April 2020

OREGON'S GROUNDFISH INVESTIGATIONS IN 2019

Marine Resources Program
Oregon Department of Fish and Wildlife

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Newport, OR 97365
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OREGON DEPARTMENT OF FISH AND WILDLIFE
2020 AGENCY REPORT

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Agency Overview

MRP Program Manager: *Dr. Caren Braby*
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The Oregon Department of Fish and Wildlife's Marine Resources Program (MRP) is responsible for assessing, monitoring, and managing Oregon's marine habitat, biological resources, and fisheries. The MRP's main office is located at the Hatfield Marine Science Center in Newport, OR and includes two additional offices in Newport. There are also field stations in Astoria, Charleston, Brookings, and Corvallis. The MRP has primary jurisdiction over fisheries in state waters (from shore to three miles seaward), and participates in regional and international fishery management bodies including the Pacific Fishery Management Council, the International Pacific Halibut Commission, and the North Pacific Fishery Management Council. Management strategies developed at all levels affect Oregon fish and shellfish stocks, fisheries, resource users, and coastal communities. Staffing consists of approximately 60 permanent and more than 60 seasonal or temporary positions. The current annual program budget is approximately $9 million, with about 76% coming from state funds including sport license fees, commercial fish license and landing fees, and a small amount of state general fund. Grants from federal agencies and non-profit organizations account for approximately 24% of the annual program budget.

ODFW staff place rockfish with barotrauma in a recompression cage during an at-sea survey.

Contents

Surveys

Recreational Fisheries Monitoring and Sampling

Sampling of the ocean boat sport fishery by MRP's Ocean Recreational Boat Survey (ORBS) continued in 2019. Starting in November 2005, major ports were sampled year-round and minor ports for peak summer-fall season. We continue to estimate catch during un-sampled time periods in minor ports based on the relationship of effort and catch relative to major ports observed during summer-fall periods when all ports are sampled. Lingcod (*Ophiodon elongatus*), multiple rockfish species (*Sebastes* spp.), cabezon (*Scorpaenichthys marmoratus*) and kelp greenling (*Hexagrammos decagrammus*) are the most commonly landed species.

The ORBS program continued collecting information on species composition, length and weight of landed groundfish species at Oregon coastal ports during 2019. Since 2003, as part of a related marine fish ageing research project, lingcod fin rays and otoliths from several species of nearshore groundfish, including rockfish species, kelp greenling and cabezon, were gathered. Starting in 2001, a portion of sport charter vessels were sampled using ride-along observers for species composition, discard rates and sizes, location, depth and catch per angler. Beginning in 2003, the recreational harvest of several groundfish species is monitored inseason for catch limit tracking purposes.

Other ODFW management activities in 2019 include participation in the U.S. West Coast Recreational Fish International Network (RecFIN) process, data analysis, public outreach and education, and public input processes to discuss changes to the management of groundfish and Pacific halibut fisheries for 2020.

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Commercial Fisheries Monitoring and Sampling

Commercial fisheries monitoring data from commercial groundfish landings are collected throughout the year and analyzed by ODFW to provide current information on groundfish fisheries and the status of the stocks off Oregon's coast. This information contributes to fisheries management decisions, stock assessments, in-season adjustments to nearshore fisheries, and economic analyses.

Commercial fishery data, including logbooks, fish tickets, and biological data, are uploaded to the Pacific Fisheries Information Network (PacFIN) on a regular basis and are used for in-season monitoring and as a primary commercial data source for federal stock assessment. In 2019, preparations continued to add fixed gear fishery logbooks to the PacFIN database. Species composition sampling of rockfish and biological sampling of commercially landed groundfish continued in 2019 for commercial trawl, fixed gear, and hook and line landings. The majority of the landings were monitored at the ports of Astoria, Newport, Charleston, Port Orford and Brookings, with additional sampling occurring routinely at Garibaldi, Pacific City, Depoe Bay, Bandon, and Gold Beach. Biological data including length, weight, age (from collected age structures: otoliths, vertebrae, and fin rays), sex, and maturational status continued to be collected from landings of major commercial groundfish species.

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Marine Reserves

The ODFW Marine Reserves Program is responsible for overseeing the management and scientific monitoring of Oregon's five marine reserve sites. These sites, from north to south, include: Cape Falcon, Cascade Head, Otter Rock, Cape Perpetua and Redfish Rocks. Reserves are a combination of marine reserves (no fishing) and marine protected areas (some types of fishing activities allowed), as determined by public process. Each reserve has distinct habitat and biological characteristics, and as such, requires site-specific monitoring and research planning. This section presents an update on management and ecological monitoring and research activities from 2019. More information is available on the Oregon Marine Reserves website at http://oregonmarinereserves.com/

Management

Nothing new to report for 2019.

Monitoring

Ecological Monitoring was conducted at five marine reserve sites this past year. Monitoring included sampling with core tools (ODFW-led) and through collaborative activities. Sampling was conducted both in the reserves and in comparison areas outside of the reserves still open to fishing. Sampling with core survey tools conducted this year as part of on-going monitoring included:

- Hook and Line Surveys
- Scuba Surveys
- Video Lander Surveys
- ROV surveys

Sampling through collaborative activities included:

- Oceanographic surveys (PISCO-Oregon State University and ODFW)
- Juvenile fish recruitment surveys (led by Oregon State University)
- Intertidal biodiversity surveys (led by UC Santa Cruz and Multi-Agency-Rocky-Intertidal-Network)
- Sea star wasting disease recovery monitoring in rocky intertidal areas (ODFW, Oregon State University)
- Urchin Surveys (led by ODFW South Coast Shellfish Team)

- Ocean acidification monitoring in rocky intertidal areas (led by PISCO-Oregon State University)
- Microplastic research in black rockfish (led by Oregon State University)

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Research

A new pilot study began in 2019 to study the diversity of small, cryptic invertebrates with autonomous reef monitoring structures (ARMS). Researchers all around the world – from the Arctic to Antarctica, are setting out ARMS as a standardized way to quantify biodiversity. These invertebrate condos are set out on the ocean floor and consist of 8 PVC plates stacked on top of each other, providing multiple levels for small invertebrates to grow or hide. In Oregon, ARMS were deployed at the Otter Rock Marine Reserve and its comparison area off Cape Foulweather. Invertebrates will settle onto the plates for two years, when researchers will then return and collect the ARMS units for organism identification and processing. When the ARMS are retrieved, species will be documented, identified and then genetic sampling will be conducted. This will be a collaborative effort by the ODFW Marine Reserves Program and researchers at the University of Oregon, Oregon State University, and NOAA Northwest Fisheries Science Center.

