Supporting a Spatial Analysis of the Distribution and Size of Rebuilding Stocks in the Rockfish Conservation Areas Through Directed Fishing Surveys

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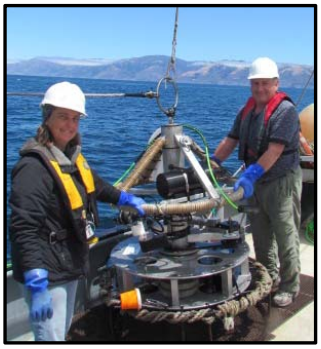

Interim Report to the Pacific Fishery Management Council for the November 2013 Briefing Book.

I. Project Overview

The U.S. West Coast groundfish fishery is comprised of more than 90 species of fish, many of which are inherently vulnerable to overfishing because of long life spans and low productivities. Managing and assessing multi-species fisheries that include stocks of various resiliences to overfishing has proven challenging. Nine species in total were declared overfished by the National Marine Fisheries Service (NMFS) between 1999-2002 including: Bocaccio (*Sebastes paucispinis*), Canary Rockfish (*S. pinniger*), Cowcod (*S. levis*), Darkblotched Rockfish (*S. crameri*), Pacific Ocean Perch (*S. alutus*), Widow Rockfish (*S. entomelas*), Yelloweye Rockfish (*S. ruberrimus*), Lingcod (*Ophiodon elongatus*), and Pacific Hake (*Merluccius productus*). The Magnusson Stevens Act (MSA) requires an end to overfishing, and as a result of an overfished status and a requirement for mandatory rebuilding plans, a set of strict measures were implemented to eliminate overfishing. These measures include catch reductions, gear restrictions, and establishment of the coast-wide Rockfish Conservation Areas (RCAs). The RCAs were established in 2002 by NMFS as a set of depth based spatial closures along the outer edge of the continental shelf and upper slope. The primary goal of the RCAs was to help protect overfished species (OFS) that occur in discrete depth zones and help with rebuilding efforts (67 CFR 57973). In addition, as the trawl sector of the groundfish fishery transitioned to an IFQ program, requirements for full accounting of catch were implemented, including a requirement for 100% of trips to include human observers.

These management measures have proven useful for rebuilding stocks of OFS; however, fishing opportunities, and the economic and social benefits associated with them, may be unnecessarily constrained in the groundfish fishery, because the RCAs cover a large percentage of continental shelf and slope habitats due to a lack of understanding of the spatial distribution of OFS. Landings of many targeted species (e.g. Lingcod, Yellowtail Rockfish, and Chilipepper) are significantly lower than quota allocations due to efforts by fishermen to avoid encountering rebuilding species during exploratory fishing or fishing near the RCAs.

To date, there has been little research on the finer scale demographic and distributional patterns of OFS that could help fishermen target healthy populations while avoiding depleted ones. Our collaborative research project aims to bring a diverse array of partners together to develop a better understanding of the distribution of OFS. As a first step in the process, the NOAA Biogeographic team has developed coast-wide predictive distribution maps for OFS and target species using existing fisheries dependent and independent data. As a second step, we are conducting surveys to ground-truth those predictive maps in the central CA coast (between Pt. Conception and Half Moon Bay). We are doing so by using directed fishing surveys inside the RCA using standardized hook and line surveys to estimate encounter rates with OFS. This fishing is occurring through an Exempted Fishing Permit (EFP) [Permit #: 13-14-TNC-01 "Supporting a spatial analysis of the distribution and size of rebuilding stocks in the rockfish conservation area through directed surveys"]. We are also conducting visual surveys using a stereo-video camera system to characterize abundance, length, and habitat associations of OFS and target species in those same locations.

The goals of the project are to:

1. Compile existing data about the distribution of OFS collected from NMFS trawl surveys, underwater visual surveys, and historical catches;

2. Use the combination of existing fisheries independent and dependent data and local knowledge to develop predictive maps on the distribution and abundance of overfished groundfish stocks along the entire West Coast;
3. Ground-truth the predictive maps by performing scientific sampling (visual surveys and directed fishing) to assess encounter rates with OFS in a subset of locations inside the RCA in Central California with predicted high, medium, and low density ("hotspots", "warm spots", and "cold spots" respectively) of OFS, and;
4. Characterize the abundance, length, and habitat associations of OFS in those same locations, as well as collect biological samples of OFS for growth and maturity studies.

