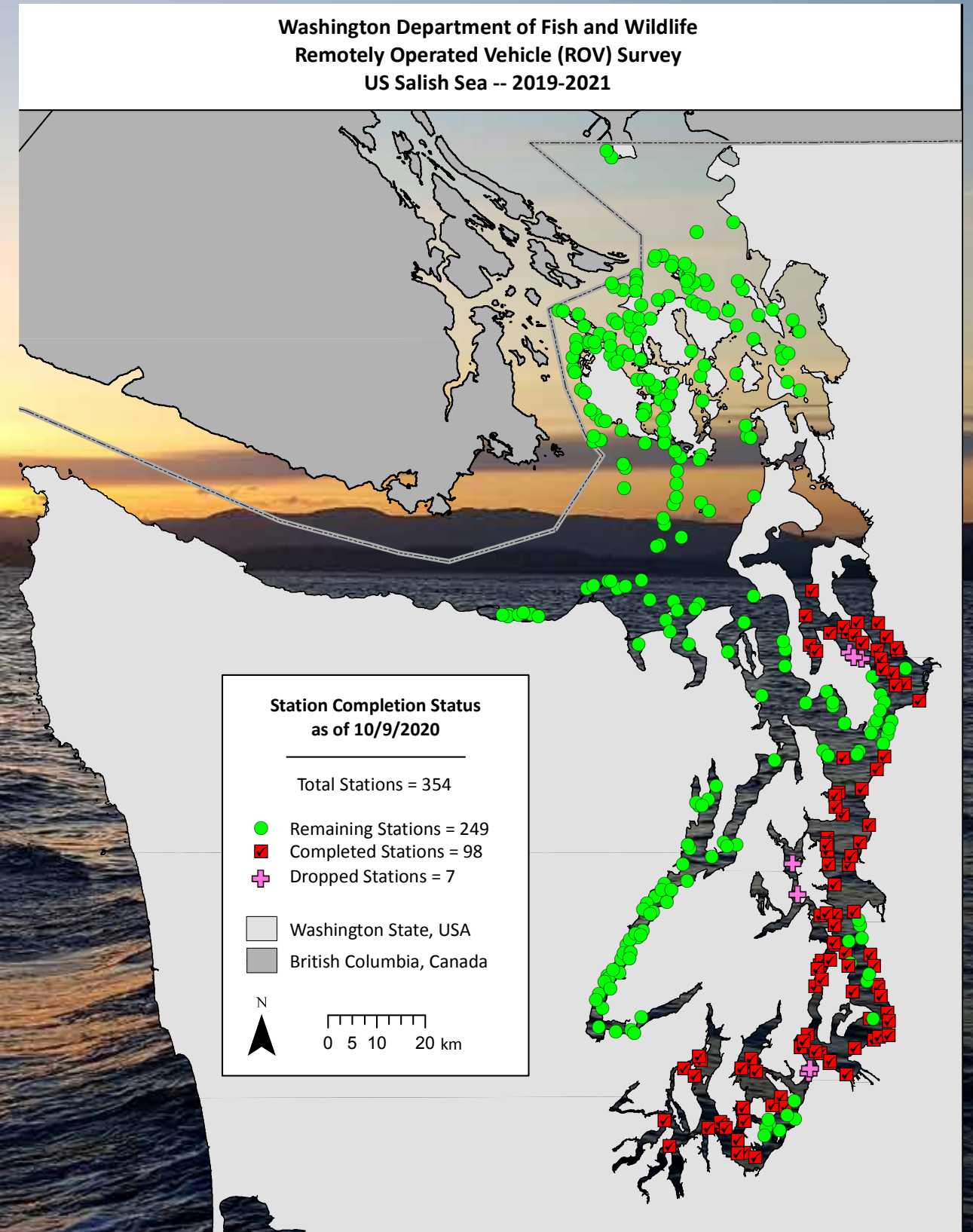