REVIEW OF AGENCY GROUNDFISH RESEARCH, ASSESSMENT AND MANAGEMENT

Hagfish

Management

The commercial hagfish fishery operates year-round. Two types of trap gear are typically used by the hagfish fleet, a 55-gallon drum and five gallon bucket. Each of these contains escape holes to increase the size selectivity of the commercial fishery. Commercial hagfish landings in 2019 were 1,587,585 pounds, or 99.2% of state Harvest Guideline (HG) of 1.6 million pounds. No major hagfish management actions were taken by ODFW in 2019.

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Dogfish and Other Sharks

Nothing to report.

Skates

Research
In 2019, the ODFW developed a comprehensive commercial skate catch reconstruction to cover the years 1978 – 2018. This reconstruction covers all observed skate species in Oregon, but primarily longnose and big skates. Unfortunately, skate speciation was inconsistent over time, and therefore, three time periods (1978 – 2008, 2009 – 2014 and 2015 – 2018) were created to apply species compositions to. Species compositions were applied at the time period, gear, PFMC area, and market category level. This methodology was reviewed at a pre-assessment workshop in March 2019.

The majority of landings occurred in the trawl and longline gear categories, and over 99% of all landings were from longnose or big skates. A depth-based approach was necessary in the application of species compositions in the mid-water trawl category, and this remains a source of uncertainty in the reconstruction. Estimated species-specific landings are available upon request from ODFW currently, but will be incorporated into PacFIN eventually.

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Assessment
ODFW staff provided data for the longnose and big skate federal stock assessments in 2019. These data include the reconstructed commercial landings (described above) and the enhanced data collection program (EDCP) data at the haul level to aid with estimating discards of skates. Staff also participated in a pre-assessment workshop that reviewed the skate commercial reconstruction in detail but also reviewed the other federal stock assessments for the 2019 cycle.

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Pacific Cod
Nothing to report.

Walleye Pollock
Nothing to report.

Pacific Whiting
Management
The US (and Canadian) whiting TAC and catch continues to be near record high levels. Reducing bycatch of Chinook salmon in whiting and other groundfish fisheries has been a recent focus at the Pacific Fishery Management Council. The Council adopted salmon hard caps and new mitigation tools (e.g., area closures) to prevent the caps from being exceeded. The whiting industry has also made voluntary avoidance a top priority by avoiding hotspots and using salmon excluders. Documentation of avoidance measures by the whiting cooperatives in Salmon Mitigation Plans approved by the National Marine Fisheries

Service is expected to help minimize Chinook salmon bycatch and support the effective use of these measures in the cooperatives' own real-time operations.

The Council also removed hard caps for rockfish bycatch in the at-sea whiting processing sectors and is now using set-asides, or "soft cap" allocations. This switch reflects the rebuilt status and increasing abundance of these rockfish stocks. For each of several rockfish stocks, the Council has attempted to find a balance of set-asides high enough to allow the fleet to efficiently catch whiting, but low enough to avoid unnecessarily reducing the shore-side trawl sector allocations for these target stocks.

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Grenadiers

Nothing to report.

Rockfish

Research

Depth-associated variability of Deacon Rockfish (*Sebastes diaconus*) age, growth and maturity parameters in Oregon waters and their effect on stock status. In review.

The goals of this study were to understand how age, growth and maturity parameters vary with sex and depth in the Deacon Rockfish. As efforts were made to sample a variety of size classes, from both the nearshore and offshore, we also assessed how age composition differed between the two areas and determined what the implications of these differences would be on the reproductive output of the population. Finally, we incorporated the results of this study into the most recent Deacon Rockfish stock assessment and evaluated how altering life history parameters influenced the stock status.

Deacon rockfish were collected nearly monthly at offshore and nearshore sites during favorable weather periods out of Newport, Oregon. Samples were collected on 12/13/16, 02/22/17, 3/20/17, 4/21/17, 5/30/17, 5/31/17, 7/5/17, 8/8/17, 8/16/17, 10/04/17, 10/05/17, and 11/06/17. The offshore study area was Stonewall Bank and the surrounding area out to 146 m of water depth. The nearshore study areas included Seal Rock and Siletz reefs. Recreational hook and line gear was used for all collections. Terminal gear included a variety of plastic baits, small to medium sized flies and Sabiki rigs (herring jigs). Prior efforts to collect small Deacon and Blue Rockfish in nearshore waters off Oregon have shown that Sabiki rigs are capable of capturing Deacon Rockfish from adult sizes down to as small as ~8 cm, helping to offset gear-related bias in size-selectivity of typical hook and line fishing gear. Approximately 50 Deacon Rockfish were collected per reef area per sampling day. Fish were measured (cm, fork length) and sexed and otoliths collected for age determination. Ovaries and testes were be examined and assigned a maturity stage. For females, a small section of ovary from fish in stages 1, 2, 3, 6 and 7 were collected and placed in cassettes for histological preparation and microscopic evaluation of maturity. Ovary samples were preserved in 10% buffered formalin and later transferred to 70% ethanol for storage. Ages were determined using the break and burn technique applied to sagittal otoliths) or a variation of the technique in which sagittal otoliths are broken and "baked" for several minutes prior to age determination. For all fish 21 cm or shorter, a caudal fin snip was taken and stored in 100% ethanol (molecular grade) for DNA analysis to confirm species identification.

