OREGON'S GROUNDFISH FISHERIES AND INVESTIGATIONS IN 2016

OREGON DEPARTMENT OF FISH AND WILDLIFE

2017 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 is based in Newport at the Hatfield Marine Science Center, with 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 and the International Pacific Halibut Commission. 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 $8.75 million, with about 77% 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 the remaining 23% of the annual program budget.

II) Surveys

a) Sport Fisheries Monitoring

Sampling of the ocean boat sport fishery by MRP's Ocean Recreational Boat Survey (ORBS) continued in 2016. 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 2016. 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 2016 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, 2017-2018, and beyond.

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b) Commercial Fisheries Monitoring

Data from commercial groundfish landings are collected throughout the year and routinely analyzed by ODFW to provide current information on groundfish fisheries and the status of the stocks. This information is used in management, including in-season adjustments of the commercial nearshore fishery, which is conducted in state waters, and for participation in the Pacific Fisheries Information Network (PacFIN). Species composition sampling of rockfish and biological sampling of commercially landed finfish continued in 2016 for commercial trawl, fixed gear and hook and line landings. Biological data including length, age, sex and maturity 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

Sampling tools for collecting biological data from commercial groundfish landings have not changed in many years. Currently, lengths are determined on manual plastic length boards. Data are recorded on paper datasheets, and transcribed and entered into spreadsheets once back in the office. Funding was secured in 2015 to acquire and test new electronic-based system that includes an electronic length board and scale connected to tablets for commercial landings in 2016. Field and office based tests collected data on effort, precision and accuracy of the new electronic system throughout 2016 to compare with the existing paper-based system. Study design was finalized in early 2016, and testing occurred during the second half of 2016 and early 2017. Preliminary results indicated that the electronic system did not save sampling time in the field, but did save time in the office (data entry) time component, particularly with large samples. A final report for the project will be developed in 2017.

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d) Pilot study – Reinitiating the Shore and Estuary Boat Survey (SEBS)

In July 2005, sampling of the shore and estuary fishery was discontinued due to a lack of funding. Marine finfish catches outside the ocean boat modes have not been sampled since. In late 2015, ODFW received funds from two outside sources to resume a survey of limited scope for estimating shore and estuary marine finfish catches in 2016. This pilot study includes two main components – an angler intercept survey and a fishing effort survey that compares effort estimates from both phone and mail surveys.

In preparation for data collection (a) the angler intercept survey was redesigned by the SEBS coordinator and the SEBS advisory team, (b) a database was designed by ODFW staff to collect angler interview data electronically on hand held instruments (i.e., NOMADS), and (c) phone and mail survey instruments were constructed for offsite data collection. Shore and estuary boat angler catch data was collected through an in-person angler-intercept survey for Lincoln County, and statewide marine effort data was collected using phone and mail surveys for recreational trips taken from May 1 through October 31, 2016.

Data analysis is currently in progress. If this project is successful, we will develop improved estimates of finfish catch in bays and estuaries and from the shore. In addition, this project will directly compare and evaluate use of phone and mail surveys to estimate recreational fishing effort off Oregon. This

comparison will allow us to select the best method to estimate fishing effort for a potential SEBS program.

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III) Marine Reserves

a) Management

The ODFW Marine Reserves Program is responsible for overseeing the management and scientific monitoring of Oregon's five marine reserve sites. ODFW has launched a new Oregon Marine Reserves website: OregonMarineReserves.com. Also, a new Oregon Marine Reserves *Ecological Monitoring Plan* was released in 2015, which includes information on survey study designs, the four core monitoring tools used by the Marine Reserve Program, and site specific monitoring plans and timelines for ecological surveys. Finally, harvest restrictions began at Oregon's fifth and final marine reserve site, at Cape Falcon, on January 1, 2016.

b) Monitoring

Hook and Line Surveys: The ODFW Marine Reserves Program continued hook and line surveys in 2016 at two of the marine reserves: Cape Perpetua and Cascade Head and their associated comparison areas. Data collection was broken into two periods: Spring (April-May) and Fall (September-October). Surveys were conducted on 18 at-sea fishing days with the assistance of 84 volunteer anglers. Although each site is unique in species composition, the 2016 survey caught a total of 2,855 fish, representing 16 species and three families.