This is a collaborative project that involves many partners interested in developing a better understanding of OFS distributions to inform fishing and management decisions. Partners include: Central California Seafood Marketing Association (CCSMA), The Nature Conservancy (TNC), Environmental Defense Fund (EDF), Moss Landing Marine Laboratories (MLML), California Sea Grant, University of California at Santa Barbara, the National Marine Fisheries Service/Southwest Fisheries Science Center (NMFS/SWFSC Santa Cruz lab), and the California Department of Fish and Wildlife. Quota to conduct the directed fishing surveys were supplied by TNC, in collaboration with the California Risk Pool, and is being closely monitored to ensure hard caps for rebuilding species are not exceeded.

Through the EFP process, we requested permission to conduct directed fishing surveys of areas with predicted high, medium, and low fish density ("hotspots", "warm spots", and "cold spots") inside the RCAs to develop the scientific support for important fishing and management decisions. This EFP is a key part of a broader research project that will result in a synthesis of existing data and best available information regarding the spatial distribution of overfished stocks; to help inform bycatch avoidance plans and maximize fishing opportunities of healthy stocks. Furthermore, this work will provide new data on the abundance and productivity of stocks within the RCAs that may help support bycatch avoidance plans, stock assessments, and spatial management decisions. Using a combination of spatial modeling, fishermen's knowledge, and scientific surveys, the opportunity exists to increase the potential for fishermen to meet target quotas, while reducing interactions with rebuilding species.

This interim report is intended to provide the Pacific Fishery Management Council (Council) with information on the planning and early implementation phases of this multi-year project. Some preliminary information is provided on field research efforts and landings to date; however, the first year of field research is still underway and a more detailed and comprehensive report of the first year of directed fishing efforts will be provided to the Council at their September 2014 meeting.

II. Progress to Date on Key Project Elements

This EFP is part of a multi-year collaborative research effort to advance our understanding of the distribution of OFS. Here we report on progress on key elements of the project.

A. Securing the EFP

This EFP was approved by the Council at their June 2012 meeting in San Mateo, CA. It was approved with recommended revisions from both the Council and the Scientific and Statistical Committee (SSC). The SSC recommendations were accepted and included in the revised May 2012 application, and only 2 further recommendations were given by the Council at their June 2012 meeting:

1) That the permittee be granted an exemption from the non-trawl RCA, and;
2) There should be no testing of trap gear to target lingcod.

TNC then submitted the revised EFP application to NMFS in November 2012, and the EFP terms and conditions were finalized in early September 2013. TNC, as a partner and holder of the trawl permits and quota assumed the leading role in matters related to the issuance and management of the EFP, including serving as permittee on behalf of the research partners.

B. Securing Observers for the project

One of the requirements the EFP is 100% human observer coverage. Project partners went through a process to select observers and an observer provider, and Alaskan Observers Inc. (AOI) was selected based on a competitive bid process. Two observers were chosen by both AOI and project partners based on their qualifications and knowledge of fisheries. Both observers went through the catch share observer training program during May and completed all of the required coursework and passed their exams to become certified federal at-sea observers and shore-side monitors.

C. Selecting Fishermen and Vessels for the Directed Fishing

Project partners worked with local fishermen and representatives from the Morro Bay Commercial Fishermen's Organization (MBCFO) to develop an application form to guide the selection of fishermen for the directed fishing portion of the study. The application was distributed to: harbor masters, city representatives, commercial fishermen organizations, fish processors, and fishermen up and down the coast between Port San Luis and Half Moon Bay in mid-April 2013.

Interested and qualified applicants had until May 24th, 2013 to complete and return the applications to TNC. Once all applications were received a review committee of 5 members representing city officials, academic, non-profit organizations, and representatives from a fishermen coop organization independently scored and ranked each of the candidates. Based on those scores, the selection committee chose 4 candidates (Roger Cullen of the F/V Dorado, Mike Ricketts of the F/V Sea Hawk, Brad Leage of the F/V Princess, and Tom Mattusch of the F/V Hulicat). Selected candidates then had the required background check conducted by NMFS Northwest Region Office of Law Enforcement to ensure that they had no violations.

D. Selecting a Fishermen and Vessel for the Visual Surveys

NOAA (grant NOAA-NFA_NFAPO-2012-2003133) is providing funding for the fishing vessel days to support the visual surveys. NOAA put out a request for proposals (RFP's) to select an appropriate vessel with specifications to support the visual surveys using a drop camera system. Captain Tim Maricich of the F/V Donna Kathleen was selected to provide vessel support for the visual surveys.