Our primary goal was to better understand how age, growth and maturity parameters differed between Deacon Rockfish that resided in nearshore and offshore waters off central Oregon. Our study suggests that age and growth parameters do differ by both area and sex but, not surprisingly, sex was a more influential factor than area. We were unable to compare nearshore and offshore age and length at 50% maturity due to the small number of immature females collected offshore. We did find that age and length at 50% maturity values were similar between the nearshore and when we combined the nearshore and offshore samples. However, based on larger lengths of offshore females, our work suggests that a significant component of the total reproductive output in Oregon may come from offshore. It is worth noting that this is based on the assumption that the number of females in the nearshore and offshore are equal.

Although our best fit von Bertalanffy model included both sex and area, the effect of area on the parameter estimates was relatively minimal. Primarily, growth rate (k) differed with males in the nearshore growing faster than males in the offshore whereas females in the offshore grew faster than females in the nearshore. Regardless of area, male growth rate was faster than for females. The larger offshore individuals (both male and female) had a more diverse distribution of ages than individuals of the same size class in the nearshore. The offshore individuals we sampled stopped experiencing fishing pressure in 2007 due to the establishment of the Stonewall Yelloweye Rockfish Conservation Area. In the 10 years since its closure, the offshore fish have experienced essentially no fishing pressure allowing larger individuals to obtain older ages than normally occurs for populations experiencing fishing pressure. However, the >10 year age difference suggests that while the complexity of offshore age structure has increased due to the lack of fishing pressure, there were, prior to closure, likely more, older fish offshore. It is worth noting when the offshore re-opens to fishing these larger older individuals are likely to be removed from the population. Although most of the offshore individuals were large mature females, we did capture young-of-the-year individuals. This finding is important because regional knowledge suggests Deacon Rockfish only settle in the nearshore and exhibit an ontogenetic migration from the nearshore to the offshore. Our finding may indicated that there is less movement of individuals between the nearshore and offshore than previously hypothesized.

Re-running the most recent stock assessment and forcing it to use some of the different growth and maturity parameters influences the spawning stock biomass trajectory and estimates of stock status, but all of the estimates were within the range of uncertainty estimated with the base Oregon Blue/Deacon stock assessment model. Although all of these runs were within the range of uncertainty, the stock trends were effectively the same regardless of where the parameter estimates were obtained from, except for the estimates from California, which caused dramatic differences in the stock trend. Incorporating spatio-temporal variability of growth data into stock assessments is increasingly being shown to have profound impacts of stock trajectory and status. As such, for nearshore stocks that are relatively data poor and rely on each individual state to collect their own data, it is important that growth function parameters be estimated (at a minimal) for each state (using locally obtained data) and the relative effect of spatial dynamics are considered. Further, although spatial variation on growth function parameter estimates are often shown to vary with latitude, few studies consider the effects of cross-shelf variability in growth functions. We argue that cross-shelf variability is important to consider as circulation changes dramatically as you move across the shelf and ultimately these differences may affect both growth rates of adults and the dispersal of their larvae.

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Sex matters: Otolith shape and genomic variation in deacon rockfish (*Sebastes diaconus*).

Little is known about intraspecific variation within the Deacon Rockfish (*Sebastes diaconus*), a recently described species found off the West Coast of North America. We used an interdisciplinary approach to test for population structure among fish sampled at two nearshore reefs (Siletz Reef and Seal Rock) and one offshore area (Stonewall Bank) off the Oregon coast. We found that fish sampled from the three sample sites are differentiable based on otolith shape and genetic variation whether analyzed independently or classified into nearshore and offshore groups. We also identified 92 outlier loci that distinguish males and females, potentially representing sex-linked, putatively adaptive variation. Although sex-linked genetic variation did not appear to affect geographic comparisons, males and females were readily distinguished. Morphometric results indicated that there was significant secondary sexual dimorphism in otolith shape, but further sampling is required to disentangle potential confounding influence of age-structure. We found small but statistically significant otolith shape and genetic differences among Deacon Rockfish sampled off the Oregon coast, regardless of whether the three sample sites were analyzed independently or organized into nearshore (Siletz Reef, Seal Rock) and offshore groups (Stonewall Bank). Although differentiation was low, the fact that we detected statistically significant otolith shape and genotypic differences over such a small geographic scale (<50 km^2) is remarkable in itself. Furthermore, both morphometric and genetic results were comparable to findings from other marine fishes sampled over larger geographic distances.

Sex mattered in our otolith shape and genetic analyses. We found evidence for secondary sexual dimorphism in otolith shape. This result may reflect differences in the growth and lifespan of males and females, and further research is required to disentangle these potential effects among the sample sites. We identified 92 outlier loci that are likely sex-linked sites in Deacon Rockfish, and males and females exhibited statistically significant neutral and putatively adaptive genetic differences. Our otolith shape and genetic results do not provide strong evidence for two potential fish stocks of Deacon Rockfish in the nearshore and offshore. Although morphological and genetic differences were statistically significant, values were low and there was considerable overlap among specimens, and comparisons analyzing the three sample sites independently demonstrated similar results. Stock assessments using similar methods have relied upon stronger patterns in results in order to delineate a stock boundary.