Lander Surveys: In 2016, the ODFW Marine Reserves Program completed lander surveys at Cascade Head, Cape Falcon, and Otter Rock marine reserves and their associated comparison areas. A total of 174 drops were conducted with 46% meeting requirements for view, habitat and visibility. Surveys were conducted March - May and August-September of 2016. The drops conducted at these three sites contained observations of nine different species from four families.

ROV Surveys: The Marine Habitat project conducted video transect surveys of seafloor habitats, fish, and invertebrates using a remotely operated vehicle (ROV) at Redfish Rocks Marine Reserve and its two nearby comparison areas, Orford Reef and Humbug Reef. These surveys were part of the ecological assessments for this Marine Reserve that was closed to fishing in 2010. Over 8 days in April and May 2016, at total of 74 transects were conducted at the three sites in water depths between 18 and 45 meters.

ROV surveys were also initiated for Cascade Head Marine Reserve and its two comparison areas, Cavalier Reef and Schooner Creek. Two days of transects were attempted in October 2016, but unsuitable visibility and poor ocean conditions forced the postponement of the rest of the intended survey to spring 2017.

Both 2016 surveys incorporated a new stereo camera approach in addition to the traditional HD video main camera. GoPro cameras were mounted in custom dive housings in a stereo configuration on the front of the ROV, allowing the measurement of length for many of the fish observed.

c) Research

Development and Testing of a Fishery-independent Longline Method for Studying Demersal Fishes on Nearshore Rocky Reefs:

While in the early stages of establishing robust, long-term monitoring protocols for evaluating fish communities in Oregon's system of marine reserves, the ODFW Marine Reserve Program is experimenting with alternative fishery-independent methods tailored to each specific reserve site. In 2016, the longline pilot study was continued for the second year and conducted concurrently with a hook-and-line survey in an attempt to increase the catch of species of interest (e.g. rockfishes such as Quillback, Copper, China, Vermilion, and Yelloweye), that are valued in the local fishery surrounding Redfish Rocks Marine Reserve. Our objectives were threefold. First, we sought to document selectivity, or the probability of observing a species, among the sampling approaches. Second, we wanted to compare the observed species richness, catch rate (i.e. CPUE at the day scale) and size distributions for fish species among the sampling approaches. Finally, we sought to compare the cost-benefit of each approach including survey costs, workforce needed and prevalence of body injury and mortality on fishes by sampling method.

Over 12 days of sampling (2015-16), a total of 638 fishes were caught on longline, while 655 fishes were caught on hook-and-line. Twelve species comprised >1% of the catch. Daily catch rates between the two gear types were comparable (longline mean: 54.17 fish/day ± 3.92 SE; hook-and-line mean: 55.08 fish/day ± 8.23 SE) and did not differ statistically (two sample t-test, t-ratio= -1.58, $P = 0.14$). While total number of fishes landed were similar between the gear types, the species composition of those landed fishes differed significantly among the gear types (ANOSIM: Global $R = 0.80$, $P < 0.01$). Species-specific catch rates per sampling day differed among the two gear types. Black Rockfish, the dominant species observed, were more than twice as abundant in the hook-and-line catch as the longline catch. Hook-and-line gear also caught significantly more Kelp Greenling. However, for the remaining 10 species, longline daily catch rates equaled or exceeded the hook-and-line catch rates. For several of the target species, including Cabezon, Copper Rockfish, and Vermilion Rockfish, this difference was significant (t-test or non-parametric Wilcoxon Rank-Sum test; $p < 0.05$).

The sizes of fish caught by the two gear types differed. In general, larger individuals were caught on the longline. For four different species (Blue/Deacon Rockfish, Canary Rockfish, Quillback Rockfish, and Lingcod), this difference in mean size was significant. Longlining resulted in higher incidence of hook damage (7%), bodily injury (3%), and mortality (3%) in the fishes retrieved than hook-and-line gear (5%, 1%, and 0%, respectively). The mortality observed during longlining was restricted to three species groups: Black, Blue/Deacon, and Canary Rockfish and was highest for the Blue/Deacon complex (33% of individuals caught died, largely from predation events from Lingcod). Incidences of observed barotrauma symptoms among the rockfishes were lower for longlining compared to hook-and-line.

