OREGON'S GROUNDFISH FISHERIES AND INVESTIGATIONS IN 2017

OREGON DEPARTMENT OF FISH AND WILDLIFE

2018 AGENCY REPORT
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I) Agency Overview

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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 and also 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.

II) Surveys

a. Recreational Fisheries Monitoring and Sampling

Sampling of the ocean boat sport fishery by MRP's Ocean Recreational Boat Survey (ORBS) continued in 2017. Starting in November 2005, major ports were sampled year-round and minor ports for peak summer-fall season. Catch is estimated 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 2017. Since 2003, as part of a related marine fish aging 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 at-sea 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. In 2011, ORBS samplers also began collecting information on at-sea discarded rockfish, including species composition, depth of capture and whether a descending device was used.

Other ODFW management activities in 2017 include participation in the U.S. West Coast Recreational Fish International Network (RecFIN) process, data analysis, public outreach and education, and substantial public input processes to discuss changes to the management of groundfish and Pacific halibut fisheries for 2018, 2019-2020, and beyond.

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b. 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 stock assessment. In 2017, preparations were made to add fixed gear fishery logbooks to the PacFIN database. Species composition sampling of rockfish and biological sampling of commercially landed groundfish continued in 2017 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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c. Pilot Study – Using Electronic monitoring in Commercial Fishery sampling

Port biologists sampling commercially-caught finfish in Oregon's ports have been successfully collecting valuable biological data using pencil and paper for many years, but improving accuracy and efficiency are potential benefits to electronic sampling systems that were explored in this pilot study. Program staff evaluated various electronic data collection systems, and opted to purchase a system offered by Big Fin Scientific in late 2015. The development of a suitable master electronic template and support software required to upload electronically collected biological sample data from the application lasted from January through December of 2016, taking much longer than initially planned. A functional import process from the application into the current ODFW sampling database was completed in March 2017.

In early 2016, a preliminary experiment was conducted to evaluate the precision and efficiency of the two measuring methods under experimental conditions. Results indicated that there were no differences in the data captured by the electronic system when compared to the manual system, though there were inadvertently differences in fish length after freezing samples. Initial field trials to evaluate the data collection process and software application began as scheduled in mid-2016 in the port of Astoria. The goal was to collect representative samples of the variety of fish and fisheries typically encountered during port sampling activities and data was evaluated for differences among fish lengths and sampling time between systems. A focus species from three species assemblages, representing different morphology characteristics, including rockfish, flatfish, and roundfish, was selected for analysis. Required sample sizes were estimated using a series of power analyses. In order to evaluate differences in the length distributions of species by system, a randomized block design was implemented throughout the field testing season. A total of 133 timed samples were collected throughout the field testing phase. There were 2,220 fish sampled with the electronic system and 1,228 fish sampled with the manual system.

Overall, there were no differences found between the electronic system and the manual system in either the total time per sample or the total time per fish in sample in directly comparable samples with identical sampling activities. Multiple factors were found to affect the mean length of each of the focus species, though these factors differed by species. Regardless of whether mean lengths were affected by the choice of system, the shape of the length distribution curve was found to be significantly different for all three of the focus species. It is worth noting that the basis for comparison is the data collected concurrently with the manual system, and there was no clear evidence of a systematic bias with the electronic system. Evaluating length distributions from a similar time period in previous years may provide a better metric for direct comparison, as there is certainly intra-annual variability in the length compositions encountered in commercial fishing.

An electronic sampling system shows potential to provide a more efficient, accurate, and flexible way of port sampling. More work is needed to make a reliable system with a simple, streamlined process before ODFW will move forward with incorporating electronic sampling into our current sampling methods. This pilot study has yielded many valuable conclusions that will help ODFW inform future decisions and will provide insights to other agencies exploring electronic fisheries sampling.

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d. Pilot Study – Reinitiating the Shore and Estuary Boat Survey

The Marine Resources Program received funding to re-implement a pilot Shore and Estuary Boat Survey in 2015. Sampling was conducted in 2016 and the final report from the project was completed in 2017. An angler intercept survey was utilized to collect on-site interview data from anglers that fish for marine finfish from shore or in the estuary by boat. Sampling only occurred in Lincoln County on the central Oregon coast due to funding limitations. The objective was to intercept anglers in the field to obtain catch, effort, and biological data without the sampling biases present in the original survey. This project implemented strict field sampling schedules for personnel that removed subjectivity in an attempt to create unbiased estimates of estuary and shore-based catch. Sample design changes did not significantly impact sampling efficiency. Mean interviews per day for the new design were similar to those collected during previous shore and estuary surveys. Estimates of catch and CPUE were produced, but measurements of variance and error were not completed and further analysis is necessary.