This study provides a first step towards the investigation of intraspecific variation in the recently described Deacon Rockfish species. This study demonstrates the potential of RAD sequencing studies to provide substantial population genetic information for species that have not been previously investigated. Much work is still required to study how the species differs from Blue Rockfish (and other relatives) in biology and management requirements. If future genetic analyses of *Sebastes* want to include the Deacon Rockfish, the sequence data presented here should be compatible with reads from the previous RADseq studies of other rockfish species that also used the *SbfI* restriction enzyme. The SHAPER otolith digitization method easily allows datasets to be combined as well, and therefore both geometric morphometric and genetic data from this study should permit genus-wide studies of rockfish diversity.

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Habitat use and activity patterns of Deacon Rockfish (Sebastes diaconus) at seasonal scales and in response to episodic hypoxia. In review.

Knowledge of fish movements and residency are key to design and interpretation of results from bioacoustic sonar and visual survey methods, which are being developed as tools for use in nearshore rocky reef surveys to estimate biomass and species composition. Fishers in Oregon report that an important component of the nearshore catch, Deacon Rockfish (*Sebastes diaconus*), become unavailable to harvest seasonally, and suggest periodic migration away from nearshore reef areas. Seasonal and spatial variation in landings data potentially support this theory. We used a high-resolution acoustic telemetry array and a combination of presence/absence receiver arrays, to study the daily and seasonal movements and the activity patterns of 11 acoustically tagged Deacon Rockfish on a nearshore rocky reef off Seal Rock, Oregon. Over the 11-month study period, most fish (n=6) exhibited high site fidelity. For the duration of the high-resolution array (5 mo), these fish had small home ranges (mean 95% kernel density estimation=4,907 m^2) and consistent activity patterns, except during seasonal hypoxia (defined as dissolved oxygen concentration [DO] < 2 mg l^{-1}). During the summer months, resident fish were strongly diurnal with high levels of daytime activity above the bottom in relatively rugose habitat, followed by nighttime rest periods in deeper water in habitat of relatively less rugosity. During hypoxia, fish exhibited moderate activity levels with no rest periods and moved well away from their core activity areas on long, erratic forays. Wintertime activity levels were moderate with less defined daily patterns, but fish continued to remain within the array area.

Overall, resident Deacon Rockfish displayed high site fidelity and coherence in both seasonal and daily movement patterns, but those consistent patterns were completely altered during extended hypoxia. High long-term survival and consistently high detection of resident fish over 11 months indicates that at least some Deacon Rockfish do not exhibit a seasonal migration away from nearshore reefs. Food items ingested by sampled Deacon Rockfish during this study included gelatinous zooplankton and small planktonic crustaceans: the colonial tunicate *Pyrosoma atlanticum*, hydrozoan *Velella vellela*, ctenophore *Pleurobrachia bachei*, brachyuran zoeae/megalopae, and pelagic amphipods. We suggest Deacon Rockfish may be resistant to standard fishing techniques due to these strong prey preferences, hook size, and potentially eye and visual abilities which allow both Blue and Deacon Rockfish to see and feed upon very small and/or transparent prey items such as gelatinous zooplankton.

Although our sample size was necessarily small, detection and position data for tagged fish was excellent, a trade-off due to using a high density of receivers and co-located sync tags. Mid-water schooling behavior of this species benefits detection rates, which can be problematic for more benthic rockfish in high relief habitat. The high-resolution inner VPS array, combined with the perimeter fence, and accelerometer/depth sensors in the tags, provided additional certainty about the fate of fish that remained inside or left the array. A larger study in southern Oregon, using similar methods but tagging both Deacon and Blue Rockfish inhabiting the same area, could shed light on differences in the two species' movements in various habitats including offshore reefs, which may act as refuges for older, more fecund fish in Oregon, in unfished rockfish conservation areas.

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Sex identification PCR-RFLP assay tested in eight species of *Sebastes* rockfish. In review.

The phenotypic identification of sex in *Sebastes* rockfish is difficult and often impractical from a management perspective, and the genetic basis of sex determination in the genus is currently uncertain. We tested a previously developed sex identification polymerase chain reaction restriction fragment length polymorphism (PCR-RFLP) assay on 8 species of *Sebastes* rockfish. Results indicated that restriction is species dependent rather than sex dependent in most species.

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Operationalizing a survey of Oregon's nearshore semi-pelagic rockfish.

A primary challenge for an acoustic-based rocky reef survey is identifying the species composition and size distribution of schools, as species identification of acoustic targets is currently not possible for mixed schools of morphologically-similar rockfish species. Identifying an efficient strategy for quantifying these variables using a suspended pelagic stereo drop-camera was the goal of this proposed work. Acquiring drop-camera footage from as many different schools as possible, containing a diversity of species compositions and size distributions, informed us about the range of school structures and allowed us to evaluate the level of sampling effort needed for future broad-scale surveys.

In the fall of 2017 we established 50 transects off of Newport at Seal Rock reef. These transects were evenly spaced in areas 2 and 3 of the ODFW black rockfish pit tagging project. These transects were established as a test location for conducting a "mock" hydroacoustic survey for nearshore semi-pelagic rockfish. This location presented an ideal test location due to 1) its nearness to the ODFW offices and 2) the presence of robust population estimates for the reef's black rockfish (*Sebastes melanops*) population. Over the course of four days, using a contracted local charter passenger fishing vessel, we collected hydroacoustic data using a Biosonics 200kHz split beam transducer. For each transect we deployed our suspended stereo camera system 3 times on locations with either large schools of rockfish or rocky reef habitat. For each video drop we collected a minimum of 2 minutes of on bottom time (based on preliminary examination of existing data). A total of 70 miles of acoustics data were collected and 140 video drops were conducted.

We determined that the best way to process our video data was to use a mean MaxN approach rather than the common MaxN approach. We also demonstrated that there was no effect on the size of the fish observed with each method. Finally, regardless of the method used, the distribution of fish size classes from the fishing fleet was similar to that observed with the camera. The only notable difference is the camera saw larger and smaller fish than those observed in the hook and line data. Our system also has downward facing camera that allows us to compare the fish counts in the acoustic deadzone to the counts from the forward camera system. Our work suggests that there was no statistical difference in the number of fish in the down camera for black rockfish and that there were significantly more Blue/Deacon rockfish in the forward camera than the down camera. These data provide an initial suggestion that that the acoustic deadzone will be a manageable concern in relation to our data.