With the over-arching goal of improving ODFW's ability to resolve ecological changes within the state's newly established system of marine reserves, this study illustrates how supplementing the existing hook-and-line monitoring surveys with longlines can expand the dataset for currently under-sampled species that are targeted in the local fishery around Redfish Rocks marine reserve. By combining longline and hook-and-line sampling, we will be able to broaden both the species and size ranges we are sampling. This study is an example of tailoring our monitoring efforts to reflect local

fishing activities to help ensure the effects of marine reserve protection are being adequately studied. This pilot study was recently submitted for publication to Marine and Coastal Fisheries.

Construction and Evaluation of a Custom Stereo-Video Lander System:

Stereo-video imagery is becoming a popular non-extractive technique for measuring fish length *in situ.* The importance of understanding population and age structure, using size as a proxy, is a critical component for fisheries management considerations. Particularly in marine reserves monitoring, where documenting ecosystem function is often a key objective, size and age structure provide metrics of biomass and replenishment stability. Stereo-video methods use two cameras mounted on a rigid beam with overlapping fields of view. Through calibrating the dimensions of this overlapping field of view, subsequent observations of fishes and other organisms are possible. The objectives of this pilot study were threefold: 1) develop a stereo video system to take stereo measurements, 2) assess the error variability within the stereo system's field of view, and 3) assess feasibility of a lander platform (for data continuity with current single camera video lander).

Two nearly identical stereo video camera systems were constructed for this project. Both systems were constructed to accommodate two *GoPro™4 Black Edition* cameras in *Sexton™ GoDeep Acrylic* housings, bolted onto an aluminum beam 1cm thick and 60cm long by 8cm wide. The cameras were separated by 44 cm and angled inward at 7 degrees to allow for overlapping stereo images. A custom aluminum lander frame was built to hold two of the stereo systems described above, facing opposite directions. The cameras are positioned at a height of 42cm from the seafloor, to mimic the same height-off-the seafloor the mini-lander systems. The total height of the lander system (66cm) was kept to a minimum in order to increase the ease of hauling it onboard ODFW's *RV Shearwater* with the vessel's davit and pot-hauler.

To test whether error in size estimates varies with fish size and/or video reviewer, five independent reviewers used fish length software to size the 57 fishes at 3m distance, centered in the overlapping field of view of the cameras. To test whether error varies with size and/or distance from the camera the same set of fishes were measured at varying distances (1m, 3m, 5m, and 7m) from the camera. Finally, to test whether error varies for fish size and/or distance off the center line of the camera was tested by measuring the fishes at 3m distance from the cameras and at varying distances (0.5m, 1m, 1.5m, and 2m) off the center line.

Overall the results of this pilot study found that this new stereo lander design is able to collect relative abundance estimates, community composition, and species richness metrics that were collected with the previous lander while also allowing size data to be collected. Video reviewers were able to collect fish size data with this tool, as long as fish are within a meter off center in either direction and are closer than 5m from the camera to still be within the pre-determined margin of error (10%).

More information, including copies of monitoring plans and reports, is available on the Oregon Marine Reserves website at OregonMarineReserves.com.

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IV) Review of Agency Groundfish Research, Assessment and Management
   a) Hagfish

i) Research

No research on hagfish was conducted by ODFW in 2016.

ii) Assessment

No hagfish assessments were completed by ODFW in 2016.

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 2016 were 1,498,829 pounds, the lowest total since hagfish were first recorded on fish tickets in 2010. No major management actions were taken in 2016 by ODFW.

Contact: Brett Rodomsky, (Brett.T.Rodomsky@state.or.us), Troy Buell (Troy.V.Buell@state.or.us)

b) Dogfish and other sharks

i) Research

No research on dogfish or other sharks was conducted by ODFW in 2016.

ii) Assessment

No dogfish or shark assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for dogfish or other sharks by ODFW in 2016.

c) Skates

i) Research

No research on skates was conducted by ODFW in 2016.

ii) Assessment

No skate assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for skates by ODFW in 2016.

d) Pacific cod

i) Research

No research on Pacific cod was conducted by ODFW in 2016.