E. Developing Predictive Maps of the Distribution of OFS and Target Species

Project partners worked with the NOAA Biogeographic team from the National Center for Coastal and Ocean Science (NCCOS) to develop predictive groundfish models (maps) using fishery-independent trawl survey data collected as part of the annual West Coast Groundfish Bottom Trawl Survey and provided by the NWFSC-Fisheries Resource Analysis and Monitoring Division (FRAM). Annual surveys conducted from 2003 to 2010 were compiled into a single dataset and used to develop a single predictive response surface representing the long-term average catch per unit effort (CPUE) of each species. Abundance data from the trawl surveys were analyzed with other data sets on habitat, depth, oceanographic parameters using generalized linear models (GLMs), so that fish-environmental relationships could help generate better predictions.

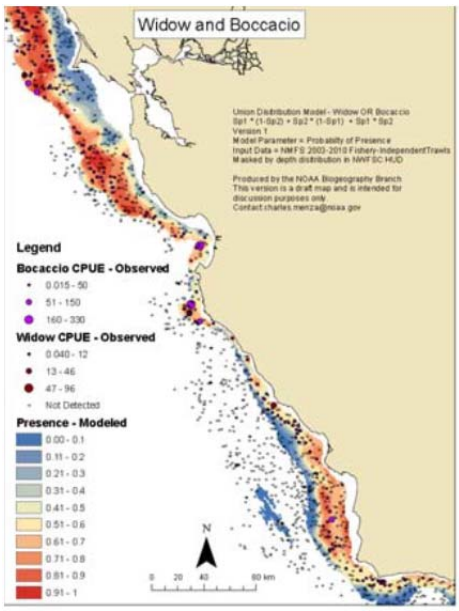

Figure 1: An example of Modeled Widow rockfish and Bocaccio CPUE based on NMFS Trawl Survey Data.

F. Site Selection and Study Design

The field surveys are being conducted along California's Central Coast between Pt. Reyes and Pt. Conception. We have identified specific study sites using a collaborative approach with fishermen, external scientists, and our study team. We conducted meetings with fishery managers, fishermen, habitat ecologists, and other informed stakeholders to select study sites that are based on the spatial analysis and predictive modeling by the NOAA Biogeographic team, existing submersible and ROV survey data, and information from historical catches by participating fishermen. We identified a total of 28 potential study blocks, covering a range of predicted hot, medium, and cold areas for OFS. These are located within or adjacent to the trawl RCA (100-150 fathoms) where predicted abundance from the spatial analysis and modeling correlates well with observational information and local knowledge (e.g. an OFS hotspot would

be a location where the spatial analysis predicts high abundance and observational data or prior catch would predict high abundance of OFS).

We stratified the study blocks to account for regional variability, as well as improve study logistics by minimizing travel time from port. We are surveying at least two types of habitats: areas with canyon walls (e.g., nearly vertical heads and sides of canyons) and areas with high relief rock outcrops, either on the continental slope or on the shelf edge. The following figures show the study blocks that have been selected, broken out into 4 geographic regions.

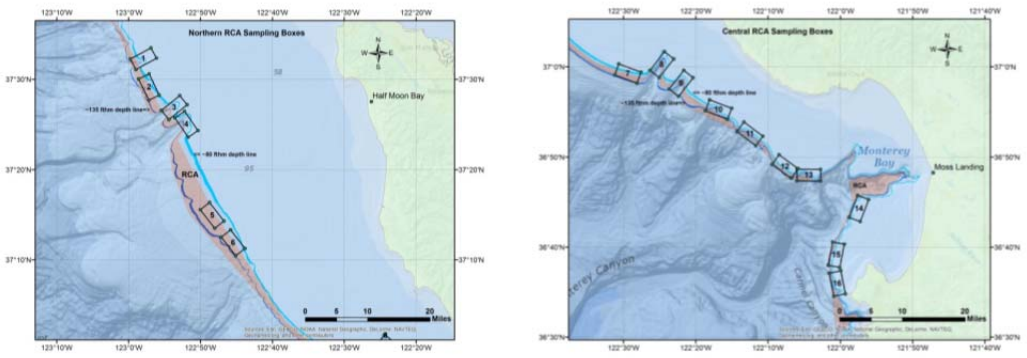

Figure 2: Northern Study Region (left) and Central Study Region (right).

