California Department of Fish and Wildlife
Agency Report
to the
Technical Subcommittee
of the
Canada-United States Groundfish Committee

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I. Agency Overview

Within the California Department of Fish and Wildlife (CDFW), the Marine Region is responsible for protecting and managing California's marine resources under the authority of laws and regulations created by the State Legislature, the California Fish and Game Commission (CFGC) and the Pacific Fishery Management Council (PFMC). The Marine Region is unique in the CDFW because of its dual responsibility for both policy and operational issues within the State's marine jurisdiction (0 – 3 miles). It was created to improve marine resources management by incorporating fisheries and habitat programs, environmental review and water quality monitoring into a single organizational unit. In addition, it was specifically designed to be more effective, inclusive, comprehensive and collaborative in marine management activities.

The Marine Region has adopted a management approach that takes a broad perspective relative to resource issues and problems. This ecosystem approach considers the values of entire biological communities and habitats, as well as the needs of the public, while ensuring a healthy marine environment. The Marine Region employs approximately 140 permanent and 100 seasonal staff that provide technical expertise and policy recommendations to the CDFW, CFGC, PFMC, and other agencies or entities involved with the management, protection, and utilization of finfish, shellfish, invertebrates, and plants in California's ocean waters. Groundfish project staff are tasked with managing groundfish and providing policy recommendations to the CDFW, CFGC, and PFMC. Other staff work indirectly on groundfish, such as our California Recreational Fisheries Survey staff that sample our recreational fisheries and our Marine Protected Areas Project and their remotely operated vehicle (ROV) work that benefits groundfish. Additionally, Pacific States Marine Fisheries Commission staff sample the state's commercial groundfish fishery.

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II. Surveys

ROV Visual Survey and Analysis for MPA and Fishery Data Needs

CDFW Marine Region's Statewide Marine Protected Area (MPA) Management Project collaborated with Marine Applied Research and Exploration to complete a statewide visual survey using ROV (see 2015 and 2016 TSC reports for description of the program). A total of 142 sites were surveyed from Pt. Saint George (Crescent City) in the north to Point Cabrillo (San Diego); completing 370 kilometers (230 miles) of quantitative transects during 2014-2016. Over 400 hours of video and 45,000 high resolution digital still images were recorded during these transects. Currently, data from all three years of surveys are being analyzed to inform California's MPA and fishery specific management activities. This extensive effort provides much needed fishery independent data for multiple management uses and establishes an unprecedented set of index sites across the entire California coast.

In February 2017, CDFW entered a partnership with University of California Davis, funded by the Ocean Protection Council, creating a postdoctoral fellowship to

develop and integrate spatial modeling techniques for MPA monitoring using CDFW's ROV survey data. Dr. Nicholas Perkins from the University of Tasmania was hired for the fellowship and is currently working with CDFW in Eureka, California. Along with examining MPA performance questions, this work will provide the basis for spatially specific abundance models and expansions, by combining ROV based visual survey data and bathymetric mapping product covariates. Utilizing spatial point process models, the precise location of fish observations and associated habitat covariates can be used to predict total abundance and map species distributions across sites while accounting for spatial autocorrelation in the data. These models perform better than models that use bathymetry derived covariates without accounting for spatial correlation between observations. Model parameter estimates from the spatial point process models are being used to run simulations of sampling effort needed to detect changes over time inside and outside of MPAs. These simulation based power analyses will provide explicit recommendations regarding the sampling effort needed to effectively monitor changes in abundance and size-structure of populations through time. Preliminary results of this work were presented at the 2018 Western Groundfish Conference, and indicated that for some species, a reasonable increase in sampling effort may provide high statistical power for detecting expected changes 3-5 years earlier than with current levels of sampling.

CDFW will present the methods for estimating density of fish per square meter as an index of abundance and total biomass from expansions with data from habitat mapping for select species using design and model based approaches to the PFMC's Scientific and Statistical Committee's off year science and stock assessment methodology review in early 2019. This review will focus on methods to utilize visual based ROV survey data for stock abundance and biomass estimations of select nearshore species. The survey estimates will be evaluated for use in stock assessments as: 1) density estimates as an index of relative abundance, 2) estimates of abundance from habitat area expansions as an index of absolute abundance, 3) absolute estimates of abundance used to scale integrated assessments, and 4) independent estimates of absolute abundance multiplied by current F_{MSY} proxies to derive overfishing limits.

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III. Reserves

Marine Protected Areas Research and Monitoring

California's 124 MPAs were sequentially implemented over four coastal regions (central in September 2007, north central in May 2010, south in January 2012, and north in December 2012) to create a redesigned statewide network of MPAs. California's MPA network is managed collaboratively through the MPA Management Program, which includes four focal areas: outreach and education, enforcement and compliance, research and monitoring, and policy and permitting. With respect to research and monitoring, following regional MPA implementation, each region subsequently entered into Phase 1 of 2 of California's Statewide MPA Monitoring Program.