ii) Assessment

No Pacific cod assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for Pacific cod by ODFW in 2016.

e) Walleye pollock

i) Research

No research on pollock was conducted by ODFW in 2016.

ii) Assessment

No pollock assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for pollock by ODFW in 2016.

f) Pacific whiting (hake)

i) Research

No research on whiting was conducted by ODFW in 2016.

ii) Assessment

No whiting assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for whiting by ODFW in 2016.

g) Grenadiers

i) Research

No research on grenadiers was conducted by ODFW in 2016.

ii) Assessment

No grenadier assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for grenadiers by ODFW in 2016.

h) Rockfish
   i) Research

There were several ongoing research projects for rockfish. These are detailed below.

Combined visual acoustic survey of semi-pelagic rockfish
The goal of our recent stock-assessment-related hydroacoustic research is to determine if we can use a combination of hydroacoustics and stereo-video to estimate the approximate size of major nearshore rockfish populations, primarily black and the deacon/blue rockfish complex. Determining the approximate size of nearshore rockfish species populations should be extremely helpful in developing more reliable stock assessments for fishery management. The first component of this research is to complete what we call the "school study". The objective of the school study is to determine if the estimates of mean target strength produced from hydroacoustic data for individual fish schools (suspended fish) can be used as a proxy to estimate species composition of these schools.

Work has been completed on fabrications and implementation of a live feed GoPro based stereo camera system. This device has been purpose built for a visual component in estimating species and size composition of suspended rockfish schools for use in conjunction with acoustic estimates of rockfish abundance. The data gathered so far suggest a strong possibility of using target strength estimated from hydroacoustic data to estimate species composition, although some video sampling would still be recommended for any survey. Continued sampling during 2017 will be conducted to ensure the target strength method is valid at other locations in the state and to test additional assumptions inherent in a hydroacoustic survey.

Contact: Matthew Blume (matthew.blume@state.or.us)

Yelloweye discard mortality
The study of discard mortality of hook-and-line caught yelloweye rockfish with barotrauma was published in 2016, in Fisheries Research.

Rebuilding of some U.S. West Coast rockfish (Sebastes spp.) stocks relies heavily on mandatory fishery discard, however the long-term condition of discarded fish experiencing capture-related barotrauma is unknown. We conducted two studies designed to evaluate delayed mortality, physical condition, and behavioral competency of yelloweye rockfish, Sebastes ruberrimus, experiencing barotrauma during capture followed by recompression (assisted return to depth of capture). First, we used sea-cage and laboratory holding to evaluate fish condition at 2, 15, and 30 days post-capture from 140 to 150 m depth. All external barotrauma signs resolved following 2 days of recompression, but fish that survived (10/12) had compromised buoyancy regulation, swim bladder injuries, and coelomic and visceral hemorrhages at both 15 and 30 days post-capture.

For the second study, we used a video-equipped sea-cage to observe fish behavior for one hour following capture and return to the sea floor. Trials were conducted with 24 fish captured from 54 to 199 m water depth. All fish survived, but 50% of fish from the deepest depth ranges showed impairment in their ability to vertically orient ($P < 0.01$). Most (75%) deep-captured fish did not exhibit "vision-dependent" behavior ($P < 0.001$) and appeared unable to visually discern the difference between an opaque barrier and unobstructed or transparent components of the

cage. These studies indicate physical injuries and behavioral impairment may compromise yelloweye rockfish in the hours and weeks following discard, even with recompression. Our results reiterate the importance of avoiding fishing contact with species under stock rebuilding plans, especially in deep water, and that spatially-managed rockfish conservation areas remain closed to fishing.

Contact: Polly Rankin (polly.s.rankin@state.or.us.)