In addition to the angler intercept survey, phone and mail surveys were executed simultaneously to create estimates of statewide recreational fishing effort for marine target species. The goal of this portion of the pilot study was to evaluate potential bias and precision of phone and mail surveys and compare effectiveness and expense. Results demonstrate that a mail survey was a practical alternative to a phone survey, however, further evaluation of survey error sources are needed, as both surveys produce different biases in their estimates. Mail survey effort estimates were more precise than those created by a phone survey, with reduction in the percent standard error for all modes of fishing, and the inclusion of an incentive decreased overall mail survey costs per returned response by 21%. Mail survey costs were greater than phone survey costs, however, response rates for the mail survey, with the inclusion of an incentive, were nearly double those of the phone survey.

This project was designed to assess the need and cost of implementing an improved shore and estuary boat survey statewide. ODFW is currently seeking funding to expand and continue this pilot project.

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III) 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 and marine protected areas with 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 2017. More information is available on the Oregon Marine Reserves website at OregonMarineReserves.com.

a. Management – 5 Year Program Review

Harvest restrictions began in specific reserve sites in 2012, and as of the beginning of 2016, all reserves have areas fully closed to resource extraction and ocean development. Monitoring and research for the oldest marine reserves began prior to harvest restrictions in 2010.

The Marine Reserves Program met with the Oregon Scientific and Technical Advisory Committee (STAC) in Corvallis, Oregon on Thursday April 13, 2017 to discuss:

- The ODFW Marine Reserves Program's management, research, and monitoring activities accomplished and lessons learned since the program's inception in 2009.
- Planning for the Marine Reserves Program evaluation due in the year 2023, as required by the state legislature

A copy of the meeting agenda, a summary of the discussions had throughout the day, a timeline for the Program evaluation, and copies of the presentations given by ODFW staff are available on the Oregon Marine Reserves website at http://oregonmarinereserves.com/2017/05/15/review_updates/.

b. Monitoring

We conducted monitoring and research at four marine reserve sites this past year at Cape Falcon, Cascade Head, Otter Rock, and Redfish Rocks. Sampling was conducted both in the reserves, and in comparison areas outside of the reserves still open to fishing. Surveys conducted this year as part of our ongoing long-term monitoring included:

- Hook and line surveys
- Longline surveys
- SCUBA surveys
- ROV surveys (led by the ODFW Marine Habitat Project)
- Juvenile fish recruitment surveys (led by Oregon State University)
- Ocean acidification monitoring in rocky intertidal areas (led by PISCO-Oregon State University)
- Sea star wasting disease recovery monitoring in rocky intertidal areas (ODFW and The Nature Conservancy)

In addition, an Ecological Monitoring plan was updated in 2017 (ODFW 2017) that details the Marine Reserve program goals, ODFW's general approach to ecological monitoring and research in the marine reserves, and site-specific monitoring plans for each of the five Oregon marine reserves. The Human Dimensions Monitoring plan was also updated in 2017. This plan describes the Marine Reserve program's approach to socioeconomic research and monitoring of Oregon's marine reserve system, and includes

studies relating to the social and economic characterization of the reserves, attitudes and perceptions of Oregon residents towards marine reserves, and an evaluation of the value of the reserves to both local residents and to the state of Oregon. Both of these plans are available at oregonmarinereserves.com.

c. Research

The Marine Reserve program completed a pilot study looking at the use of a stereo video system for use in our video lander and SCUBA surveys. The pilot study looked at whether this technology might be used in these surveys to provide more accurate fish length data. The pilot study is currently being written up as an ODFW Information Report (Huntington and Watson in prep).

IV) Review of Agency Groundfish Research, Assessment and Management

a. Hagfish

i. Research

No research on hagfish was conducted by ODFW in 2017.

ii. Assessment

No hagfish assessments were completed by ODFW in 2017.

iii. 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 2017 were 1,630,061 pounds, higher than 2016 landings, which were the lowest on record since hagfish were first reported on fish tickets in 2010. No major management actions were taken in 2017 by ODFW.