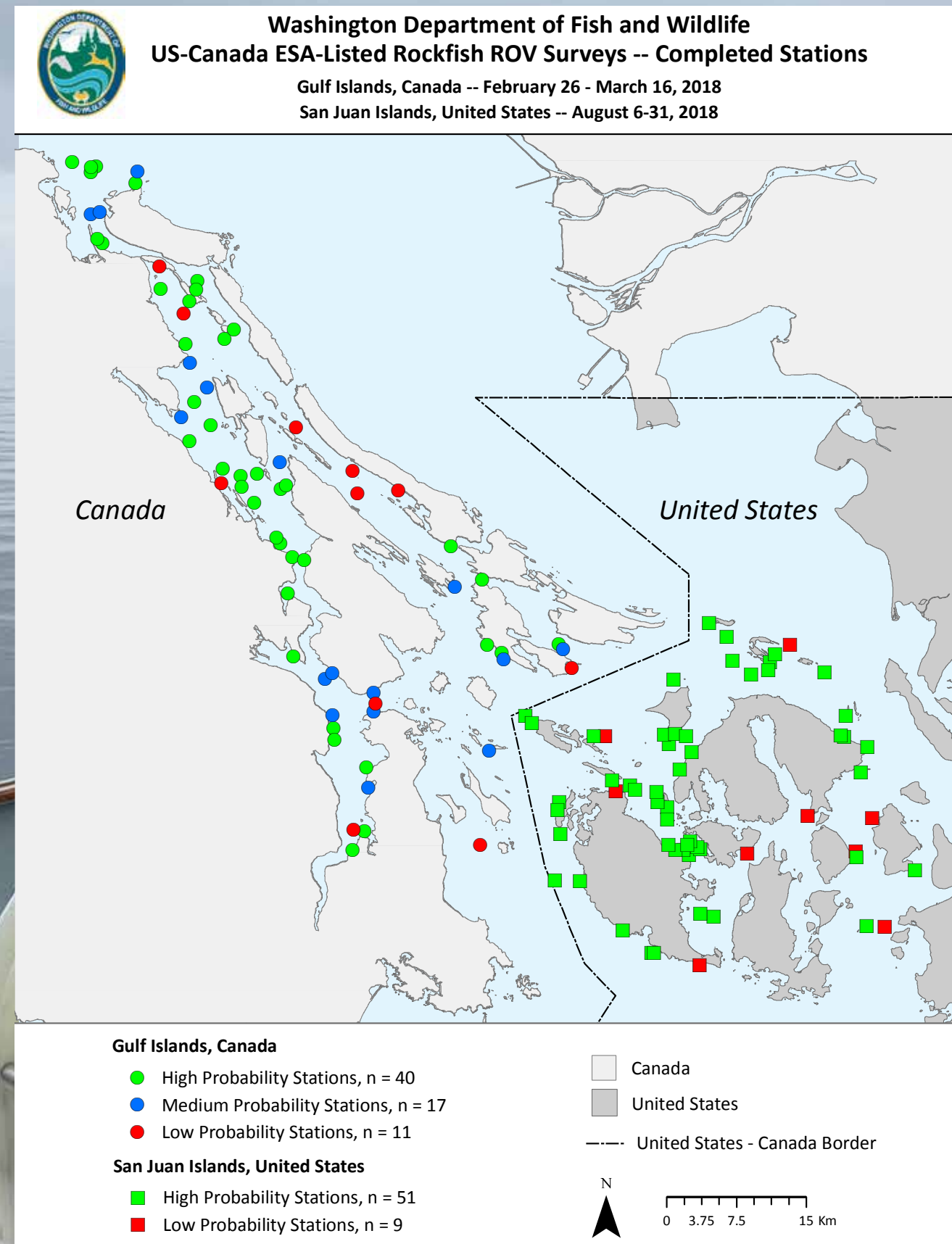