To establish how the deployment and retrieval of the BASS camera affects the behavior of semi-demersal rockfish, we spent multiple days this summer deploying the camera system directly below the transducer that was ensonifying a school of fish. We then remained over the camera system while we ensonified the school and as we retrieved the camera system. Our analyses suggest that the deployment of the camera system on the schools of fish does not result in the attraction or repulsion of fish to the school. Finally, using the data we collected in September of 2017 we were able to generate population estimates for Black and Blue/Deacon rockfish at Seal Rock reef. Our work found similar orders of magnitude population sizes of Blacks as those estimated by the pit tagging project.

A statewide survey was planned for September 2019 however problems with contracting resulted in this work not being operationalized. Therefore we are going to operationalize the survey in fall 2020. The hydroacoustic survey will be conducted using evenly spaced transects conducted over the rocky habitat as identified from available GIS layers of nearshore habitat. For each acoustic transect the suspended stereo camera system will be deployed to provide length and species composition estimates. Once collected these data will be used to generate population estimates for Black, Blue and Deacon Rockfish for the state of

Oregon using standard acoustic and video analysis methodologies. This project will provide the first fisheries-independent regional population estimates for Black, Blue and Deacon Rockfish in the state of Oregon.

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Assessment

Two rockfish were assessed during the 2019 federal stock assessment cycle, including cowcod and a gopher/black-and-yellow complex. ODFW staff contributed commercial landings to these assessments via PacFIN. However, these species are rarely encountered in Oregon.

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Management

Fixed-Gear Nearshore Commercial Fishery

Nearshore rockfish compose the majority of take in the commercial nearshore fishery. In Oregon, this fishery became a limited-entry permit-based program in 2004, following the rapid development of the open access nearshore fishery in the late 1990's. The commercial nearshore fishery exclusively targets groundfish with separate management groups for Black Rockfish, Blue and Deacon Rockfish, Cabezon, Kelp Greenling, and Oregon's "Other Nearshore Rockfish" complex. The fishery is primarily composed of small vessels (25 ft. average) fishing in waters less than 30 fathoms. Fishing occurs mainly with hook and line jig and bottom longline gear types. The majority of active permit holders are located on the southern Oregon coast, resulting in most of the catch landed in Port Orford, Gold Beach and Brookings. Black Rockfish continue to comprise the majority of landings. The fishery supplies mainly live fish markets, but also provides fresh fish products.

Landings are regulated through bimonthly trip limits, minimum size limits, and annual harvest guidelines (HG). Landings from 2018 commercial nearshore fishing, logbook compliance, economic data, and biological data were published in the 2018 Commercial Nearshore Fishery Data Update (Rodomsky *et al*. 2019). Weekly updates on landings and model projections allow MRP staff to effectively manage the fishery in-season. In 2019, in-season increases of 600 pounds were made to each Black Rockfish bimonthly trip limit for periods 4-6 when catch mid-year was low. This was the only Nearshore Rockfish commercial management action in 2019. End of the year attainment of the Black Rockfish state HG was 95.2%, was 97.4% for Other Nearshore Rockfish, and was 39.6% of the Blue and Deacon Rockfish HG.

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Recreational Fishery

Black rockfish (*Sebastes melanops*) remains the dominant species caught in the recreational ocean boat fishery; however the black rockfish harvest limit continues to decrease by 2-5%

due to the most recent stock assessment and applying the time varying sigma to the output of that assessment. With blue and deacon rockfish taken out of the nearshore rockfish complex, the harvest guideline for that complex was greatly reduced. The retention of yelloweye rockfish (*S. ruberrimus*) was prohibited year-round, as it has been since the early 2000s. In order to remain within the yelloweye rockfish impact cap (via discard mortality), the recreational groundfish fishery was restricted pre-season to inside of 40 fathoms from May 1 to September 30, changed to September 3 inseason. Black rockfish and nearshore rockfish species have become as much of a limiting factor as yelloweye rockfish. The fishery season structure and regulations, such as bag limits (species specific sub-bag limits) and depth restrictions, attempted to balance impacts, as what reduces impacts on one species may increase impacts to the other. Even with those efforts the nearshore rockfish complex harvest guideline was reached in mid-August, at which time ODFW required anglers to release those species. 2019 was another high effort year, with just over 100,000 bottomfish angler trips.

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Outreach

To reduce bycatch mortality of overfished rockfish species in the sport fisheries, ODFW began an outreach campaign in 2013 with the goal of increasing descending device usage among sport anglers. The effort, branded "No Floaters: Release At-Depth", has distributed over 16,000 descending devices to date, to all charter vessel owners and to the majority of sport boat owners who had previously targeted groundfish or halibut. ODFW staff have also participated in a number of angler education workshops, meetings, and shows to educate anglers and distribute devices. In addition, several thousand stickers and a few hundred hats bearing an emblem of the brand have been distributed with the goal of making rockfish conservation an innate aspect of fishing culture. This outreach and education campaign continue to be successful. Prior to the campaign, fewer than 40 percent of anglers reported using descending devices. Since the campaign began, the percentage of anglers reporting use increased to greater than 80 percent. To further increase usage, anglers requested that ODFW make descending devices mandatory for any vessel fishing the ocean for bottomfish or halibut. This regulation went into place beginning January 1, 2017, and increased the angler reported usage rates to approximately 95 percent in most ports and months. Additional outreach efforts include: videos online that show fish successfully swimming away after release with a device, rockfish barotrauma flyers, and videos on how to use the various descending devices. This outreach campaign has been the result of collaboration between ODFW, two angler groups (Oregon Coalition for Educating Anglers and Oregon Angler Research Society), Utah's Hogle Zoo, ODFW's Restoration and Enhancement (R & E) program, and the National Marine Fisheries Service (NMFS) Saltwater Recreational Policy. ODFW staff are planning to continue the outreach and education efforts.