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b. Dogfish and other sharks

There were no research, assessment or management activities related to dogfish or other sharks by ODFW in 2017.

c. Skates

There were no research, assessment or management activities related to skates by ODFW in 2017.

d. Pacific cod

There were no research, assessment or management activities related to Pacific cod by ODFW in 2017.

e. Walleye Pollock

There were no research, assessment or management activities related to Walleye pollock by ODFW in 2017.

f. Pacific Whiting

There were no research, assessment or management activities related to Pacific whiting by ODFW in 2017.

g. Grenadiers

There were no research, assessment or management activities related to grenadiers by ODFW in 2017.

h. Rockfish

i. Research: Deacon Rockfish Offshore/Nearshore Population Comparison Study

It has recently been acknowledged that fish previously referred to as blue rockfish (*Sebastes mystinus*) throughout California and Washington marine waters are actually a pair of cryptic species, the blue rockfish and the recently described deacon rockfish (*Sebastes diaconus*). The two species look very similar, however, diagnostic characteristics for species identification have been determined. Recently some new, species-specific life history information, including data on growth and female length and age at maturity, have been developed to facilitate stock assessments for the two species.

Video lander observations of deacon rockfish from Oregon waters suggest that while adult and juvenile deacon rockfish are frequently seen together in nearshore waters, offshore schools from about 40-70 fathoms are comprised of mostly large individuals (ODFW unpublished data). Deacon rockfish exhibit strong sexual dimorphism in size, with males being smaller than females at all ages (Hannah et al. 2015, Love et al. 2002), raising the question of how this apparent ontogenetic migration influences the age and sex composition of nearshore and offshore segments of the population. Fishery-dependent data used in stock assessment of these two species is almost exclusively from the hook and line commercial and recreational catch taken from the nearshore segment of the population. Data on the size, age and sex composition of the offshore segment of the population therefore may aid in determination of the structure of stock assessment models. Gathering such information is the objective of this research.

Deacon rockfish were collected monthly at offshore and nearshore sites during favorable weather periods out of Newport, Oregon. So far samples have been collected on multiple dates from December 2016 to November 2017. The offshore study area is Stonewall Bank and the surrounding area out to 146 m of water depth. The central coast, nearshore study area includes Seal Rock reefs and Siletz reefs. Recreational hook and line gear is 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 about 8 cm, helping to offset gear-related bias in size-selectivity of typical hook and line fishing gear.

Approximately 50 deacon rockfish are collected per reef area per sampling day. Samples from the chosen nearshore reefs and Stonewall Bank are collected within 24 hours, except on 8/08/17 at Seal Rock when samples were difficult to obtain and had to be augmented with additional samples collected on 8/16/17 at Siletz Reef. Fish are be placed on ice at sea and sampled in the laboratory after returning to port.

Fish were measured (cm, fork length) and sexed and otoliths collected for age determination. Ovaries and testes were examined and assigned a maturity stage following the criteria of Westrheim (1975). For females, a small section of ovary from fish in stages 1, 2, 3, 6 and 7 are collected and placed in cassettes

for histological preparation and microscopic evaluation of maturity. Ovary samples are preserved in 10% buffered formalin and later transferred to 70% ethanol for storage. Ages are determined using the break and burn technique applied to sagittal otoliths (Chilton and Beamish 1982) 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 and under in length, a caudal fin snip was taken and stored in 100% ethanol (molecular grade) for DNA analysis to confirm species identification. Finally, on both 10/05/17 and 11/06/17, 50 fin clips (25 nearshore and 25 offshore) were preserved in ethanol. These samples were used for RAD-seq analysis of potential nearshore and offshore population structure. Age and sex composition was compared for the two segments of the population.

Preliminary analysis of these data suggest the offshore segment of the population is, as hypothesized, older and larger; however, it should be noted small young-of-the-year specimens were collected offshore, suggesting settlement does occur offshore. Length at age fits with von Bertalanffy growth curves differed with sex and area. However it is likely the differences in area are due to the lack of small fishes in the offshore segment of the population anchoring the curve close to the origin. Calculation of a length-weight residual condition index, indicates that the offshore segment of the population is, in general, in poorer condition than the nearshore segment of the population. Average monthly gonadosomatic index values and mean oocyte diameters indicate that October-December are the best months for histological examination of female ovaries. Using the histological analysis from these months suggests there is little difference in age or length at 50% maturity between the offshore and nearshore segments of the population. Finally, very preliminary analysis of the genetic population structure indicates the nearshore and offshore segments of the population mix and are ultimately a single population.

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ii. Research: Movements of Deacon Rockfish (*Sebastes diaconus*).