Figure 3. ROV survey station locations for improved abundance estimates of rockfish, Lingcod, and Kelp Greenling in the U.S. Salish Sea.

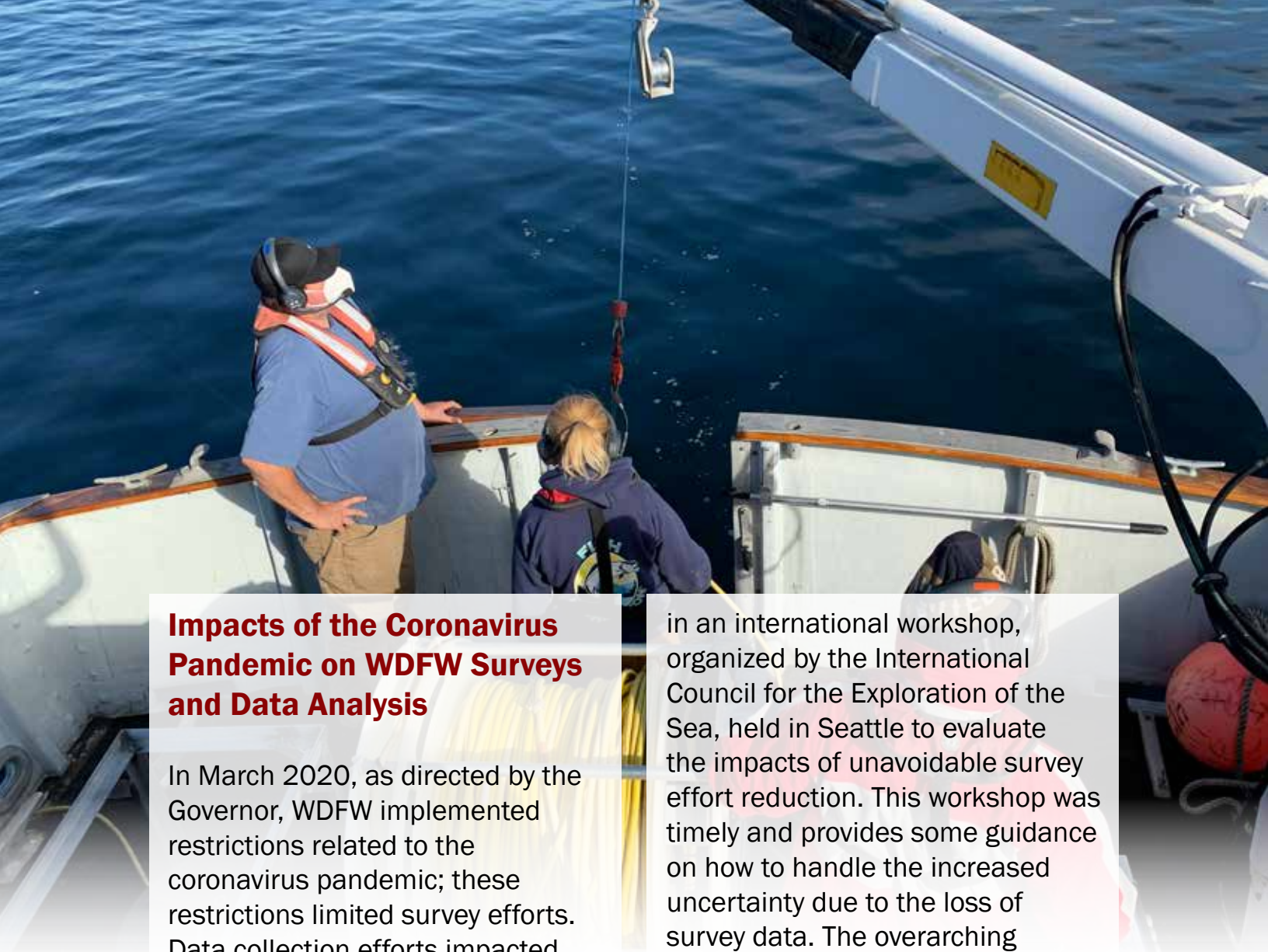
**US-Canada  
ESA-Listed  
Rockfish  
ROV Survey  
(partial RRA support)**

Healthy fish populations consist of individuals in multiple age classes. This age class diversity negates the loss of mature individuals from a population resulting from fishing and natural mortality because they are replaced as the next age class matures. Documenting the proportions of juvenile, sub-adult, and adult fish in a population helps determine whether existing fishing regulations and management policies are preserving the population in a healthy state throughout its range. The documented ranges and DPSs of the two Puget Sound ESA-listed rockfish, Bocaccio and Yelloweye Rockfish, extend north across the US border into Canada. Understanding the population distribution, age structure, and abundance of ESA-listed species throughout their entire range is imperative for consistent and effective cross-boundary management.