Offshore Yelloweye Rockfish Lander Survey
In September, the Research team conducted a one-day test of the most recent version of the baited HD stereo video lander, equipped with a pair of stereo-calibrated high-definition Canon Vixia® HFS21 video cameras, in the relatively deeper (depth range), darker waters of Heceta Banks. A previous survey in 2011 of this area was unsuccessful with standard definition video in imaging yelloweye rockfish, and lead the team to investigate different lighting options. This current configuration has increased the illumination from two Deep Sea Power and Light, LED Mini-SeaLites® (850 lm, 6500 K) to two DSPL Sea Lite Spheres totaling 7000 lm, @ 6500 K. Additionally, a WetLabs ECO-BBB Scattering meter (measuring water clarity) and a Wildlife computer MK9, ambient light, temperature, and depth meter were installed on the frame of the lander to quantify video footage. Yelloweye Rockfish were readily imaged, as were canary rockfish, kelp greenling, a tiger rockfish, and a Deacon Rockfish (submitted as a depth extension to Milton Love). Bottom time was 12 minutes, and bait consisted of herring squid and sardines.

Contact: Matthew Blume (matthew.blume@state.or.us)

Pilot Study: Deacon Rockfish Offshore/Nearshore Population Comparison Study
Fishery-dependent data for the newly described cryptic species, Deacon Rockfish, is largely from the hook and line catch from nearshore areas. ODFW video lander observations show adult and juvenile fish are both present nearshore, but offshore schools observed at Stonewall Banks are comprised of larger fish. In 2016, we initiated a year-long study to capture and sample Deacon Rockfish monthly, in order to provide fishery-independent data on the size, sex, and age composition of both the offshore and nearshore populations. The goal of this study will be to provide data to aid in interpretation of stock assessment models.

In the spring of 2016 we tested and confirmed our ability to differentiate live adult blue and deacon rockfish and to capture small fish of a size not usually landed, but needed for age and length data. We started sampling Dec 2016, and were able to target Deacon Rockfish and catch a wide variety of sizes in the nearshore. Offshore fish collected were considerably larger and small fish remained elusive in that area. Data collection included: photos upon capture, length, weight, gender, gonad weight, gonad histology sample for all females and unknowns, otoliths for ageing, and DNA samples on fish ≤ 21 cm to confirm species.

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Pilot Study: Movements of Deacon Rockfish (Sebastes diaconus)
In May 2016, the At-Sea Research team executed 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 we used a number of techniques to

try to mitigate this challenge. 1. We elected to use large fish to compensate for the weight and size of the tag, so fish tagged were females ranging in size from 33-41 cm. 2. 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.* 3. We used external tagging methods 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 6 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 6 fish remained within the array, demonstrating very high detectability and high site fidelity for the entire 7 months. 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 6 fish, during a period of summertime hypoxia.

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ii) Assessment

Multiple federal rockfish assessments were scheduled to begin in 2016, including blue/deacon rockfishes, yelloweye, yellowtail, and darkblotched rockfish, and Pacific ocean perch. These assessments will be completed in mid-2017. Beginning in fall 2016, ODFW staff were creating data products for all of these rockfish assessments, with a focus on the nearshore species, blue/deacon and yelloweye rockfish. ODFW staff also began the process of assembling data-use agreements, providing background, and disseminating data products to the assessment authors. An ODFW staff member will be on the stock assessment team and a co-author on the blue/deacon rockfish stock assessment.

iii) Management

Commercial fishery: Nearshore rockfish are mainly taken in the commercial nearshore fishery. The commercial nearshore fishery in Oregon 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 more effectively manage the fishery in-season.

2015 reductions to allowable impacts to federal minor nearshore rockfish continued in 2016. To manage to these reductions state trip limits for other nearshore rockfish and Blue/Deacon Rockfishes were reduced from 2014 levels, however set at levels higher than 2015. Landings from 2015 commercial nearshore fishing, logbook compliance, economic data, and biological data were published in the 2015 Commercial Nearshore Fishery Summary (Rodomsky et al. 2016). Overall, 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 continued to comprise the majority of landings. In-season management in 2016 included increases to two-month trip limits for Black rockfish, Blue rockfish, Other Nearshore Rockfish, Greenling, and Cabezon. ODFW also conducted a mailer survey to gauge permit holders' satisfaction levels with current commercial nearshore management. Results from that survey will be available in the 2016 Commercial Nearshore Fishery summary.

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Recreational fishery: Black rockfish (*Sebastes melanops*) remains the dominant species caught in the recreational ocean boat fishery. 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. New in 2015, and continuing in 2016 for the first time since 2004, retention of canary rockfish (*S. pinniger;* one fish sub-bag limit) was allowed, due to increasing trends in the stock abundance.