In May 2016, the At-Sea Research team initiated a pilot study to investigate the movements of deacon rockfish, in the nearshore reef area of Seal Rocks, Oregon. Deacon rockfish are particularly vulnerable to fatal injuries from barotrauma and show reduced submergence success with rough handling (being dropped on the deck), so a number of techniques were utilized to mitigate this challenge. First, large fish were used to compensate for the weight and size of the tag, so fish tagged were females ranging in size from 33-41 cm. Second, fish were captured hook and line in water depths less than 26 m and were immediately recompressed in drum-type cages. Fish were held at depth for 24 hours to resolve barotrauma *before tagging.* Finally, external tagging methods were employed to attach acoustic tags to avoid trauma, surgery and venting needed to create room in the body cavity. After tagging, all fish were able to swim down under their own power, without recompression assistance.

Fish were tagged with Vemco coded tags which transmit and ID, depth, and accelerometer (activity) data. The acoustic array included a 21 receiver VPS high-resolution grid (250 m spacing) and a 19 receiver perimeter "fence" placed several hundred meters outside the array (500 m spacing) to detect any fish leaving the area. Additionally moored was a CTD/O2 sensor, scattermeter and a light meter. The VPS and Fence arrays were pulled 9/30/16, but due to the continued presence and high detectability of six fish, we elected to leave a 9-receiver "presence/absence" array in place over winter.

Three fish tags were confirmed inactive (one in May, 2 in July) either in the array or on the fence. Two fish are missing: one resided on the fence for several weeks before departing and the other tag was detected leaving the area through the fence. However six fish remained within the array, demonstrating very high

detectability and high site fidelity for the entire seven month study period. Preliminary analysis of activity levels shows definitive patterns of activity, depth distribution, and home range, as well as a disruption of that pattern for all six fish, during a period of summertime hypoxia.

The deacon rockfish acoustic telemetry array continued to provide movements data on fish throughout the winter of 2016 through March 2017, when the tag battery life ended, as predicted. We reduced the original array to nine Vemco VR2W acoustic receivers spaced approximately 450 m apart, and placed it within the original rocky reef array area to serve as a presence/absence type detection system. This wintertime receiver array covered an area approximately 1.35 km^2 and was deployed 9/30/2016 and remained through April 18, 2017, with downloads on 11/18/16, 1/29/17, and 4/18/17. One mooring was found missing on the final grid removal. Five deacon rockfish remained present and well-detected in the grid through the duration, and tags provided consistent activity and depth data during that time. One fish tag was no longer detected on 1/18/17, suggesting departure from the array area.

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iii. Assessment

Marine Resources Program staff contributed to federal stock assessments for multiple rockfish species in 2017. These species include assessments for: Pacific Ocean perch, darkblotched rockfish, yelloweye rockfish, yellowtail rockfish and a combined blue and deacon rockfish assessment. MRP staff took part in a groundfish pre-assessment workshop with federal stock assessors and Pacific Fishery Management Council staff in March 2017. This workshop detailed available data sources and provided preliminary staff input for each of the assessments. Staff were formal members of Stock Assessment Teams and participated in multiple Stock Assessment Review (STAR) panels throughout the summer of 2017. The level of involvement differed depending on the assessment, and ranged from data creation and contribution, providing input on model structure and development, and co-authorship (Dick et al. 2017). Assessments are available from the Pacific Fishery Management council website: https://www.pcouncil.org/groundfish/stock-assessments/by-year/gf-2017/. Finally, MRP staff also participated in a stock assessment process review workshop in December 2017 to review the process and recommend improvements for the following assessment cycle.

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iv. Management: 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 development of the open access nearshore fishery in the late 1990's. The commercial nearshore fishery exclusively targets groundfish, including black rockfish, blue/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. Fish landed in this fishery supply mainly live fish markets, but also provide product for fresh fish markets. Landings are regulated through two-month trip limits, minimum size limits, and annual harvest guidelines. Weekly updates on landings allow MRP staff to effectively manage the fishery in-season. Landings from 2016 commercial nearshore fishing, logbook compliance, economic data, and biological data were published in the 2016 Commercial Nearshore Fishery Summary (Rodomsky & Calavan 2017). The majority of active fishery 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.

ODFW also analyzed a mailer survey that gauged permit holders' satisfaction levels with current commercial nearshore management and learned permit holders generally support the current State limited entry management system. Detailed results from that survey are available in the 2016 Commercial Nearshore Fishery summary.