In cooperation with the DFO, and with support from NOAA Fisheries, the WDFW conducted a 3-week long ROV survey in the Canadian Gulf Islands from February 26 to March 16, 2018 (Fig. 4). The survey design was based on results of the Maxent species distribution model with data inputs from both US and Canadian research. A similar survey was then performed in the US San Juan Islands from August 6-31, 2018. In the San Juan Islands, 60 stations were completed and to date primary video annotation and secondary checks have been completed for 32 of those stations. These surveys were conducted in a similar fashion to the ESA critical habitat ROV survey done in 2015-16, in that the WDFW deployed a small ROV at survey stations and recorded video as the pilot flew the ROV along the bottom for 30-minute intervals. In addition to the typical study protocols used for ROV surveys, researchers successfully integrated a stereo-camera, allowing for the collection of accurate fish length data. Survey data will be used to populate a spawner-recruit model as a basis for tracking recovery of ESA-listed rockfish across their ranges.



**Figure 4. ROV survey locations for the US-Canada ESA-listed rockfish survey.**



### **Impacts of the Coronavirus Pandemic on WDFW Surveys and Data Analysis**

In March 2020, as directed by the Governor, WDFW implemented restrictions related to the coronavirus pandemic; these restrictions limited survey efforts. Data collection efforts impacted by these restrictions for this report included the spring coastal rod and reel index survey, the spring and summer ROV survey for improved abundance estimates, the 2020 Puget Sound trawl survey, and the proposed juvenile rockfish exploration efforts.

The loss of these data cannot be remedied, and long-term data sets used to evaluate rockfish trends will have missing information. In February 2020, several MFS staff participated

in an international workshop, organized by the International Council for the Exploration of the Sea, held in Seattle to evaluate the impacts of unavoidable survey effort reduction. This workshop was timely and provides some guidance on how to handle the increased uncertainty due to the loss of survey data. The overarching concept was to discuss how survey elements interact on different time-scales to assist survey managers in decision-making. Best practice recommendations from the workshop are that survey managers increase preparation for survey loss and ecosystem changes by expanding surveys into new areas to assure continued relevance of survey information and to develop and expand simulation studies and research on model-based capabilities that can be used to define methods for intentional survey effort reduction.

## **Research Activities Proposed from July 2020 to June 2022**



From July of 2018 through June of 2020, the 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 WDFW 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 discussed below:



### **Ongoing Projects**

#### **Coastal Yelloweye Rockfish Longline Surveys and the Coronavirus Pandemic**

Managers have proposed the continuation of sampling at the WDFW-funded sites that accompany the annual IPHC longline survey, with the intent to target Yelloweye Rockfish, in the summer of 2021 and the summer of 2022. The WDFW is not planning to repeat the spring and fall seasonal expansion surveys during the next reporting period. However, based on findings from the seasonally expanded surveys, the IPHC summer survey will incorporate modified hook sizes to better target smaller rockfish at the WDFW rockfish sites.

### Coastal Rockfish Rod and Reel Survey and the Coronavirus Pandemic

The coastal rockfish rod and reel index survey, as proposed, will continue in the spring of 2021 and 2022, focusing on Black Rockfish and other pelagic schooling rockfish species. The fall 2020 survey, focused on bottom-dwelling rockfish and other rocky-habitat associated bottomfish species, was planned but was canceled due to the coronavirus pandemic. This demersal bottomfish survey is scheduled to continue in the fall of 2021 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 2022 assessment cycle.



### ROV Survey for Improved Abundance Estimates and the Coronavirus Pandemic

The Puget Sound-wide ROV survey, that began on August 6, 2019, was designed to sample predicted habitats of benthic rockfishes (including ESA-listed Bocaccio and Yelloweye), Lingcod, and Kelp Greenling. This survey is anticipated to recommence in October 2020 until the remaining 249 stations are completed. The coronavirus pandemic protocols for safe operation on the new research vessel, the RV Salish Rover, have been approved and the vessel is operational. Once complete, this survey will serve as a baseline for rockfish population status using methods that are tailored specifically to the assessment of rockfishes, rather than broadly utilized, but admittedly biased, bottom trawling.