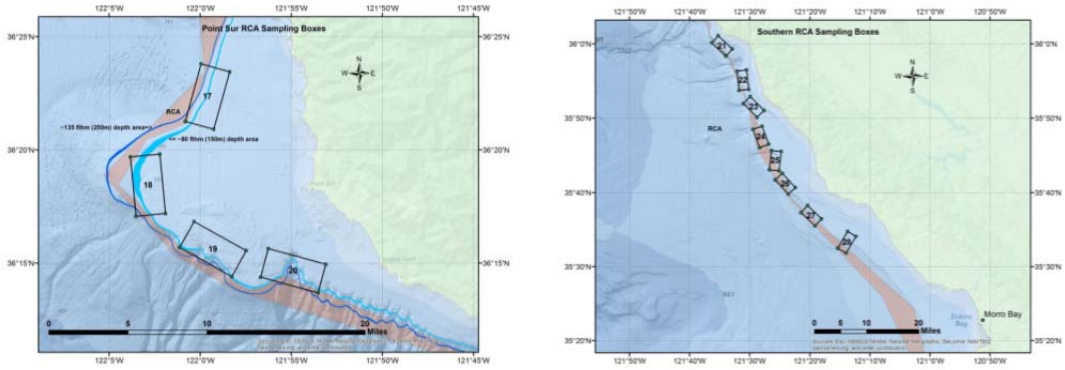

Figure 3: Pt. Sur Study Region (left) and Southern Study Region (left). Note: no directed fishing surveys will occur at Pt. Sur due to limited OFS quota and high risk of yelloweye rockfish encounters.

G. Directed Fishing Surveys

Within each study block we are conducting standardized, timed fishing activities using vertical hook and line gear (hydraulic snapper reel with 15 hooks/line, 10/0 stainless steel hooks baited with squid). The onboard researcher directs a fisherman to fish within that block to catch target fish such as chilipepper, widow rockfish, and lingcod. Each deployment of the vertical hook and line gear constitutes a sample unit, and we aimed for less than full saturation of hooks to help estimate CPUE. The vertical

hook and line gear is deployed twenty-five feet above the seafloor to target Chilipepper, Widow Rockfish, and to minimize the risk of encountering Yelloweye Rockfish and Cowcod (constraining OFS for which there is limited quota). We will not be fishing in the Pt. Sur blocks given the high risk of encountering OFS, but will be conducting visual surveys in those locations.

Fishing vessel captains are instructed to distribute their efforts across all blocks in their geographic region with at least a minimum of 5 locations within each block. Fishing was categorized by two depth zones, shallow 49-82 fathoms (90-150 m) and deep 82-140 fms (150-250 m), targeting chilipepper and widow rockfishes.

Any overfished species landed are immediately put on ice and brought to the NOAA SWFSC lab in Santa Cruz, CA, where growth, maturity, and fecundity data will be collected by Dr. John Field (NMFS project partner). Target species of interest to NMFS stock assessment scientists are also being provided for biological analysis. Target species not needed for biological analysis will be sold commercially by the fishermen.

H. Visual Surveys Using a Video Lander System

TNC contracted with Marine Applied Research and Exploration to design, build, and test a Stereo Video Camera Lander (a "video lander system") for this study. This video lander system can be deployed to depths of 300 m and has a rotating turntable so the paired cameras rotate 360 degrees. Preliminary surveys have demonstrated that both target and OFS species are readily observable with this drop camera within the depths of the RCAs.

Within 1-2 days after a fishing sample has been collected, we are deploying the Video Lander System at the fishing locations to assess density, size, and habitat associations of fish. We are also conducting visual surveys in other areas of habitat structure where fishing is not occurring. Video images from the paired cameras are transmitted to the surface and stored on a hard drive for post processing by MLML. We are using software developed by Euan Harvey and Jim Seager (www.seagis.com.au/) to obtain lengths, density, and habitat association of fishes observed by the Video Lander System.

III. Fishing Effort and Landings to Date

To date we have completed the 1st phase of the directed fishing surveys for the southern geography. A total of 15 days of fishing by two vessels (F/V Dorado and F/V Princess) between September 9-23, 2013. In this geography, 236 vertical hook and line sets resulted in 722 individual fish caught for a total of 3,474 lbs. landed (Table 1). At the same time, using the stereo video lander we recorded species abundance, length, and habitat associations for 96 locations within the southern geography.