In 2017, commercial harvest guidelines changed from 2016 levels for Black Rockfish, Other Nearshore/Blue/Deacon Rockfishes and Greenling. The commercial Black Rockfish harvest guideline was cut by approximately 10% as a result of the 2015 federal stock assessment. 2017 in-season management resulted in increases to two-month trip limits for only black rockfish with no decreases to other species groups. The 2017 federal Minor Nearshore Rockfish ACL was increased as a result of the 2015 China rockfish stock assessment. As a result, the State commercial harvest guideline for Other Nearshore, Blue and Deacon Rockfishes increased 25% allowing for higher trip limits for Other Nearshore, Blue and Deacon Rockfishes relative to 2016. Landings of Other Nearshore, Blue and Deacon Rockfishes exceeded the combined 2017 harvest guideline for these species by 0.6% due to the exceptional weather driving record effort and greater than projected landings in December. Commercial landings of Other Nearshore rockfish total 9.0 metric tons and landings of blue and deacon rockfish total 5.3 metric tons. Commercial landings of black rockfish did not exceed the 2017 harvest guideline. Commercial landings of black rockfish, including estimated discard mortality, total 125.9 metric tons.

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v. Management: Recreational fishery

Black rockfish (*Sebastes melanops*) remains the dominant species caught in the recreational ocean boat fishery; however, the black rockfish harvest limit decreased in 2017 and will continue to decrease for the next several years as a result of the 2015 federal stock assessment. As in recent years, the retention of yelloweye rockfish (*S. ruberrimus*) was prohibited year round. In order to remain within the yelloweye rockfish impact cap (via discard mortality), the recreational groundfish fishery was restricted pre-season to inside of 30 fathoms from April 1 to September 30. However, in 2017, black rockfish became 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. New in 2017, the retention of canary rockfish (*S. pinniger*) was allowed, due to the stock being declared rebuilt from its 2015 federal stock assessment, and the annual catch limit increasing substantially.

Even with pre-season adjustments, the recreational bottomfish fishery closed in mid-September due to the attainment of several harvest limits. The federal annual catch limit for black rockfish in Oregon was exceeded by 16.1 metric tons (3.1%) in 2017, due to the recreational fishery exceeding its state harvest guideline. The commercial nearshore fishery did not exceed its harvest guideline for black rockfish in 2017. Changes to the management of the recreational fishery will be explored in 2018, with input from stakeholders, in order to prevent exceeding harvest guidelines in the future.

Beginning on October 1, targeting of flatfish species (flounders, soles, sanddabs) and mid-water rockfish species with longleader gear only was allowed outside of 40 fathoms. The groundfish bag limit was increased to 10 fish during this time period. This gear type targets underutilized stocks of primarily

yellowtail and widow rockfish, while maintaining low bycatch levels of nearshore species and benthic-associated overfished species, such as yelloweye rockfish. Longleader gear has been allowed for recreational fishing since 2007, however, effort has been limited. There were numerous outreach activities to promote the opportunities available from the longleader fishery in 2017, as detailed below.

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vi. Management: Outreach

To reduce bycatch mortality of overfished rockfish species in the recreational 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 15,000 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 appears to be very successful. Prior to the beginning of the campaign, fewer than 40 percent of anglers used descending devices. After the campaign, the percentage of users increased to greater than 80 percent. The percentage of users has remained at approximately 60 percent over the last two years.

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 usage rates to approximately 94 percent for 2017. Additional outreach efforts include: videos online that show fish successfully swimming away after release with a device, rockfish barotrauma flyers have been produced, and videos on how to use the various descending devices have been produced. 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.

Additionally, ODFW has been educating anglers on a new opportunity to use what is termed longleader gear to target underutilized midwater rockfish species such as yellowtail (*S. flavidus*) and widow (*S. entomelas*), 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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i. Thornyheads

There were no research, assessment or management activities related to thornyheads by ODFW in 2017.

j. Sablefish

There were no research, assessment or management activities related to sablefish by ODFW in 2017.

k. Lingcod

i. Research

There were no research activities related to lingcod conducted by ODFW in 2017.

ii. Assessment

Marine Resources Program staff contributed to the federal stock assessment for lingcod in 2017. MRP staff took part in a groundfish pre-assessment workshop with federal stock assessors and Pacific Fishery Management Council staff in March 2017. This workshop detailed available data sources and provided preliminary staff input for each of the assessments. MRP staff participated in the Stock Assessment Review (STAR) panel for lingcod during the summer of 2017. The lingcod assessment is available from the Pacific Fishery Management Council website: https://www.pcouncil.org/groundfish/stock-assessments/by-year/gf-2017/. Finally, MRP staff also participated in a stock assessment process review workshop in December 2017 to review the process and recommend improvements for the following assessment cycle.