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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 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 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 near between those two levels, at approximately 60 percent over the last two years. 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.

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i) Thornyheads

i) Research

No research on thornyheads was conducted by ODFW in 2016.

ii) Assessment

No thornyhead assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for thornyheads by ODFW in 2016.

j) Sablefish

i) Research

No research on sablefish was conducted by ODFW in 2016.

ii) Assessment

No sablefish assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for sablefish by ODFW in 2016.

k) Lingcod

i) Research

No research on lingcod was conducted by ODFW in 2016.

ii) Assessment

A federal stock assessment of lingcod was scheduled to begin in 2016, and to be completed in mid-2017. As with the rockfish assessments, beginning in fall 2016, ODFW staff were creating data products for this assessment. ODFW staff also acquired a data-use agreement from the assessment author, provided preliminary assessment data background, and began disseminating data products to the assessment author in 2016. A stock assessment review panel will convene to review the assessment in mid-2017.

Contact: Alison Whitman (alison.d.whitman@state.or.us)

iii) Management

Lingcod are landed both commercially and recreationally. Commercial lingcod landings are monitored weekly as part of the nearshore commercial groundfish fishery. In 2016, nearshore landings were dominated by hook and line catches (84%) and totaled 106,768 pounds. Recreational lingcod landings are monitored by ORBS and subject to a daily bag limit (two fish) and a minimum size limit (22 inches). Recreational landings of lingcod were 142.8 metric tons in 2016.

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l) Atka mackerel

i) Research

No research on atka mackerel was conducted by ODFW in 2016.

ii) Assessment

No atka mackerel assessments were completed by ODFW in 2016.

iii) Management

There were no major management actions taken for atka mackerel by ODFW in 2016.

m) Pacific halibut & IPHC activities

i) Research

ODFW did not conduct any halibut research projects in 2016.

ii) Assessment

ODFW did not complete any halibut assessments in 2016.

iii) 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 2016, the IPHC recommended an annual catch limit for Area 2A (Oregon, Washington, and California) of 1.14 million pounds. The recreational fishery for Pacific halibut is managed under three subareas with a combination of all-depth and nearshore quotas. In 2016, the Columbia River subarea quota was 11,009 pounds, the Central coast subarea quota was 206,410 pounds, and the Southern coast subarea quota, was 8,605 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 2016 recreational landings in the Central coast subarea was 202,651 pounds (98% of quota). Landings in the Southern subarea were 4,173 pounds (48% of quota) and in the Columbia River subarea, landings were 11,896 pounds (108 %).

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n) Other groundfish species

i) Kelp greenling

Kelp greenling are a component of both the nearshore commercial fishery and the recreational fishery. Commercial landings from the nearshore commercial fishery totaled 18,262 pounds in 2016. Recreational catches totaled 5,732 pounds (2.6 metric tons).

ii) Cabezon

Commercial cabezon landings from the commercial nearshore fishery in 2016 were 35,208 pounds. Recreational landings were 11.1 metric tons in 2016. Continuing in 2016, the cabezon season was modified to July 1 through December 31. This allowed the cabezon season to proceed with a lower chance of inseason actions being necessary.

V) Ecosystem Studies

a) Development of a Fishery Independent Survey

The Marine Resources Program in 2016 reiterated its commitment to the development of a fishery independent survey for nearshore groundfish species as a high priority for the MRP. Four working groups were established in 2015 to accomplish this and other identified high priorities, and all working groups continued to meet and move forward with research and projects in support of this goal in 2016. One specific task assigned to the Stock Assessment and Management working group was to host a workshop with federal assessors to invite their input on preliminary designs and tools appropriate for a fishery independent survey. This is detailed in section V.g below.

Multiple projects at MRP have been working on the development of both visual and acoustic tools for the purposes of estimating population size and fish habitat associations of various types of groundfish for many years. Further information on these tools can be found in sections V.b – V.c below and in the Marine Reserves section above (Section III).

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b) Video lander development and surveys

The study investigating the effects of ambient light and turbidity/scattering on the effective sampling range of a stereo-video lander was published in 2016 in Marine and Coastal Fisheries journal.