### Enhanced Shore-side Sampling of Coastal Recreational Fisheries

The WDFW'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. Due to the coronavirus pandemic some of these efforts were hindered, but sampling strategies were adapted to ensure that shore-side sampling data collection continued.

## New Initiatives Under Consideration

### Evaluating the costs of new initiatives:

#### 1. Juvenile Rockfish Biological Data Collection and Surveys

The WDFW has periodically assessed localized areas for juvenile rockfish abundance and habitat use via SCUBA surveys. Recently, the coronavirus pandemic, staffing, and funding shortages have made it impossible to continue any type of shallow water monitoring or habitat evaluation for juvenile rockfish. 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, the WDFW is increasing momentum towards coordinating shallow-water juvenile rockfish surveys. In coming years, the WDFW would like to establish SCUBA surveys with a juvenile trapping component to arrive at a systematic, ongoing monitoring plan for these species and habitats.



#### 2. Conductivity, Temperature and Depth Instrument (CTD) Data Analysis

During coastal longline surveys, researchers used an electronic CTD that measures dissolved oxygen, conductivity (salinity), temperature, and depth. The CTD was deployed at each longline station and measurements were 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 surveying which can lead to a better understanding of species distribution and abundance by area. Currently, this survey data has not been analyzed and the WDFW management is evaluating the cost associated with this analysis.

#### 3. Evaluating Education and Outreach Efforts

A 2012 research project clearly demonstrated that the majority of marine fish anglers in Puget Sound struggle to properly identify bottomfish to species group, let alone species. In many cases, even ESA-listed rockfish could not be confidently identified. Since 2012, the 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. Evaluating education and outreach effort effects was proposed for 2020, but actions were postponed due to the coronavirus pandemic. In early 2021, the WDFW plans to initiate an evaluation of the efficacy of these efforts to improve angler rockfish and other marine fish species identification skills. Results can be used to refine, or rethink, outreach and education approaches in coming years.

# Appendix

## (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 lbs. to 5 lbs. but may reach 30 lbs. 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 State. 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.

### Management Overview

The Pacific Fishery Management Council (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 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, the 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**
- 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 rockfish fishing-related mortality when harvesters are targeting other bottomfish. For most rockfish, mortality rates are high even when they are released after capture because rockfish have a gas-filled swim bladder that can over-expand, 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). Research has shown that releasing rockfish using a descending device allows for recompression of expanded organs and increases survival. Extensive public outreach and education initiatives by the WDFW and angling groups have promoted a greater understanding of this issue. In 2017, the 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 the 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.



*Yelloweye waiting to be descended.*

*“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).”*

**Within Puget Sound, the 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**
- 5. limit incidental catch of rockfish by other commercial gears, in part, by eliminating fisheries.**