Phase 1 – Regional baseline monitoring

In early 2018, Phase 1 of the MPA Monitoring Program was completed, yielding an unprecedented amount of high quality scientific information across the state's coastal habitats. Comprehensive ecological, oceanographic, and socioeconomic data were collected, including data from areas that had previously not been extensively characterized. Data and results from Phase 1 are found in individual technical reports for each funded project, as well as a summarized "State of the Region" report (Table 1). This information informed CDFW's 5-year management review regarding the regional MPA implementation. Phase 1 benchmark data and reports provide a resource against which future ecological and socioeconomic changes across the MPA network can be measured.

Table 1. Phase 1 products by region.

North Coast (completed 2018)	North Central Coast (completed 2015)	Central Coast (completed 2013)	South Coast (completed 2017)
Baseline Monitoring Projects (2014-2018)	Baseline Monitoring Projects (2010-2016)	Baseline Monitoring Projects (2007-2013)	Baseline Monitoring Projects (2011-2017)
State of the California North Coast report	State of the California North Central Coast report	State of the California Central Coast report	State of the California South Coast report
CDFW's Management Review	CDFW's Management Review	CDFW's Management Review	CDFW's Management Review

Phase 2 – Statewide long-term monitoring

Building on the local knowledge, capacity, and unique considerations for each region, California is now implementing Phase 2. A Statewide MPA Monitoring Action Plan is currently in development and when finalized will guide future cost-effective long-term monitoring. The Action Plan will take into account MPA design and planning criteria, Phase 1 information, and additional expert input and analyses, in order to identify a priority list of indicator species and index sites for long-term monitoring.

Upon completion of the Action Plan, requests for proposals will be released in Fall 2018. These requests for proposals will fund monitoring projects across a range of habitats spanning the statewide network, and will aid in the evaluation of MPA network performance at meeting the six goals of the Marine Life Protection Act. For those interested in getting involved in Phase 2 development, a public comment period for the draft Action Plan is anticipated in August 2018. You can sign up for the MPA Management Program mailing list to receive updates about the program.

Contributed by Amanda Van Diggelen (Amanda.VanDiggelen@wildlife.ca.gov)

IV. Review of Agency Groundfish Research, Assessment and Management

A. Hagfish

There are two species of hagfish that reside off California, Pacific Hagfish (*Eptatretus stoutii*) and Black Hagfish (*E. deani*). Of the two, the Pacific Hagfish (hagfish) is the preferred species for California's export-only fishery. Using traps, fishers land hagfish in live condition. The hagfish are usually stored dockside until packaged for live export to South Korea where they are sold live for human food. Considered scavengers, hagfish are found over deep, muddy habitat.

1. **Assessmen**t

Little is known about the status or biomass of Pacific Hagfish stocks. Since 2007, CDFW's Northern and Central California Finfish Research and Management Project has been monitoring the fishery and documenting changes in the average weight and spawning status of landed hagfish through dockside sampling. Sampling activity began with the emergence of the fishery in Moss Landing, ended there in 2008 due to market changes, occurred in southern California from 2009 to 2011, and began in Morro Bay in 2010 and Eureka in 2012. The Moss Landing fishery reemerged in 2016 with one vessel making landings of hagfish taken with barrel traps, and sampling resumed. Due to the physical impossibility of accurately measuring hagfish in a live condition, staff employs a count-per-pound method to monitor changes in average size of retained hagfish. Randomly selected hagfish from sampled landings are retained to determine spawning status by sex and length frequency. Landings have been relatively stable from 2010 to 2016, fluctuating between 360 and 833 metric tons (0.8 and 1.8 million pounds) annually with an ex-vessel value of $565,000 to $1.56 million. In 2017 there were 948 metric tons landed for an ex-vessel value of $1.80 million. Fishing effort and export demand is market driven by the South Korean economy and can be influenced by the price and availably of bait and by the fishing activities of Washington and Oregon hagfish fishers.

2. Management

The commercial hagfish fishery is open access; only a commercial fishing license and a general trap permit are required. Hagfish may be taken in 19 liter (5 gallon) bucket traps, Korean traps, or barrel traps with dimensions up to 1.14 m (45 in.) long and 0.64 m (25 in.) outside diameter. The maximum number of traps allowed is 200 bucket, 500 Korean, or 25 barrel traps. Fishers must choose one trap type and may not combine hagfish trap types or have other non-hagfish traps onboard when fishing with a chosen hagfish trap. There is no limit on the number of groundlines for bucket or Korean traps; however, barrel traps may be attached to no more than three groundlines. All traps must have a CDFW approved destructive device and all holes, except for the entrance, in any hagfish trap must have a minimum diameter of 14.2 millimeters (9/16 in.). When in possession of hagfish, no other finfish species may be possessed on board. Currently logbooks are not required for this fishery. There are no annual quotas or minimum size limits.