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iii. Management

Lingcod are landed in both the commercial and recreational fisheries in Oregon. Commercial lingcod landings from both the open access and limited entry sectors are monitored weekly in conjunction with the nearshore commercial groundfish fishery. Commercial landings in 2017 increased to 72.7 metric tons, from 53.3 metric tons in 2016. In the recreational fishery, lingcod is currently managed under a two fish bag limit with a minimum size limit of 22 inches. Following the closure of the nearshore recreational groundfish fishery in mid-September 2017, lingcod was re-opened in late September for spearfishing gear only. Total recreational landings, including discard mortality, for lingcod are 176.9 metric tons in 2017.

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l. Atka mackerel

There were no research, assessment or management activities related to Atka mackerel by ODFW in 2017.

m. Pacific halibut & IPHC activities

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 coordination. Marine Resources Program staff continued to participate in the IPHC annual meeting, at which the results of the coastwide halibut stock assessment are presented and management for the coming year is determined. In 2017, the IPHC recommended an annual catch limit for Area 2A (Oregon, Washington, and California) of 1.33 million pounds, an increase of approximately 16% from the 2016 2A catch limit. The recreational fishery for Pacific halibut in Oregon is managed under three subareas with a combination of all-depth and nearshore quotas. In 2017, the Columbia River subarea quota was 12,709 pounds, the Central Coast Subarea quota was 240,812 pounds, and the Southern Oregon Subarea quota, was 10,039 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 2017 recreational landings in the Central Coast Subarea was 244,046 pounds. Four thousand pounds were transferred into this subarea's quota from the Southern Oregon Subarea inseason, and Central Coast subarea landings attainment was 99.7 percent of the adjusted quota. Landings in the Southern Oregon Subarea were 2,811 pounds (53.5% of the adjusted quota) and in the Columbia River Subarea, landings were 14,014 pounds (109 % of subarea quota).

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n. Other Groundfish species
    i. Kelp Greenling

Kelp greenling (*Hexagrammos decagrammus*) are a component of both the nearshore commercial and recreational fisheries. In 2017, commercial harvest guidelines changed from 2016 levels for kelp greenling. The commercial harvest guideline increased ~625% as a result of an increased federal annual catch limit and new management measures implemented based on the 2015 federal stock assessment of kelp greenling. Commercial fishermen only attained six percent of this new harvest guideline as few fishers targeted this species. However, commercial landings did increase by approximately 26% from 2016, totaling 11.5 metric tons in 2017. The majority of the commercial landings were from hook and line gear in the southern ports. Recreational landings, including estimated discard mortality, totaled 3.2 metric tons in 2017. In mid-September, the nearshore groundfish recreational fishery was closed due to attainment of several harvest guidelines of other groundfish species, and retention of kelp greenling was prohibited for the remainder of the year.

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    ii. Cabezon

Cabezon (*Scorpaenichthys marmoratus*) are landed in both the nearshore commercial and recreational fisheries. Commercial landings, including estimated discard mortality, totaled 29.8 metric tons in 2017, a 94.4% attainment of the annual commercial allocation. Approximately half of the commercial landings are from hook and line and half are from bottom longline gear, and most of the catch occurred in the southern ports.

In the recreational fishery, continuing from previous years, retention of cabezon was prohibited until July 1 to reduce the chances of inseason management action. In order to remain within the yelloweye rockfish impact cap (via discard mortality), the recreational groundfish fishery was restricted pre-season to inside of 30 fathoms from April 1 to September 30. In mid-September, the nearshore groundfish recreational fishery was closed, despite inseason action to slow landings, and retention of cabezon was prohibited for the remainder of the year. Recreational landings and estimated discard mortality totaled 22.3 metric tons in 2017. This exceeded the 2017 Oregon recreational harvest guideline by approximately 33%.

Additionally, the federal Oregon annual catch limit for cabezon was exceeded by 5.1 metric tons (11%) and the federal overfishing limit was exceeded in 2017 by 3.1 metric tons (6.3%). This was primarily due to overages in the recreational sector and was compounded by an unprecedented surge in commercial landings in December, which were more than 12 times higher than average in 2017. This increase in the commercial sector was likely due to a combination of factors, including a delayed commercial crab season and favorable weather and ocean conditions.

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V) Ecosystem studies

a. Combined visual acoustic survey of semi-pelagic rockfish

The purpose of this project is to further the development of a nearshore fishery-independent survey to improve stock assessments and promote sustainable management of nearshore rocky reef fish stocks off of Oregon. The specific goals are to gather detailed data to inform the selection of the optimal combination of visual survey tools and hydroacoustic data collection for quantifying nearshore rocky reef fish abundance and biomass, with a focus on the semi-pelagic rockfish species that are most critical to Oregon's coastal communities. Determining the total abundance of nearshore rockfish species populations would be extremely helpful in developing more reliable stock assessments which routinely struggle with scaling the population size appropriately. This work is supported by a Saltonstall-Kennedy Grant to ODFW. There are two specific objectives for this project.