## Ongoing Research Supporting Fish Conservation and Management

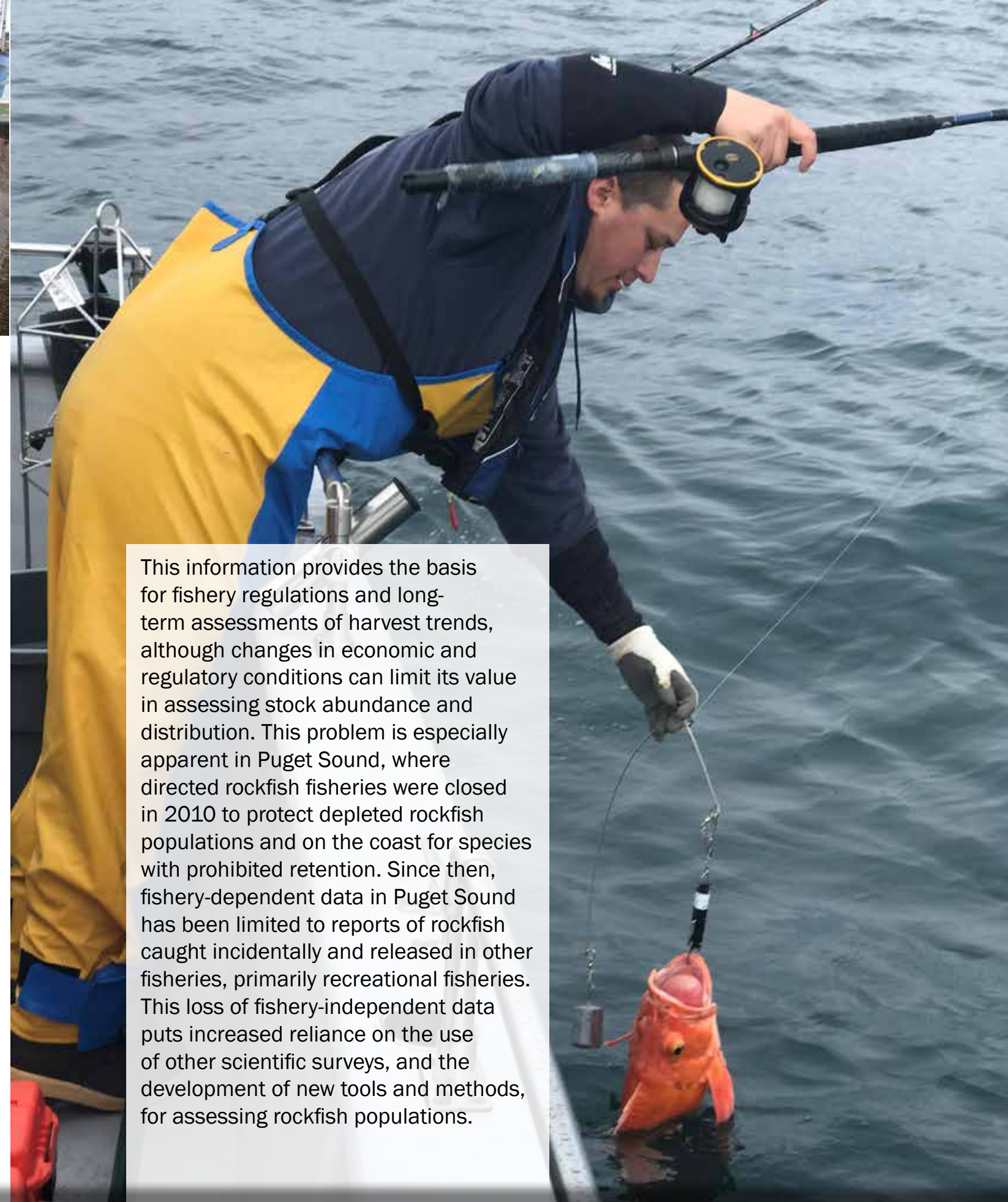


Scientific research is one of the key components in the effective management of fish species in both state and federal waters. Information drawn from population surveys, catch monitoring programs, and tag recapture studies provide the basis for developing informed stock assessments. Stock assessments 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.

### Fisheries Monitoring

#### **Fish-receiving Tickets, Logbooks, and Port Sampling**

The WDFW has separate systems for monitoring commercial and recreational fisheries. For commercial activities, the 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, the 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

The WDFW has conducted scientific bottom-trawl surveys of bottomfish – including rockfish – in Puget Sound on a periodic basis since the mid-1980s. In 2008, the WDFW adopted a standardized survey design that equally samples several 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. For the past 10 years, this survey has been one of the primary methods of evaluating stock status and trends for bottomfish in Puget Sound. The 2020 Puget Sound bottom-trawl survey was cancelled due to the coronavirus pandemic.



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; sampling must be strategic and low impact.**

### Coastal Longline Survey

A traditional source of data for coastal rockfish populations has been the annual longline survey conducted by the International Pacific Halibut Commission (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, the 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 the 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.



### Rod and Reel Survey

The 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 or 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 the WDFW's ROV enables the collection of accurate length measurements that can be used for developing size/age-structured population assessments.

Photo by Ian Chun

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