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B. Groundfish, all species combined

1. Research off California
   Scientific Collecting Permits are issued by CDFW to take, collect, capture, mark, or salvage, for scientific, educational, and non-commercial propagation purposes. Permits are generally issued for three years, except that student permits are for one year. During 2017, Marine Region staff reviewed 92 Scientific Collecting Permits requesting to take groundfish species; an increase of one third compared to the recent annual average number of permits reviewed. While a complete report of groundfish-related research activities isn't available for this report, the permits fall into four broad categories: 1) public display in aquariums and interpretive centers; 2) environmental monitoring; 3) life history studies that include age and growth, hormone assays and genetics for population structure; and, 4) studies related to changing environmental conditions such as ocean acidification and hypoxia.

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2. CDFW Research
   In 2017, Marine Region continued its ongoing research on Yelloweye Rockfish (*Sebastes ruberrimus*). The population off the West Coast was designated as an overfished stock in the early 2000s. Commercial and recreational regulations were implemented to minimize gear interactions in combination with a prohibition on retention (or limited retention in designated fishing sectors) and area closures. As a result, there has been limited opportunity to collect biological information for studying age and growth parameters that are crucial components of stock assessment modeling.

   In 2010, CDFW implemented a data collection policy within the recreational sampling program (California Recreational Fisheries Survey Program; CRFS) to collect Yelloweye Rockfish that are that mistakenly landed by recreational anglers.

   In 2017, CDFW collected 71 Yelloweye Rockfish from the recreational fishing sector. Length, weight, sex, and otoliths were collected from specimens. Fish ranged in length from 249-632 mm in total length, and were approximately 40 percent male, 40 percent female, and 20 percent unknown. Data from these fish will be used to inform future stock assessments on Yelloweye Rockfish.

   Beginning in late 2017, CDFW began collecting ageing structures from recreationally caught Lingcod (*Ophiodon elongatus*) south of Cape Mendocino for use in the next Lingcod stock assessment. Collection activities will continue in 2018.

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3. Yellowtail Rockfish
   Starting in 2013, the PFMC recommended issuance of an Exempted Fishing Permit (EFP) to commercial fishermen to study a method of commercial jig fishing to determine whether it is possible to target Yellowtail Rockfish (*Sebastes flavidus*) inside the Rockfish Conservation Areas (RCA; spatial closures to protect overfished species) while avoiding overfished rockfish species. The goal of this study is to determine if targeting species in the midwater column can provide additional fishing opportunities for the commercial fishery in the RCAs while avoiding overfished stocks that are more likely to reside on the bottom. Data from trips taken between 2013 and 2015 indicate that the gear is successfully targeting healthy stocks (Yellowtail and Widow (*S. entomelas*) rockfishes) while avoiding overfished species. Catch of overfished species Bocaccio (*S. paucispinis*), Canary (*S. pinniger*) and Yelloweye Rockfish was minimal. In 2015, the geographic extent of the EFP was expanded to Point Conception and additional vessels were added to allow for additional data collection in more southerly areas. This EFP has been extended through 2018 with minor changes.

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4. Assessment
   CDFW contributed Yelloweye Rockfish otoliths collected between 2010 and 2016 for use in the stock assessment conducted in 2017. The addition of these new age data from California waters contributed to the more optimistic outlook of the stock. CDFW was also involved in the formal review process of several stock assessments conducted in 2017, including Yelloweye Rockfish, Blue Rockfish, Lingcod, and California Scorpionfish.

5. Management
   Groundfish management is a complex issue and is conducted by the PFMC with input by CDFW as well as the states of Oregon and Washington and the treaty tribes, and guided by the federal Pacific Coast Groundfish Fishery Management Plan. With the exception of some nearshore species, harvest guidelines, fishery sector allocations, commercial trip limits and recreational management measures (e.g., bag limits, season limits, RCAs) are established by the PFMC and implemented by National Marine Fisheries Service (NMFS).

6. Commercial Fishery Monitoring
   Statistical and biological data from landings are continually collected and routinely analyzed by CDFW staff to provide current information on groundfish fisheries and the status of the stocks. California's primary commercial landings database is housed in CDFW's Commercial Fisheries Information System (CFIS). Outside funding also enables California fishery data to be routinely incorporated into regional databases such as Pacific Coast Fisheries Information Network.