Additionally, ODFW has been educating anglers on a relatively new opportunity to use what is termed "longleader gear" to target underutilized midwater rockfish species such as yellowtail (*S. flavidus*) and widow (*S. entomales*), while avoiding more benthic species such as yelloweye rockfish. The longleader gear requires a minimum of 30 feet between the weight and the lowest hook, along with a non-compressible bloat above the hooks, to keep the line vertical in the water column. ODFW has produced informational handouts with the gear specifics, species allowed, and other associated regulations.

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Thornyheads

Nothing to report.

Sablefish

Management

Sablefish is the most economically valuable species in the West Coast bottom trawl and fixed gear fisheries. Sablefish prices were depressed due to market saturation before COVID-19, and market perturbations caused by the pandemic are leading to even more disruption. The Pacific Fishery Management Council has focused on two sablefish management topics recently: revising the method used to allocate sablefish quota between two geographic areas on the West Coast (north and south of 36° N latitude), and the ongoing issue of "gear switching", or using non-trawl gear to harvest sablefish in the trawl IFQ fishery. The revised allocation method relies on a rolling average of fishery-independent trawl survey results from more recent years, rather than a long-term historic average. For the 2021-2022 groundfish management biennium, the result is a shift of some quota from the southern area, where it has consistently been underutilized, to the northern area, potentially resulting in increased economic benefits from the west coast sablefish stock. The gear-switching issue arose during the first 5-year review of the trawl IFQ program, and is centered on concerns by trawl fishermen that fixed gear participation has led to higher sablefish quota lease rates and reduced their ability to catch co-occurring stocks. Gear-switching participants are concerned that limits adopted now could undermine significant investments already made to fish in the IFQ fishery with non-trawl gear, under a legal provision of the program. In June 2020, the Pacific Fishery Management Council will receive a report from an ad hoc committee that has been developing several alternatives that would restrict gear switching for the Council's consideration.

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Assessment

A full age-based stock assessment for sablefish off the U.S. west coast was completed in 2019. ODFW staff contributed data directly to this assessment, including the historical commercial landings (pre-1986), commercial biological samples that included the grade of the landing, ticket-level landings associated with biological samples, and documentation on sablefish sampling practices. ODFW staff also participated in the pre-assessment workshop in March 2019, where all federal assessments were reviewed.

This assessment was unique in that it used an environmental index (sea level) to estimate recruitment deviations. It was found that the results generally matched the signal from age compositions. The assessment showed that the stock had been subject to overfishing in retrospect, which was mainly attributed to quotas that were based on future projections which assumed an average level of recruitment, whereas actual recruitment was lower. However, the stock is now projected to be above the Pacific Fishery Management Council's target biomass (40 percent of estimated unfished biomass). The Council just adopted a slightly higher fishery exploitation rate due to these positive assessment results.

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Lingcod

Management

Recreational Fishery

Lingcod (*Ophiodon elongates*) is a popular target in the Oregon recreational bottomfish fishery. Many anglers especially like to target lingcod during the months when the fishery is open to all-depths, as larger lingcod are thought to occur there. Lingcod have their own daily bag limit (2 per angler per day), separate from the other bottomfish. There is also a minimum size limit of 22 inches. In 2019, anglers landed just over 50,000 lingcod, totaling 152 mt.

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Atka Mackerel

Nothing to report.

Pacific Halibut

Management

Oregon's recreational fishery for Pacific halibut continues to be a popular, high profile fishery requiring International Pacific Halibut Commission (IPHC), federal, and state technical and management considerations. In 2019, the recommended an annual catch limit for Area 2A (Oregon, Washington, and California) was 1.5 million pounds which the IPHC Commissioners indicated would be in place for four years, until 2022. The recreational fishery for Pacific halibut is managed under three subareas with a combination of all-depth and nearshore quotas. In 2019, the Columbia River subarea quota was 15,127 pounds, the Central coast subarea quota was 271,592 pounds, and the Southern coast subarea quota, was 11,322 pounds. Landings in the sport Pacific halibut fisheries are monitored weekly for tracking landings versus catch limits. The majority of halibut continue to be landed in the central coast subarea, with the greatest landings in Newport followed by Garibaldi or Pacific City. Total 2019 recreational landings in the Central coast subarea was 116,982 pounds, 3 percent of the quota. Landings in the Southern subarea were 7,350 pounds (65% of the quota) and in the Columbia River subarea, landings were 17,258 pounds (114 %). Fishing in the Central Coast Subarea was severely restricted by weather for much of May, June, and August. This is the reason for the low attainment of the allocation. The Columbia River Subarea was allowed to exceed the allocation due to additional quota being available from other Washington subareas.

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Other Groundfish

Kelp Greenling

Management – Commercial Fishery

The commercial Greenling harvest guideline (HG) for 2019 was 128.5 metric tons. Greenling are targeted by very few commercial fishers regardless of the relatively high HG and price per pound paid for live fish. The bimonthly trip limit in 2019 was 1,000 pounds per period set after considering public input, markets and local depletion concerns. Greenling landings were down with only 7.5% of the HG attained. Barring changes in targeted effort catch rates and markets, Greenling attainment is likely to continue to remain low.

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Cabezon

Research – Age and Growth

Previous aging of cabezon by the ODFW used thin-section method because of the small otolith size and a perceived increase in clarity. However, in 2019, ODFW staff elected to test alternative age methodologies and ultimately chose a break-and-burn methodology to process more recent commercial and recreational samples for the 2019 federal stock assessment of cabezon. The goal of this study was to 1) determine how much bias existed between these two sample methodologies, and 2) assess bias and precision between current and previous ODFW age readers. Additionally, alternative growth models were fit to updated age data, including young fish in some models, and were presented for use in the federal stock assessment.