We studied how variation in seafloor water clarity, ambient light, and fish fork length influenced the maximum detection range of fish with a stereo-video lander on three temperate reefs of different depths (12–40, 44–91, and 144–149 m). Although the results are somewhat approximate and specific to the camera system, the methods we used can be applied to any stereo remote underwater visual survey system. In the 52 total lander deployments distributed between nearshore, mid-shelf and deep-shelf reefs in Oregon waters, seafloor light levels varied over 4 orders of magnitude, primarily as a function of depth. The seafloor scattering index was higher (low water clarity) and highly variable at the nearshore reef and lower (high water clarity) and less variable at the deeper reefs. In the 15 deployments with sufficient numbers of fish for detection range analysis, the mean maximum range of detection across species varied from3.89 to 4.23m at the deep-shelf reef, 3.32–5.55 m at the mid-

shelf reef, and 1.57–3.42 m at the nearshore reef. Multiple regression analysis of the analyzed deployments showed a strong negative relationship between mean maximum detection range and the scattering index but no relationship with log of seafloor ambient light. The lack of a light effect showed that the artificial lights were adequately illuminating the field of view in which fish were identifiable, potentially an important system test for sampling across a range of seafloor light levels. Analysis of detection range versus fish fork length for Blue Rockfish Sebastes mystinus and Deacon Rockfish S. diaconus from a single deployment showed a reduction in detection range for 10–20-cm fish of about 1.15 m relative to the detection range of 25–45-cm fish, or about 41%.

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Surveys of subtidal rocky areas with the video lander: Surveys of shallow (<55 m) subtidal rocky areas were continued in the spring of 2015 in the waters near Newport, OR. This effort focused on exploring the use of the video lander designed by ODFW (Hannah and Blume 2012) as a tool for fishery independent surveys of nearshore rocky reef associated fishes and invertebrates and their habitat associations. In addition to collecting information to classify the primary and secondary substrates in view, water column properties were collected at the drop site using a casting conductivity temperature depth instrument (Seabird 19plus) equipped with an oxygen sensor. In 2015 we sampled 102 stations, adding to the 105 stations sampled in 2014. The lander sampled the bottom for approximately 14 minutes. Initial examination of the video collected in 2014 by both this project and similar video lander tools utilized by the ODFW marine reserves group suggests that the number of fish species seen in the videos collected on Oregon's nearshore rocky reefs tends to level off after approximately 8 to 10 minutes and the maximum number for any given species seen at any one time also occurs within that time frame.

We utilized Canonical Correspondence Analysis (CCA), a direct gradient analysis technique to examine the relationship among a suite of measured environmental gradients and the community of fish species observed. Abundance for 12 species at each location was characterized by maximum number observed in a single frame for each lander drop. Seven types of primary and secondary substrate, five categories of biogenic habitat, time of day, visibility, view, temperature, salinity, depth, dissolved oxygen, latitude and longitude for each sample were some of the environmental variables examined. Raster bathymetry data in ArcGIS was used to derive a number of other environmental variables that were examined including: rugosity at 4, 8, 10, 20, 30, 40 and 50 m extents; the maximum and mean slope at 4 and 30 meters; and the fractal complexity at 10, 30 and 50 m extents. We used CCA to examine data from 51 video lander drops for which all 41 environmental variables were available.

The final selected model included 5 environmental gradients that explained 17.2% of the total inertia in the fish community, with the first three axes of the selected model explaining 81.5% of the constrained inertia. The selected model was: $\log_{10}$(Fish Spp. MaxN) = $\log_{10}$(Longitude) + Large Boulder Primary Habitat + $\log_{10}$(Complexity (50m)) + $\log_{10}$(Complexity (10m)) + $\log_{10}$(Dissolved Oxygen). CCA model results provide coefficients that indicate the relative importance of each environmental gradient along each of the three axes in predicting community composition. CCA also provides species scores that indicate the environmental optima for each species on the three axes with the abundance and/or probability of occurrence for the species decreasing as the distance from the optima center increases. This exploratory analysis was done with a relatively small data set with limited spatiotemporal extent, but it would be beneficial to utilize these techniques with a dataset with greater spatial and temporal coverage.