   Commercial sampling occurs at local fish markets where samplers determine species composition of the different market categories, measure and weigh

fish and take otoliths for future ageing. Market categories listed on the landing receipt may be single species (e.g., Bocaccio), or species groups (e.g., group shelf rockfish). Samplers need to determine the species composition so that landings of market categories can be split into individual species for management purposes. Biological data are collected for use in stock assessments and for data analyses to inform management decisions.

Inseason monitoring of California commercial species landings is conducted by CDFW biologists. This work is done in conjunction with inseason monitoring, management and regulatory tasks conducted by the PFMC's Groundfish Management Team. Weekly and monthly tallies of landing receipts in CFIS are used for inseason monitoring.

7. Recreational Fishery Monitoring
CDFW conducts weekly recreational fishery monitoring for several species of concern, including Yelloweye Rockfish, Cowcod (*Sebastes levis*), Canary Rockfish, and Black Rockfish (*S. melanops*). To track catches inseason, CDFW generated an Anticipated Catch Value by using sample information directly from CRFS weekly field reports to approximate interim catch during the six week time lag until monthly CRFS catch estimates are available. Recreational regulations in 2017 allowed increased fishing depths for much of the state, a reduction to the Black Rockfish sub-bag limit from five to three fish, and allowed limited retention of Canary Rockfish for the first time in more than a decade as a result of the stock being declared rebuilt.

   Catches of Yelloweye Rockfish were higher than anticipated during late summer and early autumn, prompting the need to implement more restrictive fishing depths north of Point Conception on October 16, 2017. This change allowed the fishery to remain open through the remainder of the calendar year, but constrained anglers to depths where encounters with Yelloweye Rockfish would be reduced.

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C. Pacific Halibut & International Pacific Halibut Commission activities

1. Research and Assessment
Research and assessment activities for Pacific Halibut (*Hippoglossus stenolepis*) off the coast of California are conducted by the International Pacific Halibut Commission (IPHC). The IPHC conducted research surveys in California in 2017, and for the first time extended the survey to include waters off San Francisco. The prior surveys off California in 2013 and 2014 only extended as far south as Cape Mendocino and Point Arena, respectively. CDFW staff met the IPHC vessel when offloads occurred to collect biological information from rockfish that were incidentally caught while targeting Pacific Halibut. This rockfish biological information, especially for Yelloweye Rockfish, is used in stock assessments.

2. Management

The CDFW collaboratively manages the Pacific Halibut resource off the coast of California with the IPHC, NMFS, PFMC, other west coast states, and the CFGC. Pacific Halibut management activities occur on an annual timeline, with most changes to management occurring through the PFMC's Catch Sharing Plan and federal regulations published by NMFS. Changes to the Catch Sharing Plan for the following year are approved in November by the PFMC.

3. Commercial Fishery Monitoring
   The directed commercial fishery for Pacific Halibut is managed under a coastwide quota and operates as a derby fishery. The fishery opened on June 28 and is structured based on 10 hour openers that are spaced two weeks apart. The fishery continues to operate until the coastwide quota has been met, which usually allows for two to three fishery openings per year. California effort in this fishery continued to increase in 2017 with five vessels participating in the fishery and 3,782 dressed pounds (1,717 dressed kilograms). CDFW staff met vessels offloading Pacific Halibut to collect biological samples for the IPHC's fishery monitoring program. In 2017 the IPHC conducted a pilot study to gather sex ratio information in the commercial fishery. The program was voluntary and involved externally marking the fish based on sex to facilitate data collection by dockside port samplers.

4. Recreational Fishery Monitoring
   The recreational fishery was scheduled to be open May 1-June 15, July 1-15, August 1-15, and September 1 through October 31, or until the quota was met, whichever was earlier. This was an increase of 16 days compared to the 2016 season due to an increased quota.

   To track Pacific Halibut catch, CDFW generated an interim preliminary projected catch value using sample information directly from CRFS weekly field reports to approximate catch during the lag time until monthly CRFS catch estimates are available. This information was made available online so the public could track the progress of the fishery. Using this inseason tracking methodology, the fishery closed early on September 11, 2017. Final season catch estimates were 30,541 net pounds (13,866 net kilograms), 88 percent of the 34,580 net pound (15,699 net kilogram) quota.

   Contributed by Melanie Parker (Melanie.Parker@wildlife.ca.gov)

V. Publications

CDFW. 2018. California Department of Fish and Wildlife Report to the International Pacific Halibut Commission on 2017 California Fisheries. 14 p. Available at:https://iphc.int/uploads/pdf/am/2018am/iphc-2018-am094-ar08.pdf.