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Management – Commercial Fishery

The commercial harvest guideline (HG) for Cabezon in 2019 was again 30.2 metric tons. Cabezon catch in the fishery ran high, especially late season, continuing the trend seen in 2018. In anticipation of this possibility, ODFW reduced initial 2019 bimonthly trip limits 50 – 60% pre-season to 1,000 pounds for all periods. High Cabezon catch continued all season requiring implementation of a Period 6 daily trip limit. On 12/13/2019, a daily limit of 30 pounds per day went into effect, in addition to the 1,000 pound period 6 trip limit, to slow catch with until year's end to keep the fishery from exceeding the HG. Final commercial fishery attainment was 97.1% with in-season adjustments.

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Management – Recreational Fishery

Cabezon (*Scorpaenichthys marmoratus*) is another popular target for some recreational bottomfish anglers. Cabezon have a one-fish sub-bag limit as part of the general marine bag limit, and a 16 inch minimum size, additionally the season does not open until July 1. The cabezon harvest guideline has remained relatively constant over the last ten years. Even with the average angler catching less than one per day, the quota goes very quickly. In each of the last three years, the quota has been met in six weeks, at which time ODFW prohibits retention. Fishing is prohibited January through June as that is the time that cabezon generally spawn and nest guard. Prohibiting fishing during that time, is intended to protect cabezon during that time.

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Assessment

ODFW staff were co-authors on the federal 2019 Cabezon stock assessment, in addition to contributing multiple data streams. Data contributions include modelling of multiple indices of abundance from both recreational and commercial data, age compositions, and other fishery dependent data. ODFW staff also participated in a pre-assessment workshop and attended the STAR panel where this assessment was reviewed in detail.

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Ecosystem Studies

Mapping Rogue Reef

The purpose of this study is to provide a map showing the predicted location of hard and soft substrates of Rogue Reef, OR, and the surrounding rocky reef areas. These data will be used to inform survey design for a statewide Black Rockfish assessment, which will target areas where fish are likely to be found (i.e. hard rocky bottom). To create the map, we used acoustic backscattering data and spatial multivariate analysis to predict bottom type over our surveyed region. We employed a stratified line transect design consisting of southern (42.3° N to 42.2° N), central 42.5° N to 42.4° N), and northern (42.6° N to 42.5° N) blocks, with the central block encompassing the Rogue Reef complex. To ground truth acoustic observations, we completed n=20 drops using an underwater stereo video system. Post field collection, backscattering data was imported into Echoview Software Pty Ltd and bottom type was then classified using the Echoview bottom classification algorithm with a ping interval of 5. We used seven bottom characteristics from Echoview and multivariate analysis to categorize substrate types into hard and soft bottom types. We used seven bottom characteristics from Echoview and multivariate analysis to categorize substrate types into hard and soft bottom types. Specifically, we employed a k-means cluster analysis to group bottom pings (n= 84,486) into hard and soft substrate groups. -means clustering identified with 7 clusters of sizes n= 20963, 13979, 17540, 4325, 1760, 10085 and 15834 (Figure 2). The 7-cluster model explains 73.3 % of variation between groups (between SS/ total SS). Depth profile plots suggested that groups 1-4, and 7 represented soft substrates, while groups 4-6 were likely hard substrate types (e.g. bedrock, boulders, rock walls, pinnacles). This observation was verified by drop camera video of the benthos.

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Effectiveness of quantitative stereo landers during day and night.

The need to develop fisheries independent estimates of demersal fishes in Oregon remains an important need for ODFW. Remote underwater vehicles (i.e. landers) are being used for this purpose in multiple countries throughout the world as well as providing stock assessment data to at least four of the regional fisheries management councils. A key benefit of their use is their simplicity in deployment and retrieval which ultimately makes them an economically strategic tool for monetarily limited agencies. However, there remain ways for us to increase their efficiency. Chartering vessels is inherently costly and time investment to either 1) have a boat not work at night or 2) make runs back and forth to port is not cost effective. Therefore, being able to operate a vessel both during the day and night allows a vessel to be run more efficiently. However, if the species and number of fish detected differ significantly between day and night the results can have dramatic impacts on the development of an index.

Lander drops are being conducted at three regions: nearshore reef sites (Seal Rock or Siletz Reef), mid-shelf reef site (Stonewall Bank), and near-shelf break (Daisy Bank). At each region three grids of 100 drops were established over areas presumed to have a rocky substrate based on available multibeam data. Sample locations were selected that are >400 m apart. Beginning 5 hours before sunset the odd numbered drop locations were sampled until sunset. Following sunset sampling reversed back on the grid only sampling the even numbers. Two stereo lander systems are hop-scotched throughout the study area to increase efficiency. CTD casts equipped with a light meter are made haphazardly throughout the day to characterize the water column. Landers are left on the bottom for 15 minutes to record video. Videos are then scored for both MaxN and mean MaxN. Field work for this project is ongoing.

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Untrawlable habitat survey in partnership with NWFSC and AFSC

Survey biologists with NOAA Fisheries in Seattle and Newport are interested in partnering with the commercial and sportfishing industries in the Pacific Northwest to improve stock assessments for lingcod and shelf rockfish. We are planning to charter one commercial and one sportfishing vessel to conduct a study comparing the effectiveness of four different methods for collecting abundance and biological data for groundfish species found in rocky, high-relief habitats. The four methods are:

- Hook and line gear deployed by rod and reel
- Stereo video imagery from a small, stationary lander
- Stereo still camera imagery from a semi-moored housing
- Environmental DNA (eDNA) collected from water samples near the seafloor

The research will be conducted this fall from late October –early November off the Oregon coast between Cascade Head and Heceta Bank in a depth range of 20 –125 fathoms and will target a variety of banks, reefs, and other rocky habitats. Results from this study will help determine the most effective and efficient gear to use in designing a larger, more comprehensive monitoring program for groundfish in the untrawlable habitats of the Pacific Northwest. Sampling was conducted in fall of 2019 and video review is undergoing.