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c) Acoustic survey development

Surveys for Pacific herring in Yaquina Bay with an acoustic system began in 2014 to estimate spawning population size in early spring. A DT-X acoustic system was purchased from BioSonics Inc. to continue these surveys in 2015 and to expand use of this system to groundfish fishery independent surveys. Accompanying tool development was initiated by the Research Project and infrastructure for acoustic deployment on larger vessels was manufactured in late 2015. Initial testing of simultaneous deployment of the acoustic and drop camera occurred in 2016 and will continue in 2017.

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d) Aging Activities

During 2016, 5358 age estimates were produced for recreation, commercial, and research purposes within the Marine Resource Program. For recreation and commercial programs, 3,476 deacon and 908 blue rockfish ages were produced, with an additional 693 and 182 test ages respectively generated. To fulfill research needs within MRP, 82 black rockfish (17 tested), were aged.

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e) Maturity Studies

In 2016, a report summarizing the efforts within ODFW's Stock Assessment Research Project from 2000 – 2016 to improve maturity data for a variety of groundfish species was completed. The goal of the report is to both provide a status report of past efforts and guide future maturity research efforts. Additionally, new length and age-at-maturity data are provided for two species, China rockfish and cabezon, with data from a greater geographic coverage from originally published. A list of citations and summary age- and length-at-maturity statistics are provided for each species. Database structure is detailed in the report as well. Agency Informational Reports on individual maturity report findings can be accessed at: http://www.dfw.state.or.us/MRP/publications/#Research. The summary report will be posted on MRP's website in 2017.

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f) Historical Catch Reconstruction workshop

Multiple ODFW staff attended a workshop on groundfish historical catch reconstructions in November 2016, in preparation for the upcoming federal stock assessment cycle. Historical estimates of groundfish landings are key to determining unfished biomass levels, a primary component to setting current harvest levels. The purpose of the workshop was to improve understanding of the different approaches used by the state agencies to develop reconstructions, and to highlight major issues related to uncertainties and choices in development of the reconstruction. The workshop focused on years prior to those covered by PacFIN (pre-1981).

ODFW staff presented information on ongoing issues with the Oregon historical commercial reconstruction, a recently identified issue with unspeciated rockfish landings during the PacFIN era for two market categories (URCK and POP), and progress related to the ongoing effort to comprehensively reconstruct historical sport landings. A workshop report was being developed in late 2016 to detail best practices and identify areas of improvement among state reconstructions, and would be finalized in early 2017.

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g) Workshop for Fishery Independent Surveys

Hosted by MRP staff, the "Workshop on Developing Fishery-Independent Surveys to Support Nearshore Stock Assessment" occurred in March 2016, and included experts on stock assessment, fishery-dependent surveys and fishery data from ODFW, OSU, WDFW, CDFW and the Northwest and Southwest Fishery Science Centers. The workshop was held over two days and included updates on fishery-dependent monitoring programs and presentations on tools and techniques to develop nearshore fishery independent surveys. Specific objectives included sharing information on existing surveys and experience with various visual, extractive, tagging, and acoustic tools and methods; identifying opportunities for cooperative work; and discussing pros and cons of various approaches in order to narrow the range of possible survey efforts to those most likely to be informative to nearshore assessments.

There were multiple conclusions drawn from the workshop and its associated discussions. First, that communication and coordination between the state agencies and NFMS is critical. High levels of documentation and standardization are necessary. Uncertainty was identified as an ongoing issue, and quantifying uncertainty is challenging but critically important. Approaches with combinations of multiple tools is needed to adequately survey and provide necessary information and data to stock assessments, including extractive surveys. The overall value of a fishery-independent survey would be to provide population scale estimates, allowing for the calibration of assessment models. A report summarizing the workshop and its outcomes is currently in development.

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VI) Publications

Hannah, R. W. and M. T. O. Blume. 2016. Variation in the Effective Range of a Stereo-Video Lander in Relation to Near-Seafloor Water Clarity, Ambient Light and Fish Length. Marine and Coastal Fisheries: Dynamics, Management and Ecosystem Science Volume 8: 62-69.

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Rodomsky, B. T., T. R. Calavan, and A. L. Carpenter. 2016. The Oregon Commercial Nearshore Fishery Summary: 2015 (pdf). Oregon Department of Fish and Wildlife Marine Resources Program. 51 pp.