The ratio of target species catch to rebuilding species catch for the fishing surveys to date is 8:1. The most abundant species caught was Vermilion Rockfish (*S. miniatus*) with 2,911 lbs. total, followed by other target species such as Yellowtail Rockfish (*S. flavidus*), Chilipepper (*S. goodei*), and Lingcod (*Ophiodon elongatus*).

The overfished species weight caught to date for the project was 371 lbs. of Bocaccio and 14 lbs. of Canary Rockfish. These specimens were sent to Dr. John Field at the NMFS/SWFSC Santa Cruz lab. No Yelloweye Rockfish or Cowcod have been caught to date, but we have seen several of each of these species with the stereo video lander, including some large individuals.

It should be noted that the fishing and visual surveys for 2013 are still underway and due to be completed by October 20th, thus these results are preliminary and incomplete for the 2013 EFP implementation.

Table 1: EFP project total landed and discard weight by species (September 9-23, 2013). Please note discard weights are not finalized yet.

Species	Project Summary 9/9/13-9/23/13	
	Landed Wgt (lbs)	Discard Weight (lbs)
*** Bocaccio**	371	0
*** Canary Rockfish**	14	0
Chilipepper	34	7
Lingcod	43	27
Southern Shelf Rockfish	2,909	6
Halfbanded Rockfish	0	1
Speckled Rockfish	3	0
Vermilion Rockfish	2,906	5
Widow Rockfish	3	5
Yellowtail Rockfish	97	6
Project Totals	3,474	52

***Refers to overfished/rebuilding species**

All data in Table 1 were recorded by the shore-side monitor/first receiver for landed weight, while discard weights were recorded by at-sea observers.

Please note that discard weights should be considered preliminary as observers are still working to verify this with their de-briefers. Also note that the data above represent only a portion of the first year of fishing effort, and that these efforts are part of a two year directed fishing effort study.

IV. Next Steps

The next steps for the project are as follows:

October 2013:

- Complete remaining fishing and drop camera surveys for central and northern geographies

November 2013 – June 2015

- Analyze fishing data and video from year 2 (Nov. 2013 – May 2014)
- Complete year 1 annual report (June 2014)
- Conduct 2nd year of directed fishing and drop camera surveys (Sept. – Oct. 2014)
- Analyze fishing data and video from year 3 (Nov. 2014 – May 2015)
- Conduct outreach to agencies, fishing community, others (ongoing)
- Complete year 2 annual report (June 2015).

V. Summary

There is a growing awareness of the need to incorporate spatial information in fisheries management and fishing decisions and a need to build off of the knowledge of local resource users. Our collaborative approach aims to advance our understanding of OFS and fill in gaps and knowledge of their spatial distribution, habitat associations and demographic patterns to inform management and fishing decisions at smaller scales. Specifically, we are testing an approach to bridge the gaps among data of different spatial scales (i.e. between coast-wide data and fine-scale data collected at sites) and between science (e.g. coast-wide trawl survey data, site-scale observational data from submersibles, remotely operated vehicles, etc.) and local fishermen's knowledge to advance our understanding of OFS distributions.

The project to date has developed new approaches (e.g. modeling) and tools (e.g. Stereo video lander) to try to fill the gaps in our understanding of OFS distributions. Our preliminary impressions of field surveys are that the video lander is a useful tool in determining the relative abundance of several OFS across a broad region of the coast, the fishing gear we are using can selectively target specific high-relief habitats, and that OFS are contagiously distributed. It is important to consider this clumped distribution of OFS in high-relief; non-trawlable areas when developing stock assessments.

VI. Acknowledgements

The project partners wish to extend many thanks to local area fishermen who provided valuable input into the study design and objectives and for sharing their local knowledge of fishing grounds including: Jim Anderson, Geoff Bettencourt, Bill Blue, Roger Cullen, Vince Doyle, Steve Fitz, Tom Hafer, Chris Kubiak, Brad Leage, Tom Mattusch, Joe Penissi Jr., Joe Penissi Sr., Mike Ricketts, John Rowley, and Mark Tognazzini.

We also appreciate the generous support from the California Risk Pool, comprised of members from CCSMA and the Fort Bragg Groundfish Association (FBGA), for providing OFS quota for the study and for their valuable insight and input on the study design, helpful comments and suggestions, and also for their enthusiasm and support for the projects research efforts and collaborative partnership.

Also, the work could not have been completed without the help of staff and students from all of the project partners and contractors.