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Video Lander Surveys

In December 2019 ODFW published an Informational Report titled "A nearshore video lander study of a nearshore rocky reef". The report examines the practicalities of sampling with the video lander tool, provides quantitative abundance estimates of groundfish species observed, and provides information on certain macro invertebrates with the lander and wildlife observed from the boat during surveys. The document can be found on the Marine Resources Program publications page (HERE).

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Aging Activity

In 2019, a new Age Reading Specialist was hired to replace Lisa Kautzi, who had led the project for several years. Before leaving, Lisa produced break-and-burn age estimates for 218 Cabezon from the recreational fishery (63 tested) and 24 from the commercial fishery (23 tested, with an additional 18 tested that were initially aged in 2018). These ages were used for the 2019 Cabezon federal stock assessment and were included as the primary data for an age and growth study.

A new specialist, hired in late August 2019, prioritized Black Rockfish and aged 954 (191 tested) from the commercial fishery and 508 (102 tested) from the recreational fishery. He also transferred MRP’s large, historical aging structure collection to a more suitable storage unit out of the coastal tsunami zone. Historical collections from the late 90’s and earlier stored wet (in ethanol or oil/thymol) are in the process of being assessed, cleaned, and dried for proper dry storage.

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Assessing benthic habitat impacts and recovery processes in association with major changes in bottom trawl closed areas off the Oregon coast

The Pacific Fishery Management Council’s Groundfish FMP Amendment 28 reopens the current Rockfish Conservation Area to bottom trawling off Oregon and California, and modifies the current configuration of Essential Fish Habitat Conservation Areas along the entire West Coast. In its 2013 Research and Data Needs document the Pacific Council identified evaluating the effects of fishing on habitat and response of habitat to spatial closures as one of its highest priority Ecosystem Based Fisheries Management (EBFM) issues (PFMC 2013). More recently, the Pacific Council’s newly updated 5-year research and data needs planning document identifies fishing effects on benthic habitats along with the collection of baseline data as one of its highest priorities. (PFMC 2018) continues to highlight the need for studies on the impacts of fishing to benthic habitats. Referring to the upcoming groundfish EFH amendment (28), the Pacific Council describes areas that will be reopened to trawling after 18 years as “providing unprecedented opportunities to facilitate applied research to address management questions about impacts and recovery of habitats and associated species, and the benefits of long-term closures for fish populations.”

In 2019 ODFW initiated a study to focus on the RCA openings, taking advantage of the opportunity that the new openings offer to evaluate the current condition of these areas prior to the onset of bottom trawling. Our research will establish baseline information about condition of habitats and the diversity and abundance of fishes and invertebrates, and subsequently will evaluate of the effects of new trawling on these habitats in the years after reopening.

The preliminary (2019-2020) objectives of the work are: 1) To establish baseline information on representative habitats and associated biota in a segment of the Rockfish Conservation Area (RCA) on the Oregon continental margin after an 18-year bottom trawl exclusion before trawling resumes in areas to be reopened in 2020; and 2) to evaluate the short-term effect of bottom trawling on habitats and associated biota in newly opened trawl areas at depths to 250 m off the Oregon coast. Our approach for achieving these objectives is to conduct before/after non-extractive video transects using a remotely operated vehicle (ROV) to evaluate habitat condition, evidence of substrate disturbance, and associated organisms. By capturing an extensive, high-resolution video record of habitat conditions prior to the RCA opening, we will be providing a baseline dataset that will be valuable in perpetuity for future assessments of changes in habitat structure and utilization. Observations made during the project's second field year on the same transects surveyed in the first year (approximately nine months after the onset of trawling) will enable evaluation of the short-term effects of trawling on the newly-opened habitats in those specific areas where trawls intersect the established transects. This comparison will be valuable to fishery managers in contributing to an understanding of how 18 years of closure is related to habitat structure and associated biota.

Sampling in 2019 was conducted on 11 days across four separate cruises, beginning August 28 and continuing through Nov. 6. Video surveys were completed covering approximately 19 km of seafloor along 38 individual ROV transects in the Rockfish Conservation Area (RCA), prior to the January 2020 bottom trawl fishery opening. The transects covered a range of substrate types (including trawlable and a few untrawlable sections) between 180 and 300 m depth over a 47 km long survey area between 44° 2′ and 44° 32′ N latitude. Video review has been initiated, and to date complete data have been extracted on fish abundance and fish size distributions in stereo-video footage. Substrate characterization and quantitative assessment of anthropogenic disturbance (e.g., trawl gear marks) is underway. Collaborators at Oregon State University have found opportunities to collect a total of nine sediment cores from locations adjacent to ROV transects on two separate cruises with additional coring operations planned for 2020 and 2021. A revised grant proposal was submitted to the NOAA Fisheries Saltonstall-Kennedy program to support continued ROV sampling and analysis in 2020.

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ROV survey of Redfish Rocks Marine Reserve and associated comparison areas

Remotely operated vehicle (ROV) video surveys were conducted in Redfish Rocks Marine Reserve and associated comparison areas in April 2019, contributing to ongoing monitoring efforts for this reserve established in 2010. Fifty-three dives were conducted, each targeting a 500 m transect. Cape Perpetua Marine Reserve was also surveyed by ROV, adding to a time series of observations originating in 2001. Forward-oblique (30 degrees below horizontal), downward, and stereo-video HD camera systems were utilized.

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