Objective 1: Assess the effectiveness of paired acoustic and pelagic drop-camera surveys for documenting semi-pelagic rockfish density and biomass.

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 is a core goal of the proposed work. Acquiring drop-camera footage from as many different schools as possible, containing a diversity of species compositions and size distributions, will provide information on the range of school structures and allow for evaluation of the level of sampling effort that would be needed for future broad-scale surveys. Therefore for Objective 1, the focus is to sample as many schools of fish as possible in nearshore waters less than 50 m with high-speed echosounder surveys of subjectively selected reef features to find schools, using the sampling vessel's wide-beam sounder.

Schools of fish were acoustically sampled using a BioSonics DT-X split-beam scientific echosounder with a 200 kHz, 6.5° digital transducer, followed by sampling using a pelagic drop-camera system developed by ODFW. The pelagic drop-camera is an anchored suspended stereo video camera system capable of being deployed at various depths off bottom. In order to obtain adequate stereo video footage for length measurements it was designed to remain upright and orient into the current. In addition to two forward looking stereo cameras, the platform has a downward looking camera to provide fish counts within the acoustic dead zone adjacent to the bottom. The platform is outfitted with sensors to record depth, temperature, camera system tilt and optical back scattering. Tilt data can be used to improve hydroacoustic biomass estimates, and scattering data allows for quantification of fish detectability. Initial findings indicate that the combination of acoustic data and pelagic drop-camera are effective for determining species composition and abundance of semi-pelagic species in Oregon's rocky reefs. The height of the buoyant camera above the bottom is determined by an adjustable attachment to a weight that is lowered to the bottom, resulting in the camera system sampling a known, fixed height above the bottom.

A number of single day cruises have been conducted at different reefs to assess the validity of combining our suspended camera system with the hydroacoustic data to generate population estimates. Preliminary analyses suggests this combination of tools is ideally suited for this project. A preliminary survey of Seal Rock reef has also been completed to provide an extensive mini-survey that can be used as a trial. Based

on previous pit tagging studies, there is an estimate of the abundance of black rockfish in this area. Therefore the results of the combined video-hydroacoustic survey can be compared to the pit tagging population estimates as a base calibration. Finally, a subset of videos are currently being analyzed to determine what video review methodologies will maximize efficiency while ensuring precise and accurate data. All of these data are being used to assess uncertainity and help in overall survey design and parameterization through the development of a survey simulation.

Objective 2: Assess the importance of near-bottom fish (including target species and non-target species) for interpretation of acoustic-based abundance estimates. Evaluate the ability of three visual survey tools (drop-camera, lander, ROV) to quantify the contribution of these fish to total abundance for target species. While the pelagic drop-camera has been developed specifically for use with the acoustic system, there is the potential for bias in its sampling frame, as it is geared towards mid-water column data collection, and therefore may underestimate abundance and bias species compositions by not sampling near-bottom species that are acoustically detected. Additionally, an inherent feature of acoustic data collection is the presence of a near-bottom "dead zone" in high relief habitat. MRP has an ROV that is capable of capturing species composition and length distributions of benthic fish, including those adjacent to or within the acoustic dead zone. By evaluating each of these tools, in concert with the acoustic and pelagic drop-camera combination, a more complete picture of the species present will be provided and would quantify the importance of regularly sampling the benthos during a nearshore survey. To evaluate this objective, multiple reefs will be surveyed with all four sampling tools. Densities of near-bottom fish will be compared from all three tools or tool combinations, and sampling area population estimates will be produced. Field work for this objective is proposed for spring and fall 2018.

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b. Surveys of subtidal rocky areas with the video lander

Video lander survey data from an approximate 30.2 km2 area of subtidal nearshore rocky reefs in the marine waters from Cape Foulweather to Alsea Bay Oregon was analyzed in 2017. The focus of the work was to investigate the use of the video lander as a tool to characterize the fish community and habitat characteristics and evaluate the potential for a lander to provide density and abundance estimates for fish species. Sixteen fish species were observed on 145 lander drops, with the blue/deacon rockfish complex being counted as one. The frequency at which species were observed varied from 53.1 % for kelp greenling to 0.7 % for wolf-eel and tiger and yelloweye rockfish. Based on the sum of MaxN species counts, the maximum number visible in a single frame, ten species made up more than 99 % of the fish identified to species with the remaining six species combined making up less than 1 % of the total. Density and abundance estimates for species observed were calculated and compared the estimates for black rockfish, which had the highest density and abundance for the species observed, to abundance estimates derived from previous PIT tag work in the same area. Preliminary estimates from both the video lander and the PIT tag project were of a similar magnitude. Bedrock was the most frequently observed primary substrate, occurring in 82 (57%) of the samples. A diversity of substrate types were observed in the study area, with 29 distinct combinations of primary and secondary substrate types occurring in the samples.

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c. Aging Activities

During 2017, 5,204 age estimates were produced from recreational and commercial sampling for research and assessment purposes from three rockfish species, including black, blue and deacon rockfish. With the primary goal of preparing for the 2017 combined blue and deacon rockfish federal stock assessment, 2,409 commercial blue and deacon rockfish structures were aged. Additionally, MRP staff re-aged, or tested, samples from both the commercial and recreational fishery to provide estimates of aging error for blue and deacon rockfish. A total of 446 commercial structures (18.5%) and 64 structures from the recreational fishery (19.6%) were aged a second time. While the MRP aging lab did not age the lingcod fin rays needed for the 2017 federal lingcod stock assessment, staff cut and mounted onto slides 1,040 fin rays for aging by an outside lab.

Post stock assessment, work continued with aging black rockfish (recreation collection: 545 aged, 110 tested) and fulfilling aging requests for blue and deacon rockfish research (1081 aged, 223 tested).

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d. Habitat Studies

i. ROV surveys of Cascade Head and Cape Perpetua Marine Reserves

Remotely operated vehicle video surveys were conducted in Cascade Head Marine Reserve and associated comparison areas in May 2017, contributing to ongoing monitoring efforts for this recently established reserve. Thirty-two dives were conducted, each targeting a 500 m transect. Cape Perpetua Marine Reserve was also surveyed, adding to a time series of observations originating in 2001. Stereo video was added to the standard Phantom ROV equipment, providing improved estimates of fish sizes and transect width.

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ii. Development of new approaches for stereo-video transects

A project was initiated to develop and test equipment and techniques for conducting stereo video transects from a small boat. The cost and logistical/vessel constraints of large ROV surveys, and the availability of affordable new technologies, spurred this effort to fill in gaps in MRP's survey capabilities, with the ultimate goal of conducting inexpensive single-day habitat, groundfish, or invertebrate surveys from ODFW boats to augment larger-scale multi-day ROV surveys. The design settled on a small hand-deployable and affordable ROV as the platform for carrying stereo GoPro cameras and additional lights. The platform was tested in the context of a study to investigate the use of stereo video for assessing red sea urchin populations at depths below those accessible by SCUBA divers. Despite substantial technological hurdles associated with the adoption of this low-cost ROV, built on open-source software, the project demonstrated a high potential for the approach. The ROV is configured to either fly freely in standard transects, or to be towed near the sea floor in suitably low-relief areas.

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iii. Pilot Study: Evaluation of acoustic-based habitat assessment

ODFW's acquisition of a BioSonics DTX split-beam scientific echosounder provided an opportunity to evaluate approaches to classifying substrates in unknown areas, particularly in the so-called "white zone", inshore of the shallow limit of existing multibeam bathymetry and backscatter survey data, and also in

other distinct habitats of interest such as sand dollar beds. In conjunction with the development of towed stereo video techniques (described above), Habitat project staff tested deployment methodologies and data analysis approaches for acoustically classifying substrates, using groundtruth video data acquired synchronously with the acoustic data acquisition. Results demonstrated consistent ability to differentiate groups of substrates, but struggled with the consistency of low-relief type classifications across surveys conducted at different depths and on different days. The development of a data library representing known substrate classes, against which new survey data could be compared, shows promise for improving the ability to resolve substrate types.

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VI) Publications

Dick, E., A. Berger, J. Bizzarro, K. Bosley, J. Cope, J. Field, L. Gilbert-Horvath, N. Grunloh, M. Ivens-Duran, R. Miller, K. Privitera-Johnson, & B. Rodomsky (2017) The Combined Status of Blue and Deacon Rockfishes in U.S. Waters off California and Oregon in 2017. https://www.pcouncil.org/groundfish/stock-assessments/by-year/gf-2017/. 413pp.

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Huntington, B. & J. Watson (2017) Tailoring Ecological Monitoring to Individual Marine Reserves: Comparing Longline to Hook-and-Line Gear to Monitor Fish Species, Marine and Coastal Fisheries, 9:1, 432-440.

Oregon Department of Fish and Wildlife (2017) Marine Reserves: Ecological Monitoring Plan. http://oregonmarinereserves.com/. 32 pp.

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